Metso systems
Technology at work for you
Features and capabilities

Metso brings an unbeatable combination of innovative sustainable technology and a dependable global service network.
Contents

• Metso introduction
• Systems capabilities
• Systems experience
• Life cycle services
• Services business line
• Conclusion
Metso Corporation

Metso is a worldwide recognized supplier of sustainable technology and services for the mining and construction, power generation, oil and gas, recycling, as well as pulp and paper industries.

28,000 employees in over 50 countries

5.5 billion euros 2010 net sales

Shares listed on NASDAQ OMX Helsinki Ltd
Worldwide sustainable technology and services

Metso Mining and Construction

Crushing and screening equipment business line
- Jaw crushers
- Cone crushers
- Impact crushers
- Screens, feeders, and scalpers
- Track mounted mobile crushers and screens
- Wheel mounted crushers and screens
- Equipment and plant automation

Minerals processing solutions business line
- Mining crushers
- Mining screens
- Grinding mills
- Process equipment
- Bulk material handling
- Pyro processing
- Systems
- Technology development
- Equipment and plant automation

Services business line
- Wear and spare parts
- Engineered-to-order (ETO) parts
- Repairs
- Life cycle services
- Process technology and innovation
- Materials technology
- Pumps
Metso MCT history – where we came from
Metso systems

Introduction
Metso systems

Introduction

Metso has built a solid foundation on:
• Globally recognized machinery
• Advanced process technology
• Increased availability and optimization
• Dependable equipment and parts
• Exceptional service response
• Environmental responsibility
• Personnel safety
Close to you.
Wherever you need us.

Approximately 9,600 total MCT Staff Worldwide

© Metso
### Metso product and service capabilities

<table>
<thead>
<tr>
<th>Category</th>
<th>Services</th>
</tr>
</thead>
</table>
| **Comminution**           | • Crushing  
• Screening  
• Grinding  
• Metso VERTIMILL® and SMD                                             |
| **Process equipment**     | • Flotation  
• Classification  
• Magnetic separation  
• Sedimentation, dewatering  
• Filtration                                                        |
| **Pyro processing**       | • Calcining, roasting, drying  
• Incineration  
• Rotary kilns  
• Fluid beds                                                           |
| **Bulk materials handling** | • Stockyard equipment  
• Car dumpers  
• Conveying  
• Feeding systems                                                      |
| **Wear protection**       | • Rubber  
• Polyurethane  
• Ceramics  
• Combination of wear materials                                         |
| **Process technology**    | • Process optimization  
• Process control solutions  
• Smart equipment and controls  
• Process design and equipment sizing                                 |
| **Life cycle services**   | • Increased availability  
• Maintenance contracts  
• Optimized service costs  
• Metso knowledge-base                                                  |
| **Automation**            | • PLC control systems  
• OCS controls  
• Smart controls  
• Instrumentation                                                        |
Metso systems capabilities
Scope of work
Systems Philosophy

Targets

• Maximum recovery and grade
• High plant availability
• Greater energy efficiency
• Less engineering hours
• Integrated equipment optimization
• Designed for easier maintenance
• Minimize ramp-up and project execution time
• Safety during project execution and operation
Typical collaborative model

Client project team

<table>
<thead>
<tr>
<th>Metso</th>
<th>Engineer</th>
<th>Local contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Process design</td>
<td>• Detailed engineering</td>
<td>• Local engineering</td>
</tr>
<tr>
<td>• Basic engineering</td>
<td>• Local supply</td>
<td>• Earth works</td>
</tr>
<tr>
<td>• Process guarantee</td>
<td>• Spec./RFQ all non-Metso equipment</td>
<td>• Concrete</td>
</tr>
<tr>
<td>• Equipment engineering</td>
<td>• Construction management</td>
<td>• Buildings</td>
</tr>
<tr>
<td>• Critical equipment supply</td>
<td>• Site services</td>
<td>• Structural steel</td>
</tr>
<tr>
<td>• Site supervision</td>
<td>• Training</td>
<td>• Infrastructure</td>
</tr>
<tr>
<td>• Training</td>
<td>• Overall project management</td>
<td>• Construction</td>
</tr>
<tr>
<td>• Commissioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Service contracts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Metso at the design stage

