

PUMP ACTION

THE OFFICIAL NEWSLETTER OF THE PUMP CENTRE

JULY 2014

IN THIS ISSUE:

EDITOR'S COLUMN	P3
MEMBERS' NEWS	P4
CONFERENCE & EXHIBITION 2014 REVIEW	P12
TALKING TECHNICAL	P14
PUMP PROJECT OF THE YEAR 2015	P19
WIMWG YEAR 2 LAUNCHED	P21
TRAINING & AWARENESS DAY PROGRAMME 2014	P23



Efficiency and reliability doesn't have to cost the Earth

W22 IE3 and IE4

Saving energy
Saving costs

CONTACT DETAILS:

TEL: 01925 843512

FAX: 01925 843500

EMAIL:

pumpcentre@esrtechnology.com

www.pumpcentre.com



www.weg.net

CELEBRATING 5 YEARS OF PIONEERING TECHNOLOGY!

Our proven Class 0 certified (ISO 8573-1) oil-free screw blower technology helps you save over 30% on energy.

Atlas Copco Compressors
Phone: 0800 181085
Email: compressor.sales@uk.atlascopco.com
Web: www.encyclopedia.com



Atlas Copco

Sustainable Productivity



Contents

Editor's Column & Council News.....page 3
 Members' News.....page 4
 Conference & Exhibition 2014 Review page 12
 Talking Technical page 14
 Pump Project of the Year 2015..... page 19
 WIMWG Year 2 Launched page 21
 Training & Awareness Day Programme 2014.. page 23

Editor's Column

Dear Reader

The last couple of months have been an extremely busy, but rewarding time for the Pump Centre team

A lot of work was focussed on the annual Pump Centre Conference and Exhibition which took place at the end of April. The Conference has grown significantly over the past few years and it has now become "The Event" to attend for engineers working on pumps and pumping systems. It is predominantly, but not exclusively Water Industry focussed and it provides engineers with a fantastic opportunity to:

- Learn about the latest products & innovations
- Network with other engineers within the industry
- Gain access to "free" technical training sessions
- Meet all their key suppliers under one roof.

If you and your colleagues are going to attend one event in 2015, then make it the Pump Centre Conference. It is a high quality event that is free to attend! The date for your diary is Thursday, 14th May 2015.

Charity Work

Every year the Pump Centre holds a charity raffle at Pump Centre Conference Dinner. Great prizes are donated by the Pump Members who support the event and all the dinner guest pay to enter the raffle. Every year we select a different, but equally deserving charity. This year we selected the Stroke Association, which is the only UK charity concerned with combating stroke in people of all ages.

Due to the fantastic support of all those attending the conference dinner we raised a fantastic £4247 for the charity.

Pump Centre Manager:

John Howarth
 Tel: 01925 843506
 Fax: 01925 843500
john.howarth@esrtechnology.com
www.pumpcentre.com

Publishing:

Imedia Marketing Consultants Ltd
 1 Norton Place, The Lakeside Centre,
 180 Lifford Lane, Kings Norton,
 Birmingham B30 3NU
 Tel: 0121 451 2156
imedia@blueyonder.co.uk

Advertisement sales:

Jon Masding
jon.masding@blueyonder.co.uk
 Tel: 0121 451 2156

Design and artwork:

Marc Pittaway
 Advertising Matters Ltd
marc@advertisingmatters.com

Disclaimer

This newsletter is designed to provide information of a general nature and is not intended as a substitute for professional advice in a particular matter. You should always seek appropriate advice from a suitably qualified professional before taking, or refraining from taking, any action. The opinions and interpretations expressed within this newsletter are those of the contributors/authors only and may not reflect those of other parties. No representation or warranty, express or implied, is made as to the accuracy or completeness of the information contained in this newsletter and therefore the information should not be relied upon. The contents of this newsletter should not be construed as professional advice and ESR Technology Limited and the Pump Centre disclaim liability for any loss, howsoever caused, arising directly or indirectly from reliance on the information contained within this newsletter.



Picture of Louise Kay (Stroke Association), right, handing over the official thank you letter to Karen Bridgeman (Pump Centre)

Young Engineer of the Year Award

One of the main aims of the Pump Centre is to help promote engineering within the UK. As part of this process the Pump Centre presents an annual award to Young Engineers who have made a significant technical contribution to their company in projects relating to pumps and pumping systems.

This year we had some excellent candidates and the apprentice and professional awards were won by Chris Walker (Wessex Water) and David Pattinson (ATKINS), respectively. It was great to meet Chris and David at the Pump Centre Conference dinner, they are both a credit to their company's and will no doubt make a fantastic contribution to the quality of UK engineering over the coming years.



Picture left of David Pattinson (ATKINS) and picture right of Chris Walker (Wessex Water) being presented with their Young Engineer certificate by Mike Rush, the Pump Centre Chairman and Mechanical & Electrical Engineering Manager, Engineering & Capital Delivery at United Utilities



Coming Soon! The new Pump Centre website

The new Pump Centre website is close to completion. It is hoped that the new website will offer Pump Centre members a much better online experience than the existing site.

The new site will contain features such as

- Pump Centre news, events and training
- Member news and information
- General technical resources
- Job vacancies
- WIMES project data

Plus much more. All members will be notified just prior to the launch.

John Howarth
 Pump Centre Manager
john.howarth@esrtechnology.com

© ESR Technology Ltd
 Pump Centre, ESR Technology Ltd, Whittle House,
 410 The Quadrant, Birchwood Park, Warrington, WA3 6FW

People on the move

The Pump Centre Member companies employ thousands of staff within the UK, some of these have been in the industry many years and others are new starters. In this section we feature staff who are taking up new roles with their respective companies.

Atlas Copco Compressors appoints **Adriana Restrepo** as Low Pressure Product Marketing Engineer

Atlas Copco Compressors has announced the appointment of Adriana Restrepo as Product Marketing Engineer for Low Pressure within its Oil-Free Air division in the UK. Commenting on her new role, Adriana said: *"My goal is to apply my technical knowledge to help expand Atlas Copco's share of the blower market in the UK. I'm looking forward to promoting our energy efficient ZS blowers within the water and wastewater industry and I also see opportunities to raise awareness among industrial companies of how this innovative technology can be used in other applications such as pneumatic conveying. It's exciting to be able to come to market with a low pressure blower offering that offers tangible process improvements and energy savings to a wide variety of customers."*



Adriana Restrepo

Adriana began her engineering career as a supply chain operations intern with Procter & Gamble in Italy, before a period as an operations analyst for Accenture in Colombia. Her next career move saw Adriana progress from project management through to applications engineering and, finally, product marketing engineering, with Texas-based Houston Service Industries (HSI), a leading manufacturer

of centrifugal turbo blowers and control systems, which was acquired by Atlas Copco in 2012.

She is a graduate in Production Engineering from Universidad Simon Bolivar in Venezuela, which included an exchange year at the Politecnico di Milano in Italy.

In her new role in the UK, Adriana will focus on supporting wastewater treatment process operators within the municipal and industrial markets, as well as maximising sales opportunities for Atlas Copco's energy-efficient ZS screw blowers within pneumatic conveying applications.

