

ABB SWICOM: Smart switchgear with predictive capabilities

MechChem Africa talks to Danie Maré of ABB Electrification (EL) about SWICOM with ABB Ability™, the company's connected switchgear solutions that offer rapid protection and ongoing condition monitoring options for upstream and downstream electrical feeders and infrastructure such as transformers, electrical motors, industrial plant and municipal distribution networks.

“We at ABB EL are involved with switchgear at two levels. We've got the medium-voltage (MV) equipment that ranges from above 1.0 kV to 36 kV as well as the low-voltage (LV) switchgear for industrial load and control centres, which includes the safety switchgear for electrical systems below 1.0 kV, typically 525 V and 400 V systems used for supplying electrical motors for industrial plants,” begins Danie Maré, sales manager for ABB Electrification (EL) in South Africa.

“We also support utilities with the switchgear required for feeding electricity into suburban substations and then on into households or commercial buildings. This happens at two levels. On the MV side, we have primary switchgear (e.g. Unigear), which caters for higher fault levels. This is typically

the switchgear that utilities use in their main substations to feed into the rings supplying the suburbs with power. In the industrial environment, primary MV-switchgear will be used at the main substations to feed the plant environment,” says Maré.

Moving into secondary switchgear (e.g. SafeRing), he says that the miniature substations we see on street corners will be equipped with secondary circuit breakers protecting the lines that feed into individual properties. Secondary switchgear would also be used to protect the downstream distribution lines in industrial plant and the feed lines from step-down transformers feeding electrical load centres.

“In principle, the role of switchgear is the same as that of a circuit breaker on a household distribution board (DB) board. The breaker trips in the event of any earth leakage,

over current or short circuit – but on a much bigger scale and with much more safety and smart technology incorporated into the units.”

As part of ABB Ability™, the holistic condition monitoring platform for electrical equipment, Maré says that ABB's MV and LV switchgear is now available with SWICOM, a purpose built monitoring and diagnostic system for continuously tracking and monitoring the condition of the switchgear and that of upstream and downstream electrical infrastructure. “SWICOM is a monitoring and diagnostic module that provides mechanical and electrical health status of switchgear and the equipment connected to it. It acquires data by communicating with IEC 61850-based protection relays, and via sensors such as temperature sensors, partial discharge sensors as well as by inputs from current and voltage transformers or, more recently, current and voltage sensors, to accumulate the data needed to compile accurate diagnostic reports,” notes Maré.

“Temperatures and partial discharge data collected at critical points on primary switchgear are key indicators of switchgear health,” he continues. “By incorporating SWICOM into the switchgear control panel, safety and condition information can be uploaded into a cloud-based ABB-Ability platform for smart analysis, which will highlight any equipment condition-related risks so that rapid and appropriate decisions can be taken based on accurate real-time data,” he tells MechChem Africa.

“If using SWICOM to protect the switchgear itself, for example, two main indicators of switchgear condition are partial discharge and temperature. By continuously monitoring, recording and analysing these two parameters, trend information can be accumulated and tracked. This enables the real condition of the switchgear to be assessed at any time and a potential failure or fault to be predicted well in advance of a failure,” Maré explains.

Partial discharge, he adds, gives an indication of deterioration of insulation in switchgear and its conductors, enabling plant owners to identify potential problems well before insulation breaks down completely. “Should insulation fail entirely, an internal arc fault is likely to occur, which could be catastrophic in terms of safety and equipment damage,” he

Measurement techniques

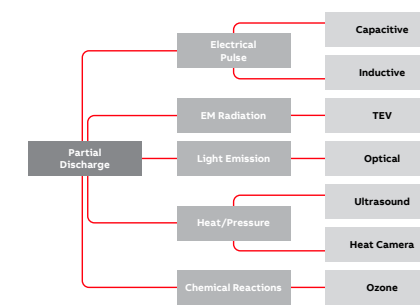
Different sensing approaches

Partial Discharges can be detected and measured using several measurement approaches

The choice of the method depends often strongly on the environment, the type of installation tested, etc.

Type of PD measurement systems:

- Classical PD Lab system
- Monitoring in the field
- Temporary measurement in the field
- Diagnostic tests



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PD can be detected using a number of different sensor strategies, depending on the environment, the type of installation being tested, and a number of other factors.

says. “Temperature monitoring, on the other hand, gives an indication of the condition of the circuit breaker contacts as well as the loading. When healthy, the temperatures will be within limits but if the circuit breaker contacts are not mating properly, this temperature will creep up and any sudden increase in temperature outside of the trend limits indicates that urgent action is needed,” he says, adding that it's important to be able to predict potential failure beforehand so corrective action can be taken well before a failure occurs.

While these are predictive tools, the protection relays are key devices in switchgear systems. They need to trip the power immediately should there be an overload, short circuit or earth leakage fault anywhere on the connected circuit. “ABB has got some very advanced technologies to minimise the impact of a hard-fault failure, most notably a product called UFES: ABB's ultra-fast earthing switch,” Maré continues.

UFES, he explains, is a safety switch that creates a bolted three phase short circuit to earth in the event of an arc fault. It senses the current and light levels of any internal arc fault to activate the switch. Once activated, UFES basically diverts the arc-fault energy down to earth – within four milliseconds – allowing the protection relay (ABB's Relion Protection Relay, for example) to operate to isolate the fault.

