

Metso:Outotec

Flotation technologies

Maintaining recovery and ensuring availability and sustainability while keeping costs under control is challenging. Our tailor-made flotation solutions maximize your return on investment by enabling gains in throughput, grade, and recovery, with minimized environmental impact. Our automation solutions keep your equipment running reliably, reduce variations in end product quality, and reduce additive and chemical consumption.

Benefits

- Proven metallurgical superiority
- Minimized capital expenditure through optimized circuit design, optimum cell size and minimal footprint
- Reduced operational cost through efficient hydro-dynamics, robust design, and advanced materials
- High availability through ability to handle fluctuating feeds and oversized materials
- Safe, easy operation and maintenance



Harness the power of our experience

With expertise based on over 100 years in flotation technology, and over 15,000 flotation cells installed around the world, Metso Outotec has the experience you need to maximize your operations' productivity and efficiency.

Scalable solutions

Metso Outotec provides tailor-made flotation packages with support services, modular process sections, and even whole concentrators.

Maximum efficiency

Our wide range of cell sizes enables plants to be more compact, economical, and efficient. Fewer units in a flotation plant lead to substantial savings in capital expenditure, while our reliable equipment delivers high availability and contributes to a rapid return on investment.

A lifetime of support

We offer solutions for the whole life cycle of your flotation plant, from installation and commissioning services to modernizations and upgrades.

Tailored service

Each and every flotation operation is unique and when you choose Metso Outotec as your services partner, you are partnering with an organization that is committed to understanding the precise needs of your business.



Planet Positive



Sustainability is one of Metso Outotec's key strategic priorities, we are committed to limiting global warming to 1.5 °C. The filtration solutions are a part of the Planet Positive offering, since they are designed to improve water efficiency, lower emissions and 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.

Our long-term goal is to provide customers with products and services that are even more sustainable. We will continuously develop our filtration offering, with a focus on energy efficiency, reducing emissions, water efficiency, circular solutions and safety.

Optimized performance and productivity



Our expertise at your service

Achieving and maintaining optimal recovery of valuable minerals is not something that happens by chance. Designing a new flotation process, or choosing the right equipment for an existing process, requires experience and a deep understanding of minerals processing and metallurgy. Our solutions are designed in our R&D centers by experts specialized in minerals processing, metals production, and technology development. Using state-of-the-art laboratories and pilot plants for the most demanding test work, our specialists help you evaluate the best options for your process and make informed decisions for the entire life cycle of your plant.



Designed for your productivity

The productivity of your process has a direct effect on the profitability of your operations. Our decades of experience working with metals and minerals processors around the world has enabled us to develop some of the most innovative and productive flotation technologies on the market. For example, by improving flotation hydrodynamics and pumping performance at high air dispersion rates, our FloatForce technology enhances particle recovery in the flotation cell, while also reducing power consumption and the risk of sanding.

TankCell® flotation cells — proven, high-performance technology

Metso Outotec TankCell® offers superior flotation performance for wide particle size range with cell sizes up to 630 m³. The cells are easy to operate, low on power and air consumption, and allow for a modular layout.



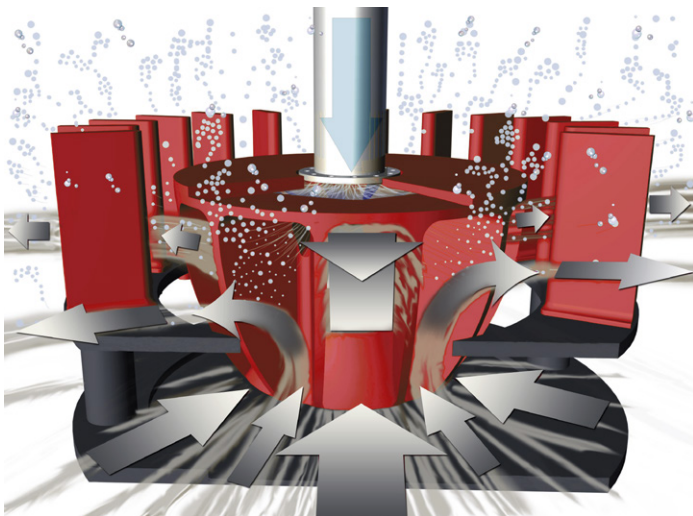
TankCell flotation units are built to last, with components and electrical equipment selected for maximum operating life. For instance, Metso Outotec rotors and stators have proven to be the most wear-resistant available. The wide range of cell sizes enables a compact, economical, and efficient plant design without the risk of short circuiting, even in today's high-tonnage operations. Fewer units mean substantial savings in construction costs, piping, cables, instrumentation, and auxiliary equipment.