Building upon Atlas Copco's global leadership in medium and high pressure compressor technology, Adriana recognises the potential to introduce the benefits of low pressure blower technology to a tradition-bound market. *"In low pressure it's all about the process. Therefore what Atlas Copco brings to the table is expertise in a variety of different applications, innovative control systems and efficient machine technologies that ensure customers are satisfied,"* she commented.

www.atlascopco.co.uk

Personnel changes at Pulsar Process Measurement

Pulsar Process Measurement is delighted to announce a new appointment, a well-deserved promotion and a legend of the industry bowing out after more than thirty years in the ultrasonic level measurement industry.

Alistair MacKinnon takes over the hot seat as Director of Sales and Marketing from Keith Flint, who has been a Director of the business since its inception in 1997. Keith is stepping away from the day-to-day running of the business but retains his Directorship and will focus on Pulsar's growing business in the Middle East. MacKinnon takes over at an interesting time, with the launch of a number of new products, including the web-enabled Ultimate Pump Controller providing major new pumping station control opportunities. Alistair has been with the company since early 1998 and steps up from the Sales Manager's role. Continuity is the name of the game there, too, as that position goes to Terry Chambers, another long-time member of the team.



Alistair MacKinnon

New to the business is Jeff Cassells, who joins Pulsar as Area Sales Manager for the North West and Yorkshire area. Jeff has giant boots to fill, taking over from Andy Ledgard, who is retiring after spending the last thirty years in non-contacting level measurement. Jeff has spent the last eight years at RS Components, where he held a field sales role.

www.pulsar-pm.com

Progressing Cavity or Rotary Lobe?



Which Pump is Better?

Some might claim these pumps compete with each other but, as the only global manufacturer of both, NETZSCH knows they complement one another. Correct pump type selection, based only upon application requirements, is critical. NETZSCH can offer you genuinely impartial advice as to which pump type is best for you.

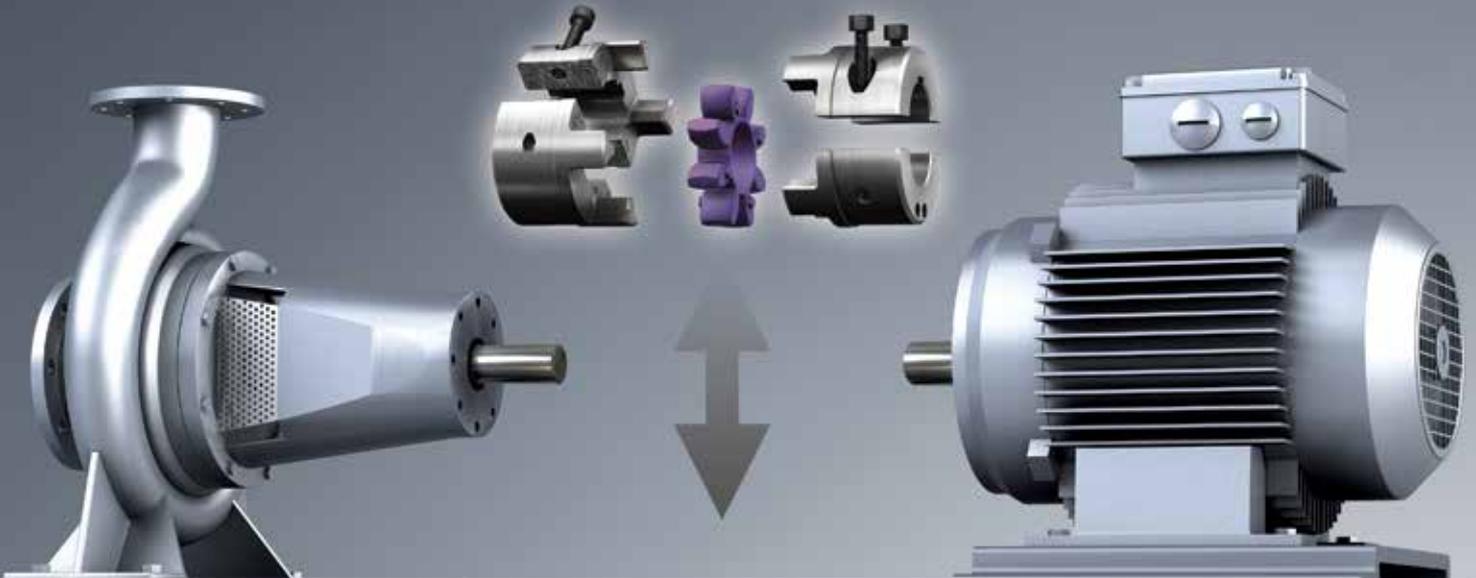



NETZSCH

NETZSCH Pumps & Systems Ltd.

info.npu@netzsch.com
www.netzsch.com

Made for Motion



ROTEX® Split Hub Coupling

Removing the hassle of moving your system

www.ktr.com
0114 258 7757

seepex Smart Conveying Technology reduces opex at United Utilities Shell Green site

seepex has supplied eight pumps fitted with Smart Conveying Technology to United Utilities as part of continuous cost saving initiatives. The Shell Green sludge processing site takes sludge from a wide catchment area for processing at a centralized facility where it is dewatered before being used to generate energy.

United Utilities asked seepex to look at the pump systems feeding the dewatering centrifuges to reduce operating costs. After a full diagnostic check of the system by seepex and UU engineers, seepex proposed a trial with a pump fitted with seepex Smart Conveying Technology (SCT). SCT is an innovation in progressive cavity pump design that increases uptime and offers a significant reduction of whole life costs

During the trial stator life was extended compared to the existing pumps by adjustment of the retaining segments which hold the 2 part stator in place.

The SCT pump ran for 30% longer before the stator was replaced and this, combined with lower stator costs for this design, has generated 70% savings in spare parts costs alone. In addition to increased operating uptime, maintenance downtime is reduced by 85% as rotors and stators can be changed without dismantling pipework.

The trial was so successful that 8 centrifuge feed pumps have now been replaced by seepex SCT pumps with projected savings on operating costs in the region of £50,000 per year.

www.seepex.com





What do the “Internet of Things” and Altivar Process drives have in common?

They both help you achieve optimal business and process performance

Forget what you know about ordinary drives

Because now, Altivar™ Process, the first ever variable speed drive with embedded intelligent services, joins the Internet of Things to help you optimise process performance and Total Cost of Ownership.

Maximise energy efficiency and asset performance

Enriched data on asset performance is served in real-time, allowing the automation system to instantly detect efficiency drift, and to react immediately before it impacts your bottom line.

What’s more, it enables truly predictive maintenance through condition monitoring, remote diagnostics, and troubleshooting that helps you minimise unplanned downtime, improve energy efficiency, and reduce TCO right down to the asset level.



Altivar Process is a complete range of variable speed drives for applications from 0.75 kW to 1.5 MW



“Three steps for reducing TCO in pumping systems”

Download our **FREE** white paper and see how!

Visit www.SEreply.com Key Code 47299p

Schneider
Electric™

Diaphragm dosing pumps with IE4 efficiency level EC motors

From 1st January 2015 all motors will need to reach the IE3 level (or IE2 motors can be used if they are controlled by variable-speed drives).

The International Electrotechnical Commission (IEC) has published a new standard which, for the first time, officially defines IE4 Super Premium efficiency motors, as well as eight-pole motors with outputs from 0.12kW to 1MW for operation on 50Hz and 60Hz supplies.

