

THIS MONTH:

- The machine automation controller (MAC)
- Streamlining automotive manufacturing in SA
- PPP brings fuel cell technology to the healthcare sector
- Global pneumatics market leader to open in South Africa

MECHANICAL



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Published monthly by
Crown Publications cc

Crown House
Cnr Theunis and
Sovereign Streets
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The views expressed in this journal are not necessarily those of the publisher or the editor.



Transparency You Can See

Average circulation
(April–June 2015)
3 722

Printed by:

Tandym Print – Cape Town

The nuclear ‘new build’: a call for pragmatism

I attended a nuclear roundtable earlier this month, organised by Kelvin Kemm’s Nuclear Africa and sponsored by Rosatom. The idea was to dispel some of the misconceptions being generated in the media and to better communicate nuclear realities.

The government’s nuclear procurement goals, as far as we know, are still based on the 9 600 MW of nuclear generation capacity suggested in the 20-year Integrated Resource Plan of 2010 (IRP 2010-2030) and approved by cabinet in March 2011. The goal back then was to generate 23% of our total energy needs from nuclear plants by 2030.

This 9 600 MW target was reaffirmed in the president’s state-of-the-nation address of February 2015, and Zuma assured us of an open and fair bidding process involving the US, China, France, Russia and South Korea. Yet it remains hard not to see Rosatom as the preferred bidder?

So the procurement process has begun. Energy Minister, Tina Joemat-Pettersson, says that a strategic partner will be selected by March 2016 and the first unit is scheduled to be on line by 2023.

Here are some of the ‘realities’ that were communicated to me at the roundtable event:

- The 9 600 MW of generation involves eight individual nuclear plants at three power stations, suggesting 1 200 MW nuclear ‘units’ and power stations with capacities of 3 600 MW (two) and 2 400 MW (one).
- Three sites have already been identified and assessed, the environmental impact assessments have been completed and all have passed muster.
- The sites are likely to be Thyspunt, 70 km down the coast from Port Elizabeth; Bantamsklip, a rocky stretch of coast in the Overberg district of the Western Cape; and Duynefontein, two or three kilometres south of the existing Koeberg power station.

Two key issues dominated the roundtable debate: safety and costs.

On the safety side, I didn’t need much convincing. I am one of those who believe that Fukushima is actually testament to the safety of nuclear power technology. Radioactivity is undoubtedly dangerous, but it is safely used for nuclear medicine and radiographic testing all over the world. In terms of accidents, Chernobyl, the worst-ever in the nuclear power industry, resulted in 31 deaths at the time, which, although grave, pale into insignificance compared to the Bhopal chemical disaster of 1984, where estimates of the death toll range from 4 000 to 20 000 – and ongoing health issues persist. Also reassuring is the involvement of the IAEA (International Atomic Energy Association) in the safety approval processes for all the world’s nuclear plant.

The cost of nuclear, however, mostly because of the safety technologies and approvals that have to be put in place, is high. But how high? The nuclear lobby seems to have become obsessed with dismissing the R1-trillion price tag attached to the 9 600 MW nuclear build programme. At the round table, Dawid Serfontein, on pressed to give a cost estimate, suggested it would be closer to R650-billion, but quickly conceded that this was based on 2012/2013 data.

The appropriate coal/nuclear cost comparison is the combined cost for Medupi and Kusile, which will also generate 9 600 MW when completed (2×4 800 MW). This is currently predicted to have already risen to R154-billion for Medupi and R172-billion for Kusile, totalling in excess of R326-billion.

As Serfontein argues, while nuclear ‘overnight’ costs are high (at around US\$5-billion per 1 200 MW reactor), the operational and maintenance costs are lower than coal-fired equivalents and the life of nuclear plants (60 years plus) is significantly longer. His analysis, which uses the post-tax weighted average cost of capital (WACC%) to compare the R/kWh levelised costs of electricity (LCOE) for coal and nuclear generation options, concludes that, provided government’s post tax WACC rate demand from Eskom remains below 4.0 %, nuclear energy will be less expensive than coal.

I don’t fully understand the analysis or the sources of the costs, but it seems clear to me, providing the costs and the interest rates on capital can be contained, that a total cost of ownership model positions nuclear energy as an affordable and sensible option – and a relatively green one.

But given skills shortages, localisation imperatives and the time and cost overruns for Medupi and Kusile, isn’t it obvious that bidding for and building three expensive nuclear power stations, while simultaneously trying to complete two new coal-fired plants, is a fence too high to climb?

Let’s build the two-unit nuclear power station first, at more manageable costs in the R150-billion to R200-billion range. And if the costs overrun, or shale gas becomes a reality, then we can modify the energy mix to suit.

We don’t have to adhere to a plan formulated in 2010.

Peter Middleton



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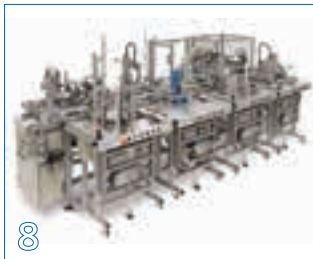
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ON THE COVER



Wagon tipplers for more efficient unloading of bulk materials

Following the successful delivery of a tandem rotary tippler to the port of Nacala in Mozambique, sales manager, Matthias Göing and sales engineer, Luc Tellier of ThyssenKrupp Industrial Solutions, Resource Technologies, talk about the advantages of their technology for the sustainability of mining, exports and power stations.

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Wagon tipplers for more efficient unloading of bulk materials

Following the successful delivery of a tandem rotary wagon tippler to the port of Nacala in Mozambique, sales manager, Matthias Göing and sales engineer, Luc Tellier of ThyssenKrupp Industrial Solutions South Africa, Resource Technologies, talk about the advantages of their technology for the sustainability of mining, exports and power stations.



Luc Tellier and Matthias Göing.

“Globally, wagon tipplers are one of our flagship products, but ThyssenKrupp is not as well recognised for this equipment in sub-Saharan Africa as we are in the rest of the world,” begins Göing. “There are only two premium OEMs of wagon tipplers in the world and we share the global market relatively evenly. But here, due to historical reasons, we are not nearly as well-known as we should be,” he adds.

To transport bulk materials over long distances in large volumes, typically millions of tons per year: “operators need to load at the mines and transport the material efficiently, economically and in an ecologically friendly way to its destination, be that a power station or an export terminal”.

“For distances of up to 50 km, overland conveyors are arguably the better option, but for the overland transfer of bulk materials over greater distance, only trains make sense. And for unloading material from railway wagons at a destination, wagon tipplers are, by far, the most productive and efficient solution,” explains Göing.

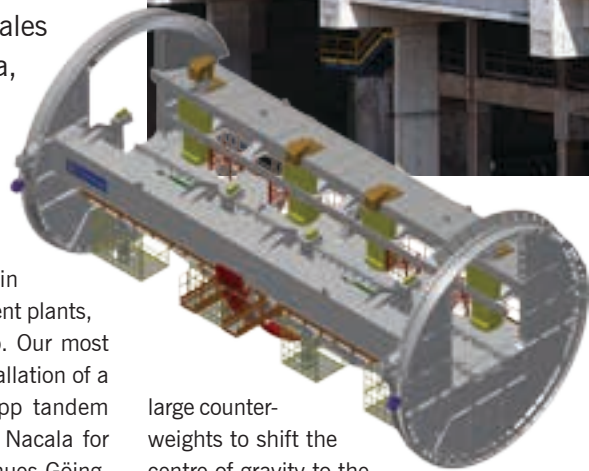
Wagon tipplers are used in South Africa, in Richards Bay at the end of the coal line and in Saldanha to unload

iron ore from Sishen. “We supplied some side wagon tipplers to Saldanha Steel in the early 90s and to the cement plants, but that was some time ago. Our most current success was the installation of a state-of-the-art ThyssenKrupp tandem rotary tippler at the Port of Nacala for Vale in Mozambique,” continues Göing. This system unloads trains bringing coal to the deep-water port from the Moatise Basin in the Tete Province of Mozambique, estimated to contain 2.4-billion tons of coal. “We have installed and commissioned a tandem O-type wagon tippler in Nacala with a throughput capacity of 6 500 t/h,” he tells *MechTech*

Random and side tipplers

Tellier describes the different types of wagon tipplers available from ThyssenKrupp. “Most commonly used in South Africa are random tipplers, which require that the train is broken up into smaller sections, called rakes, before being unloaded. Typically, a large random tippler would be able to discharge a 10-wagon rake, but they are most commonly used to discharge one or two decoupled wagons at a time,” he explains. “These are ideal for smaller plants and power stations,” he says, adding “the key advantage of random tipping is that any type of wagon can be accommodated, depending on the ore being transported.”

Side tipplers are the simplest random option and are generally used to tip a single uncoupled wagon. “The turning point of a side tippler is off centre and side tipping involves lifting the wagon around in an arc, unloading the material along the side of the track into a bin at ground level.” These systems have



large counterweights to shift the centre of gravity to the offset turning point. This means that wagons have to be decoupled due to the lateral movement. The key advantage is that less underground civil work is required, since the ore can be offloaded at ground level.

Another solution, currently being used due to the shortage of bulk ore wagons, is the container tippler. “Operators are looking to use strengthened 20-ft containers instead of dedicated bulk wagons to transport ore. Two containers are then transported on each flat bed wagon in a train. “At its destination, the container filled with commodities is then lifted off the train using a container tippler hanging off a crane. The tippler allows the container to be rotated underneath the crane hook to discharge the material onto a stockpile. “This is an interim solution though, which while flexible, cannot substitute for a dedicated wagon tippler solution,” Göing argues.

Rotary tipplers and unit trains

Bigger bulk operations, such as Nacala, Richards Bay and Saldanha Bay, operate unit trains, which are purpose-built trains designed with rotary wagon tipping in mind. Unit trains incorporate rotary couplings so that the wagons do not need to be decoupled from the loco or the other wagons before tipping the materials. “And for higher throughput, unit trains can also be coupled in pairs



Above: ThyssenKrupp's most current success, a state-of-the-art ThyssenKrupp tandem rotary tippler at the Port of Nacala. These systems require deep bunkers underneath the rotary tippler to accumulate the material. **Left:** Rotary tipplers are designed so that the turning point coincides with the axis of rotation of the wagon couplings in the tippler. **Right:** Side tipplers are the simplest random tippler option.

– two wagons hard coupled together with a rotary coupling between each pair. This arrangement allows for tandem tipping, where two hard-coupled wagons are unloaded simultaneously,” says Tellier.

At the Majuba power station, one of Eskom's largest power plants (4 110 MW) and one of the few without its own dedicated coalmine, a random rotary tippler is being used to accommodate rail delivery of 0.42 Mt/month (14 000 t/d) from coalmines in Ermelo. A further 0.74 Mt is delivered less efficiently by road, using approximately 700 trucks per day. “Trucking is currently necessary because of the inadequate railway infrastructure to power stations, but it does not help the overall efficiency and productivity of our plants,” Göing suggests.

Rotary tipplers are designed so that the turning point coincides with the axis of rotation of the wagon couplings in the tippler. “These systems require deep bunkers underneath the rotary tippler to accumulate the material. Both single and tandem rotary tipplers are available, depending on throughput requirements and coupling arrangements on the unit-trains,” he explains.

Adds Göing: “There are two types of rotary tipplers, the O-type and the C-type. The C-type design has an opening to the one side to allow the wagon positioner to pass through the tippler unhindered. If using an O-type tippler, the wagons need to be pushed into and out of the tippler from further up or down. There is a small time savings associate with a C-type tippler, because the positioner can operate closer to the wagons being pushed into the system.”

Positioners and clamping

Before tipping, the wagons need to be accurately positioned into the tippler so that they can be securely clamped and safely rotated. A positioner fitted alongside the railway line performs this function. A hydraulic arm swings down onto the wagon couplings between wagons and pushes the train or the rake of wagons along the track, moving the empty wagons out of the tippler and the following loaded wagons in. “Modern positioners are driven on a rack and pinion system by a hydraulic or electric drive. These systems move the entire train and position the wagons to within a centimetre,” Tellier informs *MechTech*, “and this is all done automatically with the positional accuracy being ensured by an advanced control algorithm and feedback sensors”. “Multi-body dynamic simulations are used to correctly size the positioner drives and to optimise the positioner control algorithm,” he says.

Once positioned, the wagons are locked onto the tippler using a clamping system. “We are globally renowned for our hydraulic clamping system, which is a lightweight, flexible and efficient modern system, but gravity clamping has become preferred in South Africa – and as world leaders in tipplers, we can offer gravity clamping solutions just as easily,” Göing assures. Gravity clamping works off mechanical linkages and counterweights, which cause clamps to lock onto the top edges of the wagon as soon as the tippler begins to rotate.

Showing a Scada image on a wagon tippler, Tellier points out the feeder bins underneath a rotary tippler. “Each tip-

ping action is depositing 80 t (single) or 160 t (tandem) of material into the bins below, and you want to make sure that the material is able to flow smoothly and continuously onto the conveyors and that the bulk does not hammer directly onto the vibratory, apron or belt feeder below. So the levels of the bins and the belt loading rate is carefully controlled to optimise material flow and to best match the wagon unloading rate,” he explains.

The ore from the wagon tippler is channelled into separate bins below the system, and the level of each of these is carefully monitored – typically by using 3D radar measuring technology from Indurad – and automatically controlled to balance the output flow with the batch unloading of the wagons. “These systems can deliver at 6 500 t/hr, so several feeders are required to match the unloading speed and remove the material fast enough,” he adds.

“We are a local OEM capable of designing and manufacturing entire wagon tippler systems – the tippler, positioners, bins, apron feeders and conveyors – to smooth the flow of material while allowing wagons to be emptied as fast as possible,” says Göing.

“And in addition to ThyssenKrupp's wagon tippler offering, we can offer solutions from the mine stockyards and load-out stations, through the rotary tipplers and all the way to the stackers, reclaimers and ship loaders. Our modern solutions enable efficient transportation of bulk materials that can significantly improve the competitiveness and long term sustainability of local mining operations,” he concludes. □

Air Products and Mercedes Benz Trucks sign 'promise charter'

A relationship between Air Products South Africa and Mercedes-Benz Trucks, which began two years ago, was further strengthened recently at a 'promise charter'-signing event in East London



Air Products has acquired sixteen new Mercedes-Benz Actros 2644's for its Bulk Gas division, four for its Packaged Gas division, and a further four for its Bulk division.

between the two companies.

Impressed by Mercedes-Benz's customer-focused service as well as cab design, comfort and fuel-efficiency, Air Products placed its first order of sixteen new Mercedes-Benz Actros 2644's for the Bulk Gas division. The company has subsequently purchased four more of these vehicles for its Packaged Gas division, and a further four for its Bulk division.

"Brendan Ekermans at Mercedes-Benz Commercial Vehicles, East Rand has been a pleasure to deal with and is an asset to the company," comments Seelan Gounden, general manager of Supply Chain at Air Products South Africa. "Brendan and his team showed us nothing but focused, friendly service," Gounden adds.

"Efficiency, safety and unrivalled

service are what Mercedes-Benz Trucks promises to deliver to Air Products, as they are one of our most valued customers. As testament to this commitment and summed up in our corporate tagline, we produce "trucks you can trust," says Clinton Savage, divisional manager: Mercedes-Benz Trucks.

"In our 46th year of market leadership in this country, we are very excited to be collaborating with a like-minded partner such as Mercedes-Benz; and we look forward to a long and fruitful association with them.

"In our quest to 'deliver the difference' to our customers around the country, our fleet of Mercedes-Benz trucks, backed by excellent service and support, will play a crucial role going forward," concludes Gounden. www.airproductsafrica.co.za

SA students' solar car takes on the world's best

Engineering students at the North-West University (NWU) are taking a big bull by the horns when, in October this year, they take part in the Bridgestone World Solar Challenge in Australia.

Following NWU's successes in the local Sasol Solar challenges in 2012

and 2014, the team decided to build a better and faster solar vehicle. The first competition NWU competed in covered more than 5 000 km and, along with the team from the Tokai University in Japan, the local team shared the laurels.

According to professor Albert Helberg,



NWU's latest solar vehicle is faster, lighter, more efficient and stronger.

team leader, they have now harnessed new technology to make the latest vehicle faster, lighter, more efficient and stronger, which all allows this NWU solar car to be propelled by the amount of energy used by a hair drier. The competition takes place from 18 to 26 October and starts in Darwin in north Australia, where 45 vehicles from 25 countries will be racing more than 3 000 km across the country to Adelaide. "We should cover the distance in seven days but we are aiming to do it in five," says Helberg.

"We will be competing against the top universities in the solar energy fields and want to prove that we can align ourselves with their expertise. We can indeed compete with them and we want to prove this to the world."

www.nwu.ac.za

ABB to install microgrid solution

ABB, the leading power and automation technology group, has announced that it will install an integrated solar-diesel microgrid at its Longmeadow premises in Johannesburg, South Africa. The 96 000 square meter facility houses the company's country headquarters as well as medium voltage switchgear manufacturing and protection panel assembly facilities. The innovative solution includes a rooftop solar photovoltaic (PV) field and a PowerStore™ grid stabiliser that will help to maximise the use of clean solar energy and ensure uninterrupted power to keep the lights on and the factories running, even in the event of grid supply outages.

