

# Metso:Outotec

Optimization and laboratory services

## Expert Services

Get the most out of your  
entire operation





## Optimization and laboratory services

Our portfolio is supported by deep technical knowledge, experienced people, and specialized tools to maximize your profitability. With commissioning services as well as tailored solutions available for drill and blast, comminution, flotation and thickening, we can help you get the most out of your entire operation.

Are you reaching  
your full  
potential?

A photograph of two workers in orange high-visibility jackets and white hard hats, viewed from behind, standing on a yellow metal walkway in a large industrial mining plant. They are looking at a document held by the worker on the right. The background shows complex machinery, pipes, and structural steel of the plant.

# Driving gains across your operation

A global team of mining industry professionals who provide expert consulting, laboratory services, hardware and software products to the mining industry worldwide.

Our professionals have extensive experience in addressing challenges such as improving recoveries, de-bottlenecking processes, increasing availability, and sustainably optimizing the overall mine-to-plant process. Solutions and capabilities can be performed both in-person and remotely and are scalable from a single crushing circuit to an entire mine-to-port study.

As a team, we are dedicated to the optimization of mining practices and downstream processing of valuable minerals and metals. We are focused on providing guidance, analysis and advanced technology to our customers, ensuring they can maximize the economic benefits of the resources they mine.

Explore our downstream offering presented here from lab and field studies — to commissioning for specific technologies — to process evaluation and optimization.

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## Ore characterization



Ore properties govern the ultimate performance that is achievable in all mining operations.

Ore characterization helps you build a clear picture of the ore types in your mine and determines how to extract maximum value from your deposit.

### Your challenges

Within most ore bodies, there is considerable variation in the properties of the ore including hardness, abrasivity, grade and mineral liberation characteristics. Many mines continue to run their equipment based on the initial ore assessment and do not take into account the changes in feed ore properties over the life of the mine. Without a thorough understanding of current ore properties, significant variations in throughput, machine wear, recovery and final grade can result.

### What it is

Samples are collected and sent to our modern commercial laboratories for testing. Remote or on-site guidance can be provided by our team of expert laboratory engineers to ensure representative samples are collected. A range of internationally recognized and industry-standard ore characterization tests and measurements are conducted with the results quickly made available in a comprehensive report.

The results can also provide the basis for further blasting, comminution, flotation, thickening, and filtration optimization services. These can be provided on-site or remotely. Metso Outotec experts carry out specialized analysis to develop a detailed understanding of the ore characteristics, their spatial distribution in the deposit, and the corresponding impact on mining and processing operations. This way, processes can be optimized for each ore type to increase production, improve recovery and reduce costs.

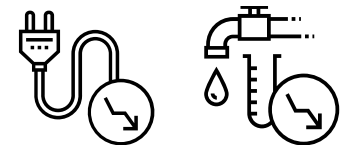
### How it helps

#### Improved profitability

Ore characterization is required to ensure maximum recovery of your valued minerals by reducing the losses caused by poor liberation and incorrect flotation chemistry. Operating costs can also be reduced by lowering energy consumption per ton and designing appropriate wear parts to take wear properties of the feed into account.

#### Sustainability advantage - energy savings

Understanding the characteristics of each ore type allows you to apply the right amount of energy at each stage of the comminution process to reduce overall energy requirements. Knowing the mineralogy will also help you select the appropriate chemicals and determine the right dosage therefore reducing waste.



### More information

[www.mogroup.com/ore-characterization/](http://www.mogroup.com/ore-characterization/)

# Metso:Outotec

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## Drill and blast fragmentation assessment and forecasting



Optimal blast fragmentation saves on overall energy consumption and improves downstream plant performance.

Achieve optimum run-of-mine (ROM) fragmentation, defined by downstream process requirements, with our drill and blast fragmentation assessment and forecasting service.

### Your challenges

Many mines and quarries face poor or inconsistent ore fragmentation due to variable ore mass characteristics. This can directly impact downstream process plant performance in terms of throughput, specific energy, operating costs and wear. Eliminating these inconsistencies benefits the entire operation.

### What it is

Varying ore types in open pit mines and quarries require different drill and blast designs for optimal fragmentation results. Using a statistical approach with modeling and simulations enables us to analyze, assess and forecast in order to implement blasting practices for best operational performance.

A site-specific blast model is calibrated with data related to ore properties, blast design, explosive properties, implementation details and resulting fragmentation. Simulations are conducted and blast design parameters defined for targeted ore types to achieve optimum fragmentation.

