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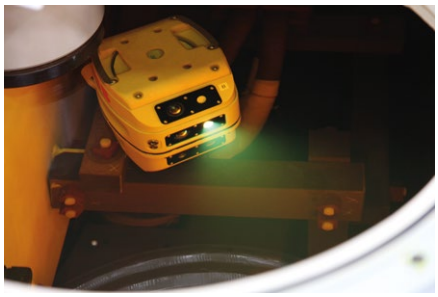

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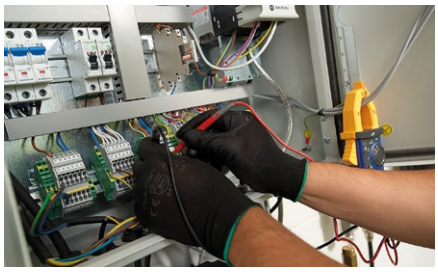

Remote monitoring for humidifiers

Keep dust in its place

Unlocking productivity: Best practice maintenance for manufacturing equipment p4

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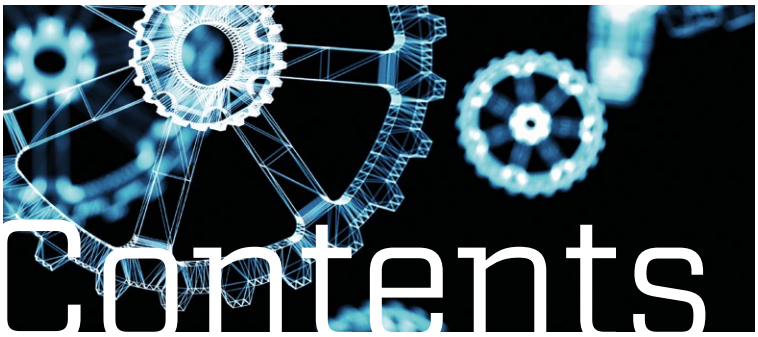

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New technology must reflect business strategy

David Fowler MIStructE, Editor
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Uncertainty looks set to be a defining characteristic of 2019. For the UK, this arises not least from the continuing Brexit stalemate – but there is also a technological dimension.

A new report from software specialist SSG Insight (see News) warns that though businesses may be preoccupied with short-term events and concerns about the economy, the pace of technological change is continuing unabated.

It identifies five key technology trends that it expects to shape progress in manufacturing for 2019. They are the arrival of the next generation of mobile networks (5G); increasing levels of automation; intelligent manufacturing systems exploiting artificial intelligence, machine learning and the cloud; the growth of e-learning; and the need for an evolving, more technologically-orientated workforce.

Developments such as these have the potential to improve productivity, in which the UK lags behind its competitors. At the same time they could also play an important role in helping UK industry adapt to Brexit, SSG Insight argues.

But, as M&E's newly-inaugurated Editorial Advisory Board warns in this issue, UK companies are being slow to exploit the potential of Industry 4.0 technologies: some are adopting them in a piecemeal fashion, others are unsure where to start.

Trends in the adoption of digital techniques was the subject of a roundtable discussion at the board's first meeting (see page 8 for detailed report). The group, drawn from academics and consultants at the front line, observed that companies want to adopt techniques such as condition monitoring and predictive analytics, but many collect data without a clear purpose, or inconsistently. In small and medium firms particularly, technology such as augmented reality or artificial intelligence are treated warily because they are regarded as unproven. Such firms, it appears, are more confortable with concepts such as lean manufacturing, which can be addressed through training. Other barriers include concerns about cybersecurity, and a lack of resources or technical skills.

But SSG Insight warns, "Manufacturers have no choice but to move with the times." The software firm and M&E's board offered similar advice for companies as they set off or continue down the Industry 4.0 path.

Companies keen to derive insights from condition monitoring and other data should not rush in, the editorial board advised. They should take a more systematic view, and ask what information would improve their decision-making process, and collect data on that basis.

SSG Insight stresses that it is not enough to invest in technology for its own sake. "Investment in technology should reflect the competitive strategy of the business", it argues: it's not about buying the latest software, but about identifying how the business model can be changed to improve its competitiveness.

Technology will not help the business to evolve without the right skills to exploit it, so investment needs to be complemented by investing in recruiting more technologically aware staff, the company argues. It concludes: "There is no substitute for wisdom in business, and technology cannot replace the fundamentals of management."

