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### FEATURES

- Petrochemicals
- Pumps and valves
- Design and materials of construction
- Waste management

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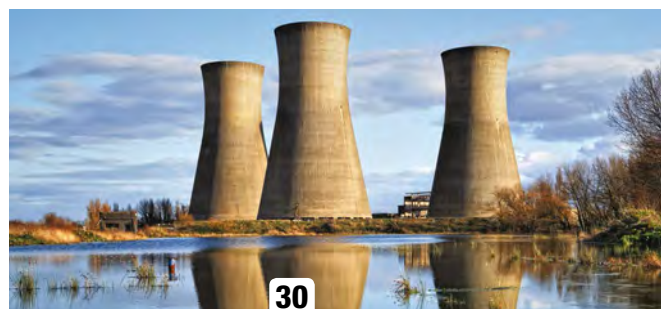
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## Economic growth alone is not enough to face Africa's challenges

by Helen Clark, Administrator of the United Nations Development Programme

**A**frica has recorded impressive economic growth over the last decade; its ability to address emerging challenges will be strengthened by investing in citizens' health, education and participation in society, said Helen Clark, the UN's development chief, at the opening of the "International Conference on the Emergence of Africa", organised by the Ivorian government in association with UNDP, in Abidjan, the capital of Cote d'Ivoire earlier this year.

"There are many reasons to be optimistic about Africa," she said. "Steadily increasing revenues have created more opportunities to transform economies and societies, clearing the way for an emergent Africa. The goal of emergence must also embrace the pursuit of greater wellbeing."

Helen Clark was speaking with the support of the World Bank and the African Development Bank. The event brought together global and regional leaders, experts, and researchers on inclusive social and economic development from around the world; to share lessons learned and challenges in order to support strategies and policies on emergence.

The Abidjan conference was set against the backdrop of increased momentum on the continent towards emergence. Some 30 African countries have included the aim of reaching 'emerging' or 'emerging country' status in their national development strategies. This is also in line with the African Union's Agenda 2063, that provides a pathway to ensure positive socio-economic transformation within the next 50 years, focused on a more peaceful and prosperous continent.

"There is much we can learn from each other about emergence. Through this Conference, we look to build and consolidate lasting partnerships and boost South-South

co-operation. All present can be partners in translating the long-term vision of 'emergence' shared by many African countries into the specific policies and initiatives which will make it happen," she said.

The African Development Bank projects that, by 2050, an 'emergent Africa' would have tripled the continent's share of global GDP, enabling 1.4 billion Africans to be part of a middle class, and reducing tenfold the number of people living in extreme poverty.

"These are exciting prospects," said Helen Clark. "An 'emergent Africa' will ensure that all Africans have the opportunities they need to improve their lives."

She outlined a number of concrete steps leaders could take, including to reduce inequalities, harness the potential of youth, improve livelihoods, maintain ecosystems, and reduce the drivers of conflict and instability.

"Africa has the leadership and it has the vision necessary for emergence," she continued. "With a commitment to inclusive and sustainable growth and governance, a commitment to arrest environmental degradation and build resilience to shocks, with a drive for greater equality and harnessing the full potential of women, youth and indeed of all Africans, emergence will happen. Human and sustainable development will be the winner."

"For me, the goal of emergence is not GDP growth per se: it is the pursuit of greater human health and happiness so that each one of us can fulfil our potential and participate fully in our societies. In so doing we can contribute to building a more peaceful and prosperous continent and world," she concluded.

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## Dewatering pontoons decrease costs and improve efficiencies

**Pontoon or skid-mounted pump sets offer a flexibility not always possible with conventional dewatering solutions.**



**A**s mines seek ways of improving efficiencies, whilst simultaneously reducing operational costs, there is an increased focus on the streamlining of dewatering operations. Dewatering of open pits and slimes dams often poses a challenge in terms of the choice between undertaking civil construction for pump stations or selecting a mobile pontoon or skid-mounted pumping solutions.

Howard Jones, Weir Minerals Africa's Product Manager – Dewatering Africa and Middle East, emphasises that while each application requires a customised approach, the land-based pump station does not always have the same flexibility that pontoon or skid-mounted pump sets would offer. "Conventional dewatering solutions are less effective and require expensive civil works, whereas pontoons are installed at the source making pumping more efficient as the pumps face consistent site and suction conditions."

Another major advantage of pontoon or skid-mounted pumping solution is the ability to migrate the pump to wherever it is needed. The costly and time-consuming alternative would be to develop a new pump station for each location.

He cautions that the determination of the most appropriate solution should be based on accurate information garnered from an on-site inspection, which will determine and assess the specific requirements endemic to the unique challenges posed by each site. He cites factors such as topography, volume of water, quality of water, the total distance to be pumped, the difference in elevation from the start of pumping to the discharge point, the preferred piping material and

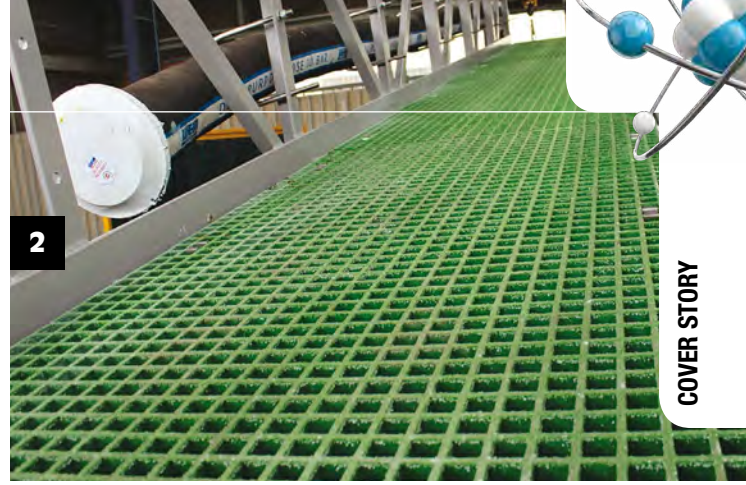
the availability of electricity, as critical to the resolution of the dewatering issues. If there is no electricity on site, then diesel driven options would be considered.

"When you design a suitable dewatering system it will also be dependent on the specific mining methodology. An example would be in a mineral sands application where the pond is continuously moving as mining operations take place. This scenario necessitates a system that can be easily manoeuvred, yet is robust enough to withstand the rigorous conditions in which it will be required to work," says Jones.

Weir Minerals operates global design centres in a number of countries, South Africa being one of three that focuses on pontoon and structural design specifically, thus providing the South African operation with immediate access to a database of information and references that can be modified and used for local conditions. "This level of international expertise and experience in a wide range of commodity sectors and differing applications allows us to provide best practice solutions. We are thereby able to offer pumping solutions that are engineered for the application at hand and which abide by international engineering codes. This ensures the structural integrity of this equipment as well as adherence to the health and safety requirements around its operation," Jones points out.

The selection of the pumping unit could include any of the well-established Weir Minerals brands such as Warman® and Multiflo® and could vary from pure dewatering or dirty water pumps to submersible dirty water pumps, as well as heavy duty slurry submersible and end suction products.

The majority of the pumps supplied are manufactured lo-



cally at Weir Minerals Africa's facilities, allowing for ready accessibility to spare parts and components through the Weir Minerals Africa sales and service centre network. Supervision of the installation and commissioning of the pumping solution is undertaken by Weir Minerals Africa to ensure that the exact specifications are met.

Jones explains that Multiflo® pontoons are constructed with integral access walkways which could either be fixed to the bank or floating. The floating walkway holds the cable and piping from the docking station to the shore and provides ready access to the pumps for inspection or regular maintenance. The pipes comprise Linatex® rubber hoses which are also locally manufactured by Weir Minerals Africa and offer the customer extended wear life because of the specialised rubber compounds used in their manufacture.

Pumps on Multiflo® pontoons often need to be impervious to corrosion and this should be taken into account when selecting materials of construction. Weir Minerals uses a variety of construction materials including complete steel pontoon barges to linear low density polyethylene flotation devices with steel frames for lighter applications, where mobility from one pond to another is required. These designs can handle most Weir Minerals pump offerings, with a load bearing capacity from 500 kg to 10 t, including the structure. The steel-hulled heavy

duty pontoons can easily have a total mass of 30 t.

Versatility and flexibility in application is the hallmark of all Weir Minerals Africa solutions. In addition to a standard range of fully engineered pontoons, the company also designs and develops bespoke engineered solutions which can accommodate extended walkways or larger barges for acid mine drainage applications of large ponds, dams and alluvial sea applications, as well as situations where harbour mouths or tailings dams require desilting. Units for larger applications can also include workshops and sleeping quarters for personnel, should the site be large enough, as is the case in the Canadian market.

Service level agreements that include ongoing maintenance of the pump system by the company's technical personnel, are available to provide the seamless operation of the dewatering function and the elimination of unplanned downtime. "Ultimately, our solutions are based on providing the customer with increased productivity through maximised uptime and this hinges on the expert knowledge and experience we bring to the table, combined with the high quality levels and robustness of our solutions," Jones concludes.

**For more information contact** Rene Calitz on tel: +27 11 929 2622; email: r.calitz@weirminerals.com; or go to [www.weirminerals.com](http://www.weirminerals.com) ■



1. A trailer-mounted diesel-driven Warman DWU pump set.
2. Linatex dual purpose hose assembled onto a fixed pontoon walkway.
3. One of two Warman DWU 125 dewatering pumps mounted to a pontoon and walkway during assembly phase.
4. The dewatering team work closely with suppliers to ensure the unique requirements of the customer are met.

# WirelessHART automates cooling tower operations

by Nikki Bishop and Jason Sprayberry, Emerson Process Management

**Wireless instrumentation and an asset management system reduce chemical, maintenance, lost production and repair costs.**

Cooling towers are heat removal devices used to transfer process waste heat to the atmosphere. They vary in size and in the amount of instrumentation to monitor process variables. Accurate, reliable measurements are critical in calculating cooling tower efficiency, and are important for controlling blow-down and makeup flows, as well as the pH of the water to minimize fouling of the equipment.

Cooling tower instrumentation in many refineries is often old, with many measuring devices out of service (Figure 1). Measurements are difficult because the process environment is corrosive to wiring, mainly due to chemical vapours. As a result, these areas can be poorly instrumented and poorly controlled. Consequently, control and monitoring are poor, operations are inefficient, and the towers require a great deal of maintenance and manual operator interaction.

This article discusses how to use WirelessHART instrumentation and asset management software to automate cooling towers by obtaining the information needed for more reliable and efficient operation.

## Cooling tower problems

Large fans generating air flow are the principle heat removal devices in cooling towers. Typically, each process area has a cooling tower, and each tower has six to 12 cells with one or two cooling fans in each cell. These fans are expensive and monitoring is critical to prevent failure. At one refinery, it costs an average of \$1.6 million per fan in maintenance and repair fees when a fan runs to failure.



Refineries naturally do not want the fans to fail, but they also do not want to over-maintain them, as each time maintenance is done on a fan, the entire cell in the cooling tower is shut down.

The most common leading indicator of failure in a cooling tower fan is high vibration of the motor (Figure 2). Fan failure decreases the cooling capacity and efficiency of the tower, and emergency shutdowns due to cooling tower damage can last 4-8 hours, causing a significant loss in revenue.

These fan failures also cause an increase in water consumption, which leads to an increase in the quantity of chemical needed by the cooling tower. Chemical dosing is often provided by an external company, but they frequently do not have the necessary data about the behaviour of each fan or the pH and conductivity measurements, so they can only apply chemicals in relation to water consumption.

Cooling towers are a very tough environment with chemical vapours highly corrosive to wiring, and wired instruments require frequent maintenance. As a result, operators spend a good deal of their time manually gathering process information. At one refinery, operators perform three rounds per day, or 1 095 rounds per year, which calculates to 8 760 hours annually, as rounds take a long time. This is not only time-consuming and unsafe for operators, but also often results in poor readings.

Although excessive maintenance, fan replacements and chemical costs are significant, the biggest problems most refineries face are shutdowns because of equipment failures.





Figure 1: Cooling towers at many refineries have old instrumentation, some of it out of service.

When a cooling tower goes offline it slows production. In some cases it can even cause the refinery to shut down completely.

### Automating cooling towers

On-line measurements are required to provide the data needed to tightly control cooling towers, maintain the assets and prevent over-maintenance. Automated monitoring also prevents failures, thus limiting downtime in each cooling tower section.

Automated monitoring provides better control to improve tower efficiency and minimize water consumption. Having the right data enables proper dosing of the cooling tower water to prevent excess chemical use, and to provide the right water chemistry to avoid fouling and damage to the pipes. Proper dosing also improves cooling tower efficiency as well.

Cooling towers are evaporative coolers and thus are limited by the wet bulb temperature of the cooling air. Wet bulb temperature measures how much water vapour the atmosphere can hold at current weather conditions. A lower wet bulb temperature means drier air and lower cooling tower temperatures. Tower performance is calculated as a function of supply and return water temperature, and wet bulb temperature.

With proper data, the control system can calculate and monitor the cooling tower performance index, saturation index, conductivity, pH, and fan and supply pump health, and take the necessary steps to control the system or instruct maintenance to solve a problem. Typical measurement points

include fan vibration, wet bulb temperature, level of the water supply, pressure and temperature on the water supply and return, and pH of the water supply.

### WirelessHART makes it possible

While it is desirable to make such measurements, the cost of installing and maintaining conventional 4-20 mA wired instrumentation can be prohibitive. As noted above, the process environment around cooling towers is corrosive to wiring, mainly due to chemical vapours. This means extra care must be taken in installing wiring, conduit, cable and intrinsic safety devices in the presence of flammable gases.

In addition, wired instrumentation requires a power supply, I/O cards to accept the signals, a data acquisition system to collect data from multiple sensors, and a means of transmitting the data back to the control system.

WirelessHART instruments, on the other hand, do not require much of this infrastructure. Because WirelessHART devices can be battery-powered, they do not require a power supply, intrinsic safety equipment or any kind of wiring. The transmitters send data wirelessly to a WirelessHART gateway, either directly or through a network of other WirelessHART devices.

