Outotec offers leading technology and life-cycle solutions for the production of high-quality alumina from bauxite and non-bauxite raw materials. Our integrated refinery concept features state-of-the-art process technology and proprietary equipment and is designed to minimize energy and raw material consumption, as well as overall environmental impact. Our highly modular and standardized solutions offer the ideal balance between customizability and cost effectiveness.

**BENEFITS**
- Integrated process design for greenfield and brownfield projects
- Easily customizable for your specific feedstock, capacity, environmental, and economic needs
- Optimized and sustainable process solutions
- Flexible delivery and implementation options, from modular solutions to Lump Sum Turnkey (LSTK) and EPC delivery
Our refinery concept has been developed through continuous R&D and covers the entire Bayer process, offering everything from pre-feasibility to EPC project implementation of process islands. We design a completely customized solution based on your specific needs that will minimize both upfront capital investment and lifetime operating costs. Our integrated refinery solutions are ideal for both greenfield projects and the expansion and optimization of existing brownfield operations.

**Integrated refinery concept**

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**Integrated process design approach**

- Combination of technologies tailored to suit your specific ore composition
- Optimal integration of all process islands and equipment
- Optimization of closed circuit based on in-depth understanding of the process

**Alumina refinery offering**

- Test work and concept studies for alumina characterization and project scoping
- Pre-feasibility studies
- Basic and detail engineering
- Project implementation
- Expansion and upgrade studies and implementation
Customized delivery solutions for alumina refineries

Based on a fully integrated refinery design to suit your specific requirements, we can deliver solutions for the following process steps in red-side, white-side, and ancillary areas:

- Bauxite enrichment
- Grinding
- Pre-desilication
- Digestion
- Sand separation and washing
- Red mud separation and washing
- Red mud treatment and disposal
- Security filtration
- Precipitation and hydrate classification
- Evaporation
- Organic control
- Aluminum trihydrate washing and filtration
- Calcination
- Alumina storage

Outotec’s integrated alumina refinery concept combines end-to-end, in-depth process know-how with state-of-the-art technologies and proprietary equipment.
Outotec’s solutions for the red-side areas in alumina refineries focus on maximizing the extraction and separation of aluminum trihydrate from bauxite in order to minimize raw material losses. We create tailor-made processes that perfectly meet the characteristics of your bauxite.

Our offering covers bauxite enrichment processes, open and closed grinding circuits, and desilication plant solutions. All are designed to improve aluminum extraction in the digestion plant by maximizing the performance of heat-transfer equipment and reducing erosion rates in piping.

We also offer complete solutions for settlers, washers, and filtration plants producing polished pregnant liquors. Our processes feature improved mud separation and high wash efficiency in order to maximize caustic recovery and ensure the highest quality end product.

**SOLUTIONS FOR RED-SIDE AREAS**

**Proven proprietary grinding solutions**

Our grinding portfolio includes semi-autogenous, autogenous, ball, and rod mills. By optimizing the grinding circuit arrangement, the amount of equipment can be kept to a minimum while ensuring the optimal particle size in the solid phase.

**Energy-efficient digestion plant solutions**

We offer a broad range of digestion solutions, including single-stream high-temperature tube digestion. This technology, delivered under the Hatch-Outotec unincorporated joint venture (HOT), is a highly energy-efficient method for treating boehmitic bauxites. We also offer split-stream and single-stream low-temperature digestion.
Proprietary equipment for thickener systems
Our portfolio features a wide range of thickener types, including conventional clarifiers, solids contact clarifiers, and lime saturators, as well as high-rate, high-compression, and paste thickeners. Outotec thickeners include innovative features such as auto-dilution systems, low-drag rake arms, and a robust control system. These can be implemented in settlers and washers, as well as slaked lime and oxalate plants.

Proprietary equipment for filtration
Outotec vertical pressure filters are suitable for fully automated security filtration of pregnant liquor, which enables the highest end-product quality with minimum manual intervention. We also offer filter presses for fully automated mud dewatering, which maximizes both solid content and the recovery of caustic.

