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Welcome to the New Year! Welcome to 2015. It is not possible to begin the year without reflecting, for a moment, on how critical the state of Eskom is to our economy. One result of this, of course, is that everyone has an opinion on the matter. Frankly, quite rightly so.

Ignoring the reasons for the predicament in which we find ourselves for a moment, a homeowner (let alone an industrial concern) has every right to be indignant when experiencing unplanned power outages. This becomes increasingly annoying when one thinks back to the heady days of 2008 when we had significant rolling blackouts – and a call to action to sort things out. That was five years ago. There is a sense that the challenges remain unresolved. A loss of power is not convenient; it makes us grumpy.

This is compounded by the fact that we still have areas where ongoing power failures can be ascribed to simple things like cable theft. Yet there seems to be no way to stop the thieves. This makes one want to shake one's head in dismay. Is it really that difficult to tackle the problem? Surely it cannot be.

The key, of course, is the will to stop the problem. It is the will that is needed. Another result of this, of course, is that many, who should know better, end up saying things that are either ill-informed or regrettable – or both. The fact of the matter is that we are behind on the build of the new stations and that we have run some of the plant really close to the wind.

I can only imagine that it must be extremely difficult to focus on where we need to get to – given the current challenges faced by Eskom. And... spare a thought for the staff at Eskom, who are frequently referred to in less than complimentary terms. Of course there can be no denying that we find ourselves in this predicament because actions that needed to be taken long ago were not taken.

This is not to lay the blame on the past. Nor is it to lay that blame (if we can indeed call it that) at the door of any single entity – be it technical, political or social. The responsibility is ours

as a country. I cannot help but be somewhat amused when thinking back to when Eskom introduced the Eskom Energy Effective design awards (the Eta Awards). People found it funny that we could possibly have a situation where a company was actively trying to sell less of its product.

The point was profound. Eskom had been through an extended period of over-predicting growth, and was clearly aware that build would need to slow down – or stop. Indeed, we mothballed power stations for the simple reason that we no longer needed the energy being produced – or we were able to generate that energy more efficiently.

As we learned, to build stations after many years of not doing so, and even to re-commission stations, is a non-trivial task – and can be made that much more difficult by a tranch of unanticipated circumstances - some of which seem quite unique to the South African context.

Energy was remarkably cheap in the past, and it was readily available. The reality is that energy, anywhere, is a scarce commodity. But a scarce commodity needs to be carefully managed. My sense is that none of this is really difficult. The trouble seems to be a shyness about implementing policy and taking hard decisions to get the matter resolved. This requires leadership.

I remain confident that this leadership will emerge.



Ian

Ian Jandrell

Pr Eng,
BSc (Eng) GDE PhD,
FSAIEE SMIEEE



On top in Africa – for 'Smile'



Wits Students' Surgical Society's Graham Moore and Matthew Grant – for the Smile Foundation.

During 2014 Crown Publications supported the Wits Students' Surgical Society in its bid to raise funds for the Smile Foundation, a non-profit South African charity organisation that sets up resources to enable children with severe facial deformities to receive the treatment and care that they need to be able to eat, speak and develop normally. As part of the fund-raising effort by the WSSS, a group of students climbed to the top of Kilimanjaro from 21 to 29 November. Mount Kilimanjaro, a dormant volcanic mountain in Tanzania, is the highest mountain in Africa and the highest free-standing mountain in the world at 5 895 metres above sea level. The Kilimanjaro Challenge 2014 formed part of the Society's community outreach project and Crown Publications was 'delighted' to be part of the initiative, says Jenny Warwick, director. The funding will be used to support the surgeons in the Department of Plastic and Reconstructive Surgery to operate on as many children as possible who need reconstructive surgery, psychological support, speech therapy and dental assistance. The students, who aimed to collect R500 000, exceeded their target by over R100 000.



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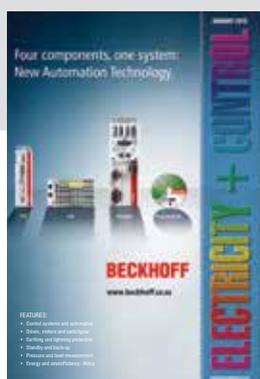
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Beckhoff's 'New Automation Technology' philosophy represents universal and open control and automation solutions that are used worldwide in a variety of applications. *Read more on page 11.*

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Conveyor control system for mining

By C du Plessis, ifm electronic

The conveyor control system described in this article allows connection of all stations in a conveyor system.

In the mining industry conveyors are used to transport the raw material from underground facilities to the processing plant. The mineral bearing rock has to be moved over a long distance via robust conveyor systems. These conveyors can be longer than 2 km and have to be very flexible owing to changes in the locations of the mining fields. The conveyor control system developed by ifm electronic (referred to in this article as 'the company') allows connection of all stations in a conveyor system e.g. rope switches, emergency stop switches, belt alignment switches, temperature sensors, speed sensors, start-up alarms and more.

The AS-i (Actuator Sensor Interface) conveyor control system is a hot-pluggable alternative to conventional wiring technologies that is easy to use and easy to extend. Speed, reduction of installation, plant and maintenance costs and high availability are features of this manufacturer-independent interface system. The AS-i is ideally suited for the robust transmission of small quantities of data under rugged industrial conditions. It has proven itself and has become accepted as the standard for the networking of sensors and actuators in many application areas for economic and other reasons. The two-core cable for data and energy transmission, the connection in the clamping technology, the mapping in the PLC as an I/O component assembly, and extensive diagnostic possibilities lead to significant savings in project planning, installation, documentation, maintenance, and downtime in the case of failures.

The AS-i is designed for the lowest level of the automation hierarchy where it offers an easy, reliable, and fast transfer with optimal price-performance ratio. Higher-level systems such as Profibus DP, EtherNet IP, Modbus, DeviceNet or CANopen are connected via gateways.

Decentralised solutions relieve the control system. Depending on the extent of the set-up, this permits cycle times of typically 2 ms for one AS-i branch. The system can be flexibly extended and may be commissioned in partial areas only. It reduces the communication on higher-level field buses and offers an increased failure resistance through autonomous sub-areas.

The AS-i shadow logo designates devices that have been certified by the independent AS-i centre. This permits simultaneous problem-free operation of devices from different manufacturers on one AS-i branch.

The heart of the system is the AS-i master or the AS-i gateway with respective diagnostic possibilities. Current PLC or PC software solutions can continue to be used as the AS-i acts like an I/O card

in a downward direction. The devices control and monitor the data exchange with the modules and AS-i sensors/actuators according to the master-slave principle. Viewed from the primary field bus, the gateway acts as slave participant with up to 248 bits of input and 186 bits of output data (V 2.1). Power is supplied via AS-i power supply units with data decoupling. Bus-terminators or tuners and repeaters permit line extension beyond 100 m. For this purpose, the repeater separates the primary and secondary sides electrically to achieve increased safety in case of a short circuit. An unlimited amount of repeaters may be operated in star configuration but no more than two in sequence. Together with the repeater, a further AS-i power supply unit must be used to provide power to the additional AS-i circuit.

Slaves are available in many designs, binary or analogue, for use in the field, either in a switch cabinet or in the terminal box. For the EX areas, solutions with ATEX approval are also available.

The benefits of this conveyor control system are that it is safe and cost effective.

With a manual address-programming device, individual modules can be addressed and configured easily at a desk or directly on site. However, it is also possible to address an entire AS-Interface branch via the AS-i master.

Based on the same technology and the same protocol, safety-oriented components such as rope switches, emergency-stop devices, opto-electronic protective devices and safety guard interlocking devices can also be integrated. This only requires the installation of one safety monitor and some safe slaves on the branch. A mixed operation of both safe and non-safe AS-i slaves is easily achieved. The safety monitor monitors the data communication on the AS-i line. For the safe slaves, dynamic code sequences (8 x 4-bit data sequence) that are stored in each slave are transmitted. These are 'learned' by the safety monitor during commissioning. During operation, the safety monitor compares the expected with the actual sequence in each cycle and carries out a safe shut-down within 40 ms if there are any deviations, e.g. as a result of device failure, communication problems or the like. The time for re-activation is 100 ms. Safe field and switch cabinet modules are available as slaves, including intelligent safety sensors and safety command devices with an AS-i chip. The system can be used up to control system category 4 according to EN 954-1



AS-I	– Actuator Sensor Interface
ATEX	– Atmosphere Explosive
EX	– Explosive
I/O	– Input/ Output
IP	– Industrial Protocol
PC	– Personal Computer
PLC	– Programmable Logic Controller
Profibus DP	– Process Field Bus - Decentral Peripherals
SCADA	– Supervisory Control and Data Acquisition
SIL	– Safety Integrity Level

Abbreviations

- o The Actuator Sensor Interface AS-i conveyor control is ideally suited for the robust transmission of small quantities of data under rugged industrial conditions.
- o The Actuator Sensor Interface AS-i conveyor control system allows connection of all stations in a conveyor system.
- o The AS-i conveyor control system is designed for the lowest level of automation hierarchy.



take note

[1] or up to SIL 3 according to IEC 61508 [2] and may be used for stop category 0 and 1 according to EN60204-1 [3].

'The company's' Safety Rope Emergency Stop switch detects both pull and slack rope conditions and allows integration of safety signals into the plant diagnostics. Visual indication is available to provide local indication of switch status. Steady green – machine running and flashing red – machine stopped.



Conclusion

The conveyor control system consists of the AS-i master, AS-i power supply, the safety monitor/relay device, AS-i cable and various I/O modules (safe and non-safe). The main benefits and features of 'the company's' conveyor control system is a safe control system that is cost effective. It allows for fast and flexible expansion and status of rope pull switches and emergency stop switches that are displayed locally by the AS-i master display and also remotely in the PLC and on SCADA.

References

- [1] EN 954-1. 1997. Safety of machinery (replaced in 2006 by EN ISO 13849-1: Safety of machinery, Safety-related parts of control systems, Part 1: General principles for design).
- [2] IEC 61508. 2006. IEC 61508 Standard for Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems.
- [3] EN 60204-1. 2000. Safety of machinery – Electrical equipment of machines – Part 1: General requirements.

Drift monitoring of conveyor belt installations

A belt drift switch has been designed for heavy duty applications and used for drift monitoring of conveyor belt installations. The belt drift switches are used to protect the installations from damage or destruction in the event of belt drift and are positioned in pairs on both sides of the conveyor belt. The ball bearing stainless steel actuating roller is resistant to wear and is used for belt speeds up to approximately 5 m/s. The device features a robust aluminium housing and is equipped with two force-actuated changeover contacts with snap-action function with two adjustable switching points (5 ° to 15 °, 15 ° to 35 °).

Inadmissible belt drift occurs when the belt edge approaches the end of the supporting rollers through lateral movement and surpasses it, resulting in the actuator (roller lever) being operated and displaced. In case of displacement of the actuator, the cam operating switches are activated. The switching angle can be set via an adjustable camshaft. In this way, a pre-warning can be implemented in addition to the safety shutdown.

As soon as the belt moves correctly, the roller lever automatically returns to its home position.



Conrad du Plessis began his career in 1996 in the Pulp and Paper industry. After gaining an extensive background in industrial automation he joined ifm electronic in 2008 in the position of field sales engineer and owing to his extensive PLC experience he was appointed as product specialist for AS-i systems in 2010. In 2012 he became product manager and has since developed a team of highly trained product specialists in AS-i, Octavis condition monitoring systems and R360 mobile control systems. Enquiries: Tel. 012 450 0370 or email info.za@ifm.com

LED website – guidance for ideal lighting solutions

Banner Engineering has launched its new lighting microsite, led.bannerengineering.com. Featuring Banner's WLB32 Industrial LED light bar, the interactive microsite provides LED technology education, tips and tools for facility managers, sustainability managers, design engineers and OEMs in planning their lighting project.

With an easy-to-use interface, the LED microsite offers a streamlined design that informs users about the WLB32 technology, showcases application-specific examples of Banner's LEDs in use and delivers tools and guides for planning a project. The microsite also includes an Ask an Expert function, which allows users to input exact information for a Banner expert to directly handle their application.

"Our LED microsite was designed to educate and speak to our customers'

unique application needs and interests," said Tracy Sherk, Vertical Industry marketing manager at Banner Engineering. "With useful information, quick-reference visuals and intuitive planning, this microsite serves as a valuable industry resource—allowing our customers to obtain all the information they need in one place."



The WLB32 microsite offers a variety of benefits, including:

- o Exclusive planning tools, including a lux/lumen calculator to identify how much light is needed and cost of ownership calculator to maximize savings
 - o Easy three-step guide to design a lighting solution tailored to users' exact needs
- Success stories featuring the WLB32 in real-world examples
- o Immediate download of Banner's educational 'Considerations for Lighting' in a Manufacturing Environment white paper

To learn more about the WLB32 Industrial LED light bar for your lighting application, visit led.bannerengineering.com

Enquiries: RET Automation Controls. Tel. 011 453 2468. Visit www.retautomation.com

Expanding process analyser systems business

Yokogawa Electric Corporation opened Yokogawa Analytical Solutions in Malaysia to manufacture process analyser systems for use in oil refineries, petrochemical plants, and other industrial facilities. It is expected that the new company will play a role in expanding Yokogawa's process analyser systems business.

Process analyser systems consist of gas analysers, liquid analysers, and sampling instruments, and are installed in a dedicated structure that is called an 'analyser house'. As demand for such systems is expected to grow in Malaysia and other South East Asian countries, Yokogawa Analytical Systems was established to speed up its response to customers in these markets.

The engineering of process analyser systems requires advanced technical knowledge and expertise. To improve the quality and reduce the cost of such systems, Yokogawa Electric Corporation has shared its engineering and assembly expertise with other companies in the Yokogawa Group. Previously, Yokogawa companies in the US and Singapore were principally responsible for large process analyser systems projects. Yokogawa Analytical Solutions will work with these companies to optimise the utilisation of production resources within the Group. Through the establishment of this new collaborative network, Yokogawa aims to increase the sales for its process analyser systems business from 15 billion yen in fiscal year 2013 to 20 billion yen in fiscal year 2020.

By localising Yokogawa Analytical Solutions' procurement of materials and hiring of personnel, Yokogawa aims to provide a boost to the Malaysian economy.

Enquiries: Christie Cronje. Tel. 011 831 6300 or email Christie.cronje@za.yokogawa.com

Communication processors for telecontrol



CP 1243-7 and CP 1242-7 version 2 are two new communication processors for telecontrol applications using Simatic S7-1200 controllers. These two new CPs from **Siemens** offer enormous application scope for remote maintenance, diagnostics and control.

Both variants allow the cyclically and event-driven transmission of measured and nominal values as well as alarms to a control room. Measured values from outdoor areas, for instance, can be transmitted to a control centre, or automatic emails can be sent to maintenance personnel. Without the need for complex programming, using the Step 7 Professional engineering software for TIA Portal, the user simply selects the data to be transmitted from the Simatic-

S7-1200 CPU and stipulates the required communication parameters. The CPs are able to seamlessly buffer values and provide them with a time stamp in order to prevent loss of data in the event of a connection failure. When the connection is restored, the buffered values are automatically transmitted to the control centre in the historically correct sequence. Comprehensive diagnostics, locally using LEDs or in the engineering tool Step 7, offer the user rapid, meaningful analysis of the station status. The secure connections of the new modules are simply and quickly engineered by means of data point configuration in Step 7.

Enquiries: Visit www.siemens.com/industrialcommunication



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Schneider
Electric

Encoders for dynamic pitch control on wind energy turbines

Countapulse Controls has a range of Hengstler encoders available for sophisticated pitch control on wind turbines. Wind energy turbines are not only exposed to strongly fluctuating winds but have to use these forces as efficiently as possible. Therefore dynamic pitch control is essential to boost the efficiency by adjusting the rotor blade to the required angle.