To protect the devices from the corrosive atmosphere, pump vibration, flow, temperature, level and pH transmitters can be installed in enclosures mounted near the cooling tower (Figure 3). Gateways can be located close to the cooling tower, but away from the corrosive environment. Wired



Figure 2: Cooling tower fan failures can shut down a process – sometimes an entire refinery.



Figure 3: An enclosure protects WirelessHART transmitters from the corrosive environment near cooling towers.

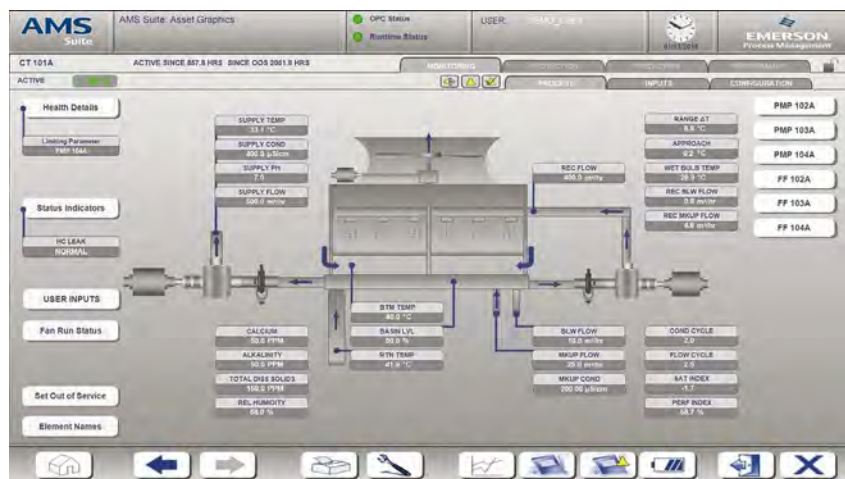


Figure 4: Operators are alerted to cooling tower equipment problems via an AMS Asset Graphics screen.

integration from each gateway into the refinery’s DCS can be done via Modbus or other digital data network, and a backhaul network with 802.11 Wi-Fi radios can provide data integration into local HMIs via OPC.

**Analyzing the data**

The next step in improving cooling tower control is analyzing the data gathered from the wireless transmitters. Various software packages exist for doing so, such as Emerson Process Management’s Essential Cooling Tower Monitoring Solution (EAM) that provides early warning of limited cooling. It also provides diagnostics to help operators spot bearing, lubrication, or alignment problems in cooling tower pumps and fans. Automatic alerts flag personnel to cooling water conditions so they can adjust blowdown rates and minimize the use of water treatment chemicals. This helps refinery operators recognize and prevent cooling failures before they occur.

The EAM software runs as part of Emerson’s AMS Asset Management System. Pre-engineered, ‘plug-and-play’ solutions like EAM analyze process and asset data to determine faults. These solutions also apply statistical analysis to detect meaningful changes. EAM presents this data as overall asset health information via user-friendly operator displays with automatic alerts (Figure 4). This allows refinery operators to:

- Take action based on real-time alerts

- Diagnose root causes
  - Employ predictive maintenance in the cooling towers
  - Prevent devastating failures by heeding early warnings.
- EAM provides early detection of asset health degradation to give a refinery time to perform preventive maintenance. The refinery can bring a spare online before the fan shuts down unexpectedly, avoiding downtime and costly repairs to the fan.

Taking a fan out of service before it fails catastrophically saves repair costs. Instead of \$1,6 million to overhaul a fan that was run to failure, repairs may only cost \$40 000 per fan.

Asset Graphics provide alarms and alerts that otherwise would not be available without a cooling tower expert looking at instrumentation data. Asset Graphics analyzes the data and alerts the operators, who can then call in a cooling tower expert for analysis and to determine a plan of action. This on-line, continuous analysis is vital for early warning in order to avoid shutdowns.

**Dramatic results**

- At one refinery, the savings from using WirelessHART and analytical software was dramatic:
- Rounds took a total of 8 760 hours annually before wireless. That has been reduced to 1 100 hours annually – a savings of 87 % or 7 660 operator hours.
- Better water chemistry reduced chemical costs. That, in



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addition to lower blowdowns (eg, lower water use), reduced chemical costs by 20 % or \$150K/month, saving \$1,8 million/year.

- EAM alerts give early warning of failure, enabling the mechanical department to schedule repairs before they fail, cutting costs by \$4,8 million.
- Reduced process slowdowns from cooling tower cell shutdowns saved, on average, \$350 000 per year in lost production.
- Reduced downtime due to cooling tower failures in the alkylation plant eliminated losses that totaled as much as 2 587 BPD or \$5,9 million.
- Wireless monitoring improved process efficiency of the cooling towers between 10%-15%.

The refinery estimates that the wireless monitoring system for one cooling unit paid for itself in a little over two weeks, and the company owning the refinery is proceeding to install similar systems at other facilities.

Although much of this article dealt with the specific case of cooling towers in refineries, most of the principles discussed apply to any facility with large cooling towers such as power and chemical plants.

**For further information contact** Michael Eksteen at Emerson SA on tel +27 11 451 3700, or email Michael.Eksteen@Emerson.com ■

## Adding value to the African power, oil and gas aftermarket

The recently-established Voith Africa Power, Oil and Gas (POG) Division covers the full scope of maintenance, servicing, upgrades and repairs across Africa. The company has filled a gap in the local market by providing a comprehensive and dedicated aftermarket services offering.

Voith is globally-recognised as the leading OEM for high-speed rotating equipment, including; high-speed gearboxes, fluid couplings, geared fluid couplings, variable speed drives, turbine controls and torque converters.

Voith Africa POG vice president Derain Pillay states that the division boasts global technology and expertise that is customised for local operating conditions. "With our dedicated African presence, qualified experts assist local clients in configuring, operating and maintaining their equipment for each particular application in the most efficient and cost-effective manner," he says.

Pillay adds that the Voith Africa POG division also provides maintenance contracts in order to increase the availability of the equipment, while reducing downtime and unnecessary costs. The division supplies critical spares and skilled service engineers for breakdowns or upgrades upon request.

Pillay highlights the fact that the Africa POG division also has unlimited access to Voith's pool of global resources and expertise. "Should a complex challenge arise

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that the local team is unable to deal with, we will endeavour to send an international expert onsite to resolve this.”

All newer-generation power stations in South Africa rely on Voith’s high-speed rotating components to operate. More recently, the Africa POG division was commissioned to custom design a total of 36 Vorecon variable speed planetary gears+ for use in coal-fired power plants. The enormous, yet intricately-designed Vorecon weigh more than 60 tons each when filled with oil, and assist in transmitting around 20 MW of power individually.

Voith Africa POG division focuses on the entire Africa region. Pillay notes that key markets that have been identified for measurable growth are Angola, Algeria, Kenya and Nigeria, in particular. “We are currently supplying a large amount of equipment to an offshore floating production, storage and offloading (FPSO) oil facility in Angola, in addition to power plants and oil pumping facilities in Kenya,” he concludes.

**For more information contact** Terry-Lynn McIntosh on tel: +27 11 418 4000 or email Terry.McIntosh@voith.com ■

## Petro.t.ex Exhibition and Conference 2015

The biennial Petro.t.ex Exhibition and Conference is once again taking place (Gallagher Conference Centre, Midrand, Gauteng); the conference on 20 May 2015 and the Expo from 20 - 22 May 2015. This event is one of the main opportunities industry leaders, government and interested parties have to examine and discuss the latest trends in equipment, policy and service-related issues all under a single convenient banner, alongside and part of the SA Industry & Technology Fair.

A broad series of topics will be covered at the conference. Avhaphani Tshifularo, Executive Director of the South African Petroleum Industry Association (SAPIA), will give the keynote address, entitled ‘The Overall Status of The Liquid Fuel Industry in South Africa’. SAPIA represents the collective interests of the South African petroleum industry with members being BP, Chevron, Engen, Sasol, Shell, Total and PetroSA.

Topics to be covered at the conference include ‘The Role of Independent Storage Suppliers’, alternate fuels, ‘Adjustment to Economy regarding the falling Oil Price’, ‘Maximising the sustainable development opportunity in SA’ and ‘Fuel Security for SA and the Hijacking of Tankers’, as well as climate change, environmental issues, and clean fuels.

A networking cocktail event will take place in the expo area after the event.

**For bookings and more information contact** Bette McNaughton on +27 (0) 11 234 1196 or email: events@ingadaevents.co.za. ■



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## Lab capacity boosted with new equipment

WearCheck, a leading African condition monitoring company, recently invested over R2 million on new laboratory equipment. The shopping list included a new Gas Chromatograph (GC), a new Inductively Coupled Plasma spectrometer (ICP) and a new High Performance Liquid Chromatograph (HPLC).

All the new equipment uses the latest technology to ensure WearCheck's legacy of accuracy and reliability of sample results and diagnoses, said a company spokesperson.

WearCheck serves the earthmoving, industrial, transport, shipping, aircraft and electrical industries through the scientific analysis of used oil from mechanical and electrical systems. Additional services include the analysis of fuels, transformer oils, coolants, greases and filters. The new laboratory equipment will benefit customers across all industries, and particularly transformer analysis.

An expansive network now includes ten WearCheck laboratories spanning the continent and beyond, including Gauteng, KwaZulu-Natal, Mpumalanga Province, and international laboratories in India, Dubai, Ghana, Mozambique and Zambia (at Lumwana mine and Kitwe), with a presence in Cape Town, Rustenburg, Steelpoort, Port

Elizabeth, Zimbabwe and Namibia.

ICP spectrometry analysis provides high-speed detection and identification of trace elements at very low concentrations in oil to determine the levels of wear metals, contaminants and oil additives in lubricating oils. The ICP has been installed in WearCheck's Middelburg laboratory.

The HPLC separates compounds within a transformer oil sample, revealing the presence and quantity of trace degradation products, which in turn provide information on the operation of the transformer and whether there has been any breakdown of insulating material.

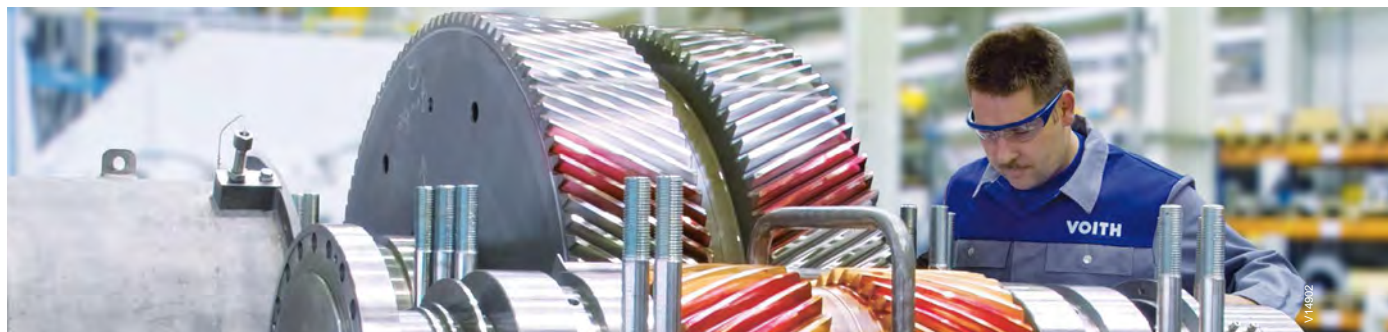
The GC separates and analyses compounds that can be vaporised without decomposition, revealing critical information about the presence of contaminants via the composition of the oil sample. The new GC and the HPLC are in operation in WearCheck's speciality laboratory (WSL) in Johannesburg, and have enabled more samples to be processed in a faster turn-around time.

Managing director Neil Robinson is committed to ongoing investment in new technology. All laboratories are largely automated and integrated with the latest



WearCheck's managing director, Neil Robinson, is confident that WearCheck's ongoing commitment to remain at the forefront of laboratory innovation, will ensure that the company remains at the helm of the condition monitoring industry.

information technology. For more information tel: KwaZulu-Natal head office +27 31 700 5460, email: support@wearcheck.co.za or go to [www.wearcheck.co.za](http://www.wearcheck.co.za) ■



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Engineering Excellence **3**



## Energy-saving potential in high-vacuum brazing furnaces using diffusion pumps

by Uwe Zoellig and Hans-Werner Schweizer both of OerlikonLeybold Vacuum GmbH, Cologne, Germany

**For many years, energy efficiency has been the number-one topic with manufacturers and users of vacuum furnaces for thermal treatment. The search for energy-saving possibilities concentrated mainly on the furnaces themselves and the optimisation of the heat-treatment processes.**

Furnace designs and operating conditions were established and optimised long ago. Measures for heat recovery and other concepts to reduce energy consumption were clearly gained. With the new digital age upon us, however, further investigation into energy-savings possibilities should again be explored.

The vacuum system, as part of the furnace, was often neglected in those efforts to reduce power consumption. Despite this, vacuum pump manufacturers worked diligently on the improvement of energy efficiency for their products. For example, modern screw vacuum pumps have been developed with a focus to reduce their energy consumption down to the level of long-standing oil-sealed rotary-vane or rotary-piston vacuum pumps. Improvements in enhanced robustness along with a marked reduction in maintenance costs were also attainable. In addition, next-generation roots pumps utilise modern built-in motor concepts to improve leak tightness, minimize power consumption and reduce parts wear.

In comparison to the absolute power requirement of a furnace of around 200-800 kW (depending on furnace size), the energy demand of the main fore-vacuum system only represents a small fraction of that consumption. The nominally installed power of a fore-vacuum system is typically in the range of 10-30 kW, while during most operation time, these pumps only require 30-50 % of their nominal power. A realistic power-consumption reduction of between 1-4 kW by optimised pump design does not, therefore, offer



significant savings. Nevertheless, even such small savings add up over the life span of the furnace.

Another vacuum pump technology mostly utilised in brazing furnaces that offers far-higher saving possibilities is the diffusion pump. Although these pumps have the highest power requirement of the entire vacuum pump system, optimisations to higher energy efficiency were completely neglected in the past. Very little development work was invested in this dated technology by pump manufacturers. A diffusion pump with 50 000 litres/sec. nominal suction speed has an installed heater power of 24 kW. Until now, this 24 kW was fully consumed during the entire operation of the pump. An energy-saving potential here would offer much larger cost reductions.