A 750 kW rooftop PV plant and a

1.0 MVA/380 kWh battery-based PowerStore will be added to the existing back-up diesel generators. This will enhance the use of renewable energy and provide continuity of supply when power is disrupted and during transitions from grid to island operation.

Power shortages, availability of renewable energy sources such as wind and solar, fossil fuel price volatility and environmental concerns are leading to the search for sustainable solutions and there are thousands of facilities across South Africa and the continent that could leverage microgrid technologies to address these challenges.

South Africa has the highest electricity consumption in the sub-Saharan region and

demand continues to outpace supply. As highlighted in a recent report by McKinsey & Company, sub-Saharan Africa will consume nearly 1 600 TWh of electricity by 2040 – a four-fold increase on 2010 consumption – and sub-Saharan Africa could consume as much electricity as India and Latin America combined.

"Alongside traditional and renewable generation, microgrids are increasingly being deployed to provide electricity to remote or isolated areas," says Claudio Facchin, president, ABB's Power Systems division. "They can also serve as a flexible backup source for industrial and commercial facilities and help address power disruptions."

new.abb.com/southern-africa

The Queen meets pump royalty

Her Majesty, Queen Elizabeth, was recently shown a scale model of the world famous Warman® slurry pump on a visit to the Weir Advanced Research Centre (WARC) at the University of Strathclyde's Technology and Innovation Centre in Glasgow, Scotland. Warman slurry pumps have been manufactured around the world since 1938. The Minerals division of The Weir Group is now the global market leader in slurry pumps used for minerals processing.

The collaboration with the University of Strathclyde is part of Weir's commitment to continuous innovation of its products, a commitment that includes engineers working with academics from some of the world's leading technological institutions. Weir already has similar research relationships with Imperial College London, the University of Sydney, the University of Queensland, and the Royal Melbourne Institute of Technology.

The Queen was shown a scale model



Queen Elizabeth visits the Weir Advanced Research Centre (WARC) at the University of Strathclyde in Scotland.

of a minerals processing plant and learned of Weir's global operations empire, which stretches over more than seventy countries and includes more than 200 manufacturing and service centres. The most recent addition to the company's portfolio is the Trio® range of comminution products for crushing, screening and grinding.

www.weirminerals.com

Emerson signs 10-year agreement with BP

BP and Emerson have signed a global agreement for Emerson Process Management, a global business of Emerson (NYSE:EMR), to provide automation technologies and aftercare services for BP's upstream oil and gas operations. The new 10-year agreement extends the existing arrangement between the companies, allowing Emerson to provide an expanded scope of technologies and expertise to help ensure safe and competitive projects and to support BP's Field of the Future® programme for enhanced operating efficiency and oil recovery.

"This agreement further underscores BP's commitment to safe and reliable operations, as well as our commitment to remaining at the forefront of upstream oil and gas technology," says Adrian Luckins, vice president of Global Project Solutions at BP.

In addition to automation that helps

companies like BP run their processes smoothly, safely, and efficiently, Emerson also provides services and technologies to reduce project cost, schedule risk, improve reliability and reduce expensive downtime in ongoing operations.

Under the scope of the new agreement, Emerson will continue to supply automation system technologies, including distributed control systems and safety instrumentation, but will now also provide valves and measurement instruments as well as technologies for supervisory control and data acquisition, asset management, and machinery health monitoring.

As BP's main automation contractor, Emerson will also continue to deliver a range of project and support services that include system engineering, installation, configuration, testing, and ongoing support.

www.emerson.com

Independent power to copper mines in the DRC

Master Power Technologies (MPT) has supplied two copper mines in the DRC with power generation capabilities totalling around 15 MVA. MPT's partner in the region, FG Wilson, installed the solutions and the company will continue to provide maintenance services to the mines.

Master Power was tasked with the

project after winning the tender from FG Wilson. Using P1250P3 diesel generators, MPT was able to deliver high quality 15 MVA power station solutions to this remote area of the DRC. FG Wilson provides the mines with local service and warranty support from local FG Wilson dealers.

www.kva.co.za

In brief

Presenting at the annual **Infrastructure Africa Business Forum**, the **Africa Progress Panel (APP)** in its recent "Power, People, Planet" report, suggests sub-Saharan African governments should be aiming to increase electricity generation capacity tenfold and achieve universal access to electricity by 2030.

WorleyParsons is progressing with the design engineering contract to provide concept and detailed design and procurement, construction and commissioning support to **Group Five International**, the EPC contractor on the US\$374-million, combined cycle Kpone Independent Power Plant (KIPP) in Ghana.

The first shipments from Germany were recently offloaded at Coega Bay for **Cennergi's** 134.4 MW Amakhala Emoyeni Wind Farm project in the Eastern Cape, where 56 N-117 2.4 MW Nordex turbines will produce wind energy for the national electricity grid.

Speaking at the **SA Innovation Summit**, deputy director general of the **Department of Trade and Industry** Malebo Mabitje-Thompson announced the launch of the new **Support Programme for Industrial Innovation (SPII)**, which will provide grants to entrepreneurs. "Innovation is going to be the only solution to some of the problems we face today," she said.

The **Energy Training Foundation**, together with the **City of Cape Town** has developed a training programme focused on non-technical staff such as facility managers, building operators and maintenance staff. The City has, to date, trained 45 of its building facility managers with the vision to ensure sustainable management of its facilities.

FAW Vehicle Manufacturers SA announced the lowest-cost-per-ton truck on the SA market when it introduced its FAW 8.140 FL range, with a record-breaking price of R239 000 (excluding VAT) for the FAW 8.140 FL chassis cab.

SEW-Eurodrive has appointed Johan van Graan as technical trainer for the SEW Drive Academy. With a diploma from the Tshwane University of Technology as well as P1 and P2 Technicon qualifications, Van Graan has in-depth experience in electronic and mechatronic design and manufacturing.

To meet the needs of customers in Cape Town, **SKF South Africa Training Solutions** has opened its first official Regional Training Centre in that city. "We are living the group's global vision: 'to equip the world with SKF knowledge'," says the company's Training Solutions manager, Steve Parkinson.

Global pneumatics market leader

to open South African facility

Following initial establishment earlier this year as the local subsidiary of SMC Corporation, the Japanese TOPIX Large 70 company, SMC Pneumatics South Africa is in the process of finalising 4 000 m² of manufacturing, assembly, warehousing and engineering development space in Midrand, Gauteng. *MechTech* talks to Adrian Buddingh (right), the South African subsidiary's general manager.



A 3D Architectural model of SMC new building in Midrand. "The new facility will have manufacturing, assembly and full-on systems integration capabilities," says Buddingh.

Specialising in pneumatic control engineering in support of industrial automation, Japan-based SMC is an original equipment manufacturer (OEM) for a broad range of pneumatic equipment and associated control systems, such as: directional control valves; pneumatic cylinders and actuators; valve terminal blocks; electronic controllers; air line filtration and drying equipment; and a host of supporting components for automation systems and control applications.

With its head office in Tokyo, Japan, the company has a global engineering network with additional technical facilities in the United States, Europe and China. "Internationally, SMC is the largest pneumatics company on the planet, having established a 32% global market share," says Buddingh, "but in South

Africa, in spite of a distribution history going back 20 years, our presence remains small, probably below 5.0%," he reveals.

Hence SMC's formal entry into South Africa to "raise the profile of the pneumatic side of the automation business".

While SMC has a 180+ page catalogue of pneumatic components, Buddingh describes the company as "experts in automation". "We use pneumatics to put together factory and manufacturing control systems, and we will have a full suite of facilities in our new building to help us engineer, design, assemble and set up fully functional integrated systems," he adds.

The construction of the new building in Midrand, Gauteng is currently being finalised by Growthpoint Properties. "The new facility will have manufacturing, assembly and full-on systems integration

capabilities," Buddingh says, opening a floor plan of the new building.

"Half of the floor space is a double volume local manufacturing area, mostly for the machining of customised cylinders to suite local applications. While standard products tend to be more economical if manufactured in one of our dedicated high-volume overseas plants, 20 to 25% of the cylinders used in South Africa need to be customised in some way, so we are setting up to enable us to quickly respond to these needs," he explains, pointing out the positions of CNC machines, automatic cut off saws, assembly presses and a spray booth for corrosion protection and finishing.

"The Japanese are very particular about quality and material specification, so for the time being, we will import our raw materials, but we have not precluded local sourcing should the quality and price be right," he continues. Typically, shafting for pneumatic cylinders is made in 316 stainless steel, while hard-anodised aluminium is used for the barrels. "In Japan, everything is made by SMC. They even have their own extruder to make the barrels directly from billets. It is one of the only companies in the world to have taken on quality and manufacturing responsibility all the way from raw materials to finished products," he says. "In South Africa, though, we will assemble components to specific customer specification and engineer turnkey automation systems," he adds.

The other half of the building is split into two levels. "Downstairs, we have an SMC showroom and training centre. We will be offering training on anything relevant to our growing portfolio," Buddingh continues. SMC's International training

Via its competence centres, SMC Training has specialised in identifying the skills demands in pneumatic automation and provides training solutions to face the challenges.





offering includes: seventeen product families of didactic equipment, all flexibly configurable to develop automation skills sets; sixteen eLearning courses on the theory of different technologies; and an internationally recognised certification programme endorsed by the SMC Competence Centre.

“The Japanese have a unique strategic approach to new developments. They see the benefit of developing large numbers of well-qualified engineers in growth areas to directly support customers and the distribution network. This is because, in new regions, neither customers nor distributors have the experience, knowledge and expertise in the technology to know what the possibilities are. So training is key: for customers, distributors and also for all of our new staff. SMC focuses heavily on excellence when it comes to the use of pneumatic components in automatic applications, so we are very committed to the didactic model,” Buddingh assures, adding that, “every one of our 17 new employees has already been to SMC’s European headquarters in Milton Keynes, UK for induction and technical training.”

The floor above the training area of SMC’s Midrand facility is configured as office space for engineering, sales staff and IT support.

“Start up inward investment from SMC Japan and Europe is around R120-million, £6-million. In addition, the overall investment for machinery is R16.5-million and, for exhibition equipment in the showroom, R4.5-million. We also have R20-million worth of stock on the water right now,” he reveals.

“We take occupation of the facility in October and hope to be functional from

November,” he tells *MechTech*. The machinery is on order from Japan and SMC’s UK team will be installing and commissioning it. A series of manufacturing approvals will follow, with products being sent back to Japan for quality assurance. Installation should be complete by the end 2015 and production will be ramping up during the first quarter of 2016.

“An experienced production manager from the UK has been assigned to us for the first year of local production to establish the procedures and quality systems. Cape Town and Durban sales engineers have been appointed and SMC intends to open offices with over the counter sales outlets in these two cities. We are currently looking to employ up to 25 new people by the end 2015 and 40 to 50 people by end 2016,” Buddingh says.

Describing SMC’s growth philosophy, he adds: “SMC is all about market share: In Japan, SMC enjoys 62% of the market, but worldwide, SMC has 32% of the total pneumatic market, which makes it the largest pneumatic components’ OEM. The global target is to get to a 50% share of the market. Our local objective is to grow our market share to better match SMC’s global success.

“But SMC takes a long-term view. Five years is short term and this initial investment is being made to reach the break-even point by year five. Up to that time, the company is prepared to operate at a net loss, but from there on, the goal is to grow market share every year to contribute positively to the company’s global growth ambitions,” he explains.

Buddingh believes that the local pneumatic market is currently stagnant, and while optimistic about the new company’s ability to improve market share,

he points out the SMC has the benefit of other niche products, such as chillers, industrial filters, process gas equipment and air (de) ionisers. “We have a host of other products that give additional opportunities in the processing sectors, for clean room applications and processing systems in the chemical, petrochemical, water and wastewater industries, for example. We specialise in automating filtration and purification plants and accurate air temperature control of critical processing environments,” he adds.

On the pneumatics side he says that SMC is very strong in the automotive sector. “Toyota is one of SMC’s largest international customers, so, in conjunction with our local distributors, we will be offering support to companies such as Toyota, Nissan as well as second and third tier suppliers such as Bridgestone.

“And while you might expect German automotive manufacturers, such as Mercedes Benz, to rely exclusively on the German pneumatics manufacturers, this is not the case,” he says, citing an SMC success story for the new C-class being manufactured in East London. Because of the extensive use of aluminium for the body frame, self-piercing rivets are being used instead of traditional joining techniques.

“A Cape Town-based subsidiary of a UK company is the specialist supplier of this technology in South Africa and its self-piercing riveting systems all use SMC system components,” Buddingh informs *MechTech*. Through companies such as these and the existing distribution network, SMC Pneumatics South Africa will now take on the role of servicing all existing clients in South Africa.

“SMC’s quality is as good or better than any of the world’s premium pneumatic OEMs, but we offer a pricing advantage of between 15 to 20% below premium quality equivalents. As well as a massive standard product range, we also offer the flexibility of local manufacture for customisations.

“We think we have the best employees and, from a customer experience point of view, their expertise is what really matters. Service excellence is an inherent quality in Japanese culture, so our commitment to service is a given, from the point that an application is identified all the way through to the reliability, routine maintenance and upgrading needs of the system in operation,” Buddingh concludes. □



Slurry valves, abrasion and lowering TCOs

Valves, according to product manager Kobus Steyn (left) of Weir Minerals Africa, “form an integral part of the Weir Minerals product offering, complementing our other product ranges, such as pumps, cyclones and screens, in mill and slurry pumping circuits.” He talks to *MechTech* about the valve range and some global successes.

In response to recent tougher times in the mining and mineral resources sectors, Weir Minerals adopted a holistic approach to its product and solutions offerings. “We are providing an increasingly complete range of products and solutions for every conceivable minerals processing application,” begins Steyn.

With the acquisitions of crushing and separation equipment OEM, Trio Engineered Products, Weir Minerals can now offer an extensive range of crushing equipment – including jaw, cone and gyratory crushers – along with screens, feeders, washers and conveyors. “On mill circuits, we are able to supply equipment for every aspect of ore processing, from milling all the way through to the tailings line: mill liners; screens; mill circuit pumps; rubber linings for pumps and pipes; cyclones, cyclone feed pumps and separation equipment; and a complete range of valves and actuators for all slurry, dewatering, separation and dosing applications,” Steyn says.

Due to the highly abrasive nature of today’s minerals processing circuits, Weir Minerals’ approach is underpinned by the application of advanced wear resistant materials in their products, along with seeking innovative ways to simplify maintenance tasks, such as replacing liners.

“Across our product offering, we base our decisions on lowest total cost of ownership (TCO) principles. In the current global market, lowering operational costs per ton is vital, which, along with increasing throughput levels, makes uptime a critical factor for success. We develop products to directly suit the application, wear and maintenance needs of our customers, ultimately, to offer them the lowest possible TCO solution,” he assures, citing the company’s Isogate® slurry valves as an example of this approach.

These slurry valves are manufactured in Weir Minerals’ world-class manufacturing facilities in Bangalore, India. “The range includes push through knife gate slurry valves with pressure ratings of up to 50 bar, the highest pressure rating possible for this technology. These are widely used in on/off slurry control applications for the full spectrum of minerals.

Describing the push through system, Steyn says that, when closed, rubber seats surround the knife-blade of the valve and, when open, these seats seal against each other to keep the valve leak tight.

“On actuation, the knife-blade pushes through slurry product in the valve, opening the seats. The base of the knife pushes through the bottom of the seal, expelling a little of the slurry product,” he explains.

The alternative to push through knife gate valves is the closed-bottom valve, which has a closed seat at the base of the valve where the knife rests. “With these valves, a gradual build up of solids can accumulate along the seat line, which prevents the knife from seating properly. This makes conventional closed bottom valves less suitable for slurry applications,” Steyn adds.

Referring back to the TCO of Weir Minerals’ slurry valves, he says that Isogate® push through knife gate valves come with a set of elastomer sleeves that are replaceable in the field. The design enables the valve to be quickly unbolted and opened for the sleeve to be extracted and replaced, before reconnecting the valve to the piping circuit. “A complete seal set replacement cost is 5 to 10% of the valve’s replacement cost. This makes refurbishing these valves very cost effective. In addition, maintenance downtime is significantly reduced,” he notes.

The Isogate MP double acting mechanical pinch valve range, which closes

by pinching a Linatex® premium rubber sleeve along the flow centreline, “also has field-replaceable sleeves and, in common applications such as gold, chrome and copper processing circuits, the Linatex rubber we use can last four to five times longer than competitor equivalents in certain conditions – and replacement sleeves cost 20-25% of a valve replacement,” Steyn tells *MechTech*.

“Many cheaper slurry valves do not provide easy access to the liner, which means that the valves either have to be switched out for refurbishment offsite, or scrapped and replaced,” he suggests, before highlighting some global success stories.

