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MAY 2017

# AFRICA

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PUBLICATIONS

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### This month:

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Vacuum Technique: a fifth business line

Zero hour high horsepower engine remanufacturing

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# CONTENTS



## CROWN PUBLICATIONS

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### PLANT MAINTENANCE, LUBRICATION AND FILTRATION

- 8 Zero hour high horsepower engine remanufacturing  
Cummins Southern Africa has transformed its Kelvinview engine service centre in Johannesburg into a fully-fledged Cummins Master Rebuild Centre (MRC). *MechChem Africa* tours the facility and talks to its leader, Patrick Mohale.
- 11 Turnkey filtration system for cement plant
- 12 Cost-efficient grease solutions for SA's sugar mills
- 13 High quality, virgin process oil range
- 14 Inferno raises need for fire prevention
- 15 Latest dual-laser portable alignment kit
- 16 Mario on maintenance: From 'predictive protection' to predictive maintenance

### MATERIALS HANDLING

- 18 Maximum value minerals processing  
*MechChem Africa* talks to Cedric Walstra, Glencore Technology's Africa business development manager, who paints a broad picture of the high-recovery, high-efficiency processing equipment on offer from the technology side of Glencore's business.
- 21 HMA Group establishes African presence
- 23 Topless tower crane technology
- 24 Focus needed on optimising transfer points
- 25 Turnkey new crushing plant

### CORROSION CONTROL AND COATINGS

- 26 Promise of stainless steel undermined  
This article explains how the South African Stainless Steel Development Association (sassda) is fighting to uphold industry standards and be a voice for best practice.
- 28 Tracking industrial trends: Bridges, corrosion and lifecycle cost thinking

### HEATING, COOLING, VENTILATION AND AIR CONDITIONING

- 32 Refrigerated air dryers safeguard against condensation  
Recognising the importance of correctly prepared compressed air, SMC Pneumatics strives to provide quality air dryers to combat moisture.
- 35 Complete ventilation solutions in SA

### WATER AND WASTEWATER PROCESSING

- 36 Mobile discharging of PAC from bulk bags helps solve pesticide overload  
Transvac has deployed its mobile TransPAC dosing systems in a number of UK water treatment works for pesticide concentration emergencies, taste or odour problems. These incorporate mobile powder handling and carbon dosing system from Flexicon.
- 39 Certified Water Efficiency Professional (CWEP) to launch in SA

### SPECIAL REPORT

- 40 Vacuum Technique: a fifth business line  
*MechChem Africa* talks to Atlas Copco's Sofiane Kerfali, regional business line manager for vacuum pumps and systems; and Willem Brits, the local representative for Industrial Vacuum.

### INNOVATIVE ENGINEERING

- 42 Bloodhound: an engineering and educational adventure  
Christopher Maxwell from Bloodhound SSC presents the technology behind the first 1 000 mph car.

### REGULARS

- 2 Comment: Water distress and our distracted response
- 4 On the cover: Butterfly valve triples life in cement application  
Francois van der Merwe of Gemü Valves Africa talks about a successful application of its butterfly valves.
- 6 SAICHe News: Mine water and the alarming water situation in SA
- 42 Product and industry news
- 48 Back page

# Water distress and our distracted response

Peter Middleton

## COMMENT



At the time of writing, the Constitutional Court is hearing arguments about the 'secrecy' of the vote of no confidence against Jacob Zuma; Brian Molefe has been reappointed as Eskom, CEO; and, in spite of the brakes being applied to the nuclear procurement programme by the Western Cape High Court – because of a lack of due process – African Utility Week in Cape Town is expected to be dominated by the nuclear debate.

These issues, along with radical economic transformation, the threat of a third downgrade to 'junk status' by Moody's and the divisive nature of the ANC's presidential succession campaigns, are so dominant that the importance of environmental issues are being downgraded to 'trivial'.

At SAChE's Gauteng dinner late last month, a stalwart in the environmental space, Mariette Liefferink, presented an overview of the state of South Africa's water, with particular emphasis on the effects of mining. Liefferink's legal background and the litigation experience of the organisation she leads – the Federation for a Sustainable Environment (FSE) – were evident in the meticulous referencing and credits associated with every fact she presented.

These are sobering, if not chilling and MechChem Africa's summary of her talk is a 'must read' in this issue.

From a water availability perspective, 12 of South Africa's 19 Water Management Areas (WMAs) require intervention, based on a detailed map presented courtesy of Fred van Zyl, chief engineer for macro planning for the Department of Water and Sanitation (DWS).

An online report of a briefing to Ministers by the DWS on its Infrastructure Master Plan, dated 3 June 2015, reports that '... the total estimated replacement cost (of water infrastructure) was R1.18-billion, and the estimated investment requirement over ten years was R805-billion, or R81-billion per annum. The total funding available was R46-billion per annum, meaning there was a funding deficit of R35-billion per annum' [ref: pmg.org.za/committee-meeting/21011].

A little further down in the summary, we read: '... DWS was dealing with a backlog of over 100 years in the making, and to eradicate it in 21 years was impossible, with the changing urban landscape, the mushrooming of informal settlements and the increase in urban migration'.

This report predates the first appointment of Brian Molefe as the permanent CEO of Eskom (Sep 25, 2015) to 'sort out' our load shedding issues. Have any

equivalent appointments or interventions been taken since to resolve SA's water distress issues?

The key focus for Liefferink at the FSE is the mining industry and its impacts on the environment, most notably, water pollution and acid mine drainage (AMD). She points out early in her presentation that mine water acidity as a phenomenon associated with pumping water from pits was already recognised back in 1903. And 20 years ago in 1987, the US Environmental Protection Agency recognised that "... problems related to mining waste may be rated as second only to global warming and stratospheric ozone depletion in terms of ecological risk."

Under the 'polluter pays' principle, the historical knowledge of the AMD problem should put the reparation responsibility back onto the mining companies. But the nature of the problem is such that it manifests most dangerously after a mine has been shut down. Many of the original mine owners are no longer in business and, while current owners are more responsible, most of the treatment costs are still being borne by the public purse and water end-users.

Quoting published reports by the Department of Water Affairs and Forestry from 2003 and 2006, (DWAf), Liefferink says: "... mine void water exceeds the maximum allowable limits (Class II) of the SABS 241 Drinking Water Standard, in many cases by several orders of magnitude: pH, EC, TDS, SO<sub>4</sub>, Fe, Mg, Ca, Mn, Al, BP, Co and Ni". Much of the water is also radioactive.

It is currently acceptable to treat AMD by neutralisation or pH adjustment. In this process, dissolved metals precipitate out of solution in the form of highly toxic sludge, which is often being 'contained' in unlined pits, where future ingress risks remain.

In addition, the pH-adjusted water contains significant percentages of dissolved salts, so the treated water requires dilution using purer and more expensive resources in order to make it safe. Hence the need to adopt more modern and more expensive reverse osmosis or ion exchange treatment technologies.

The treatment costs, as quoted by the May 2016 Long Term Treatment of AMD document, estimated the capex cost to be in the region of R10- to R12-billion, with ongoing opex costs of R25-million per month, with at least 33% being borne by the public.

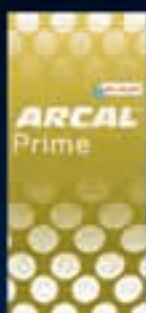
South Africa is, undoubtedly, faced with multiple imperatives. Water, however, already underfunded and poorly prioritised, is being dangerously neglected due to the prevailing noise. □

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# Butterfly valve triples life in cement application

Gemü Valves Africa offers a flexible range of rugged customised solutions that are fine-tuned to best suit customer applications and to maximise reliability and valve life. *MechChem Africa* talks to Francois van der Merwe about the company's soft-seated butterfly valves and a successful application at an AfriSam blending and packing plant.

According to Van der Merwe, Gemü has a long history of making valves that last longer, particularly when used in the harshest applications. "Our valves are different in that each one is specially designed and then adapted so that it will perform reliably for much longer," he begins.

"Before we supply a valve, we go into the details. Starting with failure analysis, we identify problems and resolve them to ensure that our valves last longer, particularly when conveying wet slurries or for the pneumatic conveying of dry powders, which are often used for transporting highly abrasive media," he says, adding that "every valve we produce needs to help clients towards lower operating costs, better uptime and more profitability."

Gemü is a family owned business from Germany with some 52 years of experience in the design and manufacture of valves and valve solutions. "We are the world market leader for the pharmaceutical, food and biotech industries and we also offer a highly competitive industrial product range," he says.

As well as valves, Gemü also produces control, measurement and instrumentation equipment to allow the valves to be managed to best suit the demands of the applications. "We also offer a full range of actuators, including manual, pneumatic or electric options," he adds.

"Our valve solutions are supported by over 400 000 combinations of different products.

Each valve can be supplied in all the common sizes with different connection options, different disc sizes and pressure classes. Because of our product variety, we have the flexibility to define a best-fit solution for any application," he notes.

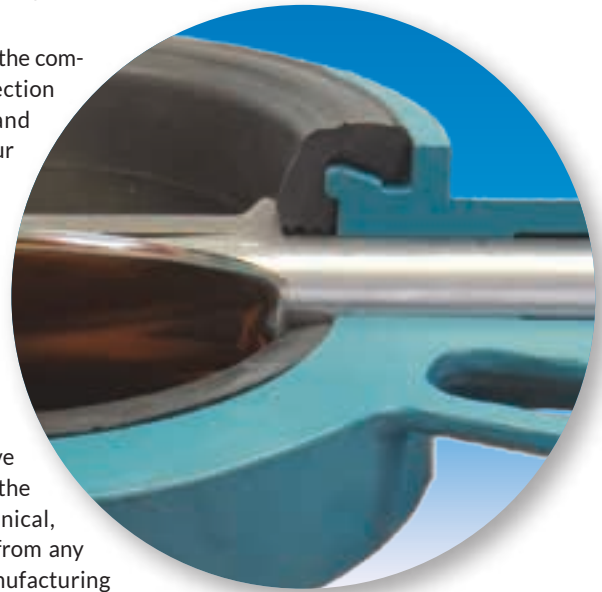
From a production and distribution perspective, Gemü has six manufacturing facilities worldwide and 28 sales subsidiaries. "Globally, we are active in more than 50 different markets worldwide and we have the capacity to network inside the group: from Germany for technical, design and admin support and from any of our production sites for manufacturing and logistics".

Van der Merwe goes on to highlight Gemü Valves' local presence. "We are a service oriented company. Our strong local presence enables us to offer customised solutions for our clients' applications, which, to prove the benefits, we will often develop, install and test prior to finalising the contract.

"In addition, the local office enables us to better control delivery times, technical and contractual aspects and to develop better understanding of our customer's needs," he says.

## Industrial solutions and the AfriSam solution

Strong products on the industrial side in South

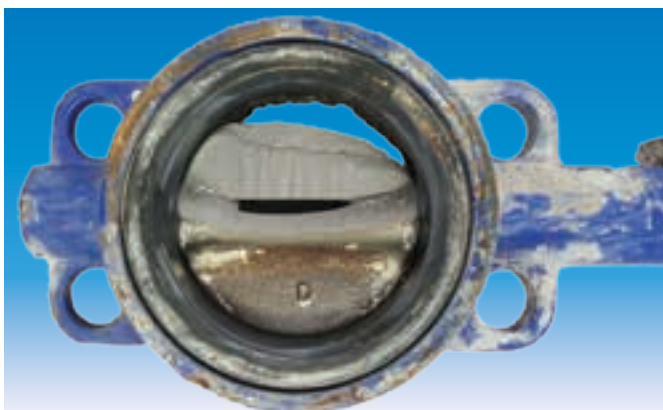


*These Gemü butterfly valves incorporate three anchoring points for the rubber liner to keep it from moving in any direction.*

Africa include the Gemü diaphragm and butterfly valve ranges, which are routinely used for controlling wet slurries or dry powders, respectively.

"Every conveying application is different. We can support the conveying of coal, cement, clay, flour and hundreds of other materials and powders. Some are sticky, some are abrasive and some might even be explosive. At the end of the day, the valve used needs to be well adapted to the application.

"In the industrial space, we focus more



*Compared to the previously installed valve (left), which was lasting no more than three months of service, the Gemü butterfly valve (right) was still usable after nine months of service.*

on abrasive powders rather than the sticky powders. When our valves last two months instead of the usual two weeks, it helps operators to save costs. This also offers huge advantages with respect to the safety of the operation and protection of the environment, which are currently increasingly important focus points for industry," Van der Merwe tells *MechChem Africa*.

Ultimately, however, the use of high quality, well-designed valves that are finely tuned to suit the systems in which they operate results in massive cost savings for the operation.

"Industrial plants are wasting money hand over fist because they are using the wrong technology and they are not willing to adopt more modern solutions," he argues. "Cheaply made, low quality valves that use the wrong materials are often being used. These wear out and break down very rapidly, because the construction simply cannot cope with the abrasive wear inherent in the application. In some cases, butterfly valves are being changed every three months or sooner," he notes.

Describing a recent success at AfriSam, Van der Merwe says that Gemü Valves Africa was trialling its four-inch soft-seated butterfly valve at one of AfriSam's cement blending and packaging plants.

"We have been trialling a test valve on the pressurised offloading system, where dry cement powder is offloaded from trucks and trains into the cement silo of the blending plant," Van der Merwe tells *MechChem Africa*.

"This is a pressurised system that supports three loading bays where trucks offload their 30 to 34 t payloads. With 20-25 trucks offloading per day, 600-850 t per day of cement is being passed through these butterfly valves," says Van der Merwe.

"The pressurised line gets up to a temperature of 60 °C, but the valve sits in the middle of the line and its disc temperature is significantly higher due to the abrasive action of the cement being conveyed past it at pressures of between 1.5-2.5 bar," Van der Merwe continues.

The butterfly valves used have to seal perfectly when closed in order to shut off the airflow. "When used in the blending side of the silo, any leaks will compromise the blending accuracy and the whole plant may have to be shut down," he says.

The trial valve was first used on the blending side of the operation, where it was trouble free for three months of operation. "It was then moved to the offloading line for the remainder of the trial. The previous valves were lasting no more than three months in this application, and when ours was removed for examination after six months and compared to its worn competitor, the difference was remarkable," he says, showing comparative

photographs of the Gemü valve and that of a worn equivalent from a competitor. The bottom half of the disc of the non-Gemü valve is seriously worn, to the point where neither sealing nor shut-off are possible.

The Gemü butterfly valve, on the other hand, shows very little wear on the disc and only slight wear on the outside edge of the EPDM-rubber lining, neither of which are at the point of compromising operational effectiveness. The valve was re-installed and has now been operating for nine months in this application.

The disc and the rubber lining, according to Van der Merwe, are the two elements of any butterfly valve that wear most quickly. So what has Gemü done to extend the wear life of these components?

"First, to prevent damage to the rubber liner, it needs to be held firmly in place. These Gemü butterfly valves incorporate three anchoring points for the liner to keep it from moving in any direction. This holds the rubber firmly in place while the disc opens and shuts. Each time the disc is closed, it exerts pressure on the liner and, unless well anchored, it will shift every time disc opens or closes. Cheaply made valves do not have additional anchoring points, so the liner will move and wear much faster," Van der Merwe explains.

On the discs of these valves, as well as carefully selecting the most appropriate material to use, Gemü also optimises the size of each of its discs to better match the applications pressure requirements. "There is no reason to install a valve capable of holding 16 bar pressure for a 2.0 or 3.0 bar application. By adapting the disc size diameter to suit a lower system pressure, the power requirements and costs of the actuator can be reduced and the wear life of the liner can be increased," he explains. In addition, the discs all have polished edges, which lowers the contact fric-



According to Peter Nematamvuni, blending and packing plant manager, the performance of the Gemü butterfly valve on the offloading system exceeded AfriSam's best expectations.

tion against the rubber, reducing wear rates."

From an installation perspective, he notes that butterfly valves should always be installed with the shaft horizontal, to prevent particulate from building up and grinding down the shaft journal below. "The valve must also be installed the right way around so that it always opens in the direction of flow," he adds.

For these and for many other reasons, the Gemü butterfly valve installed at AfriSam's blending and packaging plant has now been running for over nine months, while its predecessor only lasted three months before being completely destroyed.

"And the cost of more cheaply made valves are not necessarily lower either. We can comfortably compete on price against products of significantly lower quality and durability," Van der Merwe concludes. □



Gemü Valves Africa's four-inch soft-seated butterfly valve at one of AfriSam's cement blending and packaging plants.

# Mine water and the alarming water situation in SA

At the Gauteng Branch's annual dinner at the Wanderers Club on April 20, 2017, which followed SAChE's annual general meeting, Mariette Liefferink, CEO of the Federation for a Sustainable Environment (FSE), delivered a keynote address on acid mine drainage (AMD) and the state of South Africa's water resources. *MechChem Africa* attends and reports.

Liefferink's first slide shows that, in terms of water availability in South Africa, 12 of our 19 Water Management Areas (WMAs) require intervention, with the requirements exceeding or very close to exceeding total water availability. For South Africa as a whole, our current requirement is already perilously close to the 14 000 million m<sup>3</sup>/annum currently available to us.

By 2025, all four international river basins – the Orange, the Limpopo, the Incomati and the Maputo – will move into absolute water scarcity leading to economic stagnation and potential social decay. This before taking climate change into account.

The Limpopo River Basin is already over-allocated by about 120% and is facing a 241% increase in demand by 2025, Liefferink says, referencing a 2009 study by Ashton.

She cites some reasons for the dramatic increase in water demand in the region, which include: current and proposed mining activities; Sasol's proposed Mafuta coal-to-liquid fuel projects; the exploitation of the vast coal reserves in the Waterberg; the expansion of the Grootegeluk coal mine to supply the Medupi Power Station; Medupi, Kusile and proposed new Eskom power stations; and the implementation of the Ecological Reserve, which is expected to result in serious deficits in some of the main river catchments.

Touching on the DWS' 2014 Reconciliation Strategy for the Orange River, she points out that supply and demand are currently

at the crossover point. While intervention is required immediately, the situation will not improve before the Polihali dam is completed in around 2023 – and this will only achieve temporary relief.

As well as growing water shortages, however, the salinity in the Orange River is increasing alarmingly because current AMD treatment strategies involve neutralisation only, which results in water containing dissolved salts being discharged into the river.

## Mining and AMD

There is wide acceptance that acid mine drainage (AMD) is responsible for the most costly environmental and socio-economic impacts. AMD is a long recognised problem within the gold mining industry; it was referred to as an established phenomenon concerning pumped water on the Witwatersrand back in 1903.

AMD has a low pH and high acidity, but in addition to the acidity of AMD minewater, a number of other elements/determinants are also present in the water, mostly metals. Many of these are present in toxic concentrations in the water. Radioactive metals also occur in the water.

AMD, says Liefferink, is associated with surface and groundwater pollution; degradation of soil quality; for harming aquatic sediments and fauna; and for allowing metals to seep into the environment. Long-term exposure to AMD-polluted drinking water may lead to increased rates of cancer; decreased cognitive function; and the appearance of skin lesions.

In addition, metals in drinking water could compromise the neural development of the foetus, which can result in mental retardation, she points out.

Highlighting a problem relating to radioactive water contamination, she says that test results indicate that U-levels (uranium) in water resources of the whole Wonderfontein spruit catchment have increased markedly since 1997, even though U-loads emitted by some large gold mines in the Far West Rand have been reduced. This apparent contradiction is explained by the contribution of highly polluted water that



decanted from the flooded mine void in the West Rand from 2002 to 2012.

Coetzee *et al*, 2003 reported a uranium concentration in a surface-water body next to the northern watershed of the headwater region of the Wonderfontein spruit (Robinson Lake) of 16 mg/l after underground mine water decanting into the Tweelopiespruit was pumped into the lake. This resulted in the National Nuclear Regulator (NNR) declaring the lake a radiation area. This extreme concentration is believed to be the result of remobilisation of uranium from contaminated sediment by acidic water.

