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Chemicals are an integral part of our natural and urban environments. Their contribution to society is invaluable, but unless we manage them well they can cause harm to humans and the environment.

Compiled from edited extracts from the document GDFCI/2013 prepared by the International Labour Organization: Sectoral Activities Department, Geneva

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The quality and cleanliness of fuel is a major factor that contributes to the performance of diesel engines and components. Contaminated fuel leads to higher maintenance costs and engine downtime, thus good fuel filtration is vital for engine performance. 'ChemTech' discusses some of the recent offerings from Cummins, designer and manufacturer of power generation equipment, power systems, gasoline engines, and custom power supplies.

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by Dr William Kaiser, Department of Electrical Engineering, UCLA and Dr Philip Rundel, Department of Ecology and Evolutionary Biology, UCLA, Los Angeles, California

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by Samridh Mudgal, Food Engineer Liquid Food Solutions, Danny Milla, R&D Manager Liquid Food Solutions, and Greg W Schrader Director of Integration and Technology Advancement Liquid Food Solutions, all of JBT.



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Festo gives customers a taste of its Process Automation offering

Festo recently hosted a series of whisky tastings on a national scale. Festo partnered with a professional whisky tasting company called The Whisky Rebellion. The specialists imported four types of Scottish single malts for the occasion and supplied whisky experts for the main event.

Each event was backed up by a strong Festo team presence. Some of the senior management team from Festo's head office who were present included Olaf Mayer-Mader (Industry Segment Manager: Process Automation), Steward Mbele (Industry Segment Specialist: Chemicals) and Kershia Beharie (Marketing Product Manager). They were all present at each event as was the majority of the local regional staff.

"The Whisky tastings were a way of reaching our client base in a direct, one-on-one, fashion, while simultaneously providing them with valuable information on process automation and our offerings in that field," said Steward Mbele.

The tastings took place in Port Elizabeth at the prestigious Radisson Blu hotel on the 6th October; in Durban at the esteemed Hilton hotel on the 14th October; Cape Town at the Feathers Boutique hotel on the 21st October; and lastly in Johannesburg at the Festo Head office on the 28th October.

These events formed part of the company's Process Automation campaign for the year. Mbele continued: "Festo is traditionally known for its superior pneumatic components product range. However, we also offer that same quality in other fields such as Process Automation. More specifically, we offer automation components for the chemical, mining, water and wastewater, pharmaceutical and food and beverage industrial segments to name a few. We strongly believe that our products in these sectors have the capability of giving our clients the competitive edge.

"We were looking for a fun and unique forum to enhance our customers' knowledge on our offerings and whisky tasting was the perfect platform to do this. There's a great connection between whisky and process automation. Whisky has a unit operation. It undergoes a multitude of processes such as malting, mashing, etc."

In addition to the actual whisky tasting, Festo gave a short presentation on its Process Automation offering and showcased a number of physical products and displays.



Here is an overview of some of the products highlighted at the events:

Solenoid valves VOFC/VOFD:

Valves that make your processes incredibly reliable and your systems more productive.

These valves are ideal for installation outdoors and in areas with potentially explosive atmospheres: the piloted VOFC and the directly actuated VOFD. Both are very sturdy and have hard-emetallised housings. This provides long-term protection against corrosion and mechanical stress.

New variants made of stainless steel, with manual override, additional solenoids, a low-temperature variant and larger ports up to ½", make this valve series even more attractive. The VOFC/VOFD can control valve actuators in chemical, petrochemical and pharmaceutical production.

They also operate extremely reliably and safely in fail-safe applications. The solenoid coils for use in areas with a potentially explosive atmosphere are available with standard types of ignition protection.

- Extremely corrosion-resistant for a long service life
- New variants of the stainless steel designs
- Types of ignition protection Ex-em, Ex-d, Ex-ia
- Tested by the German Technical Control Board (TÜV)
- International certification to IEC Ex, ATEX, Inmetro,
- Nepsi, UL, Gost
- SIL 3 certified in accordance with IEC 61508.

Sensor boxes SRBC /SRBE/SRBG for quarter turn actuators:

Another element that ties into the chemical aspect of Process Automation is that whisky distilleries are full of explosive material. For these situations, Festo offers a complete world of sensor boxes. Our sensor boxes are ideal for use indoors or outdoors. The weatherproof SBRC is a cost-optimised, high-performance and reliable series with many switch variants.

The SBRE comes with worldwide certifications and is ideal for use in areas with potentially explosive atmospheres. The compact, inductive double sensor SRBG can be mounted on quarter turn actuators directly, quickly and neatly without mounting components.

We offer a range of options so you can choose the right sensor box for your operating conditions:

SRBC

- Weatherproof aluminium housing
- Mechanical, inductive or magnetic switch variants
- Intrinsically safe version in accordance with ATEX.

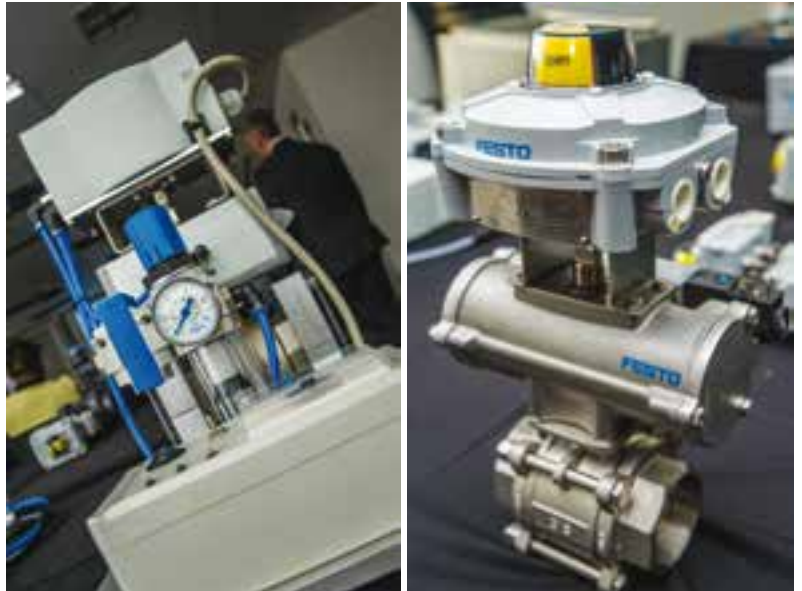
SRBE

- Explosion-proof certification in accordance with ATEX, IECEx, cCSAus
- Mechanical, inductive or magnetic sensor variants.

SRBG

- Inductive double sensor
- Direct mounting on quarter turn actuators to VDI/VDE 3845
- Intrinsically safe.

“ In an ever-competitive market, Festo always looks to help our clients attain an advantage with reliable, quality products. ”



DFPD: The new benchmark for quarter turn actuators:

Whether it is used as an individual actuator or as part of a complete Festo process valve, the rack-and-pinion combination of the DFPD with its modern, simple and compact design sets a new benchmark for quarter turn actuators. Its torque range of 10 ... 480, its angle of rotation of up to 180° and its corrosion-resistant variants make the DFPD suitable for most applications – from ball valves, butterfly valves or air dampers in the chemical, beverage and pharmaceutical industries as well as solutions for water treatment.

- Single or double-acting
- Very compact, particularly the single-acting variant
- Highly modular
- Optimised spring design for more efficient single-acting operation in steps of 0,5 bar
- Flexible: adjustable at both ends
- For extreme temperatures: –50 ... +150 °C
- Mounting plate for pilot valve in EU (G) and US versions (NPT).

Olaf Mayer-Mader concluded by saying that, “In an ever-competitive market, Festo always looks to help our clients attain an advantage with reliable, quality products. However, over and above providing the product we truly believe in building relationships with our customers. Events such as these allow us to do just that!”

For more information on these products as well Festo's other offerings; Contact Kershia Beharie on 08600 FESTO (33786), email her at kershia.beharie@festo.com or go to www.festo.co.za



MechChem Africa: integration is the name of the game

From January 2017, *Chemical Technology* will be merging with its sister magazine at Crown Publications, *Mechanical Technology*, under the new title: *MechChem Africa*. As editors, we strive constantly to establish an identity for our own magazines, not an easy task when the subject matter covers such a broad spectrum of topics associated with chemical ‘things’ or mechanical ‘things’. As it happens, the two mags had their origins in *Technology SA*, a magazine started by Crown in the early ‘90s.

Chemical engineering’s history as a vocational subject had its roots in the late 1900s in the existing chemistry and mechanical engineering programmes of the time. In the ‘20s, chemical engineering education focused on the study of unit operations such as separators, reactors and mixers. But after 1960, when a key textbook was published, a new paradigm was adopted and referred to as chemical engineering science. In the ‘70s safety began to be emphasised and only in the ‘90s did sustainability and green engineering enter the scene.

Since the early days of considering mostly just the kinds of engineering that processes raw material by physical, chemical or biological means into different products, chemical engineers have had to learn to understand a broad range of topics, including biological processes, control of processes, fluid flow, heat transfer, mass transfer, material

balances, process dynamics, process equipment design, solids handling and thermodynamics, amongst many others. The same trend has taken place in the field of mechanical engineering where the basics have expanded to include subjects covering aerospace, automotive; acoustics and vibration; manufacturing/production, mechatronics; biomedical; fluid mechanics; emissions and the environment; and energy systems.

Thus, when attempting to identify the manner in which to evolve both *Mechanical Technology* and *Chemical Technology* as one hybrid unit, seeking advantage (the foundation of evolution), is the logical starting point. First among these is that both magazines have expanded in many directions over the years and, although always focusing on their core disciplines, several overlapping areas have naturally emerged, pumping systems, plant maintenance, instrumentation and process control, to name just three.

Both chemical and mechanical engineering features involve, for example, topics such as industrial plant, machines and equipment across the engineering spectrum, from mill circuits to refineries and food and beverage plants. These include highly integrated technologies which incorporate expertise, coatings, materials and treatment solutions derived from the chemical industries and also aspects of mechanical, electrical and IT control systems. Both publications

have in the past been positioned to service the technically minded. In *MechChem Africa*, these key technical strengths will be retained, with the content enriched by deliberately seeking out areas of interest to both chemical and mechanical engineers. Both chemical and mechanical topics will feature every month; the new features list ensures content continuity.

Along with supporting long-term transformation and survival, comes the opportunity to refocus on a holistic publication offering. Our content-driven approach will form the base for offering readers and advertisers opportunities to connect with, and inform each other, by means of this rich technical content.

Using the magazine’s content as a springboard, numerous opportunities reveal themselves for reuse and reorganisation of this content to suit different sets of digital consumers. It can be circulated via email, enewsletter, Facebook, LinkedIn or Twitter. Content can be made ‘findable’ by attaching some carefully selected keywords and, by using mechanisms such as hashtags, collections of related articles can be reorganised in a multitude of ways.

Crown Publications is excited about the shift. “It is important not to remain static,” says publisher Karen Grant. We see increasing service levels for clients, cooperation across magazines and the combination of print and digital media platforms as a sure way of remaining relevant.”

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E-mail:
chemtech@crowns.co.za

Website:
www.crowns.co.za

Consulting editor:
Carl Schonborn, PrEng

Editor:
Glynnis Koch
BAHons, Cert Feature Writing,
LDip Bibl, DipBal

Advertising:
Brenda Karathanasis

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Chemical Engineering Matters

Mapping out the many ways in which chemical engineering impacts positively on the world around us is a complex but rewarding task.

IChemE's 'Chemical Engineering Matters' initiative breaks the challenges down into four areas, which are central to quality of life: water, energy, food and drink, and wellbeing. Much of the work undertaken by chemical and biochemical engineers is applied in one or more of these areas. Each of these is affected by six cross-cutting issues and concerns, such as process safety, education, and advances in biotechnology. The need for sustainability underpins all of this across the full product and process lifecycle.