At an open pit copper mine in Arizona in the US, a client was experiencing repeated failures on their knife gate valves, which were premium-brand closed-bottom valves. “What typically happens with these valves is that abrasive debris builds up in the seal. Eventually, the blade can’t seal properly and slurry leaks through, causing accelerated abrasion on the bottom edge. Once this has happened, the valve is irreparable and has to be replaced,” he relates.

“The competitor in this case sug-



gested an exchange programme, at 80% of the replacement cost. But by adopting our push through Isogate WS knife gate slurry valve, the root problem was solved. A flushing plate was added to the bottom of the system to overcome their leakage concerns. Compared to the 80% exchange cost, we are able to reduce this to a liner set replacement cost of between 5% and 10% of the valve cost and we achieved an eight-fold life improvement between replacements,” Steyn tells *MechTech*.

At a semi-soft coal tailings operation at Mount Thorley Warkworth in New South Wales, Australia, mine superintendent, Gary Cooke described a valve problem: “After a short time with the valves not operating, the tailings would dry out and thus restrict the blade from moving through its operation.”

A Weir Minerals push through Isogate valve for slurry applications was recommended and installed. Following seven months of smooth operation, the Isogate valves have more than proved themselves in the tailings line. “We wanted something that would be easy to operate, easy to maintain and have very good reliability, and that’s what we have with these valves,” said Cooke. “These are huge pluses for productivity.”

At Oceana Gold’s Macraes processing plant in New Zealand, failure to seal was preventing routine maintenance on the downstream pumps. “This was causing costly downtime of the Pressure Oxidation plant, essentially ceasing gold production,” according to Tim Shearman, maintenance planner for the plant. The cause was again traced to the closed-bottom valves being used and, by changing over to Isogate push through valves, maximum uptime was restored. “Isogate valves are

being fitted to replace all failing units and not one of the new valves has required any maintenance so far,” said Shearman.

“While traditional closed-bottom valves are a little less expensive, if you look at downtime and failures, they do not often offer the best TCO. We are finding that replacing closed-bottom valves with push-through valves almost always improves reliability and uptime,” Steyn informs *MechTech*.

But closed-bottom knife gate slurry valves have an important role to play in some applications. “If slurries are very corrosive, for example, or very valuable, then leakage has to be prevented. Closed-bottom valves can also handle higher pressures and temperatures, because they are available in a host of different materials to suit specific slurry conditions,” he continues.

Weir Minerals has recently added products from US-based Delta Industrial Valves to its global product portfolio. Delta Industrial™ valves are high performance, zero leakage and closed-bottom knife gate slurry valves. “The Delta Industrial range consists of valves made to ASME B16.34 in classes 150 and 300 (PN20 and PN50), along with some Class 600 (PN100) products, accommodating a pressure range from 20 to 100 bar,” Steyn adds.

To overcome the inherent debris problem of traditional closed-bottom designs, Delta Industrial valves incorporate guided shear gates that can repeatedly close to provide bi-directional, zero leakage isolation, no matter what the pipe contains. The gate’s chisel-shaped tip is fully guided in its travel and brings a shearing action to a machined interface in the valve body. Guiding concentrates the tip’s force at a point, allowing the

knife gate to crush, cut, sever and expel solids that may be in the fluid stream.

“This, in my view, makes the Delta Industrial valve one of the best closed-bottom isolation valves for applications where traditional equivalents fail due to debris accumulation along the bottom seal,” Steyn explains.

The full port design of Delta Industrial valves also helps protect the sealing surfaces from erosive and abrasive flows while allowing maximum volumes at minimum pressure losses.

“We also own the BDK brand of valves: a complete industrial range of gate, globe, check, ball, plug, diaphragm and butterfly valves. And in the Isogate range, disc-type non-return valves and autoball double non-return valves for quick changeover between a duty pump and standby are also available – and these use Linatex premium rubber,” he adds.

Locally, Steyn cites Trident’s Sentinel copper project as an example of the success of Weir Mineral’s holistic and TCO focused approach. “On the valve side alone, Weir Minerals supplied 611 Isogate knife gate slurry valves in various sizes and actuator types. Sentinel recently ordered a substantial number of additional valves, which is testament to being satisfied with our high quality, high performance and cost effective valve offering,” he concludes. □

Left: Weir Minerals Africa’s integrated offering pairs Isogate® valves with Linatex® hoses and rubber lining and Cavex® hydrocyclone clusters.

Centre: Isogate knife gate valves installed at Mount Thorley Warkworth.

Below: Production of a three-way Cavex cluster incorporating Linatex premium rubber and Isogate knife gate valves.



ZEST

WEG Group



Maintain plant pumps during tough times



Neil Britz, sales and marketing director at AESPUMP (right), highlights the need for pump plant operators to continue to focus on maintenance during the economic downturn and to resist the temptation to turn to pirate parts, which will result in reduced reliability, more downtime and much more costly repairs at a later stage.

When money is tight, vehicle owners usually continue with scheduled services, knowing that to skip them and drive a car until it breaks down will cost more in repair bills than they would have spent on the services. The same logic should apply to process plant, yet there are plant managers who skimp on maintenance, waiting for more favourable economic conditions and hoping that the machine will keep going until then.

Neil Britz, sales and marketing director at specialist pump company AESPUMP, believes that more should be done to persuade management to treat process plant as they would their own motor vehicles. "It's important for plant owners to realise that if they don't invest in machine maintenance and condition monitoring, then they should prepare for expensive machine failures and even more expensive plant downtime," says Britz.

Even before the economic downturn began, AESPUMP had begun to phase in a programme of working closely with its customers to help minimise maintenance costs on the Sundyne pumps and compressors that the company supplies – and the programme has been accelerated in recent months.

With each customer, the first part of the process is to check that the machine is being operated correctly: how it is being started and stopped and how valves are being opened and closed. Next, an assessment is made of the operators' knowledge of machine capabilities, limitations, operating parameters, best efficiency points, design flows and design discharge pressures. "This is because the probability of a machine failure obviously increases if the pump is being operated outside its parameters," Britz explains.

Simple changes such as raising the level of liquid in a suction tank to ensure positive pressure into the pump will often eliminate cavitation that the operator knew was present, but did not know how to prevent. Cavitation is a major cause of bearing and sealing failures in

pumps, because of the vibration that it causes. "We find that we can achieve a longer MTBF by ensuring the correct operation of installed equipment, saving the customer hundreds of thousands of Rands," said Britz.

AESPUMP also has a focus on preventative maintenance. "We ask how long the machine will be allowed to operate before switching over to a standby unit, if there is one, and we check on things such as whether gearbox oil changes are being made regularly," Britz continues.

He says that one preventative maintenance measure widely carried out without prompting is that of vibration monitoring. Britz notes that most plant operators are well aware that excessive vibration in a machine running at high speed can damage it within two days, necessitating repairs and causing expensive downtime.

Of course, the counter argument to AESPUMP's presentation is that to run the pump until it fails, and then replace it, will cost less than would maintenance and condition monitoring because of the very high potential costs of lost production in cases where there is no standby machine to permit maintenance.

Not so, says Britz, because in such cases condition monitoring becomes more than important – it becomes essential – and continuous, real time condition monitoring should replace periodic checks, with the necessary instrumentation permanently installed and connected to the control room to ensure maximum machine uptime.

"AESPUMP offers all the necessary instrumentation, either fitted to the machine at the time of its manufacture in the factory in France, or as a retrofit here in South Africa," he says.

Although most of AESPUMP's customers have condition monitoring teams as part of their reliability departments,



AESPUMP's dedicated workshop at its Secunda facility was commissioned to service pumps from Sundyne subsidiaries HMD and Ansimag. The new workshop is a 'clean-room' and supplements a separate, dedicated flame-proof pumps workshop.

many of them admit to grey areas. For example, monitoring the level in a suction tank does not guarantee that liquid is actually entering the pump, because liquid flow may be impeded by strainers, pipe bends or blocked valves.

"In one installation we examined, we found that even when a brand new pump was installed together with an even deeper suction tank, the flow medium was still not able to reach the pump in the correct volumes. The cause was a blocked pipe."

Britz says that by helping customers to focus on keeping existing equipment running, AESPUMP aims to build relationships that will stand the company in good stead into the future.

The company also uses this interface time with customers to explain the dangers of using pirate parts on Sundyne equipment. "While we understand that customers are being forced to look at alternative, cheaper spare parts, the use of non-OEM parts can complicate repair work when it becomes necessary. And that usually happens when the customer stops using pirate parts because of premature failure, and makes the decision to revert to Sundyne spares designed for these high-quality, high-speed turbine machines.

"The result of using pirate parts is that customers spends more money on spares than they would have done had they remained with Sundyne parts in the first place," Britz concludes. □

SlurrySucker dredge unit for easier

Integrated Pump Rental has proactively addressed the need for easier removal of silt and built-up sediments from process water ponds, return water ponds and other water storage areas. The introduction of the SlurrySucker Dredge Units into the company's short- and long-term hire fleet will assist mines to perform on-going maintenance, while its new range of pump flotation devices (PFD) and hose flotation devices (HFD) are ideal for protecting pumps from burrowing, becoming damaged or lost.

“**S**everely silted up ponds and reservoirs can impact on the water storage capabilities of a mine or plant, negatively affecting downstream processes. Designed and engineered locally by Integrated Pump Rental, the SlurrySucker Dredge Unit is capable of extracting high tonnages due to the design and engineering of the dredge head,” says Lee Vine, general manager at Integrated Pump Rental.

This innovative dredge unit is suitable for dredging and cleaning water capture areas where silt or slimes is an issue or where water retention and water holding capacity is being threatened. With this dredge unit, regular cleaning of process water ponds, return water dams or other water storage areas is made simpler and faster.

During the developmental stages, Integrated Pump Technology made use of computational fluid dynamics (CFD) to optimise and validate the design. This provides customers with the as-

urance that the performance of the SlurrySucker and its engineering integrity are maximised.

Vine points out that two standard units are available. The smaller or SlurrySucker Mini is capable of extracting 120 m³ per hour of slurry/water mixture, equating to 30 to 40 dry tons per hour. Double this extraction volume can be achieved with the SlurrySucker Maxi, which will remove between 70 and 80 dry tons per hour. The SlurrySucker Mini has a 100 mm discharge and the SlurrySucker Maxi has a 150 mm discharge.

Manufactured using locally produced components, the SlurrySucker Dredge units incorporate pumps from the respected Grindex slurry and dewatering range. This means that lead times are significantly reduced for both complete units as well as the requisite parts, since the need to import components has been eliminated. Selection of the pump will be determined by the dredging operation at hand and could include either Grindex dewatering pumps where agitation of the slurry is required, or Grindex slurry pumps where there is a need to remove slurry from ponds or dams.

“The biggest advantage of this new dredging unit is that the pumps can be changed to accommodate specific customer applications. An example of this would be where the customer needs to remove



The SlurrySucker Dredge Unit is capable of extracting high tonnages due to the design and engineering of the dredge head.

160 dry tons per hour. In this instance, the dredging unit can be custom engineered to handle the required flow,” says Vine.

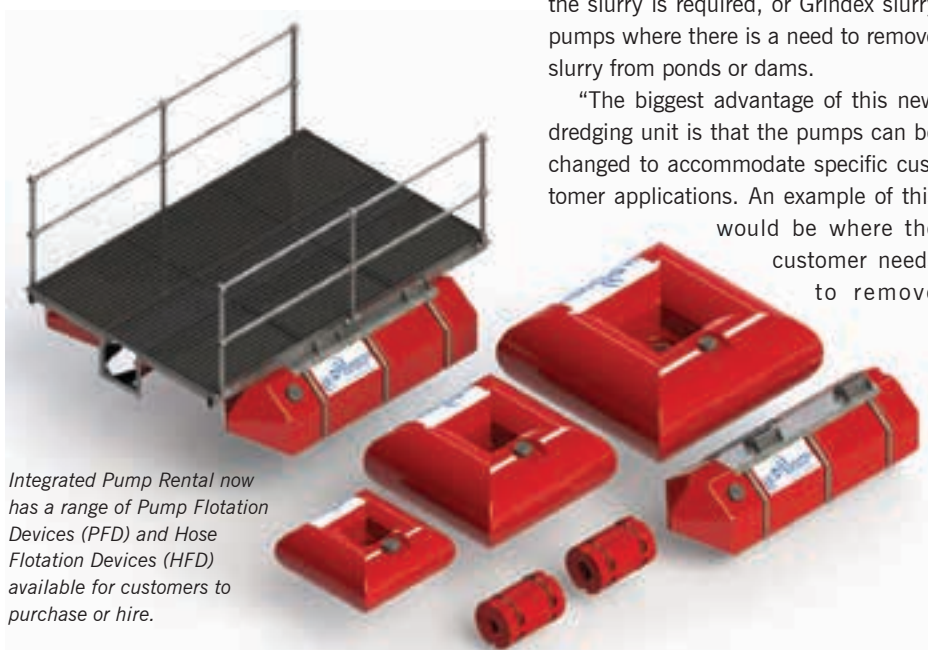
“The SlurrySucker Dredge Unit can be used on plastic lined dams without any damage to liners. This is very important from an environmental perspective as there is no risk of the liner being cut and water leaking out,” Vine adds.

Galvanised steel is used for the construction of the dredging unit framework and, for use in highly corrosive applications, it can be fabricated from stainless steel. Engineered as a robust, compact dredging unit, the SlurrySucker Dredge Unit can be easily transported on a standard road trailer, making it simple to move from pond to pond on a mine site.

The dredging units can be operated by one person and for those instances where plants do not have the necessary manpower available, Integrated Pump Rental can undertake the pond or dam cleaning on a turnkey contract basis.

A major advantage of this unit is that the dredging operation can be performed without any downstream processes having to be halted. When other traditional methodologies are used to dredge water storage ponds then the dam or pond needs to be taken off line and this shutdown can be costly in terms of production.

“Integrated Pump Rental aims to make pumping solutions available to industry that will maximise uptime and be easy to use for our customer base. The introduction of the SlurrySucker Dredge Unit is a classic example of how we have



Integrated Pump Rental now has a range of Pump Flotation Devices (PFD) and Hose Flotation Devices (HFD) available for customers to purchase or hire.

silt removal



This innovative SlurrySucker Dredge Unit is suitable for dredging and cleaning water capture areas where silt or slimes is an issue or where water retention and water holding capacity is being threatened.



worked together with Integrated Pump Technology to alleviate a pressing industry need,” Vine adds.

Pump and hose flotation devices

Integrated Pump Rental also now has a range of Pump Flotation Devices (PFD) and Hose Flotation Devices (HFD) available for customers to purchase or hire. As a sister company to Integrated Pump Technology, Integrated Pump Rental focuses on providing its customer base with cost effective solutions that meet specific needs in the market.

By remaining close to all industries where its pumps are put to use, Integrated Pump Rental retains close interaction with its customer base. According to Vine, extensive experience has shown that industry and customer needs drive expansion of the company’s product ranges. The inclusion of PFDs and HFDs is a natural extension of the company’s existing offering and represents its basic operating model.

Vine explains that a Pump Flotation Device (PFD) is used to suspend the pump during pumping operations. “This prevents the pump from burrowing into the bottom of the dam/stopes/pond, thus eliminating situations where a pump could be damaged or lost if this happened. The use of a PFD will also significantly reduce the wear on the pump, since it is not in direct contact with the sediment at the bottom during pumping operations.”

The exterior or outer skin of the PFD used by Integrated Pump Rental is manufactured from low-density high strength polyethylene and is filled with polyurethane foam, which ensures that the flotation device will not sink, even in the unlikely event of the outer skin being punctured.

Integrated Pump Rental is able to supply three different sizes of PFDs with carrying capacities of 250 kg, 600 kg and 1.2 t. In the event that a heavier mass needs to be suspended, a number of PFDs can be used in series to accommodate this.

Hose Flotation Devices (HFD) are used to suspend hoses during pumping operations where either pontoons or barges are used and the hose needs to be suspended above the water, or where hosing is laid across the water instead of around the perimeter of the water. “In these instances, we advise customers to route the pipework across the direct line of sight to the barge or pontoon.

This will result in substantial cost savings,” Vine points out.

The HFD from Integrated Pump Rental has been engineered to accommodate cables that cover the same distance as the hoses. HFDs are available in all common hose sizes.

“All products used by Integrated Pump Rental are ISO 9001 certified and advice on the most suitable flotation device for specific pump applications is provided by our experienced team. As with our pump offering, we take complete responsibility for all maintenance of flotation devices on site and we keep a comprehensive maintenance record. This allows our team to determine when proactive, scheduled maintenance is required and when equipment reaches end of life,” Vine concludes □



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Total head and density

In this pump guy article, Larry Bachus defends the statements: “the term head is the constant for the pump manufacturer”; “a pump that generates 30 m of head can elevate any liquid to 30 m above the surface level of the liquid’s source”; and “if I use the word ‘head’, the liquid’s density is not important”.