This article will describe measures that can help clearly reduce the power demand of a diffusion pump.

### Working principle

To understand the energy-saving potential, one must first understand how a diffusion pump operates. The main components of diffusion pumps are a cooled pump body with intake and exhaust ports, a system of nozzles and the pump boiler (Figure 1).

The pump fluid contained inside a boiler is heated until it starts boiling. The uprising vapour stream is directed through a nozzle system into the pump body, where a vapour jet with ultrasonic speed is created that is streaming with a specific angle downward.



Image: Bodycote [www.bodycote.com](http://www.bodycote.com)

Loading a vacuum furnace.

Reaching the cooled pump housing, the vaporised pump fluid condenses on the cold wall. The liquid fluid runs downward and returns into the boiler from where it will be evaporated again. Why does this principle pump at all?

Figure 2 shows a detailed view into the pumping mechanism of the diffusion pump. We can see the vapour jet on its way from the jet system toward the water-cooled wall.

The jet consists of 'degassed' fluid vapour, which means it only contains extremely low partial pressure of the gases that should be pumped. The area above the vapour jet, therefore, contains a much higher partial pressure of the gas. Driven by partial-pressure difference, the gas from above diffuses into the jet stream to compensate.

The jet stream will push the gases toward the cooled wall and the next nozzle stage of the pump. Finally reaching the exhaust side of the pump, the gases will be pumped away by the backing pump. The vacuum inside the boiler will ensure that the reboiling fluid will contain the lowest partial-pressure of gases again.

### Energy-saving measures

The following measures have been identified as having the highest influence on the power consumption of a diffusion pump:

1. Pump design features
2. Electronic regulation of heater power
3. Regulation of cooling water
4. Housing insulation

5. Correct heater adjustment according to the selected driving fluid
6. Standby operation/intelligent process management

### Pump design features

It is obvious that the total diffusion pump must already be designed to minimise consumption. To save energy and consumables, modern diffusion pumps are optimised with some design features:

- Heaters are positioned inside the boiler
- Reduction of heat-transfer losses, thereby lowering power demand
- Grooved pump body with built-in cooling-water coils
- Reduction of weight and therefore total energy for initial heating
- Optimisation of contact surface/heat-transfer efficiency, thereby reducing cooling-water demand
- Water-cooled cold-cap baffle at inlet
- Reduction of fluid backstreaming into the vacuum chamber, thereby reducing fluid losses
- Water-cooled fore-vacuum baffle at outlet
- Reduction of fluid losses into the fore-vacuum line

### Electronic regulation of heater power

One general statement to first consider: More heating power does not automatically result in more suction speed!

As previously described, the main driving force for the pumping mechanism is the partial-pressure difference

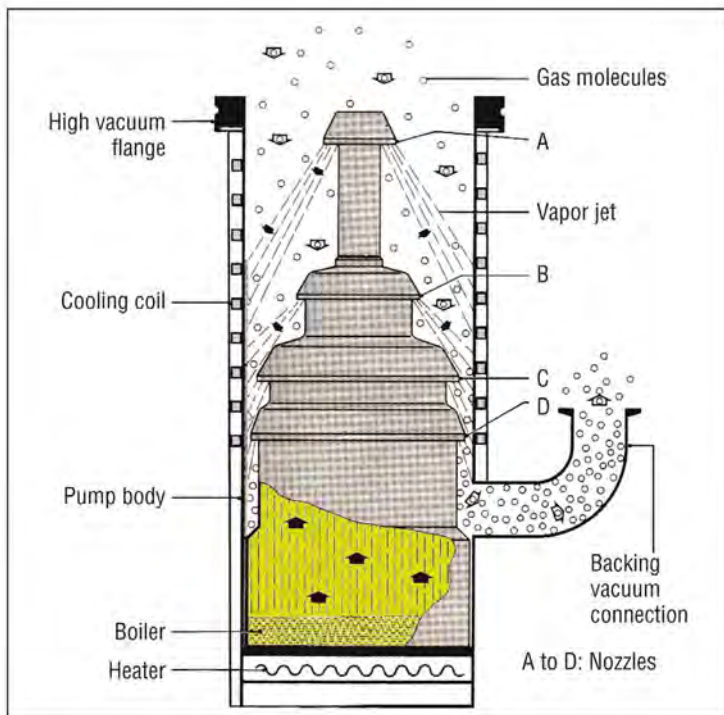


Figure 1: Function principle of a diffusion pump

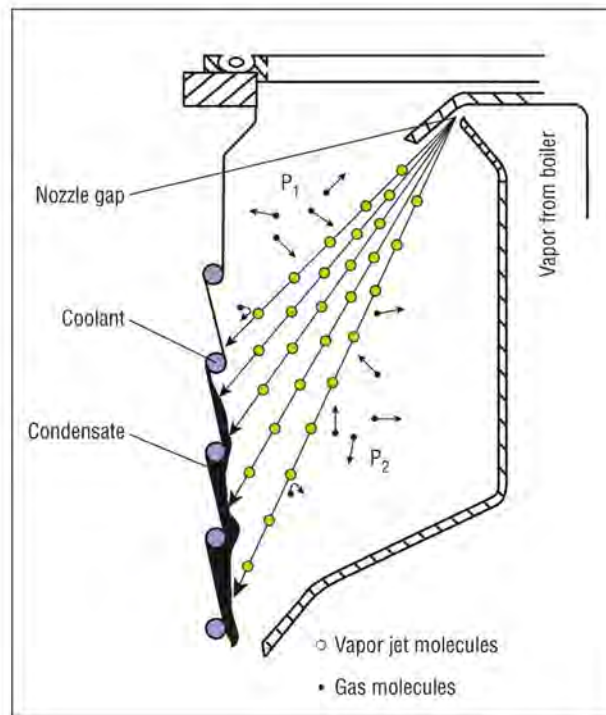


Figure 2: Vapour jet and partial pressure

between the gas entering the pump and the vapour jet. As long as the vapour jet is stable, there is no difference in suction speed independent of more or less vapour streaming toward the cooled walls.

The heaters contained in today's diffusion pumps are typically not regulated at all. The full heater power is required to ensure a short heating-up time and quick availability of the diffusion pump, but after reaching the optimal operation temperature, the full heater power only results in evaporation and degradation of fluid with no increase of the pump's suction speed. Depending on the chosen operation fluid (eg. mineral oil or silicon oil), there are different temperatures that enable the fluid to deliver best performance.

Modern, digital controllers (Figure 4) can be coupled with diffusion pumps and allow for the optimal temperature as the regulation point. A temperature sensor inside the boiler detects the actual temperature. As soon as the actual temperature reaches the optimal level, the heating power will be reduced. This regulation allows a reduction of power consumption in the range of approximately 15-35 %, depending on the chosen fluid. A savings example of 30 % would equate to approximately 7 kW if using a 50 000 litres/sec. pump, which is quite a high value.

To avoid overheating, a maximum fluid temperature is also monitored by the control unit. If this temperature is exceeded, the controller will transfer a warning signal toward the furnace control via its Ethernet or USB interface.

### Regulation of cooling water

The operating principle of the diffusion pump requires a generous cooling of the housing surface because this works as a condenser for the fluid vapour. Approximately 80 % of the heater power will be removed by the water cooling. By combining the diffusion pump with a thermostat valve, depending on water temperature, the cooling-water consumption could be reduced by up to 50-60 % of the standard value.

For further optimisation, the cooling-water lines for the housing must be separate from those used for the inlet and outlet baffles. The baffles must utilise the coldest-available cooling water for optimal operation, while the housing, which is also responsible for most of the cooling-water consumption, may be cooled with warmer water.

For a DIP20000, the cooling-water demand could, for example, be reduced from 720 litres/hour down to 380 litres/hour.

### Housing insulation

A significant heat loss is generated by the hot surfaces of the pump, especially in the boiler area. About 10 % of the pump energy is lost over the surfaces. A suitable housing insulation will save an additional 2-4 % of heating energy. In addition, the insulation will enhance the safety of the pump because operators cannot be burned by hot surfaces.

### Correct heater adjustment according to the selected driving fluid

Depending on the specific application, the user can choose between various fluids for their diffusion pump. These different fluids have unique vapour pressures and, therefore, different optimal operation temperatures to fulfil their full function.

Mineral oils are typically low boiling. They usually start boiling around 190 °C. The vapour jet is not stable yet at this fluid temperature, but some suction speed is already measurable. To deliver full stable suction speed, the operation temperature is typically around 245-250 °C. These temperatures will be exceeded by uncontrolled full-power heating, which will waste energy and even rapidly degrade the oil as temperatures begin to exceed 270 °C. Choosing the right temperature setpoint, therefore, is as important for energy saving as it is for oil life.

For silicon oils, the temperature setpoint should be lower,

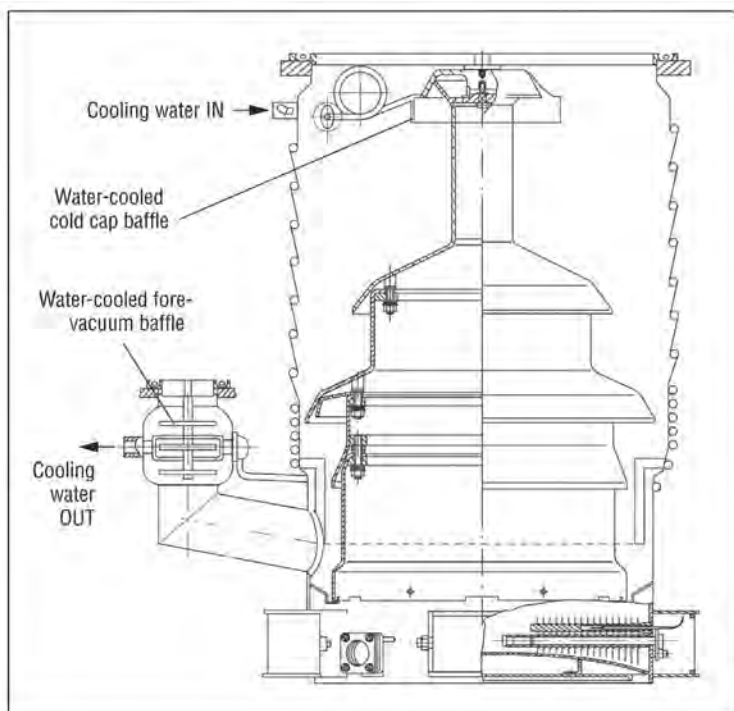


Figure 3: Energy-saving design of a modern diffusion pump

typically around 235 °C. The specific energy to evaporate the heavy silicon-oil molecules is clearly higher than for mineral oils. For this reason, power savings by heater regulation is clearly lower. The energy-saving potential is only up to 10 %.

The selection of the right diffusion-pump fluid has a significant influence in total power consumption. Silicon oils are more expensive and require more power. The user should only select these if the application really requires such inert fluid.

### Standby operation/Intelligent process management

Often, diffusion pumps are idling between batches. Since a complete warm-up of a diffusion pump requires up to 45 minutes (depending on pump supplier), the pumps are typically not switched off and utilise 100 % power even during downtime.

The usage of the innovative control unit opens new and different possibilities today. The aforementioned measures will not only ensure that the diffusion pump will work with minimised power demand at its operation point but also during downtime between batches.

During the idling time we simply reduce the temperature to a 'holding temperature', which keeps the pump in standby and allows a very quick reheating to full power. By reduction of the boiler temperature to approximately 170 °C, the energy consumption during idling can be decreased by an additional 10-15 %. The pump fluid stays degassed under vacuum, and the reheating of the pumps to full temperature can be done in 5-8 minutes (eg. during the pump-down of the furnace with the fore-vacuum system).

### Summary

Users of diffusion pumps have never challenged the power consumption of these products in the past. The pumps have



Figure 4: Digital diffusion pump controller

been necessary, and the standard was that they did not offer any energy-saving possibilities except to switch them off if there was enough time in between the batches. This situation changes completely with the development of modern, digital control units. Diffusion pump users can easily reduce their costs in energy consumption, oil consumption and heater maintenance.

In vacuum brazing, after reaching operating pressure or during standby, the power consumption of a diffusion pump can be reduced by more than 30 %. Considering a large-capacity 50 000 litres/sec. pump, this equates to 8 kW less consumption or cost savings of more than \$8 500/year (based on 8 000 hours/year operation and electricity costs of \$0,15/kWh), a value that cannot be ignored.

With such savings in mind, even a retrofit of existing pumps should quickly be considered.

**For more information** on diffusion pumps, contact Mario Vitale, OerlikonLeybold Vacuum USA, Inc on tel: +1 724 325 6565; email: [mario.vitale@oerlikon.com](mailto:mario.vitale@oerlikon.com) or go to [www.oerlikon.com/leyboldvacuum](http://www.oerlikon.com/leyboldvacuum) ■

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## Networked technologies in the factory of the future

“Integrated Industry – Join the Network!” is the motto of this year’s Hannover Messe trade fair. At the Online Press Conference held by Festo on 25 March 2015, attendees were given a foretaste of the highlights awaiting visitors to the fair.

Industry 4.0 involves a number of challenges – for example the search for the business model of the future, matters of data privacy protection or universal standards for communication between machines. The increasing volume of rapid networking at the technological and organisational levels will be decisive when it comes to realising more efficient value-added chains and product life cycles in future business models. Festo Didactic is the world market leader in technical education and offers integral solutions in education and training for Industry 4.0 to enterprises and universities throughout the world.

At the Hannover Messe, Festo will be showcasing three innovative application concepts of superconductor technology. “We are

now not merely showing impressive levitation effects but are actively discussing their potential together with the automation industry. We are currently working towards initiating our first pilot projects,” said Georg Berner, Head of Strategic Corporate Development, Group Holding Festo.

The SupraHelix exhibit makes use of two cryostats with superconductors that are arranged alongside each other on a semi-rotary drive unit. When cooled to below their transition temperature, they suspend a shaft with integrated permanent magnets beneath them and hold it at a distance of eight millimetres.