Managing safety and risk in chemical engineering is very different from managing risk in other industries. Designing and operating high-hazard facilities, where accidents are rare, but can have devastating impacts, demands a more exacting approach to safety and loss prevention. IChemE focuses on collaborating and exchanging ideas with industry, government, regulators and other stakeholders. Developing a common understanding of risk and sharing best practice is of paramount importance.

IChemE accredits higher education programmes at 67 university departments in 13 countries. The Institution also validates and accredits company training schemes and promotes chemical engineering to school pupils – the work in this area in the UK has proved extremely successful and applications to study undergraduate chemical engineering degrees trebled between 2005 and 2015.

Chemical engineers tackle many of the world's grand challenges. The need for properly-funded chemical engineering research is clear, and the sector is evolving quickly, with new tools such as molecular modelling, quantum chemistry, and synthetic biology emerging.

Chemical engineers can bring a unique perspective to multidisciplinary research. They are trained to think holistically, and to understand processes and whole systems in their full complexity. IChemE continues to press for adequate investment in research, and for first-rate teaching to be treated on an equal footing with research.

Water is essential to sustaining life on our planet. However, clean water for drinking and domestic cooking is a limited resource which is coming under increasing pressure through population growth, industrialisation

and agricultural demand. Environmental factors, including climate change, add further pressure. Chemical engineers have a huge role to play, be it treating and recycling wastewater or making industrial and communal water use more efficient. In addition, advanced treatment processes make it possible to recover valuable materials from wastewater, including metals, nitrates, phosphates and biogas.

Securing access to clean and affordable energy is one of the most pressing problems of our time. Chemical engineers, through their central role in designing manufacturing processes and understanding complex systems, are directly engaged in the quest for sustainable solutions.

Chemical engineers are supporting the development of carbon-free, low carbon and renewable energy solutions through new technologies, including electric and fuel-cell propulsion, biofuels, and nuclear power generation. The role of energy storage at scale, alongside managing electricity supply and demand, will be central in allowing renewables to reach their full potential.

Global food production has broadly kept up with population growth, but limited availability of land and water, and the impact of climate change, threatens to disrupt this equilibrium.

Chemical engineers are working on processes to improve the overall efficiency and sustainability of producing food, including developing low-impact solutions such as CO₂-enriched hydroponics. With as much as half of the food produced being wasted, we need to minimise waste and explore other options such as energy recovery from food.

Increasing urbanisation impacts on physical, social and mental wellbeing. Major population centres must adapt to accommodate expanding population in a sustainable way, respond to changes in use, and be ready for potential extreme weather that may result from climate change. Chemical engineers support the quest for sustainability by creating new products and alternative materials with greater atom efficiency, reduced ecological footprints, and renewable feedstocks.

Chemical engineering plays a vital role right across the manufacturing industries – from



IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

primary resource extraction to the production of finished goods. The potential for chemical engineers to improve extraction processes is substantial. There is also significant scope to identify and exploit new renewable resources, design more flexible manufacturing plants, and reduce raw material consumption.

Chemical and process engineering is subject to a range of external influences, including politics, economics, public opinion and ethics. Professional engineers often express frustration at the perceived lack of scientific and engineering knowledge in political circles. IChemE encourages debate based on sound science and good engineering practice, and supports constructive dialogue with policymakers.

IChemE is working alongside the wider chemical engineering profession to highlight the positive benefits of the discipline. We will continue to support and train members who are interested in engaging with the policymakers and the media. Through its global corporate partnerships, the Institution encourages companies to be more forthright about the value that chemical engineers add to their business.

Chemical engineers don't need to be told that chemical engineering matters. This report will help chemical engineers to tell others.

To continue the conversation, contact: email: cem@icheme.org; twitter: @ChemEngMatters and #chemengmatters

This is a shortened version of the Executive Summary in 'Chemical Engineering Matters', 3rd edition, published June 2016 by IChemE. Original publication written and edited by Alana Collis.



A clear signal

PumpMeter optimises fluid handling in the life sciences industry

by Christoph P Pauly, KSB Aktiengesellschaft, Frankenthal, Germany

Whether or not a pump is running in its optimum operating range is difficult to judge from the outside. Although vibrations or unusual noise levels are an indicator of irregularities, for a long time we did not know exactly what was happening inside a pump.

Since KSB developed the PumpMeter for centrifugal pumps a few years ago, thousands of pumps have been optimised. This helpful tool is now also available for pumps used in hygienically demanding processes.

Despite all endeavours to optimise pump systems, we have found that in real life most pumps are operated far outside their optimum operating range, ie, nowhere near their best efficiency point. The consequences of operating a pump in the low-flow or overload range are grave: Not only does efficiency remain under the optimum, but the service life and reliability of wear components such as shaft seals and bearings are also reduced.

Since the introduction of PumpMeter in 2010, pump users have been benefiting from a valuable tool. PumpMeter provides information on the pump's condition via a display so that users can immediately establish how their pump is operating. A typical pump curve illustrates in which range the pump is operating at a particular point

of time. This allows the pump user to see at a glance if the pump is operating in an efficient and cost-saving manner, or if its availability might be in jeopardy (Figure 1).

Today, this product has been installed in around 30 000 systems around the world. Offering this product for pumps used in hygienically demanding applications such as the pharmaceutical or food industry was an option considered by KSB right from the start. "Adapting the sensors to meet hygienic standards posed special challenges from a design point of view," says Daniel Wetter, Life Sciences Product Manager at KSB. "PumpMeter, a product originally designed for standard process conditions, incorporates the kind of uncovered threads and dead volumes that are a no-go for LSA applications as these spaces cannot be cleaned properly."

Focus on quality and energy costs

In general, energy consumption was not always considered top priority in the pharmaceutical and food industries

as their focus was firmly on the quality of the product. In Wetter's experience: "Although this focus remains in place, energy consumption has meanwhile become a major point of interest."

A significant factor favouring the installation of PumpMeter is where many of the sensitive fluids handled in these industries require cooling; any form of energy input into the fluid must therefore be avoided. At the same time, the fluid must be handled as gently as possible. "If a pump is operated in the low-flow or overload range, this always entails increased shear forces. Fluids can only be handled gently if the pump is running at its best efficiency point," adds Wetter.

A further persuasive factor is that a pump running at its best efficiency point always guarantees low maintenance costs. Given the fact that many life science processing companies regularly operate their pumps around the clock, and in some cases, especially during the harvesting periods, they would face catastrophic consequences in the event of pump failure. "A pump that is operated at its best efficiency point has a markedly longer service life," says Wetter.

Optimally adapted to meet hygienic requirements

Based on the conventional PumpMeter, KSB has developed a variant that is suitable for use in hygienic processes. The main differences between PumpMeter LSA and the conventional PumpMeter are the sensors and the way they are installed in the pipe. The sensors have been designed in accordance with the standard food industry guidelines, ie, they are EHEDG-certified and comply with the FDA and EN 1935-2004 standards. PumpMeter LSA will be available for KSB's Vitachrom and Vitacast hygienic pumps.

Normally, when PumpMeter is not used for demanding hygienic processes, it is screwed into the pump via two tapped holes. These tapped holes involve dead volumes, and cleaning the threads is impossible. Sensors used for the food industry are also designed with larger diameters in order to comply with hygienic requirements. Installing the sensor directly into the pump was thus not feasible; adapting the sensor required a fundamentally new approach.

"The solution found is an adapter in the form of a socket welded to the pipe by orbital welding in such a way that it is not situated in the no-flow zone," explains Wetter. "This way, the sensor's diaphragm is as flush with the pipe as possible." The diaphragm is also sealed with an O-ring whose material is compliant with FDA requirements. Importantly, the combination of orbital welding socket and sensor has been tested and certified by EHEDG.

Visualising correlations

Like its big brother, PumpMeter LSA comprises pressure sensors as well as an analysing and display unit attached to the pump. It measures suction pressure, discharge pressure and differential pressure. The difference between the two pressures is used to calculate the pump head, including the dynamic head share.

For pumps driven by an asynchronous motor operated at a fixed mains frequency the pump speed depends on

the torque. The torque, in turn, depends on the motor slip. When the motor load is low (centrifugal pump operating at low flow), the slip is small; when the motor load is high, the slip is large. The correlation between slip, torque, speed and the load on the asynchronous motor is described in engineering literature by the Kloß formula.

We can make use of this interdependence to calculate the operating point. First, the precise speed of the pump set is derived from the pressure pulsation caused by the passing impeller vanes. Then, the speed is used as a basis to compute the torque and the pump input power. This method supplies the pump input power in addition to the measured pressures and the head to determine the operating point of the centrifugal pump.

Green stands for optimum

PumpMeter continuously analyses the pump operating data, establishes a load profile and makes the operator aware of energy-saving potential that could be leveraged by using a variable speed system (Figure 2). If the EFF (energy efficiency) icon lights up, the unit signals that there is potential for optimisation.

However, the tool also offers further information: If many operating hours are being recorded in low-flow conditions and the operating point is moving over a broad range of the characteristic curve, retrofitting a variable speed system is a recommended option.

If the operating hours are in the far right of the load profile, the pump set has been operated near the limits of its operating range. Pump and motor overload are likely. "Operators should ask themselves whether they actually need this flow rate," argues Wetter. "Trimming the impeller might be an option to lower the energy consumption." Another option could be that the application generally requires a smaller pump type.

Conclusion

There are many reasons why PumpMeter LSA is an interesting product for both the life sciences and the food industry

Alongside reduced maintenance costs, PumpMeter LSA ensures that the fluids involved in these industries' processes are handled gently and the products' quality is increased as a result. A further benefit offered by the PumpMeter LSA unit is that it replaces the pressure gauge upstream and downstream of the pump, the pressure transmitter for the



Figure 1: Interpretation of current operating point



Figure 2: Load profiles

control functions and additional monitoring equipment which makes for considerable cost-saving.

At the same time, the data collected can also be made available to a central process control system via standardised interfaces.

This offers potential for further optimisation in the overall process. After comprehensive testing at KSB's in-house test facility, the units are currently undergoing tests in the field. June this year saw the official sales start of PumpMeter LSA and marked a new era in the life sciences industries in terms of pump optimisation.

Optimising energy efficiency in pump systems



The KSB SupremeMotor

The majority of pump manufacturers claim to be offering higher efficiency pumps as they respond to the demands imposed on industry to reduce carbon emissions and from end-users seeking to keep down production costs.

There is no single solution or answer to improving the operating efficiency of a pump because any number of factors will influence its performance once it has been installed and commissioned. What the pump manufacturer can do is to develop a pumping system that utilises the optimum number of energy-saving devices and components including the latest energy-efficient motors and also assist the customer in the pump selection and specification process.

At the outset, it is necessary for the pump manufacturer or supplier to have a comprehensive profile of the customer's application before the pump is selected. Where pumps are being replaced, then an in-depth analysis of how the incumbent pump(s) have operated should be carried out. In many applications, particularly where a large number of smaller powered pumps may be required, carrying out such in-depth analysis can be impractical. Where the pumps may be up for replacement, there can often be reluctance from the end-user to consider looking at an alternative proposal.

KSB has responded to this type of scenario by developing a monitoring device that will measure the suction pressure, discharge pressure, differential pressure and head and calculating the values will produce a pump curve illustrating the operating range and produce a load profile of the pump. From this, the pump supplier and the user will be able to deduce if the pump is operating efficiently or not and see at a single glance if the pump is providing

efficient and cost-saving operation or if its availability is compromised. This monitoring unit replaces the pressure gauges upstream and downstream of the pump, plus the pressure transmitter normally required for the control functions and any additional monitoring equipment.

Secondly, it is necessary to select the most appropriate pump material and pump size for the application. Over sizing pumps just to be safe is a common error made by many end-users and is one of the greatest contributing factors to energy consumption. Thirdly, the efficiency of the hydraulic parts has to be addressed as these have to be matched exactly to the performance required. The impeller diameter is a specific example of a hydraulic element that can influence performance. At the same time the hydraulic efficiency of valves is important as pressure losses will affect pump performance.