The standard – IEC 60034-30-1:2014, titled Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors (IE code) – supersedes the 2008 edition of IEC 60034-30, which has now been withdrawn. It will be followed shortly by IEC 60034-30-2 that will define efficiency classes for motors rated for use on variable frequency supplies.

Equipped with an EC motor offering efficiency levels greater than 90% or IE4 motor efficiency levels, the diaphragm dosing pump Memdos LP from Lutz-Jesco represents an energy-efficient solution and available in a number of material designs, with delivery capacities of between 4 - 1,010 l/h at up to 16 bar backpressure.

Heinz Lutz, CEO of Lutz-Jesco stated *"This demonstrates our commitment to the environment by embracing new technology leading to energy savings & ultimately reducing CO2 levels"*

www.lutz-jesco.com



FORENSIC ENGINEERING



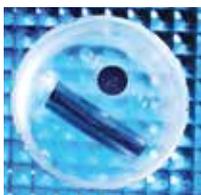
Our world-class engineers and consultants are committed to delivering the highest quality, technically accurate and scientifically supportable engineering analysis.

SERVICES

- ▶ Failure Investigations
- ▶ Root Cause Analysis
- ▶ Engineering Analysis
- ▶ Tribology
- ▶ Metallurgy
- ▶ Mechanical Testing
- ▶ Materials Selection
- ▶ Surface Analysis
- ▶ Non-destructive Testing
- ▶ On-site Capabilities

Clients have included:

United Utilities
Maersk Oil
ABB Ltd
Thames Water
South West Water
Sewer Trent Water
National Grid
EDF Energy
Amec



Contact us to discuss your requirement:
info@esrtechnology.com
+44 (0) 1925 843 400



ESR Technology Ltd
Whittle House | 410 The Quadrant | Birchwood Park
Warrington | Cheshire | WA3 6FW | United Kingdom
Tel: +44 (0)1925 843400 | Fax: +44 (0)1925 843500

www.esrtechnology.com

Not Spending Money Like Water

KIT Wassertechnik AG, (canton Bern), Switzerland, develops environmentally friendly water utilisation systems for a wide range of different requirements. The company places particular importance on the use of rain and spring water and the recycling and treatment of water, especially process water. For many years KIT Wassertechnik has used components from Eaton to control its plants. This is also the case in one of its latest projects: A plant for a car wash centre in which the water is completely reconditioned and the water loss replenished with rain water. Part of the installation includes an illuminated fountain that serves as an ornamental feature in the grounds of the wash centre.

Challenges

"Our client wanted a water conserving and environmentally-friendly solution for its new car showrooms and connected car wash, which would also reuse the waste water produced during operation", Roland Graf, CEO of KIT Wassertechnik, *"They also wanted a fountain system as a special feature of the new building which was required to run at night with a precisely controllable variety of colours".*

Solution

The core of the installation is a central localised, multi-stage water treatment plant. From here the water is pumped to the car wash and the fountain and to the consumers of the car showroom several hundred meters away. *"Rain water and the waste water returning back from the plant is first collected in the raw water storage tank",* Roland Graf explains, *"this raw water is cleaned using band filters and multi-layered active charcoal filters and membrane filters. It is then kept in a storage water tank with a capacity of 7,500 litres".* The 100,000 litres of stored rain water in two tanks is used to compensate for the water loss of the car wash centre.

The stored water is also enough to run the installation on its own during periods of drought. The car wash is operated almost exclusively with treated water and with rain water: *"Replenishment with fresh water is really only necessary occasionally"* says a pleased Roland Graf of the highly environmentally-friendly system. The KIT system is also impressive in terms of the financial investment involved: the plant paid for itself in just over three and a half years simply through the savings made in fresh water and drain water costs alone.

Water treatment is a complex process that requires permanent water analysis and process control to be perfectly matched and reproducible. Subsequently, KIT chose to use eight Eaton easy819 control relays that are interconnected at distances of over 300m. The simple and inexpensive networking capability and expandability of the easy800 system made it possible to create an impressive decentralised control system. *"Seven devices are also connected to easy618 expansion modules via easyLink, so that we are able to operate over 250 I/O points with this system"* Roland Graf explains. The extensive fountain system at the entrance to the car wash centre is really eye-catching. Three more easy819 control relays provide a delightful water display for visitors. As soon as it gets dark, these trigger the fountains to change colours. *"For this we use the easy806 with SmartWire-DT. It fits in precisely because we needed analogue outputs for automating the LED dimmers"* says Roland.

"We are completely free to program the colour changes as we like and can

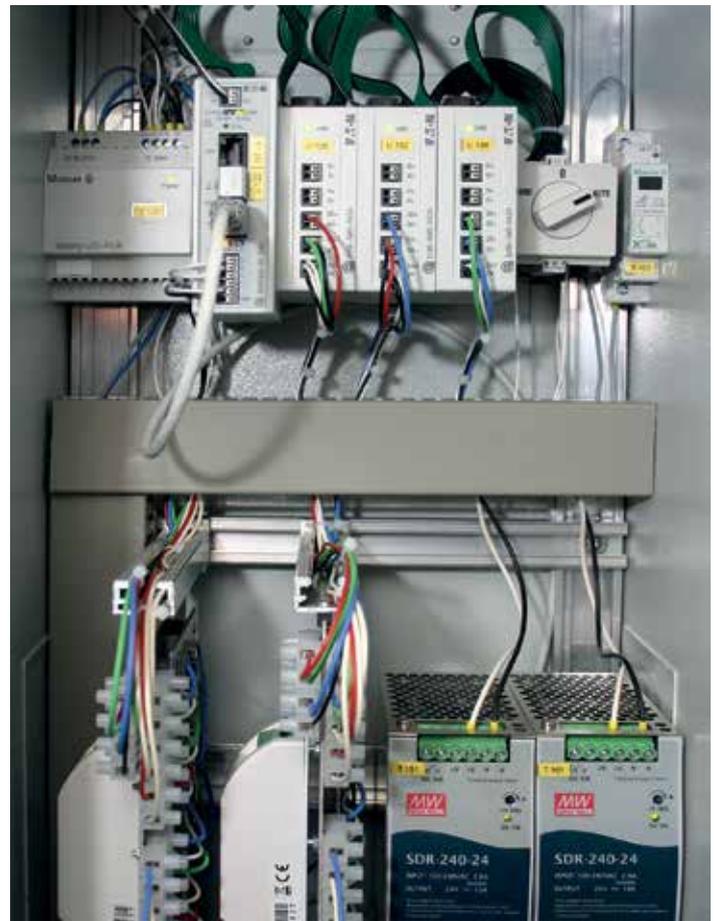
generate a precise 0–10 V control signal that enables a slow and precisely defined colour change".

KIT Wassertechnik also appreciated the space saving design of the SmartWire-DT system: *"The system combines the functionality of an easy800 relay with the direct connection to the communication for switchgear. This is perfect for our application"* Roland Graf adds.