Metso Outotec FloatForce®

Mixing mechanism performance has a direct impact on the three key areas of flotation: metallurgical performance, energy consumption, and operating costs. The Metso Outotec FloatForce mixing mechanism delivers measurable value in all of these areas. By improving flotation hydrodynamics and pumping performance at high air-dispersion rates, FloatForce enhances particle recovery in the flotation cell while also reducing power consumption and the risk of sanding.

Froth management solution

Using a launder with the correct design and orientation for your specific application helps to ensure optimal metallurgical performance. We can design a froth management solution that maximizes your flotation cell performance and gives you greater metallurgical control with the optimal lip length, froth area, and transportation distance for the specific cell duty, plus robustness for feed grade and capacity changes.



The FloatForce mechanism maximizes bubble and particle contact in the shear zone between the rotor and stator.

Benefits

- Lower energy consumption
- Reduced plant footprint
- Less auxiliary equipment
- Proven superior metallurgical performance for all flotation applications
- Easy operation and maintenance

CASE

Project

CSA mine, Australia

Application

Copper

Challenge

Engineering, design, installation, and commissioning of three Metso Outotec TankCell 30s within tight schedule.

Solution

TankCell technology, and a strong partnership between CSA and Metso Outotec Services projects teams.

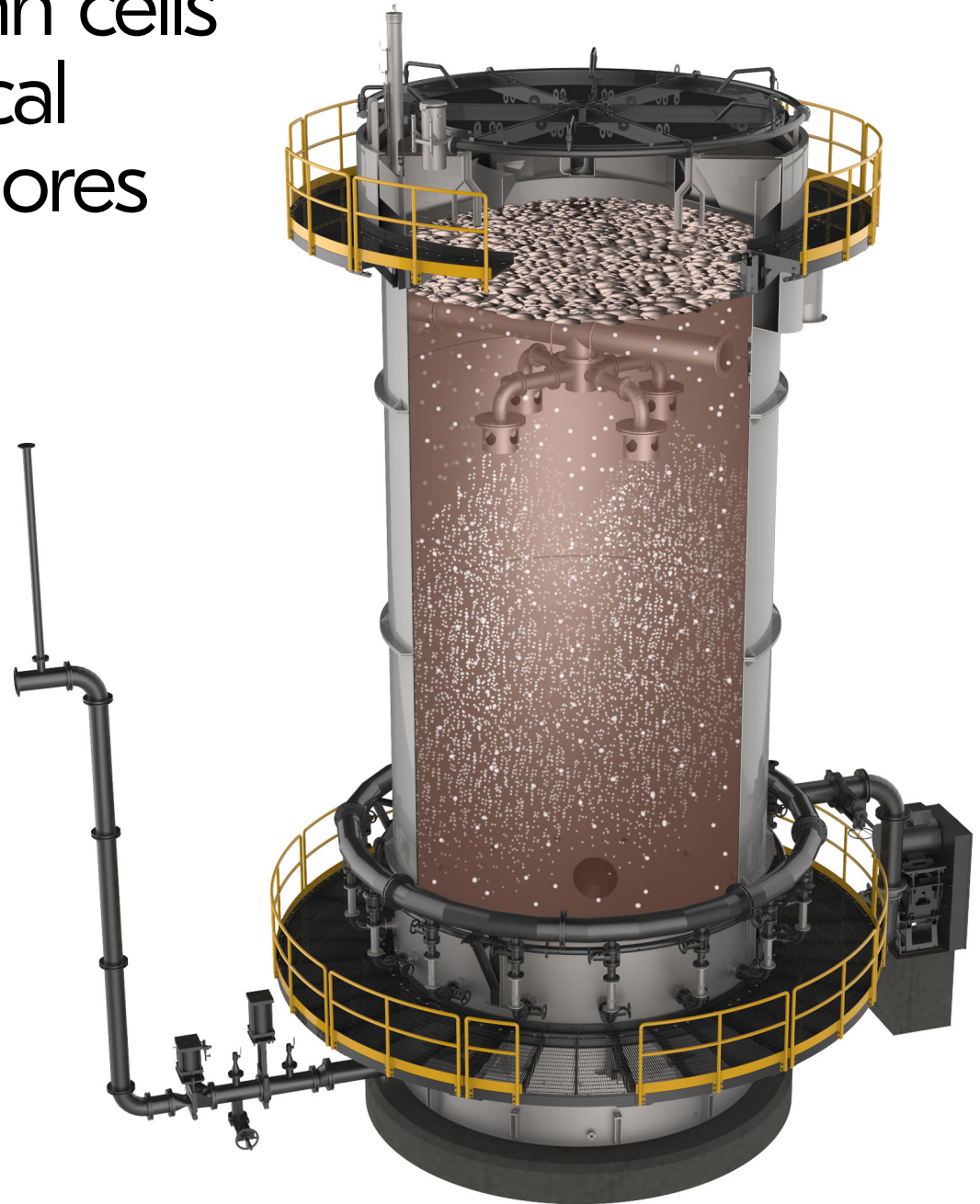
Benefits

- Optimized technology, leading to higher recoveries
- Improved control system (accommodating fluctuations in feed grade and throughput)
- Low maintenance and no flotation cell downtime since installation
- Major energy savings (40%)

Metso Outotec column cells — superior metallurgical performance for fine ores

Get the best flotation performance for your fine ores with the Metso Outotec column cell, across all duties in flotation circuits. Column cell units are available in a wide range of sizes, allowing high capacity and the most appropriate heights for different duties.

Metso Outotec has the most comprehensive portfolio of sparger solutions on the market, including Microcel™, SonicSparger™ Jet and SonicSparger™ Vent. The absence of moving parts and the options for different types of lining minimizes maintenance and enables high availability.