The fourth issue relates to pump speed. Controlling the pump speed offers the by far the greatest saving potential, but matching the power input to the actual demand is still far from standard practice in many areas of industry. Solutions are available to control the speed of the pump exactly to the output that is needed. Using a variable speed drive provides dynamic pressure compensation, which will facilitate extra savings under low flow conditions. Using a throttling valve is another approach. However, variable speed drives can reduce power consumption by up to 60% and KSB's motor-mounted PumpDrive, which also allows frequency converters to be added, can be retrofitted to existing equipment.

Energy-efficient motors like the high-efficiency SuPremE electric motor series are an issue that all pump users are having to address. It is clear that simply fitting an energy-efficient motor is not sufficient on its own to reduce a pump's energy consumption

Whether motivated by saving energy to increase profits, reduce production costs or to comply with IEC regulations, pump users can examine any number of ways to make their systems run more efficiently.

Author: Christoph P Pauly of KSB AG, Germany



MegaCPK

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FOCUS ON PUMPS AND VALVES

Parker releases new air-driven liquid pump



Parker Autoclave Engineers, part of Parker Hannifin, a global leader in motion and control technologies, has released an innovative new air driven liquid pump, the AHL118.

A high volume, double-ended, double acting high pressure pump, the AHL118 is designed for use in oil and gas, chemical, industrial and research applications.

The pump operates to a pressure range of 23 000 psi and at 25,5 litres per minute. The AHL118 is designed to be extremely robust, featuring a carbon-based prioritised coating to the plunger, which is three times harder than Stellite. This makes the plunger unscratchable, extending the lifespan of the seals and reducing downtime, repairs and servicing, delivering major savings to the customer.

All AHL118's hydraulic parts are manufactured from stainless steel, making them very durable with extended Mean Time Between Maintenance (MTBM) and increasing safety. All AHL118's pump hardware is manufactured from stainless steel, which is anodised to the bottom and top caps for superior corrosion resistance.

Shawn P Landry, IPD Product Manager - Pumps/Systems for Parker Autoclave Engineers, said: "This air driven liquid pump offers unrivalled performance and reliability, bringing huge benefits to customers. When developing the product, we analysed what the issues were in the market and so designed a pump that would last significantly longer, lowering downtime and maximising efficiency."

Parker Autoclave Engineers has over 70 years' experience in manufacturing air driven high pressure liquid pumps, valves and fittings for a wide range of markets. The company offers a comprehensive range of products, with a wide choice of sizes, flow capabilities, output pressures and additional features. The company's products are used in a variety of different industries and applications, including hydrostatic/burst/leak, chemical injection, valve/gauge/hose testing, bolt tensioning, hydraulic control systems, laboratory research and autofrettage systems.

For more information, go to www.parker.com, or its investor information website at www.phstock.com

Becker Mining's PVS vortex pumps 'most efficient' for sludge and slurries

Becker Mining South Africa's PVS range of vortex pumps has been designed to efficiently pump sludge and slurries containing large abrasive solids and fibrous materials in light, medium and heavy service industries.

The PVS (pump or vertical spindle) range, which can handle solids to 72 mm (3 inches) and S.G.'s (specific gravities) to 1,5, achieves up to 87 m heads at speeds of 2 950 rpm. These units are available in two and three inch models, with a 0,7 m spindle length and single motor drive.

"The most important feature of these vertical pumps is the recessed, non-clog impeller design that prevents binding and clogging problems. Since the impeller is clear of the pump casing, any solids and fibrous materials that enter the suction inlet will be expelled through the pump discharge, without damaging the impeller," says Theo Cambanis, Becker Mining South Africa. "Another advantage of Becker's pumps design is that spares are completely interchangeable. This reduces inventory management costs and simplifies on-site repairs. Because all

components are locally manufactured, these pumps are readily available and a large stock holding of spares and raw materials ensures swift delivery throughout the country."

The PVS series, with a robust one piece casing, has been designed to efficiently cope with all types of solids and fibrous materials. A locknut that fastens the impeller to the shaft prevents the impeller from turning off if the motor is started in the wrong rotation direction.

These pumps have a sleeve stuffing box clearance that minimises blow-back of materials being pumped around the shaft sleeve, without requiring sealing contact. A high strength pipe column maintains alignment between the bearing frame and its casing. There are no submerged bearings on the cantilevered shaft.



Becker Mining South Africa's PVS range of vortex pumps has been designed to efficiently pump sludge and slurries containing large abrasive solids and fibrous materials in light, medium and heavy service industries.

For further information: Theo Cambanis,
Becker Mining South Africa
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Initiatives in the management of chemicals in the chemical industry

Chemicals are an integral part of our natural and urban environments. Their contribution to society is invaluable, but unless we manage them well they can cause harm to humans and the environment.

As chemicals are everywhere, including in our workplaces, it is necessary to ensure that each chemical product comes to market only after it has been properly identified, an assessment of any possible hazardous properties has been carried out and safe-handling methods have been developed to manage risks. Chemicals can be released at every stage of their life cycle, from production or importation and processing, through manufacturing and use, to disposal. At all stages, this may lead to exposure of workers and the general population and pollution. It makes sense that an integrated approach be taken to assess and manage these risks rather than isolated measures, as some of these risks may have a global impact. Here we look at some of the challenges that lie ahead.

Global initiatives on the sound management of chemicals

The International Labour Organization (ILO) constituents have participated for many decades in the development of international policies and commitments on the sound management of chemicals. These efforts have led to the birth of Multilateral Environmental Agreements (MEAs), which include the ILO Chemicals Convention, 1990 (No. 170), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their

Disposal, and the Stockholm Convention on Persistent Organic Pollutants.

However, one disadvantage of these Conventions is that, with the exception of ILO Convention No. 170, MEAs are designed to protect one particular medium without addressing others, which leads to inconsistencies. A recent report from the Center for International Environmental Law (CIEL) advocates the promotion of synergy across multilateral environmental agreements (MEAs), with a lifecycle approach to the sound management of chemicals.

In addition, following the resolution concerning the harmonisation of systems of classification and labelling for the use of hazardous chemicals at work, adopted by the ILO in 1989, the issue was taken up at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992 (also known as the Earth Summit). Subsequent work was coordinated and The Strategic Approach to International Chemicals Management (SAICM) was developed as a voluntary mechanism to fill the gaps not covered by MEAs.

Established by the ICCM in 2006, the SAICM was conceived as a policy framework to guide efforts to achieve the goal set out in the Johannesburg Plan of Implementation of the World Summit on Sustainable Development that, by 2020, chemicals would be produced and used in ways that

minimise significant adverse effects on human health and the environment.

The chemical industry and trade unions participated positively, together with the ILO, in the formation of the SAICM. The industry's participation sent an explicit message to the public that the industry would take a lead role in the safe management of chemicals in the global arena. To this end, the industry has promoted a set of voluntary initiatives, including the Responsible Care Global Charter, the Global Product Strategy, the Long-range Research Initiative, and the SubChem platform.

In 2007, the ILO organised a Meeting of Experts to Examine Instruments, Knowledge, Advocacy, Technical Cooperation and International Collaboration as Tools with a view to Developing a Policy Framework for Hazardous Substances in order to promote the SAICM among ILO constituents and others. The Meeting of Experts adopted recommendations which included a plan of action based on the following: information and knowledge; preventative and protective systems aimed at reducing risks; capacity building; social dialogue; and good governance.

Responsible Care (RC) initiatives

The chemical industry's voluntary initiatives contribute to creating a consistent and coherent sound management of chemicals globally. RC is the chemical industry's unique global initiative that drives continuous improvement in health, safety and environmental performance, together with open and transparent communication with stakeholders.

The International Council of Chemical Associations (ICCA) is the key forum for promoting RC, taking a lead role through the participation of nearly 60 national chemical manufacturing associations, which are the key implementing actors at national level. RC has fostered the development of the Global Product Strategy, which seeks to improve the industry's management of chemicals, including the communication of chemical risks throughout the supply chain. Through RC, the chemical industry is reporting and tracking its progress on critical elements of product stewardship. There are, however, some areas for improvement with respect to RC.

An American Chemistry Council (ACC) external advisory panel for RC issued recommendations focused on improvement and expansion in four key areas: product safety, performance improvement, communications and governance, and globalisation. The ACC has formed task forces of member company executives to focus on these segments.

Protection from hazardous chemicals OSH challenges

In 2008, some 651 279 deaths were caused by exposure to dangerous substances, including workplace chemicals. In 2006, it was estimated that nearly 440 000 people throughout the world died as a result of occupational exposure to hazardous chemicals.

Cancer is considered to be the most serious occupational disease: over 70% of the total figure, or nearly 315 000 people, died of cancer. The figure is thought to be an underestimate of the real burden attributable to chemicals, as only a small number of chemicals were included in

the analysis owing to limited data availability.

No chemical substance can cause adverse effects without first entering the body or coming into contact with it. There are four main routes of exposure for chemical substances to enter the human body: inhalation, absorption, ingestion, and transfer across the placenta of a pregnant woman to the unborn baby. Most chemicals used at the place of work may be dispersed into the air to form dust, mist, fumes, gas or vapour and can then be inhaled. In this way, workers who do not handle them but stay within their reach can be exposed to a mixture of chemicals from various sources.

Handling chemical substances without proper protection exposes the worker to the risk of absorbing harmful amounts of a chemical through the skin. This usually happens when handling the chemical in liquid form. Dust may also be absorbed through the skin if it is dampened by, for instance, sweat. The capacity of different chemical substances to penetrate the skin varies considerably. Skin absorption is, after inhalation, the second most common route through which occupational exposure may take place. The protective external layer of skin may be softened by toluene, dilute washing soda solution, thus permitting other chemicals to enter readily into the bloodstream, such as aniline, phenol, benzene.

Eyes may also absorb chemical substances, either from splashes or from vapours. Dangerous chemicals can enter the body through ingestion as gases, dusts, vapours, fumes, liquids or solids. Inhaled dust may be swallowed, and food or cigarettes may be contaminated by dirty hands.

Addressing the risks caused by hazardous chemicals at enterprise level

An essential purpose of occupational safety and health (OSH) is the management of occupational risks. In order to do that, hazard and risk assessments have to be carried out to identify what could cause harm to workers and property, so that appropriate preventive and protective measures can be developed and implemented.

Two risk assessment processes that are essential for the management of occupational risks are the determination of occupational exposure limits (OELs) and the establishment of lists of occupational diseases. Most industrialised countries establish and maintain OEL lists. These limits cover chemical, physical (heat, noise, ionising and non-ionising radiation, cold) and biological hazards. One list that is outstanding in terms of coverage and strong scientific





peer-review process, and therefore used as a reference by other countries, is the list of threshold limit values (TLVs) of the American Conference of Governmental Industrial Hygienists (ACGIH).

In addition, technical measures can be used to prevent chemical hazards at source, and to prevent the transfer of dangerous chemicals. It is possible to reduce the exposure of workers by technical means. First, an effective control method for any hazardous chemical is substitution: the hazardous chemical is replaced with a less hazardous one. Choosing a safer process or changing an old and hazardous process to a less dangerous one effectively reduces the risks. Second, if hazardous chemicals cannot be replaced by less dangerous ones, exposure must be prevented

by protecting the worker: enclosing the hazardous process or chemical is an effective method. However, it is not always possible to enclose all dangerous operations.

Properly designed local exhaust ventilation is the second choice when it comes to removing contaminants at source. Where it is difficult or impossible to prevent hazardous chemicals, fumes, dusts, mists or particles from entering the workplace air at source, a general dilution ventilation can be installed.

A safety committee should be formed with the task of working regularly with safety issues. It could work with organisational measures; by assessing chemical hazards and setting priorities concerning safety in the organisation; and much, much more too.

The management systems approach is critical in creating improvements. ILO-OSH 2001 reflects the ILO tripartite approach and the principles defined in its international OSH instruments.

Addressing the risks caused by hazardous chemicals at international level

Regulations have been introduced on the management of chemical substances which should contribute to improving workers' occupational health and safety by providing better information, establishing and improving channels of communication between employers and suppliers, and removing substances that pose a high risk to human health and the environment from the market.