Results

Ecology and economy were key criteria for the end user. The solution supplies a perfect symbiosis: It puts less strain on the environment – and on cash flow. *"Our customer is very satisfied and the installation is totally reliable. Eaton technology is making a decisive contribution here. In all the years we have never had a report of a failure in any of our projects"* concludes Roland.

www.eaton.com





William Hackett Chains Ltd.

inc. BRADNEY CHAIN AND ENGINEERING COMPANY LIMITED

GRADE 50 316L STAINLESS STEEL PUMP LIFTING SOLUTIONS AND CHAIN SLING SYSTEMS

... designed and manufactured in the West Midlands
specifically for the water utility sector



Mechanically Assembled and All Welded Construction
Pump Lifting Chains
Corrosion Resistant Chain Hoists

Also available in standard 316 and galvanized finish

MAYPOLE FIELDS, CRADLEY, HALESOWEN, WEST MIDLANDS, UNITED KINGDOM B63 2QE

Tel. 01384 569431 Fax: 01384 639157 Email: info@williamhackett.co.uk Website: www.williamhackett.co.uk

Verder Pumping Solutions



Chemical Dosing



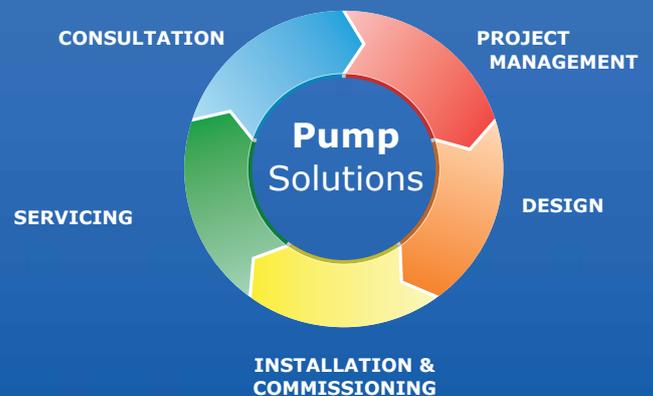
**Anaerobic digestion
& Food waste**



**Bespoke turnkey
package systems**



Verder provides pumping solutions to many of the leading utility companies, waste management organisations, manufacturing and chemical processing plants.



Meeting new regulations and maximising energy efficiency

Energy efficiency has never been more important and is high on the industrial agenda. The introduction of the 2005/32/EC Ecodesign Directive has already gone a long way towards reducing carbon footprints, but, with the next phase of the regulations coming into effect in January 2015, there is more to do, and for pump manufacturers to take note. Marek Lukaszczyk, European Marketing Manager at WEG, looks at the new regulations that are due to come into force next year and how pump manufacturers can increase the energy efficiency of their systems.

The 2005/32/EC Ecodesign Directive regulations were introduced in June 2011 to establish minimum efficiency requirements for electric motors (see the box below for the definition of motors covered by the Directive). This Directive is based on the IEC 60034-30:2008 harmonized efficiency levels standards IE1 (Standard Efficiency), IE2 (High Efficiency) and IE3 (Premium Efficiency). The European Ecodesign is also the first Directive that extends beyond the electric motor, including also the utilization of variable speed drives.

From June 2011 until now, the regulations stipulated that motors shall not be less efficient than the IE2. However, the new regulations take it one step further, stipulating that from 1st January 2015 motors with a rated output of 7.5-375 kW shall not be less efficient than the IE3 or meet the IE2 efficiency and be equipped with a variable speed drive (VSD).

If they haven't already done so, now is the time for pump manufacturers to put in place strategies to meet these regulations.

Motors account for as much as 70% of industry's energy usage and are responsible for over 40% of total global energy consumption. It's clear to see that increasing their efficiency will have a massive impact on reducing energy consumption worldwide, and no wonder that much is being done to increase their efficiencies. Selecting motors that have been designed with energy efficiency as a priority and that comply with the latest regulations are the first step in conforming.

However, there is another step to take in achieving the most energy efficient set up throughout the drive chain and meeting the regulations, and that is the control of the motors. By optimising the motor using a VSD or inverter enables energy savings of between typically 40% and 60% to be realised.

VSD describes equipment used to control the speed of motor-driven machinery. Typically applications do not run at full load 100% of the time, and this is specifically true for variable torque applications like pumps. Therefore, varying the speed of the drive by installing a VSD can help users save energy and money by controlling the speed of the process and adjusting it to the specific load at any time, compared with other techniques for flow control.

Traditionally, physical barriers are used to control the speed of flow, for example, valves are used in pump applications and dampers are used in fan. However, on variable torque applications, such as a fan for airflow control, normally the motor always operates at a fixed speed: for example 1500 rpm for a four-pole motor, and all the while the motor is running at a constant speed, so energy is being used.

Of the 65% of electricity consumption for driving motors, an estimated 20% is wasted in throttling mechanisms that are used to regulate the flow of air and liquids. Therefore, if the system requires varied flow, then installing a VSD can save a lot of energy, which is key to productivity and it is far more efficient to control the speed of the motor.

There are many considerations to take when determining which VSD and drive solution will offer the most energy savings, for example, when and how long will the motor be running for, what is the application and how much does energy cost?

WEG can support the shift towards these new high efficiency levels by offering a comprehensive range of products that exceed the IE2 and IE3 criteria. Additionally, its VSDs are perfectly matched to its motors, affording pump manufacturers the most reliable package of motor / drive products in industry and enabling them to comply with the new regulations coming in to force in January 2015.

www.weg.net

Definition of a motor:

- Electric single speed, three-phase 50 Hz or 50/60 Hz, squirrel cage induction motor
- 2, 4 and 6 poles
- Rated voltage of U_n up to 1000 V
- Rated output P_n between 0.75 kW and 375 kW
- Rated on the basis of continuous duty operation





Conference

Feedback from this year's Conference & Exhibition has been excellent and the event proved to be a great success with both delegates and exhibitors. The Conference was sponsored by the following companies and the majority of them have already signed up to sponsor again in 2015!



The Conference was aimed predominantly, but not exclusively at the Water Industry and the technical theme was "The Future of Fit for Purpose Pumping".

This year there were many excellent presentations covering topics, such as:

- Rag testing
- Pumping station refurbishment
- Intelligent pumping
- Fixed asset monitoring
- The effect of maintenance on total expenditure



The 800 attendees at the conference had "access all areas" passes. Once they registered they were able to select who and what they wanted to see and what they wanted to do. They were able to create an agenda that suited their own specific interests and needs.

There was plenty going on throughout the day with the technical sessions

starting before 10am and finishing just before 4pm. The main conference included speakers from Thames Water, the Environment Agency and Heathrow Airport. The breakout sessions covered a much wider range of general engineering topics including: positive displacement pumps, problem solving, condition based maintenance, mechanical seals, non-return valves, variable speed drives and motor selection.



The exhibition consisted of almost 90 stands from major UK Water Industry suppliers. The Pump Centre exhibition is now the premier engineering exhibition in the Water Industry calendar. It is the ideal place to network with key end users and suppliers within the industry. It is not just the quantity of people who attend, but more importantly it is the quality of people.

The exhibition hall was specifically designed to give an open layout with large areas for socialising and mini-meetings.

On the evening prior to the exhibition, the Pump Centre held its conference dinner which was attended by about four hundred and thirty invited guests. The dinner is the ideal environment for the Pump Centre to entertain and network with its members. The highlight of the after dinner entertainment was the Three Singing Waiters who gave a dazzling performance of many well-known operatic songs and the annual charity raffle which raised almost £4250 on behalf of the "Stroke Association".



& Exhibition 2014



The Pump Centre Conference provides the ideal opportunity for all parties within the Water Industry to get together, to find out about the latest technology, to share innovative ideas and to network with like-minded professionals.

