



ABB Equipment at Rio Tinto Kitimat smelter substation

The power of electricity

Worldwide, ABB is involved in major power or industrial projects where energy is involved. The company is a respected reference in the supply of technology solutions to more than one hundred aluminium smelters all over the world. This article looks at new electrification technology for aluminium smelters.

By **Ghislain Gonthier***

Aluminium current market conditions are presenting challenges and most smelters are adopting strategies of either securing their assets to reduce operational risk or attempting to maximise the most efficiency out of existing assets. China is currently forecast to engage in building new production capacity, whereas the rest of the world producers are either curtailing production or creating solutions to increase output of existing assets.

Different solutions are currently being implemented in Canadian smelter operations and ABB is a pro-active agent of this transformation. At the substation level, three main strategies are being implemented by aluminium producers, such as, 1. Increasing DC current; 2. Revamping DC output control; and 3. Substation Advanced Services.

Increasing DC current supplied from the substation can be achieved with installation of additional rectifier systems. This technique brings several benefits. In a case where existing equipment has been in operation, for example, for several

decades, bringing new DC supply capacity allows a reduction on the burden of the existing "legacy" equipment. It can also provide the ability to extend shut downs of other units for revamp, inspection and other maintenance. All these have a direct impact on extending the life of rectifier and transformer substation equipment.

Revamping DC output control also brings several benefits. Primarily, the first benefit is the reduction of operational risk. Over time, the spare parts on the controller components are difficult to source, sometimes unavailable or are unsupported by the manufacturers. Moreover, modern communication elements such as IEC61850 for Intelligent Electronic Device (IED), which were not available on previous generation equipment, can greatly improve efficiency. Availability of machine-to-machine communication brings more information, faster. If well used, it could increase availability of equipment by better predicting equipment behaviour and prevent failure.

Increasing potline current stability

allows producers to focus their attention to other aspects of process variability to maximise potential aluminium output. ABB is experienced in implementing high-speed controller systems that can precisely monitor DC current output from rectifier substations. As an example, an ABB customer, after reviewing his before and after current output curves from the smelter potline, informed ABB that the signal was so nice it must be filtered somewhere. In fact the signal was a direct measure of the current at the main DC bus just before entering the potline.

Modern rectifier controllers offer high speed I/O with imbedded software capabilities that make it possible to reduce imbalance within rectifier legs or wheels, then between several rectifiers. ABB experience shows, with respect to certain project contexts where the imbalance correction was significant, the investment was repaid for the whole project within several months.

Substation Advanced Services enable the asset owner to manage the risk

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of operating and maintaining substation equipment to ensure optimal investment to keep the desired system reliability.

Three different solutions were developed to address the asset management challenge: a) Substation Assessment, b) Substation Care and c) Substation LifeStretch.

All three together provide a clear understanding of the actual risk profile of the substation and also a path forward to long term operations.

Substation Assessment: A reliability model of the installation is built to understand risk related to each component and prioritise the technical recommendations to improve substation reliability, which are then presented into an Assessment technical report.

The risk associated to each component is calculated based into the site assessment of the condition and the calculation of its importance which is related to the failures modes and consequences of a potential failure.

Substation Care Packages: Maintenance investment optimisation is a process where the cost related to all planned tasks must be balanced with the benefit of the investment.

The challenge lies on performing the right action at the right time.

Reliability centered maintenance (RCM) methodology is based into planning the cost allocation based on the risk related to each component in the substation. By following this methodology, total maintenance investment is reduced. The number of unnecessary maintenance actions planned is minimised. Increased uptime of equipment is achieved by shedding light on the critical items where focus should be.

Substation LifeStretch: Multiple technical solutions can be considered both when the substation lifecycle is reaching the design limit, and when there is a need to extend the functionality of the asset.

ABB has developed LifeStretch methodology, which is used to support the asset owner and help to make informed decisions.

These are based on a detailed analysis of the alternatives considering multi-objective criteria including financials, technology and technical KPIs such as lifecycle cost, failure rate, expected cost of power interruption or environmental and health and safety considerations.

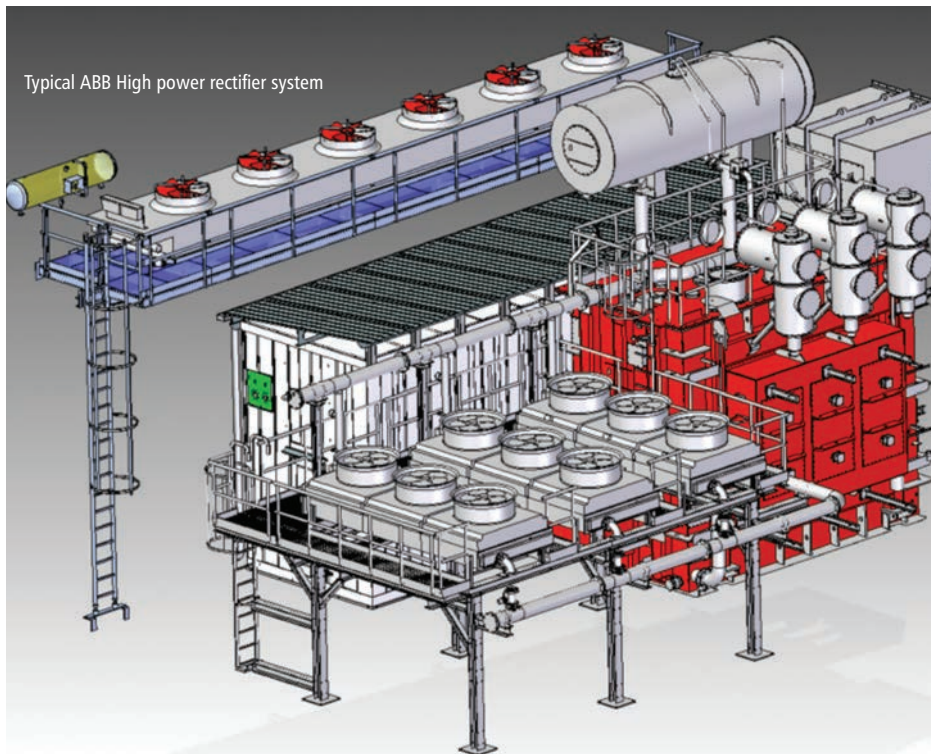
All three strategies described above allows the increase in DC current supply availability with limited investment, compared to adding new potlines.

When well planned, it brings the substation back to N operating condition that is often lost because of multiple creeping programs implemented over the years. It also has a positive and significant impact to insurance premium.

The new Kitimat smelter built by Rio Tinto is a great example of current stability and modern communication. Equipped with the latest controller, the current is always optimum. Substation equipment were supplied by ABB.

They are made of modern control systems with high speed I/O and IEC61850 connectivity. Building a brand new smelter in a brown field environment is challenging, however, equipment was energised on time and made 100% available. ■

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Typical ABB High power rectifier system