One such example is the European Union's Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), which entered into force in 2007, with the aim of ensuring a high level of protection of human health and the environment from the risks that can be posed by chemicals. REACH makes industry responsible for assessing and managing the risks posed by chemicals and for providing appropriate safety information to their users.

A number of chemical substances for which sufficient hazard and exposure data are available is of great concern. The ILO List of occupational diseases (revised 2010) is used by ILO member States as guidance for establishing and maintaining their national lists of occupational diseases.

REACH requires chemical manufacturers and sellers to develop health-based Derived No-Effect Levels (DNELs). These are used to establish risk management measures that must be communicated to employers and workers.

These and other regulations concerning the management of chemicals should improve good practice on the part of chemical users and workers, as well as encourage implementation of current guidance in order to minimise exposure.

New materials, such as nanomaterials, pose additional challenges. The growing list of nanomaterial applications includes cosmetics, food packaging, clothing, disinfectants, surface coatings and paints. It is estimated that 400 000 workers were employed in nanotechnology industries worldwide in 2010, and this number is expected to rise to 6 million by 2020.

'Global chemicals outlook: Towards sound management of chemicals', published by the United Nations Environment Programme (UNEP), states that, of the estimated over 140 000 chemicals on the market today, only a fraction have been thoroughly evaluated to determine their effects on human health and the environment.

The Globally Harmonized System (GHS) of Classification and Labelling of Chemicals and the Chemicals Convention, 1990 (No. 170), are important tools that countries can draw upon to develop national chemical hazard communication systems: they provide a basis for establishing comprehensive chemical safety programmes; they represent a key step in harmonizing national chemical hazard communication systems worldwide; and they have great potential to improve chemical safety across all relevant sectors.

The ILO participates in the United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonised System of Classification and Labelling of Chemicals (UNCETDG/GHS). The ILO and the United Nations Institute for Training and Research (UNITAR), through the UNITAR-ILO Global GHS Capacity Building Programme, are the focal points for capacity building.

Conclusion

Collaboration and coordination need to be fostered among voluntary initiatives and MEAs, with a particular emphasis on promoting the ratification and implementation of the ILO's OSH-related instruments and the implementation of the GHS.

This article consists of edited extracts from the document GDFCI/2013 prepared by the INTERNATIONAL LABOUR ORGANIZATION: Sectoral Activities Department, and entitled 'Promoting decent work in the chemical industry: Innovative initiatives'. This was an issues paper for discussion at the Global Dialogue Forum on Initiatives to Promote Decent and Productive Work in the Chemical Industry (Geneva, 26–28 November 2013) Geneva, 2013 and is used with kind permission of the ILO.



Cummins – Developing new products and technologies worldwide

The quality and cleanliness of fuel is a major factor that contributes to the performance of diesel engines and components. Contaminated fuel leads to higher maintenance costs and engine downtime, thus good fuel filtration is vital for engine performance. ‘ChemTech’ discusses some of the recent offerings from Cummins, designer and manufacturer of power generation equipment, power systems, gasoline engines, and custom power supplies.

Cummins South Africa is organised to serve four distinct but complementary business segments. Cummins’ various operations and functions, such as, for example, engineering, warehousing and distribution, and remanufacturing of components, support the major role that the company enjoys in the diesel business throughout the southern African region, according to a spokesperson for the company.

The four segments, in a nutshell, are:

- The Distribution Network serving all its customers, products and engine applications;
- The Engine Business, which manufactures and markets engines and aftermarket products for heavy and medium duty trucks, buses, RVs and light commercial vehicles and for equipment in many different markets, such as mining, agricultural, and marine.
- The Power Generation Business is a global provider

of electric generators, power systems and related accessories, components and services, whose products include diesel and gas generators used in various types of vehicles, plus diesel and gas generator sets, transfer switches, and switchgear used in commercial facilities for emergency back-up and prime power.

- The Filtration and Other businesses include Cummins Filtration which provides Fleetguard and Nelson filters, silencers, emissions after-treatment and exhaust systems; and Cummins Turbo Technologies which provides Holset turbochargers to a wide range of partners, manufacturers and distributors.

Bulk fuel filtration improves engine performance

Fuel contaminants such as dirt, sediment and water can be introduced into the fuel through channels such as the

processing stages, transportation and when the fuel is delivered to the point of use. As a result, Cummins Filtration designed a Bulk Fuel Filtration system with an engineering company for a customer in Egypt. Cummins Technical Sales Manager for Africa, Gerald Annandale, explained to us that the system will be installed on site for a main storage tank to achieve cleaner fuel.

“This Bulk Fuel Filtration system has a filter with a micron (μ) rating of 3, which means it will filter the contaminants of 3 μ or larger. The filter’s efficiency to remove contaminants, does however, depend on the quality of the fuel initially received.”

Annandale told us that fuel injection system suppliers require that fuel should meet the ISO 12/9/6 cleanliness standard at the injection system, as contaminated fuel can cause components to wear prematurely. The Bulk Fuel Filtration system is intended to help with reducing contamination levels so that cleaner fuel will be obtained at the point of entry into the machine’s tank (ISO 18/16/13), resulting in less maintenance and labour costs, thus leading to greater productivity.

How it works

Fuel is pumped from the bulk fuel tank on the tank farm downstream into the Bulk Fuel Filtration system. The fuel can either be recycled to the main tank, on a kidney loop basis, or delivered to the tank of the mobile machine directly. At this point, the cleanliness level of ISO 18/16/13 or better is achievable. The cleanliness level can be improved upon at this point by running the unit as a kidney loop system, whereby ISO 16/14/12 can be achieved. Downstream of the vehicle’s tank, there is a first and second stage on-board system that is designed to achieve the desired ISO 12/9/6 cleanliness level with Fleetguard on-board NanoNet technology.

According to Nomfundo Maseko from Cummins Market-



ing Communications Coordinator, the Fleetguard range of products provides a solution for achieving cleaner fuel in conjunction with the Bulk Fuel Filtration system. “The system features a visual glass window that displays a rotating impellor that starts turning as soon as the filters restrict and this indicates that it is time to change the filters.”

The pump on the unit is sized to give a flow rate of 300 ℓ /min, and the elements fitted are at 3 μ absolute. “The unit is designed to handle up to 1 500 ℓ /min and the elements range from 3, 5, 6, 12 and 14 μ (Beta 200). The suction side of the pump is protected by a 150 μ ‘Y’ type strainer as well as an internal relief setting of 15 bar on the pump to protect the system. Furthermore, mini-mess sampling points verify the efficiency of the Bulk Fuel Filtration system – there is one sampling point before going through the filter (from the bulk tank), and another sampling point after going through the filter system.”

Supporting clean power development in Africa

Research studies have shown that industrial activity is directly related to the demand for electric motors and back-up power through diesel generators for operational support. The most prevalent end-use applications for generators include: industrial plants, manufacturing, construction, chemical applications, petrochemicals, agriculture, automotive, mining, oil and natural gas, telecommunications and healthcare.

Responses to climate change and energy efficiency worldwide have led to global fuel-source trends that would initially appear to reduce considerations given to diesel power, and increase the share of renewable and natural gas power applications in the power-supply mix.

Nalen Alwar, Projects Sales Manager for Cummins Power Generation Southern Africa, made the point that diesel fuel is still by far the most widely-used fuel source, especially in developing nations and emerging markets. “A well-established supply chain exists in Southern Africa, where diesel-generated power has shown advantages of project simplicity, short project lifecycles, lower capital cost and rapid installation time for power on-stream.”

According to Alwar, there have been key challenges with regard to operating cost and emissions levels, and it is worthwhile exploring how technological development has addressed these. “Falling crude oil prices have lowered diesel prices and impacted alternative-energy investment drivers. Furthermore, the concept of resilience through hybrid solutions has meant that diesel-generated power has to feature as a relevant component.”

Alwar also revealed to us that instability in stakeholder structures for projects with alternate fuel feedstock, together with decreasing levels in dams and lakes, which has affected the performance output of hydropower plants, has yet again resulted in diesel-generated power being called on as emergency measures in Southern Africa.

A topical issue is whether diesel power would still be relevant in the future. Climate trends are now demanding that all users of power employ tactics to reduce harmful emissions that impact the environment, and renewable energy solutions are advancing beyond the infancy stage

of the technology lifecycle in Southern Africa.

However, diesel power is still the mainstay solution for operational resilience and industrialisation in remote areas. Significant technology improvements have been made towards reduction in capital, operating costs and environmental stewardship.

Compact designs have resulted in footprint reductions and increases in power output have been achieved by increasing cylinder peak pressure, while also reducing the conventional number of cylinders required. Ductile iron blocks with the highest structural strength are used to achieve multiple overhauls, with minimal remanufacturing. Durable pistons can be forged from a single piece of steel, allowing reuse at the rebuild stage.

Alwar further elaborated: "Premium materials are used for piston rings and hardened cylinder features, together with enhanced piston cooling, reduced piston-ring temperatures and increased wear resistance and cylinder life. This reduces total lifecycle costs."

Efficiency of diesel

The efficiency of a diesel engine is most directly tied to combustion rate – the degree to which the fuel is completely burned during ignition. This is typically a function of how finely and evenly dispersed the fuel is during injection into the combustion chamber. Turbocharging, which forces excess air into the chamber, also improves the combustion rate, which is why two-stage turbocharging, with intercooling between the stages, is now common for diesel gensets.

Alwar explained that a Modular Common Rail System (MCRS) enables diesel engines to achieve exceptionally low fuel consumption for their power output. "The MCRS injectors are capable of extremely high-pressure injection, which leads to a reduction in particulate matter emissions. This method replaces traditional mechanical injection with electronically-controlled multiple high-pressure injections during each combustion cycle," he continued.

Rather than rely on separate injectors controlled by a camshaft, it uses a single system that supplies all the injectors in the engine with a common source of fuel. This allows much higher fuel pressures than a mechanical injection system, which maximises vaporisation of the fuel, and thus combustion rate. Modern high-pressure common-rail diesel fuel systems allow for much higher fuel pressures, and much more precise and flexible injection of fuel into the combustion chamber.

The future outlook

With diesel gensets typically representing either emergency generation or generation where there may be no grid power to fall back on, these are critical considerations. Oil-management systems that replenish oil automatically, based on engine-load factors, fuel filtrations systems with enhanced durability, high-pressure fuel systems and prognostic capabilities, are other improvements that reduce operating costs.



Hybrid solutions have meant that diesel-generated power remains a viable and cost-effective solution.



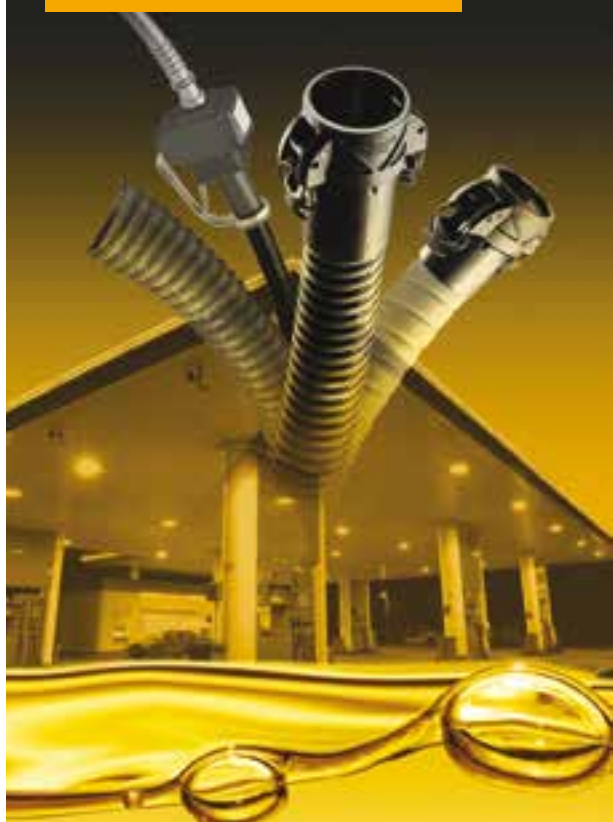
A Modular Common Rail System (MCRS) enables diesel engines to achieve exceptionally low fuel consumption for their power output.