Many engineers, technicians, pump users and even pump company employees misunderstand the concept of head. The pump industry is guilty of not properly explaining this concept to the pump users, while engineering textbooks and professors of fluid mechanics are guilty of leaving too many engineering students with doubts regarding the exact meaning of ‘head’. This is what happens after industry downsizes: older engineers are let go and mentoring as a teaching tool is abolished.

Pump companies rate their pumps in metres of head because the pump company normally doesn’t know the liquid that will move through the pumps. And what the pump company calls ‘metres of head’ is a measure of the specific energy available to the pump, ie, the energy per unit weight of fluid displaced. And this

specific energy is, therefore, independent of density. Let me explain this with an example:

A pump manufacturer in Joburg sells 20 centrifugal pump models to their distributor in Durban. The 20 pumps are rated for the chemical process industry. Durban has many applications for mid-frame, back pullout chemical process pumps.

The 20 pumps accommodate impellers up to 250 mm in diameter. The 20 pumps each have a shaft that measures 50 mm in diameter and bearings that can handle the loads generated by the shaft and impeller. The performance curve for each pump is rated at 1 450 rpm and indicates best efficiency at 78%, when pumping 24 m at 125 m³/hr.

The sales manager at the pump distributorship in Durban wants to give good service to the customers. He put these pumps on his shelf for immediate delivery. The sales reps are under instructions to promote these pumps as much as possible.

One sales rep sells three pumps to the water bottling plant in Durban to pump potable water. Water has a specific gravity of 1.0. The pumps will elevate potable water 24 m, or overcome 24 m of resistance in the pipes. At best efficiency, the differential pressure across the pumps will be about 240 kPa (24 m × 10 × 1.0 = 240 kPa). The pump manufacturer in Joburg doesn’t know three pumps were sold to pump water in Durban.

Another sales rep in Durban sells two pumps to a dairy to pump milk. Whole milk has a specific gravity of 1.07. The pumps will elevate milk 24 m, or overcome 24 m of resistance in the pipes. The differential pressure across the pumps at best efficiency will

be about 257 kPa (24 m × 10 × 1.07 = 257 kPa). The pump manufacturer in Joburg doesn’t know two pumps are in Durban moving milk.

Another sales rep sells three pumps to the petrochemical plant in Durban to pump sulphuric acid. Sulphuric acid has a specific gravity of 2.0. The pumps will elevate sulphuric acid 24 m, or overcome 24 m of resistance in the pipes. The differential pressure across the pumps will be about 480 kPa (24 m × 10 × 2.0 = 480 kPa).

With a specific gravity of 2.0, these pumps will require a motor with twice the power (kW) rating. The technician will mate and align larger motors to these pumps before shipping the pumps to the customer. In Joburg, the pump manufacturer might never know that three pumps are moving sulphuric acid in Durban.

Another sales rep sells a pump to the local paint factory to pump paint thinner. The paint thinner has a specific gravity of 0.87. The pump will elevate the paint thinner 24 m, or overcome 24 m of resistance in the pipes. The differential pressure across the pump at best efficiency will be about 209 kPa (24 m × 10 × 0.87 = 209 kPa). The pump manufacturer in Joburg will never know this, unless there is a problem while the pump is under warranty.

Let’s return to the dairy in Durban. The pumps were bought to pump milk and whole milk has a specific gravity of 1.07. However, skim milk, chocolate milk, half and half, evaporated milk, coffee cream and ice cream mixes all have different specific gravities. If a pump moves more than one liquid, the pressures and the motor’s power (to drive the pump) will vary according to the specific gravity of the liquid.

But 24 m of specific energy is always 24 m. And frequently, this is all the pump manufacturer knows. So, the pump manufacturer prints a curve that shows metres of head.

I ask those of you in doubt to review your university ‘Fluid mechanics’ textbook. Also, review some recent pump

Do You Know & Understand Your Pumps?

Larry Bachus (The Pump Guy) is the co-author of “*Everything You Need to Know About Pumps*”, one of the best selling technical books on pump systems in the world. This book is written exclusively for people who must maintain pumps. Whereas other pump books are written from a design point of view, this book is written with maintenance in mind. While most technical books sit on a reference shelf gathering dust, this book gathers dirt smudges. Its pages get creased and folded when mashed by the lid of a photocopy machine. It gets sneezed on and soaked with leaking oil, grease, and coffee. Basically, it gets used... because it’s tremendously useful. The straightforward guidance it provides will help you ensure the efficiency and lifespan of your pumping systems.

To order your copy of “*Everything you Need to Know About Pumps*”

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company literature. You will find most literature states 'metres of head' without specifying water or any named liquid. The specific gravity becomes important as you convert metres of head into pressure in kPa. The specific gravity is important as you size the motor to the pump.

Head is a measure of specific energy. The units of 'head' are metres (m).

$$\text{head} = \frac{\text{specific energy}}{\text{weight (w)}}$$

$$= \frac{\text{energy (E)}}{\text{weight (w)}}$$

And if you divide the units of energy ($\text{kg} \cdot \text{m}^2/\text{s}^2$) by those of weight ($\text{kg} \cdot \text{m}/\text{s}^2$) you get:

$$\text{kg} \cdot \text{m}^2/\text{s}^2 \div \text{kg} \cdot \text{m}/\text{s}^2 = \text{m}$$

The liquid's weight or specific gravity (density relative to water) is not a component of the term 'head'.

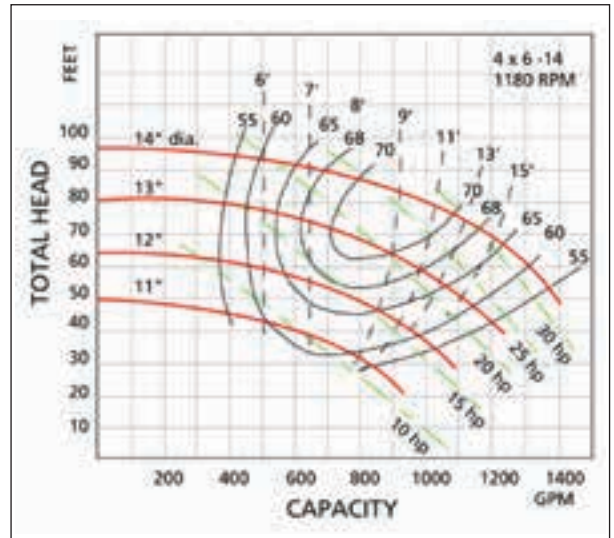
Let's go back in time a few centuries. The scientist Aristotle had theorised that the acceleration of gravity was proportional to an object's density. Aristotle said a 2.0 kg mass would accelerate toward earth twice as fast as a one kilogram mass.

In 1589, Galileo purportedly dropped two similar balls together from the Leaning Tower of Pisa in Italy, a height of 56 m. The two balls were of different

density (weight). The balls fell toward earth together and struck the ground at the same instant. As we now know, the acceleration and time of descent is independent of mass.

With this experiment 426 years ago, Galileo proved that gravity's rate of acceleration is a constant, defined today as 9.8 m/s^2 . With time and technology, gravity's acceleration is clocked slightly faster at the earth's poles compared to the acceleration at the equator. This is called centrifugal relief.

So, in the same way as acceleration due to gravity is independent of an object's mass, the specific energy required to elevate a liquid against gravity is also independent of the liquid's mass or density relative to water. Pump companies call this 'head'. 'Head' is a measure of specific energy. The units of energy are 'metres' of head against gravity. And for centrifugal pumps, head is determined by two principal factors: the impeller's speed (rpm); and the impeller's diameter.



On a typical pump characteristic curve, while the total head (specific energy) is independent of the fluid's density. But the actual pressure produced and power required to produce that pressure both depend on specific gravity or the density of the fluid being pumped.

When a pump company shows metres of head on a pump curve, the liquid's specific gravity (or density relative to water) is not important. But when you read a pressure gauge or measure the kilowatts (or amps drawn) by an electric motor, the liquid's specific gravity, density and weight are very important. □



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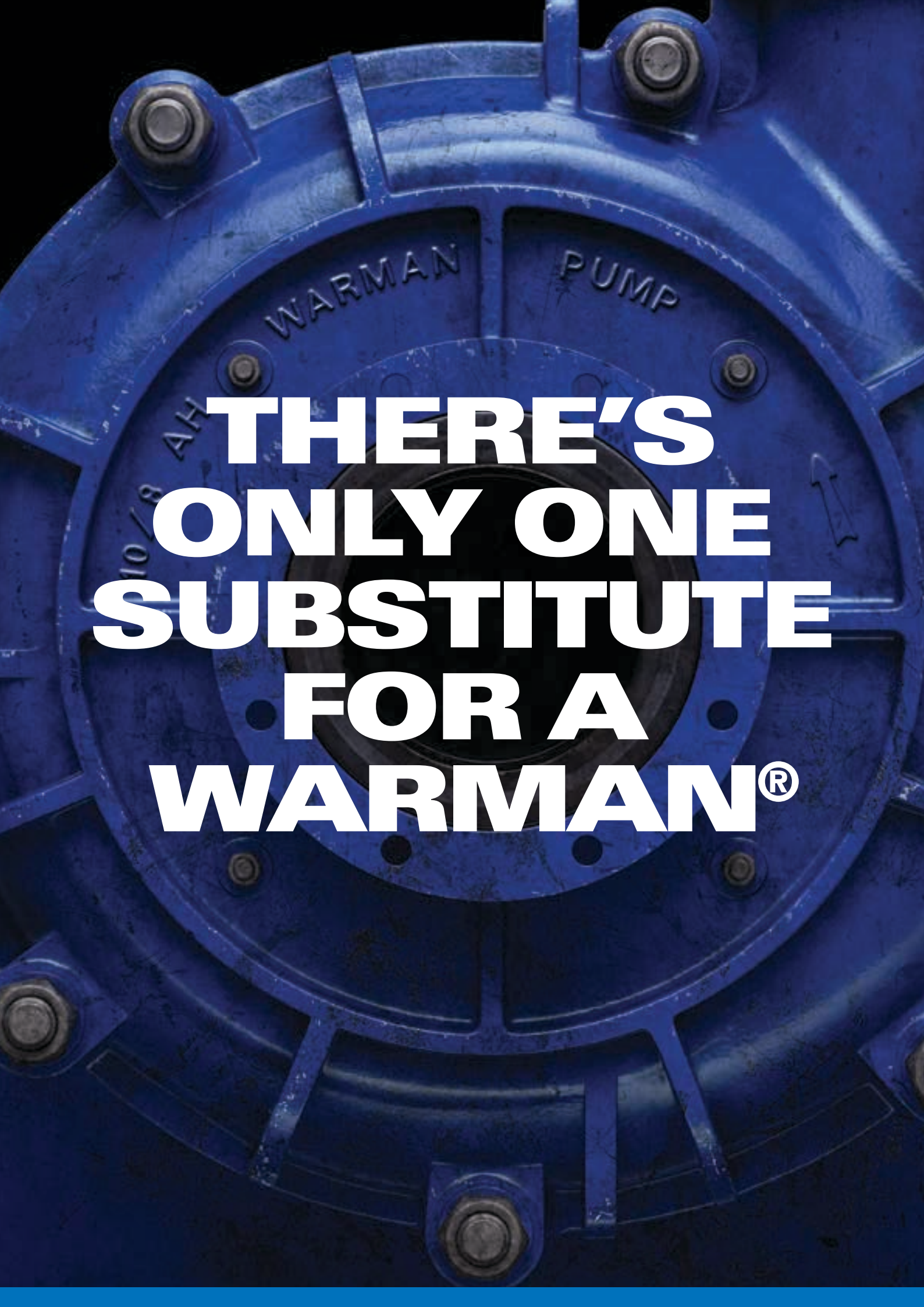
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In 2007, AZ supplied plug valves to a mineral sands operation in South Africa, where they were used to control sand slurry being pumped from the pit to the plant. The AZ valves delivered excellent performance and exceeded the client expectations.

Now, the initial mine has reached the end of its life, and a new deposit is being brought into production. AZ has supplied the mining company with new valves ranging in size from 50 mm to 500 mm nominal bore for the sand slurry application. The plug valves comply with the ANSI 300 to 600 pressure rating to a maximum of 100 bar.

As the valves will be used in corrosive, coastal conditions, the exterior of the plug was covered in a special heavy-duty, corrosion-resistant coating.

All AZ plug valves are fitted with PTFE sleeves. This allows AZ's valves to operate in the harsh sand slurry environment without failures. An important factor in the reliability of AZ plug valves is the absence of internal cavities, which eliminates damage to moving parts. The absence of cavities in the design of the plug valve also ensures a smooth slurry flow. As the PTFE sleeve is self-lubricating, the plug will not seize, even after not being used for extended periods. In these instances, the valve can be operated without risk of damage.

AZ's plug valves' design complies with



AZ-Armaturen is specialist OEM of cavity free plug valves, control valves, sampling systems and special valves for the chemical, petrochemical, mining and power industries.

internationally accepted standards, and the factory is ISO 9001 compliant. The castings for the new valves were manufactured by the South African foundry, Steloy Castings. This company has been producing castings for AZ for many years and has the ability to meet AZ's international quality standards.

For users of sleeved plug valves in South Africa, AZ offers the advantage of local manufacture and support. This is backed up by a substantial inventory of spare parts. "In line with South Africa's designated valve policy, at AZ-Armaturen, we are proud that these plug valves are almost 100% locally manufactured," explains AZ-Armaturen general manager, Erich Ermel.

AZ-Armaturen GmbH specialises in the fabrication of high acid-resistance

special valves, manufactured from top-quality materials. The company, established in 1965 at Schonach in the Black Forest in Germany, expanded over the years. Today it boasts a new manufacturing centre equipped with the most up-to-date machinery. AZ-Armaturen has 500 employees throughout the world.

Because of its technical expertise in the field of special valves, in particular plug valves, its excellent customer service, short delivery times and strict adherence to agreements, the company enjoys international renown. Today, as a result of the high quality of the AZ products, the company exports to almost all countries in the world, its particular focus being on serving the chemical, petrochemical and mining industries as well as power stations. □

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PPP brings fuel cell technology to healthcare sector

Air Products South Africa, the Department of Science and Technology (DST), the City of Johannesburg and Clean Energy Investments have formed a public-private partnership (PPP) to install a hydrogen fuel cell for backup power at Windsor East Clinic in inner city Johannesburg.

Describing how the Windsor East Clinic fuel cell project was initiated, Gavin Coetzer of Clean Energy Investments says that he first became aware of a problem at the clinic while attending a choir service at St Thomas' church in Linden. As part of its outreach programme, the church supplies tea and food to TB patients to improve the effectiveness of the medication. "The church noticed that, during load shedding, the clinic was experiencing problems maintaining the TB vaccines, which have to be refrigerated," Coetzer relates, "and it sent out an appeal for a backup generator."

Instead of diesel generators, Clean Energy Investments proposed the use of fuel cell technology to power the refrigerators during power outages: for several reasons, including lower noise, pollution and theft potential. Following engagement with the Gauteng Provincial Health department and other stakeholders, authorisation was granted for a pilot project to install a fuel cell at the clinic.

Ultimately, this led to the installation of a 5.0 kW Altery Fuel Cell supplied by Powertech Systems Integrators (PTSI); a hydrogen supply and monitoring service from Air products South Africa; the civil construction of the fuel cell's safety enclosure by Gridline Construction; and the project management, engineering design and installation from Clean Energy Investments.

"Hydrogen fuel cells, although not new, are becoming more prevalent in South Africa as a sustainable renewable energy solution for backup power. They are particular well accepted by the cell phone companies to backup up cell phone towers, but we are now seeing fuel cells in cars, clinics and schools," said Coetzer at the launch event.

Describing how they work, he says that a fuel cell consists, essentially, of two electrodes. The hydrogen passes through both of these electrodes. At the positive

anode, the hydrogen is persuaded, with the help of a platinum catalyst, to give up its electrons to become a hydrogen ion. It then passes through a membrane to the other electrode, the cathode. Once there, it receives a donor electron. "But the critical issue is that air is used to complete the electrochemical reaction. The oxygen in the air combines with the hydrogen to make water (vapour)," he explains.

"This makes it an ideal renewable energy resource if solar power can be used to split water by electrolysis into hydrogen and oxygen, and, using a fuel cell, the hydrogen is recombined with the same oxygen to produce water again. This is a closed loop system that is 100% renewable and produces very little waste or pollution," he adds.

Returning to the Windsor East solution, he says: "because this is a first of its kind in healthcare in South Africa, Air Products had to ensure that all of the codes and standards for safety, storage and implementation for a gas solution in a medical environment were met. We are all now comfortable that this is the safest hydrogen fuel cell installation possible," Coetzer assures.

The hydrogen fuel cell system went 'live' in March 2015 and has already supplied over 70 hours of backup power to the clinic, ensuring an uninterrupted power supply for both the vaccine fridges and the air conditioner unit in the clinic's pharmacy.