Flotation of fines requires special features: higher energy collection with smaller bubbles to guarantee a good recovery; a less turbulent regime / good slurry distribution to avoid bypass; and a fluid, deeper and more selective froth to generate a better product quality. Metso Outotec column cells are designed to provide all these features, tailored to the ore type, and the requirements and specifications of each project.

High concentrate and froth quality

The structure of the columns, with higher height, allows the development of deeper froths. With the column's wash water system, water is distributed over the froth in a soft, homogeneously dispersed manner. This flow of water washes the froth and displaces most of the entrained hydrophilic material back to the pulp.

Metso Outotec column cells use a perforated tray to distribute the water. The number and size of holes are calculated to promote the appropriate distribution of water over the froth. With the use of wash water, a more fluid froth develops, with a higher grade of hydrophobic material, which means a better concentrate in direct flotation or a higher recovery in reverse flotation. The internal launders design promotes the optimal lip length, froth area, and transportation distance for collection of froth, increasing froth recovery.

Easy and safe operation

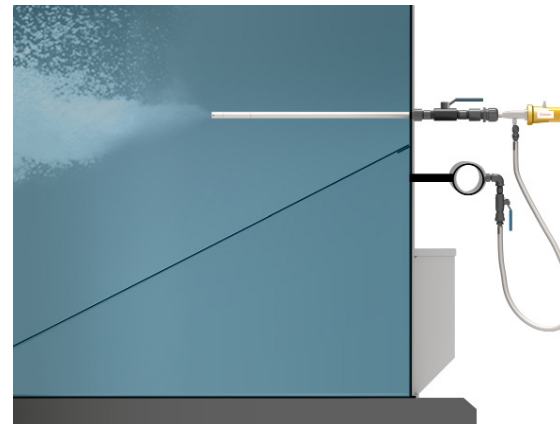
Metso Outotec column cell are easy to operate, the main controls are the level and air flow rate. Accurate instrumentation is used for air control. Level control can be performed by standard sensors or with the LevelSense, an advanced control system developed by Metso Outotec that provides the most precise measurement of slurry and froth levels.

Metso Outotec SonicSparger™ systems for enhanced recovery

Metso Outotec offers two types of SonicSparger systems; SonicSparger Jet and SonicSparger Vent. The number and position of the spargers are calculated to provide a homogeneous air distribution across the column, resulting in the best bubble surface area to enhance recovery.

Benefits

- Superior metallurgical flotation performance for fine ores
- High concentrate and froth quality
- High availability and high capacity
- Easy and safe operation
- Reduced energy consumption and small plant footprint



SonicSparger Jet is based on ultra-sonic injection of air or air plus water.



SonicSparger Vent is based on the Venturi principle.