Alwar made a point of explaining that the rise of distributed generation through decentralised power supply schemes is evolving further. "Decentralisation is not just about displacement of grid power with one energy source, but how to optimise decentralised systems with various fuel sources to achieve energy efficiency, reliability and critical process protection."

He indicated that diesel-engine power plants have synchronous technology and contribute a high level of operational stability for standby or prime power applications, together with mature diesel-fuel supply chains. "Manufacturers of diesel gensets are making steady technological gains that reduce capital intensity and emission levels, and enhance power output and efficiency. Diesel-generated power is still likely to feature on its own or be incorporated into hybrid solutions for many more years," he concluded.

To find out more about Cummins' filtration offering go to www.cumminsfiltration.co.za. You may also contact Susan Quist on email susan.quist@cummins.com. Nalen Alwar may be contacted at tel: +27 11 321 8700 or email nalen.alwar@cummins.com

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While AECOM has a strong presence in Africa, it is also one of the largest multinationals in the world, enjoying strong relationships with most of the major oil and gas companies. "As a company, we have a very good understanding of the industry and its role-players. Due to AECOM's size and diverse nature, we are one of a few companies that can offer a total solution," Africa Oil and Gas Business Line Leader Samuel Du Rand comments.

"AECOM believes a strong local industry that delivers services from within each country is essential to sustained success. It is this understanding that will allow us to add great value to the development of the industry on the continent," Du Rand adds.

He points out that the biggest factors impacting on the industry at present is the oil and gas price, in addition to technological development and the costs associated with alternative energy sources. This includes the development of large global unconventional resources such as shale gas, which will impact the long-term development of new reserves. Global oil and gas dynamics, including the shifting political landscape within the oil-rich regions of the Middle East and other areas, will also have a major impact.

Du Rand predicts that there is likely to be an increased focus on previously untapped and unexplored reserves in Africa, especially Southern and Eastern Africa. Major oil and gas companies will look to expand their reserves in Africa as an alternative supply to the known markets of the Middle East and Russia. This, in turn, will enhance trade and investment on the continent.

"Inter-country infrastructure such as pipelines between Uganda and Kenya or Tanzania, Mozambique and South Africa, for example, are typically very large investments. However, these are game changers in terms of development and macro-economic growth. Unfortunately, in Africa, as well as many other parts of the world, the discovery of hydrocarbon reserves has come with conflict."

Looking at oil-and-gas opportunities in Africa, Du Rand stresses that major discoveries in countries like Mozambique, Tanzania, Kenya and Uganda have generated a lot of excitement and interest in the region.

"However, regulatory requirements are being addressed, with Mozambique, for example, being close to ready for development. Unfortunately, the low oil price is stalling many developments at the moment. It will also be interesting to see how international oil companies will decide to develop new reserves in Africa, and how the cost of creating enabling infrastructure here compares with other parts of the world," Du Rand elaborates.

For more information contact Mmule Ncongwane at NGAGE Public Relations on tel: +27 11 867 7763; email mmule@ngage.co.za or go to www.ngage.co.za

WearCheck filters save money

Condition monitoring specialists, WearCheck, has now extended their fuels, lubricants, air and coolants (FLAC) maintenance programme to include unique bypass filters, which minimise contaminants, thereby extending the life of the oil and fuel.

The filters were initially trialled at a chrome mine on three GHH machines running air-cooled motors. Once proven effective, the filters were then fitted to a further 27 machines in the same mine. The mine has already recorded savings of R1,7 million after paying for the implementation of the WearCheck programme.

Also known as depth filters, the bypass filters are bolted externally on each component, and the oil or fuel of that component passes through the filtration system, similar to how an individual dialysis machine would assist a patient to filter their own blood.

The filters function best as part of a comprehensive condition monitoring programme, and, following the successful trials, they are being widely installed on different machines. They are designed to clean oil and fuel used in a variety of industries, including mining, earthmoving, transport, construction, manufacturing, shipping, electrical and aircraft.

Fuel typically passes through three filters – first the OEM water separator, next the OEM diesel filter, and finally WearCheck's depth filter, which is last in line, and which provides extremely fine microfiltration, screening particles between 0,5 and 1 microns in diameter.

The filters can either be fitted to existing components or installed during construction or rebuilding of the machine.

Chris Hattingh (operations/technical support for WearCheck), outlines some of the advantages of the process, "By ensuring the fuel at the injector tip in a diesel engine is super-clean, it protects the moving parts and



Bolted externally onto the machine is one of WearCheck's bypass filters for the transmission. The filters have already saved a mine over R1,5 million during an initial trial process.

keeps these within spec for much longer, allowing for better atomisation.

"During the trial process for the filters, our FLAC programme initially identified the correct oil to be used for different components, and outlined optimum cleanliness procedures for bulk oil storage. The bypass filters were then fitted and found to extend the oil's longevity and boosted the components' life.

"The advantage of cleaner burning fuel means more power. Because there are now potentially fewer by-products passing into the crank case oil, such as soot, the additive packages don't have to work so hard, so they may also last longer.

"By using scientific data on the oil's condition, and knowing that the filters have cleaned the oil or fuel effectively, we can advise customers when it is feasible to extend the oil drain interval without risk, thereby saving them money." WearCheck celebrates 40 years of condition monitoring excellence this year.

For more information contact WearCheck on Tel +27 11 392 6322 or +27 31 700 5460 or www.wearcheck.co.za email support@wearcheck.co.za



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SA lubricant market gets the Royal Purple treatment from Filter Focus

"Filter Focus is proud to be associated with Royal Purple, which offers the highest level of protection, while reducing friction co-efficiency and associated parasitic losses. With Royal Purple lubricants significant energy saving can be gained." - Chief Operating Officer, Filter Focus, Craig Fitzgerald. For detailed product information on the Royal Purple product range, visit www.royalpurpleoil.co.za.

DST- CSIR Nanomaterials Industrial Development Facility (NIDF)

Call to industry, SMMEs and researchers in academia and science councils who need to scale up chemical processes that require an autoclave, process tanks and particle drying systems.

The DST-CSIR NIDF is inviting applications for industry led projects that require the use of the scale-up facility in order to accelerate the development and commercialisation of chemical and nano-based technologies. Officially launched in December 2015 by the Honourable Minister of Science and Technology, Ms Naledi Pandor, the DST-CSIR NIDF was set up to bridge the gap between bench scale developments and industry. The scale-up facility which was established within the DST-CSIR National Centre for Nano structured Materials of CSIR will support projects by offering:

- Flexible and multi-purpose scale up plant equipped with autoclave reactors, filter press, wet mill, process tanks, rotary dryer, bag house etc.
- Access to skilled workforce with the right technological expertise (scientists and engineers trained and experienced in process development and scale up).
- Technical support (well-equipped workshop)
- State-of-the-art equipment to characterise products during scale up for rapid process optimisation and quality assurance analysis

We invite applications from industry, entrepreneurs and public institutions, and the following aspects need to be addressed in the proposal:

- The goal of the project
- Clear understanding of the market need being addressed, industry dynamics and description of the competitive environment
- Technology description including key features and competitive advantage
- Cost benefit analysis (budgets, resource requirements, capital budgeting analysis)
- Project time frame

It should be noted that successful applicants will not receive any funding through this process. Furthermore, resources allocated to projects will be agreed during the selection process.

APPLICATION DUE DATE: 30 NOVEMBER 2016

A fully completed and signed proposal must be submitted to the NIDF (nidf@csir.co.za) not later than 30 November 2016. Please limit proposal length to not more than 5 pages. All submissions will be treated as strictly confidential.

Please direct all queries to:

Dr. Manfred Scriba (Program Manager: 0128414738, mrscriba@csir.co.za) and Dr. Mike Masukume (Nanostructure Scale-up Facility Manager: 012 8414269, mmasukume@csir.co.za)



DST- CSIR Nanomaterials Industrial Development Facility (NIDF)

Call to researchers in industry, academia and science councils who need to develop and test special polyolefin plastics.

The polymer processing facility of the DST-CSIR Nanomaterials Industry Development Facility (NIDF) at CSIR, seeks to enhance the local polymer industry competitiveness by providing a pilot scale platform for new polymeric materials development by offering:

- 40 L/D co-rotating Twin Screw Extruder; 5-layer blown film extrusion line (25 & 20 mm diameter screws); 5-layer cast sheet extrusion line; 500kN Injection moulding machine
- Access to skilled researchers, technical expertise and a world-class characterisation facility comprising rheometers, thermal characterisation equipment (DSC, TGA), mechanical testers (Tensile, Impact, DMA), microscopy (TEM, SEM, POM), gas permeability barrier testers, GPC, FTIR (single or coupled with GC, MS, TGA) etc.

The facility would like to invite industrial entrepreneurs, higher learning institutions and other research institutions to partner with it to develop new polymer-based materials which are preferably at a stage beyond synthesis. The preferred materials are presently olefins including: ***nano-structured composites, multiphase polymer systems, bio-based polymer systems and high performance composite polymers.***

We invite applications from industry, entrepreneurs and public institutions, and the following aspects need to be addressed in the proposal:

- The goal of the project
- Clear understanding of the market need being addressed, industry dynamics and description of the competitive environment
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Environmental monitoring in the rain forest of Costa Rica

by Dr William Kaiser, Department of Electrical Engineering, UCLA and Dr Philip Rundel, Department of Ecology and Evolutionary Biology, UCLA, Los Angeles, California

To better understand the impact of the emission of greenhouse gases on the environment, researchers are conducting a study at La Selva Biological Station in the Costa Rican rain forest to measure the exchange of CO₂ (also known as the carbon flux) and other materials between the forest floor and the atmosphere.

The challenge consisted of supporting a wide range of wireless environmental measurements using a single device that provides robotic control, remote configuration, and data sharing over the Web for a measurement system that researchers use to characterise the forest understory microclimate and fluxes of carbon between the rain forest floor and the atmosphere.

Using National Instruments (NI) LabVIEW software and NI CompactRIO hardware, researchers developed a wireless sensor system that collects a variety of environmental measurements, offers remote configuration capabilities, permits future expansion, and gives researchers around the world access to the measurements over the Internet.

Approximately 70% of solar energy is absorbed by the Earth's atmosphere. As the Earth's surface emits this energy in the form of thermal radiation, the atmosphere

naturally captures and recycles a large portion of it, keeping the planet warm. This process is known as the greenhouse effect. Recently, the greenhouse effect has been artificially enhanced by the increased emission of gases that absorb infrared radiation such as carbon dioxide (CO₂), methane, and nitrous oxide. The increased absorption of thermal radiation may contribute to the Earth's climate change known as global warming.

Conducting carbon flux research in the Costa Rican rain forest

To better understand the impact of the emission of greenhouse gases on the environment, researchers are conducting a study at La Selva Biological Station in the Costa Rican rain forest to measure the exchange of CO₂ (also known as the carbon flux) and other materials between the for-

est floor and the atmosphere. The area under observation lies within a 3 900-acre tropical rain forest that averages 3 962 mm of rainfall per year and is located at the confluence of two major rivers in the Caribbean lowlands of north-eastern Costa Rica.

This area was chosen for observation because rain forests are naturally rich in biodiversity and are carbon sinks, meaning they function in a manner that is opposite of a human lung –absorbing CO₂ and releasing oxygen into the environment. Tropical rain forests absorb more CO₂ than any other terrestrial ecosystem and affect the climate locally and globally. However, in rain forests, carbon flux is unusually complex because of the multi-layered, diverse forest structure.

The ‘Gap Theory’ is a hypothetical explanation for the complexity of carbon fluxes. It hypothesises that small, open areas in the forest canopy caused by natural processes such as tree falls, function as chimneys, pulling out CO₂ produced by soil respiration and leaking it into the atmosphere at local points. Due to the difficulty in making measurements from multiple points on the forest floor and corresponding points in the canopy, or in a 3D manner, a balanced budget for CO₂ fluxes has been historically difficult to measure.