In the Bionic Learning Network, an association of Festo with universities, institutes and development companies, the engineers have investigated and further developed technical concepts and industrial applications based on models from nature. The BionicANTS and the eMotionButterflies illustrate how individual systems can be combined into an intelligent overall system by means of networked communication. In addition, the FlexShapeGripper shows how a flexible, adaptable gripping mechanism based on a natural model can find possible applications.

For the BionicANTS, the Festo engineers have not only taken the delicate anatomy of the natural ant as a role model. For the first time, the cooperative behaviour of the creatures has also been transferred to the world of technology using complex control algorithms. “Like their natural role models, the BionicANTS work together under clear rules,” explains Dr-Ing Heinrich Frontzek, Head of Corporate Communication and Future Concepts at Festo. “They communicate with each other and coordinate both their actions and movements. Each ant makes its decisions autonomously, but in doing so is always subordinate to the common objective and thereby plays its part towards solving the task at hand.” In an abstract manner, this cooperative behaviour provides interesting approaches for the factory of tomorrow. Future production systems will be founded on intelligent components, which adapt flexibly to different production scenarios and thus take on tasks from a higher control level.

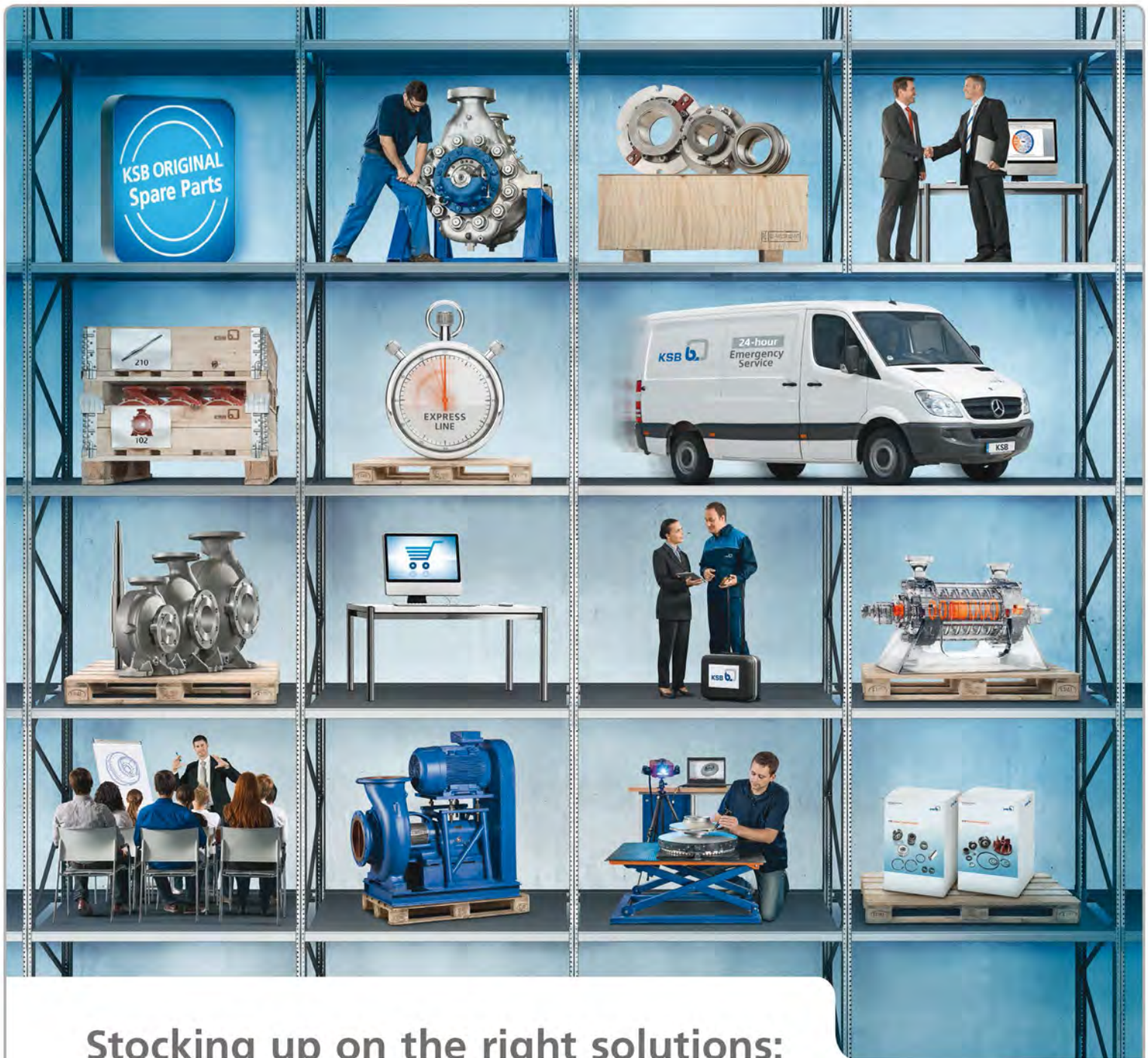
Gripping applications have always played a key role in production. In cooperation with the University of Oslo, Festo is now presenting a gripper whose working principle is derived from the tongue of a chameleon. “The FlexShapeGripper can pick up, gather and set back down several objects with the widest range of shapes in one procedure – without the need for a manual conversion,” says Dr Frontzek. The unique inherent ability to adapt to different shapes gives the FlexShapeGripper its name. This is made possible by its water-filled silicone cap, which wraps itself around the items being gripped in a flexible and form-fitting manner.

The eMotionButterflies developed by Festo demonstrate complex issues from the world of future production such as functional integration, ultra-lightweight construction and communication between individual systems that is networked and optimised on a real-time basis. The aesthetically appealing bionic butterflies show the extent to which the virtual and real worlds can grow together. The coordination between the individual flying objects is effected autonomously and safely by means of a well-networked external guidance and monitoring system. The communication and sensor technology used, which constitutes an indoor GPS system, enables the butterflies to exhibit collective behaviour without danger of collision.

The combination of integrated electronics and external camera technology with a host computer ensures process stability by means of an intelligent guidance and monitoring system.



**For more information** contact Mandisa Mbenenge on tel: +27 11 463 0366, or email: [mandisa@clockworkmedia.co.za](mailto:mandisa@clockworkmedia.co.za) ■



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## Tough, safe, unrivalled: Lined diaphragm valves and butterfly valves

In addition to its standard range of butterfly valves, diaphragm valves and globe valves in metal or plastic, GEMÜ also offers a special product range for controlling and shutting off aggressive, corrosive or abrasive media.

### Lined GEMÜ diaphragm valves

Lined diaphragm valves from GEMÜ are very versatile as they can withstand both corrosive media and high temperatures. They are used, for example, in water treatment, the chemical industry, the paper industry and in mining and wherever demanding operating condition can occur. In many cases, a valve with a full metal body cannot be used, since the corrosive medium attacks and can even destroy the material. On the other hand, a purely plastic body reaches its limits e.g. at high temperatures. GEMÜ has the right solution with its lined metal valve bodies, which meet even the strictest requirements in conjunction with the appropriate diaphragm material and thereby ensure a high degree of operational reliability. In these cases, metal bodies, e.g. made of ductile iron or investment cast stainless steel, are lined with materials such as PFA or PP. Typical application examples include for example shutting off media such as sulphuric acid, chlorine or sodium hydroxide. A metal valve body with hard rubber lining can, for example, be used when processing abrasive media such as slurries from the mining industry or limestone suspensions for flue gas desulphurization processes. In this case, the entire medium wetted part is protected by the lining.

### Butterfly valve for the control of corrosive or ultra pure media

The GEMÜ 490 butterfly valve is fitted with a TFM® liner and PFA encapsulated stainless steel disc as standard. TFM® is a further de-

veloped version of classic PTFE, whereby the outstanding properties of PTFE have been improved much further. TFM® thus has an optimised surface quality, reduced gas permeability and lower cold flow properties.

The design of the butterfly valve, especially the liner, the shaft seal and backing has been optimised to reduce actuation torques, while providing increased tightness at the same time. The technical properties of the sealing concept increase the service life and reduce the probability of failure. Thanks to this features the 490 butterfly valve is also suitable for use in temperatures up to 200 °C, fulfilling highest standards such as the TA Luft standard (German Clean Air Act).

The GEMÜ 490 butterfly valve is used in all applications where e.g. corrosive liquids and gases are to be shut off or controlled. In addition to the chemical industry such applications can also be found in the treatment of corrosive waste water or the distribution of ultra pure water in the pharmaceutical industry or the semiconductor industry. Thanks to its construction, it can also be used in explosion endangered areas (ATEX).

Depending on the application details or the given operating conditions GEMÜ's team of specialists will be assisting you in finding the best suitable technology. This will assure you with important benefits like safety for operators and environment, but also with best cost-performance ratio.

**For more information** contact Claudio Darpin at [claudio.darpin@gemue.co.za](mailto:claudio.darpin@gemue.co.za) ■

## AES Pump's new workshop for Sundyne in Secunda

This new workshop at AESPUMP's Secunda facility is dedicated to servicing Sundyne machines and the magnetic drive pumps of subsidiaries HMD and Ansimag.

It joins a dedicated flameproof pumps workshop supplementing the main floor where general pumps such as end-suction and split-case machines are serviced. Both dedicated workshops approach clean-room environmental standard, and both are comprehensively equipped with cranes, inspection tables and workbenches fitted with rotatable clamps and vertical motor stands for no-load run tests on gearboxes.

The Sundyne workshop additionally has its own component parts washer.

AESPUMP is soon to upgrade its test bay, currently equipped for end-suction pumps and sump pumps, to manage the Sundyne range as well.

For more information contact Neil Britz on tel: +27 11 466 6500 or email [neilb@aesump.co.za](mailto:neilb@aesump.co.za)

## Maintaining Africa's pumps

Having sold hundreds of thousands of KSB pumps over the past six decades, the important task of supplying after sales services is undeniably one of the most important services offered by and is prioritized throughout each division as a result.

### Mission critical

According to KSB Pumps and Valves aftermarket sales manager, Andreas Gremels, as a first-choice supplier of pumps for important applications such as bulk and municipal water authorities, power stations, petroleum refineries, mines, irrigation schemes and industry, the company has also introduced advanced condition monitoring equipment to assist customers with preventative maintenance and optimization of pump systems.

KSB's advanced SES Efficiency System is able to do a complete energy efficiency analysis, detect variations in flow rates, vibrations and other clues that it interprets and analyses in real time to optimize pumping systems and assist with the scheduling of appropriate preventative maintenance to ensure the least disruption on liquid transfer systems.

Simultaneously, field staff and service personnel are able to assist customers with the operation and maintenance of pumps anywhere on African soil. Depending on the size and scope of the pumping operation KSB Pumps are able to make available framework agreements in regards to service, repairs and spares.

### Spares for Africa

"It is important that we keep the wheels of our customers' operations running efficiently at all times and for this we maintain a massive stock of spare parts at our Spare Parts Distribution Centre in Germiston. Appropriate stocks are also maintained wherever they may be required throughout our branch and dealer network in Africa.

"Considering that we have operational pumps that were installed in the early 1950s, our logistics and resource planning systems are highly advanced to enable us to track and measure requirements of our massive customer base as required. Data input by our sales teams is tracked and entered into the system to ensure that spares holding can be accurately allocated for the pump population.

"All spares for our standard range of pumps are kept on site, while special agreements are put in place with customers who operate any of our specialised pump systems. The services and spares are available for the full range of products offered by KSB Pumps and Valves, including upgrading of pumping systems, pumps, valves and related products," concludes Andreas.

KSB Pumps and Valves, Annett Kriel, Tel: (011) 876 5600, Fax: (011) 822 1746, Email: Annett.Kriel@ksb.com, Web: www.ksbpumps.co.za ■

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## The Rietschle VC vacuum pump range

Oil-lubricated rotary vane vacuum pumps designed and built by Rietschle are used in a wide variety of industrial applications. Rietschle offers the largest range of oil-flooded vacuum pumps for industrial coarse and fine vacuum operation.

The VC range is based on three different designs.

- Compact pumps with overhung bearing design.
- Medium ranges with rotors supported on both sides, and flexible coupling.
- Large pumps with rotors supported on both sides, plus flexible coupling and double walled cylinder.

VC rotary vane vacuum pumps are air-cooled in the standard version. An oil-water cooler is available for high ambient temperatures or for heat recovery. The exhaust air is cleaned by a built-in mist filter with a very high separation efficiency ensuring oil free operation in all working conditions. During service, the oil mist filter can be changed quickly via the maintenance cover, which is sealed by an O-ring, or for sizes 50-150 directly from the outside with a bayonet fitting.

All pumps from 50m<sup>3</sup>/h up feature a gas ballast valve as standard. This optimises the water vapour and when the pump reaches its operating temperature, any water vapour pumped passes through as a gas, without condensing.

Standard features of the VC range are as follows:

- Vanes made from a special alloy for long service life.
- Oil separator with permanent oil re-circulation.
- Gas ballast valve from range 50m<sup>3</sup>/h upwards.
- Oil mist filter with bayonet fixing (sizes 50-150).
- Large maintenance cover from range 200 up.
- Stainless steel mesh filter or paper filter.
- Non-return valve.

Typical VC applications include the following:-

- Environmental engineering  
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- Industrial applications
  - Drying systems
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  - Industrial furnaces
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- Packaging industry
  - Centralised vacuum systems
  - Packaging machines
  - Vacuum moulding
- Pneumatic conveying
- Wood working industry
  - Dust extraction systems
  - Vacuum hold down

**For more information** about the Rietschle VC vacuum pump range, contact Mark Burn, managing director, Air & Vacuum Technologies, on tel: 0861 VACTEC (822 832) or +27 11 318 3240, email burnm@vactech.co.za, or go to [www.vactech.co.za](http://www.vactech.co.za) ■

## Twenty Bravo 900 submersible slurry pumps for Kamoto Copper Co in the DRC

Integrated Pump Technology of South Africa has supplied 20 Bravo 900 submersible slurry pumps and 20 M20 control panels to Kamoto Copper Company (a subsidiary of Katanga Mining) of the Democratic Republic of the Congo (DRC). These heavy duty electrical submersible slurry pumps are the largest of their kind in the Grindex product family, says Klint Bawden, General Manager: Sales & Marketing, Integrated Pump Technology.