SkimAir® Flash flotation cells flotation — improved overall recovery

Reduce overgrinding, improve overall recovery, and reduce the impact of feed grade fluctuations with our solution for flash flotation.



Metso Outotec SkimAir® is a flotation cell designed to be installed in a flash flotation role in the grinding circuit. The cell is typically installed in the hydrocyclone underflow stream to capture any sufficiently liberated, fast floating particles that may have reported there. Due to the higher specific gravity of sulfide and precious metal containing minerals, there is a strong likelihood that they will report to the hydrocyclone underflow stream despite being in a suitable size range for flotation. Recovering these particles from the circulating load prevents them from reporting back to the mill and being overground.

Excess grinding of these particles can result in slimes that are difficult to recover in downstream flotation circuits. Recovering these particles from the circulating load can boost overall plant recovery, improve mill capacity, and also lead to improved concentrate dewatering characteristics. Employing flash flotation in the circulating load has also been shown to stabilize the flotation feed grade to the main circuit.

Tough flotation duty handled by smart technology

Since Metso Outotec first implemented SkimAir technology in the 1980s, continuous technological improvement has made it the world's leading flash flotation technology. Not only has the SkimAir cell improved in wear technology to meet the demands for a flotation cell operating in the grinding circuit, but a number of design concepts have made it flexible enough to suit differing ore types and plants. The top-outlet design allows SkimAir technology to be employed with minimum impact on the water balance in the grinding circuit. Configuration options such as flash roughing have allowed it to be used in circuits where recovery from the cell is paramount, while not compromising on concentrate grade.

Benefits

- Reduced overgrinding
- Improved overall recovery
- Smooths out feed grade fluctuations
- Increased mill throughput
- Improved dewatering

CASE

Project

Didipio, Philippines

Application

Copper and gold

Challenge

To improve copper and gold recovery

Solution

SkimAir 500 cell

Benefits

- 8.8% increase in gold recovery
- 12.6% improvement in copper recovery

Metso Outotec Concorde Cell™ – Recover the unachievable ore value

Set a new benchmark in high intensity pneumatic flotation by recovering unachievable fine and ultra-fine particles. This results in significant revenue gains as well as minimizes plant operating costs, energy and water consumption per metal production targets.

The need to process more finely disseminated and complex ore grades, as well as declining ore grades and the demand for improved flotation selectivity, all bring new challenges to minerals processing flowsheets. The Metso Outotec Concorde Cell technology helps flotation circuits overcome these challenges and achieve improved efficiency in fine and ultra-fine particle recovery.

Concorde Cell™ is an ideal flotation solution due to:

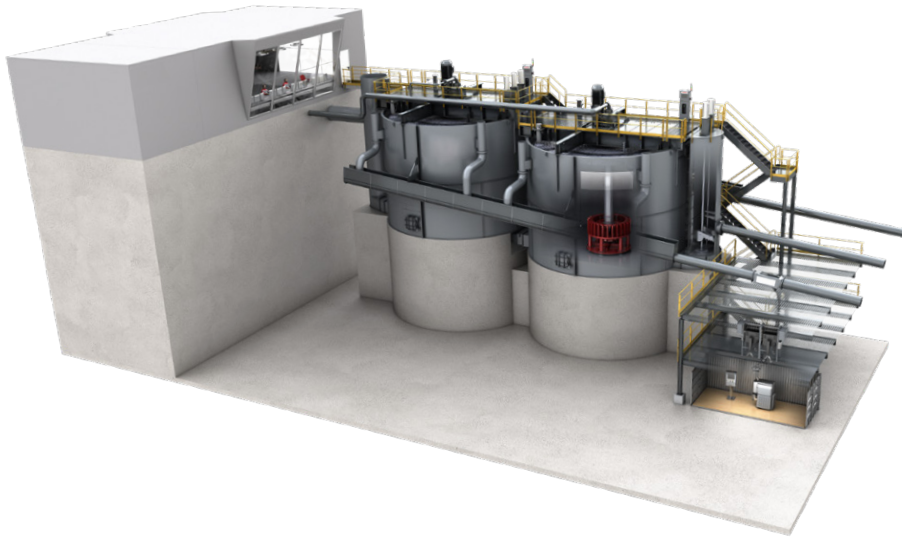
- Superior recovery: faster kinetics, improved fine and ultra-fine particle recovery, optimized froth recovery and selectivity
- Innovative technology: Pre-aerated slurry raised to supersonic velocities and exposed to high local energy dissipation for increased bubble particle collection
- Planet positive: The Concorde technology enables efficient use of earth's resources with increased recovery of fines and smaller plant footprint.