Drill and blast assessments can be done both onsite or remotely. All studies and forecasts are overseen by a Metso Outotec drill and blast expert. Practical recommendations are provided in a short technical report at the end of the study.

### How it helps

#### Production improvements

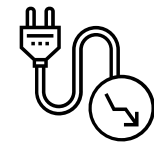
Achieving optimal fragmentation improves downstream process plant performance, in terms of throughput, operating costs, wear and equipment availability.

#### Forecasting for flexibility

Implementing the ideal blast designs for different ore types at a mine site allows site managers to change downstream operating strategies proactively.

#### Sustainability advantage - energy savings

Expending the right amount of energy at the blasting stage to achieve finer fragmentation significantly reduces downstream energy requirements.



### More information

[mogroup.com/blast-optimization](http://mogroup.com/blast-optimization)

# Metso:Outotec

Optimization and laboratory services

## Comminution circuit commissioning



Ensure the highest equipment availability and most efficient ramp-up for your comminution circuit with expert commissioning.

Ensure a smooth production start-up and quicker ramp-up to profitability with our comminution circuit commissioning and troubleshooting service.

### Your challenges

Commissioning new equipment involves certain risks which can result in delays or even serious breakdowns if not managed properly. Achieving target feed size and feedrate as well as appropriate operating conditions such as media levels, speed and cavity level can be challenging.

Understanding the circuit configuration and design criteria is critical in order to reach full capacity. After commissioning, the wear life and media consumption in the circuit will need to be assessed and optimized.

### What it is

Our comminution circuit experts will confirm proper installation and set-up of your equipment. Process commissioning support overlaps with mechanical commissioning to ensure your equipment performs according to agreed targets.

Commissioning activities include:

- Pre-operational equipment assessment
- Electrical and automation testing and inspection
- Equipment start-up
- Operating the circuit with continuous feed
- Process evaluation using analysis tools to ensure design operating parameters are met
- Performance testing and process control strategy
- Provision of as-built Piping and Instrument Drawings (P&IDs) and Process Flow Diagrams (PFDs)
- Hands-on training
- Guidance for routine monitoring and troubleshooting activities
- Safe start up with feed per IOM installation

### How it helps

#### Contributes to highest equipment availability

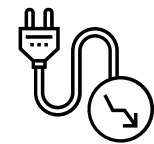
Expert commissioning support includes establishing the best operating and maintenance practices from start-up to ensure optimal equipment reliability. It will also help the circuit ramp-up quickly to its designed throughput levels.

#### Minimize risk for production disruption

By properly commissioning your equipment, the risk of delays and breakdowns impacting plant production is significantly reduced.

#### Sustainability advantage - energy savings

Proper commissioning also ensures that the control strategies and parameters are in line with operational requirements, which can lead to long term energy savings and improved beneficiation circuit recovery.



### More information

[mogroup.com/installation-and-commissioning](http://mogroup.com/installation-and-commissioning)

# Metso:Outotec

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## HIGmill™ commissioning and troubleshooting



Ensure the highest equipment availability and most efficient ramp-up for your HIGmill with expert commissioning.

Ensure a smooth production start-up and a shorter ramp-up to profitability with our HIGmill commissioning and troubleshooting service.

### Your challenges

Commissioning new equipment always involves certain risks that can result in delays or even serious breakdowns. Ensuring proper feed conditions as well as media level and slurry density can be challenging. Even after commissioning, managing the wear life and media consumption in the mill can be problematic and takes time to optimize.

### What it is

Our HIGmill process experts will ensure proper commissioning of your equipment. Commissioning activities include:

- Pre-operational equipment assessment
- Electrical and automation testing and inspection
- Equipment start-up
- Water and slurry calibration tests
- Operating the mill with continuous feed
- Process evaluation using analysis tools to ensure design operating parameters are met

Once the mill is commissioned, changes in operating conditions can cause wear and other issues. Our experts will trouble-shoot, diagnose and find the correct solution. This includes a review of all aspects related to the operation of the equipment including mechanical components, instrumentation, process control strategies and process conditions.

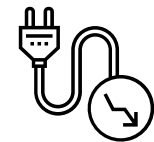
### How it helps

#### Contributes to highest equipment availability

Expert commissioning support includes establishing best operating and maintenance practices from the start to ensure optimal machine reliability. It also helps the mill ramp-up quickly to design tonnage.

#### Sustainability advantage - energy savings

Proper commissioning also ensures that the control strategies and parameters are set in-line with operational requirements. Proper settings can lead to improved stability and long term energy savings.