At low wind speeds, the rotor blades are directed towards the wind and turned away again as the wind forces increase, to ensure that the wind turbine continues to operate safely even at high wind speeds. As for many applications involving rotational movements, there are different approaches enabling the use of encoders – starting from simple solutions with only one incremental encoder right through to a combination of two redundant absolute encoders.

The gear motor positions the rotor blade while an additional brake ensures that the required position is maintained safely even in the event of a power failure. Since the encoder is mounted directly onto the drive, it has to return reliable positioning values within the temperature range from minus 40 to plus 100 °C. The optical gear based multi turn Acuro AC58 encoders from Hengstler, distributed by Countapulse Controls, have proven to be the best and most suitable solution in this regard.

Similar to AR58, AR62 is an electronic multi turn encoder that also exhibits wear free pulse wire technology. Magnetic single turn and multi turn scanning ensure high shock and vibration resistance. It is also resistant to environmental influences such as humidity and wide temperature ranges.

Enquiries: Gerry Bryant. Tel. 011 615 7556 or email bryant@countapulse.co.za



Latest in weighing transmitter technology

Instrotech, a Comtest Group company, has launched the latest multi-function weighing transmitter, the model 6004MF version II. It is a powerful, compact, field-mounted unit that can be selected for a variety of weighing functions. Specifically designed for servicing organisations, weighing equipment manufacturing companies and individual users, the 6004MF is a single electronic unit that can be used for almost any application in the weighing industry. The 6004MF finds application in the areas of loadcell transmitting, belt-weighing, loss-in-weight transmitter, through-



put weighing, bag-filling, batch-weighing and a dynamo meter. A multi-function unit allows the user to keep one spare that can replace any of the above-mentioned functions in the field. This also reduces the stock holding requirements for manu-

facturers, integrators and factories. The 6004MF weighing transmitter is housed in a rugged, powder-coated, cast aluminium housing with a splash proof keypad. It features a clear 20 mm 6-digit LED main display and auxiliary information LCD display, with user-programmable function keys, digital inputs and relay outputs. The 6004MF uses the popular and powerful ARM (Advanced RISC Machine) microprocessor with integral clock and USB I/O port. Programming, set-up and calibration are via the keypad and backlit LCD. It features pre-calibration of sensitivity and range, zero trim and deadweight span trim.

Enquiries: Pieter Deysel. Tel. 010 595 1831 or email sales@instrotech.co.za

VdS approval for rugged metal enclosure fire system horn sounders

E2S Warning Signals has gained VdS approval and CPR compliance to directive 3015/2011/EU for its AlertAlarm D112 alarm horn sounder by testing to EN54-3. It combines the field-proven electronics of its AlertAlarm A Series with a robust, corrosion resistant marine grade LM6 aluminium alloy enclosure, giving greater mechanical and UV protection. The D112 has a maximum SPL of 119 dB(A) at 1 m at the nominal 24 Vdc fire alarm system operating voltage; the CPR compliance is valid for operation from 18 – 30 Vdc. The 48 Vdc version is also compliant. The VdS approval covers the five most commonly used fire alarm warning tones and also confirms that the units operate to specification under conditions of dry and damp heat, cold, shock and vibration. The aluminium enclosure complies with Type B environmental category making it suitable for outdoor installation, and so supporting the extension of a fire detection system into areas beyond the relatively benign office environment, improving safety. Other tests include EMC, SO₂ corrosion resistance and dust and water ingress. UL approved versions for general signalling use are also available. For this version, the aluminium enclosure is sealed to IP66, NEMA Type 4, 4X and 3R. For use in a wide range of signalling applications, the AlertAlarm D112 offers a choice of 45 different alarm tones, and with the option of activating a second and third tone via additional control cables, it is a cost effective, sophisticated signalling solution

providing the versatility of multiple tones from a single unit.

Enquiries: Email nigel.may@parkfield.co.uk



Capacitive sensors with single-click teach

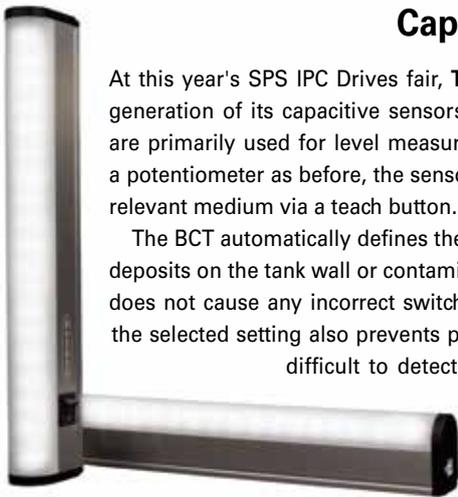
At this year's SPS IPC Drives fair, **Turck** presented the next generation of its capacitive sensors, the BCT series, which are primarily used for level measurement. Instead of using a potentiometer as before, the sensors can be taught for the relevant medium via a teach button.

The BCT automatically defines the switchpoint so that any deposits on the tank wall or contamination of the sensor cap does not cause any incorrect switching. A logical testing of the selected setting also prevents programming errors with difficult to detect media. Turck offers the BCT series as a universal NO/NC contact in a cylindrical design

as an M18 and M30 variant. This not only enables users to effectively reduce the number of device variants that have to be kept in stock but also to implement fail-safe underfill and overflow protection of tanks with a single sensor type. The output behavior can also be set via a pushbutton. All versions are available with a PNP or NPN output.

For applications that require protection against the unauthorised sensor adjustment, or in which the sensor can no longer be reached after mounting, a variant is also available with a teach output that can be taught just as easily with a teach adapter as the pushbutton models.

Enquiries: RET Automation Controls. Tel. 011 453 2468 or visit www.retautomation.com



Lifecycle approach to data centre amidst challenges

For years, the approach to data centres tended to be design- and technology-centric; what's the best design based on the need, and what are the best pieces of available technology?

According to **Schneider Electric**, that traditional approach tended to fail, however, as sites ran smack into rapidly evolving information technology (IT) trends like virtualisation, blade servers, cloud computing, and rising energy costs. These forces had a way of turning even seemingly well-designed data centres into inefficient or inflexible assets.

As a result, interest is growing in the lifecycle approach to data centres. As the name implies, it involves designs, which address long-term concerns, and a strong focus on continuous improvement.

This lifecycle concept sounds all well and good, but you might ask, how can an organisation excel at it? How can you actually become a data centre lifecycle leader?

Schneider Electric's data centre expertise is founded on a standardised, documented, and validated methodology, which leverages automation tools and repeatable processes developed over 45 years; and offers customers a complete portfolio of services to solve technical or business challenges that simplify an operation and reduce costs.

"While many factors are involved in the lifecycle approach, two key principles go a long way toward executing the concept. First, when data centres are designed and built, more attention needs to be paid to how the data centre will be operated in the future, and how it might need to change. Second, to make the data centre as efficient and reliable as possible over its lifecycle, it's crucial to establish a foundation for continuous improvement, making use of an audit and upgrade strategy," says data centre lifecycle guru Keith Murray, vice president responsible for Schneider Electric's IT Business in Singapore and Brunei.

He explains that the first principle really comes back to how do you 'design-in' the ability change.

"Until recently, not much thought has been given to the concept of designing data centre for change. The data centre was designed and built to handle a projected workload, but not much thought was given to upgrades down the road. But there are ways of making change easier.

"For example, you can design-in certain levels of redundancy in the power infrastructure, so when it comes time to do an upgrade, there is little downtime." Power and cooling infrastructure also has become more modular in recent years comments Murray, as row-

based cooling or hybrid cooling, for example, tend to be more easily scalable to changing load profiles.

"When choosing something such as cooling infrastructure, data centre managers should not only consider what the 'first cost' should be, but also other factors that play into lifecycle costs such as the agility of manageability of the system," he adds.

It is not only cooling that has become more modular, but also other key components of data centre physical infrastructure (DCPI). Another trend in data centre modularity is DCPI 'facility modules' that have the key infrastructure pre-built into a cube-like configuration, allowing for 'Lego-block' approach to adding capacity.

"However, designing for change isn't as simple as opting for modular products," warns Murray. "You also have to create models for how a data centre might change, and it's important to start this analysis at the design stage. This typically involves the use of data centre infrastructure management (DCIM) tools."

He explains that by leveraging these analytical tools early on, the organisation has a baseline to make decisions about what kinds of modular equipment are needed, how much redundancy to build in and where and how the data centre can be reconfigured. These tools are vital for the second principle of lifecycle leadership: establishing a foundation for continuous improvement.

Enquiries: NtombiMhangwani. Tel. 011 254 6400 or email ntombi.mhangwani@schneider-electric.com



Configuration suite for remote oil and gasfield applications

Emerson Process Management has introduced OpenEnterprise FieldTools, the world's first Remote Terminal Unit (RTU) and HART configuration suite that enables local and remote configuration and real-time HART device monitoring in remote oil and gas applications such as wellhead automation, flow measurement, and tank overflow protection. The software suite streamlines servicing and maintenance of multiple RTU platforms and HART transmitters across remote sites, helping improve operations and field personnel safety.

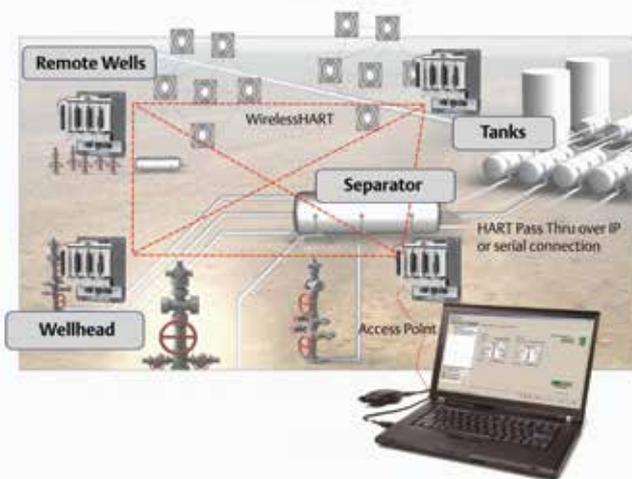
The new single software toolkit enables the configuration of Emerson's family of Remote Terminal Units, flow computers and presets including products under the ROC, FloBoss, and Control-Wave brands.

Additionally, OpenEnterprise FieldTools is a fully-functional HART communicator that supports configuration, troubleshooting, and maintenance of all wired HART and Wireless HART transmitters. FieldTools enables the seamless commissioning of HART devices by leveraging HART pass-through via Emerson RTUs and flow computers. HART pass-through enables tunneling over complex SCADA infrastructures using native Emerson RTU communication protocols.

"FieldTools provides a unique, integrated, safe solution to complex remote device configuration challenges," said Stuart Miller, vice president of marketing for Emerson's Remote Automation Solutions

business. "Installation and field set-up time can now be streamlined by leveraging the single configuration tools suite across both RTUs and field devices. Our field architecture eliminates the need for HART multiplexers as well as the complexity of Modbus data mapping."

Enquiries: Michael Eksteen. Tel. 011 451 3700 or email Michael.Eksteen@Emerson.com



For challenges in controls engineering

Eplan Experience, launched in November 2014, is suitable for existing or new customers in all industries in which Eplan is currently active. It is applicable to all companies, activities and locations, and can be implemented and tailored to specific requirements. Eplan Experience is based heavily on feedback from Eplan's global customers in a variety of industries. "Eplan Experience will help our customers meet the many challenges in controls engineering they are facing in today's fast evolving world, such as growing complexity, big data, and new types of connectivity," says Thomas Michels, head of product management. "All these – and other – challenges can be reduced to one common denominator: increased efficiency. This is exactly the objective of Eplan Experience. We help companies to do more with the same or fewer resources, to accelerate product development, and free product development resources for other value-added activities," adds Michels. Eplan Experience is totally integrated with the existing Eplan Platform. Highly modular, it consists of eight Fields of Action – specific areas of operations that a company wishes to optimise and make more efficient: IT Infrastructure involves integrating a customer's Eplan software into their IT infrastructure to ensure it is high-performing. It will lead to a problem-free and clear installation and updating process. Platform Set-up allows a customer to make an application-specific programme configuration for an ideal working environment. It will help define and implement platform settings in the most optimal way.

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Assistance in implementing standard, IP-based wireless networks

At the 2014 Automation Fair held at the Anaheim Convention Centre in California in November, Rockwell Automation and Cisco announced the release of a white paper and design and implementation guide titled: 'Deploying 802.11 Wireless LAN Technology within a Converged Plantwide Ethernet Architecture'. The detailed design guidance will help control system engineers, IT network engineers, and system integrators implement standard, IP-based wireless networks in a more robust, secure and scalable way.

The guide provides in-depth information on 802.11 wireless LAN (WLAN) solutions within a Converged Plantwide Ethernet (CPwE) architecture, including design considerations for fixed position, nomadic and mobile equipment use cases. It includes explanations on how to configure, maintain and troubleshoot WLAN for each use case, and detailed documentation on how the architectures were tested and validated by Cisco and Rockwell Automation. With this new resource, network designers can create a small network within a plant using a single autonomous access point, and scale up to create a larger, unified WLAN architecture.

"Wi-Fi networks are incredibly useful in factory and plant applications – so useful that manufacturers must thoughtfully plan their Wi-Fi networks as an infrastructure serving all types of applications," said Harry Forbes, senior analyst, ARC. "This new and timely resource from Rockwell Automation and Cisco incorporates lessons that many manufacturers learned through experience."

The recommendations provided in these documents were demonstrated in the Industrial IP Advantage booth at the Automation Fair.

The entire booth is a small-scale representation of the CPwE architecture, featuring a plant operations control room equipped with a WLAN controller and Cisco Lightweight Access Point. The network extended to process and packaging areas in the booth via the Allen Bradley Stratix 5100 wireless access point/ work group bridge, which was jointly developed by **Rockwell Automation** and **Cisco**.

Enquiries: Christo Buys. Tel. 011 654 9700 or email cbuys@ra.rockwell.com

Beckhoff

New Automation Technology

The Beckhoff 'New Automation Technology' philosophy represents universal and open control and automation solutions that are used worldwide in a wide variety of different applications, ranging from CNC-controlled machine tools to intelligent building automation.

Beckhoff – The IPC Company

Beckhoff supplies the right Industrial PC for every application. High-quality components based on open standards and the rugged construction of the device housings mean that the Industrial PCs are ideally equipped for all control requirements. Embedded PCs make modular IPC technology available in miniature format for DIN rail mounting. In addition to their application in automation, Beckhoff Industrial PCs are also ideally suited to other kinds of tasks – wherever reliable and robust PC technology is required.

Beckhoff – The I/O Company

Beckhoff has the right technology for every signal and every fieldbus. Beckhoff supplies a complete range of fieldbus components for all common I/Os and fieldbus systems. With the Bus Terminals in protection class IP 20, and the fieldbus box modules in IP 67, a complete range is available for all important signal types and fieldbus systems. In addition to conventional bus systems, Beckhoff offers a complete EtherCAT I/O range for the high-speed Ethernet fieldbus based on EtherCAT Terminals and the EtherCAT Box.

Beckhoff – The Motion Company

In combination with the Motion Control solutions offered by the TwinCAT automation software, Beckhoff Drive Technology represents an advanced and complete drive system. PC-based control technology from Beckhoff is ideally suited for single and multiple axis positioning tasks with highly dynamic requirements. The AX5000 Servo Drive series with high-performance EtherCAT system communication offers maximum performance and dynamics. Servomotors with One Cable Technology, which combines power and feedback system in a standard motor cable, reduce material and commissioning costs. The drive system XTS (eXtended Transport System) replaces classic mechanical systems by innovative mechatronics. It enables individual product transport applications with a continuous flow of material.

Beckhoff – The Automation Company

Beckhoff offers comprehensive system solutions in different performance classes for all areas of automation. Beckhoff control technology is scalable – from high-performance Industrial PCs to mini

PLCs – and can be adapted precisely to the respective application. TwinCAT automation software integrates real-time control with PLC, NC and CNC functions in a single package. All Beckhoff controllers are programmed using TwinCAT in accordance with the globally-recognised IEC 61131-3 programming standard. With TwinCAT 3, C/C++ and Matlab/Simulink are available as programming languages in addition to IEC 61131-3.