Concorde Blast Tube™ upgrade

- An upgrade that improves and optimizes metallurgical performance
- In-depth selection, engineering and installation of the upgrade package
- Better process control and stability allows optimization due to addition of forced air
- Enhanced metallurgical performance
- Optimize your flotation footprint



Automation solutions to stabilize and improve process performance



Whatever level of automation you require, Metso Outotec has the optimal solution for your plant. Automation facilitates easy scalability, starting from a basic non-automated process to advanced process controls that work independently to improve and maintain peak performance.

Without automation

- Unstable process
- Fluctuations in end-product quality and process performance
- Inconsistent operating practices between shifts
- Inability to react quickly to process disturbances
- Labor-intensive monitoring and reporting

With basic process controls

- Stable process
- Early detection of process disturbances enables timely response
- Up-to-date process performance data available 24/7
- Process data history systematically stored
- Operators have more time to focus on core tasks
- Reduced risk of human error

With advanced process controls

- A significant improvement in process performance
- Process performance optimized 24/7
- No performance variation between shifts
- Ability to react quickly to ore and other input changes
- Automatic reporting
- Remote troubleshooting and support from Metso Outotec specialists

In order to maintain profitability in the face of challenging commodity prices, it is imperative to improve the efficiency of your existing assets. This means ensuring smooth plant operation, developing a flexible process that can cope with ore changes, maintaining equipment reliability, and minimizing start-up losses. Furthermore, high personnel turnover can make it challenging to retain core skills and competencies. You may also face challenges with the high cost of consumables and the increasing demand for more comprehensive production reports.

Effective, automated, and integrated control can help you solve all of these challenges, while also minimizing the risk of production disturbances and downtime, and supporting compliance with strict health, safety, and environmental standards.

Our proven automation solutions cover virtually every type of flotation and will improve both the efficiency and profitability of your plant. They will ensure that your equipment performs reliably, help reduce variations in end-product quality, and reduce the consumption of additive agents and chemicals.

The Metso Outotec automation portfolio

Metso Outotec LevelSense™

Accurate and robust online slurry level measurement for a stable flotation process, early reaction to, or prevention of, froth collapses, and minimized operational costs.

Metso Outotec FrothSense™

Measures several essential properties of froth appearance to provide consistent information 24 hours a day for process control and optimization.

Metso Outotec Courier® on-line elemental analyzers

Quick, accurate assaying enables immediate reaction to changes in the metallurgical behavior of the flotation circuit.

Metso Outotec PSI® Particle Size Analyzers

Real-time particle size information improves average grinding circuit capacity and availability.

Metso Outotec sampling solutions

With over 50 years of experience in sampling,

Metso Outotec has an extensive range of slurry samplers for practically all applications.

Advanced Control Tools (Metso Outotec ACT)

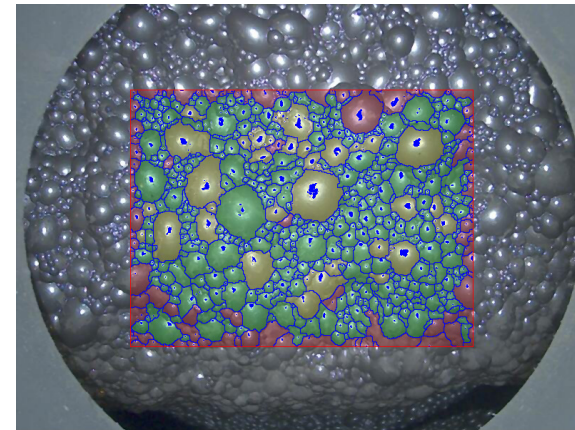
Metso Outotec ACT advanced process control provides a platform for building customized control applications. For the flotation process, these include ACT froth speed control, EXACT level control, and grade-recovery control solutions.

Metso Outotec Proscon® Automation System

Our advanced process control tool helps you to better control the overall process and monitor and adapt to changes.

Metso Outotec Chena® Chemistry Navigator

Patented technology visualizes process measurements and chemistry to improve the efficiency of production processes.



FrothSense camera image, with bubble size analysis.

CASE Project

Kevitsa mine, Finland

Application

Multi metal

Challenge

A large-scale flotation plant (including 14 300 m³ cells) with a highly variable feed in terms of ore grade, hardness, and content.