Using wireless sensors based on systems developed by CENS with NI Technology

The wireless measurement technology deployed in Costa Rica is a networked info-mechanical system (NIMS) based on LabVIEW software and CompactRIO hardware. The NIMS application was developed at the University of California Los Angeles (UCLA) by the Center for Embedded Networked Sensing (CENS). CENS develops embedded network sensing systems for critical scientific and social applications. It is a National Science Foundation (NSF) Science & Technology Center with an interdisciplinary and multi-institutional support structure that involves hundreds of faculty, engineers, graduate student researchers, and undergraduate students from partner institutions throughout California.

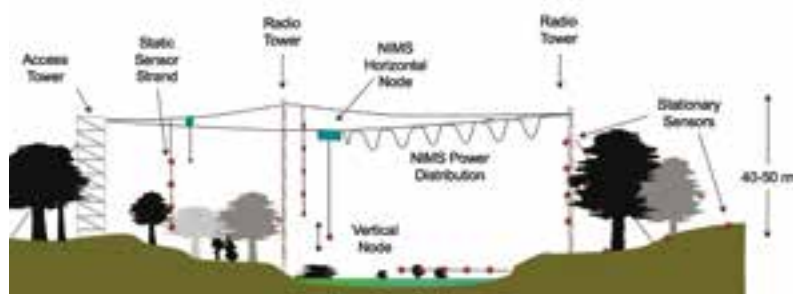
To increase the accuracy of the measurements being taken and to determine the effects of uneven carbon flux, the team developed a mobile, wireless, aerially suspended robotic sensor system capable of measuring the transfer of carbon and other materials between the atmosphere and the Earth. There are a wide range of measurements necessary to characterise the carbon flux including temperature, CO₂, humidity, precise 3D wind movement, heat flux, solar radiation, and photosynthetic active radiation (PAR).

In the past, acquiring this breadth of measurements required the use of multiple data loggers from different vendors. CENS selected a modular approach using CompactRIO. The CompactRIO platform supports a wide range of measurements using C Series modules from National Instruments and third-party vendors. The flexibility of CompactRIO addresses current measurement needs with a single platform while still leaving room to easily add new measurement modules in the future. The present system, called ‘SensorKit,’ is designed to provide flexibility, ruggedness, mobility, and ease of use, by utilising LabVIEW and CompactRIO technology.

Deploying the wireless sensors

Three of the SensorKit systems have been deployed at La Selva Biological Station for the first phase of field trials. The SensorKits are equipped with a variety of instruments, including tools for conducting basic meteorological measurements, sonic anemometers, infrared sensors, and radiometers. All of the environmental data necessary to conduct the carbon flux study is acquired through a modular approach. The wireless sensor systems are arranged at points on the forest floor and on aerially suspended robotic





This diagram shows how researchers can collect measurements using the wireless measurement systems connected between towers in the forest canopy.



The NIMS based on NI technology will help researchers take better measurements at the La Selva Biological Station.



The NIMS measurement unit using CompactRIO and LabVIEW traverses on a cable between towers at the La Selva Biological Station.

“Because of the flexibility of LabVIEW, we can configure measurement types, select channels, and even add scaling from a laptop connected to the system.”

– Dr William Kaiser, UCLA

shuttles creating the first environmental monitoring system capable of taking measurements three dimensionally.

In the initial test deployment, the wireless mobile sensing platforms traversed cables along three separate transects of the forest understory. During the deployment, the shuttle stopped at 1 m intervals along each transect for 30 s to allow sensors to equilibrate and take the required measurements. Each transect pass required 30 minutes and each transect ran for 24 hours.

Advantages of a system based on LabVIEW

By implementing the system using National Instruments' modular hardware and software, a flexible system was developed with the additional communication and configuration advantages of LabVIEW software. CompactRIO was selected as the central measurement unit and the NI Compact FieldPoint network interface with cFP-180x controllers was selected for distributed wireless measurements. The NI Wireless Access Point (WAP-3701) was chosen to transfer data between the distributed sensors, the towers, and the canopy floor.

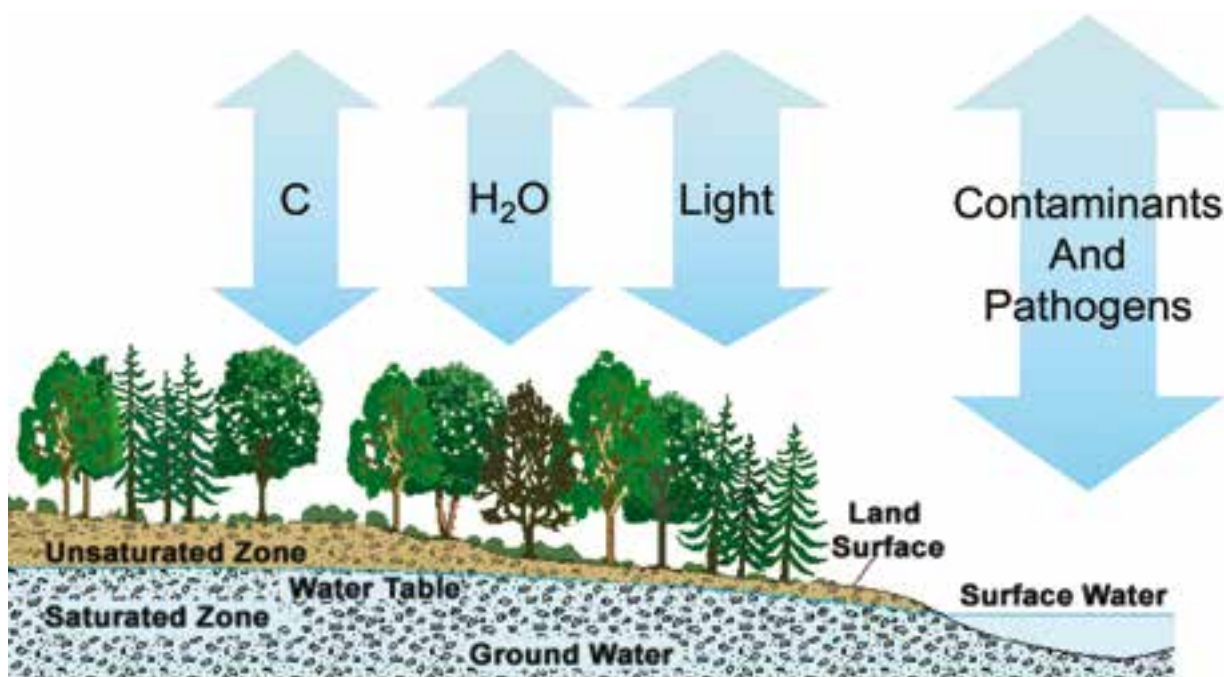
LabVIEW was chosen to connect to these distributed wireless measurement platforms and programme the embedded CompactRIO processor. Using LabVIEW, measurements to local researchers in different data formats can be provided so that they can perform post-analysis. Because of the flexibility of LabVIEW, researchers can configure measurement types, select channels, and even add scaling from a laptop connected to the system.

LabVIEW also provides advanced analysis tools for real-time embedded processing to perform local mass flux analysis and post-processing for remote researchers. In addition, LabVIEW is equipped with an HMI, so real-time measurements can be seen.

Future expansion

In conjunction with the system designers at CENS, it is planned to expand the system by adding high towers approximately 45 m above the forest floor with canopy walkways and to increase the total number of measurement systems. Students from around the world can access the canopy walkways to experience the unique atmosphere and biodiversity of the rain forest canopy.

Additionally, remote data access will be delivered through the Web to researchers and students who are not on-site. Using a Web browser and the Web capabilities of LabVIEW, researchers everywhere will be able to access and download live and archived data for their own analysis.



Scientists are deploying new measurement technologies to better understand and calculate the transfer of carbon and other materials between the atmosphere and forests.

Performing additional measurements using a 3D measurement system will provide the data needed to validate the so-called 'Gap Theory' hypothesis that carbon transfer occurs unevenly across the rain forest. Gaps in the forest canopy are sources of carbon loss while the canopy is a source of carbon absorption, which increases as the density of canopy vegetation increases. With this research, scientists will better understand the carbon absorption impact of rain forests and potentially calculate the carbon absorption value of an acre of forest, ultimately providing a method of quantifying carbon credits.



Mist rising from gaps in the forest at the La Selva Biological Station in Costa Rica.

FOCUS ON CONTROL AND INSTRUMENTATION

A new radar level sensor for water-supply and sewage systems

The VEGAPULS WL S 61 radar sensor is ideal for all simple applications in the water supply and sewage sectors. Featuring a wide range of mounting options, it is an especially cost-effective radar solution, because it can be readily integrated into existing infrastructure.

Just as with the VEGAPULS WL 61, which has been available for several years and has a large installed base, the new VEGAPULS WL S 61 offers a design optimised for use in the water supply and sewage sectors. Radar technology offers numerous advantages compared with ultrasonic sensors, which used to be standard in this sector; radar is independent of weather conditions such as strong sun, wind, fog or rain. In addition, no compensation is needed for variations in the signal transmission time due to air temperature fluctuations. With

an accuracy of ± 5 mm, the VEGAPULS WL S 61 covers a wide range of applications.

This sensor is particularly suitable for level and flow measurement in water treatment plants. Its excellent focusing enables its use in pumping stations and rainwater overflow basins, for flow measurement in open channels, and for level monitoring.

The sensor's robust housing is wear- and maintenance-free, and its high degree of protection, IP 68 (2 bar), also makes it suitable for applications where the sensor may be temporarily submerged. The unit complies with the latest LPR standard (Level Probing Radar), and is approved for open-air use without restrictions or special attachments.

An entirely new feature is Bluetooth wireless operation from a smartphone or tablet (and/or a PC with PACTware)

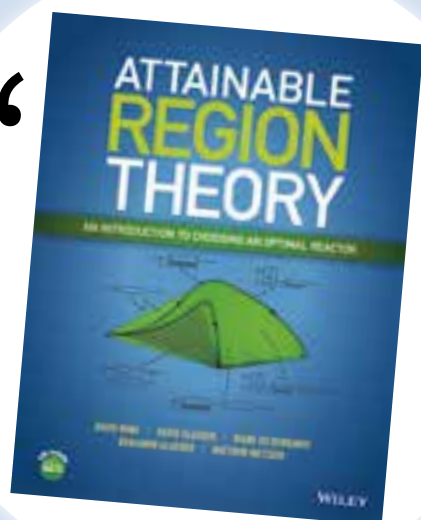
when combined with a Bluetooth USB adapter; this makes commissioning and diagnosis even simpler. Corresponding display and signal processing units enable the display of measurements and provide the relay outputs needed, for example, to control a pump.



For more information contact Chantal Groom at Chantal.groom@vega.com or tel: +27 11 795 3249.

Top Chemical Engineering academics release textbook with interactive website

This textbook is definitely NOT your ordinary chemical engineering textbook: graphical and flexible.



Cover of Book

The chemical industry has some of the most important enabling technologies for modern society. Their products cover all sectors ranging from plastics, pharmaceuticals, food and fuels to farming and practically all other aspects of modern life. At its heart are the chemical reactors (vessels in which chemical reactions take place) which are the key pieces in producing the desired products. How well these chemical plants work is vital in determining how efficient the processes are that use them. In most cases lower efficiency results in greater carbon dioxide emissions. As the chemical industry directly uses about 5% of the world's energy making it more efficient is clearly an important goal.

For instance, we can see how important these reactors are as chemical reactions very rarely produce pure products. It is the purification of the desired products from the by-products that is the biggest consumer of energy. Thus making better reactors could have a profound impact on the efficiency of these plants.

This is the first book to be published on Attainable Region (AR) theory for the optimisation of chemical reactors. One does not need to be a domain expert to understand this type of theory as it is presented here, applied to chemical reactors. It deals with optimization and design, together with

performance targeting, and it is presented graphically, which makes it easy for people to understand.