Worldwide presence on all continents

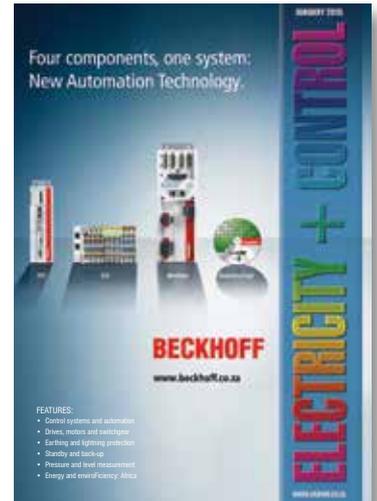
The central divisions of Beckhoff, such as development, production, administration, distribution, marketing, support and service are located at the Beckhoff Automation GmbH headquarters in Verl, Germany. Rapidly growing presence in the international market is taking place through subsidiaries in Austria, Belgium, Denmark, Finland, France, Hungary, Italy, Norway, Poland, Russia, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom as well as in Australia, Brazil, Canada, China, India, Israel, Japan, Malaysia, New Zealand, Singapore, South Africa, the United Arab Emirates and the USA. Through worldwide co-operation with partners, Beckhoff is represented in more than 60 countries.

PC-based control technology

Since the foundation of the company in 1980, continuous development of innovative products and solutions using PC-based control technology has been the basis for the continued success of Beckhoff. Many automation technology standards that are taken for granted today were conceptualised by Beckhoff at an early stage and successfully introduced to the market. The Beckhoff PC Control philosophy and the invention of the Lightbus system, the Bus Terminals and TwinCAT automation software represent milestones in automation technology and have become accepted as high-performance alternatives to traditional control technology. EtherCAT, the real-time Ethernet solution, makes forward-looking, high-performance technology available for a new generation of leading edge control concepts.

Enquiries: Beckhoff Automation.

**Tel. 011 795 2898 or email info@beckhoff.co.za
or visit www.beckhoff.co.za**



Installing and commissioning motors

By H du Preez, Consultant

When installing and commissioning a motor, certain aspects are often forgotten.

A motor frame is generally rigid, but if you place it on an uneven base when bolted down, it can and will twist. The result of this is vibration, rubbing of the seal area in the bearing housing, uneven air-gaps and problems.

'We just put it on the floor and start it up' – is sometimes heard and quite often done. Typically, this is how combined units are installed and the user will say but the motor compressor unit is on a common base. The user does not realise how this assumption can result in serious electric motor problems and failure.

It has been said that the major causes of electric motor failure are mechanical, and the 'primary cause' is often a poor job of installation – especially that the base support is too weak or too flexible. Foundation design and machinery installation require more care than is sometimes practised.

A machine user, if plagued by unexplained bearing failure, high vibration or shaft breakages, can generally assume that the fault lies with poor design and construction of the support structure – foundation, base plate and installation. A poorly designed or badly made motor base, or one that the motor has not properly mounted, too, would lead to premature motor failure.

Coplanar base

Motors generally have four mounting points of attachment to the supporting structure – base plate or foundation. All the fixing points must be 'coplanar' – that is they must all lie in a single flat plane. We know that three points will automatically form a flat plane, but not four. If the four points are not on the same plane when the hold down bolts are tightened, the motor frame, or base plate, will distort; the result will be overstress or misalignment.

That is the reason motor vibration problems can be quickly diagnosed by simply loosening one foot bolt at a time and observing the effect on vibration. If the problem disappears the mounting was not right. This can also be checked prior to running the motor, or machine, by tightening all the hold down bolts – then loosening them one at a time and checking with a feeler gauge if the foot has lifted. Only one hold down bolt must be loose at the time of checking.

Grouting

Grouting is important as it increases the rigidity of the base – and it is relatively inexpensive. If grouting is properly done, it:

- o Acts as a stiffener

- o Anchors sole plates
- o Acts as a vibration dampener
- o Acts as an infinitely adjustable shim between base plate and concrete

Grouting should be finished as shown without stress points which will break.

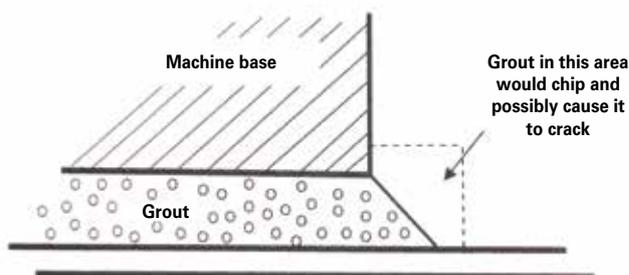


Figure 1: Grout edge finish.

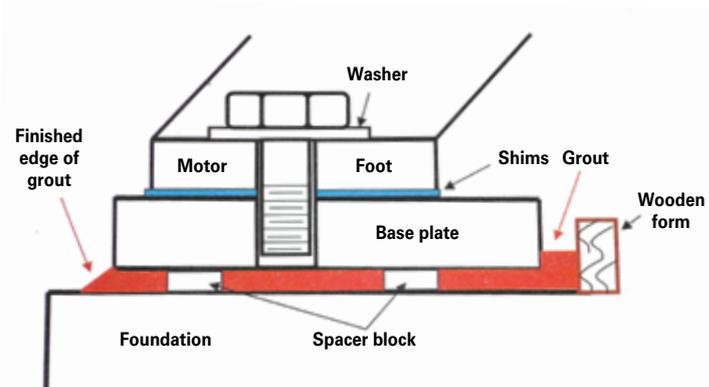


Figure 2: Common type of motor sole plate installation (not shown is the base plate anchor hold down bolts).

Forms must be carefully placed to prevent leakage of free flowing grouts.

Importance of grout

Firstly, this thin layer of cement which is poured and tamped in between the steelwork and the concrete foundation block and around the motor base during installation acts as a stiffener. This reduces resonance and vibration. Secondly, grout anchors base or sole plates so they cannot shift. Grout is not necessary where the base plates and

DOL – Direct On Line
 VFD – Variable Frequency Drive

Abbreviations

support structure are manufactured in steel. In this case, bolts, shims and dowels, if correctly designed and installed, will fix the structure together so there is no movement, vibration and resonance.

Thirdly, the grout acts as an effective vibration damper by placing a rigid mass in full contact with the steel work in the machine base.

Finally, grout acts as an infinitely adjustable shim, providing perfectly flat contact and smooth contact with the machine base. Steel base plates cannot make good contact being placed and bolted down directly on a concrete foundation. *Figure 3* shows an unacceptable form of grouting.



Figure 3: Grouting and support blocks in this example are very poor.

Dynamic loading

- The base plate may be strong enough to carry the static load but the support structure may twist under dynamic conditions
- It must be remembered that it is not only the static or operating load that must be considered but the starting torque or twisting mode – this could be two and a half or three times the operating load condition during starting. (DOL starting and high starting torque motors)

Hold down bolts

You need to ensure that the bolts are strong enough to hold the motor under dynamic load conditions. Sometimes bolts are machined smaller (undercut) to enable the motor to be shifted for alignment – but this weakens the bolts and care must be taken to ensure that the undercut bolt is strong enough. Dynamic load/ starting conditions must be considered.

Install a motor with care, monitor the operating conditions – and the motor will operate for its expected service life.

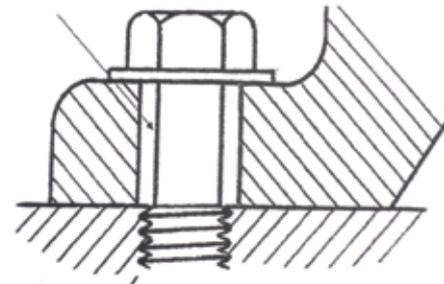


Figure 4: Machined down bolt shank to accommodate alignment.

Use reasonable sized washers particularly when a slotted or larger hole than the bolt diameter is used. Small bolt diameters used with thin washers will result in the washer being pulled into the hole in the foot of the motor. Using bolts that are too small in diameter results in the area of the head in contact with the washer and motor foot is dramatically reduced.

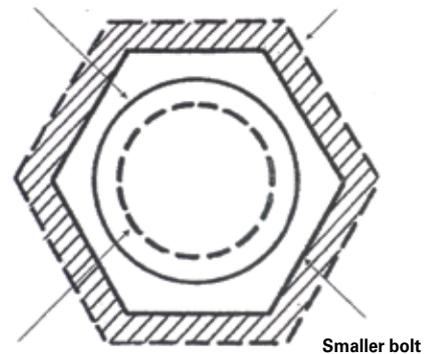


Figure 5: Comparison in using a smaller size bolt in place of the correct size.

Shimming

There are times when shimming is necessary and the shims used should be properly manufactured and installed. Commercial shims and shim materials which are uniform in thickness and dimensions are available. Refreshment cans and scraps of metal do not make good shims. Ideally, shims should cover the same area as the motor foot.

- o The major causes of electrical motor failure are mechanical.
- o The primary cause is generally poor installation.
- o A poorly designed motor base will lead to premature failure.





Figure 6: Example of poor shimming using scrap metal.

Motor foundation check list:

- o Vibration means trouble, examine the base plate, motor alignment first and the motor itself last
- o Check for dowels at all the separable joints in the assembly
- o Check all shims (no gaps). Shims should be the size of the foot of the machine (motor)
- o Hold down bolts, all in place and tight
- o Remember adjustable braces are usually out of adjustment
- o Do not assume the floor is solid. A solid base on a shaky floor is trouble
- o Watch for distortion from overhung loads
- o Expect twisting or distortion if welding is intermittent
- o Look for any additional welding after installation as this could have caused distortion
- o Box sections are generally stronger than beams or channels provided they are not split on one side
- o A drive base made in one piece is generally better than one made in several sections; deep bases are generally better than shallow ones
- o Look for stiffeners or gussets near mounting holes
- o For maximum stiffness support braces should be directly beneath the motor or load

Earthing (grounding)

Electrical systems are haunted by evil spirits and if a motor is not properly grounded the motor could be a candidate for transient surges. The grounding circuit:

Conductor

- Should not fuse under fault conditions
- Be mechanically rugged
- Have a low resistance
- Concrete and reinforcing are not earth points
- Base plates cannot be considered as earth points

Connector

- Have amp carrying capacity at least as great as the conductor
- Be able to withstand repeated faults
- Not deteriorate with age
- Note: 2 Ohm connection resistance with a fault of 250 A would mean a 500 V drop across the connection

- Earth onto earth terminals and these must not be through the fixing bolts
- Earth (ground) effectively
- Surge protection

Surge protection

- Surge protection is recommended
- Surge protection should be fitted at the motor if possible in the terminal box
- Surge protection is very dependent on a good grounding (earthing) system
- Note if the motor is feed from a VFD system there is a danger that the surge protection unit cannot handle the harmonics generated by the drive system and the supplier of the surge protection and the drive unit should be consulted. Surge protection should be fitter in front of the VFD unit, if required
- It should also be noted that VFD unit can cause partial discharges in a motor which could drastically reduce motor insulation life [1, 2]



Figure 7: Not the way to earth a motor.

Commissioning

Before powering up the motor on site the following checks should be carried out:

- Motor must be securely bolted down; but when bolting down check for 'soft footing' between the motor and the base plate
- Coupling clearances must be correct; if the motor is fitted with sleeve-type bearings, the rotor shaft is central in the bearings
- Alignment (clock gauges or preferably laser alignment)
- Motor must be running free
- Bearings must be greased, for sleeve bearings with oil lubrication, there must be sufficient oil in the bearings or system – lubrication must be the correct type and grade. If a force-fed or circulating oil system is used, it must be fully operational prior to starting.

- Check that oil rings are free and in place - if these are fitted
- Insulation resistance stator
- If bearings are insulated, check bearing insulation
- Motor earth connection
- Cable connections - including earthing; and if surge protection is fitted, check connections and earthing of surge arrestors
- Temperature sensor connections and test winding and bearings
- Space heaters - if fitted
- If the motor is designed and supplied with pedestal bearings alignment and clearance are critical and must be checked. The air gap between the rotor and stator must be checked as bolting the motor frame down could alter the air gap which could cause vibration and other problems. The air gap should always be checked in pedestal machine and large motor where provision has been made to do so after installation
- Run the motor uncoupled and check the current, vibration, bearing oil rings and lubrication system
- Couple the motor and run checking current and starting time
- Check and measure vibration
- Check and record operating current, voltage and motor conditions (temperatures and vibration)
- Set protection to the correct operating conditions and motor specifications

These values must be checked against the repairer or manufacturers test report.

Conclusion

It is important to install the motor with care and monitor the operation conditions if the motor is to operate for the expected service life.

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- [3] Nailen RL. Managing Motors. PE Barks Publications Inc.



Henry du Preez is an independent consultant with extensive experience in ac and dc electrical machines and transformers. He consults in mining and industry, locally and globally. He offers specialised training courses in association with 'Specialized Knowledge' and ABB (Transformers).
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Composite insulators for instrument transformers developed

ACTOM High Voltage (HV) Equipment has developed a composite insulator for its 132 kV instrument transformers, following its successful introduction of an ACTOM-branded composite post insulator for its 132 kV disconnectors in early 2014.

The division's move to develop composite insulators was prompted mainly by the need to provide insulators with improved pollution performance, which silicon insulators provide.

The latest ACTOM-branded offerings are for the division's 132 kV current and voltage transformers.

As with the porcelain-core insulators for its 132 kV disconnectors introduced earlier in 2014, these glass-core composite insulators are designed and manufactured according to global best practice. Terry Lawrenson, ACTOM HV Equipment's divisional chief executive officer, said the ACTOM-branded insulators have been developed in response to customer demand.

"We are progressively developing our own designs of insulators for our equipment with the goal of offering our markets the options they prefer when it comes to insulators, eventually supplying all the various types of high voltage equipment we manufacture fitted

with ACTOM-branded silicon-coated composite insulators specifically designed to suit each type," he explained.

Enquiries: Terry Lawrenson. Tel. 011 820-5369 or email terry.lawrenson@actom.co.za



Nick de Beer (right), ACTOM HV Equipment's product manager, Instrument Transformers, with Jan Venter, supervisor (insulators) with one of the new 132 kV current transformers equipped with composite insulators and a new design secondary terminal block.

User-friendly motor protection

Locally designed and manufactured, **New-Elec's** MB relay is ISO 9001:2000 compliant and is fully configurable with the aid of free front-end software or a man-machine-interface unit (MMI). Up to 1 440 event records can be date and time stamped and downloaded and viewed in MS Excel. Essential statistical data ensures information retrieved from the relay can be used for maintenance purposes before drive failure. The three-phase recorder allows the user to record motor currents, voltages, thermal capacity and power factor which can be monitored and analysed in real time. This is particularly useful when tripping occurs for no obvious reason. The user-friendly

MB relay provides advanced protection features that include starter logic and logic function blocks which, coupled with its multi protocol communication options, make it an ideal solution for plant automation. The expansion module plugs into the basic unit and caters for Profibus DPV 1, Modbus RTU and CANbus communication modules. The base unit comes complete with an integrated CTMB and CBCT current measurement range from 0.5 to 250 A. The relay is fitted with seven field inputs and four relay outputs with individual fault and I/O status indicating LEDs. Temperature measurement of the motor winding is possible utilising PT100, PTC and NTC sensors

on a four-channel configurable module with HiHi, Hi,Lo, LoLo set points. The MB range can be retrofitted into the MA range footprint so that upgrading to the MB from the MA is a simple matter.

Enquiries: Email Toll_sales@newelec.co.za or visit www.newelec.co.za



'Switched on' switchgear

Tshwane-based Rand Technical Service's (RTS), a company which specialises in innovative technologies and solutions to industrial problems, is realising the multiple benefits of its new spin filter technology in a variety of industries, notably mining.