The potential volume of AMD from the Witwatersrand Goldfield amounts to an estimated 350 Ml/day (1.0 Ml = 1 000 m<sup>3</sup>). This represents 10% of the potable water supplied daily by Rand Water to municipal authorities for urban distribution in Gauteng province and surrounding areas – at a cost of R3 000/Ml.

The gold mining industry in South Africa, principally the Witwatersrand Goldfield, is in decline, Liefferink points out. The post-closure decant of AMD is, therefore, an enormous threat – and this could become worse if remedial activities are delayed or not implemented.

## The treatment problem

The current (immediate and short term) treatment of AMD is by means of neutralisation or a pH adjustment. In most cases, metals will precipitate out of solution if the pH is adjusted upwards, that is, the water is made more alkaline. It should be noted that the metals do not simply disappear but change to a different oxidation state, changing them from a soluble form to a solid form. The metals are still there, in the area where the precipitation has occurred in the first place. This means that the process can be reversed and the contaminants

## Mariette Liefferink and the FSE

Since its inauguration in 2007, the FSE has become the most prominent environmental activist in the mining industry. Its directors, most notably, Mariette Liefferink, are listed among the 100 most influential people in Africa's Mining Industry and the Federation's contributions to environmental and social justice have been recognised via a number of environmental awards.





**Above:** The numerous open pits in the West Rand Goldfield have been identified as a source of ingress.

**Right:** West Rand, 2002 to 2016: Current AMD treatment by means of neutralisation or pH adjustment precipitates metals out of solution, which are being deposited as metal sludge into unlined pits.



re-mobilised, should the water become acidic again

The numerous open pits in the West Rand Goldfield

have been identified as a source of ingress of AMD into the West Rand Basin, the study commissioned by the mining industry estimating that these contribute approximately 30% of the total ingress.

From a salination perspective, the sulphate concentrations in neutralised AMD remain high (2 000 to 3 000 mg/l). High concentrations of sulphate are associated with acute health effects, diarrhoea, for example. Sulphate concentrations of 600 mg/l and more cause diarrhoea in most individuals and adaptation may not occur. The numerical limit for sulphate in terms of the resource quality objectives (RQOs) for the Upper Vaal is between 200 and 500 mg/l depending on the water use.

Apart from health issues, elevated sulphate concentrations also increase the corrosion rate of metal fittings in water distribution systems.

In livestock watering, it was found that sulphate levels above 250 mg/l suppress copper and selenium, which result in poor fertility and animal condition.

The Department of Water and Sanitation's Feasibility Study for the Long Term Treatment of AMD (2013) and the Reconciliation

Strategies for the Integrated Vaal River System warned that the additional salinity as a result of AMD would create water security risks. In order to comply with the regulatory limit of 600 mg/l of sulphates, good quality water will have to be released from the Vaal Dam in order to ensure that the water below the Vaal Barrage is fit for use, that is, by means of dilution.

The projected demand for increased releases from the Vaal Dam of expensive Lesotho water is also sure to increase the stress upon the water supply. The additional volume of water that has to be released as a result of the salinity associated with AMD has resulted in a considerable reduction of water supply to the Upper Vaal, so much so that the total capacity of Phase 2 of the Lesotho Highlands scheme will be completely nullified.

Approximately 100 Ml of AMD is currently neutralised within the East Rand Basin and the same volume is discharged from the East Rand basin into the Blesbokspruit. A further 80 Ml from the Central Basin is discharged into the Elsburgspruit.

The resulting metal sludge, which is in toxic concentrations and contains uranium, is currently deposited in Grootvlei Shaft 3 and

## SAICHe IChemE



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boreholes within the Eastern Rand gold fields. These are on unlined tailings storage facilities within the Central Rand gold fields. The risk of our watercourses becoming re-contaminated following flooding is apparent.

The May 18, 2016 launch of the Long Term Treatment of AMD document estimated the capex cost of the long-term treatment of AMD to be in the region of R10 to R12-billion, with ongoing opex costs of R25-million per month. The preferred treatment options, according to Liefverink, are to use modern reverse osmosis and ion exchange technologies to replace pH treatment using lime. Financing of the Long Term Treatment of AMD is to come from a combination of Treasury (67%) – to be recovered through an environmental levy from current mining companies – while the public via increased water tariffs will fund the remaining 33%.

Implementation is currently scheduled for 2020. □

# Zero hour high horsepower

Cummins Southern Africa has transformed its Kelvinview engine service centre in Johannesburg into a fully-fledged Cummins Master Rebuild Centre (MRC). *MechChem Africa's* Peter Middleton tours the facility and talks to its leader, Patrick Mohale.



“Our Master Rebuild Centre strategy has, at its starting point, a concept called ‘zero hour’ remanufacturing. By that we mean that when used Cummins engines come to us for a rebuild, we restore them to their as-new condition,” begins Mohale. “This also restores the engine’s warranty to the same as it was when it left the factory,” he adds.

“This facility started out as a service centre and repair workshop for warranty-linked servicing and customer breakdowns, but we are now also offering full zero-hour rebuild and engine exchange services. In line with Cummins’ global strategy, all service exchange units come with a full zero hour warranty and every new Cummins engine is designed for three rebuilds of this nature, extending the natural life of the engine four-fold,” Mohale reveals.

Describing a typical engine’s life, he says that, as well as routine 500 to 1 000 hour services, engines generally have a major midlife service after 10 000 hours of operation. “A first MRC rebuild will be at around 25 000 running hours”, which equates to nearly four years of operation for 18-hours every day.

“But service and rebuild intervals are being stretched and some sites are already trialling 30 000 hours between rebuilds, which, if successful, could save customers’ changeover times, thus improving machine uptimes,” he says, adding that this obviously depends on the engine’s operating conditions. “Marine engines, for example, might be able to achieve

this more easily, but in mining it is a tough ask because of the harsher and more varied conditions,” he explains.

Exceptional durability is fundamental to the design ethos of all Cummins engines. Advanced engineering features such as ferrous cast ductile iron pistons, micro-finished camshafts, fully sealed wiring harnesses and Cummins’ Prelub® engine protection system ensure outstanding levels of durability.

“But this commitment to durability goes beyond extending first engine life. Every Cummins engine is designed with a capability for multiple rebuilds with guaranteed ‘as new’ performance,” Mohale continues. This is a major benefit in prolonging equipment life without costly equipment changes.

“The fourth pillar of our four-pillar model for mining is to offer 24/7 service support. To deliver this support level, for a given number of Cummins engines of every size in use, we retain a corresponding number of remanufactured exchange units. This enables us to respond rapidly to any unexpected failure or emergency on a mine,” Mohale tells *MechChem Africa*. Initiated by investing in new engine stock, Cummins’ Kelvinview MRC now rebuilds the returned engines as exchange units.

The engine range being supported at Cummins SA’s MRC spans 15 litre, six-cylinder, 500 kW QSX15s to QSK78s, 78 litre, 60° V18, 2 500 kW engines installed in some of the largest mining haul trucks and excavators in the world. “There are different models for each engine size, though, so we routinely have many different engines on the shop floor at any given time,” Mohale notes.

Describing the MRC process, he says that engines are first removed from their equipment by the operator’s technicians or at the local Cummins branch before being delivered to Kelvinview. To minimise downtime, an exchange unit can be shipped in advance of this for immediate installation locally or onsite.

“The branch will generally inform us as to the action required, but for the certified MRC rebuild process, from teardown to final inspection, several hundred specified steps are involved, organised into three phases:

- Teardown, cleaning, component evaluation and inspection.
- Component sub-assembly and engine assembly.
- Testing, final ‘dress’ and painting, along with final inspection.

“We strip each engine down to the last bolt, checking for any damaged parts that will need to be replaced. After cleaning, the



# engine remanufacturing

engine block is sent to a precision machining company. We use Metric Automotive Engineering in Johannesburg for this, one of South Africa's most comprehensively equipped heavy-duty diesel engine machining companies. Cummins engine blocks are designed to be re-bored if they are worn beyond factory specifications. Metric Automotive Engineering will machine the block to factory specifications, and new over-size liners will be fitted," Mohale explains.

Components such as crank- and camshafts can be reused, but we have to test them thoroughly to confirm their factory specifications," he adds.

From a skills point of view, he says that localisation is key. "We use qualified diesel fitters that have been locally trained through high level apprentice training programmes. They are all trade-tested red-seal artisans. We also have our own apprenticeship programme, currently with ten second year and ten third year apprentices enrolled and being mentored by our 13 fully qualified technicians," Mohale informs *MechChem Africa*.

While the Kelvinview MRC is still active in the repair and servicing side of operator-owned engines, "the strategy is to move towards doing 100% zero hour work". Recent investments include a 15-ton crane and eight jib-cranes, along with a Tug master mover for moving these large engines between assembly stations.

"We have also redesigned our processes, so that we now use five rollover stands with two fitters working on each engine to reduce individual workshop time per unit – as op-



The Cummins PowerBuild facility in Kelvinview, Johannesburg, started out as a service centre and repair workshop for warranty-linked servicing, but it is now a fully-fledged Cummins Master Rebuild Centre (MRC).

posed to one fitter working on each engine. We have already halved the number of assembly days and we have fewer engines in the workshop at any one time. We also expect that further cost and time improvements will follow as we fine-tune this process," Mohale says.

What is different about the MRC approach compared to traditional servicing? "No ordinary service or remanufacturing centre can guarantee the engine is 'as-new' after a rebuild, and we back this claim with a corresponding 'as-new' warranty," Mohale responds. "More importantly, the performance of the engine is also as-new. So the power, performance and fuel efficiency are restored. After a rebuild, the operator should not notice any deterioration in the engine performance whatsoever, even if using a

rebuilt engine that has already completed 40 000 to 60 000 hours," he responds.

"We sell a service," says Mohale. "Through MRC and our service exchange programme, operators buy uptime. Repairing an engine can delay a mining or shipping operation if owners prefer to do it themselves. Our zero hours exchange programme radically reduces lead times. This approach is much more cost effective and convenient than either replacing failed equipment or attempting to self-service and 'nurse' an engine to the end of its life," he argues.

"By using the Cummins MRC, the maximum possible life can be extracted from each engine used, with minimum risk, maximum uptime and a best possible return on investment," Mohale concludes. □

**Left:** The Cummins MRC has redesigned its processes to use five rollover stands with two fitters working on each engine. This reduces individual workshop time per unit. **Centre:** From a skills point of view, Cummins uses qualified diesel fitters that have been locally trained through high-level apprentice training programmes.

**Right:** The Master Rebuild Centre strategy is based on 'zero hour' remanufacturing. Through a combination of new and restored components, restored Cummins engines leave the MRC in their as-new condition.





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# Turnkey filtration system for cement plant

ACTOM's environmental solutions specialist business unit, John Thompson Air Pollution Control (APC), recently developed and installed a reverse-pulse electrostatic precipitator conversion as an upgrade to the existing dust collection system at PPC's Dwaalboom cement plant near Thabazimbi in Limpopo.

Leading cement producer, PPC, recently commissioned ACTOM's environmental solutions specialist business unit, John Thompson APC, to upgrade the dust collection system serving one of the main production lines at PPC's Dwaalboom plant near Thabazimbi in Limpopo Province.

The turnkey contract, worth in excess of R30-million, was awarded to John Thompson APC in May 2016 and completed in March 2017. The contract involved retrofitting the original electrostatic precipitator (ESP) system for the plant's Kiln No.1 with a reverse-pulse filtration system deploying tubular bags to maintain dust emissions below 20 mg/m<sup>3</sup>.

"The new system represents a substantial upgrade on its predecessor. The lower emission level it maintains is to meet stricter environmental regulations which have come into effect," commented Raymond Hopkins, John Thompson APC's project manager on the contract.

The pulsejet conversion, erected on the roof of the former ESP system, contains over 3 600 tubular filter bags with a total air-moving capacity in excess of 500 000 m<sup>3</sup>/h. The baghouse is fitted with glass-fibre tubular

bags capable of withstanding temperatures of up to 260 °C.

The contract also incorporated the design and manufacture of a centrifugal induced draft (ID) fan for the baghouse comprising a 2 700 mm diameter aerofoil impeller driven by a motor of over 1.0 MW, as well as materials handling equipment consisting of drag chains and rotary valves discharging the collected dust into an existing product conveyor.

ACTOM's industrial and mining fan specialists TLT ACTOM, which John Thompson APC sub-contracted to produce the baghouse fan assembly, was also commissioned as part of its scope of work under the contract to design and manufacture a customised kiln ID fan.

"This centrifugal ID fan, although it forms part of the filtration system contract, is unrelated to the dust collection system," explained James Sole, TLT ACTOM's sales engineer, industrial and process fans.

"Its function is heat recovery, as it takes the hot off-gas from the kiln for re-use in the production process. It is designed to withstand high dust loads and temperatures and is made of exceptionally wear-resistant material due to the highly abrasive material to which it will be exposed."



A bird's eye view of the reverse-pulse ESP conversion developed and installed by John Thompson Air Pollution Control at PPC's Dwaalboom cement factory near Thabazimbi.

With a diameter of 3 600 mm, it is one of the largest fans used in an industrial application and is driven by a motor in excess of 2.0 MW.

ACTOM (Pty) Ltd is the largest manufacturer, solution provider, repairer and distributor of electro-mechanical equipment in Africa, offering a winning and balanced combination of manufacturing, service, repairs, maintenance, projects and distribution through its 40 outlets throughout Southern Africa.

The company is also a major local supplier of electrical equipment, services and balance of plant to the renewable energy projects. It also holds numerous technology, distribution and value added reseller agreements with various partners, both locally and internationally. □

## Local green masterplan for the environment

One of the most rigorous and specialised processes for the mining, industrial, manufacturing, and commercial development sectors is environmental licencing and compliance assurance, under which fall dust suppression solutions, water solutions, environmental management services, carbon solutions, agro-forestry products and fire solutions. I-CAT Environmental Solutions director, Lourens Jansen van Rensburg, explains.

I-CAT Environmental Solutions offers an 'environmental masterplan' in terms of the resulting compliance, auditing, and monitoring requirements.

These environmental-compliance solutions have a specific focus on the mining and industrial sectors, as prescribed by relevant national legislation and compliance standards, "The current economic climate in South Africa has resulted in companies cut-

ting down on budget allocation for minimum environmental compliance, while recognising their obligations to account for their activities impacting on the environmental and to accept responsibility for them," Van Rensburg says.

I-CAT offers an Environmental Masterplan solution whereby all external environmental licencing, auditing, and monitoring requirements are addressed within its Environmental Solutions department. Benefits include cost- and resource-savings, as well as ensuring that all environmental aspects are considered and assessed in an integrated, holistic manner.

"Furthermore, we can assist our clients with their sustainability and integrated reporting requirements in line with the relevant standard, covering reporting on economic, environmental, social and governance performance.

"We present our clients' values and

governance models in a holistic manner, while determining the link between their business strategies and commitment to a sustainable global environment," concludes Jansen van Rensburg.

I-CAT is a leading environmental solutions company with a primary focus on supplying products and services that assist industrial clients in various aspects of environmental compliance. The company is well positioned to assist all its clients' needs in environmental management regarding; dust suppression solutions, water solutions, environmental management services, carbon solutions, agro-forestry products and fire solutions. □



# Cost-efficient grease solutions for SA's sugar mills

Elimination of lubricant wastage, continuous control and monitoring ensure reliable and correct lubrication supply which, by reducing the risk of mill roll bearing damage or failure, optimise plant availability. These progressive, new lubrication systems are delivering significant savings at local sugar mills.

**T**he excellent control and monitoring capabilities of Lincoln Lubrication South Africa's high-pressure progressive lubrication systems are delivering significant savings for South Africa's sugar mills.

Progressive lubrication systems consist of a pump connected to at least one primary metering device. The pump supplies lubricant – oil, fluid grease, grease or compound – to the metering device, which administers the lubricant in even, predefined amounts.

Lincoln Lubrication, part of the SKF group, has supplied a number of progressive systems to the local sugar industry for bearing lubrication on sugar mill drive trains located on mill front ends. Lincoln Lubrication's regional manager for KwaZulu-Natal and Swaziland, Kevin Mills, says that the local sugar industry is facing a number of challenges.

"In addition to the prolonged drought that has affected sugar cane quality and throughput, depressed sugar prices and stiff competition from other producing countries are placing severe pressure on local sugar producers' revenues and profit margins with debilitating effects on plans for investment in refurbishing or expansion projects. Consequently capital expenditure over the last few seasons has focused only on what is deemed necessary for

safe and economical operation," Mills explains.

He further points out that in an attempt to counter the high cost of lubricant for mill bearings, many mills are experimenting with different types and brands, which can affect machine reliability. "A seemingly inexpensive lubricant can, in the long run, cost the mill dearly in downtime when allowing for repairs or replacement of damaged machines."

Most sugar mills do not have a single brand of lubrication system in use to cover all their lubrication requirements, thus making it difficult to create a standard and maintain spares inventories. "When suitable repairs and maintenance back-up for the lubrication systems are compromised, the resultant poor standards of lubrication system maintenance and lubricant management can result in contamination of lubricants and lubrication systems leading to premature failures of machinery and components," notes Mills.

"We are able to assist the sugar industry in nullifying these challenges with the installation of the high pressure Lincoln ZPU-02 progressive system with Powermaster 4 series 50:1 ratio high volume drum pump with auto filling capability." In addition, to eliminating lubricant wastage, constant control and monitoring ensure reliable and correct lubrication supply which, by reducing the risk of

mill roll bearings damage or failure, optimise plant availability.

Mills adds that data download capabilities are also available from such systems, allowing constant analysis and trending of any system problems, as well as indicating exact quantities of lubricant dispensed to the mill bearings.

The progressive system monitors mill bearing grease points for blockages/flow as well as the grease levels in the lubrication pump's reservoir. Analogue alarm signals are sent via a PLC to the mill control room for proactive intervention by the maintenance team.

If low grease levels are detected in the filling station drum, the system sounds the alarm to avoid the ZPU-02 lubrication pump reservoirs from running low. Monitoring of the filling pump functionality ensures that the mill bearings receive grease at all times. The health of the lubrication pump is also monitored; the alarm alerts maintenance in the event that the pump stops functioning so that repairs can be performed immediately with minimum disruption to uptime.

The system also measures the amount of lubricant being consumed by the mill bearings. Properly metered dosages pumped to the mill bearings can reduce the mills' overall grease consumption by as much as 30%, according to Mills.

With 14 sugar mills in South Africa and three in Swaziland, Mills says that, challenges aside, there is still tremendous growth potential in the sugar industry. "We have an aggressive growth strategy in place to harness these opportunities with our world-class lubrication technology."

The Lincoln Quiklube P203 progressive system is ideal for the lubrication of centrifugal machines, sugar dryers, diffusers, cane loaders, cane haulers and excavators at sugar mills while Lincoln grease spray systems are suited to sugar mill drive and pintle-gear lubrication. SKF oils circulation systems can be used on turbine-driven cane knives as well as on oil conditioning units for mill train gearboxes.

Lincoln and SKF Lubrication Systems solutions are available directly from Lincoln Lubrication South Africa as well as through the company's network of authorised lubrication systems dealers or the SKF network of authorised industrial distributors. □



The Lincoln Quiklube P203 progressive system can deliver significant savings at sugar mills.



John Kennedy

## High quality, virgin process oil range

Special process oils that utilise Group I base oils, are now available in South Africa from Engen under the Parprol name. They can be used in various industries as either raw materials or as a processing aid. The quality of process oils is fundamental to the outcome of a customer's final product.

**E**ngen Petroleum, a is the proud supplier of a range of high quality, virgin process oils under the Parprol name. These new generation process oils utilise Group I base oils.