Automation will boost productivity, not cut jobs

There is no shortage of examples of the march of new technology in this issue. Humidity Solutions is offering a service to monitor humidity in processes where it is critical; Brammer Buck & Hickman adds condition monitoring to complement its equipment repair services. UE Systems describes how ultrasound can accurately diagnose a range of electrical and mechanical faults. And ABB's TXplore service uses a "swimming" robot controlled by a game-style console to inspect the interior of transformers. Not only does this simplify the inspection process and reduce downtime from three days to one, it also avoids the need to drain the insulating oil and the potential hazard for maintenance staff of working in a confined space.

Another theme that emerged in our Editorial Advisory Board discussion was the fear that technology and automation will result in the loss of jobs. But, it was pointed out, since the first industrial revolution new technology has created more jobs, not destroyed them.

UK manufacturing's key problem is productivity. In addition, it faces a skill shortage, compounded by an ageing workforce which means that skills are being lost to the industry. Employers need to compete for experienced maintenance staff from a limited pool.

As the examples above show, Industry 4.0 technology is about increasing productivity, allowing staff to do their jobs more effectively and freeing their time for activities that add greater value. That can only be positive.

Unlocking productivity:

Best practice maintenance for manufacturing equipment

It's an exciting time for the UK manufacturing industry, writes **Shahina Kazi**, Shell Lubricants UK B2B Marketing Manager. A buoyant market means growth opportunities are aplenty. Operators should be looking at operational measures to lower total cost of ownership, and boost productivity across the value chain.

It's an exciting time for the UK manufacturing industry. A buoyant market has meant that looking forward, growth opportunities are aplenty. To take advantage of this, operators should be looking at operational measures available that will help to lower total cost of ownership, and boost productivity and efficiency across the value chain.

Integral to succeeding in this opportunity is an effective maintenance strategy. However, recent research from Shell Lubricants (see box) reveals that current maintenance practices, including lubrication measures, are often not optimally protecting operations. Over half of manufacturing companies do not recognise that a proactive maintenance strategy could help shorten equipment downtime (55%) or think it would help reduce maintenance costs (53%). Maintenance staff are also feeling the strain with 36% thinking they have too few personnel, and a quarter (25%) feeling a squeeze on maintenance budgets.

A key element of an effective maintenance strategy is the application of high-quality lubricants. An example of this is the Shell Tellus range of hydraulic fluids. These advanced products have been specifically formulated to meet the demands of modern hydraulic systems. For instance, Shell Tellus S4 ME hydraulic fluid lasts up to 10 times longer than the industry minimum standard oil life. Long oil life means that equipment can operate for longer without interruption: the oil's formulation, which offers excellent wear protection, also helps to prolong the life of the hydraulic pump.

Looking forward beyond current practices, to remain competitive in tomorrow's smart factories, companies must also remain informed and consider the long-term benefits of embracing Industry 4.0. Industry 4.0 is the implementation of new technologies such as artificial intelligence, big data, and the industrial Internet of Things (IoT) in factories.

With the emergence of industry 4.0, maintenance has never been more crucial. Manufacturing businesses have to optimise today's maintenance strategies to accelerate the uptake of the smart factories of tomorrow. In a smart factory, technological advances will allow for remote monitoring, maintenance and servicing as well as communication between different machines, enabling businesses to make data-driven, efficient decisions.

However, while 86% of manufacturers anticipate that Industry 4.0 technologies will result in savings, and 57% believe that they will allow for fewer breakdowns, 61% cite a lack of staff understanding about how the technologies work as a barrier to implementation.

With change on the horizon, collaboration is essential to help share knowledge and accelerate industry progress. With 56% of manufacturers feeling that there is a lack of trusted third-party experts to provide support and with 78% revealing that their maintenance staff would benefit from additional training on effective equipment lubrication, this means that as an industry we must work together to succeed.

Tapping into the knowledge of suppliers will help companies supplement their own resources to deploy field specialists where needed, to find the right technical and organisational approach to maintenance challenges, and optimisation tactics to help protect the bottom line.

Through knowledge-sharing, consultancy and close collaboration, manufacturing companies can draw on expertise from OEMs, parts and consumables developers and industry bodies to achieve measurable efficiency gains, cost savings and an improved return on investment for their equipment, their consumables and their specialist personnel.

With over 260 technical experts available to provide advice, Shell Lubricants has the knowledge and expertise to support manufacturing businesses across sectors in reducing costs and delivering business value.