RTS has recently supplied spin filters to JB Switchgear Solutions for the variable speed drive (VSD) panels the company has installed for a mining project in the Northern Cape. These spin filters are purpose-designed to accommodate a variety of applications, and offer an extremely efficient answer to the problem of heat and dust build-up, according to Ian Fraser, managing director of RTS.

"Spin filter technology is finding wide application in coal, gold, diamond and other mining environments, which include MCC rooms, control rooms, substations, transformer rooms, machinery spaces and workshops, as a cost-effective solution in both ventilation and filtration," notes Fraser.

JB Switchgear approached RTS to supply dedicated back channel cooling to the VSD panels on the mine, and, according to John Balsdon, projects director of JB Switchgear, the company has not looked back.

"RTS's spin filter technology is a unique ventilation and filtration system that is extremely efficient and ideally suited to many of the items that we manufacture. Electric

cal and electronic equipment require both cooling – through adequate movement of air – and a high degree of filtration to ensure an environment that is suitable for the sophisticated equipment used in our panels," says Balsdon.

Enquiries: Email info@rtsafrica.co.za



New switchgear meets the highest safety standards

Among the goals **ACTOM** MV Switchgear set out to achieve in developing its new AMV12 range of air-insulated switchgear was to attain an internal arc classification (IAC) of AFLR 31,5 kA for 1 second – proving that their new switchgear meets the highest standards for safety currently available.

The attainment of this important goal was confirmed in September 2014 when the AMV12 range, with ratings of 800 A, 1 250 A and 2 500 A, was successfully type tested for IAC AFLR 31,5 kA/1 sec at the world-class KEMA type test facility in Arnhem, Holland.

“This is the first switchgear product we have developed that achieves the 31,5 kA/1 sec internal arc classification. It is especially important among the various type tests that have been successfully conducted on the new range as it opens up vital new business opportunities for us that we have not had access to previously,” said Rhett Kelly, ACTOM MV Switchgear’s technology development specialist.



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Contract for infrastructure, mining project in Liberia

The **ZestWEG Group** is showcasing its full suite of products and manufacturing capabilities at a flagship infrastructure and iron ore mining project in Liberia. This follows Group company Enl Electrical clinching two major contracts for ArcelorMittal at Buchanan Port in Liberia as well as at the Tokadeh Iron Ore Mine near Yekepa in Nimba County.

“These projects will serve as a vehicle for the ZestWEG Group product portfolio to arrive on site,” Trevor Naude, managing director, Enl Electrical says. One of Africa’s largest electrical construction companies, Enl Electrical forms a significant part of the ZestWEG Group’s value addition and total service package for the African mining industry.

“While the ZestWEG Group is well known as an importer and distributor of WEG electric motors from Brazil, one of the largest ranges of its kind in the world, our full product line up includes transformers, switchgear, variable speed drives, motor control centres, gensets and renewable energy solutions. We also have three fully fledged manufacturing facilities in South Africa that we are in the process of expanding as we increase our footprint in Africa,” Louis Meiring, chief executive officer, ZestWEG Group, says.

Steel and iron giant ArcelorMittal is currently mining and shipping five million tonnes of iron ore a year from its Phase 1 operations in Liberia. A Phase 2 expansion project will boost shipments to 15 million tonnes, with first production earmarked for end 2015. The first contract focuses on a ship loading facility at Buchanan Port, where Enl Electrical will construct 6,6 kV overhead power lines in addition to all medium voltage infrastructure, electrical infrastructure and instrumentation works. The second contract relates to mine infrastructure at the Tokadeh Iron Ore Mine, which has a rail link to Buchanan Port. ZestWEG Group.”

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kirstenl@zest.co.za



The ZestWEG Group’s Enl Electrical will construct 6,6 kV overhead power lines for a ship loading facility at the Port of Buchanan in Liberia.

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When and Where should Which surge protection be used?

By Dipl Ing R Hausmann, Phoenix Contact

Answers to **WWW** for the user of surge protective devices connected to telecommunications and signalling networks are given in this article – and the most important parts of IEC 61643-22 [1] / CLC prTS 61643-22 [2] are explained.

IEC 61643-22 [1] is a guide for the application of Surge Protective Devices (SPDs) to telecommunications and signalling lines. Because telecommunications and signalling systems depend on long lengths of wire, either buried or aerial, the exposure to over voltages from lightning, power line faults and power line or load switching, can be significant. If these lines are unprotected, the resultant risk to Information Technology Equipment (ITE) can also be significant. International Standard IEC 61643-22 [1] (prTS 61634-22 [2]) describes the principles for the selection, operation, location and coordination of SPDs connected to telecommunication and signalling networks.

When should a surge protection be used?

The need for protective measures for IT systems should be based on a risk assessment considering the probability of overvoltage and overcurrent. The decision to install protective measures shall be assessed based on:

- Risk of damage to the network outside or inside the structure
- Tolerable risk of damage

For the structure and network inside the structure, the customer shall analyse these two values. Table 1 gives a general overview of the responsibility for protective measures. Annex C of IEC 61643-22 [1] provides additional information concerning Risk Management.

Table 1: Responsibility for protective measures.

Information Technology System	Responsibility
Installation inside the structure; private network	Customer
Installation outside the structure; operator's network	Network operator
Interconnection between operator's network and private network (NT)	Network operator or customer
Information technology equipment ITE	Customer (NOTE)
Additional protective measures based on risk assessment	Customer

NOTE: Resistibility requirements of telecommunications equipment are given by ITU-T K series and referenced by IEC 61663-2 [2]. They are implemented by the ITE-manufacturer.

Coupling mechanisms

When considering the application of SPDs to a telecommunications and signalling network, it is important to determine the probable overvoltage and overcurrent sources and how energy from these sources is coupled into the network. These are shown in Figure 2, as are the means for reducing the amount of energy coupled into the network.

To keep the energies of the couplings low or to avoid the couplings, the following measures are necessary: The metallic shield of the cable, if used, shall be continuous, i.e. it shall be connected across all splices, regenerators, etc, along the length of the cable. It shall also be connected to the EBB, preferably directly or through an SPD or a combination of an SPD and a capacitor (to avoid corrosion problems).

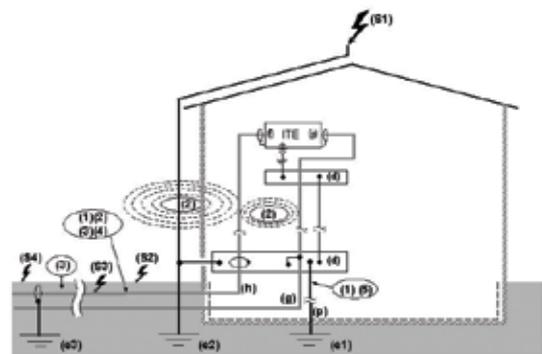


Figure 1: Coupling mechanisms.

Key

- (d) EBB (see EN 61312 [4] for earthing and bonding services entering the structure in different locations)
- (e1) Building earth
- (e2) Lightning protection system earth
- (e3) Cable shield earth
- (f) IT/telecommunication port
- (g) Power supply port
- (h) IT/telecommunication line or network
- (p) Earthing electrode
- (S1) Direct lightning to the structure
- (S2) Lightning near to the structure
- (S3) Direct lightning to the telecommunication/power line
- (S4) Lightning near to the telecommunication/power line
- (1) - (5) Coupling mechanisms, see Table 2

- EBB – Equipotential Bonding Bar
- IEC – International Electrotechnical Commission
- IT – Information Technology
- ITE – Information Technology Equipment
- LPZ – Lightning Protection Zone
- SPD – Surge Protective Devices

Abbreviations

Table 2: Coupling mechanisms.

Source of transients	Direct lightning to the structure (S1)		Lightning to earth near the structure (S2)	Direct lightning to the line (S3)	Lightning to earth near the line (S4) ^b	Ac influence
	Resistive (1)	Induction (2)	Induction ^a (2)	Resistive (1, 5)	Induction (3)	Resistive (4)
Voltage wave-shape (μs)	–	1,2/50	1,2/50	–	10/700	50/60 Hz
Current wave-shape (μs)	10/350	8/20	8/20	10/350 ^d	5/300	–
Preferred test category ^c	D1	C2	C2	D1	B2	A2

NOTE: (1) – (5) see Figure 1, coupling mechanisms.

a Also applies for capacitive/inductive couplings of switching in adjoining power supply networks.

b Due to the significant reduction of fields with increased distance coupling effects from afar, lightning strike may be negligible.

c See Table 3 of EN 61643-21 [4].

d The simulated direct lightning strike test impulse is described by IEC/TC81 as a peak current value and total charge. A typical wave shape that can achieve these parameters is a double exponential impulse, 10/350 being used in this example.

Table 2 shows the relationship between the type of disturbance/coupling mechanism (i.e. direct strike resistive coupling). The voltage and current wave-shapes and test categories are selected from IEC 61643-21 Table 3.

Depending on the over-voltage/over-current threat levels and SPDs characteristics, a single SPD can be used to protect the equipment within a building.

Which and where protection should be used

Protection devices should be applied in a cascade arrangement at the zone interfaces. The zone concept is especially relevant when a physical LPS exists. For example, the first protection level (j, m), located at the entrance of the building, mainly serves to protect the installation against destruction. This protection should be designed and rated for such a threat. The output of this protection has a reduced disturbance energy that becomes the input disturbance level for subsequent downstream protection. The following protection levels (k, l and n, o) further reduce the surge level to a value that is acceptable for subsequent downstream protection or equipment. Depending on the over-voltage/over-current threat levels and SPDs characteristics, a single SPD can be used to protect the equipment within a building. Several protection levels can be determined by means of a combination protection circuit in one SPD. In this case simply one SPD can be used.

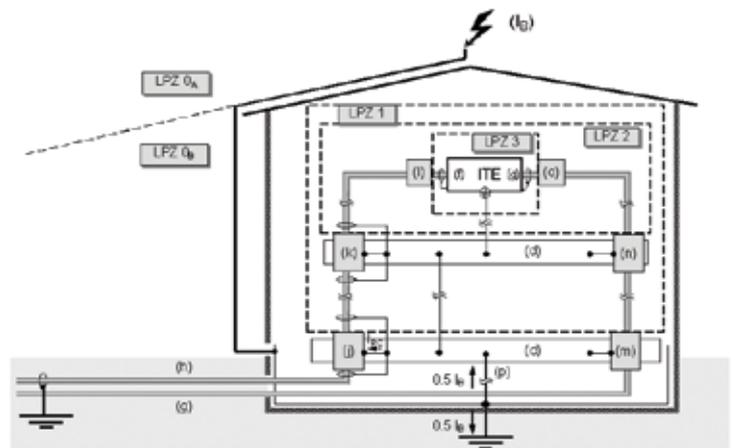


Figure 2: Example of a configuration of the lightning protection concept.

Key

- (d) EBB at the lightning protection zone (LPZ) boundary
- (f) IT / telecommunication port
- (g) Power supply port/line
- (h) IT- / telecommunication line or network
- i_{PC} Partial surge current of a lightning current
- I_B Direct lightning current according to IEC 61312-1 [4], which causes lightning partial currents i_{PC} within buildings via different coupling paths
- (j, k, l) SPD according to Table 3 (also see Table 3 of IEC 61643-21)
- (m, n, o) SPD according to test classes I, II, III of IEC 61643-11 [5]
- (p) Earthing conductor
- LPZ 0_A...3 Lightning protection zone 0_A... 3 according to IEC 61312-1 [4]



When cascading SPDs exist, the coordination conditions (s clause 5) should be considered. The corresponding performance parameters with respect to the lightning protected zones (LPZ) are listed in Table 3.

Table 3: Selection aid for rating SPDs for the use in (zone) interfaces according to IEC61312-1 [5] / IEC61000-4-5 [6].

Lightning protection zone IEC 61312-1		LPZ 0/1	LPZ 1/2	LPZ 2/3
Range of surge values	10/350	0,5 – 2,5 kA	---	---
	1,2/50 8/20	---	0,5 – 10 kV 0,25 – 5 kA	0,5 – 1 kV 0,25 – 0,5 kA
	10/700 5/300	4 kV 100 A	0,5 – 4 kV 25 – 100 A	---
Requirements to SPDs (Category from Table 3, EN 61643 21)	SPD (j) a)	D1 or B2	---	No resistive connection to the outside of the building
	SPD (k) a)	---	C2 or B2	---
	SPD (l) a)	---	---	C1

a) SPD (j, k, l), see Figure 3

NOTE: The range of surge values indicated under LPZ 2/3 includes typical minimum resistibility requirements and might be implemented into the equipment.

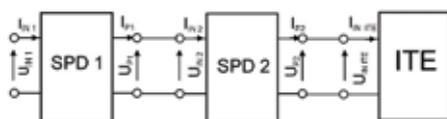


Figure 3: Coordination of two SPDs.

Key

U_{IN2} : U_{IN} ITE - open circuit voltage of the generator used for resistibility verification

I_{IN2} : I_{IN} ITE - short circuit current of the generator used for resistibility verification

U_p - voltage protection level

I_p - let through current

- o Adherence to IEC 61643-22 will prevent severe damage.
- o The need for protective measures for IT systems should be based on risk assessment.
- o Protection devices should be applied in a cascade arrangement at the zone interfaces.



take note

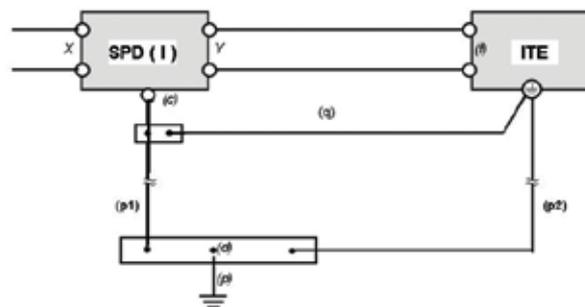


Figure 4: Necessary installation conditions of a 3, 5 or multi-terminal SPD with an ITE for minimising the interference influences on the protection level.

Coordination of SPDs respectively SPD-ITE

To ensure that two cascaded SPDs or an SPD and an ITE to be protected are coordinated during overvoltage conditions, the output protective levels from the SPD 1 should not exceed the input resistibility levels of SPD 2 or the ITE for all known and rated conditions.

Equipotential bonding between the surge protection and the to be protected device

An effective voltage-limiting outcome requires a system-specific observation which has to consider various conditions between the protective device and the ITE.

Additional measures:

- Do not run the cable to the protected port together with the cable to the unprotected port
- Do not run the cable to the protected port together with the earth conductor (p)
- The connection of the protected side of the SPDs to the ITE to be protected should be made as short as possible, or shielded



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After his apprenticeship at Deutsche Telekom Dipl Ing Ralf Hausmann studied Information Technology at a University of Applied Sciences. After qualifying as a Dipl Engineer he joined Phoenix Contact in 1987. As a team leader he was responsible for the protective devices used in data, MCR and antenna systems. Eight years later, he moved to overvoltage protection and today his responsibility is that of marketing the protective devices used in Data, Telekom, and antenna systems. He officiates as a chairman of the international standardisation committee IEC SC37A WG4 and the European standardization committee CLC TC37A WG2. The standards IEC/EN 61643-21 and -22 were substantially shaped by Ralf. Enquiries: Email rhausmann@phoenixcontact.com or tonyr@phoenixcontact.co.za

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Transportable device calibrates many types of electronic equipment

The **Comtest Group**, Fluke's authorised Test and Measurement Distributor for South and southern Africa, has introduced the Fluke 5522A multi-product calibrator which is specifically designed to improve the capabilities of calibration laboratories across all industries. The 5522A, based on Fluke's top-seller 5520A series calibrator, aims to provide daily service both inside and outside of the calibration lab because it is durable enough to be safely transported for on-site or mobile calibration of a wide variety of electronic test tools.