The Engen Industrial Lubricants team, who have taken over the management of the Parprol range, have a significant footprint throughout the country. These special process oils can be used in various industries as either raw materials or as processing aids.

"We recognise that the quality of process oils is fundamental to a customer's final product, which is why we strive to supply highly consistent quality process oils," says Herman van der Westhuizen, Engen's national sales manager for industrial lubricants.

Industries that enjoy the benefits of Engen's Parprol process oils include manufacturers of adhesives, cable compounds, ink oil, plasticisers, rope dressings, rubber, leather softener, textile batching oil, pesticides, furniture polish and wood preservers.

"Our new generation process oils are available in a variety of convenient packs including true bulk, 210 l drums and mini-bulk containers (IBCs). Engen is also able to assist with dispensing solutions to aid in inventory management, contamination control and

disposal," says Van der Westhuizen.

"Security of supply is integral to any business, which is why Engen provides a high level of supply assurance across our strong and reliable network," says John Kennedy, Engen's Lubricants' business manager. □

### Petronas Syntium lubricants on Engen forecourts

When motorists choose the Petronas Syntium range, they will experience the same advanced technology that has helped the Mercedes AMG Petronas F1 team win three consecutive constructors and drivers' championships.

Engen Lubricants business manager, John Kennedy says the company is proud that Syntium lubricants protect the current F1 champions. "This is testament to our technical capability and expertise, which is a necessary requirement in a constantly evolving and challenging sport such as

Formula One," he says.

Petronas Syntium is specially formulated to provide outstanding protection for engines running under the most extreme and demanding driving conditions. Not only does it provide motorists with a better driving experience, but it also improves engine performance.

"We are also currently phasing in Petronas Syntium with CoolTechô into Africa, which has been specially engineered to fight excessive engine heat while maintaining optimum performance," adds Kennedy. □

## KEEP YOUR TRANSFORMER WORKING.

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The current wave of power outages in South Africa means that your transformer is working harder than ever, which could accelerate ageing. Serious damage to a transformer could spell disaster - involving costly repairs or replacement of the whole unit. Not to mention lost process time. And think of the environmental impact, should your transformer explode or catch fire.

- Transformers have a degradable paper core that needs to be monitored via furanic analysis.
- The oil should be monitored for dissolved gases and corrosive sulphur, long before this becomes a serious, expensive problem.
- Contamination of transformer oil by water or dirt needs to be closely monitored as contaminants may cause grave transformer problems.
- Environmentally, transformers should be tested and retested every time oil is cleaned or changed to monitor cross-contamination and ensure it is PCB-free.

WearCheck also offers a sampling/thermography service.

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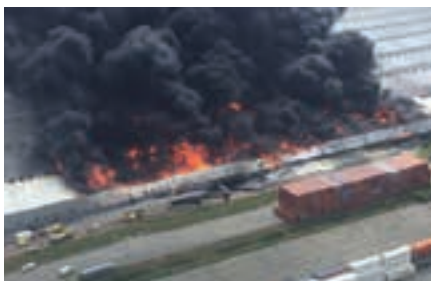


## Inferno raises need for fire prevention

A huge fire in Durban at the end of March 2017, believed to be one of the largest factory fires ever in the southern hemisphere, has raised concerns about fire prevention and risk management at large industrial estates. ASP Fire CEO, Michael van Niekerk, comments on how repeat incidents should be prevented.

Large warehouses must have a suitable automatic fire-detection system installed. This is critical, especially given the large size of such warehouses, in order to alert occupants to a fire as quickly as possible so that they have sufficient time to evacuate the premises. "This will allow on-site first respondents to tackle a fire before it grows out of control," ASP Fire CEO, Michael van Niekerk, points out.

Fire-hose reels and fire extinguishers are



Large warehouses must have a suitable automatic fire-detection system installed.

essential elements of a first respondent capability to suppress a fire successfully before it grows too large in order to be able control. An appropriate fire-suppression system such as automatic sprinklers will control a fire, provided that the product stored in the protected area does not exceed the fire load that the sprinkler system was designed to control.

Large industrial warehouse estates, and those used by logistics companies in particular, are at risk when they do not own the goods stored in their buildings. Clients do not always declare the fire risks associated with hazardous goods, as they are either unaware of the hazard or are trying to avoid paying a premium for the handling and storage of hazardous goods.

"The net result is that the actual fire load or fire hazard of the goods stored in the building far exceeds the designed fire load of the building in terms of its construction and the fire detection, fire suppression and life-safety systems," Van Niekerk continues.

"It is also difficult to manage access in and out of a very large warehouse site. Buildings that cover many thousands of square metres are not necessarily staffed to a level that allows for a fire to be detected and suppressed rapidly," he adds.

ASP Fire is able to conduct a fire-risk assessment to determine whether the actual fire load within a building exceeds the installed fire-protection system design. "We are able to advise a client accordingly and assist with a suitable fire-protection strategy and system design to cater for a worst-case scenario. ASP Fire offers turnkey fire protection projects, so we can also supply, install and maintain fire protection equipment in buildings," Van Niekerk explains.

Van Niekerk stresses that the main lesson to be learnt from the recent Durban inferno is that, ultimately, prevention is better than cure. "It is far cheaper and less disruptive to your business to stop a fire before it starts than to try and put it out once it gets going." □

## WearCheck merges with transformer services company TCS

Durban-based reliability solutions specialists, WearCheck, recently bought out Transformer Chemistry Services (TCS), adding an already-established transformer analysis and maintenance division to the company's condition monitoring portfolio.

Coupled with WearCheck's Africa-wide network, the expertise of TCS and a general growth in the number of transformers across the continent, WearCheck is now poised to provide large-scale and widespread comprehensive transformer reliability services.

The primary function of the newly formed transformer division is the promotion of transformer health through the regular assessment of insulating fluid and diagnosis of the results.

Transformers are extremely critical apparatus for providing reliable energy. No one can precisely answer when equipment will fail, but it is essential to manage risk. Compared with the cost of premature or catastrophic failure, regularly scheduled oil testing is a cost-effective and sound maintenance practice that is used to

extend the life of transformers.

WearCheck has now added the transformer tests done by TCS to its existing transformer oil analysis programme, increasing the number of available fluid and non-fluid tests, such as Insulation Paper Quality Testing. This test provides a measure of paper aging and correlates this with important physical properties such as resistance to tearing and bursting. This is a critical factor in estimating the real ageing of the main transformer insulation.

TCS was established in Westville, Durban in 1992 by Ian Gray, who has run the company for the past 25 years. Among some of the large customers serviced by TCS are Sasol, ArcelorMittal and BHP Billiton. A second TCS laboratory was built in Cape Town two years ago, in response to the needs of the burgeoning transformer industry in the Western Cape.

Offering the full spectrum of transformer reliability solutions from one condition monitoring company is one of the key benefits of the merger of TCS into WearCheck. So says WearCheck MD Neil Robinson, who constantly strives to provide customers with



WearCheck MD, Neil Robinson (right) and TCS MD Ian Gray sign the merger agreement between TCS and WearCheck.

value-for-money services that reliably boost plant availability.

Says Robinson: "The transition of TCS into WearCheck is already underway and is an extremely smooth process, particularly since the two companies share an absolute dedication to the integrity of data and a parallel commitment to customer service excellence. From WearCheck's side, we extend a very warm welcome to all the current TCS customers, and we look forward to taking new transformer clients on board to experience our new one-stop transformer maintenance shop," he says. □



## Latest dual-laser portable alignment kit

BMG's latest dual laser shaft alignment system is suitable for most combinations of machinery with coupled or uncoupled shafts and incorporates advanced digital technology. The new hand held SPM Leonova Diamond Aligner is a complete kit packed in a portable case, consisting of the control and display instrument, alignment sensors, aluminium brackets, extendable chains, rods, cables and a tape measure.

**B**MG's condition monitoring equipment range now includes the newly launched portable SPM Leonova Diamond Aligner system, designed for quick and reliable shaft alignment in many applications, including compressors, gearboxes, generators and pumps.

This dual laser system, which is suitable for most combinations of machinery and coupled or uncoupled shafts, incorporates advanced digital technology, where alignment sensors communicate with the instrument via Bluetooth. Automatic calculations and instant correction and alignment data ensure a perfect shaft alignment – even in tough operating environments.

The new hand-held Leonova Diamond Aligner is a complete kit packed in a portable case, consisting of the control and display instrument, alignment sensors, aluminium brackets, extendable chains for up to 480 mm shaft diameters, rods, cables and a tape measure.

"The alignment sensors use high precision digital complementary metal-oxide-semiconductor (CMOS) linear image detectors, which automatically distinguish from interfering light sources to provide maximum accuracy in shaft alignment," states Carlo Beukes, general manager, power transmission, BMG.

"Dual axis high precision inclinometers measure the angle of rotation of both detector units at all times. This allows measurements in fully automatic mode, within less than half a rotation of the shaft.

"This system works with standard and user-defined tolerance levels to perform accurate alignment calculations for horizontal, as well as vertical or flange-mounted machines. Other measurement programmes include soft foot checks, thermal growth compensation and tolerance checks. For user convenience, the feet lock function automatically provides alternative alignment corrections.

"Leonova produces a log file with all alignment data for documentation and printing. Specially designed modular software supports the Diamond Aligner, providing easy set-up of personalised default settings for exact user requirements," says Beukes.

The heavy duty Leonova Diamond Aligner, with a carbon-fibre reinforced IP 65 rated enclosure, has been drop tested to 1.0m. The LCD backlit colour display has a user-friendly graphical interface for easy operation and accurate results. □



*The new hand-held Leonova Diamond Aligner is a complete kit packed in a portable case.*

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# From 'predictive protection' to predictive maintenance

Martec's Mario Kuisis looks at continuous improvement in the maintenance field and presents an example of how vibration analysis that was being used to predict premature failure led to a change in maintenance practices that extended bearing life – via the use of ultrasonic detection to optimise lubrication levels.



Continuous improvement is a never-ending journey and is now an entrenched concept. It has also become increasingly important as competition escalates in today's business environment. The best forms of improvement arise from frustration and dissatisfaction with the status quo, which in itself is an improvement over what came before, and with things before that, and so on. Complacency is the enemy of improvement, so if you are feeling satisfied with where you are right now, then beware.

Like other disciplines, much has been done by way of continuous improvement in asset management over the past number of years. Proactive maintenance is one of these. But late entrants into proactive maintenance can take advantage of these improvements by leap-frogging early adopters who have



*Vibration analysis, using a modern instruments such as SKF's Microlog analyser, can be used to collect route-based data about the condition of bearings. Vibration analysis can be seen as a 'predictive-protection' technique that gives and early warning of imminent failure.*

not kept pace, whether they be in people, technology, business processes or simply management concepts. Sounds like a race or competition? Well, that's a good way to think of it.

To illustrate the principle and how it can be used to advantage, let's take a simple example in the most well-known field of condition monitoring, viz. vibration analysis.

As an aside, to many, condition monitoring is synonymous with vibration analysis. As we have learnt in this series it is only one of several dozen condition-monitoring techniques, but it is best known. Wikipedia does nothing to dispel the impression with words like "VA... is often referred to as Predictive Maintenance (PdM)". As we have learnt, there are problems enough in getting findings from the condition monitoring team not only communicated, but also constructively taken up and acted upon by the maintenance team. But let's assume you have this buttoned up and are now looking for the next improvement in the big picture of maintenance.

Before vibration analysis and in the absence of other condition monitoring options, susceptible plant would fail without warning, often catastrophically. It was therefore a big step forward to be able to detect incipient failure and proactively take steps to either prevent it, or plan for the eventuality of the failure – this applies in many situations when the asset cannot be taken out of service and run to failure is a preferred option. This can now be accomplished with a high degree of success in multiple ways. So what more can be done?

This question came up recently as a result of repeated incidents of premature failure of several identical units of critical plant on an industrial site. Impact on business operations was severe. Vibration analysis did what it was intended to do. Deterioration was detected and pre-emptive action taken to prevent catastrophic failure. However, the asset owner was dissatisfied as, in his view, this amounted to no more than 'predictive protection'. It addressed a symptom and not the cause of his pain.



*By coupling vibration analysis with an actively managed lubrication programme involving measuring friction during the greasing process and periodically in service using an ultrasonic detection system, blind greasing with fixed quantities at fixed intervals could be replaced with the application of an optimum quantity of grease at the times when needed.*

Great care had been taken to operate and maintain the asset in accordance with the requirements of the OEM. Indeed, with their participation in the maintenance programme. Yet still the failures occurred, with no assurance that they would not continue. The financial impact in direct and consequential costs was simply intolerable. What more could be done?

In this particular case, the failing component was a rotating element bearing that required manual greasing. Root cause analysis attributed the failures to operation at or beyond the design limits of the bearing combined with lubrication issues, swinging from times of over-lubrication to starvation. The construction, space constraints and commercial considerations did not permit a design change, a sealed bearing or automated greasing. There was no room for error in maintenance. Operational conditions had to be maintained at their optimum.

One may argue that this is not a good design, but these things happen more often than we would like and the maintenance or reliability engineer is obliged to find a workable solution

What better driver for finding improvement?

One of the many potential benefits of proactive maintenance is life extension. This

became the focus and single most important requirement for the asset owner. Having identified the root cause in lubrication, the logical next step was to examine why and how this happened. After all, the lubrication regime specified by the OEM was adhered to. From the findings, improvements could then be devised to overcome the problem. Investigation showed that the correct grease was applied, in the correct quantities, at the correct time-based intervals.

However, visual inspection revealed large quantities of excess grease expelled from the bearing relief valves of some units. The expelled grease that did not show evidence of functional time in the bearing, but with oil separation indicating short term exposure to excess temperature. From an examination of operational records, it was found that the duty cycle between units varied significantly, yet all received the same amount of grease at the same interval.

Evidently, the bearings were being subject to periods of over lubrication with consequent overheating and lubricant breakdown, followed by periods of starvation. The worst of both worlds. With the bearings also operating at high stress, service life was severely compromised.

Clearly this was a case that called for actively managed lubrication and presented

a great opportunity for improvement. By measuring friction during the greasing process and periodically in service, blind greasing with fixed quantities at fixed intervals could be replaced with the application of an optimum quantity of grease at the times when needed.

The end result for the asset owner is not only asset life extension, but also a reduction in grease consumption. Once implemented on the subject critical assets, the same technique and benefits can be spread across the remainder of the asset base.

From another perspective, this is one instance that shows the importance of using complementary condition monitoring technologies. Vibration for big picture rotating machine health assessment and diagnostics, ultrasound detection for active lubrication management using real time friction measurement and thermography for correlation by temperature measurement. This is what predictive maintenance is all about – making use of the insights obtained from a variety of condition monitoring technologies to make a useful contribution to the overall aims of the organisation.

The bottom line is we all need motivators to cause us to step beyond our day-to-day issues and while finding solutions to thorny issues. This is a sure way to bring about those lasting improvements. □



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- Investors, Technology Funders and Innovation Agencies
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# Maximum value minerals

MechChem Africa talks to Cedric Walstra, Glencore Technology's Africa business development manager, who paints a broad picture of the high-recovery, high-efficiency processing equipment on offer from the technology side of Glencore's business.

“I joined Xstrata Technology about ten years ago, while Glencore was a shareholder, but Glencore took us over about four years ago and the name was changed to Glencore Technology,” begins Walstra, adding that Glencore Technology develops, markets and supports niche technologies for the global mining and minerals processing and metals' extraction industries, “and not only for the mines owned by the Glencore Group.”

“Glencore Technology is a standalone company that partners with several technology suppliers to develop cutting edge equipment. My involvement has been mostly with IsaMill™ fine grinding technology and Jameson flotation cells, but I am currently responsible for promoting the whole range to mining companies in southern African,” he tells *MechChem Africa*.

## IsaMill™ grinding technology

Based on technology developed from the Netzsch mill and adding a patented product separator, different media and lining materials, Glencore Technology's IsaMill™ is a highly energy efficient, high intensity, large-scale grinding machine.

Glencor's IsaMill reduces the energy

cost of grinding circuits. Intense grinding is achieved using inert ceramic grinding media that leads to improved metallurgical performance compared with conventional steel media.

“Anglo Platinum has some 26 IsaMills currently in operation. These are horizontal fine grinding mills with cantilevered shaft and eight grinding discs. Each mill is filled to 70 to 80% of capacity with ceramic grinding beads. As the shaft rotates, the discs and beads cause attrition grinding,” Walstra explains.

“Kidney shaped holes in the discs allow the progressively milled material to pass down the mill, with most milling taking place in the feed end. A patented rotating product separator on the discharge end is used to pump coarse material back to the feed end and a feed pump pushes slurry forward under 150 to 180 kPa of pressure,” he adds.

Without having to use screens or cyclones for external classification, the system allows only fine ground material down to 5.0 to 10 µm to discharge. “Our systems are typically used for tertiary (or quaternary) grinding and flotation concentrate regrinding with typical input feed sizes of up to 300 µm, also known as mainstream inert grinding (MIG) and ultrafine grinding (UFG), respectively,” he says.



“The IsaMill is the most energy efficient, highest intensity large scale grinding machine on the market. It has a small footprint, and installation and maintenance access are simple,” Walstra notes.

## Albion process technology

Associated with IsaMills, Glencore's Albion Process™ is a combination of ultrafine grinding and oxidative leaching at atmospheric pressure. Feed materials to the Albion Process are, generally, base or precious metal concentrates. The sulphides in the feed are oxidised and liberated, allowing the wanted metals to be recovered by conventional means.

“The process uses our HyperSparge™ technology where we introduce the gas required for the leaching process at supersonic speed. This creates very fine bubbles in the slurry, improving energy transfer efficiencies and increasing leaching speeds,” says Walstra. “Via gas injection, we achieve fine control of the chemistries of leached concentrates, extracting exactly what is required and leaving the rest for later processing,” he adds.

There are four Albion Process plants currently in operation. Two plants treat zinc sulphide concentrates in Spain and Germany, a plant in the Dominican Republic is treating a refractory gold/silver concentrate, while the fourth plant is treating refractory gold in Armenia.

## Jameson flotation cells

Based on an invention by Graham Jameson, the Jameson flotation cell replaces a train of traditional mechanical cells with slurry of decreasing concentration gravitating



Glencore Technology's highly energy efficient IsaMills™ are now meeting the grinding requirements at Anglo Platinum's Waterval Retrofit plant.

# processing



**Above:** A Jameson flotation cell in operation at Lumwana in Zambia. The system offers the highest possible throughput in a very small footprint, with froth washing maximising the concentrate grade in a single flotation stage. **Left:** IsaKidd Technology, shown here in use at the Kamoto Copper Company (KCC) in the DRC, is the global benchmark in copper electrowinning accounting for over 11 mtpa of copper production from over 100 licensees.

from one to the other. “But we tend not to compete head-to-head with mechanical flotation cells because there are some niche applications for our Jameson floatation cells,” says Walstra.

“The first is for scalping duty. A Jameson cell at the head of a train of mechanical cells can be used to pull off high-grade material that is at final grade concentration. This takes the load off the rest of the flotation bank, allowing for finer tuning and higher overall efficiencies to be achieved,” Walstra explains.

The other application is the cleaning of the final concentrate. “What we are finding is that we can replace existing cleaning circuits with two Jameson cells and a single row of mechanical cells. This gives a significantly smaller footprint and lower power consumption, while still achieving the best possible concentrate grades,” he assures.

The Jameson flotation cell introduces slurry via an orifice or slurry lens, which creates a jet that sucks in atmospheric air. Consistently fine bubbles are generated and mixed into the medium without requiring mechanical agitators or spargers. “Intense mixing of the slurry and bubbles causes the particles of interest to attach to individual bubbles and froth to the surface for immediate removal as concentrate.