Over recent years the Pump Centre has grown and membership is at a record high of approximately 140 member companies, members include all the major water utility companies, most of the water supply only companies, the Environment Agency plus many other companies with an interest in pumps, pumping systems and the associated equipment.

The Centre offers its members a range of important services including:

- Technical support
- Collaborative projects
- Conference and events
- Training
- Networking and marketing activities

For more information about the conference and membership contact the Pump Centre on 01925 843512, or go to www.pumpcentre.com

WHY NOT JOIN US AT THE PUMP CENTRE CONFERENCE & EXHIBITION 2015 on 14th May 2015 at Telford International Centre? You'll be in great company.



KSB's retrofit of Omega Pumps provides solution for RWE Power Station

In 2012, with the closure of Didcot A Power Station imminent, engineers from RWE NPower were tasked with enhancing the cooling water make up system to match the reduction in demand for cooling water at the remaining Didcot B plant. Engineers from KSB were invited to survey the existing pumping station with a remit to replace the old units with more efficient pumps matched to the new requirements. After detailed analysis KSB proposed two pumps from the Omega pump range. These pumps were delivered to site on time and are now fully operational.

KSB Energy projects team selected two pumps from the KSB Omega pump range to replace the old units in the CWMU pump house at Didcot Power Station in Oxfordshire. The original pumps were rated to supply 4248m³/hr of screened river water to Didcot A (which closed in March 2013) and Didcot B power station. After the closure of 'A' Station demand for make-up water reduced to 1947m³/hr. This presented RWE with a clear case for energy savings and a reduction in the carbon footprint, by replacing the existing pumps with more efficient Omega pumps matched exactly to the new system requirements.

The KSB Omega V350-430A vertical pump units were delivered to site along with replacement drive shafts and motors in May 2013. Installation, carried out by RWE Technical Support Group, was phased to ensure the operation of the power plant remained uninterrupted. One of the key challenges KSB faced with this project was the limited space available within the dry well. For operational reasons the existing valves and pipe work could not be removed, thus the replacement pump had to be capable of being installed between the valve faces. The compact design of the Omega pump made it an ideal choice for this application.

Pump specification, design layout and the supply of new motor stools, carbon fibre drive-shafts, and ancillary items, was carried out in the UK by the Energy Projects team at KSB Ltd. Manufacturing of the pumps along with performance and hydrostatic testing was completed at the KSB factory works in Halle, Germany. The performance tests were carried out in the presence of RWE Engineers, Dave Evans, Mechanical Engineer for RWE Npower later commented, "KSB have been



cooperative and efficient in their communications and completion of milestones throughout the duration of the contract, including arranging meetings with RWE and subcontractors to discuss technical and commercial issues."

KSB offers a comprehensive range of pumps and valves to the Energy sector which ensure reliable operation. RWE acknowledged the trouble-free operation, safety and reliability of KSB's pumps and valves on the 11th November 2013, when KSB AG received the annual RWE Supplier Award in the category "Quality Global". KSB received the award for the quality of its products and the excellent price-performance ratio in a global context. The award ceremony took place at the conference centre in Essen, Germany, where the prestigious selection was made from among approximately 15,000 suppliers of the RWE Group.

www.ksb.com



Excellent
Engineering
Solutions

WEIR

Tel: 01926 424 031

Email: waterservices@weirgroup.com

www.weirpowerindustrial.com

Optimising performance, maximising energy efficiency

- Diagnosis and condition assessments
- Wear resistant and efficiency enhancing coatings
- Asset performance upgrades
- Maintenance, repair and refurbishment

• Pumps • Valves • Steam turbines • Specialist coatings

When you want the ultimate pump control, get the Ultimate Pump Controller

Pulsar's new Ultimate Pump Controller provides the complete picture when monitoring or controlling pumps, flowrates and intelligent pump performance data.

Ultimate uses the proven dB family of transducers to provide non-contacting level measurement input. It integrates PLC, RTU and pump control in a wall or fascia mount controller with expandable I/O to suit application.

- User friendly menu via touch screen HMI
- Pump Trip Auto Reset - no false call outs
- Flow Pulse pipe flow sensor gives true pump efficiency for Compliance Reports

- Real time communications - DNP3, TCP/IP, Modbus and Profibus. Interrogate Ultimate on the move via dedicated web server
- Pump reversing - patented 'Retroflo' pump monitor gives auto reverse choices
- Burst/Block - prediction of level/flow rates gives clear alarms (patented)
- Time to Spill indication via alarm or real time (patented)
- Low cost pumping via Tariff Management (patented)
- Infra-red camera for live view of your asset

The brand new Ultimate from Pulsar.

Contact us today for information.

Innovation. It's in our DNA.



pulsar
PROCESS MEASUREMENT

www.pulsar-pm.com

Malvern, Worcs WR14 1JJ, UK
Tel: +44 (0) 1684 891 371
info@pulsar-pm.com

Free Air Delivery: the critical factor in low-pressure screw blower v. lobe blower performance comparisons

From an operational standpoint, it may not always be appreciated that when comparing the energy efficiency of different blower technologies the performance data may not be presented in a comparable manner. For example, lobe blower performance data is commonly offered by indicating the air intake flow volume and the energy used at lobe element shaft, not the actual volume of air the blower package delivers - the net usable air - and not the energy consumption including all the blower package power losses.



This anomaly is all the more surprising when it applies to waste water aeration process operations. In order to maintain the desired oxygen level within the aeration lanes, the precise volume of the aeration air being supplied by the blowers is a critical factor in sustaining the aerobic process. It is for this reason that the latest revision to the Water Industry Mechanical and Electrical Specifications (WIMES) for low pressure blowers has included measuring the blower performance according to the



ISO 1217 standard, reflecting the evolving needs of the water industry.

ISO1217 requires the performance of the blower



to be measured at the blower outlet. This is a far more accurate indication of the performance of the blower and clearly qualifies the air volume that is available to the aeration system. That is why Atlas Copco ZS low pressure screw blowers' performance data is provided in line with ISO1217, which requires the performance of the blower to be stated as FAD (Free Air Delivery) - the actual volume of air at the blower outlet.

From a technical perspective, the lobe blower has to work harder and therefore less efficiently because the delivered air is compressed externally and depends on back pressure from the connected pipeline (and from water resistance in the aeration tank) to maintain the required air flow and pressure. By contrast, the rotary screw type blower demands less energy because the internal compression

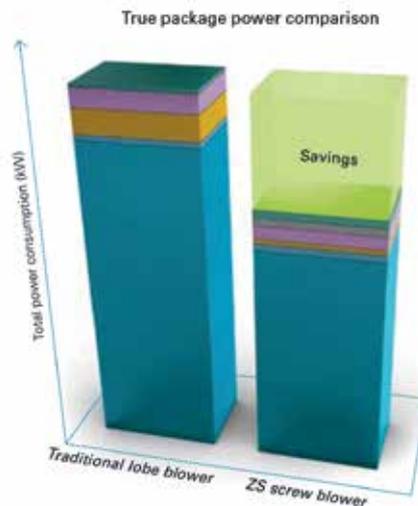
concept offers higher efficiency. This becomes even more significant when there is a variable aeration demand; the screw blower exhibits a more consistent volumetric efficiency derived from the design of the rotor elements.