The Fluke 5522A is ideal for metrology engineers, technicians and lab managers who need to calibrate many different types of electronic equipment and require a transportable instrument that delivers a

high return on operators' capital investment. For a single calibrator, the Fluke 5522A gives the flexibility to calibrate a wide range of instruments and can be fully automated with MET/CAL Plus Calibration Management Software for greater productivity. Several reliability-enhancing features protect it against damage and make it easier to transport for on-site or mobile calibration. Internal circuits and fuses protect against damage caused by applying too much voltage or current.

Front and rear access doors are removable and the 5522A can be used while its top, bottom and side panels remain protected, all without having to completely unpack and re-pack the calibrator. A redesigned front panel and carrying handles make it easy

to transport the calibrator short distances within the lab.

Enquiries: Val Verwer. Tel. 011 608 8520 or email info@comtest.co.za



HV-resistant, insulated down conductor

The HVI Conductor is a high-voltage-resistant, insulated down conductor from **DEHN**. Unlike conventional lightning protection systems, which must be adapted if photovoltaic or air-conditioning systems are subsequently installed on the roof, the insulated lightning protection based on HVI Conductors is both durable and sustainable and can remain as it stands.

When using conventional lightning protection systems, it is often not possible to maintain the necessary separation distances, but this is no problem with the HVI Conductor thanks to its unique design and special sheath. The lightning current carrying conductor of the HVI Conductor is wrapped with insulating material in such a way that the required separation distance from other conductive parts of the building, electric lines and pipes is maintained.

The coaxial conductor consists of an inner copper conductor with a high-voltage-resistant thick-walled insulation and a weather-resistant semi-conductive special outer sheath. Thus, creeping flashover along the surface of the conductor is prevented. The HVI Conductor is easy to install, as it has variable sealing ends. Tools, such as the HVI strip, further facilitate installation. The HVI Conductor is an ideal solution for external lightning protection systems on a wide range of applications; from residential and industrial buildings, to wind turbines, photovoltaic systems, biogas plants, mobile phone antennas and systems of the process industry with hazardous areas such as gas compressor stations and oil rigs.

Enquiries: Alexis Barwise. Tel. 011 704 1487 or email alexis.barwise@dehn-africa.com



Protection relay with advanced control features

NewCode is a three-phase motor protection relay with seven inputs of differential voltages from 24 to 220 V ac or dc and four fully programmable output contacts as standard. The relay caters for the low voltage motor protection market and provides advanced protection and control features. The ISO 9001:2000 compliant relay has a user-friendly operation, advanced LED indications for I/Os, fault indication, relay address and infrared data communications. NewCode provides thermal overload, over and under voltage and voltage symmetry protection, as well as frequency, power factor and power dissipation measurement. More advanced features including starter logic and logic function blocks which, coupled with its communication options, make the NewCode relay an ideal solution for plant protection and automation.

The three-phase recorder allows the user to record the motor currents, voltages, thermal capacity and power factor. The motor performance can be monitored and analysed in real time. This is particularly useful when tripping occurs for no obvious reason. The

recorder alleviates to some degree the need for sophisticated equipment to be carried around the plant. NewCode has a non-volatile and volatile memory. The non-volatile memory contains a boot loader program which is used to upload the operating software program of the relay. The uploading is done from a personal computer or laptop via the USB port. This feature also enables the user to do future software upgrades without factory assistance.

Enquiries: Email sales@newelec.co.za or visit www.newelec.co.za



Voltage measurements – their significance in motor protection

Unbalanced motor voltages may cause a current unbalance that increases the operating temperature and energy losses of the motor. These voltages can magnify the



current unbalance in the stator windings of a motor as much as 20 times. When the voltage unbalance is more than 1 %, de-rating the motor will help lessen the effects. If the unbalance exceeds 5 %, it is not advisable to operate the motor at all, even if it has been de-rated. When a voltage unbalance exceeds 3 %, the root cause should be identified and corrected. For general motor protection, it is always assumed that the system voltage is stable. This is due to legislations such as NRS 048. This legislation is divided into several parts, mainly guiding the quality of the power supply (QOS), focusing on the voltage parameters, such as magnitude and dip time.

However, during fault conditions the system is unstable and it is essential to know the voltage variation to comprehensively protect the motor. It is generally known that in a fixed power system, there is a 1 % increase in current measurement, therefore a 2 % increase in voltage. The suddenly fluctuating voltage also contributes to deteriorating winding insulation in a motor, thus reducing the motor life.

NewElec's NewCode, KE range and other motor protection and control relays measure voltage to ensure comprehensive motor protection.

Enquiries: Email sales@newelec.co.za

Powerful combined arrester for telecommunication systems

The new DEHNbox TC 180 from the surge and lightning protection expert, **DEHN**, is a compact universal combined arrester in a surface-mounted plastic enclosure, ideal for protecting information technology interfaces. The arrester has been optimised for general installation on telecommunication connections and devices such as analogue telephones, ISDN and xDSL. Field tests have shown that the arrester can even be used for high-performance VDSL2 connections. With the DEHNbox, surges are limited to an acceptable level for the connected terminal equipment without interfering with the data signal.

This compact, one-size-fits-all, arrester can be easily retrofitted at any time, thanks to its surface-mounted enclosure which is ideally suited for wall mounting, thus ensuring immediate lightning and surge protection in existing installations. The cables lead into the enclosure via an easy-to-install self-sealing rubber grommet, which not only allows fast and easy installation but also prevents the penetration of moisture and dust. The cable cores (solid and flexible with wire end ferrule) and the earthing conductor can be

connected by inserting them into the spring-loaded terminals of the fast connection system without tools. An additional, separate terminal allows direct connection to the cable shield of the equipotential bonding system. The DEHNbox TC 180 protects one balanced data interface (ISDN, analogue telephones, xDSL) and has a high lightning current discharge capacity of 2,5 kA (10/ 350 μ s) per line. The arrester can be installed in lightning protection zone boundaries from 0 A to 2 and higher. Its cut-off-frequency of 250 MHz ensures transmission of high-frequency signal parts.

Enquiries: Alexis Barwise. Tel. 011 704 1487 or email alexis.barwise@dehn-africa.com



Solution for pump motor protection



A range of electronic motor protection and control relays, especially designed to protect pumps and motors from a variety of faults associated with this market is available from **NewElec**. The entire K series is aimed at rendering assistance to pump users and consultants that specify protection requirements for pumps.

What makes these relays unique is that they incorporate features such as dry-run protection and phase reversal protection which are basic requirements for the protection of pumps. A model exists for every budget. The more upmarket models also include built-in features that allow for a user-selected pump priming time, as well as a user-selectable pump operating time slot. Automated re-start times for dry-run trips are available together with selectable automatic overload trip

resets. A useful asset on some models permit the user to measure dry-running conditions by means of power factor measurements instead of conventional current measurement so that greater accuracy can be achieved.

The range includes the most basic features that need manual adjustments directly by the user to the more sophisticated that can only be programmed by the supporting software avoiding possible setting interference by users. These include the monitoring of statistical information such as the number of starts, trip faults and pump efficiency. Motor protection is achieved by the usual current measurement methods and user-selectable phase voltage measurements.

Enquiries: Email sales@newelec.co.za or visit www.newelec.co.za

Gas-generated electric power – with benefits

By N Alwar, Barloworld Power

The case for gas engines as an alternate power generation technology is becoming more compelling along with significant gas discoveries in southern Africa. This is due to proven, reliable gas engine technology that can be quickly and efficiently installed and, of course, the cost benefits of gas compared to diesel and conventional grid power.

Southern Africa is fast becoming a gas economy with significant natural gas discoveries, particularly in Mozambique, and supportive gas prices can facilitate resolving electricity supply constraints.

In southern Africa the cost of electricity from natural gas is demonstrably less expensive than diesel given the difference in the equivalent energy tariffs. Gas engine technology is a continuous operation that enables use of the recoverable heat to create further offsets in energy efficiency.

The share of waste heat utilisation is important to improving the economics of the application, particularly since natural gas has a price premium compared to other low energy fuel gases such as biogas and landfill gas from organic waste, which also provide attractive business opportunities for the gas-to-power concept.

Reliability

In the last decade the uptime of the gas supply in South Africa has been impressive, competing extremely well with diesel. Given the upstream supply chain risks for both options, a gas pipeline supply can be considered more reliable, which assists in achieving the uptime of an engine-based power plant.

It is also worth noting that these are power plants with proven technology that typically require only a year from placement of an order to delivery of power. Such construction milestones for grid additions, or even if used locally by the customer, cannot be ignored in the larger power supply context that operates not only in a deficit, but with continuous impediments to meeting targeted on-stream dates.

Reliable technology and fast-track delivery, with connectivity to local and national grids taking up minimal land and space, have to feature as part of meeting our urgent electricity demands.

Larger power plants of 100 MW to 200 MW are definitely possible using gas engine-based technology and, with the right construction partners, immediate impact for sustainable growth can be achieved.

Technology

Barloworld Power, a division of Barloworld South Africa (referred to in this article as 'the company') is strategically positioned to meet a broad range of energy and commercial engine solutions in the southern African market. In addition to southern Africa, the company is the dealer for Cat Power, including gas and diesel driven power systems, in Spain, Portugal and a large part of Russia. Caterpillar has sold engine-based technology for gas to power for the past 77 years.

Regarding its electrical generation supply focus, the company responds to power security and sustainable energy management, two of the most pressing issues facing the private and public sectors locally and internationally. The company launched its southern African gas to power business in 2012 and has since grown its capabilities with organisational infrastructure that comprises sales, design engineering, commercial proposal and after-sales resources.

From an environmental perspective, gas generator sets enable the reduction of methane, the primary fuel component of natural gas, biogas and landfill gas. Methane is a greenhouse gas which is about 20 times more harmful than carbon dioxide. Gas generator sets also have lower exhaust emissions than those using diesel or coal.

Standard Bank complex, Johannesburg

The new Standard Bank complex in Rosebank, Johannesburg, is considered a flagship project for the company in which the gas power plant was completed a month ahead of schedule.

The gas-powered solution provided consists of a 1 MW Cat G3512E gas-powered generator set, heat recovery equipment and an absorption chiller. The generator set runs on natural gas supplied to the bank by Egoli Gas. The electric power produced supplies one fifth of the bank's electric power demand, with the generator set's thermal energy recovered for the bank's hot water and air conditioning requirements.

The new Standard Bank building in Rosebank, Johannesburg, incorporating a gas engine power plant in basement level 5.



Banks are data centres, requiring power supply systems that must satisfy the objectives of both reliability and energy efficiency. The bank thus has the utility (Eskom) supply, gas engine power plant supply, and diesel back-up as components of enhanced system reliability. However, unlike diesel powered gensets, which are typically used as a standby power source in cases of utility power failures, the gas generator set runs continuously to reduce the building's requirement for utility power.



The gas engine power plant supplies one fifth of the electric power for the new Standard Bank building, with generator set's thermal energy recovered for the bank's hot water and air conditioning requirements.

The lower cost of gas contributes to cost efficiency, but total energy efficiency is achieved with the recoverable heat from the gas engine, used for the building's thermal energy requirements (such as hot water and air conditioning), further offsetting utility consumption and cost.

Biogas

The company recently won a pioneering contract to provide an equipment solution to the biogas field, still in its infancy in South Africa. Biogas is a cheap fuel which is highly sustainable as a source of power generation in the long term and is therefore attracting a lot of attention.

The contract, the first of its kind in South Africa, calls for the company to supply Cat equipment for a 4 MW biogas-to-power project in Bronkhorspruit. The clean electricity produced by the project will be used by BMW to provide power to its plant in Pretoria.

Biogas is produced when organic matter breaks down in the absence of oxygen, and can be used as a renewable, clean energy source. The Bronkhorspruit Biogas Power Plant is an independent power producer (IPP) formed by Bio2Watt, which has a contract to purchase waste from Beefcor, a cattle farm in the area.



The Homestead Dairy where animal waste can be converted into cost efficient renewable energy.

About 40 000 tons per annum of cattle manure and a further 20 000 tons of mixed organic waste will be fed into two anaerobic digesters that will produce the biogas feedstock for a combined heat and power application using Cat internal combustion gas generator sets.

Bio2Watt has attracted significant co-funding from the Industrial Development Corporation and other foreign and domestic investors for the project and has signed a power purchasing agreement with the manufacturer.

Bosch Projects has been contracted to build the plant. The company will supply four 1 MW Cat CG170-12 generator sets with ancillary items for stepping up the produced power to a 22 kV distribution system, as well as heat recovery equipment for the digester operation.

Community projects

Local municipalities are looking increasingly at gas generators using biogas produced from their wastewater treatment plants to produce power.



An example of a project undertaken internationally by a Cat dealer involving two G3512 biogas generator sets to produce electricity.

Maintaining correct operating temperature parameters during waste digestion using recovered heat from the generator set not only improves biogas yield for electric power, but increases throughput of waste through proper bio-digestion processes, thus reducing the need for sewerage storage space.

In theory biogas can be produced from organic waste generated within informal communities to produce electricity for the community. However, for biogas-powered plants to become a reality, communities

will require co-funding from government or private sector participation to raise the capital to establish innovative power supply solutions.

The gas engine power plant supplies one fifth of the electric power for the new Standard Bank building, with the generator set's thermal energy recovered for the bank's hot water and air conditioning requirements.

Gas engine technology is a continuous operation that enables use of the recoverable heat to create further offsets in energy efficiency.

Conclusion

Caterpillar supplies the core internal combustion or reciprocating engine technology that is integrated with an alternator to create a gas generator set. The company designs the rest of the customer solution such as heat recovery equipment in the form of plate-type or shell and tube heat exchangers, and electrical scope such as switchgear, transformers and control panels and cabling for the necessary connections. The company then undertakes the supply, installation and commissioning of the power plant.

- o In the last decade the uptime of the gas supply in South Africa has been impressive, competing well with diesel.
- o Gas engine technology is a continuous operation that enables use of the recoverable heat to create further offsets in energy efficiency.
- o Local municipalities are considering gas generators using biogas produced from their wastewater treatment plants to produce power.



take note

Nalen Alwar holds a degree in Chemical Engineering Technology and a Master's Degree in Business Administration. He has nineteen years of work experience and is currently the business development manager for Gas to Power at Barloworld Power.

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World-class quality UPSs for nuclear applications

Schneider Electric was the first and is the only Uninterruptible Power Supply (UPS) company in Europe to provide completely qualified and dedicated Gutor technology in accordance with the American quality standard NQA-1 (Nuclear Quality Assurance). The requirements defined by the ASME (American Society of Mechanical Engineers) are strict and specifically created to implement US government regulations for nuclear applications, corresponding to the most exacting quality expectations worldwide. The ASME NQA-1 Standard reflects industry experience and understanding of the necessary quality assurance conditions to achieve the safe, reliable and efficient use of nuclear energy and the processing of radioactive materials.

Class 1E Uninterruptible Power Supply equipment with Gutor technology has been built for the Idaho National Laboratory (INL) and was delivered in mid-August 2014, following successful prototype testing at an American external test laboratory. Equipment testing took place under the strict NQA-1 quality standards in accordance with IEEE Std 650-2006, which sets tests and checks designed to prove the equipment is qualified to operate in the

specified environmental, electrical and seismic conditions and events. Following the positive sign-off by the customer, the equipment (dual Gutor PDW 400 kVA) could be delivered. The commissioning phase of this 15 meter long system is ongoing.

"We knew from the beginning of the project that it would be a challenge to obtain a large 800 kVA UPS system meeting the stringent IEEE Class 1E requirements necessary for the nuclear reactor industry," says William Steele, Project Manager of INL. "Following a thorough evaluation of the industrial base, we awarded the contract to Schneider Electric with its Gutor technology in April 2013. INL and Gutor experts have worked collaboratively for the last 16 months to meet numerous technical and schedule challenges."