“The system offers the highest possible throughput in a very small footprint, with froth washing maximising the concentrate grade in a single flotation stage. The system is easy to control, fast to respond and offers steady and reliable performance irrespective of changes in feed flow,” Walstra tells *MechChem*, adding that there are also no

moving parts, keeping installation and maintenance costs to a minimum and equipment availability very high.

“Cell designs are flexible, making them ideal for new projects and excellent for low cost plant expansions. Over 300 Jameson Cells have been installed, treating a range of materials including coal, base and precious metals, potash, bitumen, graphite, and for recovering organics in solvent extraction processes,” he adds.

## IsaKidd technology

“IsaKidd Technology is the benchmark in copper electrowinning technology, providing world-class plants following the integration of the ISA and KIDD Processes in 2006,” Walstra says.

The combined technologies account for over 11 mtpa of copper production from over 100 licensees worldwide, including Glencore’s own operations. “We provide clients with a comprehensive range of technology, process support and equipment including; Isa 2000 cathodes, BR and HP cathodes, duplex (LDX) cathodes, electro-handling equipment, robotic stripping machines and tankhouse cranes.

“We partnered with a Japanese company called Mesco for the supply of cathode stripping machines: These remove electroplated materials from the cathodes. The plates are left in the electrolytic cells for a predetermined time and then taken out and flexed to detach the deposit – hence the advantage of using thinner and stronger LDX stainless steel materials. Once washed, the plates can be reused in the electrowinning cell – and the

whole process can be automated,” he informs *MechChem Africa*.

## IsaSmelt technology

Another of Glencore Technology’s innovations is IsaSmelt™, which is a high-intensity, low-cost submerged lance smelting process that is simple to operate and can be used for a range of applications including copper and lead smelting.

One of the key strengths of the technology is the growing IsaSmelt family itself. Glencore Technology produces the BBOC™ – Bottom Blown Oxygen Cupel – a technology that injects oxygen directly into the reaction zone of the cupel, improving process performance and oxygen utilisation. The technology is well suited to most refining duties where base metals are selectively oxidised and eliminated from precious metal products, such as slimes bullions, PGM-bearing feeds, high purity silver refining and retorted Parkes crusts. BBOC™ technology is now installed in over a dozen sites worldwide.

“Glencore Technology solutions are available to any mining site that sees the benefit and, while we do service Glencore Group mining operations, we are an independently run company that services the whole mining industry,” Walstra assures.

“Many of these technologies were developed at Mount Isa, an operating mine in Australia, which makes them highly practical and effective. So a key strength is that our people have all worked with the technologies on mining sites. They are ‘hands-on’ guys with a broad knowledge of mining with Glencore Technologies,” Walstra concludes. □

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# HMA Group establishes African presence

Uretech, a local manufacturer of polyurethane products, has entered into an agreement with the HMA Group of Australia to have its product range distributed internationally. In turn, the HMA Group's wide product range will now be made available in Africa for the first time.

**A**n agreement between South Africa's Uretech and HMA Group of Australia, concluded at the end of 2016, will see the establishment of a new South African subsidiary of the HMA Group known as HMA South Africa, with George Hoffmann as general manager. In terms of the agreement, HMA has been appointed as Uretech's sole international distributor, including South Africa.

Established in 1966 as Halley & Mellows, the HMA Group manufactures, services, and sells a range of capital plant equipment to diverse industries. The materials handling, wear solutions, instrumentation, and geotechnical divisions of the group will be introduced into the local market, piggybacking on Uretech's representation in the African mining industry.

"Uretech has been on the lookout for an international partner since we were established in 2004," Hoffmann comments. The OEM, with its manufacturing facility in eMalahleni, has established itself as a niche market leader in Africa.

"There is a lot of synergy for both parties in terms of the agreement, as it gives the HMA Group automatic traction in the African market, while Uretech achieves global recognition. With regard to the latter, we have already received our first export orders from Australia," Hoffmann reveals.

He has worked closely with Tony Rogers, managing director of the HMA Group Australasia, in bedding down the deal. "It has been an absolute pleasure in dealing with the HMA Group, as it is very progressive and dynamic in terms of acquiring and distributing new technologies globally," Hoffmann explains.

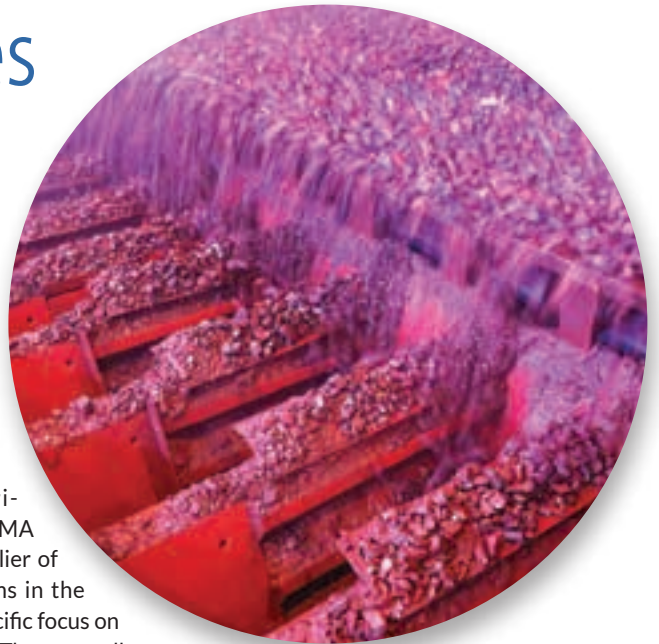
The agreement also gives the HMA Group a foothold in the infrastructure development of Africa, where there is a vast need for rail, road and port links to maximise the pit-to-

port potential of the continent's mineral wealth.

For example, the materials handling division of the HMA Group is a leading global supplier of bulk materials loading systems in the Australasian region, with a specific focus on coal, iron ore, gravel, and sand. These can all be loaded in bulk using a variety of design and operating systems. Loading systems are available for truck applications, including over-sized and multiple wagons, and train applications for flood or volumetric loading, single or multiple batch-weighed loading, and automatic or manual installations.

"It is this kind of innovative technology that the HMA Group South Africa will introduce into the African mining industry," Hoffmann highlights. He adds that local agencies have already been secured for four leading Australian instrumentation product ranges.

Commenting on the current state of the mining industry, Hoffmann says it is an ideal time for the HMA Group to enter the African



*Materials handling and wear solutions will be a main focus for HMA South Africa.*

market, as prices are on the rise, indicating that the protracted slump in the commodity super-cycle has bottomed out.

"I think it is a very interesting time for both Uretech and the HMA Group in terms of their future development. The latter has largely been focused on the Australasian region, with another office in Indonesia, and this represents its first foray into a major new territory. We look forward to expanding that relationship, and introducing our customers to the very best technology from the Australian mining industry, which faces many similar challenges and operating conditions as in Africa," Hoffmann concludes. □



*The Australia-based HMA Group is a leading global supplier of bulk materials loading systems.*



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# Topless tower crane technology

For decades Potain has built tower cranes that are easy to assemble, flexible in configuration and simple to use, and the new Potain MDT 389 topless crane is no different. Quentin van Breda, managing director of SA French talks about the advantages of topless crane technology.

**T**he largest in the new line of topless cranes from Potain, the MDT 389, is well suited to crowded construction sites where space is tight and multiple cranes are needed. Like other topless cranes it has been designed to allow more cranes to overswing in a smaller area.

Quentin van Breda, managing director of SA French, the sub-Saharan distributor for Potain tower cranes, says there are a host of features, which make Potain MDT cranes stand out from the competition.

The complete range, including the MDT 249, MDT 259, MDT 269, MDT 319 and the MDT 389, is equipped with Manitowoc's Crane Control System, or CCS. CCS is a standardised, user-friendly operating system that is being rolled out on all new Potain tower cranes.

"CCS helps users to enjoy the highest levels of comfort, flexibility, ergonomic control and, most importantly, improved lifting capacity. The enhanced productivity achieved as a result translates into a faster return on investment for Potain crane owners," van Breda says.

In addition to having a fresh and modern design that allows for ultra-fast ground preparation and assembly, the Potain MDT range easily beats the competition when it comes to transportation.

"For example, the turntable, cab mast and Ultra View cab travel in a single compact package, while the counter jib can be folded and the winch platform can be sized to take up less space," van Breda explains. Another advantage is that the mechanisms are grouped in a central technical zone for easier access and maintenance.

As part of its standard features, the Potain MDT 389 is equipped with Manitowoc's CraneSTAR, a GSM data transfer system that provides information on crane location and operation to support fleet management.

There are two versions of the Potain MDT 389, one with a 12 t maximum capacity and the other with a 16 t maximum capacity. Both versions have up to 75 m of jib available. The 12 t version can lift 3.4 t at its jib end, while the 16 t version can handle 3.3 t.

Potain also offers a smaller range of CCS



**Above:** The new Potain Topless cranes are equipped with Manitowoc's Crane Control System, or CCS.

**Right:** The new line of topless cranes from Potain is well suited to crowded construction sites where space is tight and multiple cranes are needed.

equipped cranes, the Potain MDT City line, which includes the MDT 219. Other cranes in the range are the MDT 109, MDT 139 and MDT 189.

Like the Potain MDT 389, the MDT 219 is the highest capacity model in its range. There are two versions of the Potain MDT 219, one with an 8 t maximum capacity and one with a 10 t maximum capacity. All are evolutions of previous Potain MDT City cranes with jib lengths ranging from 55 m to 65 m and hoisting capacities ranging from 6.0 t to 10 t.

Van Breda says the incorporation of CCS into the new range of Potain topless city cranes helps contractors get work done faster and with greater precision. "Aside from the enhanced levels of comfort and ergonomic control, this technology also delivers more precise control in positioning loads as well as increased capacity," he says.

In fact, for the Potain MDT 219, the inclusion of CCS gives the crane a load chart advantage of up to 12.5% over the MDT 218 A, the equivalent pre-CCS topless city crane from Potain.

These cranes can be engineered to incor-



porate one of two new crane operator elevator solutions, which provide fast and efficient transportation for the operator to and from the cab. Both systems comply with the highest levels of regulation as well.

One of the solutions, CabLIFT, exclusive to Potain cranes, has a slender design allowing it to fit inside all K-mast systems from Potain. It comes in three widths, 1.6 m, 2.0 m and 2.45 m. It is also compatible with all tower crane bases, fixing angles, chassis and cross-shaped bases. CabLIFT's intelligent design includes a service platform above the main car that provides comfortable access and safety for the erection technicians during the mast assembly process and crane erection.

The other operator elevator solution is TCL, an externally mounted system.

Potain has long been at the forefront of topless tower crane development, and with the introduction of CCS to its tower cranes, the brand is securing its market leadership position for years to come. □

# Focus needed on optimising transfer points

Mark Baller, managing director of Weba Chute Systems, talks about the importance of transfer points in chute systems, which are known to be high maintenance cost areas on many mines.

**T**he continued lack of focus on optimising transfer points is costing process plants money. It is a known fact that transfer points can contribute to some of the highest maintenance costs on a mine, yet many engineers often do not view transfer systems as a critical element of the minerals processing system.

Mark Baller, managing director of Weba Chute Systems, maintains that transfer points, by the very nature of their application, should be given the same level of importance as any other machinery in the minerals processing cycle.

“The uncontrolled discharge of bulk materials through conventional chutes has a history of escalated maintenance and replacement costs, not least of which can be attributed to excessive wear and other related problems,” Baller says. “All of which add up to unnecessary expenditure and a headache for the engineers concerned.”

Weba Chute Systems has proved through numerous successful installations that the correct design and engineering of a transfer point can dramatically increase throughput and decrease unplanned downtime with its associated maintenance costs. Baller explains that the company is known for its use

of a streamlined scientific approach to the dynamics of bulk materials handling, which completely eliminates the problems associated with conventional transfer chutes and results in significant cost savings.

Each Weba Chute System is custom designed for an application taking into account factors such as belt width, belt speed, material sizes and shape and throughput. Baller says that when used on a new project the result is the optimum design configuration for the application with the best belt cleaning arrangement and optimum selection of belt type and size. In addition, in this instance spillage can be completely eliminated.

He is quick to also point out that major benefits can apply to both retrofitted Weba Chute Systems as well as new projects and these include up to an 80% reduction in material degradation, greatly reduced levels of dust and noise, reduced production losses due to fewer blockages, significantly reduced spillage and vastly improved levels of safety.

Easy access is provided for inspection and maintenance purposes, and the system does not require ongoing supervision, again a saving in manpower and related costs.

Explaining the innovative Weba Chute System concept, Baller says that it is not an

alternative to conventional chute systems. It is a completely different and unique approach for the control and handling of bulk materials. The system uses a ‘supertube’ with a cascade scenario where 95% of the material runs on material at the same time.

Baller says that when viewed in slow motion it becomes apparent that the bottom layer of particles moves in a tumbling motion on the product screen and does not glide down the chute. “This results in significantly reduced wear, and in many cases the lip remains completely covered by material and never needs replacement,” he adds.

This manner of controlling the material movement is taken a step further by designing the internal angle of the transfer chute to match the product with the belt speed. In so doing, spillage is either completely eliminated or greatly reduced.

“We believe that our extensive experience and technical expertise coupled with our team’s applications knowledge has positioned Weba Chute Systems as the leader in transfer point design,” Baller says. Design of systems is done using sophisticated 3D computer software, and data received from the customer is always verified.

Quality manufacture also forms an important part of the process and performance guarantees are set in accordance with operational and application parameters. “These are part and parcel of all Weba Chute Systems,” he concludes. □



The Weba Chute System is a custom engineered transfer point solution designed to address the numerous issues plants face with material movement.

## Turnkey new crushing plant

A R27-million order for a turnkey crushing and screening plant for the new Rossmin plant in KwaZulu-Natal reflects equipment manufacturer Osborn's ability to deliver unrivalled, customised solutions that are a perfect match to customers' requirements.

According to Osborn's product sales manager Shane Beattie, the new crushing plant features a unique process designed by Osborn to minimise fines generation in the production of calcite and lime. Osborn supplied the plant to Umzimkhulu Industrial Holdings' Rossmin open cast limestone mining operation at Port Shepstone on the KwaZulu-Natal South Coast.

"The plant was designed and installed to only produce two sized products: 80 mm +30 mm; and -30 mm +10 mm, with -10 mm as a by-product," Beattie explains. He reveals that the process is revolutionary in that a conventional crushing plant would be a jaw and cone configuration to crush down to a -80 mm product from a run of mine (ROM) of 600 mm. "We supplied an Osborn modular 3042 jaw plant feeding into an Osborn modular 2340 jaw plant, then over an Osborn modular 6x20 triple deck screen, splitting the product into: -80 mm +30 mm; -30 mm +10 mm; and -10 mm fines. The primary reason for the two-stage jaw crushing process is to minimise the generation of the fines," Beattie expands, adding that this material cannot be used in the next stage and is a waste product.

Beattie says that Osborn's pioneering process is more effective than the conventional separation process at other plants, where all the ROM material is crushed to -1.0 mm and smaller, and then flotation is used to remove the impurities. "This process involves lots of water and waste, making it more difficult to manage," he asserts.

Umzimkhulu and Rossmin will only process the high-grade material, up to 99% calcite, Beattie states. "By only feeding the high grade -80 +30 mm to the tertiary/quaternary plant with the next stage being dry, a higher yield per ton crushed can be achieved," he notes. "Since this stage is the most expensive part of the process, by only crushing the desired calcite, the operation will be able to dramatically reduce its cost per ton, and the capacity in this stage is utilised to its fullest potential," Beattie explains.

Osborn also supplied the mine's next stage with its imported high frequency screens, to cut at -2+1.2 mm; -1.2+0.8 mm; -0.8+0.4 mm and -0.4+0.075 mm. "This is an extremely innovative process that enables us to screen out the -1.2 mm fraction. This is then sent to an air classifier, which removes the -0.075 mm from the -1.2 mm. The -1.2+0.075 mm fraction is then sent to the second 2624VM high frequency screen, a double deck 6x24-inch screen, that separates the -1.2+0.8 mm, -0.8+0.4 mm and -0.4 mm +0.075 mm fractions."

Osborn's attention to detail and commitment to clients, together with the company's quality machines and service, led to this significant order. The equipment supplied was transported to KwaZulu-Natal in 22 loads and the scope of Osborn's contract included the supply, installation and commissioning of the primary plant.

"This order has been some three years in the making and we are proud to have delivered a unique and optimal solution," Beattie concludes. □



The Osborn plant for Rossmin open cast limestone mining operation.

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# Promise of stainless steel undermined

There is a rising trend towards carbon steel fabricators moving into the stainless steel area without a proper understanding of the differences. This article explains how the South African Stainless Steel Development Association (sassda) is fighting to uphold industry standards and be a voice for best practice.

In a tough economy, consumers veer towards the cheapest option and some contractors may be tempted to cut corners. Unfortunately, contractor mistakes cost a fortune, killing profits. While both parties will blame the other, they also often blame the stainless steel material itself, through angry exchanges that waste time. So what happens when stainless steel contractors fail to deliver on promises?

Sassda executive director, John Tarboton, says: "Based on the number of complaints we receive, we have seen a rising trend towards carbon steel fabricators moving into the stainless steel area without a full understanding of the differences between the materials, often with costly mistakes. Sassda's role is to uphold an industry standard, provide advocacy and education for its members and the consumer and be a voice for best practice. Our code of conduct provides access to key pointers for contractors and consumers to consider before utilising a so-called 'expert' contractor."

During contractor altercations, end-users are often misled in order to place the blame on stainless steel as a product, however sassda counters that in most cases it may not be poor fabrication, but rather the poor installation of the product. Apart from this being a safety risk, it can lower the life expectancy of the stainless steel product as its corrosion resistance becomes compromised. Sassda is clear that member companies that fail to adhere to their code of conduct regarding best practices will see their membership terminated.

Says Tarboton: "To become a member of sassda a company needs to be ratified, mean-

ing we investigate the company, making sure correct practices are being performed together with good business ethics. We provide education and training to both our members and the public on the qualities of stainless steel, the correct selection and the required grading of the material to the application, together with its required finishes.

"Stainless steel is a quality product. We understand that mistakes can happen, but it's the way the member company handles these that sets a quality fabricator apart from the rest. We also appeal to consumers to only make use of industry standard member knowledge and practices to avoid costly mistakes."

Sassda was recently asked to intervene when approached by a disgruntled KwaZulu-Natal client unhappy with the construction, installation and workmanship of a balustrade on his upmarket home. Sassda KwaZulu-Natal regional manager, Angie Baker, visited the client on site and together with a technical expert, generated a report for further sassda review.

"It was completely unacceptable that carbon steel bolts had been used, which accelerate galvanic corrosion and would cause the balustrade to fail in a relatively short period, leading to a possible safety hazard. The balustrade materials had also been contaminated by carbon steel carry-over in places, either during fabrication or installation, resulting in premature staining of the base material. Joints in the balustrade had been glued with an epoxy or adhesive instead of being welded and had come loose, with further poor joint quality seen in its construction, and the stainless steel had not

been correctly polished after installation.

"The job clearly did not comply with the legal requirements of SANS 10400 or SANS 10160, both of which require approval of the design and installation by a suitably qualified professional engineer, which we doubt was done. Quite bluntly, the balustrade was a hazard and dangerous to the safety of the homeowner. We advised that the entire structure be removed, at the fabricator's cost, and replaced using an experienced balustrade manufacturer," says Baker.

Providing feedback on his encounter with sassda, the homeowner has since responded saying: "Sassda went out of its way to assist me with this issue. They came to inspect the work that had been done, took photographs and discussed the workmanship with me as to what was right or wrong. They then supplied me with a list of approved stainless steel suppliers in the area with whom I can deal in the future. I appreciate that they stepped in as a watchdog for the industry and assisted me and provided support."

