

**ISAKIDD™ cathode
plates and handling
equipment deliver the
best fit for purpose in
the real world.**

ISAKIDD™

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The ISAKIDD™ range of plates and handling equipment create the best fit-for-purpose in real-world copper electro-winning and electro-refining. Long the benchmark in the industry, ISAKIDD™ accounts for over 13.6 mtpa of copper production from over 116 licensees world wide, including Glencore's own operations. We provide clients with a comprehensive range of technology, process support and core equipment to ensure long term operational and economic success.

» Quality Technology and Continuous Development

ISAKIDD™ Technology is focused on delivering quality products and services to its customers whilst continuously working on technical innovations and developments to address the ever changing needs of the market. We have successfully maintained ISO accreditation since 1993 ensuring the integration of quality management principals into all aspects of our business.

Since development and commercialisation in the early 1980s, both ISA and KIDD technologies have undergone continuous improvement and today are regarded as the benchmark technologies for high intensity copper electro-refining and electro-winning operations.

Significant advancements have been achieved with both the stainless steel cathode technology and the electrode handling equipment used in copper tankhouses.

Important to our success is our close co-operation with a number of smaller technology companies to enhance the overall package solution offered. ISAKIDD™ Technology works together with these companies to continually develop all aspects of the technology ensuring our customers have the latest products on the market.

» ISAKIDD™ History

- 1978:** First stainless steel permanent cathode plate technology, Isa Process™ developed by MIM in Townsville Australia
- 1980:** Commercialisation Isa Process™
- 1985:** KIDD Process developed at Kidd Creek Refinery Canada
- 1992:** Commercialisation Kidd Process
- 2003:** Xstrata purchases MIM
- 2006:** Xstrata purchases Falconbridge – Isa Process™ and Kidd Process form backbone of ISAKIDD™ Technology
- 2013:** Glencore purchases Xstrata



Above: Glencore Technology is at the forefront of continuous development in copper ER and EW plants including electrode handling equipment and permanent cathode designs to ensure high productivity and high quality copper production.

Cathode Plates

Glencore Technology developed the first stainless steel production cathode in the late 1970s and has over 30 years experience in cathode plate development, design and manufacture. We are committed to continually improving our offerings to address customer needs. This has led to the development of different cathode types such as the HP, Isa Cathode BR™ and the Duplex Cathode.

» Hanger Bar Design

ISAKIDD™ Cathode

The patented ISAKIDD™ Cathode features a copper core fully enveloped with stainless steel, giving exceptional strength and corrosion resistance. Specifically designed for aggressive conditions found in electro-winning plants, this plate is equally suited to electro-refining. The copper core is exposed at each end to form the electrical contacts and a specially developed non-corroding 'seal-weld' joins the copper core to the stainless steel tube preventing ingress of electrolyte into the bar. The hanger bar can be retrofitted to existing blades as a replacement for any traditional design hanger bar. An affixed or welded copper contact on the top of the bar also allows it to be used with shorting frames in EW plants.

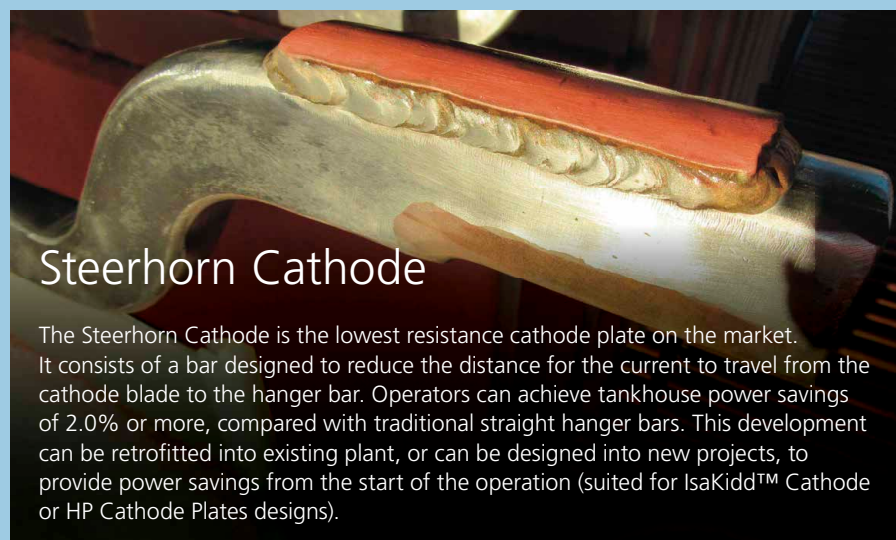
HP Cathode Plate – High Corrosion Resistance