Capabilities

• Greenfield study
  - Rock characterization, domain definition, and drill and blast design for optimum downstream process performance

• Evaluation of circuit alternatives and design
  - Use of advanced mathematical models and simulation tools
  - Evaluation of alternatives with lower operational and capital costs

• Laboratory services
  - In-house comminution and wet process laboratories, including university associations

• Liner design and alloy application
  - Based on the ore characterization and process design

• Advanced process controls
  - Integration of Expert System, OCS, image analysis modules, VisioFroth™, and VisioRock™ to optimize plant control
Process integration and optimization

Tools

- Ore characterization/domain definition
- Mathematics/models/simulations/JKSimMet
- SmartTag™
- Drill and blast simulations
- System modeling and simulation

VisioRock™

Image analysis
Project execution

Overview

• Engineering review – basic engineering contract
  - Review of test report – possible additional test work
  - Finalize PFS and massbalance – process guarantees
  - Preliminary plant layout and equipment sizing
  - Finalize battery limits and equipment list

• Finalize and agree on scope and contract model

• Prepare firm proposal and pricing

• Assign the Metso project team

• Project kick-off meeting

• Prepare detailed project execution program of works

• Prepare project coordination procedure

• Production QA/QC- Metso and non-Metso equipment

• Project schedule and cost control

Concentrator scope listing
Example

Project time schedule
Example
Metso project equipment supply

- Crushers
- Feeders
- Screens
- Grinding mills
- Flotation
- Pressure filters
- Pyro processing
- Slurry pumps
- Car dumpers
- Stockyard equipment
## Example battery limits

<table>
<thead>
<tr>
<th>Spec</th>
<th>Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start – equipment</td>
<td>Primary crusher feed arrangement</td>
</tr>
<tr>
<td>End – equipment tailings</td>
<td>Discharge flange tailings thickener</td>
</tr>
<tr>
<td>End – equipment conc</td>
<td>Concentrate stacker or shiploader as required</td>
</tr>
<tr>
<td>Start/end piping</td>
<td>0,5 m outside buildings for non-process, complete for process</td>
</tr>
<tr>
<td>Start electrical</td>
<td>Starts from the main substation, Metso to provide all internal transformers and connections</td>
</tr>
<tr>
<td>Grounding</td>
<td>One meter beyond the physical battery limits of the plant, as required</td>
</tr>
<tr>
<td>Utilities and service</td>
<td>0,5 m outside buildings for non-process, complete for process</td>
</tr>
</tbody>
</table>
Project organization

Example

- Single point of contact for client
  - Manages overall project schedule and costs
- Major equipment design and supply
- Process and equipment integration and optimization
- Site work, coordination with the EC contractor, and rapid start-up
- Support functions for non-Metso purchases and overall quality control

<table>
<thead>
<tr>
<th>Project director</th>
<th>Project manager comminution</th>
<th>Project manager process equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief design engineer</td>
<td>Chief process engineer</td>
<td></td>
</tr>
<tr>
<td>Site manager (installation, start up, and commissioning engineers)</td>
<td>Project manager process technology</td>
<td></td>
</tr>
<tr>
<td>Logistics and procurement team</td>
<td>QA/QC team</td>
<td></td>
</tr>
</tbody>
</table>
Metso at start-up and commissioning

Capabilities

• Supervision support
  - Mechanical, electrical, and automation support

• Process support
  - Use of advanced mathematical models, simulation, and control expertise to achieve and maintain optimum process performance

• Spare and wears
  - Worldwide availability for spare and wear parts
  - Consignment and local repair facilities are possible, depending on the size of the project

• Maintenance plan
  - Standard maintenance procedure for all equipment

• Training (offered in local language)
  - Operators and engineers training: computer based training (CBT), crushing, grinding, and flotation operation
  - Maintenance and operation training

• Accelerated Startup
  - Combination of process knowledge, skilled site managers, and integrated design results in shorter time to full production,
Major systems experience
Copper concentrators