Also speaking at the launch, the member of the mayoral committee (MMC) for Health and Social Development in the City of Johannesburg, councillor Nonceba Molwele said: "This initiative will assist the clinic to continue with the provision of comprehensive primary healthcare services as promised by the government. The development is in line with the City's commitment to building a smart city," adding that the project is one of the City of Johannesburg's initiatives to explore alternative sustainable energy solutions



Partnering to bring reliable backup power to Johannesburg's inner city health sector are: **Back row, standing:** Mike Hellyar, MD of Air Products South Africa; Johannesburg MMC for Health and Social Development, councillor Nonceba Molwele; and Refik Bismilla, executive director of Health, City of Johannesburg. **Front row:** Gavin Coetzer, MD of Clean Energy Investments; and Mmboneni Muofhe, deputy director general of the DST.

that benefit the environment while addressing the needs of the community.

According to managing director of Air Products South Africa, Mike Hellyar, Air Products is very pleased to have had the opportunity to be a partner in the Windsor East Clinic fuel cell pilot project. "It supports our vision of helping to create a better life for the communities in which we operate, and has given us an invaluable opportunity to demonstrate the benefits that hydrogen fuel cell technology can bring to the local healthcare sector," he says. □



A 5.0 kW Altery FPS Fuel Cell supplied by Powertech Systems Integrators (PTSI) has been installed at Windsor East Clinic in inner Johannesburg, along with a hydrogen supply and monitoring service from Air Products South Africa.

Selecting the optimum generator set

Bradley van der Spreng, project engineer and Craig Bouwer, sales engineer at Zest WEG Group's Generator Set Division talk about the importance of carefully considering the company's overall power requirements before deciding on a backup power solution to accommodate a shortfall.



Bradley van der Spreng, project engineer and Craig Bouwer, sales engineer at Zest WEG Group's Generator Set Division.

The current power constraints facing South Africa and Africa have resulted in companies being requested to cut their power consumption by at least 10% in order to alleviate the pressure on the overburdened transmission and distribution infrastructure. This appeal will, of necessity, result in companies seeking alternative power sources to accommodate their energy requirements shortfall.

However, cautions Craig Bouwer, sales engineer at Zest WEG Group's Generator Set Division, there is an apparent lack of

understanding of the many issues surrounding standby power. "Companies are generally unaware of how to assess the standby power requirements of a facility or building. By implication, this suggests that companies are also often unaware of what the optimal solution for a given application should be."

A standby power solution is an important capex decision that needs to be considered carefully in terms of the company's overall requirements. Moreover, the supplier needs to have the necessary technical expertise and relevant experience to offer a customised solution. A key consideration for a standby power solution is to understand the environment in which the generator set has to function.

Original equipment manufacturer Zest WEG Group's Generator Set Division has a dedicated facility in Cape Town and offers generator sets ranging from 20 kVA units up to 250 kVA as off-the-shelf products and 300 to 2 000 kVA individual customised units as well as multiple sets are available to achieve turnkey solutions in excess of 12 MVA for large-scale applications or projects. The company has supplied a large number of bespoke generator set solutions based on the specific application and environment in which they operate.

"A couple of recent examples include



A view inside a containerised generator set from Zest WEG Group's Generator Set Division.

the containerised three-generator unit we designed and manufactured for DRA Minerals' Lihobong Diamond Mine in Lesotho and a turnkey power station for AVI Group's Indigo Brands. At Lihobong, we designed a generator set container with a collapsible snow roof. When the roof is collapsed it facilitates easy transportation and, once deployed on site, prevents the build-up of snow on top of the container and the subsequent blocking of the louvres," says Bradley van der Spreng, project engineer, Zest WEG Group's Generator Set Division.

The scope of supply on the Indigo Brands project comprises three 1 000 kVA generator sets and three 1 000 kVA transformers. "What makes this project unique is that Zest WEG Group's Generator Set Division is designing a custom built distribution system and electrical panel for synchronisation. The company is also supplying a 23 000 litre bulk fuel storage system to support this installation," adds van der Spreng.

The successful implementation of these projects hinges on the company's ability to determine potential solutions for the customer. Amongst these are considerations for sound restructuring methods, fuel systems, electrical reticulation and interfacing, the load and the duration that this load is required to be powered.

"The type of load and the total power drawn should be measured by a qualified team from the generator supplier prior to recommending a particular diesel generator set. Following this, accurate load calculations can be carried out and a suitable system recommended. We look at the entire electrical infrastructure and



The containerised generator sets for Lihobong Diamond Mine in Lesotho incorporate a collapsible snow roof which, when deployed on site, prevents the build-up of snow and subsequent blocking of louvres.

not just the generator set itself. In this way we are able to recommend the power rating of the generator set," says Bouwer.

Another area where Zest WEG Group's Generator Set Division's experience comes to the fore is its knowledge of local regulations pertaining to different metropolitan areas. Regulations also differ with regard to the particulate levels of diesel fuel storage and sound decibel levels related to noise attenuation. "In order to disseminate relevant and important information, we form close working relationships with consultants and, wherever possible, we become involved during the design stage of a project," continues van der Spreng.

All equipment supplied by Zest WEG Group's Generator Set Division is standard with a 12-month warranty. The Group has a dedicated service department, which offers basic maintenance contracts that include measures such as replacing the generator sets' oil and

filters. Extended or long-term maintenance contracts are also offered where the equipment is for critical applications such as standby power at hospitals.

Bouwer cautions that, while maintenance is critical, companies should take ownership of their generator sets. "We propose, to mitigate risk, that a dedicated member of the customer's staff be trained through our manufacture, test, installation and commissioning processes. This enables the customer to be more self-sufficient and compliments all aspects of aftermarket support.

"There are numerous factors to consider when selecting an appropriate fit for purpose solution, so it is important for companies to align themselves with a supplier who is qualified to discuss



Zest WEG Group's Generator Set Division is able to offer solutions from a single diesel driven generator (seen here) to total standby power solutions.

all eventualities. Flexibility in approach to design and engineering will ensure that the installation is geared towards minimising the capital cost and running expenses, whilst concurrently optimising energy output for an uninterrupted and reliable power supply," van der Spreng concludes. □

Smaller customised mobile substations

Mobile substation technology has been used in South America for many years and WEG Brazil has an established reputation for the supply of this technology with an extensive footprint of successful installations. Zest Energy was responsible for bringing this technology to the African continent and since its first units were supplied to Eskom in South Africa, the company has expanded its solutions to include a wide range of mobile substations and mobile switching stations.

Coenraad Vrey, managing director of Zest Energy, says that the first mobile units engineered by the company in South Africa were mobile diesel generators and the company used this experience, together with the application of WEG's advanced technology, to engineer a mobile substation solution suitable for the harsh and demanding African conditions.

"What is particularly significant is that, with this mobile substation technology, it is possible to move these units to wherever they are required. This provides optimum flexibility, not just to power utilities, but also to other operations such as mines, quarries and rural communities," he adds.

Zest Energy leveraged WEG's 20 years of experience in engineering transformers to develop a transformer that has significant weight reduction. "This re-engineering was necessary to minimise both the weight and the physical size of the transformers. One way that we were able to achieve this requirement was by employing ODAF (oil

direct air force) cooling," says Vrey.

He explains that an intimate understanding and knowledge of various applications means that the company is able to meet very specific requirements. "As an example, for a particular mobile substation for Eskom, we engineered a transformer with a low impedance value to comply with the project specifications, while still ensuring that the overall substation weight remained within the South African road ordinance requirements.

"We worked closely with the utility and in an effort to assist with the unit's operation we made use of offload selector switches to select the primary and secondary ratios. This was essential as previous technologies required that the transformer

be opened and the links manually changed inside the transformer. Our solutions resulted in savings in time and enhanced safety, with increased ease of operation," says Vrey.

"Because these units are multi ratio and will be connected to different network voltages, we built technology into the control system that will ensure the correct voltage is selected, thus reducing any human error. The equipment has a comprehensive earthing system incorporating copper bars with connectors. This provides Eskom with different earthing interfacing points to which connections to the local earth system can be made. Similar, customised mobile substation solutions can be developed for utilities throughout Africa, all with an emphasis on fit for purpose practicality and safety," Vrey concludes. □



Overall dimensions and weight distribution are critical requirements in any mobile substation design. Zest Energy utilises a combination of a dolly trailer and the main substation trailer to conform to all legislative requirements governed by the South Africa Road Ordinance. Here shown is a 132 kV/88 kV/33 kV/22 kV, 40 MVA multi-ratio mobile substation set up for transport and ready for deployment to the operational site.

Apek-mini launched in SA

Dynamite comes in small packages, they say, and the much-anticipated Apek-mini fired heater is no exception. Energas Technologies, a leading supplier of high-end and specialised equipment to the oil and gas industries in Southern Africa, has brought to the local market yet another great innovation.



The HTT Apek-mini fired heating unit allows plants with capacities as low as 300 kW to benefit from modern efficient technologies.

Manufactured by HTT, experts in thermal oil, thermal oil systems, heat recovery and plant modernisation, the Apek-mini, a new product in HTT's range, represents a new efficiency class of heat generation. According to Laetitia Botha, product engineer for Energas Technologies: "The Apek-mini was developed as a highly efficient fired heater for smaller plants. It uses excess heat generated during process heating to preheat combustion air of the thermal oil heater, which further increases the efficiency of the heater."

With the Apek-mini, technology that was reserved for large plants can now be realised in plants with a capacity as low as 300 kW – and the advantages are manifold. The Apek-mini recovers energy from hot waste gases and its system components have been optimally harmonised to achieve 100% waste gas pollutant reduction. The system is easy to retrofit, boasts short amortisation periods, and almost all of the heat generated by the system is put to use, resulting in a distinct increase in efficiency and a lower impact on the environment.

About Energas

Energas Technologies has been a leading supplier of high-end and specialised equipment to the oil and gas industries in Southern Africa since 2001. The company's core focus is to support and supply equipment to the natural gas industry and its products find application from the gas well, through the distribution network right up to the end user.

Applications include pressure reduction and metering stations, pipeline ball valves, HDPE pipes and fittings, pig launching and receiving stations, domestic metering and regulating units. Energas also provides complete skid-mounted high pressure reduction and metering

stations with gas-fired or electric heaters.

In addition, Energas Technologies offers a range of new products from its supplier, HTT energy GmbH in Germany. These include fired heaters, indirect heating and cooling units from -80°C to 400°C, and heat recovery products.

Energas' secondary focus is on liquid storage tank protection equipment, such as conservation vents, flame arresters and emergency vents. Its products, such as valves, filters, flange insulating kits and process heaters, also find application in other industries, such as liquid pipelines, petrochemical and chemical industries.

Energas Technologies is a member of Southern African Gas Association (SAGA). □

"The Apek-mini is an optimised HTT thermal oil system and is suitable for use in various industrial sectors, such as the chemical, textile, food, metal, rubber, mineral oil, wood and printing industries," comments Botha.

The Apek-mini was developed in response to the need for smaller operations to have access to adaptable world-class heating technology. Already successfully installed in several plants across the world, the fired heater was developed and manufactured in-house through a process of design and development, planning and manufacturing of measurement, control and regulating systems and switchgear. "Preheating the combustion air of the burner of smaller units represented a challenge for us. However, through research and development, technology was engineered to make the Apek-mini a one-of-a-kind product that can do just that," remarks Botha.

Three basic principles underpin the design of the Apek-mini: its firing system; the preheating of air; and its air supply. The firing system uses the latest burner technology coupled with electronic control and low NOx burner tip assemblies to optimise combustion and achieve least-possible waste gas and pollutant.

Incoming Air is preheated through a simple design feature and is precisely controlled by an internal bypass flap, which is also available with a controlled drive. And thirdly, a cold air fan is installed directly at the air preheater for air supply. It carries a highly efficient motor and is compact to save space.

The system is available in vertical or horizontal configurations for adaptability and further space saving.

Proof in the pudding

Daub Backtechnik, a Hamburg-based global supplier of bakery equipment, had the following to say about the new Apek-mini: "We have waited a long time for such a system as the Apek-mini. With this system, our customers are able to use even small amounts of energy in the best possible way. In addition, we now have both an alternative and supplementary system for hot water generation in our customers' enterprises."

Safety first

For Energas Technologies and HTT, safety is the top priority in every installation. "The safety features built into the HTT thermal oil-fired unit complies with

DIN 4754 guidelines according to the German Institute for Standardisation for preliminary flow monitoring, minimum oil level monitoring in the expansion container, temperature supervision of preliminary heat and flue gas, as well as preliminary temperature regulation. All boilers have a CE construction design licence complying with Module B of the EC Pressure Device Directive 97/23/EG," notes Botha.

With the backing of a global entity like HTT, Energas Technologies has expert product support from a single source, which it carries through to its customers. Says Botha: "The support ranges from consultation and planning of novel products and extends to customer-specific engineering and project finance. Whether it's a completely new system, an expansion or modernisation or a refurbishment of used systems, Energas Technologies is well-positioned to develop customised solutions for its clients."

Concluding, she says: "With product maintenance, after-sales service, a 24-hour service helpline, spare parts supply and training for our customers' employees, we ensure the sustainable and smooth operation of our clients' systems and equipment." □

Reliable power, a top priority at sea

"An important part of our service to the shipping industry, is the highly technical installation and repair work undertaken out at sea by factory trained Vert engineers," says Grant Robertson, managing director, Vert Energy. "A reliable power supply is a top priority in shipping. For this reason, Vert Energy has tailored its capability to assist vessel owners – not only with routine maintenance programmes, but also in emergency breakdown situations – without interfering with the daily activities on the vessel.

"Vert Energy's field services encompass re-assembly, installation and commissioning, inspections and diagnostics, as well as on site maintenance and repair. Recent projects include the rewinding of a 750 kVA exciter stator – in situ and below deck – on board a vessel out at sea near Mozambique. There were no interruptions to the normal operation of the ship. Vert technicians have also installed and commissioned the retrofit of new generators on board a vessel in Namibia. These units were tested under various loads and operating conditions out at sea," recounts Robertson.

Vert Energy has been appointed exclusive distributor in sub-Saharan Africa for the sales

and support of DEIF generator controls. DEIF power management systems encompass diesel, gas and hydro control technologies for offshore vessels and on/offshore platforms, as well commercial, military and leisure vessels. Special vessel applications include dredgers, fishing vessels, heavy lift ships and pipe laying vessels.

DEIF's safe and reliable systems ensure optimum performance, high accuracy, minimal maintenance requirements and reduced downtime. The company's 'green technology' focuses on energy efficiency, fuel optimisation and reduced emissions.

DEIF products for marine and offshore applications include analogue instrumentation, single and multi-function controller platforms and engineered solutions for the offshore oil and gas industry's ships and rigs.

These user-friendly controllers, which eliminate the need for external controllers, encompass advanced load dependent stop/start controls, integrated remote control from alarm and monitoring systems, long-time parallel operation diesel/shaft generators and combined emergency/harbour generators.

Vert Energy is also the exclusive distributor in sub-Saharan Africa for Leroy Somer alternators and Covrad heat exchangers. □

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The two PV challenges: funding and utility connection

In this article, Jasco Renewable Energy's Kevin Norris, consulting solutions architect, and Dave Smith, managing director, argue the case for overcoming two key challenges slowing the uptake of rooftop solar photovoltaic solutions.



Kevin Norris

Dave Smith.

Given the current power challenges in South Africa, as well as a growing trend toward sustainable electricity solutions, rooftop solar photovoltaic (PV) plants have become a hot topic for organisations wanting to generate their own power.

However, despite the benefits of such systems, there are two common challenges that have emerged. Firstly, while the cost of installations is reducing and electricity tariffs continue to increase, PV plants are costly and the return on investment (ROI) takes several years to realise. This makes obtaining funding for such systems difficult. Secondly, there remain several issues with the connection of solar plants to the main grid, which has slowed the uptake of these solutions.

Grid-tied solar systems are the simplest and most cost effective method for utilising solar energy as a replacement for day-to-day power requirements. On a very basic level, the grid-tied inverter converts the direct current (dc) power generated by solar panels, into alternating current (ac) and injects this ac current into the existing load. Any excess energy is then fed into the power distribution network.

The inverter is also able to ensure that the utility supply is only used should there be a solar shortfall. This system does not necessarily require a battery for energy storage, although their use extends functionality, so the installation is very simple and efficient and maintenance is low.

While an investment in such a system will typically pay for itself within six to 10 years, what needs to be kept in mind is that solar PV systems have a predictable performance curve of 25 years and a usable life of 35 years. In addition, using a grid-tied inverter system, homeowners and businesses will one day be able to feed excess power back into the grid, either offsetting this against utility costs or selling this power to the utility provider. PV systems, therefore, should not be seen

as a depreciating asset.

They are in fact an asset that not only reduces current costs, but could also be a significant income generator for the owner.