Baker comments: "The current economy sees many people being left without a job while others might feel they are not earning enough so they start their own businesses with little or no knowledge of stainless steel. This causes a problem for the stainless steel industry because incorrect procedures are often used, resulting in the end user receiving a sub-standard job and making stainless steel look bad, in the process. Stainless steel is a great product and if fabricated and installed correctly it can last the consumer a lifetime. But if not used correctly, it can corrode in a matter of months." □



Examples of sub-standard stainless steel balustrade installation in KwaZulu-Natal.

## Stainless steel could save millions in municipal water losses

While South Africa is experiencing Stage 2 and 3 water restrictions following its worst drought in decades, a spotlight is falling on the use of stainless steel in water distribution and service pipes in South Africa to reduce leakages and maintenance costs and preserve our already strained water resources into the long-term future.

The importance of tightening up South Africa's water supply infrastructure comes into sharp focus when one considers statistics cited in a Timeslive.co.za report, which reported that up to 40% of Johannesburg's water is unaccounted for, which cost the city R1.16-billion in the year ending June 30, 2015. Of that, about R851-million's worth of water was lost to leaks.

These high losses have been attributed, in part, to the use of inferior or inappropriate metals in pipe joints and other fittings being used by municipalities including flanges, tee-

pieces, reducers, bolts and nuts. The short lifespans of these components, compounded by high-pressure systems and high corrosion levels in South African soils, are further challenges for leak detection and repair.

Sassda's executive director, John Tarboton explains: "There is high value potential in using stainless steel material for service piping and all fittings (predominantly manufactured using grade 316 stainless steel) in the service delivery of municipal water that can potentially save millions currently lost in leakage and filtration costs, as well as helping to reduce the usage of water per capita.

"With the use of corrugated stainless steel piping, the need for joints in the system is reduced, allowing the corrugated stainless steel pipes to maintain their strength, improve workability and extend the piping systems' service life. There is a clear cost

savings case, both in the treatment of water that is lost through leakage, as well as with the water that municipalities are unable to bill for its distribution and use. Stainless steel is an optimal material in water system applications and while it comes at a price, it is an investment in the country's infrastructure that offers cost-savings benefits that will still be seen 100 years from now."

Tarboton concludes by saying: "We also have the ability and the technology available currently here in South Africa to manufacture the specified stainless steel pipes, something which could be a coup for the manufacturing industry in South Africa, both at an incubator level and as a commercial enterprise. If our municipalities are already investing so heavily in leakage repairs and replacement piping, it makes sense to replace outdated pipe systems with stainless steel." □

## Corrosion protection against hazardous fuels

Specialist coatings manufacturer and supplier, Kansai Plascon, has been involved with the petrochemical and refinery industry since the mid-1970s and is always expanding its range of products, as well as offering a 360° guarantee.

Kansai Plascon offers internal and external corrosion-protection systems for tank lining and other environments in the petrochemical and refinery industry. These coatings offer ideal protection against various fuel types.

The specialist coatings manufacturer and supplier has been involved with the petrochemical and refinery industry since the mid-1970s, points out Mike Byrd, national protective coatings specification manager at Kansai Plascon.

"We assess sites for asset owners in the petrochemical and related refinery sector, compile reports on our findings, and then provide corrosion-protection solutions specific to each scenario," Byrd explains. "We offer a 360° guarantee, in addition to monitoring all progress."

Specialist coating products supplied to this sector are Plascoline 1000 internal lining, Plascotuff 3000 primer, Plascotuff MIO intermediate coating, and Plascothane 9000 topcoat. In addition, the Protective Coatings division offers technical and aftermarket support, as well as project management.

"We go to great lengths to support and supply our customers, including new product developments. Kansai Plascon has always

been at the forefront of coatings development, as we expand our product range with new technologies," Byrd highlights.

"Our custom-made solutions extend the life of essential infrastructure in the petrochemical industry by protecting tanks,

piping and structural steel from corrosion. By keeping such infrastructure serviceable, these operations run continuously, with no costly stoppages and downtime, which translates into constant production rates," he concludes. □



Specialist coatings manufacturer and supplier, Kansai Plascon has been involved with the petrochemical and refinery industry since the mid-1970s.

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## Tracking industrial trends

# Bridges, corrosion and lifecycle cost thinking

In his quarterly column, Gary i. Crawford of Mettle Strategic Creativity talks about the costs of corrosion and the modern approaches being adopted to better manage the life and lifecycle costs of bridges and other structures.



Some disciplines seem to find a sense of stability by adhering to the practices and beliefs of the past. For example, it is not uncommon to hear bridge engineers say that no sooner have they erected a bridge that they have to start preventing it from falling down. 'Solace from the inevitability of decay' rather than the 'positive predictability of designed-in lifespan', as it were.

Of course, the main culprit in bridge decay is corrosion of the steel components.

Corrosion converts a refined metal to a more chemically stable form, such as its oxide, hydroxide, or sulphide. It is the gradual destruction of materials by chemical and/or electrochemical reaction with their environment. Rusting, the formation of iron oxides, is a well-known example of electrochemical corrosion. This type of damage typically produces oxides or salts of the original metal and results in the distinctive orange colouration. Corrosion degrades the useful properties of materials and structures including strength, appearance and permeability to liquids and gases.

The primary cause of corrosion of steel bridges is exposure of the steel to atmospheric conditions. This is exacerbated by marine (salt spray) and industrial environments and the only corrosion prevention method for these structures in these environments is a barrier coating.

Until very recently little consideration was given at the design stage to ensure longevity of bridges.

According to the National Cooperative Highway Research Program ('*Bridge Life-Cycle Cost Analysis*' - NCHRP Report 483 - 2003) the United States of America has 614 387 bridges, almost four in ten of which are 50 years or older.

56 007 (9.1%) of the nation's bridges were structurally deficient in 2016 and, on average, there were 188-million trips across these deficient bridges each day. While the number of bridges that are in such poor condition is decreasing, the average age of America's bridges keeps going up and many are approaching the end of their design life.

The most recent estimate puts the cost

of the nation's bridge rehabilitation needs at US\$123-billion and this is likely to keep increasing.

According to the U.S. Department of Commerce Census Bureau, the annual direct cost of corrosion for highway bridges is estimated to be between \$6.43- and \$10.15-billion, consisting of: \$3.79-billion to replace structurally deficient bridges over the next 10 years; \$1.07- to \$2.93 billion for maintenance and capital cost of concrete bridge decks; \$1.07- to \$2.93 billion for maintenance and cost of capital for concrete substructures and superstructures (minus decks); and \$0.50-billion in maintenance painting costs for steel bridges.

Lifecycle analysis estimates indirect costs to the user due to traffic delays and lost productivity at more than 10 times the direct cost of corrosion. In addition, it was estimated that employing 'best maintenance practices'

versus 'average practices' may save 46% of the annual corrosion cost of a black steel rebar bridge deck, or \$2 000 per bridge per year.

The National Cooperative Highway Research Program of 2003 was the first serious attempt to introduce lifecycle costing to the world of bridge design and maintenance. Until then, bridge repair and maintenance costs were seemingly worn as 'badges of courage' ... with costs 'proudly' communicated. For example, the George Washington Bridge, crossing the Hudson River in New York was completed in 1931 at a cost of \$75-million and maintenance to date exceeded US\$1-billion.

A common rule of thumb is that maintenance costs about 4.0% of the initial construction cost per year. For a structure as old as the George Washington Bridge, that's a lot of 4.0%'s, even though some attempts were made to build in longevity.

In 2005, the *New York Times* reported that



The repair of the Brooklyn Bridge in Manhattan, originally scheduled for completion in 2005, took until 2016 to complete and total costs of fixes and improvements rose more than US\$600-million.



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repairs to the Brooklyn Bridge were \$100-million over budget and the completion date had been pushed back yet again due to major cracks and holes discovered during the five years of work. Engineers discovered more than 3 000 new structural 'flags' on the city's most famous span, which increased the costs of repairs and improvements from \$508-million to more than \$600-million.

The 1 595-foot span was originally set to fully reopen in 2006, but actually took until 2016.

Thankfully, since the publication of the NCHRP's 'Bridge Life-Cycle Cost Analysis', sanity seems to have begun to prevail, with lifecycle costing entering the world of bridges and other major structural designs.

Changes in environmental protection regulations have brought about a transformation in the approach to corrosion protection. Until the late-1970s, virtually all steel bridges were protected from corrosion by multiple thin coats of lead- and chromate-containing alkyd paints applied directly over mill scale on the formed steel. Maintenance painting for prevention of corrosion was rare and primarily practiced on larger bridge structures. Since the majority of the steel bridges in the interstate highway system were constructed between 1950 and 1980, most of these structures were originally painted in this manner. Therefore, a large percentage of the steel bridges are protected from corrosion by a coating system that is now beyond its useful service life.

Moreover, the paint system most commonly used contains chromium and lead, which are no longer acceptable because of the effect they have on humans and the environment. Bridge engineers of today have a choice between replacing the lead-based paints with a different coating or painting over the deteriorating areas. Removal of lead-based paint incurs high costs associated with the requirements to contain all the hazardous waste and debris.

Developments include improved and

*In its '2017 Infrastructure Report Card', the American Society of Civil Engineers brought some common sense to the table: "New technologies and materials are helping engineers build bridges that last longer. New materials such as high performance steel, ultra-high performance concrete, and composites are being used to add durability and longer life to bridges."*

environmentally safe coating systems and methodologies to optimise the use of these systems, such as 'zone' painting, which involves adjusting coating types and maintenance schedules based on the aggressiveness of the environment within different zones on a bridge.

There is now a plethora of high-performance materials available, including my personal favourite, stainless steel.

In its '2017 Infrastructure Report Card', the American Society of Civil Engineers brought some common sense to the table: "New technologies and materials are helping engineers build bridges that last longer. New materials such as high performance steel, ultra-high performance concrete, and composites are being used to add durability and longer life to bridges."

The stainless steel family of alloys has an important role to play in structures. Of the most widely used Austenitic grades 1.4301 (304) and 1.4401 (316), containing about 17-18% chromium and 8-11% nickel, 304 is suitable for rural, urban and light industrial use, whereas the more highly alloyed 316 performs well in hostile marine environments.

Load-bearing applications have led to a demand for 'lean' duplex grades in which the mechanical and corrosion properties of the duplex grades are combined with a leanly alloyed composition. Grade 1.4162 (LDX2101) is ideal for applications in construction with a proof strength in the range of 450 to 530 N/mm<sup>2</sup>.

Stainless steel is also becoming the material of choice for concrete reinforcement. It has a high resistance to corrosion particularly in chloride bearing concrete (from de-icing

salts or seacoast exposure). Significant reductions in maintenance and repair will result in applications where the structure is subject to adverse corrosion.

An article, published in the May 1995 issue of 'Concrete International', concludes that both "field and laboratory data have shown that stainless steel rebar is capable of maintaining excellent corrosion resistance in severe chloride environments," and that "the chloride tolerance for stainless steel was shown to be significantly greater than that of mild steel." This article also concludes that the "use of stainless steel is warranted when guaranteed long-term corrosion resistance is required."

As the International Stainless Steel Forum states: "Material selection is a decisive factor for the durability of infrastructural buildings and installations. It is the key to maximum availability and low lifecycle cost."

Other rehabilitation methodologies designed to extend the service life of concrete bridges include: cathodic protection, electrochemical chloride removal, overlays, and sealers. Although each of these methods has been shown to be successful, continuing developments are necessary to improve effectiveness and increase the life extension they offer.

It does appear that bridge engineers 'have seen the light' when it comes to designing for structural life expectancy. Hopefully, other engineers will follow suit and not design structures with in-built 'time bombs.'

The message is clear. Design engineers should consider the costs across a structure's entire lifecycle to make smart design and material decisions. □



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# Refrigerated air dryers safeguard against condensation

SMC Pneumatics recognises the importance of correctly prepared compressed air and strives to be the 'one supplier for all needs', going beyond pneumatics to provide solutions such as its range of quality air dryers to combat moisture.

In today's manufacturing environment, compressed air is an essential power source and therefore its quality requirements are vital. Even when meeting operational requirements, air moving through pipelines can lay down more moisture through condensation than is acceptable, causing costly damages to production machinery.

Brian Abbott, product manager at SMC Pneumatics says that a simple solution that is often overlooked is a quality refrigerated air dryer. "Water carried with compressed air to the production systems can cause significant damage to the valves, cylinders, fittings and more. Components tend to rust and lubrication is rinsed out, causing a significantly shorter life span and slower production," Abbott explains.

It is in fact, impossible to produce compressed air without depositing water into the system and as such, loss of income, replacement of parts, low levels of productivity and damage to the production system will prove more destructive than condensation itself to any business.

"Cost cutting around air preparation is never advised. As with most things, what you put in is what you get out and the solution is very simple. Dry air can easily be obtained by means of refrigerated air dryers, which are highly cost-effective in the long-run," says Abbott.

"Compressed air is led through the refrigerated air dryer, cooling it drastically to reduce the water content to between 10 and 3.0 °C at the pressure dew point. Dryers can be located on the most critical work stations in the production process, delivering air to the required ISO Class or they can be placed after the compressor for general usage," adds Abbott.

SMC's refrigerated air dryers chill the air to 3° C reducing the water content in the compressed air to around 6.0 g/cm<sup>2</sup>. The surplus water is drained directly from the refrigerated air dryer, and dumped via an auto drain.

Refrigerated air dryers are a cost-effective means of providing air with pressure dew points of 3.0 to 10 °C, thus meeting the requirements of ISO 8573-1 moisture classes 4 to 6. "All energy-efficient SMC refrigerated air dryers feature compact and quiet construction, stainless steel heat exchangers, Montreal Protocol-compliant refrigerants and low pressure drops," says Abbott.

"Models are available to meet various regional requirements in standard inlet temperature

designs as well as high inlet temperature models."

The IDU, IDF and IDH series from SMC are designed to each meet the unique requirements of factories using compressed air, offering various capacities to meet the demands of the modern customer. These energy-efficient solutions offer stable, compressed air temperature control while being able to withstand corrosion, regardless of external conditions.

The IDF refrigerated air dryer series uses refrigerants R134a and R407C to prevent any damage to the earth's ozone layer (medium size series use R22). The IDF series can accommodate an inlet temperature of 60 °C and corrosion resistance is improved by using a stainless steel, plate type heat exchanger.

Features include:

- Standard inlet temperature air.
- Stainless steel heat exchangers designed for long life and low pressure drops.
- Compact and quiet construction.
- Montreal Protocol compliant refrigerants.
- Energy efficient designs.

The refrigerated air dryer series, IDU, uses refrigerants R134a and R407C once again showcasing SMC's commitment to a greener environment (medium size series use R22). The IDU series provides a stable supply of dry air even under high demand conditions with an inlet air temperature of 80 °C.

Features include:

- Improved corrosion resistance with the use of stainless steel, plate type heat exchanger.
- Protects pneumatic equipment from moisture.
- Rated inlet air temperature of 80 °C.
- Refrigerant R134a (HFC).

SMC's IDH series of compact air dryers offers stable, compressed air temperature control with its integrated heater, regulator, dryer and filter. The IDH air dryer delivers a constant volume of compressed air at the correct temperature, dew point, pressure and cleanliness, regardless of external conditions or seasonal climatic conditions. Due to its compact size, and the ventilation holes on the front and top, the IDH can be installed close to a wall or panel.

Features include: and all-in-one air preparation with temperature and pressure control, drying and cleaning; and stable adjustable outlet temperatures of 15 to 30 °C, regulated to within 0.1 °C. □



**Above and below:** IDF series refrigerated air dryers from SMC can accommodate an inlet temperature of 60 °C and corrosion resistance is improved by using a stainless steel.



SMC's IDH air dryers are compact and offer stable, compressed air temperature control.

## Rapid sauce cooling technology now available in SA

A new, revolutionary technology that reduces sauce-chilling time from hours to minutes is now available in South Africa from Afrox. Developed by Linde, Afrox's parent company, the patent-pending ACCU-CHILL® SC in-line sauce cooling technology uses liquid nitrogen to rapidly chill pumpable hot liquid foods for the ready meals sauce market. This in-line process rapidly chills hot sauces within minutes instead of hours, increasing production capacity and improving product quality.

"Linde has been developing and trialling this new technology for some time and it is now ready for global roll-out. The ACCU-CHILL SC in-line sauce cooling technology is available in South Africa exclusively from Afrox," says Hendrik Pretorius – applications specialist at Afrox. Pretorius is part of Linde's specialist global team that develops new applications.

High viscosity sauces such as gravies, pasta sauces and soups need to be rapidly cooled down to minimise bacterial growth and maintain product quality. Traditional cooling methods rely on water immersion techniques or jacketed, tubular, scraped-surface heat exchangers.

The ACCU-CHILL SC in-line sauce cooling system is a streamlined, cost-effective alternative to traditional heat exchangers that are very costly, take up a large amount of space and have lengthy chilling times.

ACCU-CHILL uses cryogenic injector technology to inject extremely cold liquid nitrogen directly into hot, cooked sauce in a mixing container. The low temperature of the liquid nitrogen cools the sauce immediately without freezing it. The subsequent mixture of gas and sauce is transferred to a degassing vessel where the nitrogen is vented, before being pumped into packaging.

"In addition to reducing the cooling time – which reduces bacterial growth during processing – cooling technology eliminates the use of water in the cooling process and reduces sanitation time due to the elimination of heat exchangers," explains Pretorius. "Furthermore, cryogenic cooling eliminates the variation in cooling times with traditional methods, and thus prevents overcooking and improves nutritional value."

Pretorius adds that this new Linde sauce cooling system will complement future in-line cooking processes that are currently being developed.

The major components of the ACCU-CHILL® SC in-line sauce cooling system are a manifold, phase-separator and the chilling injector, which is connected to the hot sauce production line. Gaseous nitrogen is used to purge the lines and the injector after chilling to ensure that no product residue remains in the system.