The textbook, *Attainable Region Theory: An Introduction to Choosing an Optimal Reactor*, is an original work in that the content has been specifically written for the book, and is not a curated selection of previously published work. The authors are respected proponents of AR research, and include the co-developers of the founding AR theory, Professors David Glasser and Diane Hildebrandt.

The target audience is chemical/process engineers who are interested in chemical reactor design. More specifically, the book is aimed at undergraduate students in their second, third and fourth years, and lecturers/professors in chemical engineering; postgraduate/graduate chemical engineering students and researchers; and experienced practitioners in industry who are seeking means to improve chemical reactor systems. It may serve as a companion textbook for individual study, as a reference work for instructors, or as a module of a broader course on reactor network design and optimization

Attainable Region Theory: An Introduction to Choosing an Optimal Reactor offers a novel way to solve very difficult reactor problems. The specific highlights of the book are that it is broken down into two sections. The first section is for those who don't know anything about AR, and explains it in a very approachable manner. The second provides the most consistent and detailed exposition of many difficult AR concepts that has yet been published, accompanied by software and an interactive website. This will allow



Left to right: Professor Diane Hildebrandt, David Ming, Professor David Glasser

the authors to upload new content, such as examples, and enable them to assist people with specific problems using the e website. This will make it easier for people to apply the method to their own work.

"This book provides numerous resources that are not always available. It is not just a book; it is a set of tools and content. Many textbooks are accompanied with a static CD, which cannot be adapted over time. The flexibilities involved with this textbook are what make this textbook uniquely user-friendly, which in turn encourages the users to further their knowledge of AR." Dr David Ming.

The e-version is available online. The hardcover copy was released by Wiley Publishers on 31 October 2016; and can be ordered online via well-known stores such as Amazon. The AR website is live at <http://www.attainableregions.com/>

Dr David Ming is a lecturer in Chemical Engineering at the University of the Witwatersrand, Johannesburg, and is chairman of the board of directors for EWB-SA (Engineers Without Borders South Africa). Professor David Glasser (an NRF A-rated scientist) and Professor Diane Hildebrandt (NRF B-rated scientist) are chemical engineers who are the directors of the MaPS research unit at the University of South Africa. Benjamin Glasser is a Professor of Chemical and Biochemical Engineering at Rutgers University, and Dr Matthew Metzger is a Senior Scientist at Merck & Co, Inc both in the United States of America.

Contact David Ming on tel:

+27 (0) 72 224 6623; email david.ming@attainableregions.com or go to <http://www.attainableregions.com/>



Production of berry puree – Some unit operations and processes involved

by Samridh Mudgal, Food Engineer Liquid Food Solutions, Danny Milla, R&D Manager Liquid Food Solutions, and Greg W Schrader, Director of Integration and Technology Advancement Liquid Food Solutions, all of JBT

The production of berries for food processing has been steadily growing, indicating a growing demand for value-added berry fruit products. This article reviews some of the major unit operations and processing parameters involved in the production of high quality berry purees.

The pulp containing viscous and totally fruit-based paste obtained by the mechanical process from sound ripe fruit is referred to as puree [1]. Almost every fruit can yield a juice if required, however, for fruits such as berries, puree serves a better purpose for some commercial applications. Chopped, heated/unheated berry chunks from a feed tank can be processed via the FTE line of JBT turbo finishers. The FTE Finisher can also be made to work as a cold extractor for the whole berry fruit by changing the product inlet hopper and adding a pre-rotor with six knives (Figure 1), thereby combining the size reduction step and refining step in a single operation.

The rotors, with the help of centrifugal speed, push the chopped product towards the inner surface of the screen allowing the separation of puree from seeds and peel; a larger screen size can also be employed to retain seeds in the puree. The top part of the rotor blades and holes of the

screen are aligned with perfect precision, allowing smooth cutting of the berry fibers and permitting the mashing of berry fruit components into a homogenous puree. Puree quality and yield can be controlled by varying the following FTE parameters:

1. Rotor angle and speed
2. Screen angle
3. Gap distance between screen and rotor.

Puree extraction: Impact of FTE parameters

The rotor paddles (18 paddles per rotor) are offset at 2.5° or 5° angles with higher angles resulting in a lower residence time. On the FTE 100, it is possible to stagger the rotors in an offset configuration to facilitate aggressive extraction which is typically used when sticks and stems are present.

Hygienic design of the rotors is devoid of any bolts or



Figure 1: Pre-rotor with knives

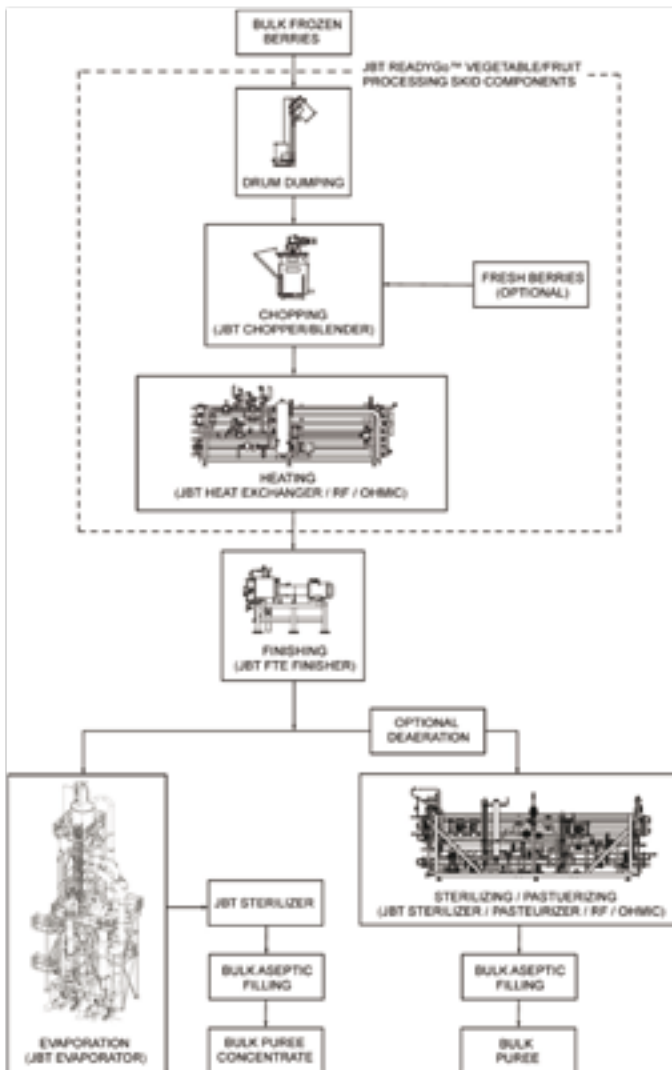


Figure 2: Processing line for berry puree

catch points, preventing accumulation of material inside the finisher.

Rotor angle and speed

The rotor speed directly relates to the centrifugal push provided by the rotor blades. Higher rotor speed results in shorter residence time and higher centrifugal force push onto the incoming feed, often yielding higher amounts of puree. Conversely, lower rotor speeds result in higher moisture content in pomace yielding less amount of puree, as

can be seen in case of blueberry puree.

Different rotor angle and speed settings offer flexibility in terms of varied feed residence times, ultimately affecting the quality and yield of puree.

The following correlation exists between puree yield and FTE Finisher parameters:

$$\text{Puree Yield} \propto \frac{1}{\text{Pomace Moisture Content}} \propto \text{Rotor Speed}$$

Screen size and gap distance

The screen acts as a primary element of separation in the FTE finisher. The screen size is determined by the desired particle size of the material being processed. The size of the pore determines the fibre dimension and quantity of material finished.



Figure 3: The Turbo Finisher is designed for puree production from chopped chunks of berry and other vegetables/fruit

The FTE screen comes in a variety of pore sizes and thicknesses. Berry puree processing requires sizes anywhere in between 0,6-1,0 mm, depending on the type and cultivar of berry. Minor changes in screen pore size can significantly alter the quality and yield of puree.

Keeping all other parameters fixed, a larger screen size yields higher viscosity, higher soluble and insoluble solids, higher volatiles and antioxidants.

Screen rotor clearance or the gap distance between screen and rotor can be set with an external wheel while the machine is in operation by changing the axial position of the screen as it relates to the rotor. In principle, a narrower gap between screen and rotor results in stronger puree extraction along with higher power absorption. A screen rotor gap of 0,9-1,0 mm provides optimum clearance, resulting in higher yields and better quality berry puree.

In a real time scenario, there are numerous variables

that impact yield and quality. Therefore, best results are obtained by an optimum interplay of above mentioned parameters. Any minor inconsistency observed can be attributed to minor changes in feed flow rates and differences in the feed fruit morphology and quality. Given the variations in quality of fruit, one or more FTE operating parameters can play a dominating role in determining the yield and/or quality attributes of puree. At constant feed flow rate and temperature, a larger screen size and higher rotor speed yields more viscous puree.

TASTE evaporator working principle

1. Juice is flashed off the inside of nozzle, then atomised and sprayed out into the distribution cone before reaching the top tube sheet.
2. Juice then enters the tube nest as a fog, a mixture of vapour and atomised liquid, expanding in the distribution cone and filling the exchange tubes in the stage body.
3. The vapour-liquid mixture accelerates downward through the tube nest as it absorbs heat from the tube walls. As the juice evaporates, the velocity of the mixture in the tubes increases.
4. The higher heat transfer rate obtained, compared with other evaporator designs, results in shorter residence time and minimal heat impact on the juice (no off-flavours and no burnt taste).
5. Vapour from the juice is efficiently centrifuged (speeds up to 700 km/hr) while separated juice is collected at the bottom. A better quality concentrate is obtained due to elimination of a recycling step resulting in much shorter residence times.

The TASTE evaporator can have multiple effects based on the needs of the plant and quality of juice/puree and can also be equipped with an essence and aroma recovery system. The essence contained in the vapours of several stages is condensed into the essence condenser with the help of the cooling effect from the juice/puree and by a Freon-glycol refrigeration unit. The condensate is collected from a decant tank where the water (aroma) and oil (essence) phases are separated by gravity. The final aroma concentration can go as high as 150-fold.

Berry juice/Puree concentrate

Concentration is an important step used to expel water from liquid foods for reducing its storage and transportation volume and improving shelf life. However, concentration is an intricate step requiring enough care to be taken to prevent any loss of volatiles and degradation of essential chemical compounds present in the liquid food. The quality of concentrate is hugely dependent on the flavour and aroma components and suspended solids in a liquid food. High quality concentrates can be obtained by:

1. Keeping lower process temperature and shorter residence time
2. Clean operation for minimising any microbial activity
3. Selective dewatering to retain all components except water.

The JBT TASTE evaporator (thermally accelerated short-time evaporation) is designed to stabilise and pasteurise berry juice during the pre-heating cycle and first evaporation

stage. With over 200 units sold worldwide for various applications such as berries, citrus, and tomato, the TASTE evaporators can be used conveniently to form a berry juice concentrate (up to 45-68 °Bx) from berry juice (10-18 °Bx).

For a viscous puree with suspended solids, a special finishing stage involving forced recirculation is added to the TASTE pre-evaporator to form a hybrid evaporator which can provide over three times higher evaporation rates and can concentrate a berry puree (10-18 °Bx) up to 20-40 °Bx concentrate.