For more information around how to optimise operations to boost competitive edge, visit the Shell Lubricants website, or download the *Optimise Today, Accelerate Tomorrow* industry whitepaper from the URL below.

www.shell.co.uk/business-customers/lubricants-for-business/plastic-injection-moulding/optimise-today-accelerate-tomorrow.html

The survey, commissioned by Shell Lubricants and conducted by research firm Edelman Intelligence, is based on 350 interviews with power sector staff who purchase, influence the purchase or use lubricants/greases as part of their job across seven countries (USA, China, India, Germany, Russia, Indonesia and the UK) from March to April 2018.

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Five emerging trends set to transform manufacturing

Five technology trends that look likely to define the manufacturing sector in the year ahead have been identified by asset maintenance "software as a service" specialist SSG Insight.

The trends emerged from research carried out with Sheffield Hallam University for a recent white paper entitled Harnessing *Brexit, Technology and Insight: British Manufacturers, a Competitive Edge in an Age of Uncertainty and Opportunity.*

The company says that new technology can be used to digitally transform the industry and boost productivity, but warns that businesses should make sure investment decisions reflect their competitive strategies.

The following five trends are predicted to define intelligent manufacturing over the next 12 months:

1: 5G is coming

Many believe that the next generation of mobile networks will be a key enabler of industry 4.0 in the manufacturing sector – from improving data management to allowing greater collaboration between suppliers and end users. 5G networks will give manufacturers the chance to build smart factories with real time connectivity.

2: Increasing automation

Greater levels of automation are thought essential for manufacturers to remain competitive and meet demands for manufactured goods. SSG Insight research indicates that a third of the UK's leading manufacturing executives expect automation to take over British manufacturing in the next three years.

3: Intelligent manufacturing

Over the next 12 months, connected systems that exploit the cloud, IoT, artificial intelligence and machine learning will provide instant intelligence and play a crucial role in making UK manufacturing smarter and more agile. Research found that 93% of manufacturers in Britain are already using live data and automation technology in some capacity, while nearly a third predict that technology which analyses big data will play a greater role in their business over the next three years.

4. Adapting to an evolving workforce

Training staff to equip them with the skills to excel in an increasingly digital environment is considered crucial in the sector. Directors must develop the skills of their staff to plan, educate, explain and execute the digital transformation of their businesses.

5. The growth of e-learning

Developing digital skills among the workforce can be supported with the use of augmented and virtual reality technologies to improve training programmes. These technologies allow employees to learn much of what they need to know without stepping foot on the factory floor.

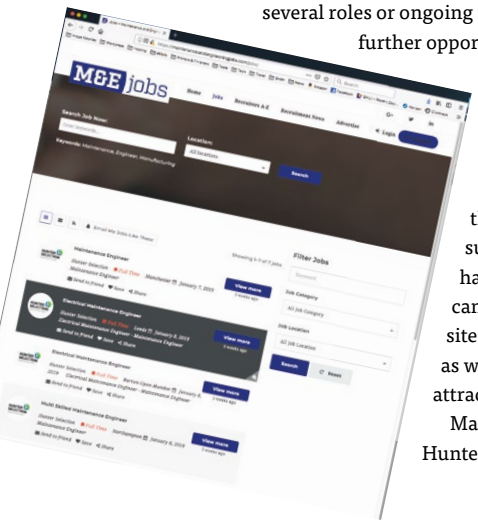
The full report can be downloaded at www.ssginsight.com/resources/harnessing-technology-and-insight/

M&E launches dedicated jobs website

M&E Jobs, *Maintenance & Engineering*'s dedicated online recruitment platform for professionals in the manufacturing and engineering industries has gone live.

The site – *www.maintenanceandengineeringjobs.com* – provides a platform for active job seekers to find relevant and current vacancies, and offers recruiters a unique opportunity to raise their profile among a highly relevant and skilled audience, drawing on *M&E*'s database of almost 11,000 industry professionals.

M&E Jobs has a variety of options available to help support recruitment campaigns of all sizes, whether it is just one role, several roles or ongoing recruiting throughout the year, as well as further opportunities for those companies wishing to position themselves as key employers and destination choices to attract talent from their market.



For employers recruiting regularly or undertaking a large recruitment drive, the new site offers a "Jobs Unlimited" subscription service, where employers have full control of their recruitment campaigns and can post as many jobs on the site as they wish, whenever they are needed, as well as receiving other benefits to help attract candidates.