In 2015 the average cost of electricity per kilowatt-hour (kWh) is similar to the lifecycle-levelised cost of energy (LLCE) of a typical grid-tied system at around R1.00 per kWh. This means that, calculated over the complete guaranteed performance lifespan of the panels (approximately 25 years), the cost per kWh from a solar PV system will be similar to the municipal cost in 2015.

Going forward the cost of electricity from the utility is very likely to increase significantly, while the cost of the installed PV system will remain at its installed price, plus a minimal cost of maintenance. Over the next 10 years, the utility cost is forecast to be as high as R3.50 per kWh, while the PV cost will remain at R1.00. And if projected over the 25-year period, the cost difference between now and then will be significantly more.

In addition, in most cases the asset is attached to a building and would result in improved valuation of the building. Not only does this have a positive financial implication, it also has an environmental implication, especially when one considers the Carbon Tax that will be levied as of 2016. The only ways to negate the carbon tax are to either recycle or produce 'green kWhs' from a renewable source like solar PV.

In order to drive adoption of solar PV solutions, it is necessary for financial institutions to recognise their value and assist businesses and homeowners with funding these systems. Forward-thinking financial institutions should look to leverage the security of a loan for solar PV power against the asset itself, as it will pay for itself many times over in years to come. The asset could also be recognised as part of the building and be financed as an extension of the building bond.

In addition to funding, connecting to the utility remains a challenge. One of the most pressing issues is the nature of pure solar solutions (without energy storage capability), in that they are only able to produce energy during daylight hours, and the energy must be used or dumped. For the majority of residential applications where nobody is at home during the day, this generated power will be wasted if a solution to feed this power back into the grid cannot be resolved.

Connection codes therefore need to be finalised, and metering for two-way energy flow needs to be implemented. It is also important to find a solution to the problem of optimising the use of all renewable energy generated to the advantage of both the end-user and the utility providers.

The concept of net metering, whereby users sell their excess renewable energy back to the utility for credit and utilise these credits when the renewable source experiences shortfalls (such as at night when there is no sun to power solar PV systems) is one that has great potential to benefit all parties concerned. For most residential applications, this form of energy trading works well.

Some utilities may limit the amount of energy you can sell back for credits to the amount of utility energy used (i.e., if you use 2 000 kWh per month, then you may only sell back a maximum of 2 000 kWh per month). Another system would be to annualise this amount, enabling owners to make better use of the credits throughout the year, such as in winter where generation may not match overall consumption.

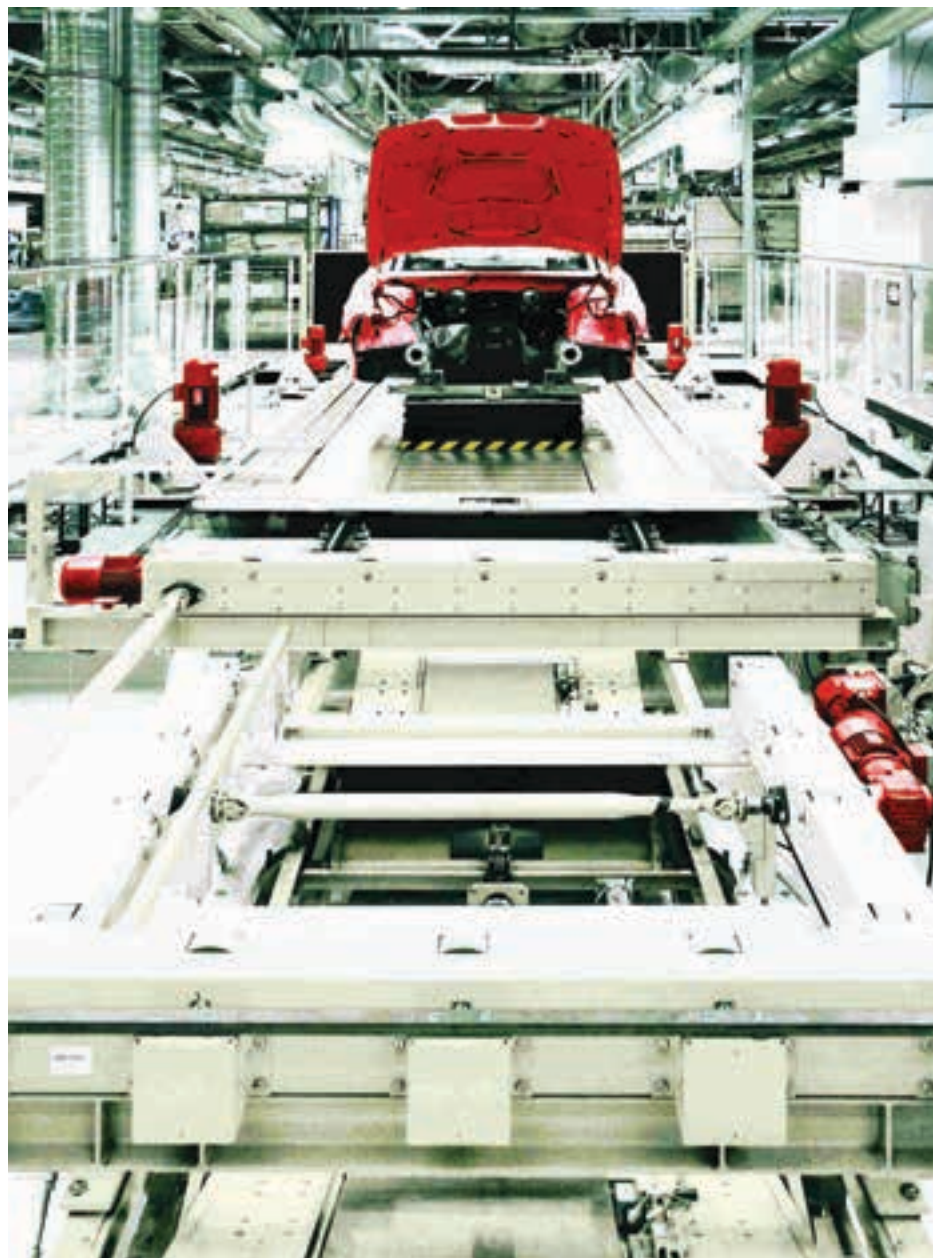
Regardless of the challenges involved, solar PV remains the most viable and cost effective alternate energy source for South Africa, a country that experiences significant hours of sunshine for much of the year in the majority of its regions. □

Streamlining automotive manufacturing in SA

SEW-Eurodrive's Port Elizabeth branch manager, Francois Sieberhagen (right) talks about the automotive industry and the introduction of Variolution packages that enable automotive manufacturers to considerably reduce the complexity and installation costs of systems.

The automotive industry is based on 'just-in-time' and 'just-in-sequence' processes for material provision and production. 'Just-in-time' is a methodology aimed primarily at reducing flow times within production as well as response times from suppliers and to customers, while 'just-in-sequence' is an inventory strategy to ensure that parts arrive at the correct point and at the exact time of need on the assembly line.

At any assembly plant, maximum system availability is essential as any downtime results in high follow-up costs. SEW-Eurodrive provides the local automotive industry with a unique product portfolio specifically designed to reliably meet 'just-in-time' and 'just-in sequence' requirements of modern automotive plants.



The production workflow in the automotive industry is based on just-in-time (JIT) and just-in-sequence (JIS) processes. The scalable drive solutions from SEW Eurodrive's Variolution® packages offer customers fewer variables and suppliers during the process of setting up a new assembly line application.

SEW-Eurodrive's Port Elizabeth branch manager, Francois Sieberhagen, says that the product offering ranges from individual components to complete packages and system solutions. "Leading automotive manufacturers choose SEW-Eurodrive because the company provides cost-effective drive solutions that deliver more value over the long-term. We provide a modular design and a reduced number of variants that increases flexibility and minimises costs."

The company's products most commonly used in the local automotive industry are: standard geared motors; synchronous and asynchronous servomotors; Movidrive B application inverters; Movifit FC decentralised standard inverters; Movipro SDC decentralised standard inverters; and Movipro ADC decentralised application inverters.

Sieberhagen indicates that the latest-generation SEW-Eurodrive Variolution packages enable automotive manufacturers to considerably reduce both the complexity of their systems as well as their installation costs. "Our drive technology and expert knowledge ensures maximum productivity, energy efficiency and reliability for clients' systems," he continues.

Variolution is essentially 'packaged-selling', whereby 80% of the package is

standard and 20% is customisable. This provides customers with some level of customisation on top of the benefit of a standard tried-and-tested solution. The benefits of such an offering is that the customer has to deal with fewer variables and suppliers during the process of setting up a new application.

"There are ten Variolution packages, which include conveyer line, packing, unpacking, lifting and automotive, to name but a few. Special modifications to meet different requirements such as energy-efficiency or hygienic design have also been taken into account. With Variolution, customers are provided with on-site commissioning and installation too," states Sieberhagen.

According to Sieberhagen, SEW-Eurodrive's recent involvement in the local automotive industry has been primarily focused on machine builders and component suppliers. He does, however, anticipate an increase in market share with scheduled upgrades due to take place at various manufacturing facilities.

To provide its client base with a more comprehensive and fully-integrat-



The SEW-Eurodrive and Variolution product offerings range from individual components to complete packages and system solutions.

ed service offering, SEW-Eurodrive's Johannesburg branch has now merged its Variolution and Maxolution offering to form the Maxo-Variolution business unit.

The company is re-positioning as a full service provider – as opposed to a components supplier – and striving to

attract application engineers to bolster the sales team's efforts.

"SEW-Eurodrive continues to work on expanding its extensive product and service portfolio, in order to support and fulfil the needs of the automotive industry," Sieberhagen concludes. □

Africa-wide affordable robotics challenge

"If teaching a young child how to do something is challenging, teaching a robot to 'think' for itself to navigate through a maze can be even more so. School learners with the ability to crack this kind of puzzle are the bright sparks the University of Johannesburg (UJ) wants to draw into its Engineering education and training programme," says Willie Viljoen, manager of the Technolab at the University of Johannesburg, UJ.

"We aim to create a pipeline of future engineering students for our university," he says. "Technolab makes robotics accessible and affordable to learners in Johannesburg through various programmes, aimed at boosting STEM: science, technology, engineering and mathematics education."

Technolab is part of the Faculty of Engineering and the Built Environment at UJ.

In July, TechnoLab entered into a partnership with the South African Institute of Electrical Engineers (SAIEE), which further extends its services to disadvantaged learners and also makes possible a continent-wide robotics challenge.

"The partnership from SAIEE makes it possible to for us to take our weekly robotics classes to schools in Soweto, Alexandra and the Johannesburg inner city. We are in

talks with various schools about extending our programme to them," says Michael Ettershank, manager of the RobotScience project at UJ's TechnoLab.

The SAIEE partnership also makes possible the first UJ-hosted AfrikaBot robotics competition, says Ettershank. Learners from schools across Africa, and even developed countries such as the USA and Europe, are all invited to enter the AfrikaBot competition. The initiative will be launched on 3 October 2015, with the first continent-wide competition taking place in October 2016. AfrikaBot is billed as 'the world's most affordable robotics competition'.

"Young people who enjoy working with robotics are often good candidates for engineering courses. However, most robotics kits are so costly that few South Africans have the means to enter competitions. To make robotics accessible to disadvantaged learners the P1X8 robot is made in part from junk you may have lying around, while you build the electronics yourself from parts you can obtain from our supplier. You can choose to program the controller microchip with free text or graphical software available on the Internet," says Ettershank.

"Learners from all schools, colleges and universities have a whole year to build and customize their robots for AfrikaBot 2016,"

continues Ettershank. "They can learn by watching videos on their cellphones on how to build their robots on our website at www.robotscience.co.za and our YouTube channel. This way they can start preparing right away for a career in electrical or electronic engineering. With the SAIEE partnership we will be sponsoring and training disadvantaged learners to enter AfrikaBot 2016."

Certainly, South African learners are likely to give their counterparts tough competition.

Adds Ettershank: "In 2013 teenagers who trained with the RobotScience project were placed second at the World Robotics Olympiad in Jakarta, Indonesia, beating a team from Germany that was sponsored by BMW. By the time you've completed the first training module with us, you can do more advanced training, where you learn how to control solar energy equipment and industrial machinery."

The UJ Technolab-SAIEE partnership is confirmed for the next year, comments Mr André Hoffman, President of the SAIEE.

"We hope that the SAIEE sponsorship for Technolab and AfrikaBot will go some way to towards accelerating these programmes. As the SAIEE we'd like our members to participate in these activities. Technolab can count on my personal interest and commitment in supporting its activities in the coming year," says Hoffman. □

Collaboration results in hazardous area certification

A collaboration between Rockwell Automation, the world's largest company dedicated to industrial automation and information; and ACTOM (Pty) Ltd, the largest manufacturer, solution provider, repairer and distributor of electro-mechanical equipment in Africa, has been awarded Exn certification for explosive gas atmospheres in the oil and gas industry.

Rockwell Automation and local electro-mechanical equipment solutions provider ACTOM Electrical Machines have been awarded a hazardous area certification for the oil and gas industry by Explolabs. The Exn certification was awarded subsequent to the testing and assessment of the ACTOM MS4 452-4 non-sparking Ex nA IIA and IIB T3 motor and Allen-Bradley PowerFlex 7000 medium voltage ac drive combination(s) for compliance to *Electrical apparatus for explosive gas atmospheres – General Requirements* (SANS 60079-0: 2012 Ed 5) and *Equipment protection by type of protection 'n'* (SANS 60079-15: 2010 Ed 4).

As a subset of a larger project, five Allen-Bradley PowerFlex® 7000 medium voltage ac variable speed drives (VSDs) by Rockwell Automation and five

ACTOM motors will be used by Engen Petroleum's Greenfields project to control Flowserve's 1 320 m³/h centrifugal pumps, facilitating the movement of product from Engen's Island View facilities to Transnet's NMPP Island View West site. Rockwell Automation's PowerFlex 7000s are fitted with an 11 kV to 6.6 kV integral transformer to power ACTOM's 650 kW, 6 600 V, four pole motors in this hazardous area.

The VSD and motor combination test was conducted to determine the maximum surface temperature of the ACTOM Electrical Machines' motors in accordance with SANS 60079-0: 2012 Ed 5 Clause 26.5.1.3 and Annex E, which included the monitoring of the motor winding temperature; ambient temperature; DE & NDE bearing temperatures; and motor supply voltage, current and rpm. The combination test was conducted at the motors maximum duty point for eight continuous hours.

Explolabs found that the drive and motor combination complied with the requirements set out in the standards and certified the installation for 'Zone 2' ('Gas: Surface') applications, i.e. as the 'location' while the 'environment' is listed as 'Group IIA and

IIB'. 'Frequency' is listed as 'abnormal' as could occur under normal operation.

"Considering the criticality of this project and the stringent Engen specification meant that we needed to supply a reliable solution that conformed to all the requirements of the various stakeholders," says Henry Craukamp, ETO sales manager – southern Europe and Africa. "The test results prove the compatibility between Rockwell Automation drives and ACTOM's motors, one of the reasons we entered into our co-operation agreement in 2013." This agreement is to supply Rockwell Automation and ACTOM customers with appropriately paired variable speed drives and motor products.

The now Exn-certified VSD and motor combination was delivered to-site and the installation completed. The Rockwell Automation commissioning team is on stand-by to begin on-site commissioning as soon as Engen completes the remainder of the installation.

"Rockwell Automation is extremely pleased with the outcome as it verifies that our VSDs have no temperature effect on the motor, whatsoever. The tests further prove that our VSDs and ACTOM's motors are compatible in one of the harshest environments. We will continue the certification process with our low voltage PowerFlex 755 series VSDs and ACTOM's low voltage motors," Craukamp says, adding that Engen Petroleum "was extremely satisfied with the result."

Allen-Bradley and PowerFlex are trademarks of Rockwell Automation, Inc. □



Rockwell Automation and ACTOM Electrical Machines have been awarded a hazardous area certification for the oil and gas industry for the combination of Rockwell Automation's Allen-Bradley PowerFlex® 7000 VSDs with ACTOM's 650 kW, 6 600 V, four pole motors.



Rockwell Automation's PowerFlex 7000s are fitted with an 11 kV to 6.6 kV integral transformer to power ACTOM MS4 452-4 non-sparking motors.

Automation expertise demonstrated at Offshore Europe

Rockwell Automation demonstrated its extensive control, safety and process automation expertise in the oil and gas industry at Offshore Europe 2015, with a clear message to exhibition visitors: “You can get more from your assets, reduce operational costs and bridge the skills gap if you embrace the company’s technology and experience”.

Drawing on its experience of the fast pace of technological evolution from industry beyond the oil and gas environment, Rockwell Automation is challenged visitors to see how they can benefit from increased connectedness between operational and information technology, while having a higher level of information visibility.

The company will be highlighting four key areas where its control and automation solutions have enhanced customer production around the world: managing obsolescence; enhancing performance through modern safety solutions; performing system migrations without interrupting production; and collaborating – using equipment from a variety of vendors to create single, efficient and modern processing solutions.