Chris Heunes, Export Sales Manager, Integrated Pump Technology, explains that the company's products are being deployed

at three different areas of Katanga Mining's operations in the DRC. These are the Lulu Metallurgical Plant, the Kamoto Concentrator (KTC) and KOV Open Pit Mine (KOV). Heunes says that EC Mining has been formally appointed as the distributor for Integrated Pump Technology for the DRC and is in the process of establishing a fully-fledged service and repair workshop at Kamoto Copper Company to cater for its aftermarket needs.

"Pumping slurry is one of the most demanding applications for any pump, due to such issues as sediment build-up leading to

costly downtime and repair costs," Bawden explains. "The Bravo range from Grindex is robust and hard working enough to result in reduced operating and maintenance costs." These pumps, with a maximum submersible depth of 20 m, do not require any support superstructure, which makes for quick and easy installation and less space needed for their operation.

**For more information contact** Klint Bawden on tel: +27 076 840 6527, email klint@pump-technology.com, or go to [pump-technology.com](http://pump-technology.com) ■

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## Engineering Consultants key to unlocking project pipeline

Consulting Engineers South Africa (CESA) reiterates that there is a distinction between engineering consultants and consultants.

Engineering consultants are registered professionals with the Engineering Council of South Africa. They are key to infrastructure delivery as they are front end leaders responsible for investigation, planning, design and construction monitoring of infrastructure projects.

The then Minister of Finance, Pravin Gordhan said in his medium-term budget policy statement in 2014, that the largest cuts to “reduce costs and eliminate wasteful expenditure” would be to the amounts spent on consultants. He added that there are of course necessary engineering and advisory services employed by government departments which bode well for CESA and its over 500 strong member firms employing over 22 000 staff. However, it needs better contract management and stricter control of consultancy fees.

CESA has been vocal, open and honest with our dealings with the State and we have proper controls that require our members to perform their duties with integrity as we subscribe to the principle of business ethics.

It believes that the government should be spending more on engineering consultants in order to unlock projects and improve infrastructure spend and infrastructure delivery, which is necessary to alleviate inequality, poverty and unemployment.

CESA's Acting CEO Wallace Mayne says that the workload of engineering consultants is two thirds government work and a third is private sector work.

The lack of engineering skills within Government leads to blocked project pipeline, poorly packaged bids to procure engineering services, delayed project implementation, inability to monitor service level agreements and implementation of projects. Consulting Engineers play a vital role in partnering with Government as their trusted advisors to en-

sure that sustainable solutions which provide both quality and value are procured by the various departments and at the same time providing skills transfer to mentor and train Government personnel to ensure continued service delivery.

“We have to reinstate the technical management capacity within government. There are enough engineering skills within the country to cope with the infrastructure workload,” avers Mayne.

He argues that the slow release of infrastructure projects is as a result of lack of technical skills in the government.

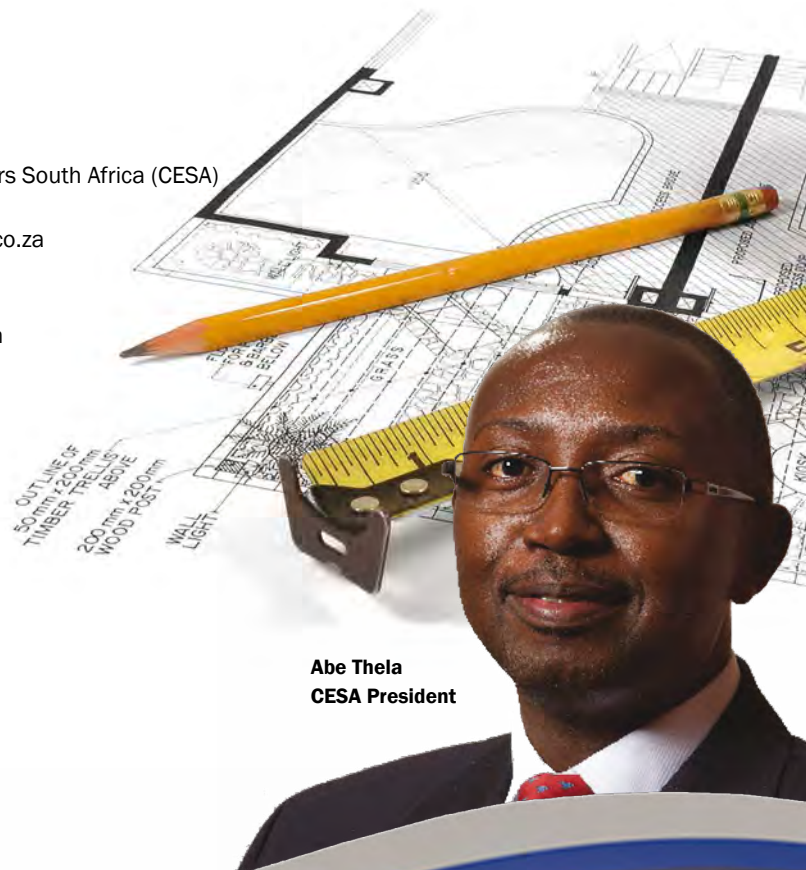
“CESA member firms are readily available to partner with Government to ensure that the project pipeline is unblocked, critical skills are transferred to the government, which will lead to service delivery imperatives being met and the quality of the lives of the people of South Africa improved,” concludes Mayne.

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Dennis Ndaba  
CESA Media Liaison  
dennis@cesa.co.za  
011 463 2022 ■

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we have proper controls  
that require our members  
to perform their duties with  
integrity as we subscribe  
to the principle of business  
ethics.**



**Abe Thela**  
CESA President

## HDK<sup>®</sup> pyrogenic silica – **Creating products by closing loops**

by Dr Robert Johnston, Director Business Team HDK<sup>®</sup>, Wacker Silicones, Wacker Chemie AG, Germany

**In chemical terms, pyrogenic silica consists of very pure amorphous silicon dioxide. Unlike precipitated silica, silica sol or silica gel, pyrogenic silica is produced by the reaction of chlorosilanes with hydrogen and oxygen in an oxyhydrogen flame at over 1 000 °C. In the flame, the primary particles fuse into larger aggregates, with typical diameters of around 100 to 500 nanometers. On cooling, flaky agglomerates several micrometres in size, form.**

**W**acker has been producing pyrogenic silica (brand name HDK<sup>®</sup>) for more than 45 years. Production currently takes place at the company's Burghausen and Nünchritz sites in Germany and in Zhangjiagang in China. The main use of pyrogenic silica is in the manufacture of silicones. Approximately half the volume produced worldwide is used to reinforce silicone elastomers and for the rheology control of silicone sealants.

Pyrogenic silica finds further application as a free flow aid, anti-settling agent, high-performance insulating material and rheology additive in a broad range of recipes and application areas. It has become indispensable in many industrial production processes and is thus in great demand. According to Wacker estimates, the market is growing by three to six percent every year.

Alongside Evonik and Cabot, Munich-based Wacker is among the world's largest producers of pyrogenic silica. At its German sites, byproducts and intermediates from siloxane and polysilicon production typically serve as the raw materi-

als, thus contributing to value creation. Byproducts generated during HDK<sup>®</sup> manufacture are also recycled or used in other production processes. Such a high degree of material-flow integration creates the foundation for a sustainable integrated production system that makes it possible to use raw materials efficiently and economically, to recycle byproducts effectively and, in large measure, to avoid waste.

Significant efficiency gains can be achieved through integrated HDK<sup>®</sup> production, as demonstrated at the Nünchritz site. Thanks to synergies and economies of scale, the specific operating costs for HDK<sup>®</sup> production at Nünchritz have improved over the years. Due to process enhancements, energy demand has decreased, while production volumes have increased on a continuous basis. These productivity advances, which are continually promoted, further strengthen the site's competitiveness and are key for the success of the product range.

Integrated HDK<sup>®</sup> production at the site also benefits the manufacture of silicones. Silicone elastomers require





The Wacker Chemie Nünchritz site outside Dresden

the addition of pyrogenic silica to obtain the necessary mechanical properties. This makes HDK<sup>®</sup> an important formulation ingredient for the manufacture of such silicones. Since the company produces the pyrogenic silica itself, it has a reliable raw material supply for this very important additive; the Nünchritz site, as a result, thus also profits as a centre of competence for silicone sealants.

As well as water-compatible HDK<sup>®</sup> grades, the chemical plant produces water-repellent ones, so-called hydrophobic HDK<sup>®</sup>. Here, the pyrogenic silica's surface is modified with the aid of silanes or siloxanes, so that it repels water and controls or prevents chemical reactions with reactive resins. Nünchritz is equipped with the necessary processes and facilities to manufacture hydrophobic HDK<sup>®</sup>.

### **Pyrogenic silica: properties and applications**

HDK<sup>®</sup> aggregates have some special features. For example, they possess an open structure, low specific density and

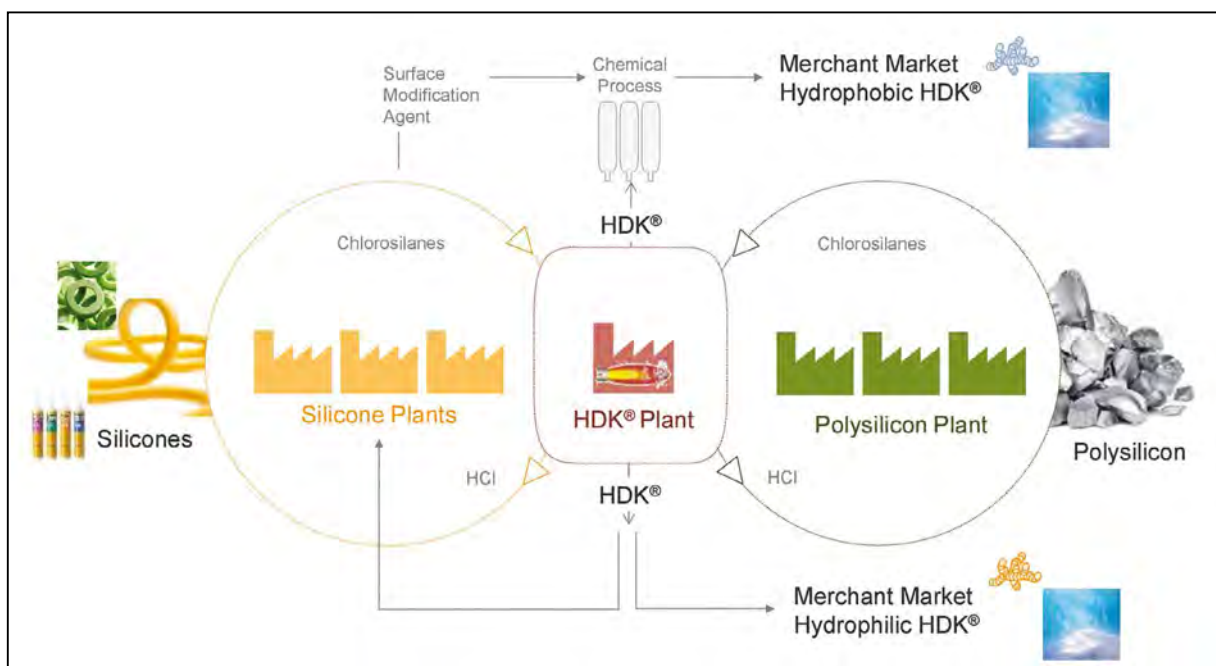
a large surface area. Their pronounced particle-particle interactions are the reason behind the superior rheology effect of HDK<sup>®</sup>.

Another characteristic property of pyrogenic silica is that its affinity to water and its reactivity can be tailored via chemical surface modification. Wacker offers two different product classes: hydrophilic and hydrophobic HDK<sup>®</sup>.

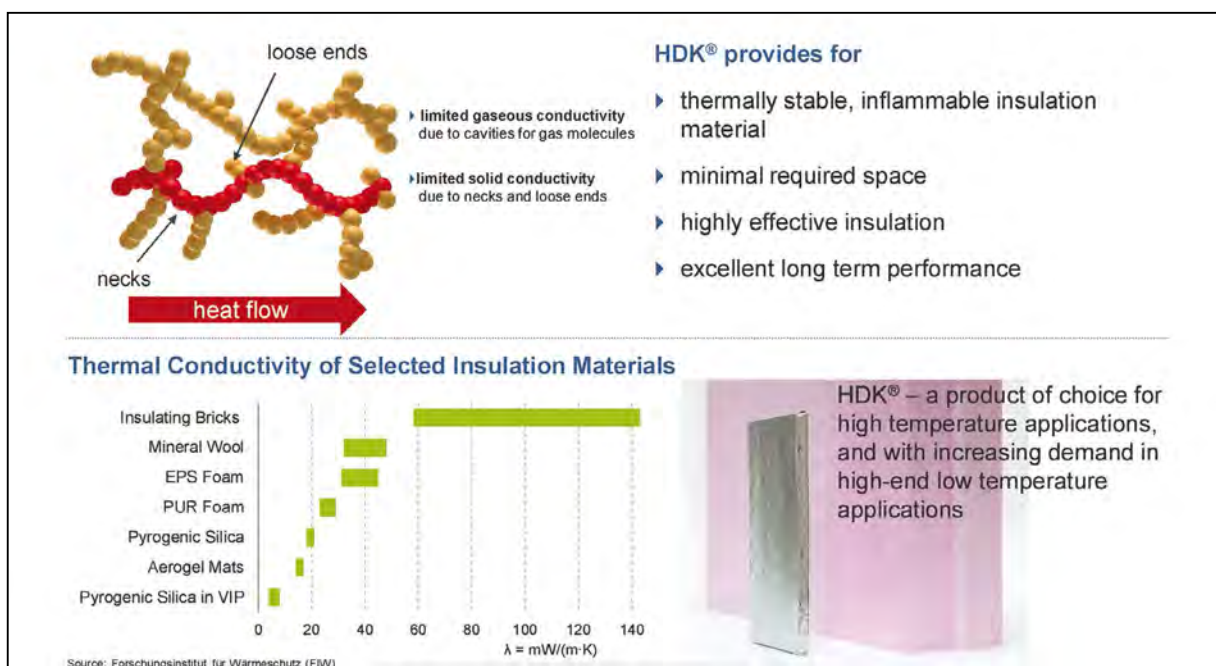
Hydrophilic pyrogenic silica finds use as a thixotropic agent in applications such as coatings, paints, adhesives, sealants and composites. For its purity and freeflow properties, the pharmaceutical and food industries frequently also make use of hydrophilic grades. Hydrophobic HDK<sup>®</sup> does not generally react with polar resins, thus finds use, for example, as reinforcing fillers in silicone elastomers and as thixotropic agents in coatings and polar epoxy, vinyl-ester or polyurethane resins.