### More information

[mogroup.com/installation-and-commissioning](http://mogroup.com/installation-and-commissioning)

# Metso:Outotec

Optimization and laboratory services

## Thickener process commissioning



Ensure the highest equipment availability and most efficient ramp-up for your thickener with expert commissioning support.

Ensure a smooth production start-up and a shorter ramp-up to profitability with our thickener commissioning and troubleshooting service.

### Your challenges

Commissioning new equipment always involves certain risks that can result in delays or even serious breakdowns. Ensuring proper feed conditions as well as slurry density and overflow quality can be challenging. After a thickener is commissioned, problems frequently arise with the management of process variables which can impact the thickener's performance. Proper commissioning will provide operators with the skills to troubleshoot and correct these issues.

### What it is

Our thickener experts provide process commissioning support which will overlap with mechanical commissioning to ensure your equipment performs according to the design criteria and agreed targets.

Commissioning activities include:

- Process verification pre-startup
- Equipment start-up
- Stabilization: inventory build-up, flocculant dosing and troubleshooting as required
- Operational fine tuning: process operation follow-up and support
- Hands on operational training: routine monitoring and troubleshooting activities

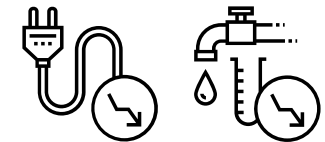
### How it helps

#### Contributes to highest equipment availability

Expert commissioning support includes establishing best operating practices from the start to minimize risks of production disruption and ensure optimal machine reliability. It will also help the thickener ramp up quickly to design tonnage.

#### Sustainability advantage - water management and energy savings

Proper commissioning and follow-up ensures that the control strategies and parameters are set up in-line with operational requirements leading to better water management. Avoiding recirculation of solids into the process can also lead to energy savings.



More information

[mogroup.com/installation-and-commissioning](http://mogroup.com/installation-and-commissioning)



# Metso:Outotec

Optimization and laboratory services

## Crushing circuit evaluation and optimization



Adjusting your operating and control strategies can help you get more from your circuit.

Improve process performance by identifying bottlenecks and areas for improvement in your crushing circuit.

### Your challenges

Variations in circuit feed including coarser run-of-mine or changing ore hardness can lead to fluctuating feed to the crushing circuit and loss in throughput. Inefficient operation can also result in lower throughput, higher energy usage, increased wear rates and lower machine utilization.

### What it is

Crushing circuit evaluation and optimization starts with an analysis of the historical operating and production data to evaluate current plant performance. Benefits can then be quantified through detailed modeling and simulation.

The evaluation stage of the process involves examining 6 to 12 months of plant operating data. Using advanced tools and methodologies, and our own experience, we are able to benchmark operations and identify potential improvement areas. From this evaluation, recommendations can be made to improve equipment utilization and adjust operating and control strategies to meet production targets.

The next step in the process is to quantify the gains by developing a model of the crushing circuit using operating data and representative samples. The model is then used to simulate the response of the circuit to different ore types, feed size distributions, circuit configurations, operating parameters and key design variables. The simulation results quantify the benefits and provide practical recommendations which can be implemented onsite to improve circuit performance.

### More information

[mogroup.com/process-optimization-connected-services/](http://mogroup.com/process-optimization-connected-services/)

### How it helps

#### Production and profitability improvements

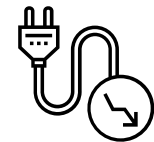
By identifying and removing bottlenecks in the crushing circuit, throughput and product size can be improved. As a result, operating costs can be significantly reduced, leading to higher profitability.

#### Improved utilization

By looking at each stage of the crushing and screening process, opportunities can be identified to reduce downtime and recirculating loads as well as improve product quality.

#### Sustainability advantage - energy savings

Implementing the recommended changes from the optimization study to better utilize overall circuit capacity can lead to significant energy savings.



# Metso:Outotec

Optimization and laboratory services

## Grinding circuit evaluation and optimization



Adjusting your operating and control strategies can help you get more from your circuit.

Improve process performance by identifying bottlenecks and areas for improvement in your grinding circuit.

### Your challenges

Variations in circuit feed including changing ore hardness, feed size or liberation size can lead to loss in throughput and downstream recovery. Inefficient operation can also result in lower throughput, higher energy usage and increased water consumption.

### What it is

Grinding circuit evaluation and optimization starts with an analysis of the historical operating and production data to evaluate current plant performance. Benefits can then be quantified through detailed modeling and simulation.