Managing obsolescence: The stand, alongside strategic alliance partners and global leaders in measurement instrumentation

and services, Endress+Hauser, featured proof-points for reducing the risk associated with unsupported and obsolete technology. Experienced Rockwell Automation engineers talked through best practices towards extending the lifecycle of existing assets, while reducing the risk of expensive shut-downs associated with equipment failures.

Safety consulting: A comprehensive portfolio of safety solutions were also showcased, including the extensive assessment and consulting services available through the Rockwell Automation global safety services teams.

Migration/hot cutover: Front of mind for many visitors was maintaining throughput while implementing overall operational improvements to their facilities. Rockwell Automation addressed the critical question on how to best plan, install, commission and integrate new control systems and electrical equipment with existing architectures without taking large sections of a plant offline.

Included in this best-practice approach is the introduction of ‘Work Packs’, which list instructions for installation and commissioning teams on how best to manage the materials, work actions and health and safety involved with a hot cut-over to more efficient modern solutions.

Multi-vendor support: At the heart of each of these approaches is the ability for critical control and safety solutions to work seamlessly with existing equipment regardless of the original vendor. Rockwell Automation staff described examples of projects from all around the world that have benefitted from the multi-vendor support available through their process offering. □



At Offshore Europe 2015, Rockwell Automation demonstrated its extensive control, safety and process automation expertise for the entire supply chain of the oil and gas industry.

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Condition monitoring in the marine industry

Following successes in the manufacturing industry, SKF is accelerating its condition-based monitoring offerings to the marine industry, says David Johansson, head of strategy and portfolio management at SKF (right).

Condition-based maintenance (CBM) is a tried and trusted technique within the world of manufacturing. It helps to improve the overall machine efficiency and ensures timely and accurate repair of machines by keeping a constant watch on their condition, and identifying errors before they can cause problems.

Any industry that uses a lot of independent machines can derive enormous benefit from CBM. For this reason, SKF sees considerable potential for CBM in the marine sector. For example, the needs of marine customers are similar to those in manufacturing: improving maintenance procedures, boosting up-time and cutting costs. However, the industry's natural conservatism coupled with reliability, stringent regulations and ever-tougher economic conditions, means that the take-up of CBM has been relatively slow.

SKF has been working with OEMs in the marine sector for many years, helping them improve the performance of their machinery. "Following our strategic acquisition of Blohm + Voss Industries (BVI) in Germany in 2013, we are now in a position where we have far greater exposure to the end user market thanks to its worldwide leading network of sales and service partners," says Johansson. BVI is a leading supplier of marine components – including stern tubes, seals and hydrodynamic bearings – and works closely with shipyards and marine operating companies.

"In many respects, the BVI acquisition has also allowed us to accelerate and improve our CBM services to the marine sector. Customers will benefit from SKF's expertise as a knowledge engineering company in combination with BVI's focus on shipbuilding and ship operations. In particular, we're now developing even more advanced condition monitoring systems, which are based on much broader end-user feedback and application data.

Together, our solutions will help to address future challenges in the ever-changing environment of the marine industry," he says

Shipbuilding is under as much pressure as any other manufacturing sector, while ship owners are also trying to make their operations as lean as possible. They must minimise cost by, for example, optimising trade routes, reducing cruise speeds and improving fuel efficiency to protect operating margins.

Although cost-conscious



On-board engineers can use handheld instruments such as SKF's Microlog to carry out portable data collection, or use online systems, where fixed sensors mounted in dangerous or hard to access areas are hard wired back to a central on-board control room.

ship owners might see CBM as an unnecessary expense, the reverse is in fact true. By investing in the CBM technologies that are already widely used and proven for reducing machine operating and maintenance costs in the manufacturing sector, ship owners and operators can benefit from the efficiencies that arise from greater machine reliability. In many instances this can have a positive impact



on the number of days that each vessel can remain at sea.

The early adopters of CBM have been the highest value vessels, such as cruise ships, and those used in the oil and gas sector. "Increasingly, however, we are seeing the implementation of CBM technology in a far wider range of cargo ships, large and small," Johansson continues.

Traditionally, a ship used in the offshore sector is brought into dry-dock every two and a half years for a complete overhaul of on-board machinery. For merchant ships generally this period is longer, at around five years. In each case, every day that the ship is in dry-dock represents lost revenue.

He argues that investing in automated condition-based monitoring systems could potentially delay the need for these major overhauls – meaning that a ship will undergo fewer major maintenance operations during its lifetime and spend more time at sea. Routine repairs can also be carried out with more confidence, and be planned so that they can be completed while vessels are in port or at sea, so that they do not affect normal operations.

Data can be gathered in a number of ways. On-board engineers can use instruments such as SKF's Microlog handheld devices to carry out portable

data collection, or use online systems, where fixed sensors mounted in dangerous or hard to access areas are hard wired back to a central on-board control room. Data can therefore be analysed by ship engineers or, more commonly for critical equipment, be transmitted to a shore-based facility for interpretation by remote experts.

“Of course, there are some key differences that do not translate directly from the manufacturing to the marine sector. One is the availability of network or satellite bandwidth,” he points out. By its very nature, condition monitoring generates large amounts of data. In a manufacturing environment, with on-site analysis, data overload is rarely a problem. On-board ship, once the vessel is out of reach of land based communications networks, it is impractical to send high volumes of data over satellite links, especially if it has to compete for bandwidth with voice or other more critical communication. Information must, therefore, be carefully analysed and filtered first, with only the most relevant data being transmitted for on-shore analysis.

“And it’s not just maintenance data that’s important. CBM is increasingly moving into performance monitoring too. Ship owners require a large array of information, such as fuel consumption and emission levels to optimise operations,” adds Johansson.

New solutions are emerging to help meet these needs. For example, BVI’s Turbulo BlueMon is an emission monitoring system that records everything in one place. By linking to GPS position data, the system helps compliance with marine MARPOL conventions, so that if a ship is approaching an area with higher emission standards, a warning can be sent to the bridge so that emission levels can be rechecked – and the data remains



BVI's Turbulo BlueMon is an emission monitoring system that, by linking to GPS position data, helps shipping companies to comply with marine MARPOL conventions.

available for 24 months, allowing later verification of compliance.

This and other systems are effectively filling in the ship’s logbook automatically – the kind of operation that is likely to become far more common in future. Fitting this technology to an entire fleet would allow a ship owner to benchmark its environmental performance against industry standards, or identify the best performing crews and vessels.

There is a further benefit of centralised data collection, in that it helps to overcome a common trend within the marine industry – that of engineers rotating between ships, with knowledge of individual vessels inevitably being lost as staff members move on.

SKF can also provide a Client Needs Analysis (CNA) to ship owners, helping them to improve on-board maintenance procedures. The CNA is a survey of around 40 questions, which are put to the maintenance operations team. It takes a full day of interviews to gather

the relevant information. SKF then generates a score of a company’s maintenance performance, often revealing immediate ways to boost procedures and cut costs. In addition, the report provides a roadmap for future improvements. “CNAs are widely used, and proven, within manufacturing,” says Johansson, “but still in their early days in the marine industry. Nonetheless, they can be an excellent first step in planning the introduction of an on-board CBM solution.”

Where next? The marine industry will not adopt CBM overnight. The main focus of marine engineers is reliability, as a means of optimising vessel availability. This has historically been managed using visual or time-based maintenance inspections, so changing the culture will take time.

Change will be driven by economic pressures and by ever-tougher regulations on, for example, emission controls and machine safety. It will also be driven by companies such as SKF entering into strategic alliances, with the goal of developing new and innovative technologies that offer ship-wide and fleet-wide condition monitoring.

Perhaps the biggest challenge faced by marine engineers is to manage multiple on-board machines. “Indeed, in many instances there are so many machines, from many different suppliers on each ship that it’s much like a floating factory,” Johansson suggests. “For SKF, with our background in manufacturing, plus our experience and alliances in marine applications, we are able to offer knowledge engineering solutions that help OEMs improve the performance and reliability of their systems and enable ship owners and operators to increase the time that each vessel spends profitably at sea,” he concludes. □

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World-class mainline locomotives rely on Voith components

In Russia, Voith has recently equipped a new fleet of TG16M series double locomotives with an advanced component set, which is currently under test.

A brand new fleet of 32 TG16M series double locomotives, currently being tested in Russia, are all fitted with advanced components manufactured and supplied by Voith. All locomotives are fitted with two Voith component sets, consisting of an L 530 breU2 turbo transmission, a cooling system, as well as highly flexible couplings from the BR 152 and BR 199 range.

For this major order, Voith has equipped its newly developed cooling system with 'SilentVent' high-performance fans and weight and space-saving double block radiators. These parts allow maximum cooling output within the specified small installation space and ensure high power density.

The highly flexible coupling in the driveline shifts the critical natural frequencies below the operating speed. This protects the system's components against critical vibrations and increases the service life and the availability of the driveline.

At the core of the driveline is the adaptable L 530 breU2 turbo transmission. In combination with the Voith Turbo drive control system and a CAN-Bus interface,

this transmission ensures high traction and optimal efficiency across the entire output range of 1 000 to 1 700 kW.

With considerable investment being placed in railway infrastructure upgrades in South Africa, Voith is well positioned to add substantial value to this market with its tried-and-trusted, and internationally recognised product offering.

"Voith will actively contribute to the development of regional industry by localising its manufacturing and sourcing of components," says Themba Makoti, projects co-ordinator for the South African rail division.

Promising progress being made on the Russian project

The Russian locomotives will undergo a number of tests and certifications over a six-month period. The test runs will be used for examining speeds and train loading before the locomotives enter regular service.

In October 2014, the double locomotive successfully passed the static and dynamic inspection in Russia. During the static inspection, Voith experts checked the installation space and all interfaces



A new fleet of TG16M series double locomotives fitted with advanced components manufactured by Voith Turbo are currently being tested in Russia.

and installed the transmission. This was immediately followed by the dynamic inspection, during which the locomotives successfully completed their first test trip.

As soon as all dynamic tests have been successfully completed, the first locomotives will be put into regular operation, where they will mainly transport raw materials such as coal. Due to the high gradient of up to three percent, the trains consist of no more than 20 wagons.

Voith Turbo, a Group Division of Voith GmbH, is a specialist developer of intelligent drive solutions. Customers from highly diverse industries such as oil and gas, energy, mining and metal processing, ship technology, rail and commercial vehicles can all rely on the company's advanced technologies. □

Improving vehicle safety with fogmaker

Fogmaker fire suppression systems have a solid reputation for protecting both human life and assets within the global bus transportation market. Designed and manufactured in Sweden, Fogmaker has an installed base of more than 100 000 systems in over 50 countries in Europe, the Middle East, Australia and the USA. The product for closed engine compartments is distributed in southern Africa by Fogmaker South Africa.

This high-pressure water mist fire suppression system is rapidly gaining popularity within a number of sectors where its value in terms of decreased downtime and reduced insurance risk are apparent. John Russell, general manager for Fogmaker South Africa, says that uptake has been high in the bus industry, and is now gain-

ing traction in industries using underground vehicles, forestry machines, marine vessels and other specialised mobile machinery.

"Due to the use of hydro-pneumatic fire detection, which is totally independent of any electric circuit, both the detection and suppression systems work even when the electricity supply is disconnected. Resetting a released suppression system is simpler, easier, faster and more effective than with powder or foam suppression systems. The total life span cost of Fogmaker suppression systems is low compared with competing systems," Russell says.

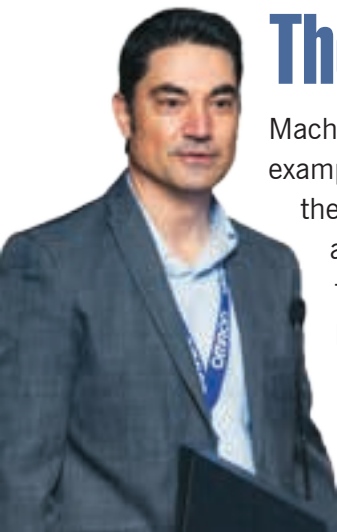
The patented discharge piston allows for a complete discharge, regardless of the orientation of the bottle. This, together with its high-pressure (100 bar) operation, results in a smaller installation footprint.

A further benefit is that the system can be installed in confined, out-of-the-way spaces in closer proximity to the required protection location.

"Fogmaker underlines our philosophy of partnering with leading specialist suppliers to ensure the protection of transportation assets," Russell concludes. □



The Fogmaker fire suppression system is a cost effective option, especially when compared to competing systems.



The machine automation controller (MAC)

Machine control hardware for automation is a clear practical example where market forces establish need and value, and then science and engineering are applied to meet them. This according to Omron Electronics' country general manager for South Africa, Victor Marques (left). In this article he presents the new technology.

During the past 50 years there has been a powerful and dramatic development of controllers: distributed control systems (DCSs), programmable logic controllers (PLCs), industrial PCs (IPCs), and programmable automation controllers.

The explosion of industrial applications continues to challenge the functionality of those controllers, fostering further innovation. The need to combine the capabilities of traditional process/discrete industrial control has led to adaptations or extensions of existing technology. The efforts to evolve resulted in underperforming machine automation due to limitations in architecture and a lack of cross-discipline expertise.

Today we see the emergence of a new controller type: a machine automation controller (MAC), which emerged after painstaking development from the ground up – specifically for high-speed, multi-axis motion control, vision and logic. Let's revisit how this point was reached.

The industrial controls market split into two distinct segments: process – where pressure, temperature, and flow were paramount – and discrete, where sequencing, count and timing were the key metrics. Programmable logic controllers (PLCs) dominated the discrete market, while distributed control systems (DCSs) led the process market.

Customers were well served. As machinery advanced, technologies converged and the programmable automation controller (PAC) was developed to address the overlapping of process and discrete markets. The PAC incorporates the fundamental capabilities of a small DCS and a PLC with the addition of low-axis-count motion control.

The PACs provide redundant processors, a single database, function block language, high-speed logic, component

architecture and online programming. While PACs cost less than traditional distributed control systems – and integrate motion and logic into a single controller – they encounter limitations when applied to high-speed motion with multiple axes. Motion control continued to be implemented with a separate network, and performance issues were tackled by adding processors. This meant additional code for controller sequencing, which resulted in inefficiencies in system synchronisation. Inevitably, machine performance was compromised.

The inevitable emergence of the MAC

Manufacturing demands performance in terms of throughput, yield and uptime: the overall equipment efficiency (OEE) model. Moreover manufacturers are always pushing for greater accuracy and lower cost while maintaining quality and safety. These factors are the key drivers.

Increasingly, manufacturing also requires moving product automatically during setup or production. This calls for a system that centres on motion and relies on speed and accuracy. If a controller has not been designed around motion, it may have inherent architecture barriers to performance when used to increase overall equipment efficiency. Consequently, machine manufacturers are forced to coordinate and synchronise the controller across technological boundaries such as motion, vision, logic, and safety.

“We started a new category called machine automation controllers (MAC) where the most important attribute is motion performance,” says Bill Faber, commercial marketing manager for automation products at Omron Industrial Automation. “A true MAC can handle applications that require a high level of synchronisation and determinism as it integrates multiple technologies stretching across the boundaries of motion, vision, logic and I/O – all without sacrificing performance.”



The Omron NJ-Series is a completely redesigned hardware platform with a powerful Intel® Atom™ processor, proven for harsh environments. This ultra-compact MAC provides ultimate flexibility without compromising reliability and robustness.

Omron's NJ-Series controller is an example of emerging MAC technology. It features an advanced real-time scheduler to manage motion, network, and user application updates at the same time to ensure perfect synchronisation.

Updating all three in the same scan is unique to Omron Industrial Automation's NJ-Series MAC. System Synchronisation occurs when the user application program coordinates with the motion scheduler, the network servo drives, and ultimately controls the motor shafts. With each motor shaft synchronised with each other, what is true for two axes is true for nine, 17, or even 64 axes.

“There are many 8-axis and 16-axis controllers on the market,” notes Faber. “If there is a need to expand the coordination of motion beyond that number of axes, another motion module is typically added. However, this is where many other controllers fall short, because the application requires synchronisation across the expansion and scalability of the motion, through to the network, and back to the application program into the motion scheduler. While MACs have this capability, for synchronised controllers to best approximate the intended motion profile, the controller must be deterministic to accurately coordinate all axes in the system.”

All this points back to the main driver: in order to increase throughput, the system requires the axes to remain synchronised with great repeatability to guarantee higher performance of throughput, yield, and uptime.

“Lower yields will result and the system may have to shut down to make adjustments,” notes Faber. “Uptime is not necessarily just a factor of the equipment itself. It’s also a factor of the production process. If motion is not accurately controlled to match the process, when speeds are increased, the result is bad parts as the machine goes slightly out of control. This clearly impacts uptime because upstream and downstream processes need to be readjusted as well. For the next generation of platforms, machine builders need to be assured their architecture will allow them to expand throughput and yield without the platform becoming a bottleneck.”

Convergence

The revolutionary step taken was to purposely design the MAC to integrate multiple, specialised controllers with precise system synchronisation to deliver high performance throughput on a single controller.