The system can be tailor-designed by the global specialist team to suit customers' specific processing needs following an investigation of customers' existing processes, while a local team from Afrox will install the application and will provide support and training. □

*The major components of Linde's ACCU-CHILL SC in-line sauce cooling system are a manifold, phase-separator and a chilling injector that is connected to the hot sauce production.*



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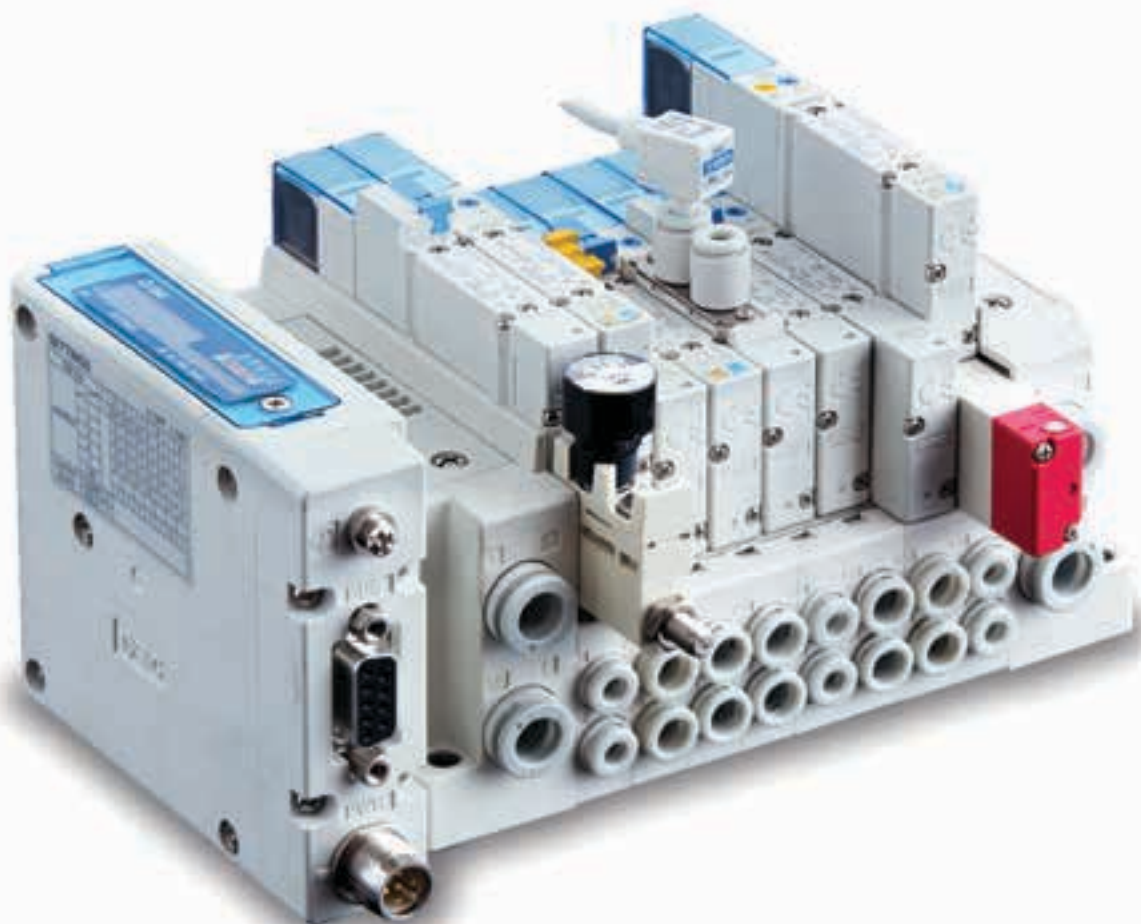
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# Complete ventilation solutions in SA

TLT ACTOM addresses the unique challenges of the African market through a combination of product design, their total ventilation solutions approach and support from TLT-Turbo. With TLT Turbo as its 'technology parent', the company believes it has the ability to offer fans for the most arduous of conditions, as well as achieving significant savings on cost of ownership.

**T**LT ACTOM aims to offer South Africa's mining and power sectors more than just innovative ventilation fans – their customised systems ensure that working conditions are safe and energy efficiency is maximised as part of a holistic total ventilation solution that aims to reduce total costs of ownership.

Operations director, Craig Johnston, believes that TLT ACTOM's approach is ideal for addressing the concerns of the Southern African market. "We have come to realise that in Southern Africa power is becoming a far higher input cost in our industries and processes than it was in the past," says Johnston.

"TLT ACTOM prides itself on applying innovative, lateral thinking to solutions that save energy by offering the best efficiency selections for applications. We can supply products that are not only more efficient in their performance but are also tailored to deliver the required air at the required time. For example, a fan that is designed to have different degrees of control in order meet the specific levels of ventilation required for increased ambient temperature or activity, or when measured pollutants move beyond a pre-set tolerance."

TLT ACTOM's total ventilation solution approach is intended to provide complete solutions to the challenges of subterranean mines, thermal power plants and numerous industrial process applications, including

cement production and waste incineration. According to Johnston, the main focus is on making clients' operations more efficient in terms of both performance and energy consumption, thereby having a significant impact on total costs of ownership.

"Capital cost is one aspect that clients are most heavily focused on, but TLT ACTOM strives for excellence in power efficiency, maintainability and life expectancy – all factors that can easily outweigh the initial purchase price. To do this we rely on superior technology derived from our parent company TLT-Turbo," Johnston explains. "The most innovative suppliers can help their clients to look beyond the initial capital cost and to consider the short, medium and long term running costs, which include absorbed power and maintenance."

Johnston elaborates with an example of how innovation can ensure that clients see a return on investment. "As part of a recent study, TLT ACTOM proposed replacing two existing mine ventilation fans with a single axial fan. Because of its higher efficiency, it will save approximately 500 kW. The calculated annual energy saving is R 3.6-million, making the payback extremely attractive."

The current installed base of process and ventilation fans is ageing and, in tough times, this equipment has to be carefully maintained to achieve the expected life. To do this, TLT ACTOM provides a dedicated skilled team

of fan specialists to monitor and maintain installed systems.

"Where replacements are required, we offer the value-added service of critically analysing the existing plant and using an intellectual approach to offer improvements, for example, in efficiency, size correction or wear durability. Wherever possible this can be achieved without replacing the entire fan, but in retrofitting the rotating element with minor modifications, thereby minimising the capital spend for the customer and ensuring an acceptable return on investment," says Johnston.

Johnston believes that TLT ACTOM is able to address the unique challenges of the African market through a combination of the design of their products, their total ventilation solutions approach and support from TLT-Turbo. "With TLT Turbo as our 'technology parent' TLT ACTOM has the ability to offer fans for the most arduous of conditions. From cement plants where wear and high temperature is a factor or mining fans where water droplet erosion can cause damage to fans where erosive and corrosive conditions exist, TLT ACTOM has a solution."

"We pride ourselves in working with our clients to fully explore options and to share the latest developments. We hope that by applying the Total Ventilation Solution approach, our current and potential clients will come to realise that TLT ACTOM sells more than just fans," Johnston concludes. □



TLT ACTOM's total ventilation solution approach is intended to provide complete solutions to the challenges of subterranean mines, thermal power plants and numerous industrial process applications.

# Mobile discharging of PAC from bulk

Transvac has deployed its mobile TransPAC dosing systems in a number of UK water treatment works for pesticide concentration emergencies, or taste or odour problems. The systems act as an alternative to traditional PAC (powder activated carbon) batch dosing systems. The TransPAC mobile powder handling and carbon dosing system includes a bulk bag discharger and two flexible screw conveyors from Flexicon Europe, and Transvac's ejector system for mixing and injecting a slurry of PAC into the municipal water stream.

**W**hen a water treatment works in northern England faced a spike in pesticide concentration exceeding the allowable concentration limit for the incoming water, the site was forced to shut down. The company then had to divert water from a regional water treatment works in order to provide clean drinking water to its customers until the problem could be solved.

The solution arrived in the form of a mobile, lorry-mounted carbon dosing system, housed in a 6.0m long steel shipping container that was delivered and activated within one day, without costly and time-consuming site preparation, construction or complex components.

Supplied by Transvac Systems, the TransPAC mobile powder handling and carbon dosing system includes a bulk bag discharger and two flexible screw conveyors from Flexicon Europe, and Transvac's ejector system for mixing and injecting a slurry of PAC into the municipal water stream.

The mobile unit requires only connections to an electric power supply, the municipal water stream, and an external water supply.

Environmental impact and site preparation are minimised, as well as the need for maintenance and planning permission. The system is safe to operate, and simple to control.

The water treatment works was restored to compliance as the dosed carbon successfully removed pesticide traces from the main water stream. Dosing is accurate and steady without over-dosing or wastage.

From the BFF-C-X Bulk-Out™ split-frame bulk bag discharger, PAC is automatically transferred from a half tonne bulk bag through a flexible screw conveyor to a surge hopper from which a second flexible screw conveyor meters the powder into the Transvac ejector.

## Split-frame discharger fits inside container

A forklift loads the 1.8 m high bag-loading frame and 500 kg bulk bag onto the 0.9 m high stationary discharger frame inside the shipping container. Once the bag spout is untied, the powder flows into a 5.0 m long, 80 mm diameter flexible screw conveyor leading to the 930 l capacity surge hopper. A second 3.5 m long, 67 mm diameter flexible screw



conveyor moves the carbon powder from the hopper outlet to the intake of the ejector that accurately doses the PAC into the municipal water stream.

The conveyors are curved to fit the tight space within the shipping container.

From the control panel, the operator sets the speeds of the conveyor drives to automatically dose the proper amount of PAC according to the site water flow. Low and high level sensors in the surge hopper signal the controller to start or stop flow through the first flexible screw conveyor when the hopper contents reach low or high levels.

## Overloaded pump station upgraded

**V**eolia Water Technologies recently revamped Ncandu pump station near Newcastle in KwaZulu-Natal, leaving it suitable to accommodate future growth.

Veolia Water Technologies South Africa was recently contracted by the Newcastle Municipality to upgrade the Ncandu pump station in KwaZulu-Natal. The existing outdated pump station, situated five kilometres from the town, was unable to meet high sewage capacities, overloaded by Municipal housing and downstream industrial businesses.

The existing old pumps were prone to tripping and often flooded the pump station, so the first step of the project saw Veolia cleaning the pumping station, situated 15 m below ground. This included removing the

sump, scraping the walls and rehabilitating the existing infrastructure for the new, larger pumps.

Veolia replaced the aged pumps with two new Sulzer pumps, imported from Germany, that were integrated into the existing pipework infrastructure. Sulzer is one of the Veolia Group's international strategic suppliers for pumps. The two submersible Sulzer XFP high-capacity sump pumps are capable of processing 220 l of raw sewage per second at a 27 m elevation.

"The pumps are set at a standby duty configuration to ensure system reliability. This means that when the first pump reaches 60% capacity, the second pump will automatically switch-on to ensure demand is met and that no flooding or overflow discharge occurs,"

comments Blake Cooley, project engineer, Veolia Water Technologies, South Africa.

"In addition, this standby configuration also ensures that if either pump malfunctions or requires servicing, it gives the pumping station a four to eight hour buffer period before breakdown or overflow." These Sulzer pumps, however, would continue to operate in the unlikely case of overflow due to their submersible designs.

Early in the installation, the existing pumps failed and flooded the entire pumping station. In addition to cleaning the waste, Veolia installed a temporary T8 pump to ensure that no effluent would be discharged during the installation period. "As this was a live operation, we had to bypass the Ncandu pump station using a temporary solution so that the pumping of the sewage to the wastewater plant could

# bags helps solve pesticide overload

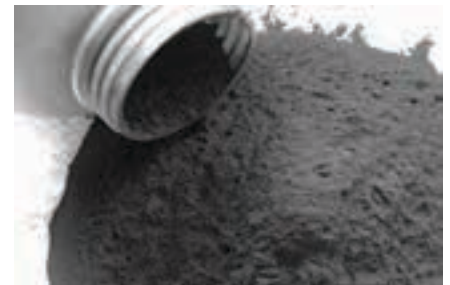


**Above:** The bulk bag and lifting frame of the BFF-C-X Bulk Out™ split-frame bulk bag discharger are forklifted onto the stationary discharger frame inside the container.

**Left:** TransPAC mobile powder handling and carbon dosing system houses a split-frame bulk bag discharger, two flexible screw conveyors, a control panel and the Transvac ejector.



The 5.0 m long flexible screw conveyor from the bulk bag discharger moves the carbon powder to the surge hopper (left), from which the second 3.5 m long flexible screw conveyor moves the powder to the intake of the Transvac ejector (right).



Extra fine powdered activated carbon is prone to dusting, but is contained by the flexible screw conveyors and dust-tight connection at the discharger's bag spout interface.

the extremely fine powder, with an average particle size of only 20 µm and a bulk density of 230 kg/m<sup>3</sup>, is prone to dusting.

Both the bulk bag discharger and flexible screw conveyors prevent dusting. The bag outlet spout is connected to the feeder by a Spout-Lock™ clamp ring, which creates a secure, dust-tight connection between the clean side of the bag spout and clean side of the spout interface.

Each flexible screw conveyor consists of a stainless steel screw rotating inside a durable polymer tube that contains the fine powder as it is conveyed. The conveyor discharge is likewise dust-free, as powder exits through a transition adapter located forward of the drive at the discharge end, thereby preventing powder from contacting bearings or seals.

Transvac has deployed its mobile TransPAC dosing systems in a number of UK water treatment works for similar emergencies for pesticide, taste or odour problems and as an alternative to traditional PAC batch dosing systems, which are large, complex, costly and require long lead times by comparison. □

The carbon dosing portion of the TransPAC system includes a header tank for incoming water, a booster pump and the ejector. The velocity of the water flowing through a venturi creates a low pressure zone in the ejector that entrains the carbon powder into the treated water stream at a rate set at the control panel. The unit operates with no moving parts.

## PAC handling problems

Powdered activated carbon adsorbs the pesticide on its surface, while the carbon and adsorbed material are subsequently removed as sludge in the flocculation process. However,

continue uninterrupted," comments Cooley.

To ensure the maintainability of the pump station, Veolia installed a penstock stainless steel gate to effectively isolate the pumps from each other. This means that when one pump requires cleaning or maintenance, the gate will isolate the sewage flow to the functioning pump only. Prior to this, the operators relied on manually handled sand bags, which proved extremely laborious and often ineffective.

In order to power the two 71 kW pumps, Veolia was also contracted to upgrade the transformer and Motor Control Centre (MCC) panels with the help of external instrumentation and control suppliers. "These MCCs provide variable speed and soft-starting pump performance ensuring that their operating capacity matches the sewage demand of the time," adds Cooley.



These intelligent systems will also immediately alert the operator, via SMS, to any potential pump tripping or overloading. Veolia also installed a precautionary one-kilometre air raid siren to alert the operator of pump station overload or failure.



Sulzer XFP pumps (shown left) wait to pump 220 l of sewage every second (above).

"These safety systems, in addition to our operator training on MCC usage and proper maintenance practices, aim to reduce the chances of any sewage discharge from this pump station in the future," concludes Cooley. □

# Consistent water plant management requires consistent excellence...



## ... in delivering specialised water-related services.

ERWAT Commercial Business follows a partnered approach offering their customers complete water plant management, whilst continuously striving towards the enhancement of the market and delivering excellence in specialised and innovative water-related services. Professional support and services are provided through an in-depth range of products geared towards managing plants, plant operations, maintenance, process optimisation and technical support. Services include plant audits, plant optimisation, water quality monitoring and compliance monitoring analysis, sludge analysis and classification, Blue Drop and Green Drop support services as well as in-house and off-site implementation of municipal by-laws and tariffs.

**East Rand Water**

Reg. No. 1992/005753/08

(Association incorporated in terms of section 21)

GPS Co-ordinates: S 26° 01' 25.8" and E 28° 17' 10.0"

Address: Hartbeestfontein Office Park, R25, Bapsfontein/Bronkhorstspuit, Kempton Park

Tel: +27 11 929 7007

E-mail: [mail@erwat.co.za](mailto:mail@erwat.co.za)

[www.erwat.co.za](http://www.erwat.co.za)





## Certified Water Efficiency Professional (CWEP®) to launch in SA

Our country is blessed with many companies and persons implementing water savings. This year, the Energy Training Foundation (EnTF) is launching the Certified Water Efficiency Professional (CWEP®), a qualification programme from International Certification Body, the Association of Energy Engineers' (AEE).

AEE programmes are designed to distinguish persons in various fields of sustainability through its Certification programmes, which recognise current knowledge and work experience largely as an eligibility requirement to successfully obtain and maintain such a qualification. The CWEP two-day training session culminates the experience gained over the years with a 4-hour examination on the third day, which has to be passed with 70% in order to attain the last eligibility requirement for the qualification.

Implementing water-efficient technologies or techniques often involves individuals with varied backgrounds, responsibilities, and levels of expertise. CWEP is designed to help educate those who have responsibilities in the sustainable or utility efficiency field on best practices for maximising results and understanding water efficiency basics.

The training will teach technical and organisational strategies, including how to conduct a water efficiency site assessment,

understanding water billing/costs, use of terminology, regulatory and international mandates and policies, efficiency technologies and application techniques, as well as water measurement and verification needs.

Key areas and sectors covered include commercial kitchens, laundries, cooling and heating systems, domestic plumbing system, filtration, softening, landscaping and irrigation systems, industrial processing systems, pools, hospitals, medical and laboratories, storm water management, HVAC and mechanical equipment, and more.

The training is ideal for person in the following professions, amongst others:

- Water services and management professionals.
- Provincial/state municipal planners and government resource efficiency managers.
- Certified energy managers (CEMS).
- Energy and water administrators & utility professionals.
- Water, energy and facilities champions and certified energy auditors (CEAS).
- Sustainability and energy professionals.

CWEP launches on 12-14 July in Johannesburg this year, with a second course running straight after the Southern African Energy Efficiency Convention 2017 from 16-18 November.

And in Kenya, some additional modules will be added to the CWEP running

from 12-15 September with the exam on 18 September 2017.

### Energy Training Foundation

The Energy Training Foundation (EnTF) has been training and certifying Energy Professionals to internationally recognised qualifications since 2002. EnTF is the sole approved training partner for the Southern African region for the US-based Association of Energy Engineers (AEE).

The available programmes in the region are: Certified Energy Manager (CEM®), Certified Energy Auditor (CEA™), Certified Measurement and Verification Professional (CMVP®), Certified Renewable Energy Professional (REP®) and Certified Water Efficiency Professional (CWEP®).

EnTF is EWSETA accredited and runs locally developed training in energy efficiency and renewable energy with all courses carrying CPD credits. □



## Wastewater – key to tackling water scarcity

The South African Department of Water and Sanitation (DWS) dedicated the week of 17 to 23 March to National Water Week.

Although significant progress towards access to water for all has been made in South Africa, water itself remains a limited resource. Increasing population and a growing industrial base place pressure on catchments and those in KwaZulu-Natal, Western Cape, Gauteng and Nelson Mandela Bay are all highly stressed.

Beyond the African experience, it is evident that on a global scale a clear strategy and action plan is required to address the growing water problem. The Sustainable Development Goals (SDGs), a UN-initiative launched in 2015 recognises the crucial role clean, safe water plays in eradicating extreme poverty, improving food security, livelihood choices and educational opportunities. The UN's World Water Development Report (WWDR) 2017, 'Wastewater: The untapped resource' was launched in Durban, South Africa on 22 March 2017 and was at the core of the World Water Day theme.

In the face of growing concerns regarding climate change, the need to meet the escalating demand and efforts towards reaching the SDGs, innovative approaches to wastewater management and water recovery is imperative. Managing director of Talbot & Talbot, Carl Haycock, notes: "Treated wastewater may be a key strategy to meet the water needs on the African continent and can also help to address parallel challenges of food production and industrial development."

Talbot & Talbot supports industrial clients across Africa to reduce their water demand, and consequently their impact on the catchment. This is achieved through the treatment and recycling of wastewater using various technologies, some of which results in the production of biogas energy as a by-product.

Industrial wastewater recovery can reach between 60% and 85% of total wastewater discharged, depending on the quality of the effluent received for reuse and the optimisation protocols applied in operation.



The water reuse by industries within their processes improves water availability in the catchment, which ultimately supports social and economic development, driving the SDGs.

The operation of municipal wastewater treatment plants also requires a high skill level. Through Talbot & Talbot's technical and process specialists and site-specific management and staff, the company can offer innovative and sustainable solutions to wastewater challenges. □

# Vacuum Technique: a fifth business line

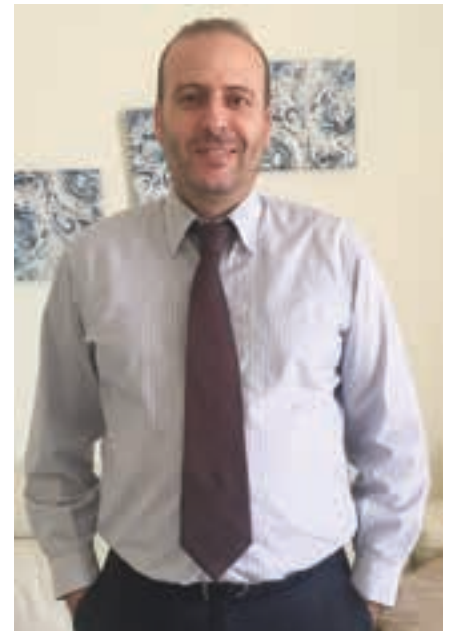
Atlas Copco Vacuum Technique has become the a fifth independent business area for the Atlas Copco Group, alongside Compressor Technique, Construction Technique, Industrial Technique and Mining and Rock Excavation Technique. *MechChem Africa* talks to Sofiane Kerfali (right), regional business line manager for vacuum pumps and systems in the Middle East and Africa; and Willem Brits (below), the representative for Industrial Vacuum in South Africa and neighbouring southern African countries including Zimbabwe and Namibia.



pumps and systems business is as big as the compressor business and, thanks to growing product offering awareness and market penetration, Vacuum Technique is now getting onto a similar path locally. As a fully-fledged business area Industrial Vacuum is now better positioned to expand by delivering turnkey vacuum solutions to our customers across the southern African region.”