### **Application example: wind turbine**

Adhesives for wind-turbine rotor blades are a striking example of a HDK<sup>®</sup> application. Rotor blades generally consist



Nünchritz: HDK® plays an essential role for Wacker's fully integrated silicon site



HDK® - the high end thermal insulation material

of two half-shells and support elements that are bonded together. During the assembly of rotor blades, the adhesive must not run after it has been applied, as this may weaken the bond and therefore the rotor's mechanical strength. For the application, itself, however, the adhesive must not be of low viscosity, otherwise the tubes and application equipment will block.

HDK® can meet such extreme rheology requirements very well. HDK®-modified adhesives have a low viscosity under pressure and shearing, yet do not sag once applied. Furthermore, HDK® prevents sedimentation. It retards the deposition of the adhesive formulation's solid components, which considerably extends the shelf life.

### High-performance insulating materials made of HDK®

Pyrogenic silica possesses outstanding thermal properties. Depending on the application, its thermal conductivity,  $\lambda$ , is typically between 4 and 25 mW/(m \* K). Hence, insulating materials made of HDK® are extremely effective. For example, the insulation performance of a 15 mm-thick HDK® vacuum insulation panel is comparable with that of a 100 mm polystyrene panel.

HDK® offers high thermal insulating capabilities at minimal space usage. Such properties are not commonly needed in everyday life. In most applications, conventional insulating materials are entirely sufficient. However, if very high or low temperatures must be controlled and there is

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HDK® is essential in a variety of markets

- Rheology Control
- Reinforcement
- Insulation, purity, free flow

Wacker's HDK® offers solutions to strengthen the competitive edge of its customers

hardly any available space, high-performance insulating materials such as pyrogenic silica are the preferred choice. HDK® insulating materials find use, for example, in industrial high-temperature applications and household Ceran®

stoves. HDK® is also specifically used in applications where space plays a key role. Examples of such applications for highly effective insulating materials include refrigerators and refrigerated containers. ■

## Wacker develops highly efficient silicone surfactant for pulp production

Munich-based chemicals group, Wacker, has developed a new silicone surfactant that greatly accelerates pulp dewatering. Sold under the name PULPSIL® 968 S, it serves as the active ingredient for dewatering formulations used in pulp washing. The silicone delivers excellent efficiency in pulp dewatering and greatly reduces the washing time. PULPSIL® 968 S rounds out the existing Wacker range of products for the pulp and paper industry, and can generate substantial energy and cost savings for pulp producers.

PULPSIL® 968 S, a medium-viscosity water-dispersible product, is a surfactant fluid based on a polyether-modified silicone. Its molecular structure has been optimised to make it less hydrophilic without compromising its pronounced hydrophobic or water-repellent properties. The resultant gain in water repellency, compared with other silicone surfactants, is what makes PULPSIL® 968 S such a particularly efficient dewatering agent.

The hydrophobic nature of the new product is reflected in its very low cloud point of 19 °C, as determined in accordance with Method E of EN 1890. This value is far lower than that of other silicone surfactants in the product series. Above the cloud point, the silicone surfactant stops dispersing itself molecularly throughout the aqueous medium. Instead, it forms tiny fluid droplets, a condition necessary for triggering rapid dewatering.

Generally, in order for a surfactant to work as a dewatering agent, the temperature of the wash liquor must exceed the cloud point. The unusually low cloud point of PULPSIL® 968 S means that it will act with maximum efficiency even in relatively cold wash liquors. However, a corollary of the



low cloud point is that products formulated with PULPSIL® 968 S need to be stabilised to prevent premature separation.

The pulp-washing process always involves a degree of air entrainment into the pulp slurry. Unless counter-measures are taken, most of the air would attach itself in the form of tiny bubbles to the cellulose fibres, and so retard drainage of the wash liquor. Processing auxiliaries such as PULPSIL® 968 S are therefore essential for efficient wash processes. In weakening the bond between the air and the fibres, they simultaneously promote coalescence of the tiny air bubbles to larger ones that will rise out of the slurry. This de-aeration creates channels that boost water drainage and greatly accelerate the washing process.

The rate at which pulp slurry is dewatered can be measured in drainage tests. Wacker's new silicone tensid PULPSIL® 968 S, accelerates dewatering significantly improving the washing process during pulp-making.

## Sub-micrometre carbon spheres reduce engine friction as oil additive

Tiny, perfectly smooth carbon spheres added to motor oil have been shown to reduce friction and wear typically seen in engines by as much as 25 %, suggesting a similar enhancement in fuel economy.

The researchers also have shown how to potentially mass-produce the spheres, making them hundreds of times faster than previously possible using ultrasound to speed chemical reactions in manufacturing.

“People have been making these spheres for about the last ten years, but what we discovered was that instead of taking the 24 hours of synthesis normally needed, we can make them in five minutes,” said Vilas Pol, an associate professor of chemical engineering at Purdue University.

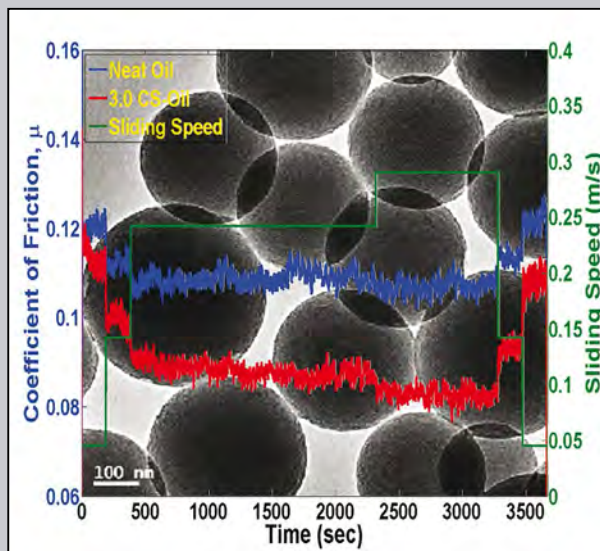
The spheres are 100-500 nanometres in diameter, a range that generally matches the ‘surface roughness’ of moving engine components. “So the spheres are able to help fill in these areas and reduce friction,” said mechanical engineering doctoral student Abdullah Alazemi. Tests show friction is reduced by 10 – 25 % when using motor oil containing 3 % of the spheres by weight.

“Reducing friction by 10 to 25 percent would be a significant improvement,” said

Farshid Sadeghi, Cummins Distinguished Professor of Mechanical Engineering at Purdue. “Many industries are trying to reduce friction through modification of lubricants. The primary benefit to reducing friction is improved fuel economy.”

Friction is greatest when an engine is starting and shutting off, so improved lubrication is especially needed at those times. “Introducing microspheres helps separate the surfaces because the spheres are free to move,” Alazemi said. “It also is possible that these spheres are rolling and acting as little ball bearings, but further research is needed to confirm this.”

Future research will include work to determine whether the spheres are rolling like tiny ball bearings or merely sliding. A rolling mechanism best reduces friction and would portend well for potential applications. Future research will also determine whether



the resorcinol-formaldehyde particles might themselves be used as a lubricant additive without heating them to produce pure carbon spheres.

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## ThyssenKrupp Industrial Solutions awarded slackwax deoiling plant contract

Plant engineering and construction specialist ThyssenKrupp Industrial Solutions has been awarded a contract for the basic engineering package and license for a hard-paraffin production facility in Czechowice-Dziedzice, Poland, located about 80 km south of Katowice.

The Client PolWAX SA is one of the largest European producers and distributors of refined and deodorized paraffin, waxes and specialty industrial paraffin compositions. The new plant with an annual capacity of 30 000 metric tons of three individual slack-wax grades will be integrated into the existing production site of PolWAX at Czechowice-Dziedzice.

The basic engineering package is scheduled to be delivered to the client within approximately seven months. Start-up of the new 2-stage deoiling-facility is planned in the middle of 2019. A mixture of methyl-ethyl-ketone (MEK) and toluene, which serves as a selective processing solvent for the combined crystallization-filtration mechanism of the solvent deoiling process, will be recovered from the individual hard-paraffin respectively footsoil product down to



Photo © ThyssenKrupp AG, <https://www.thyssenkrupp.com/en/bildstrecke/133/>

parts per million ranges and will be recycled to the filtration section.

The hard-paraffin grades produced, showing oil contents from 0,5 to 1,0 wt % are mainly used as burning-paraffin, eg, for candle and grave-light applications, or as mouldings for casting moulds.

The production of hard-paraffin with individual specifications and properties (such as oil-content, melting-point and hardness) from different sources

of oil-containing slack-waxes, requires specialist expertise and specific design features, particularly with respect to the design of the crystallisation-filtration section and the solvent recovery, which are crucial for proper plant operation and requested hard-paraffin quality.

Source: <http://www.digitalrefining.com/news/> ■

## Plasmatreat GmbH wins Würth Future Champion Award 2015

On the occasion of the Summit of World Market Leaders held in late January this year, Adolf Würth GmbH & Co KG bestowed the Würth Future Champion Award, including €10 000 prize money, on Plasmatreat GmbH (from Steinhagen in North Rhine-Westphalia).

Plasmatreat is the global market leader in the field of plasma atmospheric surface treatment, a high-technology process for lasting and highly-efficient pre-treatment and nanocoating of surfaces of a wide variety of materials. With its Openair® plasma technology, the company created one of the most efficient plasma processes to clean, activate or coat plastics, metals, glass, ceramics, recycled materials and composite materials.

The Würth Future Champion Award is presented to quickly and constantly growing and internationally successful German, medium-sized, companies that have managed to break through to the world's market leaders in the last years.

Joachim Kaltmaier, Member of the Central Managing Board of the Würth Group, presented the award to Christian Buske (CEO of Plasmatreat GmbH). He was inspired by the above-average sales growth of Plasmatreat. "You invented the niche market of plasma atmospheric surface



The Würth Future Champion Award 2015 goes to Plasmatreat GmbH from Steinhagen in the district of Gütersloh (North Rhine-Westphalia). Prof. Dr. Bernd Venohr, management expert and chairman of the jury, Joachim Kaltmaier, Member of the Central Managing Board of the Würth Group, Christian Buske, CEO of Plasmatreat GmbH and Dr. Walter Döring, former Minister of Economic Affairs in Baden-Württemberg at the award ceremony (from left to right).

treatment and set global standards. Your annual double-digit, above-average sales growth is proof of your great entrepreneurial spirit. Between 2003 and 2013, you managed to quadruple the sales volume of your company."

"For me this award is a very special recognition of our past performance and is also a great motivation for the future", said Buske.

The jury emphasized the enormous innovative power of the company: with an investment rate of 12 % of sales for research and development and 90 patents,

Plasmatreat is a pioneer in its market. This is confirmed by the many close cooperations with research institutes and universities in Germany and abroad. According to Christian Buske, the company expects to increase its sales by a factor of five to ten within the next ten years.

**For more information contact** Sonja Rauh, Corporate Communications, Adolf Würth GmbH & Co KG on tel: +49 7940 15-2717, email [Sonja.Rauh@wuerth.com](mailto:Sonja.Rauh@wuerth.com) or go to [www.wuerth.com](http://www.wuerth.com) ■

# The development of an online biofouling monitor for cooling water systems

by Kelley Reynolds-Clausen, Eskom Holdings SOC Ltd, Research, Testing and Demonstration, Johannesburg, South Africa

**The BOMM device offers a simple means of obtaining representative sessile samples from Eskom cooling water systems.**

Eskom utilises large, open, recirculating cooling water (CW) systems to condense the steam, used for power generation, back to water. The CW systems range from 48 to 128 ML in volume, depending on the age of the plant and the size of the generating units. Eskom has established a 'zero liquid effluent discharge' policy [1,2,3] and therefore there is no water released from the site except as steam. As a result the cooling water concentrates as the elements in the water are not lost in the steam [4].

The CW system is comprised of several different materials including concrete, mild steel and other steels [5]; the condenser tubes are conventionally admiralty brass although some systems, especially the newer ones, have titanium tubes. Due to the complexity of the system there are many areas of low flow and dead ends [5].

Although the CW system is controlled mainly on chemical parameters, the microbiology is also closely monitored. The development of biofilms in the CW system leads to several problems including corrosion, blockages and decreased heat transfer [6,7].

The biofilms form when the bacteria present in the cooling water adhere to the surfaces of the system [8,9]. There are several mechanisms whereby they may achieve this, but mostly they secure themselves to the surfaces by flagella and electrostatic forces. Once attached to the surfaces, they undergo a metabolic change and begin to produce a sticky slime as a by-product. The slime acts as a protective film over the bacteria and other particles or bacteria in the water may adhere to it. This increases the width of the biofilm on the surface of the system and allows the conditions nearest to the surface to become anaerobic.

In this anaerobic environment, the bacteria are able to metabolise the iron in the metal and may cause microbiologically influenced corrosion (MIC). They excrete by-products which harden to form a nodule over the corrosion site. Their metabolism allows them to release hydrogen sulphide as a by-product. When it comes into contact with water this forms sulphuric acid which corrodes the metal and may cause pitting or holes through the metal [10].