To synchronise a Cartesian robot and a vision system, there are two parts: the setup and actual production. The coordinate system of the camera must match the coordinate system of the Cartesian robot. To get the camera data to the controller in a coherent form, a lot of time is spent developing the protocol. Previously, this might have taken the combined efforts of an articulated-arm robot manufacturer, a third-party vision system engineer, and a PLC vendor. There could be three different systems, from three different companies, using three different technologies. During setup, there would be three engineers in a room, taking weeks to figure out how the systems can communicate with each other for commissioning. By design, a MAC allows these technologies to converge together so protocol development can be completed in a matter of hours.

On the performance side, the MAC’s use of a real-time network enables the passing of vision data to the motion system without losing a scan. This is only possible if vision and motion are on the same network.

As another challenge, machine builders want to adjust servo parameters on the fly. This added functionality can create performance loss as the whole system gets overloaded with a high number of axes moving at high speed with full synchronisation. According to Atef Massoud, motion and drive engineer for Omron Industrial automation, what makes MAC especially good for motion control is that it has all the elements to do this without degrading performance. “With a lot of machine controllers, there is a loss of speed if synchronised motion control is combined with a large number of axes, and there is a need for adjusting servo tuning at the same time,” he says. “Non-MAC systems require additional CPUs to accomplish this.”

The new performance benchmark

Today’s benchmark for the MAC category is processing 32 axes and updating in one millisecond. “There were many earlier attempts to create a multidisciplinary controller,” says Shawn Adams, Omron’s director of marketing. “PACs were the most prominent. There were attempts to apply them to process control, to cell control, and to machine control; but we all knew that the PAC had to have an extensive operating system. Also, for really high-speed motion control, that controller and configuration required many CPUs. The performance of motion control will drop as the number of axes increases. This is typical of many controller manufacturers who wanted to hit several birds with a single stone.”

In the wake of this scenario, the further development of a highly targeted solution such as a MAC now seems inevitable.

Where MAC applies

According to Faber, the market for MAC is where the motion market, the vision market, and the PLC market have commonality.

Companies have different types of controls and control systems. In their higher-end controllers, they may have a combined need for simultaneous higher-end performance for motion, vision, functional safety, and I/O. But they also want to program their lower-level machines in the same language. They want to reuse the same libraries in scalable systems to avoid repetitive applications development. Code reuse helps amortise the engineering investment over a wide

range of projects into the future.

Imagine yoghurt packs traveling on a conveyor. They get inspected, checked, picked up by a series of spider robots, put in boxes, lined up in cartons, and so forth. Before the MAC, a typical line like this would have many controllers that would have to be coordinated – the vision controller, the robot controller, the motion controller, and, on top, the PLC that sequenced all of them. This is a typical application where customers have been asking for one controller and one software application to determine what is happening on the production line from vision inspection to pick-and-place to synchronisation of the robot with the conveyor to packing and palletising at the end of the line. MAC meets these requirements, streamlining operations by reducing the amount of equipment and integration traditionally required when different systems were cobbled together. In the packaging industry, machines for packing, wrapping, cartoning and palletising use a certain amount of robot functionality combining vision and motion, and a great number of axes need synchronisation.

These represent the successes where early MACs have been applied. Further applications may include intelligent controllers that can handle multi-axis synchronisation at the heart of machine operations. An example of this use is an application involving soft-material cutting or 2D cutting – be it wood, plywood, glass, stone, industrial textiles – where a certain amount of path or pattern execution functionality is needed, as well as handling and positioning. It involves multi-axis control, but does not require the extremely high functionality of typical CNC controllers. “These emerging machine applications will require the functionality and flexibility that MACs deliver,” concludes Adam

The Power of new thinking

Controller inefficiencies that were exposed by machine innovation drove the new thinking that led to the development of machine automation controllers. Now that MACs have emerged as a revolutionary solution, further machine development incorporating their advances will continue evolving, with motion at the core and with the creation of value as its ultimate goal. Today, with MACs, the potential for value is being realised to a higher degree than ever before. □

Optimum efficiency slurry pumps from local OEM

Becker Mining South Africa's HS pump range, which is manufactured locally to stringent OEM specifications, includes four different models in various sizes – from two to eight inch units. HS (horizontal hydro solids), VHS (vertical hydro solids), PVS (pumpover vertical solids) and HTMS (submersible) pumps are ideally suited to many applications in mining, waste treatment, foundries and steel mills, paper and pulp, food processing, as well as power plants, agriculture and manufacturing.



Becker Mining South Africa's extensive range of light-, medium- and heavy-duty slurry pumps includes the HS range, available in vertical, horizontal and submersible configurations.

"These hydro solid vortex pumps are designed to pump sludge and slurries containing large abrasive solids, trapped air and fibrous materials in light, medium and heavy service industries," says Theo Cambanis of Becker Mining South Africa. "Due to the recessed, non-clog impeller of this range, solids and fibrous materials up to 200 mm (depending on pump size) can enter the suction inlet and be expelled through the pump discharge, without damaging the impeller.

"The PVS pump has a slightly different design, with a locknut locking the impeller to the shaft. This method prevents the impeller from unscrewing if the motor is started in the wrong direction."

HS pumps, in horizontal and vertical configurations, offer a flexible drive arrangement, including direct coupled, overhead adjustable, or Z-adjustable belt drives.

HS and VHS pumps offer head capacities of up to 40 m and flow rates of up to 800 m³/h. Solids of up to eight inches

(203 mm) and SG's as high as 1,5 can be accommodated. HTMS submersible pumps have flow capacities up to 636 m³/h at heads of 28 m at 4-pole induction motor speed (1 450 rpm). They can withstand temperatures to 90°C and pressures of up to 1 380 kPa.

In all models, a robust one piece casing facilitates the flow of solids and fibrous materials and an easily accessible stuffing box minimises blow-back of media around the shaft sleeve, without actual sealing contact.

The heavy duty, hardened chrome iron construction (650 BHN) of the wet end of these pumps increases service life. Because all components are locally manufactured, these pumps are readily available and a large stock holding of spares and raw materials ensures swift delivery throughout the country.

Another advantage of the design is that spares are completely interchangeable, which reduces inventory management costs and simplifies on-site repairs.

www.za-becker-mining.com

Compact water pump solutions

Goscor Power Products supplies an exceptionally wide range of compact, reliable and efficient water pumps to meet virtually any pump application in the agricultural and construction industries.

"A farmer's water pump requirements are as diverse as the agricultural industry itself," says Mark Bester, managing director of Goscor Power Products. "Whether a farmer needs a water pump to irrigate or fertilise his crops or to pump water to or from storage tanks, we have ensured that we stock a range of petrol and diesel water pumps that is wide enough to meet practically any water pumping requirement and budget."

The comprehensive water pump offering from Goscor Power Products includes clear water, chemical (fertiliser and salt water), slurry, semi- and trash pumps as well as high volume units. "To ensure that we meet our customers' requirements, we have gone a step further; we have extended our range to be able to offer high quality, world leading premium brand water pumps to more affordable options," explains Bester.

The PTX320 water pump is the company's flagship. Driven by the highly advanced, economical and easy to maintain Robin EX engine, this powerful pump delivers up to 1 000 l/min and boasts a

32 m pump lift capacity and a suction height of 8.0 m, making this unit ideally suited for heavy duty applications that require large pumping capacity.

The LT20XC water pump is a more affordable solution for light duty applications. The LT20XC has a 20 m pump lift capacity and a suction height of 7.0 m and can deliver up to 360 l/minute.

The complete water pump range is available and supported by Goscor Power Products' dealer network, which is strategically located across South and southern Africa including Botswana, Mozambique, Namibia, Zambia and Zimbabwe.

www.goscor-power-products.co.za



The PTX320 water pump is driven by the advanced, economical and easy to maintain Robin EX engine and can deliver up to 1 000 l/min.

Fuel injection system diagnostic service

Reef Fuel Injection Services is helping to reduce downtime for Caterpillar customers by offering an in-field fuel system diagnosis. "We can pinpoint what the exact problem is, right down to a specific faulty fuel injector which we can then remove and rebuild, as well as recalibrate the rest. This provides a massive cost saving for our customers in that we are able to test injectors individually, rather than having to replace or repair a full set," says Warren Hauser, operations manager.

"This is another example of how Reef Fuel Injection Services' significant investment in the latest repair and diagnostic technology and equipment helps customers substantially reduce their maintenance and repair costs," he comments. "Incorrectly calibrated or out of specification fuel injectors can result in problems in terms of fuel efficiency and consumption, and it is therefore important to ensure that these critical components function optimally at all times.

"This is a unique service offering that places us at the forefront of the automotive repair industry in South Africa," Hauser says, adding that the service is available for Caterpillar common rail and electronic fuel injection systems, as well as Caterpillar HEUI (Hydraulically Actuated Electronically Controlled Unit Injector) systems.

www.reeffuel.co.za

The PNC-12 Extreme CNC cutting solution

The PNC-12 Extreme from Koike, available in South Africa through Retecon, is a whole new innovative cutting solution developed as an ideal entry-level CNC cutting machine.

Based on demands for a simple, economical, and versatile CNC cutting machine, Koike has designed a cost-effective CNC solution that is portable and suitable for both plasma and oxy-fuel cutting.

Due to its size and portability, installation of the machine is easy and assembly and setup of all components, such as the machine body, rail and cross bar, do not require any special measuring tools. The PNC-12 Extreme is pre-adjusted at the factory before shipping and, apart from filtering systems and cutting tables, installation involves sliding all components together and connecting the cables.

The rail is made of robust structural steel, which ensures durability in heavy duty working environments, and the cross bar is secured with widened linear guide blocks, which stabilise the torch, even when extended to maximum length.

Oxy-fuel or plasma cutting packages are available. The oxy-fuel package comes with an oxy-fuel torch set with an integrated automated piercing sequence and gas on/off solenoid valves on all gas lines, while the plasma cutting package comes with an initial torch height sensor (IHS), arc voltage height control (AVC), a torch break away system and a 35 mm diameter plasma torch holder.

These are ideal for all customers looking for simple CNC cutting solutions.

www.retecon.co.za



The PNC-12 Extreme from Koike, is an ideal entry-level CNC oxy-fuel or plasma cutting solution.

New QES portable generators for predictable power

To meet the specific needs of the construction and general rental sectors,



The new range of application-oriented QES portable generators from Atlas Copco is available in five models, from the 9.0 kVA QES 9 to the 42 kVA, QES 40.

Atlas Copco is introducing a new range of portable generators. The application-oriented QES, now available for worldwide order, was designed to offer ease of use and straightforward service.

The new generator range currently comes in five models, from the QES 9 (9.0 kVA) to the QES 40 (42 kVA). Additional models will follow shortly. Multiple customisation options allow individual customers to choose a QES that perfectly fits their individual requirements while enjoying the predictable power they expect.

Robust and quality components, including a Kubota engine, deliver a high level of performance and long service intervals of 500 hours. The units are

New OAT engine coolant

Cummins Filtration has officially launched a new engine coolant technology into the African market: proven to extend service intervals, while reducing environmental impact.



The environmentally friendly Fleetguard ES Compleat Organic Acid Technology (OAT) coolant formulation is free from harmful inorganic compounds – such as; nitrite, amine, phosphate, borate and silicate – to ensure improved liner pitting protection and greater aluminium protection.

Cummins Fleetguard technical sales manager, Gerald Annandale, notes that coolant plays an integral part in vehicle engine maintenance, and is composed of three components, namely; water, ethylene glycol (EG) and chemical additives.

“Fleetguard ES Compleat OAT is an organic acid, extended life, EG antifreeze/coolant that boasts patented technology to provide superior diesel engine protection against freezing, boil-over, cavitation, liner pitting, erosion, corrosion, elastomer gasket degradation and scaling,” he says.

By using Fleetguard ES Compleat OAT coolant, Annandale points out that fleet owners can extend service intervals to 6 000-hours, or 500 000 km. “A four-way test kit designed specifically for non-nitrite OAT coolants contains two types of test strips and a bottle of test reagent, and should be used at 6 000-hour intervals to confirm coolant quality in the field.

“Coolant plays a vital part in vehicle maintenance, as it is more cost effective to buy a quality coolant than to replace an engine after a failure due to poor maintenance. Fleetguard ES Compleat OAT coolant is a technologically-advanced and environmentally-friendly solution that meets the stringent standards of international OEMs,” Annandale concludes.

www.cummins.com

both compact and stackable, reducing storage and transport costs. And forklift slots and lifting eye ensure the models can be easily moved from one location to another.

Each model is easy to operate and manage thanks to the new Qc 1011 controller, which provides advanced engine monitoring and protection features.

“Customers in the construction and rental industry have very specific needs. The QES was designed to meet them all,” says Angel Nieto, product marketing manager, Atlas Copco Portable Energy. “With its application-oriented design, quality components and high performance, the QES gives them tailored value through predictable power.”

www.atlascopco.co.za

Tesla launches entry-level Model S and upgrades

Tesla has announced a new entry-level Model S along with battery updates and the addition of what it is calling 'Ludicrous Mode' on the Model S P85 D.



The recently launched entry-level Tesla Model S, with the new single-motor, rear-drive and a 70 kWh battery, is priced at \$5 000 below the dual-motor version (the all-wheel drive Model S 70D) launched in April this year.

Tesla has announced a new entry-level single-motor, rear-drive Model S with a 70 kWh battery, which is priced at \$5 000 below the dual-motor version (the all-wheel drive Model S 70D) launched in April this year.

That puts the newly discounted car's price at \$70 000 – R950 000 at mid-September exchange rates. With the included US road tax subsidies and the average petrol savings over a typical five-years ownership period, Elon Musk calculates this as equivalent to buying a \$50 000 (R650 000) fuel-based car.

The entry-level version's bigger brother is the Model S 70D launched in April this year, an all-wheel drive electric car with a 0-100 km/h time of 5.2 seconds and an on-highway 400 km range. In addition to having independently operational front and rear motors, the 70D includes supercharging to enable free long-distance travel, autopilot hardware, navigation, blind spot detection and many other features. As with every Model S, the 70 and 70D will receive free over-the-air updates that add functionality and improve the driving experience for years to come.

Along with its new entry-level car, the company announced a series of upgrade options. Thanks to a redesigned fuse on the car's battery, the Model S can now be made to accelerate to 100 km/h in 2.8 seconds – similar to the times achieved by hypercars such as the McLaren P1.

The new fuse design that allows this performance boost has its own electronics and a small lithium-ion battery. Instead of melting beyond the preset amperage as is the case with the standard fuse, the new fuse constantly monitors the current and is pyro-activated to cut power whenever necessary.

This has been coupled with an upgrade to the main battery pack contactor, which eschews steel for Inconel, an oxidation and corrosion resistant superalloy. Because Inconel stays springy under the heat of a heavy current, the car's maximum power pack amperage can be increased from 1 300 to 1 500 A.

As a result, in this 'Ludicrous mode' the upgraded Tesla P85 D can accelerate 10% faster than previous generation Teslas, with a quarter mile being cov-

ered in 10.9 seconds and the zero to 250 km/h time cut by 20%.

For people who are worried about running out of charge on the go, Tesla is also offering a 90 kWh battery pack (up from 85 kWh), which, it claims, will offer over 480 km of range at a steady 100 km/h on the highway. The battery upgrade will cost \$3 000, but Elon Musk has advised owners to hold off upgrading unless they're already on the edge of the range envelope.

For the next six months, current owners of the Model S P85 D can upgrade to 'Ludicrous Mode', for an additional \$5 000 plus installation labour, while people buying a new Model S new will have to find \$10 000 for the option. □

Industry diary

October 2015 Valves Selection, Installation & Operation (4 Day)

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Johannesburg, Cedar Park
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phindi@2kg.co.za
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Offshore Energy 2015

13-14 October
Amsterdam RAI
info@offshore-energy.biz
www.offshore-energy.biz
www.navingo.com
Philip Mulder, +31 10 2092 674
pmu@navingo.com

2015 Johannesburg International Motor Show

14-25 Oct
Johannesburg Expo Centre, Nasrec.
Pula Dippenaar:
media@sashows.com
+27 11 494 3114
www.jhbmotorshow.co.za

The 2015 SAAFF annual Congress

Taking place from October 14 to 16 at the Durban International Convention Centre, KwaZulu-Natal, this year's Congress theme is 'New Frontiers', for the local freight forwarding industry.

The popularity of trade with Africa, while still perceived as a challenge for many, is seen as a huge growth opportunity for others. "As Africa has risen to prominence as an investment destination over the past few years, so the role of transport and logistics has taken on greater significance," says Andrew Shaw, PwC Transport & Logistics Leader for South Africa in his presentation 'Business into Africa'. Shaw will be speaking at the South African Association of Freight Forwarders (SAAFF) Congress 2015 in Durban in October, highlighting many of these opportunities.

"Logistics strategists can't afford to ignore the African market of the future," Shaw believes.

For more information, contact Catherine or Elize at CVLC.

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