• Metso scope
  - Pilot and lab scale test work
  - Process design
  - Equipment basic and detailed engineering
  - Equipment supply
  - Site installation advisory services
  - Commissioning and start-up supervision
  - Training

• Client scope
  - Site work
  - Civils, buildings, and infrastructure
  - Detailed engineering for civils and structures
  - Equipment installation
Major projects experience

Systems contract experience

• Diamond project in Russia
  - Approximate contract value: 50 million USD
  - Basic and detailed engineering
  - Equipment supply, buildings, structural steel, and piping
  - Electrical, instrumentation, and control supply
  - Installation and commissioning support

• Iron ore project in the Middle East
  - Approximate contract value: 40 million USD
  - Basic and detailed engineering
  - Equipment supply, structural steel, and piping
  - Electrical, instrumentation, and control supply
  - Installation and commissioning support
Major projects experience

Systems contract experience

• LKAB – concentration, flotation, dewatering, pelletizing, and installation
  - Approximate contract value: 120 million USD
  - Process basic design, including test work
  - Equipment basic and detailed engineering
  - Equipment supply and installation
  - Installation supervision
  - Commissioning and start-up supervision

• SCIP – hazardous waste incineration plant
  - Approximate contract value: 25 million USD
  - 60,000 tpa capacity mixed hazardous wastes
  - Process design
  - Complete supply from grade up
  - Installation, commissioning, and start-up supervision
Major projects experience

Not a system

• Sossego Copper Mine, Brazil-Vale
• Metso supply
  - PG 6089 plus apron feeder
  - Conveyor package and 3.6 km overland conveyor
  - 1 x SAG mill (38’ x 23’) 20 MW
  - 2 x Ball mills (22’ x 32’) 8.5 MW each
  - 2 x VTM 1500 regrind mills
  - 2 x MP800 pebble crushers
  - SAG discharge screens
  - 2 x VPA 1540-54 concentrate filters

• Two years of complete plant maintenance, including non-Metso equipment
• No process design or plant process guarantee of performance
# System references

## Recent projects

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>Type of ore</th>
<th>Type of process</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northland Resources</td>
<td>Sweden</td>
<td>Iron Ore</td>
<td>Crushing/Grinding/Flotation/Dewatering</td>
<td>2011</td>
</tr>
<tr>
<td>Nordic Mines</td>
<td>Finland</td>
<td>Gold</td>
<td>Crushing/Flotation/Dewatering</td>
<td>2010</td>
</tr>
<tr>
<td>Bhushan</td>
<td>India</td>
<td>Iron Ore</td>
<td>Grinding/Dewatering</td>
<td>2010</td>
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<tr>
<td>Nesko</td>
<td>Albania</td>
<td></td>
<td>Crushing/Grinding/Flotation</td>
<td>2010</td>
</tr>
<tr>
<td>Boliden Garpenberg</td>
<td>Sweden</td>
<td>Copper</td>
<td>Grinding/Flotation</td>
<td>2010</td>
</tr>
<tr>
<td>Pampalo</td>
<td>Finland</td>
<td>Gold</td>
<td>Grinding/Flotation/Dewatering</td>
<td>2009</td>
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<td>Tapojärvi</td>
<td>Finland</td>
<td>Copper</td>
<td>Dewatering</td>
<td>2009</td>
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<tr>
<td>CP Mining</td>
<td>Australia</td>
<td>Iron Ore</td>
<td>Grinding/Flotation/Dewatering</td>
<td>2008</td>
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<tr>
<td>Lundin Mining</td>
<td>Sweden</td>
<td>Copper</td>
<td></td>
<td>2008</td>
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<tr>
<td>ScanArc</td>
<td>Norway</td>
<td>ZnO-slurry</td>
<td>CC Lamella washing</td>
<td>2008</td>
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<tr>
<td>Kardjali, Gorubso</td>
<td>Bulgaria</td>
<td>Au + tailings from previous Cu/Pb/Zn op’s</td>
<td>CIL + DR, electrowinning and smelting Plant</td>
<td>2008</td>
</tr>
</tbody>
</table>
## System references