Unfortunately the Eskom cooling water systems are







generally maintained on a planktonic (free-floating) count. This would lead to an inaccurate representation as the planktonic phase contains only 5-10 % of the total bacteria present in the system. The remaining 90-95 % is found in the biofilm (sessile phase) which was historically not measured [11].

There have been several devices designed to monitor the biofilm development in the cooling water system. These include the Pedersen device and the Robbins device [12]. These devices require that the cooling water pass through them in order for the surfaces to emulate the surfaces of the larger system. The installation of these devices requires system downtime and plant modifications to allow water flow through the device and back into the system. They often have to be in active plant areas which can make sampling a difficult task [13].

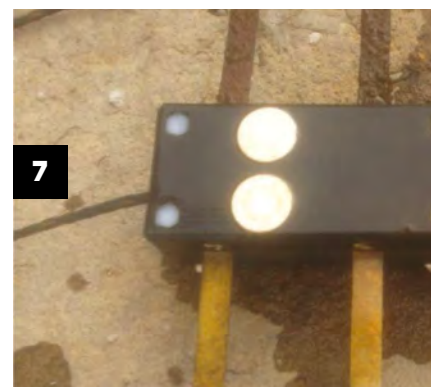
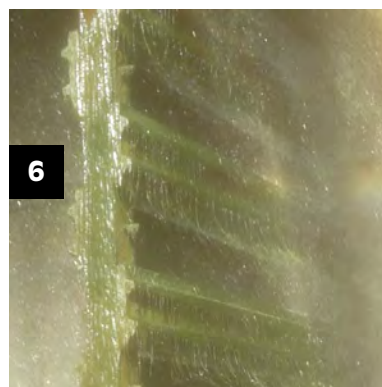
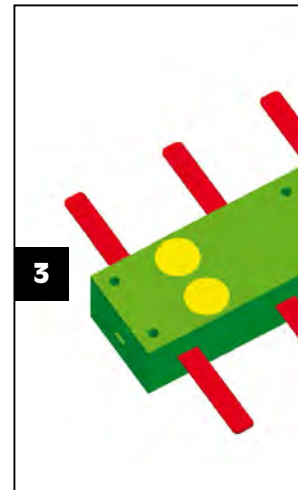
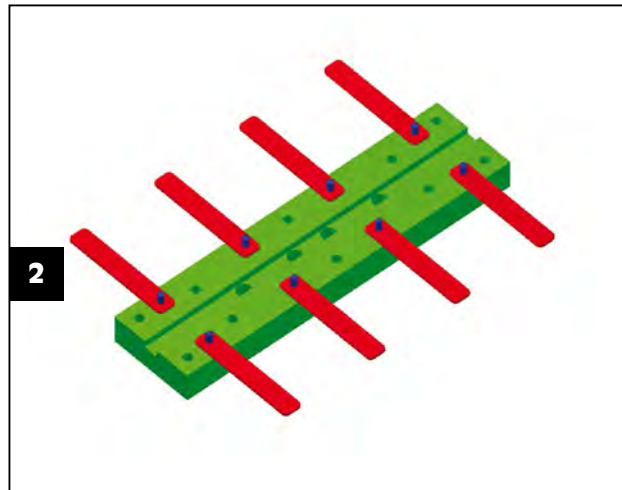
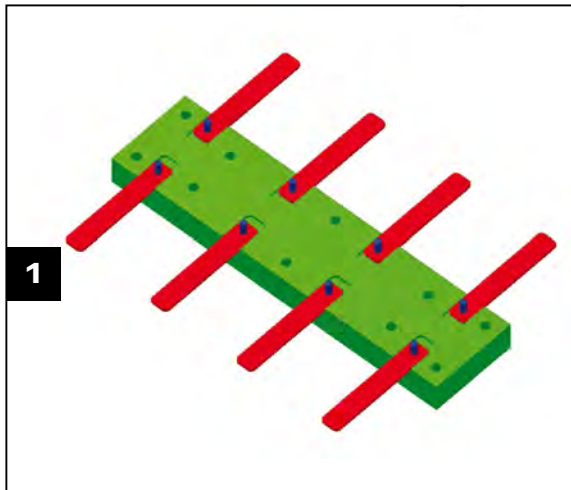
Most Eskom cooling water systems are treated with a biocide [14,15] and a biodispersant [16,17]. The former kills the bacteria while the latter limits their attachment to the system surfaces. The dosing of these chemicals is not

monitored and there is little management of the contractors and no knowledge of the efficacy of the products on the system bacteria.

In an attempt to obtain an understanding of the sessile populations within the Eskom cooling water systems, an alternative method of monitoring was essential. The monitor had to fulfil several criteria: it had to be relatively small (the Robbins device is 15 cm square and 2 m long), it had to be able to evaluate the sessile population and the corrosion rate within the system, it needed to be installed in an easily accessible area on the power plant and must not need system downtime to be installed.

### Development

The need for a biological monitor led to the initial design of a small, plastic, rectangular device which could be placed in the cooling tower basins and easily retrieved. The device became known as the BOMM (biological on-line microbiology monitor); furthermore, it had nylon insets of a known area which could be removed and the bacteria on their



enumerated. As the development continued, these insets were fixed in the device and their surfaces swabbed. This minimised the possible impact of other surfaces and any possible anaerobic zones beneath the inset were not sampled.

The requirement of corrosion rate calculations was eliminated by including corrosion coupons on the narrow sides of the monitor. Four coupons could be placed on each side, each side a different metal. In order for the corrosion coupons to be held in place, the device was made in two parts that came apart in order to hold the coupons securely (see Figures 1-3).

The entire device is attached to the side of the basin with a nylon rope, which threads through the second block, so as to not influence either the insets or the coupons.

The entire BOMM is made of plastic to ensure that there is no cathodic corrosion between different metals on the device. There are 6 plastic bolts that hold the two blocks together; these are secured with plastic wing nuts to ensure that sampling is simplified and other tools are not required.

### Monitoring

The BOMMs were installed at each station, one on each side of the cooling water system. They are placed near the screening area to ensure that there is a water flow around the device. The corrosion coupons are installed in the BOMM and their exact position, weight and date of installation recorded.

Sampling occurs on a monthly basis, in an attempt to establish a base line. The BOMM is photographed to keep a visual record. The surface of the nylon inset is aseptically swabbed to retrieve the attached biofilm (sessile), a cooling

water sample is collected from the same point (planktonic) and the BOMM is taken apart and a corrosion coupon of each metal aseptically removed.

The biofilm and cooling water sample are submitted for microbiological analysis on aerobic and anaerobic bacteria. The bacteria responsible for microbiologically influenced corrosion are also enumerated.

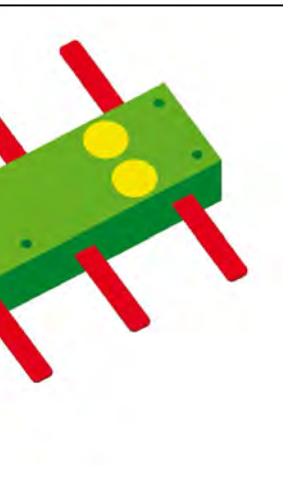
When the corrosion coupons are removed the position and date of removal is noted. Once the coupon has been microbiologically analysed and cleaned, they are reweighed. They will be referenced back to the initial installation date and weight in order to determine the corrosion rate of the metal in the particular system.

Figures 4 and 5 show the fouling that was detected on the BOMM devices.

### Case Study

One of the power stations that was involved with the initial monitoring and design testing, noted that the cleanliness of their cooling towers differed on each side, although the same raw water is utilised for both. There were severe algal blooms in the towers and the conventional cooling water treatment chemicals did not seem to have any effect (Figure 6). The power station operates the system on a continuous cycling loop and can cycle up to 30 times if there is a water release constraint.

BOMM devices were placed in the north and south cooling water systems in the basins of the fouled towers. Figures 7 and 8 show the BOMM devices after a period of one month of being submerged in the cooling water of the north and south tower respectively.



After consultation with the power station staff it was determined that the cooling water clarifier had been over-dosed with flocculant and that the water returning to the tower basin had then flocculated in the basin of the cooling tower. This sludge had settled to approximately 1 m thick in the basin and was contaminating the entire south side cooling water system. The sludge increased the organics in the entire system and the treatment chemicals could not control the microbiological growth.

The treatment chemicals' supplier was contacted and the dosage concentration increased. The basin was dredged on-line due to limitations in taking the tower off-line. The sludge that was removed had turned septic and a full inspection of the cooling tower basin will be undertaken on the next outage to ensure that there is no damage to the concrete.

## Conclusions

The BOMM device offers a simple means of obtaining representative sessile samples from Eskom cooling water systems. The results generated in terms of counts and corrosion rates offers direction to the chemical suppliers on the effectiveness of their regimes. The Microbiology department is in the process of compiling a report which offers the photograph, the bacterial counts and the corrosion rates for the two metals.

## References

A list of references for this article is available from the editor at [chemtech@crowm.co.za](mailto:chemtech@crowm.co.za) ■

**Figure 1:** Block one of the BOMM indicating the positions of the corrosion coupons (red).

**Figure 2:** Block 2 of the BOMM indicating the positions of the corrosion coupons and the rope attachment joints.

**Figure 3:** BOMM complete indicating the nylon insets (yellow) on the outsides of the blocks

**Figure 4:** BOMM showing severe fouling and scaling.

**Figure 5:** BOMM showing biofilm formation and MIC nodule formation on the corrosion coupons.

**Figure 6:** Algal fouling of the south cooling water system.

**Figure 7:** BOMM device from the north cooling tower basin.

**Figure 8:** BOMM device from the south cooling tower basin.

## New study claims biodegradable additives don't work

Additives that claim to break down polyethylene and polyethylene terephthalate don't work in common disposal situations, such as landfills or composting, a new study from Michigan State University (MSU) has claimed.

The results are a culmination of a three-year study that focused on five additives and three categories of biodegradation, which cover the majority of methods available on the market today.

The team studied biodegradation with oxygen, such as in composting; biodegradation without oxygen, such as in an anaerobic digester or a landfill; and simply burying plastics.

"There was no difference between the plastics mixed with the additives we tested and the ones without," said Rafael Auras, co-author and MSU packaging professor.

"The claim is that, with the additives, the plastics will break down to a level in which microorganisms can use the decomposed material as food. That simply did not happen."

The study was funded by packaging companies because they "wanted scientific proof to evaluate the products and disposal approaches that are available to them to break down plastic," said Susan Selke, co-author of the study and also MSU packaging professor.

Source: <http://www.waste-management-world.com/articles/2015/03/biodegradable-plastic-additives-don-t-work-claims-msu-study> ■



Photo: [http://msutoday.msu.edu/\\_img/assets/2015/sue-selke.jpg](http://msutoday.msu.edu/_img/assets/2015/sue-selke.jpg)

## Advanced MBR plant treats 10 Mℓ of wastewater daily

Malmesbury Wastewater Treatment Works plant manager Francois Malan recently told 'ChemTech' that the Western Cape-based facility is one of only two in the country that boasts an MBR plant, that has been designed for nitrification-denitrification-biological excess phosphorus removal.

"Continued urban growth prompted an upgrade of the plant in 2012. The old biofilter plant was decommissioned, and the old activated sludge plant was incorporated into the MBR as a hybrid system, which reduced the overall cost of the upgrade by maximising the use of existing infrastructure, and reducing peak wet weather loading on the membranes," he explained.

Malan indicated that the control and instrumentation systems were also subsequently modernised, and the plant commissioned three GM150 L and three GM80 L positive displacement blowers produced by German-based Aerzener Maschinenfabrik (Aerzen), a world leader in the design and manufacture of rotary air and gas conveying equipment.

The new instrumentation enables fine bubble diffused aeration (FBDA) – which provides substantial and efficient mass transfer of oxygen to the water, by generating millions of tiny air bubbles that rise from the treatment plant tank floors. FBDA is widely-recognised as the most energy efficient and environmentally sustainable wastewater treatment system worldwide.

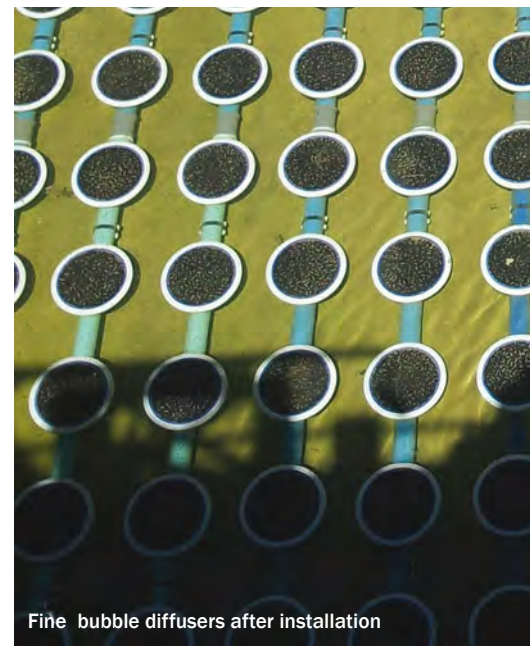
Oxygen is vital in promoting respiration for micro-organisms in wastewater treatment. The oxygen, combined with the sewage food source, allows the bacteria to produce enzymes which help break down the waste so that it can settle in the secondary clarifiers or be filtered by membranes.

Sufficient dissolved oxygen levels in the water improves the purification process and eliminates offensive odours caused by anaerobic decomposition. The use of pure oxygen can also reduce the production of foaming and volatile organic compound emissions caused by excess off-gas.

Malan indicated that, following the FBDA process, some of the treated wastewater is reused for cleaning of the inlet works drum screens and irrigation purposes. "The water is more efficiently treated to enable us to recycle greater quantities, which ultimately reduces overhead costs and wastage of this precious resource."

The Aerzen positive displacement blowers installed at the Malmesbury plant are distributed locally through Airgas Compressors, Aerzen's Sub-Saharan subsidiary. Airgas marketing co-ordinator Andreas Stubel noted that the onsite positive displacement blowers ensure oil-free conveying.

"No lubrication is required in the conveying chamber, as the rotary pistons revolve without making contact with each other and the housing. This guarantees that the air being conveyed remains free from



Fine bubble diffusers after installation

contamination of lubricants and wear particles," he stated.