When comparing blower technologies a true package power evaluation should be made. The factors to be considered should include the pressure drops within the blower, transmission losses: belt drive compared to direct drive, motor efficiency and, of course, the air volume at the blower outlet versus the total package power input.

On face value, the lobe blower may appear to offer plant operators a simple, low cost, basic option for low pressure air applications. The reality is that in a low carbon economy many industrial applications can benefit from improved performance and significant energy savings through the replacement of conventional lobe equipment with innovative and sustainable, screw technology solutions.

The increased emphasis on the ISO 1217 standard in providing flow figures from a blower will ensure that operators are provided with a truer picture of blower efficiency and the FAD volume of air that is supplied to their processes.

www.atlascopco.co.uk



- Savings
- Oil Pump, Cooling Fan, Ventilation Fan
- Motor
- Frequency Converter
- Transmission (drive gear vs belt)
- Pressure Drops
- Compression





Reduce

maintenance costs

with regular deragging, a unique feature that increases pump lifetime and efficiency.



VLT® AQUA Drive

Keeping waste water pumps clean

The deragging function standard in the Danfoss VLT® AQUA Drive ensures highest pump efficiency is maintained.

Ragging of the impeller and pump blockages are minimised, reducing down time and maintenance costs – saving you time and money.

www.danfoss.co.uk/vlt



Danfoss VLT Drives, Capswood, Oxford Road
Denham, Bucks UB9 4LH, Tel. 01895 617100,
Ireland freephone: 1 800 946332, drivesuk.sales@danfoss.com



Accurate, versatile chemical pumps

qdos
Peristaltic Metering

- Reduce maintenance costs - no valves to gas lock
- Slash chemical costs - accurate and linear flow 0-500ml/min even when process conditions vary
- Cut installation costs - no dampeners, strainers, de-gassing, back pressure or foot valves needed and a competitively priced pump

50 years of innovation in pump technology

ReNu REVOLUTIONARY PERISTALTIC PUMPHEAD TECHNOLOGY

Fully sealed for life, one minute, tool-free maintenance



qdospumps.com
wmpg.com 01326 370363

WATSON MARLOW

Watson-Marlow Pumps Group

The New Wave of Pumping Station Controllers

– Control, Comply and Monitor

With the recent launch of Pulsar Process Measurement's Ultimate Controller, sewage pumping station controllers are responding to the drive from wastewater companies for control with compliance, performance monitoring with carbon footprint reduction. That the best of them are also reducing installation and maintenance costs along with the number of man-hours required to manage each site is just an extra bonus!

A number of devices that have gone some way along this road by bringing together the PLC and RTU functions into a single box. The final part of the puzzle has been the incorporation of the main level measurement device into the pumping station controller. Now that reliable measurement is available along with the other elements, wastewater companies have access to economical, effective control systems that deliver functions that would have been prohibitively expensive to program on an individual or even a small cohort of PLC installations.

The real key to success here is, as it has always been, the reliability of the core measurement, the level in the wet well or sump. If you can't measure that effectively, then the rest of the control effort will be wasted. The best possible way to develop a complete self-contained control system is to work backwards from the wet well – start with the level measurement system and make sure that it offers the rock solid reliability you need. For example, Pulsar offers the proven track record of tens of thousands of successful wet well applications in use all over the world. All with foam, turbulence, debris and solids on the surface.

So, what are the other benefits of using an all-in-one Controller, such as Pulsar's Ultimate Controller?

As a starter, installation costs are substantially reduced. By only having a single, compact control device to install, panel space requirements are also minimised and the panel itself can be made smaller. A well-designed user interface makes the set-up of a Controller very straightforward, minimising the time and cost associated with the set up of a PLC based system.

The real benefits, of course, come from the range of sophisticated functions that become available. Many are, of course, patented. Most of the following are specific to Pulsar Process Measurement but will, I hope, give you a good idea of the sort of functionality you might be able to expect from the leading equipment:

Tariff Management (Pulsar patented) – TRIAD periods add costs, and the annual extra charges can run into millions of pounds. Tariff avoidance routines make sure that pump running is kept to an absolute minimum during high tariff periods and TRIAD periods

Time To Spill (Pulsar patented) – There are many factors that affect the time before a station spills, not only rate of change of level but also things like pumping rate compared to maximum and the inflow rate before the system can provide a clear, relevant and accurate warning of imminent spillage

Pump Trip/Reset – Many man-hours are wasted in trips to site to reset a tripped pump. One of the features built into the Pulsar Ultimate Controller is that it will attempt to automatically reset a pump so you know that if you are visiting site, there is a genuine issue to address

Burst/Block Alarm (Pulsar patented) – Using predicted change of level rates, system problems can be readily identified, such as a burst rising main or main blockage

Pump Reversing (Pulsar patented) – Pump blockages and partial blockages can be caused by many things, but can be time-consuming to spot and clear, and can be a hidden issue that affects station efficiency. It is possible to automatically reverse pump motors if a restricted flow rate is detected so, most of the time, staff don't need to worry about pump performance

There are of course, many more functions available, and other units similarly include a suite of high-end pump control functions.

In terms of hardware, new options are available that give customers real flexibility in installation and extra functionality that aids compliance and operational management. Different suppliers approach the issues in different way. At Pulsar we recognise that the management of the pumps is the core control function of the process, and much of the peripheral equipment we supply is directed toward that end. Pump Power Monitors are DIN rail mounted and sit within the motor control area of the panel, so that instrument voltage only is in the C&I section. Each pump gets its own Monitor, optionally including a feature that automatically reverses the pump if a blockage is detected. Flow monitors, such as Pulsar's non-invasive Flow Pulse, can be integrated into the process. They are important for Compliance, because measurements from flow equipment can prove that, in storm conditions, maximum theoretical flow is being achieved even if the pumping station, in a worst case situation, becomes overwhelmed.

Manufacturers are designing the hardware to be flexible. Pulsar offer DIN rail mounted I/O expansion modules available so that any and all sensors can be integrated, logged and controlled dynamically. Some of those peripherals are novel, including an optional infrared camera so that a snapshot of conditions within the well can be included and accessed remotely.

We are undoubtedly in a rich period for innovation in this important instrumentation area. As more opportunities become apparent, manufacturers now have the tools to offer new, interesting and effective solutions to improve control, help companies to hit compliance targets and achieve closer monitoring of pumping station and wastewater networks than ever before.