### Older projects

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>Type of ore</th>
<th>Type of process</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kolle Maaden</td>
<td>Middle East</td>
<td>Pb-Zn Ore</td>
<td>Flotation plant</td>
<td>1972</td>
</tr>
<tr>
<td>Felezate Yazd</td>
<td>Middle East</td>
<td>Pb-Zn Ore</td>
<td>Flotation plant</td>
<td>1972</td>
</tr>
<tr>
<td>Risbergsfältet</td>
<td>Sweden</td>
<td>Iron, Hematite-Magnetite</td>
<td>Magnetic and gravi-metric separation</td>
<td>1971</td>
</tr>
<tr>
<td>Falu Gruva</td>
<td>Sweden</td>
<td>Sulphide Ore Cu, Pb, Zn, S</td>
<td>Flotation plant</td>
<td>1970</td>
</tr>
<tr>
<td>Omico Mining</td>
<td>Philippines</td>
<td>Cu Ore</td>
<td>Flotation plant</td>
<td>1970</td>
</tr>
<tr>
<td>Bidjovagge</td>
<td>Norway</td>
<td>Sulphide Copper</td>
<td>Flotation plant</td>
<td>1969</td>
</tr>
<tr>
<td>Feng Huan Chan</td>
<td>China</td>
<td>Cu-Zn Ore</td>
<td>Flotation plant</td>
<td>1968</td>
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<tr>
<td>Trollhättans Krossprodukter</td>
<td>Sweden</td>
<td>Ferrochrome Slag</td>
<td>Sink-float</td>
<td>1968</td>
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<tr>
<td>New Zealand Steel Ltd</td>
<td>New Zealand</td>
<td>Beach Sand, Fe</td>
<td>Magnetic separation</td>
<td>1968</td>
</tr>
<tr>
<td>Tverrfjellet</td>
<td>Norway</td>
<td>Sulphide Ore Cu, Zn, S</td>
<td>Flotation plant</td>
<td>1967</td>
</tr>
</tbody>
</table>

### Additional references
Metso life cycle services

Large projects
Tesoro

Chile

• Reliability-centered maintenance contract based on KPI
• Started with the crusher plant
• Complete revision of maintenance plan
• More than 75 root cause failure analyses (RCFA)
• Availability increase from 91% to 92%
• MTBF from 26 hours to 37 hours
• MTTR from 0.89 hours to 0.82 hours
Escondida

Chile

• Reliability-centered maintenance contract based on KPI
• Started with the MP1000 and Symon 7' crushers
• Complete revision of maintenance plan
• More than 25 root cause failure analyses (RCFA)
• Availability from 78% to 93% (MP1000 pebble crushers)
• Availability from 91% to 93% (Symon 7' pebble crushers)
CVRD Sossego

Brazil

- CVRD – Serra do Sossego mine
- Located in Canaã dos Carajás, Pará State – comprising all mechanical preventive maintenance of the crushing, grinding, and processing plants
- Performance measurements were also included in the contract after the first year
- Approximately 160 Metso employees participated in the contract
Andina
Chile

• Includes plant maintenance services for Metso and third-party equipment, process technology services from mine to mill, wear parts replacement on crushers and grinding mills, parts supply, service tools, vehicles and labor

• Over 100 Metso employees participated in the contract

• Approximately EUR 13 million over 5 years

• Objective is to increase production by extending wear-life, decreasing downtime, and continuously improving the overall process from drill and blast, crushing, grinding and flotation
Maintenance service contracts (LCS)
Case study: Crusher maintenance and optimization

General information
• Mexicana de Cobre, Grupo Mexico
• 18 AC 84” Hydrocone crusher
• 3 MP800

Contract information
• 3 supervisors
• 10 maintenance technicians

Scope of work
• Preventive and corrective maintenance on 18 AC Hydrocone 84” crusher
• Liner optimization
• Consignment
• Replace sec. Hydrocone with MP800

Results
• 2007 baseline: 85,000 TPD
• After 1 year contract: 95,000 TPD
• Actual with 2 new MP800: 105,000 TPD
• Equipment availability increased from 77% to 90%
CVRD Sossego