Suited for high corrosion environments, such as liberator cells in electro-refineries and high corrosion electro-winning plants, the HP Cathode is favoured by operators seeking long cathode life in harsh environments.

The plate features a stainless steel jacket that encapsulates the solid copper head bar, protecting it from corrosion. A specially formulated corrosion resistant resin, protects the conductive interior weld between the head bar and the cathode blade throughout the interior of the jacket preventing ingress of electrolyte into the conductive interior weld.

ISA Cathode Plate

The traditional Isa Cathode features a stainless steel structural core electro-plated with high conductivity copper around the bar and partially down the blade. In the ISA Cathode BR™ Plate this copper plating is applied to the thickness and depth required by customers, with commensurate improvements in electrical conductivity of the plate.



Steerhorn Cathode

The Steerhorn Cathode is the lowest resistance cathode plate on the market. It consists of a bar designed to reduce the distance for the current to travel from the cathode blade to the hanger bar. Operators can achieve tankhouse power savings of 2.0% or more, compared with traditional straight hanger bars. This development can be retrofitted into existing plant, or can be designed into new projects, to provide power savings from the start of the operation (suited for IsaKidd™ Cathode or HP Cathode Plates designs).

Cathode Plates Fit for Purpose – Low Capex or Low Opex

Duplex Cathode

Duplex plates have been used since 2006 with over 370,000 plates ordered. Their superior mechanical properties allows for a thinner plate design and provides a high level of flexibility and reliability in the cathode stripping operation, without permanent deformation to the blade, and has demonstrated improved corrosion resistance in operation.

The patented Duplex Stainless Steel cathode design has a unique surface finish to enhance stripping performance, with successful operation in EW and ER tankhouses.

316L (GT Brand)

Supplied to our exclusive specification by the Nyby mill in Sweden, this material has superior strength and flatness to standard grade 316L. With a 30 year track-record, this material provides long life and reliable performance. Operators in copper electro-refining operations can achieve 15 years or more operation with properly maintained plates.

Standard 316L Plates

Aside from our premium brand steel we also offer industry standard 316L plates. Proven over many years of operation, these plates will meet the basic requirements of many operations. They are supplied to the same flatness as our Premium plates without the superior strength of our premium grade 316L or Duplex cathodes. They are an affordable option for operators looking to minimise capex. GT will work with its clients to find the most suitable and economic steel type for each operation.

Guarantee

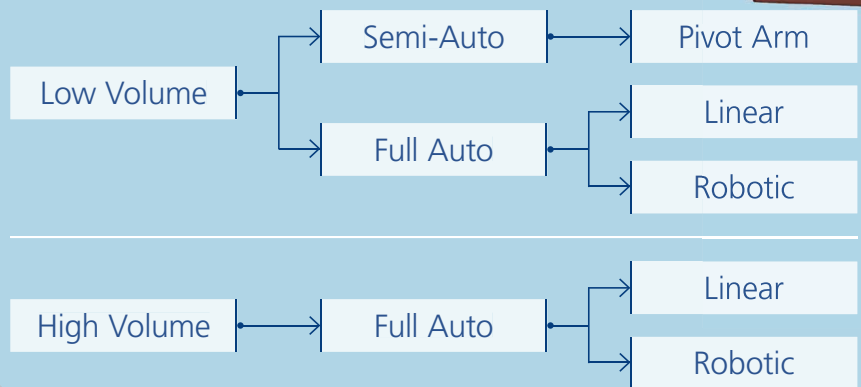
All our plates are guaranteed to meet strict specifications on flatness, verticality and dimensional tolerances for both blades and hanger bars.