Solution

Metso Outotec advanced process control with Courier, PSI, FrothSense, as well as ACT froth speed control, EXACT level control, and grade-recovery control, customized to the site's needs.

Benefits

- 1.3% Cu recovery improvement with higher grade when APC was utilized during test work
- Increased process stability

Services and solutions that boost your performance and productivity

Maintaining the efficiency of your operations and protecting your profitability with the right technology is critical to staying ahead of the competition. As your service partner, Metso Outotec ensures that every solution has the maximum impact on performance and productivity throughout your flotation plant's entire life cycle.

We are committed to understanding the unique business needs of your flotation operation. We collaborate with you to develop a safe, sustainable, and reliable service solution based on our deep process knowledge, leading technologies, and operational and maintenance expertise.

Full service portfolio

Our extensive service portfolio and customized solutions cover all phases of your flotation plant's life cycle — from maintenance inspections and spare parts to modernization and upgrades. Your tailored performance solution will be delivered with mutually agreed targets and shared responsibilities to meet your long-term goals. We can build solutions for individual projects or ones based on broader service agreements.

Metso Outotec services

- Spare and wear parts
- Maintenance, shutdowns and repairs
- Modernizations, upgrades and retrofits
- Process optimization and connected services
- Life cycle services
- Training services

Benefits

- Improved health and safety
- Improved environmental efficiency
- Improved equipment and process efficiency
- Decreased operating cost
- Improved capital efficiency

We can upgrade your existing flotation technology or retrofit other manufacturer flotation cells with solutions that provide measurable value.

See what the benefits of a FloatForce upgrade can be to your flotation process.

FloatForce value calculator:

<https://browserapps.mogroup.com/FloatForce/index.html>

See the possible benefits of a flotation cell replacement to your flotation process, both economically and environmentally.

Flotation cell replacement calculator:

<https://browserapps.mogroup.com/FlotationCell/index.html>

Service highlights for Metso Outotec flotation processes

Advisory services

Prioritize the most cost-efficient ways to improve safety, reliability, availability, and productivity based on in-depth information from equipment inspections, studies, audits, and assessments conducted by Metso Outotec experts.

For example, an Metso Outotec Maintenance Inspection provides detailed information of flotation cells' current condition and helps to identify possible issues early, minimizing unwanted downtime. The Inspection report summarizes the status of the equipment as well as upcoming service needs and gives recommendations for their maintenance and operation.

Spare and wear parts

Enjoy peace of mind with our high-quality spares that ensure the safety and functionality of your equipment. High-quality spare and wear parts are available for all our flotation technologies.

To optimize availability and response times, we have developed an electronic spare parts catalog. Our eCatalogue offers one-stop access to customized spare parts data and helps to identify equipment spare parts or solutions, with illustrations for assemblies and

related parts.

With customized solutions, we can facilitate your maintenance planning and budgeting, help you improve equipment reliability and availability, and optimize spare and wear parts consumption and costs.

Upgrades

Restore and enhance your operational performance with our comprehensive portfolio of equipment upgrades and technology modernizations. These can include:

- FloatForce upgrade
- Flotation cell replacement
- Flotation cell retrofit
- Air control upgrade
- Level control upgrade
- Froth management upgrade
- Drive unit upgrade
- Service platform upgrade

Maintenance services

Keep your plant in perfect working order and plan for the future with confidence with our comprehensive range of maintenance services. Our services range from basic equipment upkeep to full maintenance management and shutdown services.

CASE

Project

Yamana Gold, Brazil

Application

Gold and copper

Challenge

The flotation circuit had poor availability due to heavy sanding, and poor performance in terms of copper and gold recovery. Substantial maintenance was needed due to heavy corrosion but limited shutdown time was available.

Solution

- In-depth metallurgical assessment identified large improvement potential in the flotation plant
- Retrofit of 2 lines of 5 160 m³ flotation cells with 2 lines of 5 TankCell 160s
- A full turn-key delivery: shutdown planning, scheduling and management, and manufacturing of steel works in Metso Outotec Brazil's own service center
- Advanced operator training with Metso Outotec's Virtual Experience

Benefits

- Greater stability and control of flotation cells for increased process optimization
- Decreased energy consumption with Metso Outotec cells (40%)
- Minimized production losses during installation and commissioning
- Minimized sanding increases flotation circuit availability, leading to increase in production
- Improved flotation performance, in terms of copper and gold recovery