Idaho National Laboratory (INL)

Idaho National Laboratory is the U.S. Department of Energy's leading center of nuclear energy research and development where nearly 3 500 researchers and support staff work with national and international governments, universities and industry partners to deliver energy and national security solutions and expand the frontiers of science and technology.

American Nuclear Quality Requirement ASME NQA-1

Approval under nuclear quality assurance requirements, as required by the American Government, are constantly checked and will only be awarded following strict, ongoing customer audits. Guidelines chiefly regulate the challenging conditions in the nuclear environment which can lead to safety risks. The applications in particular must be secured against earthquakes, heat and humidity, as well as electromagnetic stresses. Every single component built into the Gutor technology UPS system must be dedicated and meticulously numbered and recorded. This means that it is always possible to identify from where every component comes, from the first screw to the system cabinet.

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Powering Africa's largest microgrid project

Power management company **Eaton** is providing electrical engineering services and power distribution equipment for the construction of a 5 MW solar microgrid system in Annobon Province, an island off Equatorial Guinea in West Central Africa. The microgrid has battery storage and is designed to supply reliable and predictable power to meet the off-grid community's energy demand. It will be the largest self-sufficient solar microgrid project in Africa.

The project is a part of Equatorial Guinea's National Economic Development Plan Horizon 2020, which aims to strengthen Equatorial Guinea's economy and accelerate its development through the implementation of world-class electrical infrastructure. Eaton was contracted to optimise the electrical power distribution equipment for the project by MAECI Solar, a division of Management and Economics Consulting. MAECI is collaborating with Wise Power Systems International to provide solar design, engineering and custom manufacturing of double glass modules and racking with full microgrid system integration for the Annobon Electrification Project.

"We are extremely excited to bring this solar microgrid solution to Annobon Island to help raise the quality of life for the people and bring world class decentralised electrical grid solutions to Equatorial Guinea and Africa," said William Rawheiser, president of Wise Power Systems International. "The Annobon Electrification Project will bring a much needed stable, reliable, and consistent power supply to the island, and enable the development of multi-

ple industries, bringing valuable jobs and significantly raising the standard of living."

The Annobon Province currently relies on generators for periods of reliable electricity up to five hours per day. Residents spend an average of 15 to 20 % of their income on supplemental power. The solar microgrid in development is engineered to eliminate this expense by providing clean, reliable and sustainable solar electricity 24 hours a day, seven days a week.

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Process safety through diaphragm seal systems with diaphragm break monitoring

By J Breunig and J Zipp, WIKA

The manufacturing processes within the pharmaceutical industry are generally highly sensitive. The processes need to be as automated as possible in order to eliminate potential faults. The control of individual parameters is thus based primarily on electronic measurement technology.

Take pressure for example - transmitters, process transmitters and switches are used – in critical processes, predominantly in conjunction with a diaphragm seal. This combination protects the process and measurement quality to the highest level: Diaphragm seals of a double-diaphragm design and with diaphragm break monitoring reliably prevent a possible contamination into or from the process.

Flawless purity of the products, reproducible quality and clear traceability are the core elements of the Good Manufacturing Practice (GMP) guidelines. All pharmaceutical production processes within the European Union are subject to these regulations in order to ensure the quality of medicines and active ingredients with respect to consumer protection.

From the GMP provisions, the necessary requirements for the systems engineering can be derived, and so for the pressure measurement instrumentation. This particularly applies to processes with critical media. To guarantee that the measuring instruments are able to be cleaned well and that a precise measurement can be provided reliably, the manufacturers use diaphragm seal systems for these processes.

These systems are a combination of a measuring instrument, the diaphragm seal itself and the system fill fluid. An elastic, corrosion resistant metal diaphragm shields the measuring instrument from the medium. The space between the diaphragm and the measuring instrument is completely filled with a system fill fluid. Its nature (for example glycerine or paraffin oil) depends on the measuring task at hand. The diaphragm takes the process pressure and hydraulically transmits it to the measuring instrument.

All wetted parts are, as standard, from stainless steel. Anyone demanding greater resistance against corrosion can fall back on variants from nickel-based alloys such as Hastelloy C276. Diaphragm seals are either mounted directly to the measuring instrument or connected to it via a flexible capillary. For production processes with high temperatures a cooling element can be mounted in-between. Even in the harshest of process conditions such measuring assemblies measure the pressure reliably.

Diaphragm seal systems with electronic measuring instruments contribute to increased process safety since they eliminate the potential for error that exists with manual and routinely performed control and monitoring tasks. This applies both to the actual production process and to the upstream and downstream cleaning and sterilisation processes.

Pressure transmitters and process transmitters provide the input signal for the control loop. The measured value is transmitted to the process control system, a controller or a terminal, however it can also be read on site. The data transmission is achieved using an analogue 4 ... 20 mA signal or via a bus protocol. With the Hart, Profibus PA or Foundation Fieldbus bus systems, there is the possibility to transmit further information from the process and/or measuring instrument in addition to the primary current signals, such as the operating hours or the sensor temperature. The installation cost for current-generation instruments is comparatively low due to the intuitive menu navigation that is normal today.

Effectively, a diaphragm seal system with electronic measuring instrument eliminates a number of uncertainty factors. One specific risk, however, still remains. Under very severe operating conditions, an unforeseen process disturbance could occur that will damage or even destroy the sensitive diaphragm. In such an event, the system fill fluid from the diaphragm seal can find its way into the process. As a result, care must be taken when specifying the fluid for sanitary applications and one must ensure that it is suitable for contact with the particular medium. This can be documented through conformity with the provisions of the American Food and Drug Administration (FDA). For compliance with the GMP guidelines further supporting documents are required, for example a listing in the country-specific pharmacopoeia such as the EP (European Pharmacopoeia) or USP (US Pharmacopoeia) for North America.

In addition, however, there are processes in the pharmaceutical industry in which contamination must be prevented under any circumstance – in each direction. Thus, no system fill fluid may be allowed to enter into the product, in order to protect the purity of the pharmaceutical material. At the same time, the risk of danger-

- EP – European Pharmacopoeia
- FDA – Food and Drug Administration
- GMP – Good Manufacturing Practice
- USP – US Pharmacopoeia

Abbreviations

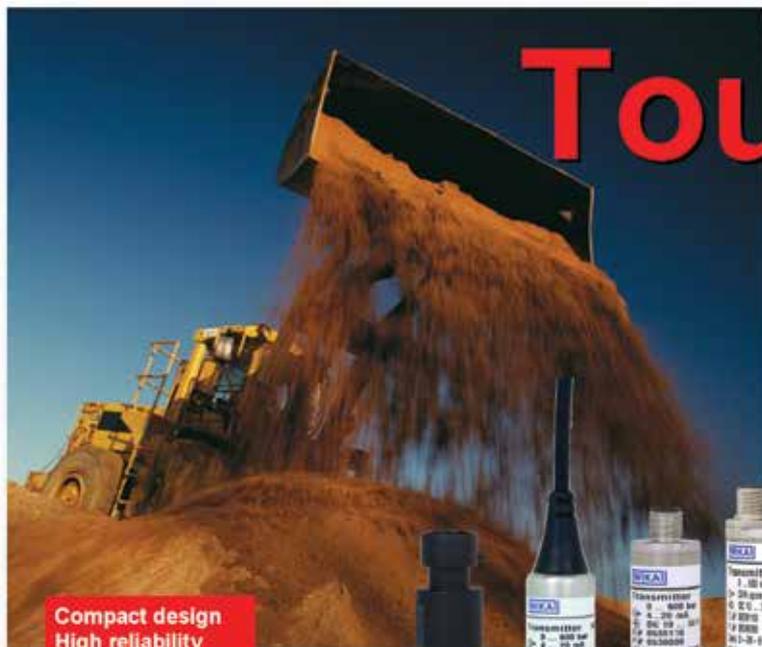
ous substances escaping into the environment must be prevented. This applies, for example, with the production of vaccines containing live viruses or production with genetically modified organisms.

For anyone who must exclude all eventualities, the diaphragm seal system developed by the company represented by the authors is available: with a double diaphragm and diaphragm break monitoring. Using this patented system, the space between the two diaphragms is evacuated and the vacuum can be monitored with a measuring instrument. The type of monitoring can be specified individually, depending on the sensitivity of the process. Should a diaphragm rupture, a pressure switch can send an optical, acoustic or electrical warning. Should the wetted diaphragm become damaged as a result of extreme loading or due to an aggressive medium, the second forms a reliable seal to the process and maintains the pressure monitoring until the damage has been rectified. Since a break within the system can be reported immediately by an alarm signal, no microbes can get past the diaphragm undetected. For pharmaceutical applications, the comprehensive process safety is the most important feature of the diaphragm seal systems with a double diaphragm.



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Figure 1: Diaphragm seal with a double-diaphragm system of the same shape; welded independently of each other.

Furthermore, these systems provide the plant operators with a significant time advantage: When utilising instruments with 'simple' diaphragm seals they must, often after each batch, remove all measuring instruments from the process and check the diaphragms for possible damage. Only then can the

product batch be released for further processing.

This operation and the waiting time before release are dispensed with when measuring assemblies with integrated diaphragm break monitoring are used.

Flawless purity of products, reproducible quality and clear traceability are the core elements of the Good Manufacturing Practice guidelines.

Conclusion

With process safety, pharmaceutical companies cannot permit any negligence – there is too much at stake. The expenditure that the industry has to put into this is considerable. Within this calculation, one can demonstrate that high-value technology, when taken into account against the safety aspects, may be an economical solution in the long run. Thus diaphragm seal systems with electronic measuring instruments also contribute to improved plant efficiency through simplified process control, reduced maintenance and downtime and minimised risk of failures.

- o With process safety, pharmaceutical companies cannot afford negligence.
- o The expenditure required to ensure 'no negligence' is an economical solution in the long run.
- o Diaphragm seal systems with electronic measuring instruments eliminate the potential for error.

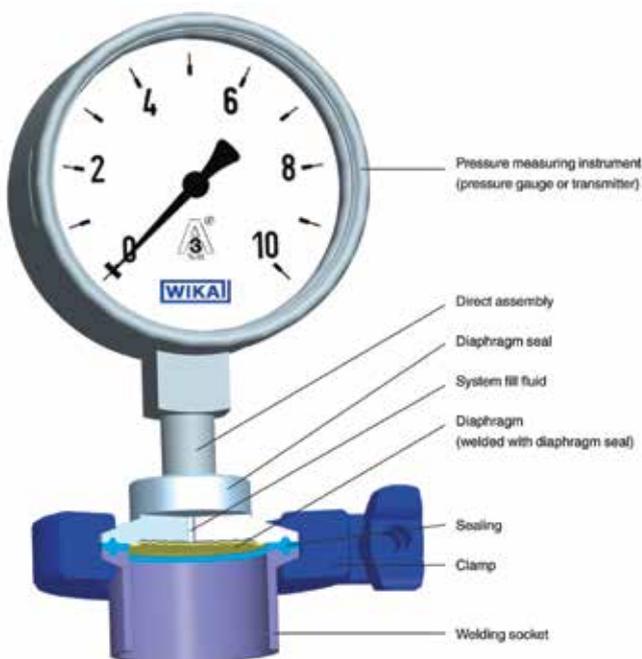


Figure 2: Design of a diaphragm seal measuring assembly.

Jennifer Breunig is the product manager of diaphragm seal systems and Joachim Zipp is the segment manager of sanitary applications at WIKA's head office in Germany.
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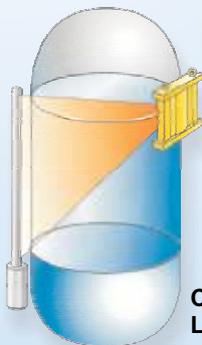
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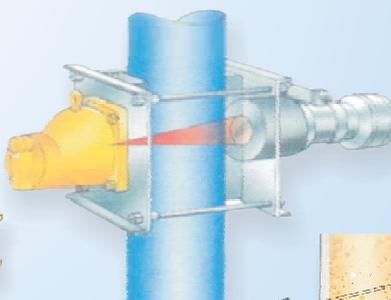
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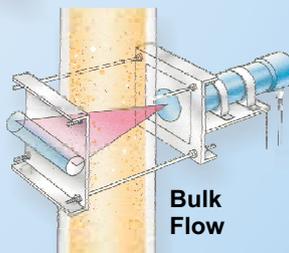
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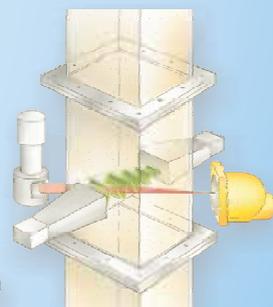
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Steam monitoring pays off in under two years

From manual calculations to automated measurement, turnkey steam monitoring solution enables the systematic reduction of energy costs.

Customer challenge: Although steam consumption is very important to the profitability of the company, consumption by the different internal customers was only calculated according to empirical standards.

As a prerequisite for any efficiency gain actions, the Energy Plant Department needed to:

- o Monitor steam production and consumption in real time
- o Have meaningful data centrally available

Application details

The steam fluxes (in tons/h) are measured using a vortex flowmeter, a temperature and a pressure sensor. Each of the overall 39 measuring points also includes an energy application manager (EngyCal) providing power (heat flow) and energy (in GJ). The device is not only able to do calorimetric calculations according to relevant standards, it also operates as a gateway and supplies the data via a fibre optic network to the workstation located at the energy centre building.

Here the values are visualised and stored in an OPC database. Finally they are processed again to provide precise and conclusive figures, instead of pure process value. Customised reports including valuable

information such as real consumption in each cost centre, amount and location of losses and overall efficiency of the steam process are now available in user-friendly format for management review.

Endress+Hauser solution: Integrated a turnkey steam monitoring solution into the company's existing energy monitoring system. The solution included:

- Instrumentation 39 steam measurement systems (Prowirl 72F vortex flow meter + TR15 temperature sensor + Cerabar PMP51 pressure transmitter with syphon and shut-off valves)
- Energy application managers (EngyCal RS33 including cabinets, cables and required system components)
- Data acquisition and visualisation (P View software, OPC server and workstation PC)
- Mechanical installation (flanges and reducer pipe works, insulation)

Endress+Hauser also performed all the associated services that were required.

Main steps

- o Energy site survey: A site survey was performed and several concepts were discussed and offered.
- o Consulting: The detailed technical solution was developed together with the customer and local partners taking into account the site-specific IT infrastructure.
- o Installation and commissioning: The

monitoring solution was installed, commissioned and the Energy Plant Department supported in analysing the measured data.

- o Consulting energy audit: An audit of the steam process was performed in order to evaluate the measuring results and the amount of losses. This was the basis to recommend effective corrective and preventive actions.

Results

- o Accurate, consolidated data on steam output, transport and consumption
- o Controlled steam consumption via precise metering of each consumer
- o Measured transport efficiency and allocated losses in the steam pipe network
- o Customised reports for management review

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Ingersoll Rand has extended its R-Series line of compressed air solutions to include small rotary compressors with V-Shield technology to reduce leaks and improve reliability.

Built on a common platform, the new R-Series 5 – 11 kW compressors are available in 5 – 11 kW with flows 8,1 cfm – 57,5 cfm and pressures up to 200 psig on fixed speed units and 145 psig on variable speed drives. The R-Series 5-11 kW models will be available for order in December 2014 through Ingersoll Rand representatives.

"The compact design of the R-Series makes it the ideal workplace compressor with a 20 % reduction in footprint and sound levels as quiet as a dishwasher," says Davor Horvat, product manager for contact-cooled machines at Ingersoll Rand in Europe, Middle East and Africa.

With the application of V-Shield technology, the leak path and connections on the R-Series compressors have been reduced by more than 15 %. V-shield technology ensures all critical fittings are secured with o-ring face seals in a method that is nearly free from distortion. Leaks are virtually eliminated and performance is not sacrificed, regardless of how many reconnections are made. Leaks are also reduced by the use of polytetrafluoro-ethylene (PTFE) braided, stainless steel hoses for all oil-carrying lines.