Regional manager for the new business line, Sofiane Kerfali adds: “In Africa, we have achieved our chosen accolade ‘first in mind, first in choice’ on the compressor side, with significant market awareness and penetration. But in vacuum, we are less well known. Vacuum Technique products are not known in Africa so we have work to do to catch up with Atlas Copco’s other business areas, work that will, undoubtedly, lead to substantial growth in the vacuum product line,” he tells *MechChem Africa*.

“We have excellent vacuum products



backed by world-class service support, systems that offer the best possible energy savings and high reliability. But Africa does not know about these products, so this is our challenge. We need to make Africa aware of our capability and that of Vacuum Technique’s product range,” he adds.

With respect to markets, Kerfali says that vacuum and compressor technologies share a lot of synergies. “We target similar industries: general industry on the handling side, plastic injection moulding and vacuum packaging, and hosts of applications such as those in the petrochemical and electronics industries, and the pharmaceutical, food and beverage, packaging and mining sectors.

“There are many customers working with established brands that are now globally owned by Atlas Copco. Through these brands and by incorporating our related compressor expertise, we can claim 150 years of experience in vacuum technology and its application,” he says.

## The flagship GHS VSD+

Core to Atlas Copco’s group ethos is a strong focus on energy efficiency, its vacuum products being no exception. “Our GHS VSD+ vacuum pumps for centralised solutions are our flagship. They have won several awards, such as *Plant Engineering’s* 2016 Product of the Year Award. This is largely due to the 50% energy savings that can be achieved compared to other similar capacity vacuum technologies,” Brits notes.

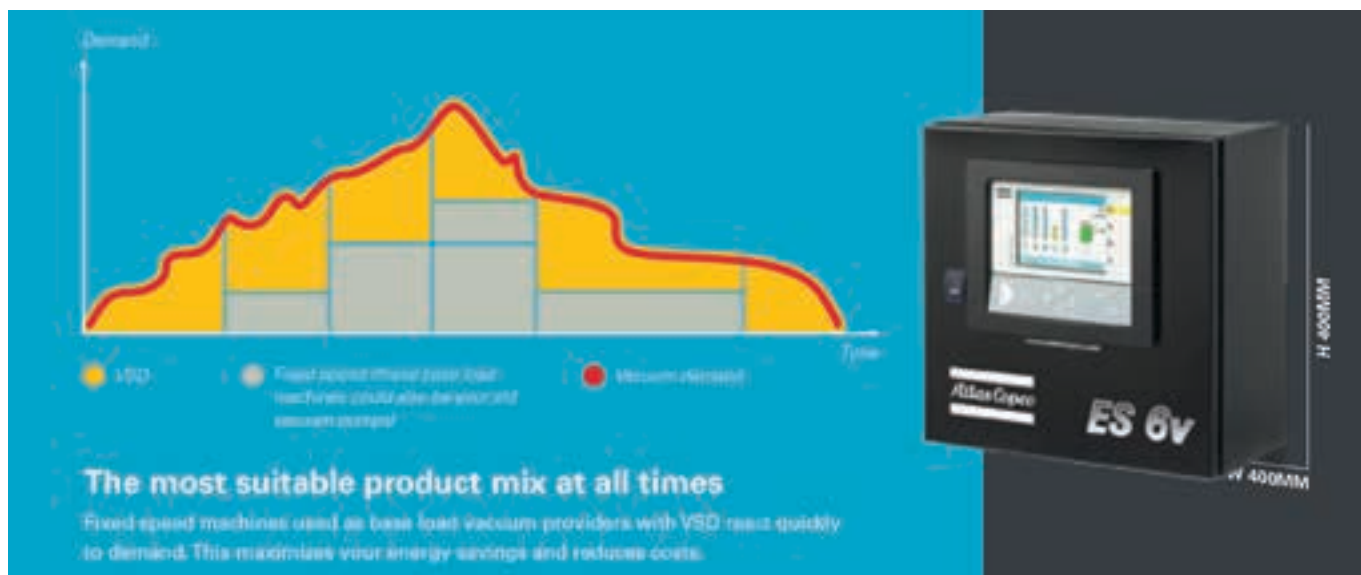
“In addition, compared to competing pumps, the oil retention of the GHS is excellent, making them more environmentally friendly than its predecessors or competitors,

**V**acuum solutions originally formed part of Atlas Copco Compressor Technique’s product portfolio. Following the expansion of the product line through acquisition of respected companies such as the Edwards Group, Leybold and Quincy, along with global earnings growth, on January 1, 2017 Vacuum Technique earned separate business area status.

Globally, according to Brits: “the vacuum



Atlas Copco Vacuum Technique’s flagship GHS VSD+ offers energy savings of up to 50% as well as superior performance against benchmarked oil-sealed, claw, liquid ring and dry vane vacuum pump technologies.



**Above:** On the control side, the very latest ESv central controllers are available to control up to six Atlas Copco compressors – and these can be a mixture of VSD-controlled or fixed speed pumps.

**Right:** AWS180-5500 Single Stage Liquid Ring Pumps from Atlas Copco Vacuum Technique are also part of the company's extended range.

with much lower oil consumption and emissions," he says.

GHS VSD+ oil-sealed, rotary-screw vacuum pump with variable speed drive (VSD) technology is based on the well known and durable, new-generation, intelligent plug-and-play design principles of Atlas Copco compressors. Notable features include:

- Superior performance against benchmarked oil-sealed, claw, liquid ring and dry vane vacuum pump technologies.
- Increased efficiency: state-of-the-art screw technology, a VSD and an innovative motor design combine to produce a leap forward in efficiency.
- Quiet operation: noise levels are around half that of comparable technologies.
- Reduced environmental impact due to ultra-high oil retention at all operating pressures.

The largest in the range is the GHS 5 400, which can evacuate 5 400 m<sup>3</sup> per hour of air and hold vacuum pressures down to 0.35 mbar absolute (35 Pa). "This machine is driven by a 90 kW motor, compared to its closest competitor, which runs off 150 kW. This translates into a direct energy saving of 40% before taking into account the savings achievable by using the VSD," Brits informs *MechChem Africa*.

In terms of the cost of ownership, he estimates that average pay back times on the capital investment for these machines is typically between one-and-a-half and four years. "While the acquisition cost is not significantly different from other premium vacuum pumps, the cost saving opportunities available in many case studies we can share show that these can be the most cost-effective vacuum pumps available. The energy cost component of vacuum pumps can be as much as 90% of

the lifecycle cost, so it is possible to recoup the initial investment in energy savings very quickly," he advises.

"At the heart of a GHS vacuum pump is a pair of the same Airtec screws used in our high-end compressors. Along with best in class IE3 motors and a state-of-the-art and patented inlet valve, these are, we believe, the best vacuum pump available," he suggests.

He also lifts out reliability and service as core features: "Smart link options can be used to continuously monitor all the internal parameters of the pump and these can be sent via a GSM network to the operator or to Atlas Copco technicians, by email or by SMS.

"On the control side, the very latest ESv central controllers are available to control up to six Atlas Copco compressors – and these can be a mixture of VSD-controlled or fixed speed pumps. We also offer our Multi Pump controller, which can also control up to six vacuum pumps, but these do not all need to be Atlas Copco pumps. This means, for example, that a controller and one VSD pump, can be added to an existing vacuum pump network to achieve accurate demand following and massive energy savings," Brits points out.

### The broadest range

As well as its flagship GHS range of oil-sealed screw vacuum pumps, Atlas Copco also offers oil-sealed vane, dry vane and dry contact-free claw systems as well as liquid ring vacuum pumps. "We also have a full range of steam ejectors," says Brits. "We are a big player, capable of finding the best-fit solution for almost any application, from rough to ultra-high vacuum," Brits adds.

He also lifts out a new financing option called operational rental: "This is a long term rental option that takes away the 'pain' of rais-



ing capital to buy one of our vacuum pumps. We have partnered with a finance company willing buy the pump from us to lease to an operator. For a five-year contract, for example, the operator will pay a monthly rental fee for the duration of the contract. After five years of payments, for an additional one-month instalment, the pump can be transferred onto the company's books as a fully depreciated asset.

"This means that the pump can be funded as an operational expense for the five-year contract term. For pumps that are consuming energy 24/7, the cost savings in energy alone can often cover the full rental cost, which effectively makes the pump free to the operator, which makes operational rental an excellent option," Brits suggests.

"Atlas Copco vacuum pump expertise is already well-established in global markets. We have the best technologies available and a history of success. In Africa, though, customers do not always make the best technology choices, which often leads to higher ownership costs.

"By right sizing and choosing the best available match for the applications, along with our new financial options, we can help to make businesses all over Africa much more successful," Kerfali concludes. □

## Festoon systems, the lifeblood of bulk materials handling

Festoon systems are the lifeblood of mobile electric bulk materials handling machinery, feeding energy, data, air or fluids to these machines to keep them moving. As operations such as open cast and underground mines, quarries, stockyards, and ports greatly depend on the reliable operation of these machines, equipment longevity, maximum uptime and high productivity levels are fundamental to sustainable production and subsequently profitability.

“No matter how extreme and arduous the conditions, it is paramount that festoon systems maintain a reliable,

efficient, seamless and uninterrupted feed to machinery at all cost,” states Powermite marketing director, Donovan Marks. “Our specialised festoon systems set the benchmark in quality and rugged reliability because there can simply be no compromise.”

Powermite is part of the Hudaco Group and has been a specialist supplier to local industry of electrical and mechanical equipment for moving machinery for close on 50 years. In partnership with French multinational, Delachaux and its Conductix-Wampfler operation, Powermite’s materials handling division has been distributing Conductix festoon systems, cable reeling drums (CRDs) and slip-ring housings to the Southern African mining and industry for over four decades.

“Drawing on Powermite and Conductix-Wampfler’s combined experience in electrification systems of over a century, the modular design of our light, medium and heavy duty festoon systems incorporates the latest state-of-the-art,

world-class technology,” continues Marks. “Benefits delivered to customers and end-users include above-average operational life, easy installation, uncomplicated operation and cost-effective maintenance with subsequent lowest possible operational and ownership costs and rapid return on investment.”

The design and correct alignment of the cable significantly influences the performance of energy and data transmission. The compact, rugged and reliable custom-made Powermite/Conductix-Wampfler cable carriers on the festoon systems effectively and efficiently handle and protect flat and round power/data cables that transfer electrical energy and data to machinery.

The Powermite/Conductix festooning range presents an extensive array of configurations for straight runs, bends and circular configurations, making these feeding systems ideally suited for virtually any type of moving equipment, including: bulk material conveyors, stackers, reclaimers, travelling hoppers, rail car and dumpers; plating lines; water treatment and car wash systems that operate in mines; steel mills; container handling and ship-to-shore power supplies; power plants; airports, warehouses; and automotive facilities.

[www.powermite.co.za](http://www.powermite.co.za)



The Powermite/Conductix festooning range presents an extensive array of configurations for straight runs, bends and circular configurations, making these feeding systems ideally suited for virtually any type of moving equipment.

## Graduate skills development programme

Graduates are finding it increasingly difficult to get into the job market, not only due to job scarcity but also because companies are often not keen to employ graduates straight from universities or colleges because of their lack of work experience. “Many companies in South Africa prefer to employ experienced graduates as they are simply not prepared to invest in training, an expensive and time intensive exercise,” says Siphindile Madonsela, a director at thyssenkrupp Industrial Solutions South Africa and the head of Human Resources.

As graduates cannot compete with people with both a tertiary education and job experience they often remain unemployed, unable to earn a living, build a career and make a positive contribution to the South African economy. Recognising the gravity of the current situation, thyssenkrupp Industrial Solutions took the decision to implement a graduate programme in late 2016.

The programme has officially kicked off and 15 graduates straight out of tertiary education are now employed by thyssenkrupp and are being given 12-months of training. “As far as possible, we have tried to place the graduates in divisions that match their line of study,” affirms Siphindile. The graduates will each spend the full period in the department to which they have been assigned to ensure that they receive thorough training and have complete understanding of that particular area.

Although thyssenkrupp has successfully employed graduates in the past, Siphindile says that it is the first time that thyssenkrupp has undertaken this type of structured initiative in South Africa. “It is the

duty of every company to be progressive on the skills development front. We are very excited about this programme and believe that it will add value and present a win-win not only for thyssenkrupp but also for the country as a whole. Although the graduates add to our staff complement they do not add to the company’s head count. While they are learning and gaining experience the graduates are in turn assisting us with projects.”

[www.thyssenkrupp-industrial-solutions.co.za](http://www.thyssenkrupp-industrial-solutions.co.za)



Graduates participating in the thyssenkrupp programme. From left to right: Kethu Nkwanyana, Yastira Singh, Zakithi Chili, Kamogelo Molokwane and Johannes Magomane.



## Industrial process measuring technology

KROHNE is a full-service provider for process measuring technology for the measurement of flow, mass flow, level, pressure and temperature as well as analytical tasks. Founded in 1921 and headquartered in Duisburg, Germany, the company employs over 3 500 people all over the world and is present on all continents.

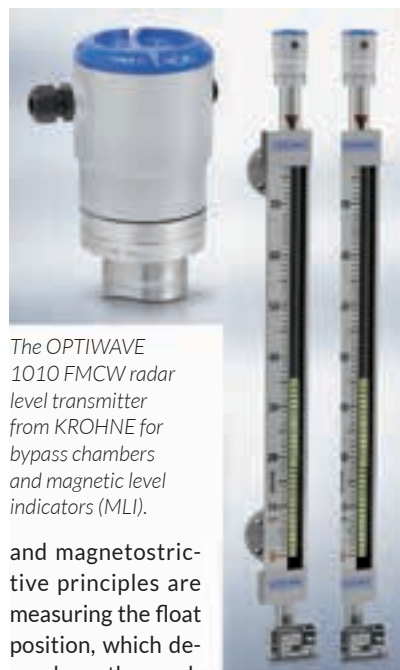
With OPTIWAVE 1010, KROHNE introduces a new radar level transmitter for bypass chambers and magnetic level indicators. The 2-wire FMCW radar transmitter is designed as a cost-effective solution for the continuous level measurement of liquids in bypass applications in various industries, such as chemical, power, water and wastewater, and automotive.

The new KROHNE FMCW radar level transmitter features: continuous measurement of liquids with no minimum dielectric constant necessary when used with a float; direct and accurate measure-

ment of level in bypass chambers; and a dual process seal system for maximum safety and removal of converters under process conditions.

The OPTIWAVE 1010 can be also combined with the KROHNE BM 26 Advanced bypass chambers and magnetic level indicators (MLI), thereby adding 4.0 to 20 mA HART outputs to the mechanical devices. The combinations can be conveniently ordered as a whole, for example, the BM 26 W1010 (OPTIWAVE 1010) welded to the BM 26 Advanced. Alternatively, it can be welded onto any bypass chamber with an internal diameter of 38 to 56 mm.

OPTIWAVE 1010 is competitively priced to replace reed chains, magnetostrictive and simple TDR transmitters that are typically used with bypass chambers or MLIs. In addition to a measuring accuracy of  $\pm 5.0$  mm, the FMCW principle offers a much better overall accuracy in bypass applications: while reed chain



The OPTIWAVE 1010 FMCW radar level transmitter from KROHNE for bypass chambers and magnetic level indicators (MLI).

and magnetostrictive principles are measuring the float position, which depends on the product density, the FMCW radar directly measures the liquid surface.

[www.krohne.com](http://www.krohne.com)

## Altair's 'Boeing Performance Excellence' award

Altair's product development services division, Altair ProductDesign, is honoured to have received a 2016 Boeing Performance Excellence Award. The Boeing Company issues the award annually to recognise suppliers who have achieved superior performance. To qualify for the award, Altair maintained a silver composite performance rating for each month of the 12-month performance period, from October 1, 2015, to September 30, 2016. Altair has received this award for outstanding achievement for the fourth year in a row and for the fifth time in the last seven years.

Mak Gilbert, programme manager at Altair ProductDesign, said: "We truly value Boeing's appreciation and recognition of the consistently smart, hard work our engineers conduct daily to support their design of lightweight, high performance aircraft."

The Altair ProductDesign approach to aerospace design includes an aggressive application of simulation technologies upfront in the development process. This 'Simulation Driven Innovation' philosophy allows Boeing to find the optimal balance between weight, performance and cost for products being developed and results in a programme with reduced risk and shorter cycle times to deliver an aircraft, helicopter or spacecraft that meets functional attributes and mass targets on time.

"We are delighted to have been chosen once again by Boeing. We strive to help

Boeing produce great products that are engineered for performance, efficiency, and safety. This award is an outstanding recognition of the exceptional Altair engineers that support Boeing engineering goals and objectives," said Brett Chouinard, COO, Altair.

[www.altairproductdesign.com](http://www.altairproductdesign.com)

Altair ProductDesign team members received a 2016 Boeing Performance Excellence Award.



## Bearing re-lubrication: a misunderstood task

One of the biggest factors in bearing failure is over-greasing and not under-greasing as is commonly thought. Martec's Ultrasound principal, SDT International, has therefore recently announced its latest innovation in ultrasound technology – LUBExpert®, an on-board lubrication and greasing assistant that uses ultrasound technology. In principle, the system incorporates clever algorithms that guide maintenance technicians in applying the correct dose of grease to the bearings.

The device monitors each grease application and its effect on bearing friction and temperature. The status of 'good', 'bad' or 'suspect' are logged back to the software to flag a follow-up. Ultranalysis Suite (UAS) software powers the data management, setting lubrication schedules based on the status of each bearing.

This continuous monitoring of friction

levels can ensure perfect lubrication each and every time to extend bearing life. It is a unique solution to the over greasing of bearings resulting in better planning of maintenance schedules and optimal lubrication parameters across all assets. In addition, the consumption of grease can be reduced by as much as 95%.

LUBExpert comes as a standalone solution or an upgrade kit for the SDT270, which is also available from Martec. [www.martec.co.za](http://www.martec.co.za)



LUBExpert® is an on-board lubrication and greasing assistant that uses ultrasound technology.