Maintenance is one of recruitment agency Hunter Selection's specialist areas, and director Simon Kinson said: "There's an overall shortage of maintenance candidates in the market, and a high level of demand." The shortage was due to the long-recognised skills gap and the fact that the economy is close to full employment, he said. "If you have the qualifications and want to work in maintenance you'll get a lot of calls once you put up your CV. You can pick and choose your job."

As well as mainstream maintenance engineer posts, he said "there's also heavy demand from clients for people with a higher level of skills and understanding in disciplines like electrical installation or automation for project work, such as putting in new equipment."

He added: "One reason we were attracted to M&E Jobs is because it provides a unique pool of candidates we can tap into."

Maintenance & Engineering commercial director Fawad Minhas said: "M&E Jobs provides recruiters with a unique opportunity to target *M&E*'s specialised audience of maintenance and engineering professionals and for jobseekers to have a dedicated place they can source and find relevant roles quickly and easily. The launch of the M&E Jobs website reflects our commitment to the continued development of the trusted *Maintenance & Engineering* magazine brand to further support and service the markets it operates in."

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Companies slow to seize Industry 4.0 opportunities

David Fowler reports on a Roundtable discussion held as part of the inaugural meeting of the M&E Editorial Advisory Board.

UK firms are often adopting Industry 4.0 techniques in a piecemeal fashion, without necessarily having clear objectives, and many barriers remain to their take-up including poor recording, management and use of data.

That was the verdict of *Maintenance & Engineering*'s Editorial Advisory Board in a Roundtable discussion on digitalisation.

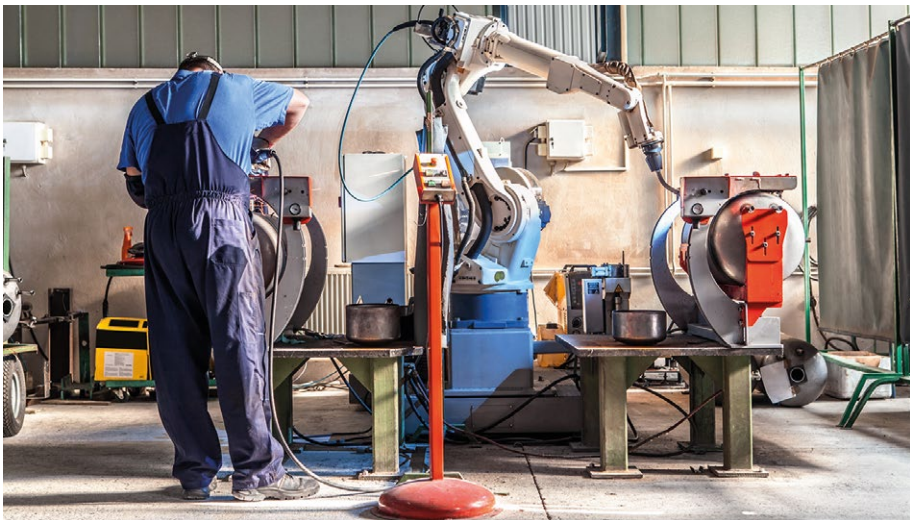
The group, consisting of academics and consultants at the front end of developments, debated the likely trends in the adoption of digital techniques in the short term and how effectively the process was being undertaken.

Included under the heading of Industry 4.0 technology were the internet of things, digital analytics, augmented and virtual reality, the use of cobots, and artificial intelligence.

"These techniques are becoming buzzwords, but the big question is are they being adopted?" asked Dr John Ahmet Erkoyuncu, deputy director of the Through-Life Engineering Services Centre at Cranfield University, chairing the Roundtable. The meeting considered the maturity of the UK approach, whether the techniques were being used effectively, the barriers to their uptake, and the question of whether government initiatives such as Made Smarter could help.

Industry 4.0 Adoption

There was a general perception that in predictive analytics and condition monitoring, data was badly recorded and badly stored, data governance was poor, and in many cases nothing was done with the data. Getting the data into the right shape and storing it correctly was a huge job. People recorded data in separate "silos".



Small and medium companies appear less willing to adopt technology such as robotics than their larger counterparts.