The evaluation stage of the process involves examining 6 to 12 months of plant operating data. Using tools and methodologies which enable us to understand and benchmark operations, we can identify potential improvement areas. From this evaluation, recommendations can be made to improve equipment utilization and adjust operating and control strategies to meet production targets.

The next step in the process is to quantify the gains through simulating the response of the grinding circuit to different ore types, circuit configurations, operating parameters and key design variables. The simulation results quantify the benefits and provide practical recommendations which can be implemented on-site to improve circuit performance.

### How it helps

#### Production and profitability improvements

By identifying and removing bottlenecks in the grinding circuit, throughput and recovery can be improved and operating costs can be significantly reduced leading to higher profitability.

#### Sustainability advantage - energy savings

Implementing the recommended changes from the optimization study to better utilize overall circuit capacity can lead to lower water consumption and significant energy savings.



**More information**  
[mogroup.com/process-optimization-connected-services/](http://mogroup.com/process-optimization-connected-services/)

# Metso:Outotec

Optimization and laboratory services

## Particle size distribution and flotation recovery



Determine the financial trade-off between increased throughput and flotation recovery to optimize your profitability.

Allow the site operation team to better control plant performance and achieve financial targets by assessing the impacts of a change in feed size distribution on mineral recovery.

### Your challenges

When pushing for maximum throughput from your plant, it is often accompanied by coarsening the comminution circuit product size, potentially compromising flotation performance. Understanding the relationship between throughput, grind size and recovery enables operations to determine the optimal grind size for maximum metal recovery.

### What it is

Our team can help establish the correlation between primary grind size and flotation recovery. The grind size-recovery relationship enables prediction of plant recovery based on particle size distribution coming from the comminution circuit.

To do this, the operation typically provides historical size-by-assay results for their flotation feed, concentrate and tailings streams to enable a recovery by size model to be established. We can then determine the optimal particle size distribution and also predict potential losses that could be incurred if the target size distribution is not achieved.

If the required data is available, this study can easily be done remotely. It can be done as a stand-alone assessment or as a part of a larger process audit. Results can often be provided days after the operational data is received. Though often conducted as a one-time study, the model can be updated as new data is received, for example as part of the routine reporting on-site or as ore properties change.

A final report is provided covering the variation in flotation performance across the range of grind sizes achieved. The analysis also includes the financial implications.

### More information

[mogroup.com/process-optimization-connected-services/](http://mogroup.com/process-optimization-connected-services/)

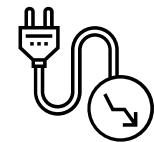
### How it helps

#### Improved profitability

Maximize the profitability of your operation by understanding the economic trade-off between throughput and recovery. Increased throughput can lead to losses in recovery and vice versa. The best financial option is that which leads to maximum overall metal recovery.

#### Sustainability advantage - energy savings

Understanding the relationship between throughput, grind size and metal recovery allows the optimal grind size to be identified for maximum revenue. The circuit can then be operated at the most energy efficient condition to achieve the throughput and grind size targets. In the flotation circuit, the correct type and quantity of reagents can be used for the feed size distribution.



# Metso:Outotec

Optimization and laboratory services

## Flotation process assessment



A flotation process assessment gathers in-depth process information that is not readily available from automation systems or daily sampling.

Benchmark your current process performance and identify potential circuit bottlenecks. Determine optimum feed size, operational parameters and circuit re-configuration options to maximize recovery and revenue.

### Your challenges

In today's environment, many mines need to process lower grade and more complex ores, making the operation of the flotation circuit more challenging. Failure to identify and respond to changing feed conditions can lead to significant and costly recovery losses.

### What it is

A flotation process assessment may either be performed remotely or in-person. It involves these four steps:

- Historical plant operating data is analyzed to better understand current plant operation, strategies and targets.
- A survey is conducted and the collected data is used to identify bottlenecks and process improvement opportunities.
- Hot lab flotation tests are performed on selected streams to assess the floatability of the slurry samples.
- Simulation software and modeling tools are used to generate insights for circuit optimization. A final report is delivered including the analysis and recommendations for maximizing recovery and improving product quality.

### How it helps

#### Improved recovery

Solutions are provided for value-adding modifications to improve process performance. Even small adjustments in terms of operating parameters can lead to significant gains in metal production and profitability.