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For more information contact John Bean Technologies

Corporation on tel: +1.863.683.5411; fax:

+1.863.680.3672 ; or email citrus.info@jbt.com or sales.parma@jbt.com

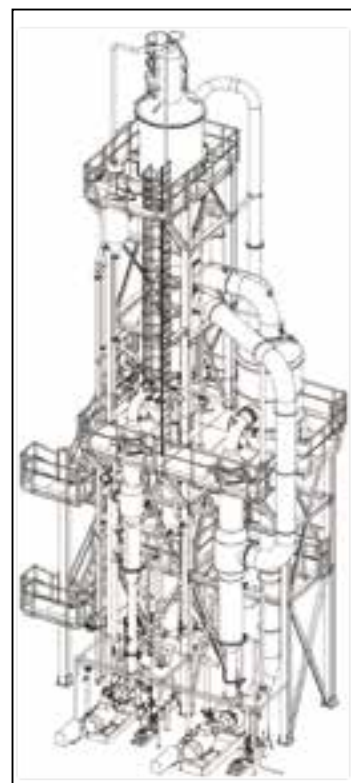


Figure 3: JBT forced circulation evaporator

Combustible silicon powder for Li-ion batteries conveyed pneumatically, safely



A dust collection system integral to the bag dump station draws airborne dust through two cartridge filters, as reverse pulse jets automatically clean the filters to and return accumulated dust to the hopper.

Pneumatic conveying system feeds weigh hopper

The powders flow from the bottom outlet of the floor hopper through a pickup adapter into the two-stage pneumatic conveying line. The first vertical section rises 90° from the hopper outlet and connects to the second horizontal section, which runs from the silicon unloading area to the main processing area. The photo alongside illustrates this the receiving hopper empties into a slurry make-up vessel.

A side channel blower downstream of the filter-receiver atop the receiving hopper provides a vacuum that pulls the material through the pneumatic line, improving dust control. The fully enclosed system transfers the silicon powder virtually dust-free. Since the system operates under vacuum, even if the integrity of the enclosed system is unintentionally compromised, the silicon powder will remain within the conveying system.

Filter receiver is isolated, safe

The filter receiver separates the silicon powder from the air stream before the powder enters the receiving hopper. Like the bag dump station, it has a reverse pulse jet system that automatically cleans the filter cartridges at timed intervals. The filter-receiver is isolated in a safe area and protected with an explosion relief panel designed to exhaust the energy associated with an explosion without causing a catastrophic failure of the filter receiver. At the bottom outlet of the receiving hopper, a pneumatically actuated slide gate valve discharges the silicon powder into the slurry tank.

One set of load cells beneath the floor hopper at the bag dump station in combination with load cells beneath the filter receiver send signals to the PLC which automate the delivery of a predetermined amount of powder to the slurry vessel.

A low level sensor near the bottom of the floor hopper signals the PLC to stop the conveyor until more material is dumped into the hopper in order to achieve the total batch weight. On the receiving hopper, a high level sensor signals the PLC to stop the conveyor if the hopper is about to overflow in case of a system malfunction.

Nexeon avoided a piecemeal approach to equipment selection and installation by relying on a complete system from Flexicon. "We are very happy with the design, construction, installation and commissioning service provided by Flexicon," explained Bent.

For more information contact Flexicon Africa on tel: +27 41 453 1871; email sales@flexicon.co.za or go to www.flexicon.co.za. Nexeon may be contacted at tel: +44 1235 436320 or go to www.nexeon.co.uk

Nexeon produces silicon anodes that improve performance of lithium-ion batteries.



The future of lithium-ion (Li-ion) batteries found in laptops, phones, hybrid cars and other applications may be taking shape at a UK startup. Nexeon

Ltd has built a plant at its headquarters in Abingdon, Oxfordshire, to produce a silicon anode it developed that significantly improves the energy density and operating life of Li-ion batteries.

A critical part of producing the silicon anodes involves transferring precise amounts of silicon powder and other ingredients from a bag dump station to a slurry tank for mixing in an aqueous solution, using a dilute-phase, Pneumatic-Con™ vacuum conveying system from Flexicon (Europe) Ltd.

The transfer is dust-free and safe. "Silicon powder is combustible and can be explosive under the right conditions," says David Bent, production director at Nexeon. "Flexicon analysed the powder and developed the pneumatic system for it, including dust control and explosion protection measures."

Bag dump station contains dust

The first step in transporting the powder is manually emptying bags of silicon powder and additives into the bag dump station mounted on a floor hopper. A bag tray support provides a work surface for the operator to stage, clean and open bags.

Interview with Rendani Mamphiswana

by Michelle Low



This month we speak with Rendani Mamphiswana – a change maker: interested in bridging the gap between theory and technology development and in mentoring. He is a Bachelor of Science in Engineering (Chemical) (2008) and Bachelor of Engineering Honours (Technology Management) (2015) graduate from the University of Witwatersrand and Pretoria respectively, and he is furthering his studies in Master of Engineering (Technology Management) at the University of Pretoria. Rendani works as an Assistant Technology Manager at Sasol. He is also the founder and President of Takalani Foundation.

ML: Tell us about yourself.

RM: Born and raised in a village of Matondoni, Limpopo, South Africa, I am passionate about process technologies and the possibility of shaping our nation and continent. Since completing my undergraduate degree back in 2008, I have had the privilege to apply some of the theoretical concepts through involvement in a variety of capital projects, from Feasibility through Basic Engineering to Beneficial operation.

During this period I gained expertise in conceptualisation, design, commissioning, and stakeholder management.

I recently joined the Research and Technology division to contribute toward technology performance and development of new process technologies to commercial status. I am also gaining expertise in technology strategy development and marrying this with theoretical elements of technology management frameworks.

ML: What made you decide to study chemical engineering and technology management?

RM: To be honest, my basis for choosing chemical engineering was the perceived link with chemistry. I happen to be good at chemistry during my high school days. Thanks to my 2nd year that gave me a taste of what chemical (process) engineering is all about, I had to make a choice at that moment and I chose to love it. It was this moment of difficulty that challenged me to assist learners in my village during school breaks.

After five years of work experience in the process engineering domain, I felt I needed a change and exposure beyond the current scope of work. I liked the offering for technology management and the possibility that I can create from the learning. The modules that drew me in are innovation management, systems engineering, strategic technology management and technology commercialisation. I thoroughly enjoyed this domain, and combining my undergrad degree and work experience has been fantastic. I am considering a PhD qualification in Technological Innovations, starting in 2018.

ML: You lived in the UK for a while; can you tell us about that and how it went?

RM: Probably the best time of my life to date. I went to the UK during 2012-2013 as a rotation engineer to Foster Wheeler (now Amec Foster Wheeler). I was based in their Reading office.

Work-wise I got involved in two projects, for Saudi Arabia and Brazil. I gained expertise in process control engineering during the detail engineering phase, and process utilities systems design during front end engineering design (FEED). It was fantastic working with some of the leading engineers in the world, some with 30 – 40 years' experience in the field.

On the personal and social sides, it was also fantastic. I managed to test some of my personal attributes that I wouldn't have if I had been in the South African setting. I came back really fired up to contribute to South Africa's and Africa's development. My wish is for everyone to have the chance to live in another country and to realign with the planet at large.

ML: What inspired you to start Takalani Foundation, and tell us more about the work that you do?

RM: The motivation came from seeing

friends become part of the university drop out numbers. Furthermore, knowing very well that the majority of learners from rural communities (like the one that I came from) continued to choose careers that they knew little about. Additionally, at university they are not mentored or looked after by seniors. Though I chose chemical engineering with a lack of a correct understanding of it, it was the seniors within the university who provided guidance during the darkest hours.

Takalani Foundation was officially born in February 2015 with the idea of bridging the gap for the learners coming from rural communities of South Africa. Our vision as an organisation is to develop capable and adaptable leaders for South Africa and Africa. We conduct a variety of programmes and activities to lead us to this bold vision. From career options and path advice, mentorship programmes, reading of books outside of curriculum, and community engagements through public holidays, as themes.

ML: What is one inspiring quote that you live by?

RM: "It always seems impossible until it is done" – Nelson Mandela

ML: How has your chemical engineering qualification helped you get to where you are?

RM: Chemical Engineering gave an opportunity to kick start my life. What I have achieved in the past eight years rests on this qualification. From networks to opportunities. Of course I had to leverage at every moment of the way and I continue to do so.

ML: Any advice for students and colleagues?

RM: To students: Please obtain more than a qualification at university. Get involved in leadership initiatives. Read a book. Learn the language of money. Figure out what you are really good at. Life outside of university demands more than the qualification.

To professionals: Please put personal development at the centre of your life. The rate of change due to the introduction of new technologies demands continuous renewal and retraining. Lastly, don't limit your life to the office. Your work is only a portion of your life, so please treat it as such.

Endress+Hauser Pyrotemp's 2nd annual Oktoberfest

Since Pyrotemp's roots originated from Product Centre (PC) Wetzlar, the temperature product centre in Bavaria, Germany, Pyrotemp South Africa decided to host an annual Oktoberfest to let their customers partake in their Bavarian heritage.

Endress+Hauser has two companies based in South Africa, the original referred to within the group as a Sales Centre (SC) and the Temperature Factory, Pyrotemp, in Benoni, as a Product Centre (PC). The SC is responsible for sales of all Endress+Hauser products and services, while Pyrotemp serves as the local manufacturing facility to produce quality temperature sensors and transmitters, timeously. Pyrotemp forms part of Endress+Hauser's global temperature network of companies, reporting to its Head Office located in the heart of Bavaria.

The Endress+Hauser temperature

network of companies prides itself on its innovative products, manufacturing capabilities and accredited services. To share such attributes with the sub-equatorial African customers, Pyrotemp hosted an open day where visitors could experience the Virtual Temperature Display Unit as well as offering an optional factory tour, showcasing the precision of the automated Thermowell production centre, SANAS accredited laboratory, innovative RTD Pt100 technologies, laser technology to serialise products for lifelong traceability and exclusive high temperature sensors with platinum sheaths. More than 140 cli-



ents were hosted on the day which turned out to be a fun filled occasion incorporating a wide variety of Bavarian food delicacies, drinks and a live oompah band.

For further information, please visit www.za.endress.com



Jody Banks

Scientists trace plant hormone pathway back 450 million years

Purdue University scientists in West Lafayette, Indiana, got a glimpse into more than 450 million years of evolution by tracing the function of a hormone pathway that has been passed

along and co-opted by new species since the first plants came onto land.

Flowering plants today, known as angiosperms, use the phytohormone abscisic acid (ABA) to keep seeds dormant until ready for germination and to open and close stomates, tiny openings on leaves used to control gas exchange.

"This hormone is important for drought tolerance," said Jody Banks, Purdue profes-

sor of botany and plant pathology. "When plants are water-stressed, ABA levels shoot up and close the stomates so the plants won't wilt as quickly."

Having shelved the research for nearly two decades, Banks, together with scientists at Australia's University of Tasmania and Germany's University of Würzburg, determined that ABA plays a key role in determining the sex of ferns, using a mechanism that was co-opted by flowering plants to tolerate desiccation.

Matching the genes of Arabidopsis, a model flowering plant, and the fern *Ceratopteris richardii*, researchers at the University of Tasmania found the homologous fern gene responsible for ABA signalling. Scientists at the University of Würzburg then found that the proteins produced when the ABA signalling pathway is turned

on do not interact with proteins that would open and close stomates. They realised that regulating stomate closing by ABA was novel to angiosperms, which evolved from ferns about 150 million years ago.

ABA, they found, promotes femaleness in ferns. When a wild type plant is exposed to ABA, the plant becomes female. They also discovered that ABA is linked to spore dormancy in ferns, just as ABA is linked to seed dormancy in angiosperms.

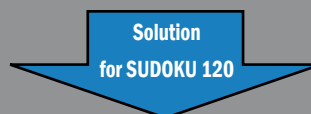
"Promoting a dormant state was likely the original function of ABA as plants came up out of the water onto the land, where you need to have dormancy to survive desiccation," concluded Banks.

For more information contact: Natalie van Hoose, at email nvanhoos@purdue.edu

SUDOKU NO 121

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>

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



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



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SOUTH AFRICA
sales@flexicon.co.za
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USA +1 610 814 2400
UK +44 (0)1227 374710
GERMANY +49 170 8 187 613
SPAIN +34 647 670 302
AUSTRALIA +61 (0)7 3879 4180
SINGAPORE +65 6778 9225
CHILE +56 2 2415 1286