Brazil

• Equipment
  - Primary 6089

• Problem
  - Much downtime and low wear life

• Note
  - All the rows of the sets 1 and 2 were made of Mn 610 that suffered strong expansion due to the hard rock of Sossego site
  - We offered the low alloy from the 3rd set, and then no expansion was observed
  - The wear life from the 3rd set was improved by higher hardness and profile design

<table>
<thead>
<tr>
<th>Item</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of concaves (units)</td>
<td>120</td>
<td>48</td>
</tr>
<tr>
<td>Downtime/liner change (hours)</td>
<td>120</td>
<td>36</td>
</tr>
<tr>
<td>Wear life (Tton)</td>
<td>2,000</td>
<td>4,300</td>
</tr>
</tbody>
</table>
Codelco Andina
Chile

• Equipment
  - SAG mill 36’ x 16'9"

• Product
  - Copper ore

• Problem
  - Customer was looking for an increased volume capacity

• Note
  - With Metso Polymet replacing the old steel liners, the capacity increased an estimated 3% due to better lifting capacity with new liner design

<table>
<thead>
<tr>
<th>Item</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks</td>
<td>Regular</td>
<td>Never</td>
</tr>
<tr>
<td>Wear life (weeks)</td>
<td>20-24</td>
<td>24</td>
</tr>
</tbody>
</table>
Minera Escondida
Chile

• Equipment
  - MP1000SH

• Position
  - Pebble Crusher

• Product
  - P80 – 12 mm

• Problem
  - Low capacity

• Note
  - Increased volumetric capacity and production with new profile. Is possible to decrease setting without ring jump

<table>
<thead>
<tr>
<th>Item</th>
<th>Previous Profile</th>
<th>Optimized Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (days)</td>
<td>90</td>
<td>Pending</td>
</tr>
<tr>
<td>Capacity (ton/hour)</td>
<td>380</td>
<td>600*</td>
</tr>
<tr>
<td>Product (P80, mm)</td>
<td>-12</td>
<td>-12</td>
</tr>
<tr>
<td>Setting (mm)</td>
<td>12-14</td>
<td>10-12</td>
</tr>
</tbody>
</table>

*Production reached peak of 800 ton/hour
Metso services business line

Services and benefits
Advanced technology

- Research and testing
- Process simulation
- High fidelity simulation
- Optimization software
- Plant optimization

Optimizing process using simulation software creates predictive flowcharts for crushing circuits.

Reliable crusher performance simulation enables crushing chamber and kinematics optimization.
## Metso services portfolio

<table>
<thead>
<tr>
<th>Services</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced technologies</td>
<td>Better process performance</td>
</tr>
<tr>
<td>Automation solutions</td>
<td>Improved productivity</td>
</tr>
<tr>
<td>Performance contracts</td>
<td>Maximum plant availability and reduced downtime</td>
</tr>
<tr>
<td>Spare and wear parts supply</td>
<td>Reliable equipment performance</td>
</tr>
<tr>
<td>Training</td>
<td>Effective preventive maintenance</td>
</tr>
<tr>
<td>Equipment refurbishing</td>
<td>Improved safety</td>
</tr>
<tr>
<td>Field services</td>
<td></td>
</tr>
<tr>
<td>Plant diagnostics and upgrades</td>
<td></td>
</tr>
</tbody>
</table>
Wear protection and spare parts

- Rubber
- Polyurethane
- Ceramics
- Combinations
- Mills, crushers, wear surfaces, etc.
- OEM parts for all Metso equipment
Life cycle services

• Routine service support
• Maintenance contracts
• Operation contracts
• $/t production contracts

Metso service personnel are trained and operate locally
Process technology

- Instrumentation
- Laboratory services
- Training
- Upgrading
- Optimization
- Blast design
Metso systems

Conclusion

With over a century of experience and a drive towards the future, Metso is committed to:

• Exceptional technological capability
• Sustainable performance
• Outstanding results
• Maximum return on investment
• Total customer satisfaction
Thank you