Other advancements on the R-Series 5 – 11 kW include:

- o A totally enclosed fan cooled (TEFC) motors that have a premium IE3 efficiency
- o A simple design and fewer components, reducing maintenance

- o Large, convenient electronic controls and a digital output display come standard to support easier programming and operation

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Looking Forward

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Uganda's energy sector: challenges and opportunities

By R Mbabazi (Makerere University), Professor B Sebitosi (Stellenbosch University),
Dr Julianne Sansa-Otim (Makerere University), Dr Richard Okou (Makerere University)

In the developed world, it has become a given that power from the electric grid must be available and stable. This, however, is still a dream in so many developing countries.

A vibrant energy sector sets the pace for the development of any nation's economy. For steady economic growth, energy, especially electricity, has to be sufficient, affordable and readily available. According to the African Infrastructure country diagnostic [1], 'the performance of Africa's power supply sector on the continent is unsatisfactory. Most of the continent's power companies are unreliable sources of supply, inefficient users of generating capacity, deficient in maintenance, erratic in the procurement of spare parts, and unable to prevent losses in transmission and distribution. They have also failed to provide adequate electricity services to the majority of the region's population, especially to rural communities, the urban poor and small and medium enterprises.

With such a dire situation, it is no wonder that the economies of many African countries – like Uganda – are in trouble.

Uganda's electricity and business sector

In order to promote growth in the energy sector, the Ugandan government implemented a Power Sector Reform and Privatisation Policy under the Electricity Act of 1999. This resulted in the formation of Uganda Electricity Generation Company Limited (UEGCL), Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Distribution Company Limited (UEDCL). These were carved out of the Uganda Electricity Board (UEB) which was a vertically integrated state-owned enterprise that was commissioned during the colonial era, but had chronic operational inefficiencies. UEGCL and UEDCL later leased their assets to Eskom (Uganda) Limited (EUL) and UMEME Ltd (energy distribution network company in Uganda) respectively. In addition, in April 2001, the Electricity Regulatory Authority was formed and given the responsibility of overseeing and regulating all the players in Uganda's electricity sector.

The electricity grid only covers the urban parts of the country, yet 80 % of the population lives in the rural areas. The rural electrification agency was thus formed in 2001 to ensure that rural electrification is improved from 1 % in 2001 to 10 % by 2012 [2]. In the meantime, at the dawn of 2012, electricity consumers in Uganda were tired of continu-

ous load shedding [3]. Industrial and commercial consumers had to bear the cost of fuel for use in generators to carry on operations. The unreliable power supply which the country had been experiencing for the better part of 2011, accounted for approximately 25 % of the processing losses incurred by manufacturers [3]. Fortunately, this did not last for long. Bujagali hydro power dam was supplying 250 MW of power to the grid and there was a sigh of relief as the load shedding stopped.

The celebration however did not last long as at the end of 2012, UMEME Ltd, the main power distribution company, announced an increase in power tariffs and the business community went up in arms again. Manufacturers said expensive power will further make Uganda uncompetitive in regional and global markets, saying the country had already lost its regional market share of manufactured goods owing to Tanzania's recent institution of a 25 % import duty on goods originating from Uganda [3].

In 2009 the Union of Producers and Transporters of Electricity in Africa (UPDEA) revealed that Uganda, at an average of 25 cents USD/kWh, had the highest power tariff in East African region [4]. Kenya and Tanzania had average of 12 cents USD/kWh and 10,5 cents USD/kWh respectively. Ironically, as shown in *Figure 1*, the power tariff has been steadily increasing since 2009. It is feared that an increase in the tariff will drive the cost of doing business up and eventually drive up the price of the commodities.

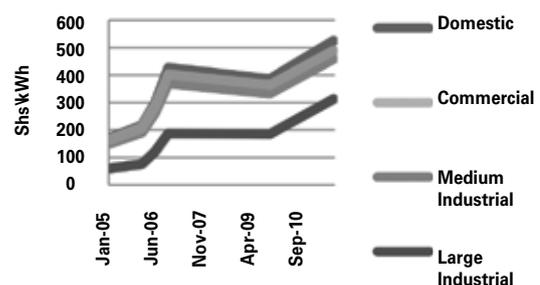


Figure 1: End user tariffs [5].



ASR	– Alkali Silicate Reaction
EUL	– Eskom Uganda Limited
FESL	– Fersult Engineering Services Limited
GPRS	– Global Positioning Network System
KCCL	– Kasese Cobalt Company Limited
KIL	– Kilembe Investment Limited
KML	– Kilembe Mines Limited
SCADA	– Supervisory Control and Data Acquisition
UEB	– Uganda Electricity Board
UEDCL	– Uganda Distribution Transmission Company Limited
UEGL	– Uganda Electricity Generation Company Limited
UETCL	– Uganda Electricity Transmission Company Limited
UMEME Ltd	– An energy distribution network company in Uganda
UPDEA	– Union of Producers and Transporters of Electricity in Africa
WENRECo	– West Nile Rural Electrification Company

Abbreviations

Study approach

The authors conducted a survey to appreciate the challenges faced by commercial users of electricity in Uganda. It was conducted in the areas of Kampala (central), Jinja (Eastern region), Mityana and Mbarara (western region). A total of 100 businesses were part of the survey. Businesses that participated in the survey comprised 6 % (industry), workshop (11 %), restaurant (12 %), shops (71 %).

In addition, the researchers carried out site visits and face-to-face interviews with engineers from two of the large hydro power stations and one mini hydro power station. They also interviewed engineers and employees of in UETCL and UMEME.

Findings

Commercial consumers

22 % of the responses said that their greatest problem with power was that it is expensive while 51 % said that the power was unstable. 27% did not respond.

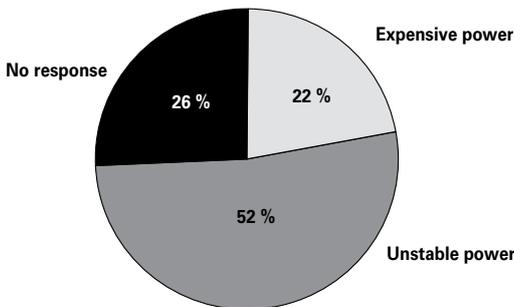


Figure 2: Power challenges.

Concerning availability of power, 77 % of the consumers said they had no power for more than three days in a week.

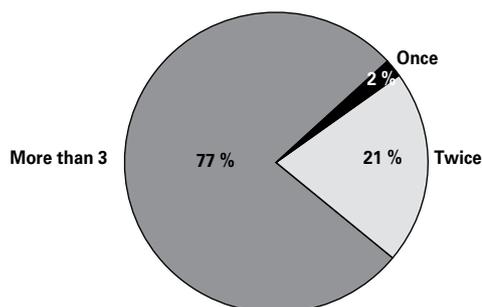


Figure 3: Frequency of power in a week.

When there is no power, 42 % of the businesses use generators while 18 % close the business for the day. 32 % use lanterns for lighting and 8 % use candles. Unstable power can lead to equipment getting spoilt. 29 % of the business owners said that their equipment had become spoilt while 70 % said that none of their equipment had become spoilt. Surprisingly 54 % of the consumers said they were just satisfied with the distribution company, while 18 % were very dissatisfied.

Generation

Currently there are over 20 generation companies in the country [5]. Uganda Electricity Generation Company Limited (UEGCL) owns the Nalubaale and Kiira hydropower generation stations and equipment in Jinja, concessioned to Eskom (Uganda) Limited. Other generation companies include, Bujagali Energy Limited which controls the newly constructed Bujagali hydropower station, Aggreko which owns thermal (diesel) generation plants at Mutundwe and Jinja, Jacobsen which owns a thermal plant at Namanve, Kasese Cobalt Company Ltd (KCCL), Kilembe Mines Ltd (KML), Electromax (thermal) and Bugoye.

Uganda's energy mix

The electricity generated in the country is from three sources; hydro power, thermal and bio mass with hydro power contributing 77 %, thermal 20 % and biomass 3 %.

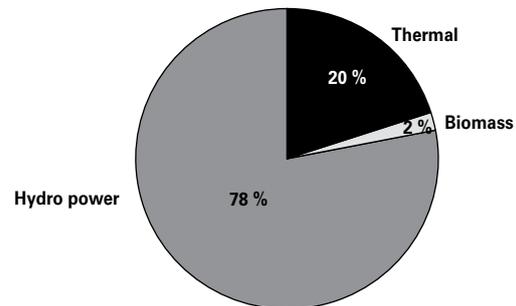


Figure 4: Power sources in the country [6].

Most of the hydro power in the country is generated by Bujagali, Kiira and Nalubaale power stations, with Bujagali contributing 36 %, Kiira, 29 % and Nalubaale 26 %. During peak periods Bujagali generates an average of 220 MW out of the installed capacity of 250 MW. Kiira and Nalubaale have an installed capacity of 200 MW and 180 MW which they do not generate due to problems that will be explained in the next subsection. Currently there is enough power in the country but with the projected increase in demand, [5], the country may have

to resort to load shedding again. For this reason, the government is in the process of setting up more dams such that by 2020 there will be an addition of at least 1 396 MW of power on the grid. *Table 1* presents a summary of the hydro power generation projects that are either in planning stages or already under construction and their expected year of completion.

Table 1: Future Hydro power stations [6].

Ayago Power Station	600 MW	2018
Isimba Power Station	140 MW	2015
Karuma Power Station	600 MW	2017
Muzizi Power Station	26 MW	2018
Nyagak II Power Station	5 MW	2015
Nyagak III Power Station	4,36 MW	2018
Waki Power Station	5 MW	2014
Kikagati Power Station	16 MW	2016
Total	1 396 MW	

In addition to the hydro and biomass, Uganda also has the potential of generating power from other renewable sources like wind, geothermal solar and peat [7]. The potential of all these sources is shown in *Table 2*.

Table 2: The potential for renewable energy in the country [7].

Energy source	Estimated electrical potential (MW)
Solar	200
Peat	800
Biomass	1 650
Geothermal	450
Total	2 100 MW

Challenges in the generation sector

The following were revealed as the challenges in the generation sector:

- o Huge investment costs: In order for the country to reach its potential in electricity generation, heavy financial investment is required. This has limited the exploitation of many renewable energy sources of power
- o Hydro power stations not generating at full capacity: The Nalubaale and Kiira dams are operating below capacity due to old

- o A vibrant energy sector sets the pace for the development of a nation's economy.
- o Critical problem areas in Uganda's electrical power grid require custom-designed smart solutions.
- o The future for any electrical grid is in converting to a smarter grid.



take note

malfunctioning machinery and decreasing water levels. In addition, the Nalubaale dam's walls are cracking due to significant alkali silicate reaction (ASR) with an expert review in 2010 giving it just another 20 years before it outlives its usefulness [8]

Transmission

UETCL transmission grid

All the generated power is transmitted on a 220 kV/132 kV/66 kV grid that is controlled by UETCL. The grid is 1 430,5 km in length, of which 72 km - 220 kV lines, 1 358,5 km - 132 kV lines and 35,2 km - 66 kV lines. It is made up of a combination of wooden and steel structures with wooden structures taking up 54 %. The oldest section of the grid was energised in 1954. There are a number of 15/30/40 MVA substations all over the country. These include Lugazi, Lugogo, Kampala North, Mutundwe, Namanve, Namungona, kabulasoke, Nkonge, Nkenda, Masaka West, Mbarara West, Tororo, Opuyo, Lira, and Kahungye substations. The power is transmitted at 132 kV, stepped down to 11 kV and 33 kV for distribution and lastly to 415 V/240 V at consumer premises. Since the state of the grid is always changing in terms load and frequency, it is important to keep it stable. UETCL monitors and controls the transmission grid through its Supervisory Control and Data Acquisition (SCADA) system that is situated at the main substation at Lugogo. Using a combination of fibre optic and microwave radio links for communication it also monitors the other substations that are providing power on the grid for example Kakira, Mpanga, and Bugoye power plants.

Challenges in the transmission grid

Interviews with UETCL engineers revealed that the transmission grid is largely stable with most problems being caused by unnatural causes. The problems depend on the type of tower. Steel towers are vandalised as well as having lightning strike the disk insulators while their wooden counterparts experience vandalism of earth wires, rotting of the poles and breaking of the disk insulators. Vandalism is also rampant in substations. Transformer oil, electrical conductors, transformer copper windings, copper and aluminium are vandalised for financial gain. This has negatively impacted on the company since it is always replacing the stolen equipment. In addition, the grid also suffers from way leave encroachment. People set up structures (semi-permanent and permanent) or carry out economic activities under the high voltage lines, endangering their lives. The company has embarked on sensitisation of the public to combat this problem.

Distribution

There are over seven distribution companies in the country. These include UMEME Ltd, Ferdult engineering services (FESL), West Nile Rural Electrification Company (WENRECo), BECs, PACMECs and

Kilembe investment limited(KIL) [3]. This article focuses on UMEME distribution network because it is the largest distributor.

UMEME distribution network

UMEME operates under a concession with a structural monopoly on the distribution of electricity across Uganda, distributing 99 % of electricity in Uganda through a single buyer model [9]. As of 2012, the UMEME distribution network consisted of 6 394 km of 33 KV lines, 4 809 km of 11 kV and 15 933 km of low voltage (5-0,41 kV) lines. It has 69 substations and over 6000 pole-mounted transformers, low-voltage (less than 1 kV) distribution wiring and meters. The control centre at Lugogo controls 35 out of the 69 substations. It only controls up to the substation level not the feeders. For communication to the control centre, the substations and control centre are connected by a combination of fibre optic and GPRS links. The fibre optic links are used in urban areas, the GPRS links are used for the substations that are far away from Lugogo.

Challenges in the distribution grid

The distribution grid suffers from a number of issues that we now focus on.

- o **Vandalism:** The distribution grid is plagued by many cases of vandalism. In just one month in 2012, 42 transformers were vandalised from Natete, a Kampala suburb; an average of four transformers every three days. Given that each transformer costs over 10 000 USD, having to spend 420 000 USD per month is quite prohibitive. In addition, since each transformer serves 2 000 customer each case of vandalism affects them directly. Vandalism has also been the cause of a number of deaths. In 2009, there were over 31 deaths countrywide due to vandalism [10]
- o **Illegal connections:** Uganda has the highest electricity tariff in East Africa, thus most Uganda’s find the electricity unaffordable. Consumers therefore invent ways of avoiding the electricity bills by making illegal connections or by-passing the electricity meter. When this happens not only does the utility company lose revenue, but also lives are put at stake. In 2012, countrywide there were 65 deaths due to electrocution as a result of illegal connections and vandalism [10]
- o **Transformer overloads:** During peak hours, transformers quickly become overloaded, thus the affected areas have to be load shedded

- o **Transformer failure:** This is a multifaceted problem that has many causes. These include vandalism, illegal connections which lead to overload, lightening and LV short circuit. From January to April 2013, 345 transformers had failed. 87 of those were due to lightening, 78 due to overload and 70 due to vandalism. *Figure 5* shows how much each cause contributes to the problem

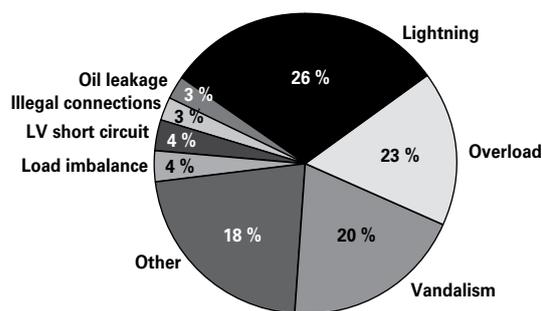


Figure 5: Statistics for the reasons for transformer failure.

- o **Lengthy sectionalisation:** The grid is ridden with many faults which have to be dealt with. In order to rectify the problem, the source of fault, has to be located. The control engineer remotely opens circuit breakers along the faulty feeder line, while a technician in the field closes the tripped circuit breaker in the substation. If the circuit breaker remains closed then the source of the problem has been identified. Otherwise the circuit breaker trips and the process is repeated. This process, known as sectionalisation is lengthy and can sometimes take a day

UMEME is implementing number of measures to deal with the challenges, these are summarised in *Table 3*.