'The immediacy of the need to get value meant people often jumped to solutions rather than thinking them out from an integrated perspective'
Dr Peter Geake, Jacobs Consultancy

Dr Peter Geake, a senior consultant with Jacobs Consultancy, said he had chaired a conference on digitalisation of integrity management in the oil and gas industry. "What came out was a great desire to make better use of data and make more value of it, but the immediacy of the need to get value meant people often jumped to solutions rather than thinking them out from an integrated perspective. Getting them to take a more systematic or systemic view was quite a challenge," he said.

Instead, he argued that the starting point should be to ask "what decisions do you actually make, what would aid that process and therefore what information do I need?". From this the required data inputs and outputs could be established. "That whole thinking was a bit startling for that group. There's a huge educational piece there in understanding the systematic approach," he said.

Dr Erkoyuncu said that there was a big challenge in UK manufacturing relating to productivity, especially for small and medium companies. By contrast, in Germany the use of robotics, for example, had increased at a much faster rate. "The number of robots has increased

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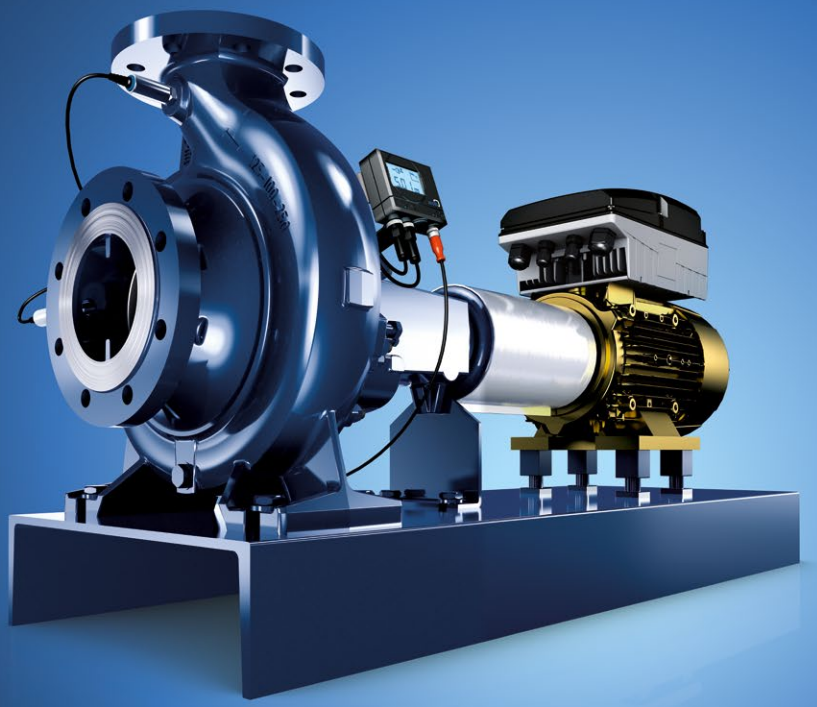

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dramatically in Germany – the number of robots per person is much higher."

MCP Consulting Group head of business development and training John Saysell said that the take-up of robots varied greatly depending on the industry sector. They were used extensively in the pharmaceutical industry, and the automotive industry was very advanced in using robots for tasks such as welding.

There was a general acceptance that robots were being used widely for packing in sectors such as food manufacturing. "Robots on the end of the line are replacing low-skilled labour," said Dr Atai Winkler, principal consultant of PAM Analytics. It was felt that the UK relied too much on cheaper labour from overseas. One effect of Brexit could be to limit the supply of such workers – and as a result drive further automation. But at the same time it was necessary to invest in recruiting experts in the technology, and it was felt that there might not be the required numbers of software and robotics engineers to program and make use of the robots.

'The take-up of robots varies greatly depending on the industry sector'
John Saysell, MCP Consulting Group

Regarding cobots, it was felt that in maintenance, as opposed to on manufacturing lines, their application could be more challenging. "In maintenance there's the need to diagnose, and the problem can be different every time," said Dr Erkoyuncu.

Barriers

Dr Erkoyuncu referred to a recent survey of small and medium companies in the UK, which had uncovered a reluctance to adopt new technology. "This may be the biggest barrier to Industry 4.0 and digitalisation," he said. "These firms won't bring in a new technology that they feel is not proven."

Technology such as augmented reality and artificial intelligence are not necessarily proven, he continued. "In many ways they need to be developed for a specific purpose for a specific company's needs. They're not off the shelf, where you can just pick it up and use it."