Mud-treatment technologies
Our mud-treatment technologies use acid, carbon dioxide, or seawater to neutralize the caustic liquor contained in mud, helping you minimize the environmental impact of your mud disposal area.

Our mud-treatment technologies help you minimize the environmental impact of your mud disposal area.
SOLUTIONS FOR WHITE-SIDE AREAS

Our solutions for white-side areas in alumina refineries focus on maximizing the recovery of aluminum trihydrate and its conversion into aluminum trioxide. Our portfolio comprises solutions for:

• Aluminum trihydrate precipitation
• Hydrate classification
• Organics control
• Aluminum trihydrate washing and filtration
• Alumina calcination

Precipitation and hydrate classification
Outotec’s precipitation and classification circuits cater for a wide range of liquor impurities. They are designed to maximize precipitation productivity while maintaining hydrate grain size and strength.

Organics control
Outotec screens and applies appropriate solutions to deal with organics using proven technologies such as wet oxidation, oxalate co-precipitation, and side-stream oxalate crystallization.

Washing and filtration
Our complete solutions for hydrate washing and filtration systems combined with calcination are based on the best available technology. They are designed to reduce moisture, maximize caustic recovery, and improve end-product purity.

CALCINATION

Outotec alumina calcination plants are based on Circulating Fluid Bed (CFB) technology, which we introduced to the alumina industry in 1970. Since then we have installed more than 60 calciners worldwide.

Our innovative technologies are renowned for their low energy consumption and excellent performance. The benefits of our CFB calcination technology include:

• Extremely stable operation
• Very low pollution levels
• Low energy consumption
• Small footprint
• High plant flexibility in terms of partial load and overload behavior

The Outotec Circocal® process further improves energy efficiency in calcination plants by allowing more efficient recovery of waste heat compared to a standard plant design.
SOLUTIONS FOR ALUMINA PRODUCTION FROM LOW-GRADE BAUXITE AND NON-BAUXITIC MATERIALS

Through extensive research and development, we have developed expertise in non-Bayer process routes for the production of smelter-grade alumina or for specialist applications such as the production of high-purity alumina. In addition to low-grade bauxite, other non-bauxitic raw materials may prove to be sources of chemical, special grade, or smelter-grade alumina, including:

- Clay
- Nepheline
- Alunite
- Feldspar

These types of raw material require alternatives to the Bayer process route, such as:

- Acid-based processes (hydrochloric and sulfuric or sulfurous based routes)
- Lime-based sintering and complex alumino-silicate processing
- Alunite roast reduction using a modified Bayer process

Our offering for low-grade bauxite and non-bauxitic ores covers the following:

- Sintering, roasting, grinding, leaching, and calcination test work and concept studies
- Pre-feasibility studies
- Basic and detail engineering
- Project implementation

Demonstration plant for aluminium chloride decomposition in L’Estaque, France.

We have developed expertise in non-Bayer process routes for the production of smelter-grade alumina as well as specialist applications such as the production of high-purity alumina.
OUTOTEC SERVICES FOR ALUMINA REFINERIES

When you choose Outotec as your partner in alumina solutions you are partnering with an organization that is committed to understanding the precise needs of your business. We collaborate closely with you to develop a safe, sustainable, and reliable service solution based on our world-class technologies and process, operation, and maintenance expertise.

We create your customized service solution by first assessing and benchmarking your current situation. Then we design precisely the right bundle of services to achieve a step change in your process performance, ensuring integrated delivery and execution, followed by monitoring and verification of the results.

Our comprehensive services portfolio
The individual services that make up our portfolio can be combined into a customized solution to meet your precise requirements and asset needs.

Outotec Services
- Advisory Services
- Maintenance Services
- Operations Services
- Remote Services
- Spares and Wears
- Training Services
- Upgrades

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