Table 3: Solutions to challenges.

Problem	Solution
Vandalism	Public sensitisation through the media.
Illegal connection to the grid	o Use of aerial bundle conductors which are tamper proof but increase capital costs o Installation of prepaid meters.
Transformer overload	Load shedding to relieve the over-loaded transformer
Lengthy sectionalisation	Implementing sectionalises along the feeders between the substation and the transformer

Smart grid made in Uganda

A smart grid (also known as the future grid) is an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources so as to meet the varying electricity demands of end-users [11]. Through bidirectional flow of electricity and communication, the smart grid intelligently integrates the actions of all users connected to it in order

 At the dawn of 2012, electricity consumers in Uganda were tired of continuous load shedding.

to efficiently deliver sustainable, economic, and secure electricity [12]. Upon comparing information from the generation and transmission sector with that of the distribution sector, we find there is enough power being generated and the transmission network is fairly reliable but the bottleneck is in the distribution network. We therefore propose the following smart grid applications for Uganda:

- o **Automatic Metering Infrastructure (AMI) and Demand Side Management (DSM):** Consumers are suffering from the effects of high tariffs, unstable and inadequate power. With AMI and DSM, the price of power would be varied basing on demand such that power during peak hours electricity is more expensive than at off peak hours. Consumers would control their consumption during peak hours thus reduce transformer overload. Consumers would also be empowered to control their consumption so as avoid the high power tariff. Lastly if smart appliances and sockets are used in the consumer premises, direct load control would be possible [13]
- o **Distribution automation:** The distribution network suffers a lot of faults which sometimes take long to sectionalise. Distribution automation would ease fault management and possibly control vandalism
- o **Distributed generation:** There is a need to have distributed generation in order to relieve the load on the transformers in the distribution network
- o **Energy storage:** The country relies 70 % on hydro power, which varies with water levels. It would be good if in the rain season, electricity would be stored

Conclusion

The future for any electrical grid is in converting to a smarter grid. However before this can happen it is important for countries to clearly articulate the specifications of the smart grid that address their problems and thus propose smart solutions to them. This paper has explored the status of Uganda's electrical power grid and identified critical problem areas that will require custom designed smart solutions. The next stage of this research will be to study documented cases from elsewhere in the world and identify similar aspects and the emerging technology options that could be adapted to address the Ugandan power grid issues.

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Ruth Mbabazi holds an MSc degree in Data communication and software Engineering. At present she is a PhD student at Makerere University.



Professor Ben Sebitosi holds a PhD in Electrical engineering from the University of Cape Town. Currently he is a professor in the Department of Mechanical and Mechatronics Engineering, Stellenbosch University.



Dr Julianne Sansa-Otim holds a PhD from the University of Groningen. Currently she is lecturer in the department of networks, Makerere University.



Dr Richard Okou holds a PhD in Electrical Engineering, from the University of Cape Town. Currently he is lecturer in the department of Electrical and computer Engineering Makerere University.

Pyrolysis technology is making headway in South Africa

Gauteng based Milvinetix is one of South Africa's first fully functional pyrolysis plants. Working closely with the Recycling and Economic Development Initiative of South Africa (REDISA), over the last year and a half Milvinetix has received an infrastructure development grant of R310 per tonne of waste tyre – delivered at no charge by REDISA registered transporters.

This grant has been used by the company to develop existing infrastructure and purchase new equipment so that the business can expand, and ultimately take more waste tyres.

Pieter Buckle, managing director of Milvinetix said: "The infrastructure development grant paid by REDISA is a solid and reliable source of income. This has allowed us to focus on developing our core business and is an essential part of our company's ability regarding our planning strategies - particularly to potential future growth."

At this processor, tyres are transformed into smaller and simpler compounds. These compounds can then be turned into various products including carbon char, oil, and may also be used to generate electricity. Currently Milvinetix supplies its products to an organisation that further purifies the oil and sells it into the market. In addition, carbon char is supplied to interested parties who in turn re-process and refine the product which again is sold off to the market.

"Despite initial start-up challenges, we at Milvinetix continue to look for solutions in terms of creating synthetic fuels. This is not only leading to job creation opportunities, but also a cleaner South Africa," said Buckle.

All processors involved in the REDISA Plan are required to meet stringent criteria, and are subject to a vetting process.

"We applaud the work that Milvinetix has done to date. The company is certainly proving that pyrolysis is an upcoming industry for the South African market and is showing huge potential. Setting up a pyrolysis plant is an incredibly technical and expensive exercise, but companies like Milvinetix are going a long way towards assisting REDISA in setting up the new tyre recycling industry," said Stacey Davidson, director at REDISA.

Enquiries: Email info@redisa.org.za



EnviroFicient head office

Dr Musa Gumede, deputy city manager: Community and Emergency Services, officially opened Magnet's environmentally-friendly head office in Riverhorse Valley, Durban. "Special care has been given to every aspect of power usage in the building, to ensure minimum electricity consumption," says Brian Howarth, managing director, **Magnet**. The new premises utilise energy efficient LED lighting technology; occupancy sensors for the control of lighting and heat pumps which reduce conventional water heating costs. A 60 kVA solar array has been grid tied to eThekweni Electricity and photovoltaic (PV) modules, which convert solar energy to electricity, have also been installed.

Enquiries: Brian Howarth.
Email brianh@magnetgroup.co.za

Solar powered PC lab

Africa's first commercially available Solar powered PC lab built within a shipping container, will improve access to information and communication technologies (ICT) in non-affluent, rural and remote communities; a challenge that has been contributing to economic and social inequality in South Africa. 715 Learners at Umhloti Primary School in Verulam, KwaZulu Natal will benefit from the ongoing power of the sun when product developer, giveITback, in partnership with Poynting and African Union Communications, will donate the first of its Solar Powered Computer Labs valued at R450 000 RRP, on 05 December 2014. The digital divide, where less fortunate learners do not have access to, use of, or knowledge of ICT, has a major impact on economic and social inequality in South Africa.

Enquiries: Tel. 011 826 5959 or email info@giveitback.co.za

'Gusty' support for local wind power

Nordex, multi-megawatt wind turbine manufacturers supports the local wind power sector through job creation and continuous supply of cutting edge technology, employs 40 people at their three wind farm sites in the Eastern Cape and their Cape Town offices. Anne Henschel, managing director of **Nordex Energy South Africa**, spoke at WINDABA 2014, the 4th annual wind industry conference, hosted in November by the South African Wind Energy Association (SAWEA). Henschel formed part of a keynote session where industry leaders engaged multilaterally with the Department of Trade and Industry on South Africa's wind energy.

Enquiries: Email ahenschel@nordex-online.com

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Bizz Buzz

Award for training and skills development

Yokogawa South Africa recently received a Merit Award from the Vaal University of Technology (VUT) for their 'Consistent attainment in participation in and practice of the co-operative education'. VUT is one of Yokogawa's Tertiary Institution partners facilitating the Work Integrated Learning (WIL) Programme to students in the field of Process Instrumentation & Control. Work Integrated Learning forms part of a learner's three year curriculum to complete a National Diploma in Electrical Engineering. Learners spend two years at a University of Technology to complete the academic work (theory and practical), followed by one year of Work Integrated Learning at a company that has been accredited to facilitate the WIL Programme.

*Enquiries: Tel. 011 831 6300 or email
Christie.cronje@za.yokogawa.com*

Mandela School - first year's success

The Mandela School of Science & Technology in the Eastern Cape has concluded a successful first year of teaching and learning as powerful contribution to Madiba's education legacy. 420 learners in Grades 8 - 10 started classes at the Mandela School in January 2014 after the school was opened by President Jacob Zuma as a world-class education institution in the Mvezo birthplace of former statesman and South African President Nelson Mandela. The pioneering new school was built by **Siemens** following a 2010 request from Mandela himself, then handed to the Eastern Cape Department of Basic Education. The young people of Mvezo were able to attend secondary school close to home for the first time, and to specialise in the skills South Africa needs most, including Science, Engineering, Technology and Agriculture. The school is already full for 2015, with 540 students from Grade 8 to Grade 11. The first matric (Grade 12) class commences in 2016.

Enquiries: Tel. 047 495 0113

Furnace gas project near Saldanha

GE is honoured to play a role in the Tronox Namakwa Sands furnace gas project, near Saldanha in the Western Cape, which recently won the Southern African Association for Energy Efficiency (SAEE) 2014 Project of the Year Award. The 13,6 megawatt Tronox Namakwa Sands gas project uses eight of GE's Jenbacher gas engines to recycle furnace gas, a waste by-product of the smelting process, to generate electricity. The energy-efficient co-generation project reduces the environmental impact of the smelter plant and creates a source of onsite power, reducing reliance on the constrained national power system.

Enquiries: Tel. 011 237 0019 or email Thulisile.phiri@ge.com

Excellence in steel and engineering

To encourage growth and celebrate excellence in the metals and engineering sector, the Steel and Engineering Industries Federation of Southern Africa (SEIFSA) has taken the initiative of introducing the annual SEIFSA Awards for Excellence.

To foster a culture of excellence in these industry sectors, the awards offer 10 different categories and SEIFSA invites manufacturers in metals and engineering operating in Southern Africa to submit their entries. The 10 categories are:

- o The Most Innovative Company of the Year will be awarded to a company showing the highest level of innovation in research and development or production
- o The Health and Safety Award of the Year will be offered to a company with the best legal compliance record in Health and Safety or the lowest Lost Time Injury Frequency Rate
- o Entries are also called from companies whose Corporate Social Initiative programme bears a major impact on the lives of its beneficiaries
- o Companies rated the highest in customer performance by the industry will receive the Customer Service Award of the Year
- o Most Transformed Company of the Year award will be received by a company that shows the highest transformation in the composition of its Board of Directors, Executive Management and Managerial Team. This award allows for companies employing fewer than 100 people, and companies employing more than 100 companies
- o This is the Decade of the Artisan, and an award will be made to the company that has trained the highest number of artisans
- o The Environment Stewardship Award will be awarded to a company that has made the biggest and best strides towards conserving the environment, and in mitigating the impact of its operations on the environment.
- o SEIFSA's member companies and affiliated Associations will also be honoured at the Awards function taking place in March 2015

Companies operating in these vital economic sectors are encouraged to not only enter proposals for any one of the categories offered, but to also consider taking up the various marketing opportunities available at www.seifsaawards.co.za.

*Enquiries: Alison Spratley. Tel. mobile 082 467
or email alison@brandivison.co.za*

Security, safety, fire and protection expo

The world-class security, safety, fire and protection exhibition IFSEC South Africa, is set to relaunch under the well-known and highly respected Securex brand for its show in 2015.

Securex will be the largest and most comprehensive show of its kind in Africa and the only show exclusively dedicated to the very latest developments in security, safety, fire and protection. It is aimed at all those in the trade who consider issues of business and personal security, protection and safety to be of paramount importance.

OSH Expo Africa will be rebranded as A-OSH (African Occupational Safety and Health) Expo, and will run concurrently with Securex. This popular expo is aimed at the African occupational health, safety and environmental markets and offers professionals and business operators from across a broad range of industries the opportunity to source new products, hear keynote seminars and take part in exclusive networking events tailored for the African market.

Securex and A-OSH Expo will run from 12 - 14 May 2015, at the Gallagher Convention Centre, Johannesburg.

Enquiries: Joshua Low. Email joshual@specialised.com

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2nd Annual Cable Anti-Theft Technologies Summit

24 & 25 FEBRUARY 2015

Emperors Palace, Kempton Park Gauteng

OBJECTIVES

- to update strategies against cable theft
- to investigate technology ways of preventing copper cable theft
- to understand laws regarding cable technology

Opportunities to participate, please tick

Speak Sponsor Exhibit

ASPECTS TO BE COVERED

- to discuss technologies against cable theft
- to understand laws regarding cable technology
- roles played by municipalities, SAPS, Metro Police
- visible policing to curb cable theft
- improvements on applied technology and equipment
- way forward

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DEHN protects St Melanie's school

DEHN PROTECTION South Africa recently extended the protection of the young attendees of the St Melanie's Day-care and Pre-school in Pretoria, Gauteng, with the donation of much-needed sunshades for the outside play area, as well as a main gate for the school. Alexis Barwise, managing director of DEHN PROTECTION South Africa, along with Dr Philipp Dehn, chief executive officer of the DEHN group and Bernhard Stadlmann, international sales senior executive at DEHN+SÖHNE, were on hand to assist with the installation of the new equipment as well as to enjoy the playground with the kids. Says Barwise: "By assisting St Melanie's with this donation, DEHN has helped ensure that the school's pupils now have access to a much safer outside environment, both in terms of providing a more secure playground as well as protection from the heat of the sun."

Enquiries: Tel. 011 704 1487 or email alexis.barwise@dehn-africa.com



Dr Philipp Dehn (DEHN Group) Alexis Barwise (DEHN Protection South Africa) and Bernhard Stadlmann (DEHN+SÖHNE).

Zest WEG Group assists educational facilities

Training to meet dire skills shortages remains a motivating issue for the Zest WEG Group. The company has donated in excess of R2 M worth of products to training schools, colleges and other educational institutions as part of its corporate social investment (CSI) initiative. The donations cover the whole spectrum of educational levels, from pre-primary, to primary schools, high schools and tertiary education.

Enquiries: Kirsten Larkan. Tel. 011 723 6000 or email kirstenl@zest.co.za



Nokuthula Shabangu (Zest WEG Group), Bruce Mbuli (Nkangala College); Peter Phahla (Nkangala College) and Phumelele Brown (Nkangala College). Back: Elias Thobejane, driver.



Zest WEG Group: Kevin Venketroyalu, Brandon MacDonald and Nokuthula Shabangu. Pretoria Technical College: Sicelo Gumede and Muano Magoro.



Hygienic design of food processing plants

10 - 11 February (Cape Town)
21 - 22 April 2015 (Johannesburg)
Enquiries: Email andrew.murray@mweb.co.za

7th Annual Africa Energy Indaba

17 - 18 February 2015, Sandton Convention Centre
Enquiries: Email mbali@siyenzaevents.co.za

Cable Anti-theft Technologies Summit

24 - 25 February 2015, Emperors Palace, Gauteng
Enquiries: Email amandab@mogorosicomms.co.za

Power & Electricity World Africa 2015 featuring the Solar Show Africa

24 - 25 March 2015, Sandton Convention Centre, Johannesburg
Enquiries: Email marketing@go.terrapinn.com

Domestic Use of Energy (DUE) - Towards sustainable energy solutions for the developing world

30 March - 1 April 2015, Cape University of Technology
Enquiries: Email due@cput.ac.za

15th annual African Utility Week and Clean Power Africa conference

12 - 14 May 2015, International Convention Centre, Cape Town
Enquiries: Email nevenka.ristic@spintelligent.com

Energex Africa

For manufacturing, engineering, water, petrochemical, plastics and energy sectors
20 - 22 May 2015, Gallagher Convention Centre, Midrand, Johannesburg
Enquiries: Email sales@exhibitionsafrica.com

The 3rd POWER-GEN Africa and DistribuTECH Africa

15 - 17 July 2015, Cape Town International Convention Centre, Cape Town
Enquiries: Email ferrial@tradeprojects.co.za

ICUE-2015 Conference (Industrial and Commercial Use of Energy)

17 - 19 August 2015. Cape University of Technology
Enquiries: Email icue@cput.ac.za

25th AMEU Technical Convention 2015

4 - 7 October 2015, Sandton Convention Centre, Johannesburg.
Call for papers - proposals of no more than 200 words to be submitted to the AMEU Secretariat by Friday, 3 April 2015
Enquiries: Jean Venter. Tel. 011 061-5000 or email 011 061-5000

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