#### Sustainability advantage - emission reduction and water savings

Recommendations can assess the feasibility of potential emission-reducing upgrades. Efficiently run circuits can reduce reagent consumption, which can improve process water quality and lead to better resource utilization.



### More information

[mogroup.com/flotation-process-assessment/](http://mogroup.com/flotation-process-assessment/)

# Metso:Outotec

## Process performance and mill liner wear review



Operating your mill at its optimal settings allows you to maximize throughput and energy efficiency.

Identify trends in key process indicators such as throughput, mill power, mill weight and speed to determine best operating practices over the life of the liner.

### Your challenges

A drop in grinding mill production at various stages of the liner life can be due to many interacting factors. Understanding what is causing the variation and knowing which parameters to adjust is the key to achieving optimal performance over the life of the liner.

### What it is

A process performance and mill liner wear review involves an analysis of the plant operating data, as well as outputs from each wear report, to identify the contributing factors for the loss in performance.

Parameters analyzed include liner plate thickness, lifter profile, grate and pebble port apertures, mill power, speed, weight, ball charge and ore properties. The analyzed data helps to identify when and how the operating parameters can be adjusted to compensate for liner wear and maintain the desired production level.

The optimal liner change-out point can be identified based on the economic trade-off between increased downtime and reduced process performance.

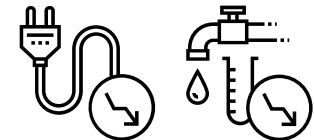
### How it helps

#### Improved mill performance over liner life

Maintain throughput and overall mill performance by operating at optimal settings while taking into account the stage of life of your liners.

#### Sustainability advantage - energy efficiency

Understanding all of the contributing factors to changes in mill performance allows you to make the best decisions in terms of energy usage. For example, reducing the ball load in a ball mill can be a solution to recovery losses due to over-grinding. It also saves power. Reducing SAG mill speed also reduces the power draw and is beneficial when the higher speed is overthrowing the charge and causing reduced liner life and breakage efficiency.



### More information

[mogroup.com/process-optimization-connected-services/](http://mogroup.com/process-optimization-connected-services/)

# Metso:Outotec

Optimization and laboratory services

## Thickener evaluation and optimization



Understanding and adjusting your operating and control strategies can help you get more from your process.

Optimize thickener process performance by identifying bottlenecks and opportunities for improvement.

### Your challenges

Achieving continuous operation while maintaining optimal underflow density can be a challenge. Ensuring that the overflow characteristics fall within the target specifications can also be problematic. Having a better understanding of your thickening process variables allows you to take the correct actions for optimal performance.

### What it is

Thickener process evaluation and optimization starts with an analysis of the historical operating and production data to evaluate current performance. Benefits can then be quantified through detailed analysis.

An audit is conducted to assess the thickener feed and reagent addition parameters as well as inventory, liquor level and density management. Available thickener controls and instrumentation are also evaluated.

Throughout the evaluation stage, key streams are sampled to measure percent solids and particle size distribution to validate against the application and design parameters. Laboratory testing is also conducted to identify opportunities to improve the clarity of the overflow, settling rates and reagent selection.

Conclusions, observations and recommendations for process optimization as well as next steps will be provided.

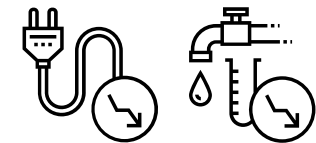
### How it helps

#### Production and profitability improvements

By identifying and removing bottlenecks in the thickener process, throughput can be improved by achieving density and stability targets. The quality of the overflow water can also be improved leading to less material recirculation.

#### Sustainability advantage - water management and energy savings

Optimization ensures that the control strategies and parameters are set in-line with operational requirements leading to better water management. Avoiding recirculation of solids into the process can also lead to energy savings.



**More information**  
[mogroup.com/process-optimization-connected-services/](http://mogroup.com/process-optimization-connected-services/)

# Planet Positive



Sustainability is one of Metso Outotec's key strategic priorities - we are committed to limiting global warming to 1.5 °C. Over 100 products are a part of our recently launched Planet Positive offering, since they are designed to improve water-efficiency, lower emissions & lower amount of energy consumed.

Planet Positive is our all-encompassing approach to sustainability, which covers the environmental, social and financial aspects. Our Planet Positive offering has a central role in our sustainability agenda and 1.5 °C journey as it represents the key means of improving the resource efficiency of our customers' operations.

[mogroup.com/corporate/sustainability/offering-and-innovations/](https://mogroup.com/corporate/sustainability/offering-and-innovations/)