Electrode Handling Equipment

Glencore Technology has a long history of developing and providing a wide range of Electrode Handling Equipment, suitable for all types of cathode plates.



Cathode Stripping Machine Types



From Robotic High Volume to Semi-Auto Low Volume Copper Electrode Handling

ISAKIDD™ offers electrode handling machines for all volumes of cathode handling. This means you secure fit for purpose and value.

ISAKIDD™ was first to use robotics for electrode handling in tankhouses, greatly improving efficiencies, while improving handling practices. The same technology was adapted for copper stripping operations in electro-winning and electro-refining, successfully stripping cathodes using robotics.

ISAKIDD™ engineers realised that to increase stripping rates with existing technologies meant designing the process for the 'rare' problematic cathode, which posed a stripping limitation with

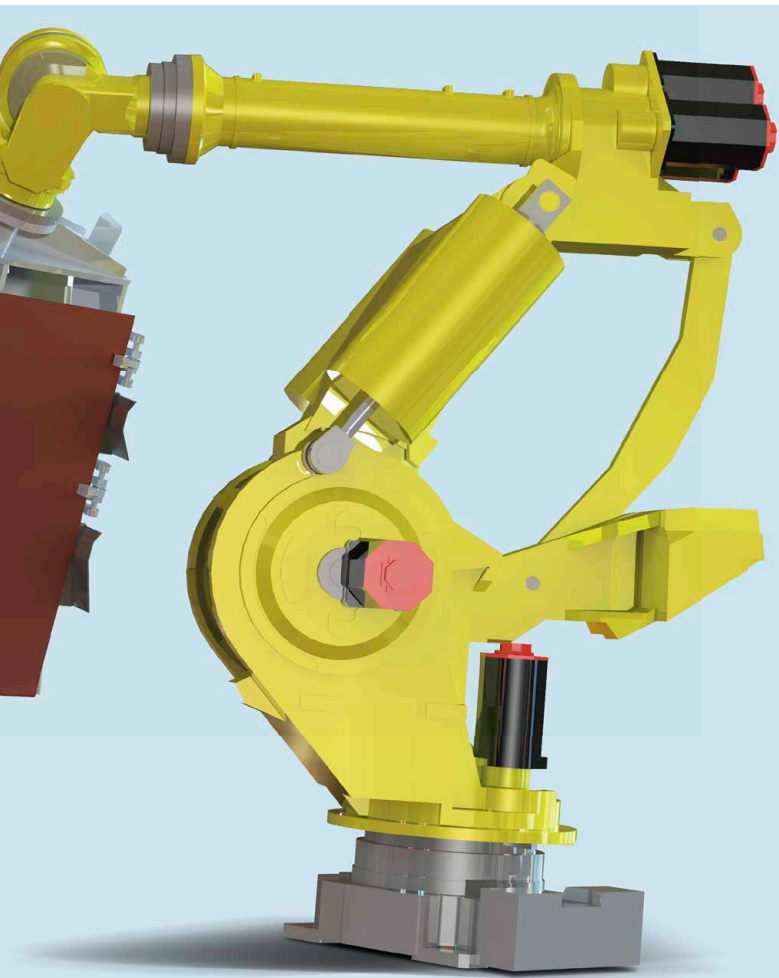
mechanical stripping machines. However with the development of the robotic stripping machines, they can overcome this limitation, as they can be programmed to accommodate the many and varied forms of copper cathode that can be produced in tankhouse operations. ISAKIDD™ engineers have further optimised the stripping process with proprietary stripping mechanisms, enabling high speed, successful stripping operations.

Our semi-automatic cathode stripping machine forms processes automatically and manually under hydraulic, pneumatic and electrical control systems. Receiving, washing, pivot transferring, flexing and chiselling, stacking, discharging and rejection are all provided.