“Potentially, this can save the lives of people working in front of the switchgear when the problem occurs, and it can significantly reduce equipment damage due to the time it takes to operate. Compared to a high-quality standard switch that can typically respond in 30 to 40 milliseconds, UFES offers seven to ten times faster response rates,” he adds. Turning attention back to SWICOM and communication, Maré says various network protocols and communication options at

several levels are possible. All the sensors communicate with the SWICOM module, which then sends the data to a cloud-based platform where the equipment condition can be tracked and assessed via live dashboards. Communication from SWICOM to the cloud is done via a dedicated secure gateway keeping the data safe and secure. Communication from devices to SWICOM is done via MODBUS TCP/IP and IEC 61850 protocols while connection between SWICOM and the display unit is through a CAN BUS connection.

Data analyses and well as additional ABB Ability modules connected to other parts of the plant can also be combined to track and trace condition-based issues across the electrical network. “Overload, short-circuit and earth leakage faults can be identified and traced back to the zone in which they occurred, making it easy to isolate, identify and repair the problem. In addition, specific equipment, such as motors, tends to have fault signatures, which can be flagged using expert

data analysis routines,” he points out.

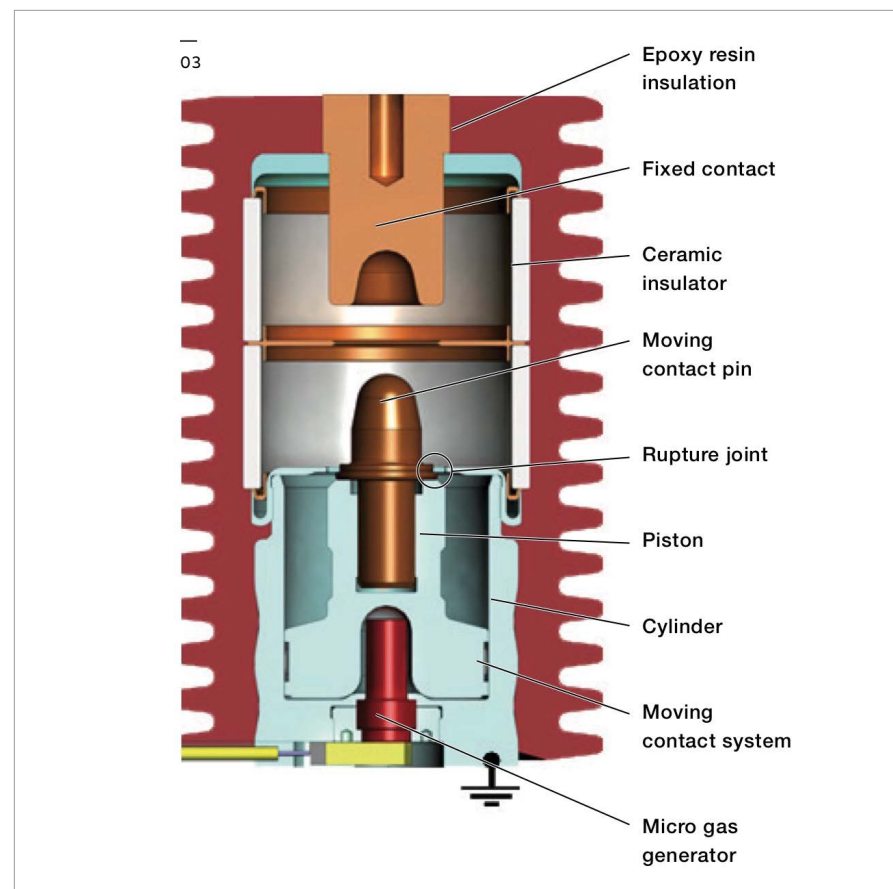
‘Also, by monitoring the temperature of a specific feeder from the switchgear – feeding a motor, for example – a trend can be established and tracked, so an overload on that motor can be identified early on,” he explains.

Going back to the role of a circuit breaker, however, Maré reiterates the critical importance of monitoring the condition of the circuit breaker itself: “A non-operational protective device is useless and very dangerous, but its faulty condition may not be obvious until it is far too late. This is the core advantage of ABB's SWICOM. It tracks the number of operations that the specific circuit breaker performs, detect hotspots and can accurately predict how fit-for-purpose every breaker is at any point in its life.

“A lot of our industrial and mining customers are now seeing the value of predictive maintenance solutions such as SWICOM. They understand the huge cost implications of downtime due to unforeseen failures and how the combination of best possible protection along with data analysis, trending and real-time condition monitoring can help to predict, and ultimately minimise, massive and avoidable failure costs,” Maré concludes. □



ABB Ability™ is a condition monitoring solution for switchgear that focuses on partial discharge (PD) monitoring of ABB's Smart SWICOM switchgear solutions.



UFES™ (ultra-fast earthing switch) consists of an electronic device and corresponding primary switching elements that, in the event of an arc fault, initiate a three-phase earth with an extremely short switching time to extinguished the danger immediately after it arises.



Partial discharge (PD) plays a key role in insulation failure. The physical signs that PD is occurring include, amongst others: the smell and presence of Ozone (O₃), a burnt wire smell; discoloured trails along insulation; and carbon tracks.