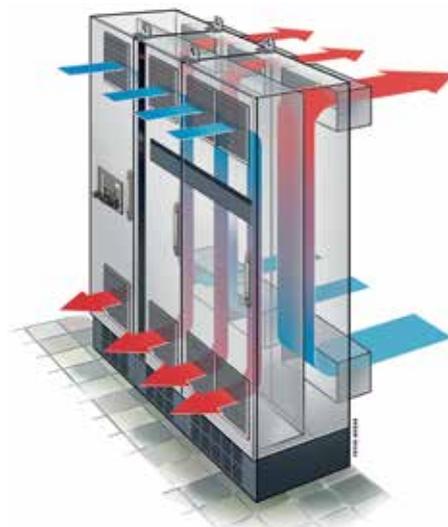
www.pulsar-pm.com



Unique Back Channel Cooling Concept optimises system efficiency

Although modern day Variable Speed Drives (VSD's) have become more compact, more reliable, more user friendly and more efficient; they all still have losses (W). With most VSD manufacturers now claiming that their products are around 98% efficient, how we limit and control the heat from these losses is the challenge. While high enclosure IP ratings are readily available, allowing the VSD to be mounted outside the control panel; in many industries the norm is to mount the drives within a control panel or MCC. This uses forced ventilation in the form of door mounted fans (and filters) to remove the heat losses from the cubicle and maintain an ambient suitable for the continual operation of the VSD. This technique does not cause

Although Danfoss High Power Drives are now designed up to 98% efficiency levels, Danfoss have incorporated a unique back channel cooling concept within the VSD to ensure up to 90% of the heat losses are removed from the MCC and/or switch-room using the internal heatsink fan within the VSD rather than multiple force vent fans mounted on the doors of the MCC itself.



much of an issue for smaller VSD's, however using higher power drives results in larger heat losses. This inevitably means multiple force vent fans running constantly at full speed regardless of system load, consuming additional energy while creating high acoustic noise levels.

As an example, Danfoss Drives recent work with a UK based panel builder to integrate a 400kW VSD into their MCC reduced the number of cooling fans required for the MCC from six to only two. As the full project consisted of 4 x 400kW VSD panels this resulted in a total of 16 fans being eliminated from the original design; resulting in reduced material cost, reduced labour cost, reduced running costs, less risk of panel/filter contamination and a significant reduction in acoustic noise. A further benefit of this unique cooling concept is that the Back Channel Cooling fan is controlled by heatsink temperature. The VSD cooling fan will only run when the temperature rises to a switch on level and we have also adapted this cooling fan to be variable speed control, meaning it will also only run to a speed required to remove the associated heat based on the loading of the system. This is an important benefit as it further enhances the efficiency of the



system and reduces acoustic noise.

The back channel cooling system is standard on Danfoss high power drives, whether you choose IP20 for mounting within an enclosure or IP54 for wall mounting or floor standing.

www.danfoss.com



Pump Project of the Year 2015

If you think your project deserves recognition why not put it forward for the Pump Centre Pump Project of the Year.

The project chosen will:

- Be featured in an article in the February 2015 issue of the PumpAction newsletter and also on the Pump Centre website.
- Have a display area at the 2015 Pump Centre conference.
- Be a key presentation at the 2015 Pump Centre conference.

To qualify the project must involve:

- Pumps and pumping technology.
- A Pump Centre member company, as part of the project team.

To enter please contact the Pump Centre (john.howarth@esrtechnology.com) and request a nomination form.



Keeps clean all by itself

(but only one stays low weight)

- IE3 motors
- Super Efficient self cleaning blades
- Ultra low speed – high flow options
- Adaptable mounting brackets
- Ceramic options



WILO EMU Mixer

At their best deep down

(but only one has abrasion and corrosion resistant Ceramic internal options)

- 4" to 24" diameter
- Bronze, Cast Iron, Stainless & Ceramic options
- Super High Efficiency Hydraulics & Motors
- Highly Wear Resistant
- Inverter ready winding
- Extensive options/custom engineering



WILO EMU Borehole

t:+44 (0) 1283 523000
www.wilo.co.uk
 e:sales@wilo.co.uk
 f:+44 (0) 1283 523099

wilo

Schneider Electric Launches First Intelligent Drives Family

Schneider Electric, a global specialist in energy management, has announced the launch of its first service oriented, intelligent drives family – the Altivar Process.

Developed for all manufacturing and process industry sectors – to include the food & beverage industry, water and wastewater industry, mining, minerals and materials, oil and gas and finally, general manufacturing – the Altivar Process has been launched to help factory owners, plant managers and engineers better manage their processes, to ensure they are performing as efficiently as possible.

The Altivar Process family of drives adds digital intelligence to even the smallest of field devices. This enables users to make fully informed decisions about their entire plant, from the top down, in order to increase flexibility, reduce downtime by identifying faults, speed up processes; and ultimately reduce a plant's carbon footprint.

Previously, there was little focus from the plant managers to monitor the efficiency of their devices, such as pumps and determine whether each pump is operating at its best efficiency point (BEP). The performance of an operating pump is affected when it operates away from its BEP. The likely effects are low efficiency, noise and vibration giving reduced life to bearings and temperature rise due to dissipated energy created by low efficiency.

Altivar Process, with embedded process control, helps digitalise processes by allowing information to be extracted via the drive, from the device. In the case of a pump, the Altivar Process would display the pump curves of each individual pump based on the flow rate, head and how efficiently the pump is pumping, informing the user of any drift detection from the BEP.

This enables users to make informed decisions about when to carry out certain processes and for how long, reducing valuable energy costs; and also saving a further 8 per cent on total lifecycle cost of the device itself. Altivar Process also alerts users to faults and shows operators exactly where and when a fault has occurred and why, reducing expensive downtime spent fault-finding.

Nipun Sibal, product marketing manager, drives domain at Schneider Electric comments, *"The Altivar Process has been designed to answer three key needs of today's plant managers and operators, namely – increased operational effectiveness and faster productivity, better environmental sustainability so users can do more with less; and finally the need to reduce downtime and increase asset availability and flexibility."*

The Altivar process allows operators to extract real-time intelligence from every aspect of their plant or facility, giving them a fully holistic view. This not only helps with predictive maintenance and allows manufacturers and engineers to make quicker business decisions; but can reduce energy consumption and costs by a massive 60 per cent."

www.schneider-electric.com

Contract Law For Engineers Coming Soon!

25 & 26 September 2014

Holiday Inn, Runcorn

More details go to: www.pumpcentre.com

Fish Friendly Pumps go Direct Drive for Cam Pumping Station

Bedford Pumps, the UK's leading manufacturer of large submersible and conventional pumps for the Land Drainage industry, has recently installed and commissioned a Direct Drive Variant of their Fish Friendly pumps for Cam Pumping Station in the South Level Cambridgeshire Fens.

The Fenland area is comprised of mainly high grade agricultural land, much of which is below sea level, considerably below flood level, and therefore totally dependent on pumped drainage. Cam Pumping Station is one of three stations within the district and part of a 7,000 acre (2857ha) pumped catchment, managed by Waterbeach Level Internal Drainage Board.

Cam Pumping Station, located close to the village of Streatham, discharges directly into the River Cam. The pumping station had been operating with a combination of old diesel driven and one electric pump, but with a requirement for the pumps to be upgraded combined with new legislation requiring that measures be put into place to reduce eel mortality at pumping stations, the decision was made to install two new pumps from Bedford's Fish Friendly range.

Bedford Pumps manufactured, installed and commissioned two DAF (Fish Friendly Direct Drive Axial Flow) pumps for Cam Pumping Station through consultants Hannah Reed. The pumps have been installed in a vertical suspended position with below floor discharge, in a new sump on the existing site. The pumps are powered by electric motor through a gearbox with an external PTO facility. This offers the ability to drive the pump by tractor in the event of a power failure. Each pumpset will discharge 1,150 l/s at 5.6m head.



Bedford Pumps' Fish Friendly impeller

In addition to the pumps, Bedford Pumps also supplied Siphon Breaker Valves and Sub Bellmouth Flow Splitters for the units. They also undertook the M & E works for the site, taking out the old control panel and replacing it with a new Motor Control Centre. This will operate both the new pumps and an existing pump, which was retained as a stand-by.

