

ELECTRICAL ENGINEERING IN MINING

By Peter Hogg - Group Business Development Manager, Ampcontrol.

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Electricity is an important input for all forms of mining. It is a major energy source for the transport of personnel, materials and ore movement, production machines, mineral processing, and equipment monitoring and protection systems. In addition it is an exclusive power source for vital health and safety related applications such as the pumping of water, ventilation and refrigeration.

There are two types of mining environments, metalliferous and coal. Both have the common requirement of electricity reticulation for general usage, the pumping of water and ventilation to remove dust, fumes and gas to provide healthy environments for workers. These needs aside, the regulations for electricity in mining cause the two environments to differ.

DRIVE FOR SAFETY

However, joining the two mining environments is the constant entrenched drive for safety. Australia has an enviable record that is second to none. An overview of the entrenched culture is highlighted by NSW safety figures for electrical related incidents over the last 50 years. These show that there has been 17 fatalities in that time, the last one occurring some 18 years ago and the last electrocution 20 years ago. This shows that the industry has vastly improved electrical equipment and strives for good electrical engineering practice. As the industry moves forward it is imperative that there is no erosion of the basic fundamentals.

In a country like Australia that has a focus on employee's safety, there is a failure to link the common electrical safety requirements such as work practices, certification procedures, competency skills and electrical protection standards. This common link is different between the types of mining environments and the states in which the mining takes place. This prevents equipment being used from one environment to another and also restricts the establishment and utilisation of a common skill base.

HIGHER ENERGY LEVELS

The ever increasing demands on the mining electrical system is reducing the safety margins on equipment and work practices as the required fault and voltage levels approach the limits of the equipment rating. The consequence of the risks associated with higher energy levels is placing more urgency on the development of a quality skills base, engineering practices and risk management.

22KV OR 33KV RETICULATION

The need to become more efficient and produce higher tonnages at lower costs has seen the evolution of high energy electrical systems and a focus on control and monitoring to increase reliability. In recognition of these advances in Australia, customers from around the world come to our shores to source expertise and product to help them achieve the same results.

Today's mining environment is planning for 22KV or 33KV reticulation, 3.3KV mining machines, larger conveyor drives and 11KV motors for longwall installations. A key to the successful implementation of any of this type of equipment is to ensure that the electrical distribution system is correctly specified, designed, installed, commissioned, operated, maintained and disposed of in a manner that manages the safety and production risks at the mine.

Ampcontrol has been able to focus its R&D and Engineering to ensure that advances in mining electrical systems provide the end user with a more efficient mine while ensuring safety is not compromised.

UNDERGROUND FLAMEPROOF SUBSTATION

A recent example of this has been the design and manufacture of the world's largest underground flameproof substation. Weighing in at 55 tonnes the 6.5MVA, 11KV/3.3KV, 10 outlet substation provides power to a high energy longwall system in North Queensland.

The focus on reliability and the benefits obtained from this type of equipment is seen in the use of gas filled transformers. A distinctly Australian innovation this is a significant diversion from flameproof units used in other underground environments around the world. The gas filled units employ the technique of explosion protection by exclusion. By maintaining a

positive pressure inside the tank, methane, moisture and other contaminants cannot enter the transformer enclosure and cause an explosion. The gas filled transformer has undergone significant development since the first units were installed in the early 80's, to the point where the cooling characteristics are equal to similarly rated oil filled units. This technology has been seen as being an advancement to reliability and safety and has now been adopted by many prominent coal producers in China.

DC POWER

Ampcontrol is also a world class supplier of High Powered Rectifiers. Combining a transformer and rectifier in a single package, it converts large quantities of three phase AC electrical power, usually at very high voltages, into DC in a controllable form. Typical output ratings involve voltages from 30 to 1000 volts, at currents up to and exceeding 120,000 amps. Typical mining applications requiring large amounts of DC power are electrolytic production and refining of metals such as Copper, Zinc and Magnesium.

MONITORING

The efficient use of electrical system energy reduces the costs of production and improves productivity. To enhance this modern day requirement Ampcontrol has developed the patented iMAC, Integrated Control and Monitoring System. Installed on the world's longest conveyor in Western Australia the system provides monitoring and message referencing along pullwires. All data is available along the length of the 51km conveyor. Recognition of these benefits has seen similar systems supplied for mining in the USA and port facilities in China where iMAC is also used as a backbone for remote isolation and gas monitoring.

SUMMARY

Ampcontrol is a specialist in the design, manufacture and servicing of electrical and electronic equipment for the mining industry. The company can offer a complete in-house designed and manufactured package of electrical and electronic products engineered to Australian and International standards embracing everything from the electrical point of supply on the surface, right through to the mining face.