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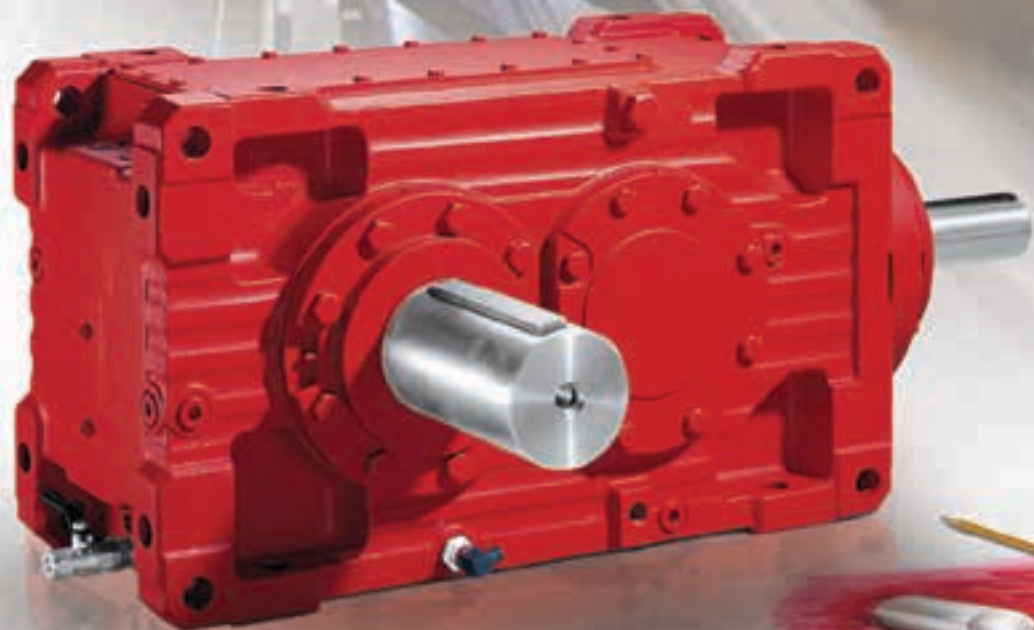
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SEW-EURODRIVE offers innovative drive solutions for all applications in the mining industry.

All SEW-EURODRIVE products and systems make the best use of the space available around the machine and ensure great flexibility and reliability. Minimum maintenance and simple operation ensure that you will operate machines and equipment efficiently from the very beginning.

Thanks to the modular design and countless combination options, all drive engineering components can be replaced quickly, if the need arises. From gravel mining to the excavation of gold, platinum, coal and diamonds – we put the drive into all facets of the mining industry.

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## Falk grid couplings for reliable performance

BMG's heavy industrial Rexnord Falk Steelflex® couplings are known globally for highly efficient and reliable performance, even in arduous applications.



*BMG's heavy industrial Rexnord Falk Steelflex couplings are known globally for highly efficient and reliable performance, even in arduous applications.*

"Falk Steelflex couplings have also been proven to minimise downtime – an important factor in determining the total cost of ownership," says Carlo Beukes, general manager, power transmission, BMG. "Couplings are put under enormous pressure from high impact loads on conveyors, shredders and mixers in harsh operating environments. Also, vibratory loads on high speed applications, such as pumps or compressors can cause the breakdown of couplings."

BMG's Falk Steelflex grid couplings reduce the impact of high impact loads on equipment by up to 30%. These couplings have a unique 'replace in place' design that eliminates the need to remove or reposition hubs or re-align shafts, which would be required with gear couplings and many elastomer designs. This feature significantly reduces element change-out time.

These couplings also offer equipment protection against shaft misalignment. The grid, which is quench and tempered, is free to rock, pivot and float within the hub teeth. This means misalignment capacity is provided, without producing detrimental bearing side loads created by conventional couplings.

When subjected to normal shock or vibratory loads, the grid coupling torsionally deflects. These couplings offer enhanced vibration damping and reduce peak torque by about 30%, also reducing wear on connected equipment components. The couplings act as a shock absorber for rotary motion, relying on the predictable resilience of the steel grid for torsional flexibility.

The Falk grid range is available in 25 sizes with various bore, speed and torque capacities. There are 11 models available, including high speed, spacer, flywheel, brake and controlled torque. They have a maximum bore of 508 mm, a maximum torque capacity of 932 000 Nm and speeds of up to 10 000 rpm, depending on the coupling model and size.

[www.bmgworld.net](http://www.bmgworld.net)

## Optical encoder for speed regulation

The new Hengstler Acuro® AX73 is a class-leading optical encoder that offers smooth speed regulation with high levels of precision. Its compact dimensions make it suitable for installation in areas where there are space constraints.



Available from the official Hengstler distributor for Southern Africa, Countapulse Controls, this absolute rotary encoder is ideal for ATEX-rated applications. The Acuro AX73 encoder carries ATEX and IEC Ex certification for gas and dust explosion proof requirements.

This advanced optical encoder offers benefits for a myriad of applications including winches, cranes, drills and other oil and gas industry equipment, as well as in paint plants, petrochemical facilities, bottling plants and grain mills.

[www.countapulse.co.za](http://www.countapulse.co.za)



## fact

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# Bloodhound: an engineering

At the first African Altair Technology Conference (ATCx) held at River Meadow Manor, Irene, Gauteng on 28 March 2017, Christopher Maxwell from Bloodhound SSC presented some of the technology behind the car being developed to break the land speed record – by breaching the 1 000 mph benchmark – and Altair’s involvement with the project.

**L**ate in 2018, the team behind the Bloodhound supersonic car (SSC) will attempt to set its first World Land Speed Record by travelling at over 763.035 mph or 1 227.985 km/h, a benchmark set over twenty years ago. The attempt is to take place on the Hakskeen Pan in the Northern Cape of South Africa, initially with a world record speed of 800 mph being targeted.

The ultimate goal for the team, which is being led by the past and the current world land speed record holder Richard Noble and Wing Commander Andy Green, is to break the 1 000 mph mark, or 1 600 km/h – with Andy Green in the driving seat.

The Bloodhound SSC is 13.5 m long and 4.5 m high. It produces a total of just under 1.0 MW of power (127 000 hp), weighs 7 500 kg and is designed for a top speed of 1 690 km/h, approaching Mach 1.4.

Less than half of its thrust is provided by a Eurojet EJ200, a military turbofan used by the Eurofighter Typhoon. “Air is pumped into the inlet pipe of the EJ200 at 700 km/h to start up the turbines. When running, the air flowing over the monocoque of the car is aerodynamically slowed down before reaching the intake duct so that the 9:1 thrust to weight ratio can be generated on combustion,” explains Maxwell, adding that the EJ200 takes the car up to about 1 300 km/h.

From there, a hybrid rocket engine from the Norwegian aerospace and defence company, Nammo, will kick in to push the car’s speed over the final hurdle. The Nammo hybrid rocket is designed to house high-test hydrogen peroxide (HTP) as the oxidiser and hydroxyl terminated poly-butadiene (HTPB) as the fuel grain.

Liquid HTP is pumped at roughly 40 litres per second through a silver-plated catalyst pack at extremely high temperature and pressure (around 70 bar). The catalyst pack causes the peroxide ( $H_2O_2$ ) to decompose into steam ( $H_2O$ ) and oxygen ( $O_2$ ), which is released at 600 °C into the combustion chamber.

The  $O_2$  ignites the synthetic rubber creating very hot combustion gases (3 000 °C) at high pressure. The gases are forced out through a nozzle to produce lower pressure at high velocity, which creates the rocket’s thrust.

A cluster of four Nammo rockets was chosen for the final design. “Initially, the rocket engine was placed above the EJ200, but this caused unequal down force into the ground. A suggestion by a nine-year old primary school learner, however, to put the rocket engine below the jet engine, was used to resolve this problem,” notes Maxwell, by way of emphasising the value of the educational aspects of the Bloodhound programme.

An auxiliary power unit – a 550 bhp Jaguar Supercharged V8 engine – is also required to pump the HTP from the fuel tanks into the hybrid rocket engine. The Jaguar engine has to sit alongside to the HTP tank, but it is vital that the heat from the engine doesn’t transfer to the HTP itself, which could cause it to explode. The engine’s exhaust is, therefore, covered with a ceramic coating that reduces its surface temperature by 30%.

## Optimising the air brakes with HyperMesh and HyperWorks

The Bloodhound will cover the measure mile (1.6 km) record segment in 3.6 seconds. It then

needs to be stopped within the confines of the 19.3 km test track. Aerodynamic drag will first slow the car down to about 1 300 km/h. Then, two ram-actuated airbrakes, one on each side of the car, will open outward from the car’s body. A parachute is then deployed to provide increased drag. These are designed to slow the car to 300 km/h, so that the wheel brakes can be safely engaged.

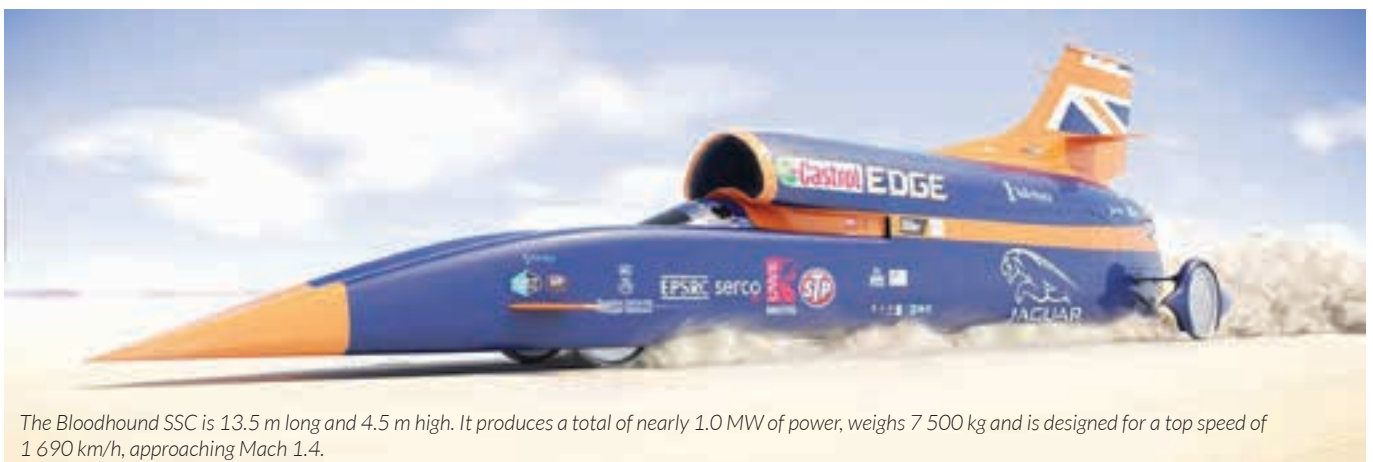
Because of the position of the airbrakes, their actuator arms and door hinges could be no larger than 0.6 m<sup>2</sup> and no thicker than 50 mm. A door machined from a single piece of aluminium and a composite door structure were considered.

The material used had to exhibit a minimum first natural frequency of at least 45 Hz and had to withstand aerodynamic loading when deployed at speed, without excessive deflection or flapping. Modelling and finite element analysis (FEA) – using HyperMesh and HyperWorks from Altair Engineering – were used to accurately represent the stiffness of the entire assembly during modal analysis.

The analysis determined that a hybrid ‘door’ construction with an aluminium honeycomb core sandwiched between carbon fibre face sheets was the optimal solution. The resulting doors weigh only 19 kg each, compared to 70 kg for the fully aluminium versions.

## The fastest wheels in history

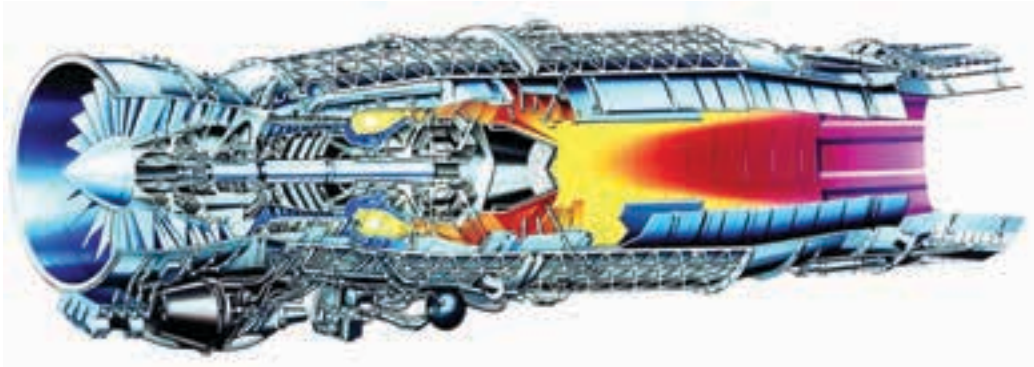
Spin tests on Bloodhound’s wheels, carried out at Rolls-Royce’s test facility in Derby, saw the wheels successfully spun to 10 429 rpm. The results were satisfyingly similar to the predictions calculated using



The Bloodhound SSC is 13.5 m long and 4.5 m high. It produces a total of nearly 1.0 MW of power, weighs 7 500 kg and is designed for a top speed of 1 690 km/h, approaching Mach 1.4.



# and educational adventure



About half of its thrust is provided by a Eurojet EJ200, a military turbofan used by the Eurofighter Typhoon.

Altair's Hyperworks simulation software. The expansion of the wheel's 902.6 mm diameter by 1.6 mm was as expected, as was the 'dishing' caused by the variation in expansion rates between the wheel's aerospace grade aluminium (Al 7037) and its steel hub.

Design tweaks earlier in the process ensured that these deflections would fall well within acceptable parameters. Vibration frequencies were also "pretty damned close" to those predicted, according to Bloodhound's Lead Stress Analyst, Roland Dennison.

## The goat's head

Another major piece of work recently completed was the front suspension assembly, now known as the 'goat's head'. This is an aluminium structure that supports the front wheels, suspension and steering and must be able to carry loads of up to 300 kN.

The goat's head structure has to be both light and hugely strong, and was designed using Altair's topological optimisation software, a software technique that starts with a solid block of virtual metal and removes every possible bit of material that is not absolutely necessary. The goat's head look was a result of this process, done using Altair HyperWorks' OptiStruct design-synthesis technology.

Following topology optimisation, the component was machined from a solid aluminium billet on a 5-axis machine at AMRC Sheffield. The process took, in total, 97 days of machining, which reduced the goat's head weight to just 68 kg, with 856 kg of trimmings being recycled.

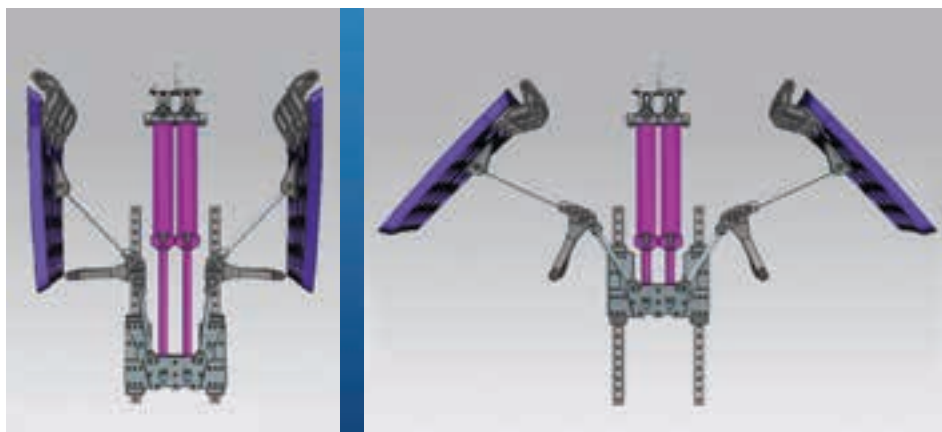
## Why build a 1 690 km/h car?

Showing a picture of the late Neil Armstrong with Andy Green, Maxwell says that both of these legends are champions of the educational side of this project. "Our core aim is to create a surge in the popularity of science, mathematics, engineering and technology," he says.

"We have an education programme involving over 10 000 schools participating in designing rocket cars that are tested in school playgrounds at speeds of up to 600 km/h – and we have primary school students using CAD/CAM to build these vehicles," he says.

"Following the Apollo Space Programme in the 1960s, there was a massive spike in the number of physics PhDs. This was known as the Apollo effect," Maxwell points out.

"We aim to do similarly via the Bloodhound effect. We hope to inspire a new generation of people to come through the ranks, not only at university level but across the spectrum of technological careers," he concludes. □



From about 1 300 km/h, two ram-actuated airbrakes – modelled and designed using HyperMesh and HyperWorks from Altair Engineering – will open outward from the car's body. These will slow the car to 300 km/h before the wheel brakes can be safely engaged.

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# Cassini's last brush with Titan and final Saturn orbits

NASA's Cassini spacecraft recently had its last close brush with Saturn's hazy moon Titan and has begun its final set of 22 orbits around the ringed planet.

**C**assini made its 127<sup>th</sup> and final close approach to Titan on April 21 at 4.08 pm (UTC) and on April 22, passed at an altitude of about 979 km above the moon's surface, transmitting images and other data to Earth following the encounter.

During the last week of April 2017, scientists looked at their final set of new radar images of the hydrocarbon seas and lakes that spread across Titan's north polar region. The planned imaging coverage included a region previously seen by Cassini's imaging cameras, but not by radar. The radar team also used the new data to probe the depths and compositions of some of Titan's small lakes for the first (and last) time, and to look for further evidence of the evolving feature researchers dubbed the 'magic island'.

"Cassini's up-close exploration of Titan is now behind us, but the rich volume of data the spacecraft has collected will fuel scientific

study for decades to come," said Linda Spilker, the mission's project scientist at NASA's Jet Propulsion Laboratory in Pasadena, California.

## The Grand Finale

The flyby also put Cassini on course for its dramatic last act, known as the Grand Finale. As the spacecraft passed over Titan, the moon's gravity bent its path, reshaping the robotic probe's orbit so that, instead of passing just outside Saturn's main rings, Cassini began a series of 22 dives between the rings and the planet. The mission will conclude with a science-rich plunge into Saturn's atmosphere on September 15.

"With this flyby we're committed to the Grand Finale," said Earl Maize, Cassini project manager at JPL. "The spacecraft is now on a ballistic path, so that even if we were to forgo future small course adjustments using thrusters, we would still enter Saturn's atmosphere on September 15 no matter what."

Cassini received a large increase in velocity of precisely 860.5 m/s with respect to Saturn from the close encounter with Titan.

After buzzing Titan, Cassini coasted onward, reaching the farthest point in its orbital path around Saturn at 1:46 pm (UTC) on April 22. This point, called 'apoapse', is where each new Cassini lap around Saturn begins. Technically, Cassini began its Grand Finale orbits at this time, but since the excitement of the finale began in earnest on April 26 with the first ultra-close dive past Saturn, the mission celebrated the latter milestone as the formal beginning of the finale.

The spacecraft was out of contact during

the dive and for about a day while it made observations from close to the planet. Images and other data began flowing in shortly after communication was re-established on April 27.

A new narrated, 360° animated video gives viewers a sense of what it might be like to fly alongside Cassini as it makes one of its Grand Finale dives.

The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington. JPL designed, developed and assembled the Cassini orbiter.

[saturn.jpl.nasa.gov/grandfinale](http://saturn.jpl.nasa.gov/grandfinale)

## Industry diary

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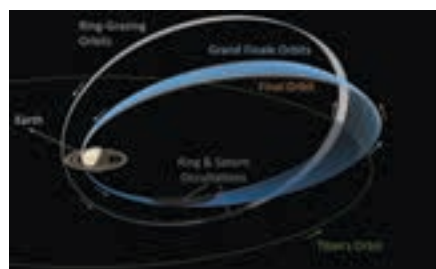
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A graphic illustrating Cassini's flight path during the final two phases of its mission: the 20 ring-grazing orbits (grey); the 22 grand finale orbits (blue); and the final partial orbit (orange). Cassini's flyby of Titan in late April 2017 caused its path to jump over the rings and pass through the gap just above Saturn. NASA/JPL-Caltech

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## Index to advertisers

Africa Automation Fair .....	17
Air Liquide Industries .....	3
Atlas Copco .....	20
Bearings International.....	10
Endress + Hauser.....	28
ERWAT.....	38
Flexicon .....	OBC
GEMÜ Valves Africa.....	OFC, 15
Hahn & Hahn.....	IFC
Kansai Plascon.....	30
Krohne .....	45
KZN Industrial Technology Exhibition.....	33
Martec.....	IBC
Powermite.....	25
SEW Eurodrive .....	44
SMC Pneumatics.....	34, 47
Thermaspray .....	31
ThyssenKrupp.....	22
Wearcheck.....	13

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