Bedford Pumps' new range of Fish Friendly pumps are a complete solution for eel regulation compliance. There need be no changes to the civil structure, nor additional fish scare tactics. Utilising a Fish Friendly pump will even improve hydraulic efficiency with an 8% reduction in power absorbed. Bedford Pumps' Fish Friendly pumps cover from 400 to 9,000 l/s at 2m to 14m head. Fish Friendly pumpsets are available as a submersible, mixed flow or direct drive variants.

Bedford Pumps Fish Friendly pumps have proven credentials awarded from independent research consultants in the field of water management, VisAdvies BV, following extensive and stringent trials. The tests prove conclusively that Bedford Pumps' range of submersible and direct drive pumps are fish and eel friendly with no direct mortality observed from exposure to the pump. Copies of the official report which state that Bedford Pumps have manufactured the "best fish friendly pump on the market" are available on request.



Diesel engine driving the old pumps at Cam P.S.



Bedford Pumps new Fish Friendly pump being installed at Cam P.S.

Bedford Pumps range of Fish Friendly pumps offer a complete solution for eel regulation compliance. There need be no changes to the civil structure, nor additional fish scare tactics. A Fish Friendly pump can be retrofitted in place of an existing pump and can be installed in a variety of configurations. Utilising a Fish Friendly pump also demonstrates a significant improvement in hydraulic efficiency with up to 10% reduction in power absorbed.

www.bedfordpumps.co.uk

Water Industry Maintenance Working Group (WIMWG) – Year 2 Launched!

The Pump Centre held a meeting at the end of February to launch the second year of its collaborative project which is focussed on maintenance procedures and strategy within the Water Industry.

The meeting was attended by representatives of 12 different water companies and an outline programme for Year 2 of the project was agreed. The first technical meeting of the group took place at the end of May in Edinburgh and it included a visit to Seafeld WWTW to allow participants to view the work being undertaken by Veolia Water on Lean Reliability Centred Maintenance (LRCM).

For more information contact john.howarth@esrtechnology.com

Meet the family
the fast way.
All our Eta pumps
at a glance.



Eta keeps the world on the move

Our Eta pump family keeps the world on the move. And there are plenty of big reasons: the highly efficient top-class hydraulic system. Dozens of sizes, materials and drives in almost any combination. And service that puts rivals in the shade. After millions of great pumps, the new generation is here. So discover what Eta can now do for you.

www.ksb.com/eta-en

• KSB Limited • 2 Cotton Way • Loughborough • Leicestershire • LE11 5TF • 01509 231872 • www.ksb.co.uk



Etanorm



Etaline



Etabloc



Etanorm SYT



► Our technology. Your success.
Pumps - Valves - Service





Training & Awareness Day Programme 2014

Title	Date	Full Price	Members Price
Centrifugal Pump Repair Awareness Day (Sunderland)	10 Sept 2014	£120 + VAT	£96 + VAT
Pumps for Beginners & Intermediates (2 days)	17 & 18 Sept 2014	£550 + VAT	£385 + VAT
Pumps for Beginners	17 Sept 2014	£350 + VAT	£245 + VAT
Pumps for Intermediates	18 Sept 2014	£350 + VAT	£245 + VAT
Contract Law for Engineers (2 days)	24 & 25 Sept 2014	£550 + VAT	£385 + VAT
Introduction to Pumping System Design	30 Sept 2014	£120 + VAT	£96 + VAT
Scottish Mini Conference (Glasgow)	9 Oct 2014	£120 + VAT	£96 + VAT
Valves for Beginners	4 Nov 2014	£350 + VAT	£245 + VAT
Improving Pump Maintenance	5 Nov 2014	£350 + VAT	£245 + VAT
Why Mechanical Seals Fail	6 Nov 2014	£350 + VAT	£245 + VAT
Pumping in the Water Industry (4½ days)	10 – 14 Nov 2014	£995 + VAT	£695 + VAT

(Awareness Days are highlighted in red).

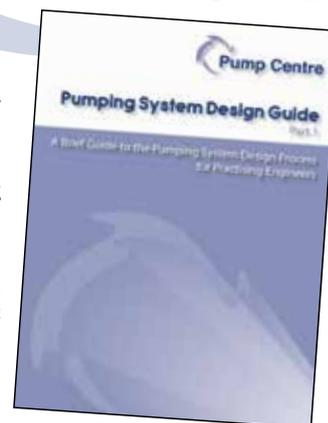
Featured Awareness Day – Introduction to Pumping System Design

The performance and reliability of pumping equipment is directly related to the quality of the system into which it is installed. Therefore, it is vitally important at the design stage to create a system that allows satisfactory pump operation. Poor system design invariably leads to higher operating expenditure due to lower pumping efficiency and higher maintenance costs.

This Awareness Day has been developed as an introduction to the subject of pumping system design and is based on the "Pumping System Design Guide" published by the Pump Centre.

The Guide is a support tool for the practising engineer/designer to highlight the important questions that should be asked during the development of a pumping system in order to avoid common operational problems. The Guide has been written with centrifugal pumps, for waste water and sewage applications, in mind. However, wherever possible, it has been written in generic terms and much of it is also applicable to other applications.

Each delegate will receive a complimentary copy of the Pump Centre's Pumping Station Design Guide – Parts 1, 2 and 3



Pump Centre members receive 30% discount off training courses and 20% discount off Awareness Days

All training courses (unless indicated) will be held at:

Holiday Inn – Runcorn
 Wood Lane
 Beechwood
 Runcorn
 WA7 3HA
 Tel: 0871 942 9070

The majority of our training courses can be run "In-House" at a venue selected by the Client. In-house courses become cost effective when clients have 8 or more members of staff to be trained. Please contact the Pump Centre for a quote.

To discuss your training requirements contact:

Jim Eaves: 07968 707753 or email jim.eaves@esrtechnology.com

To reserve your places contact:

Karen Bridgeman: 01925 843512 or email

karen.bridgeman@esrtechnology.com

For more training information visit www.pumpcentre.com

Flexible, efficient and safe metering

Motor-driven diaphragm metering pumps Sigma (S1Cb/S2Cb/S3Cb)



The entire Sigma motor-driven metering pump product range, control type S1Cb/S2Cb/S3Cb, has been equipped with intelligent features to provide a high level of operating convenience, safety and efficiency. The pump range comes with a removable operating unit and an automatic overpressure cut-off as standard. Adjustable metering profiles ensure optimum metering results. The mobile operating unit offers additional operating convenience ensuring that the pump can be quickly and easily adapted to any specific application.

Speed control with an integrated frequency converter can adapt the metering behaviour to the chemical or application. Motion and speed profiles are also recorded as is energy demand. The supply of energy depends on the amount of power needed and is controlled to suit the requirements of the application in hand.

Benefits

- Process safety thanks to multi-layer diaphragm with diaphragm rupture warning system
- Ventilation option provides reliable function
- Metering profiles for optimum metering results
- Removable operating unit with large illuminated LCD for maximum operating convenience
- Simplified management of spare parts when using the Sigma product family
- Simple integration in systems with bus networking using PROFIBUS® or CANopen interface

Metering options

- Volume-proportional
- Measured variable-dependent
- Time-controlled
- Pulse-controlled

Capacity range

- Pump capacity 20 – 1000 l/h
- Pressure 12 – 4 bar