The Aerzen positive displacement blower handling capacities range from approximately 30 m<sup>3</sup>/h to 65 000 m<sup>3</sup>/h in either a vertical or horizontal flow configuration. They feature an operational pressure of up to 1 000 mBar gauge, and suction of up to -500 mBar gauge.

**For more information contact** Andreas Stubel on tel: +27 11 474 2193, email: [astubel@airgas.co.za](mailto:astubel@airgas.co.za) or go to [www.airgas.co.za](http://www.airgas.co.za) ■

## Putting sustainable ideas in motion

This year's Sustainability Week, a highlight in the annual environmental calendar, is taking place, under the theme 'Get ready to put ideas in motion', from 23 to 28 June 2015 at the CSIR International Convention Centre in Pretoria.

One of the focuses at the conference will be sustainable societies and economies, which all rely on their supporting infrastructures. For example, the reduction of greenhouse gas emissions can be achieved by reducing demand through efficiency, but the fundamental key to achieving this objective is to ramp up the percentage of renewable generation in the grid, and that is a matter of infrastructure.

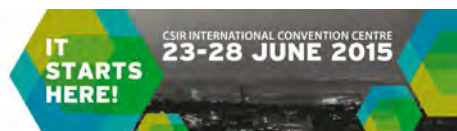
The **African Capital Cities Sustainability Forum** will explore various opportunities to address the sustainability imperative arising from the current and numerous challenges African cities face on a daily basis. African cities can reach high levels of quality urban life when supported by appropriate policies, design ingenuity, innovation, technical proficiency, robust implementation mechanisms and adequate infrastructural investments.

Green buildings is rapidly becoming the norm for new large building projects. New design strategies, building materials and approaches are contributing to an ever more innovative and rapidly changing environment. This year's ninth annual **Green Building Conference** will share the latest thinking, perspectives, case studies and projects as they unfold.

**Water Resource Seminar** - Water scarcity is a reality in South Africa and will become ever more apparent as climate change intensifies. Demand and supply-side management are two key strategies in protecting against absolute scarcity. Water efficiency is vital to the sustainability of our water resource on the demand side. On the supply side, it is imperative that issues such as pollution, land-use management, groundwater management, ecological infrastructure and acid mine drainage management are considered.

South Africa is experiencing a waste explosion with landfills overflowing and production and disposal not slowing down. The **Vision Zero Waste Seminar** will see leading industry, government and related NGO executives, as well as fringe stakeholders, such as the Pickers, report back on actions and initiatives.

Energy efficiency and renewable energy are converging fast into one bold new field - smart energy. The **Sustainable Energy Seminar** will explore the idea that every effort should be made to redesign and reconfigure processes to be more energy efficient and reduce peak demand.



Market forces are such a powerful driver of ingenuity and innovation that they have created the modern world with all its wonders, and all its terrors. How do we harness the market to a significantly greater degree to drive South Africa towards a green economy? This is the key question the **Green Business Seminar** will seek to answer.

**Transport and Mobility Seminar** - Mobility is a human right, but for most urban-based Africans movement across our cities has become an economic inhibitor. Poor urban planning and rapid urbanisation has resulted in massive pressure on ailing infrastructure.

Transport is a high impact sector, with tail pipe emissions accounting for a high percentage of national GHG emissions per country. The transport sector needs constant maintenance, upgrading, and rolling out of new roads, which ultimately affects communities and the biosphere in profound ways. A key strategy to reduce these impacts is to invest in rail infrastructure and to create the economic conditions to entice appropriate freight to move from truck to rail.

**Food Security Seminar** - Political instability, uneven access to resources and funding, poverty, skills shortages, a lack of interest in farming among young rural people, and a changing climate are just some of the complex factors that perpetuate food insecurity among Africans. This seminar invites thought leaders and experts in the field of food security, agriculture and related industries, to share the latest thinking and examples of best practice, presenting the changing face of African agriculture.

Mining is South Africa's most important sector, employing hundreds of thousands of workers. 'Mining IQ' mentions that the mining industry contributes an average of

20 % to South Africa's GDP and boasts a total annual income exceeding R330 billion. Mining and all extractive industries have a heavy impact on communities and the environment, but not all mines are planned, run, and decommissioned in the same manner. The **Sustainability in Mining Seminar** will bring mining executives and other stakeholders together to share knowledge and best practice approaches to energy and water use, waste generation and reclamation, effluent creation and treatment, transport and social issues.

**Green Manufacturing and Supply Chain Seminar** - Localisation of inputs is critically important for the ongoing development of South Africa's manufacturing sector. Companies will compare experiences and best practice in finding ways to localise manufacturing along the supply chain, seek out energy, water and waste efficiencies, protect communities and the environment, and compete locally and internationally.

**Sustainable Infrastructure Seminar** - A sustainable society and economy must rely on infrastructure that supports it. Reducing the environmental impact of the built environment can be advanced through the design, construction and operation of green buildings, but the fundamental key to achieving this is a matter of infrastructure.

Other items on the Sustainability Week programme include a **Responsible Tourism Dialogue**, a panel discussion for Youth and the Green Economy as well as a **Green Home Fair** at Brooklyn Mall.

**For more information** on Sustainability Week, visit [www.sustainabilityweek.co.za](http://www.sustainabilityweek.co.za), contact Winet Fourie on tel 081 412 5680 or email [winet@reputationmatters.co.za](mailto:winet@reputationmatters.co.za) ■

## Age of 'Little Foot' provides twist in story of hominid evolution

An early hominid named Little Foot has been dated to 3,67 million years old, making the timeline of human evolution even more complicated. Little Foot was found in a cave at Sterkfontein in South Africa, an hour's drive from Johannesburg in 1980, and identified as hominid in 1994. According to co-author Ronald Clarke, a professor

at the Evolutionary Studies Institute at the University of Witwatersrand and Little Foot's discoverer, the name came from a play on the mythical Big Foot, and because four foot bones were discovered first. For more information go to [www.crown.co.za/latest-news/chemical-technology-latest-news](http://www.crown.co.za/latest-news/chemical-technology-latest-news)

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### SAIChE IChemE Gauteng Branch

The Gauteng Branch Committee has the pleasure of inviting you and your spouse to our Annual General Meeting.

**Save the date:** 29 May 2015

**Time:** 18:45 for 19:15

**Place:** TBC

Nominations are needed for the Gauteng Branch Committee. Please take note of the following part of item 8.1 of the Rules of Conduct of the Gauteng Branch: "... members shall serve for two years with retirement of half the members each year. Retiring members of the committee shall be eligible for re-election." The nomination form can be found via the SAIChE IChemE website <http://www.saiche.co.za/> or contact us for more information [saiche@mweb.co.za](mailto:saiche@mweb.co.za)



**IChemE**  
SAIChE IChemE

### IChemE Training courses offered: Plan your professional development for 2015

#### Fundamentals of Process Safety Management – May

The course has been accredited by ECSA and is worth 4 CPD points

**Date From:** 25 May 2015

**Date To:** 29 May 2015

**Location:** South Africa

**Description:** An intensive course covering the fundamentals and highlights the importance of having a clear understanding of the principles of process safety management throughout an organisation.

**Event Type:** IChemE Course

**Venue:** Boksburg, South Africa

**Organiser:** IChemE

**Contact Name:** Rod Prior

**Contact Phone:** +27 (0)82 554 0010

**Contact Email:** [r.prior@mweb.co.za](mailto:r.prior@mweb.co.za)

**Fees:** R13 000

**Early bird discount:** 5% if payment is received before 17 April 2015

<http://www.icheme.org/fpsm>

### Layer of Protection Analysis (LOPA) - October

**Date From:** 19 October 2015

**Date To:** 20 October 2015

**Location:** South Africa

**Description:** Covers the basic methodology of LOPA and the detailed stages of its application. Participants are shown how to identify significant scenarios, estimate frequencies for the worst-case events and how to assign risk categories.

**Event Type:** IChemE Course

**Venue:** Boksburg, South Africa

**Organiser:** IChemE

**Contact Name:** Rod Prior

**Contact Phone:** +27 (0)82 554 0010

**Contact Email:** [r.prior@mweb.co.za](mailto:r.prior@mweb.co.za)

**Fees:** R5 500

<http://www.icheme.org/lopasa>

**SAIChE IChemE contact details**

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**tel: +27 11 704 5915;**

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**website: [www.saiche.co.za](http://www.saiche.co.za)**

*Chemical Technology is the only publication in Africa for chemical engineers focusing on all unit operations in a comprehensive way*



SUDOKU NO. 104

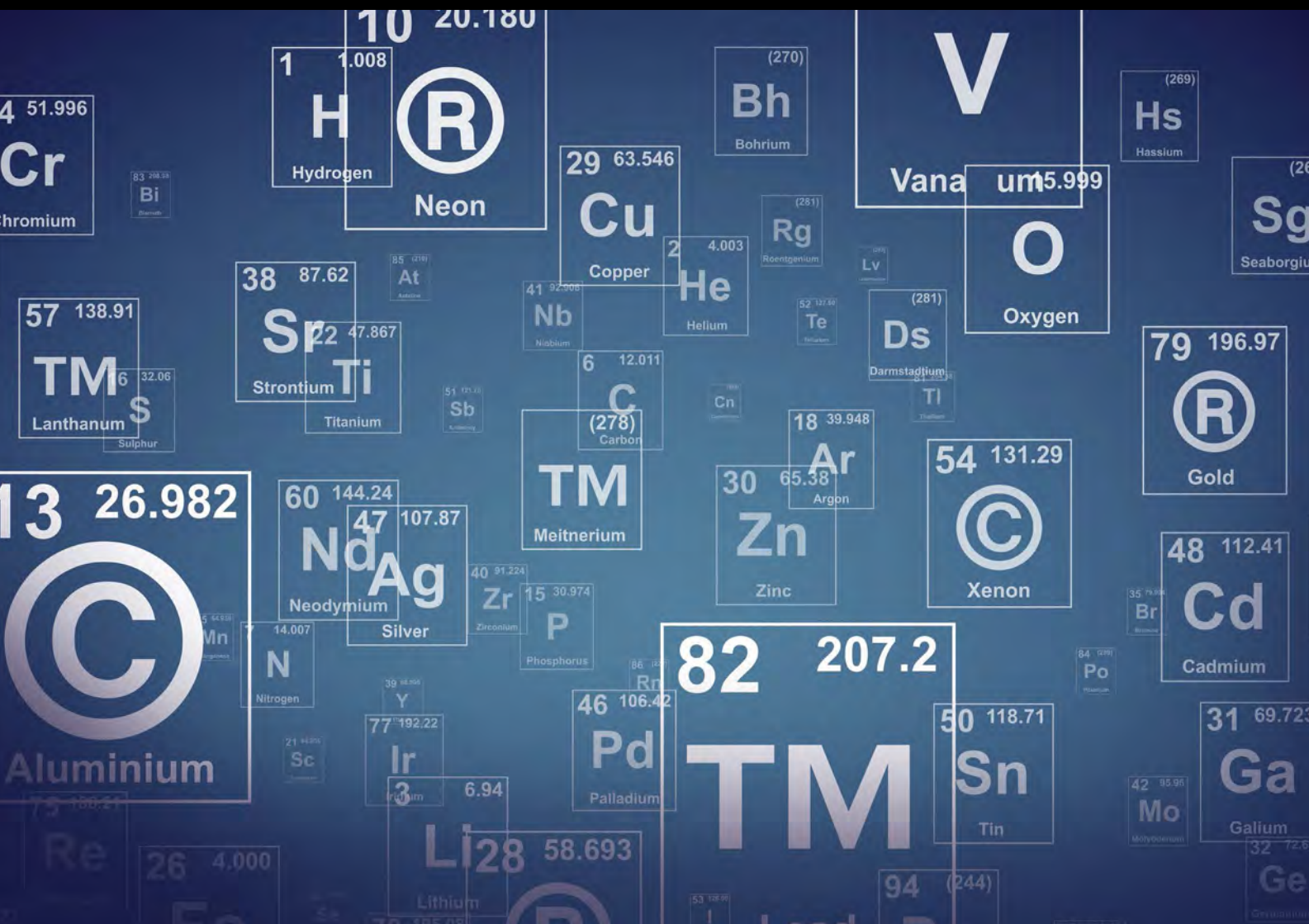
Complete the grid so that every row across, every column down and every 3x3 box is filled with the numbers 1 to 9. That's all there is to it! No mathematics are involved. The grid has numbers, but nothing has to add up to anything else. You solve the puzzle with reasoning and logic. For an introduction to Sudoku see <http://en.wikipedia.org/wiki/Sudoku>

			5			9		4
		9			8			
		3	7					
	2	7	1	5				
	5					2		
6	1		8				9	
	6			3			1	
								8
			2		7	5		

**Solution  
for SUDOKU  
103**

4	9	6	2	5	1	3	8	7
3	8	2	9	6	7	4	5	1
1	5	7	4	3	8	2	6	9
2	4	9	6	7	5	1	3	8
5	6	3	8	1	9	7	2	4
7	1	8	3	2	4	5	9	6
8	2	5	1	4	6	9	7	3
6	7	1	5	9	3	8	4	2
9	3	4	7	8	2	6	1	5

# ARE YOU NEGLECTING A VITAL ELEMENT IN YOUR R&D PROCESS?



With the largest Chemistry and Chemical Engineering practice group in Africa, Adams & Adams can make sure your products and processes stay yours. We can assist with every aspect of Intellectual Property Rights including Patents, Trade Marks and Copyright.

Our specialist areas include Chemical Processes, Biotechnology, Mining, Metallurgy, Explosives, Polymers, Plastics, Energy (including renewable and nuclear energy), Software Inventions as well as Mechanical, Civil, Electrical and Electronics Engineering. So, if you're in any of these fields, or others related thereto, make a call to Adams & Adams: the first step in your R&D process.

# Comparing apples with apples?



**There's no comparison!**

Because we are lawyers who are engineers and scientists with 60 years experience, we know how things work!

Specialising in:

- Consumer Protection Law
- Food Law
- Intellectual Property Law
- Patents and Trademarks

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