“After years of development, ISAKIDD™ offers manual and robotic stripping concepts – suitable for the smallest to the largest operations.”

» Equipment and technology available:

- » Cathode stripping machines (CSM) both single sheet (up to 600 plates per hour) and enveloped/taco style (up to 700 plates per hour)
- » Anode preparation machines
- » Anode scrap washing machines
- » Tankhouse cranes
- » Tankhouse management system



Robotic Stripping Machine

The robotic stripping machine is based on the learnings of over 30 years of copper refining and winning technology. It still uses flexing rams, to release the copper deposits from the stainless steel cathode, as well as a 'pre-opening' device to ensure separation at the top of the copper and the mother blank.

The robotic stripping function is performed by robots fitted with a proprietary wedge tool at the end of the robot arm. The wedge tool has been designed to slide between the copper deposit and the mother blank to prevent scratching of the stainless steel mother plate, and then 'down ends' the copper to produce either individual or envelope copper sheets. This approach greatly improves splitting and separation with minimal deformation of copper sheets, even where lamination has occurred and with no impact on the stainless steel.

The robotic stripping function can successfully strip poorly grown cathode copper that cannot be handled by conventional machines. Efficient and reliable, the robust stripping technology and can be designed for low and high capacity automatic operation, across a wide range of cathode types.

Guarantee

All our robotic and semi-automatic machines are guaranteed for 12 months. Fabrication and functionality are secured. Performance testing is made and handover is not considered complete until the machine is performing as we promised.

Robotic Cathode Stripping Machine

- › Suitable for enveloped/taco cathodes and split sheets
- › Less maintenance
- › Less operator input when stripping poorly grown cathodes



Above: Robotic stripping at Nikkelverk refinery.

“Robotic Stripping Machines are fully automated and designed to operate continuously without manual interaction.”

Process Design

ISAKIDD™ Technology teams provide complete engineering for a project from the initial concept study right through to commissioning and start up services. Highly experienced engineers and technologists provide the latest designs for clients, based on over 100 installations, over the last 30 years.

» Our services include:

Engineering Design for Electro-Refining and Electro-Winning Tankhouses

- » concept
- » pre-feasibility
- » feasibility
- » bankable feasibility
- » basic engineering

Detailed Engineering Review

- » layouts and material handling designs
- » process and tonnage guarantees
- » equipment warranties
- » flowsheet development
- » impurities treatment

Plant Optimisation

- » technical audits
- » electrode handling optimisation
- » process optimisation studies
- » process troubleshooting
- » metallurgical consulting

Commissioning and Start-up Services

- » technical and operational training
- » oversight of core equipment installation
- » start-up assistance covering operational and technical issues
- » spare parts supply
- » technical and engineering reference and backup
- » exchange of know-how and experience with other ISAKIDD™ operators



» Process Design



» Plant Optimisation



» Commissioning and Startup Services

Technology Partnership

ISAkIDD™ technology is used extensively in some of the world's biggest Electro-Refining and Electro-Winning operations. The technology was initially developed at Glencore operations, and further developed to address individual client site needs.



*ISAkIDD™ Licensees
Conferences facilitate
learning between clients*

» More than a machine

The ISAkIDD™ Technology package is more than just a cathode plate or stripping machine, but rather a technology solution encompassing all aspects of design and operation to ensure a highly efficient and functional copper refining operation.

Technology Partnership Concept

Our Technology Partnership concept is an approach that makes a wide body of knowledge and experience available, resulting in clients achieving the full benefits of ISAkIDD™ Technology.

Glencore Technology prides itself with an ongoing technical relationship with users. We facilitate interchange and learning between clients. Glencore operations provide a core reference base for ISAkIDD™ and clients.

The strong operational foundation of ISAkIDD™ ensures rapid technology transfer to your operation.

Licensees are invited to participate in regular ISAkIDD™ conferences where latest developments are presented and technical and operational issues discussed.



Commissioning Kazzinc Copper Refinery, Kazakhstan

“We facilitate interchange and learning between clients.”



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