Dr Geake added: "The only times I've seen an organisation do that [adopt an unproven technology] has been when the organisation is in a distressed state and it has no alternative but to take a leap of faith."

Other barriers were considered to be cybersecurity, which was felt to be an increasing challenge.

Cybersecurity continues to be seen as a barrier to adopting Industry 4.0 technology.

Another was identifying a return on investment to convince senior management to invest in the technology. Mr Saysell said: "From a maintenance perspective, the approach we use is to do a criticality study first, so we identify a critical asset, make sure you focus on it and then make sure you analyse the data."

"It's a huge task to persuade people," said Dr Winkler. "When we give presentations we've adopted the approach of giving a very technical presentation to the relevant technical people. The very technical people are the ones who get it best. For the non-technical people, they don't get where are you coming from and what are you trying to do. The more technical people understand their problem, they might know what the solution is, but they don't have a solution at hand and then know how to implement it."

Dr Erkoyuncu felt there was a different approach between large and small companies. "For large companies it's built into their systematic annual review, and they have a budget allocated for R&D... they have a kind of structure which is continuously exploring improvement. But with the SMEs I don't get that feeling. With techniques such as lean manufacturing, the kind of things where you can train people, that seems to be more feasible for them to adopt than picking up a new augmented reality device. Skills seem to be easier to handle than bringing in technology."

Mr Saysell pointed out that there was often a mismatch in resources – typically a company might buy a new machine for £4m but only allow £4,000 for training in its operation and maintenance.

Data

There was a general feeling that the collection and use of data left much to be desired. Dr Erkoyuncu said digitalisation required asking which data do we need to collect and why do we need it, but he felt these questions were not being asked enough and instead companies were trying to collect everything.

Dr Geake said: "I agree that harvesting data to describe everything without really understanding if you need to or not is bad enough, but then if you put it into a rigid data system which you can't manipulate easily or remap easily, you can really waste very significant sums of money."

'In many ways augmented reality and artificial intelligence need to be developed for a specific company's needs. They're not off the shelf'
Dr John Erkoyuncu, Cranfield University

It was difficult to get companies to understand the benefits of a flexible database in which everything was time -stamped and mapped so that it could be manipulated. "Even if you can't make up your mind what data you want, at least put it in something where you can manipulate it, and then if you've got it wrong you can put it right."

Most data is still collected and input manually, by hand, even in large high-tech firms. "How do you engage the person who enters the data?" asked Dr Geake. "How do they benefit from entering the data? If they don't benefit in some way they don't pay attention and they don't want to do it. How do you catalyse that interest?"

Dr Winkler said that usually the person collecting the data was a very small cog in a big organisation. They would be likely to regard many parts of their job as having no purpose or being just form-filling and would probably see collecting data in the same way. They might have no idea where the data went or what it was used for.

Dr Geake felt it was vital for a company to employ a data scientist. And based on the principle that the board of directors should manage risks enterprise-wide, he said: "The board should manage data enterprise-wide. Data management should be reported to the board so they've got the data under control for the company."

Data management should be overseen at board level because of its importance, members argued.

Automation, skills and employment

Dr Erkoyuncu said: "A big perception and resultant worry is that when you bring robots in, employment's going to go down."

He felt that evaluating the impact of technology from a socio-technical perspective was an area that was not receiving enough attention. He had recently given a presentation in a defence setting about how augmented reality could improve productivity and efficiency. "At the end of the presentation a few people came up to me and said, 'Your technology's going to reduce employment'."

Dr Geake felt that in many cases it would be possible to redeploy people. Many departments were actually under-resourced, and increased automation might allow them to do things they should have been doing but were neglected because of a lack of time.

'Technology has always increased the range and breadth of work, not decreased it'
Dr Atai Winkler, PAM Analytics

Dr Winkler argued that "Technology has always increased the range and breadth of work, not decreased it."

Dr Erkoyuncu said Nissan expected to have autonomous vehicles on the market by 2021, and they would depend on AI. "The numbers are probably debatable but AI is coming into use already. I wouldn't be surprised if it has a big impact in maintenance soon."

Autonomous vehicles, such as the Nissan IMx Kuro concept car, will depend on artificial intelligence and could be on the market by 2021.

Government initiatives

The board considered whether government/industry projects such as the Made Smarter initiative could help overcome some of the barriers and increase uptake of new technology?

Dr Geake had been involved in two initiatives managed by the DTI and Eureka in the field of asset management. "I think technically they both produced brilliant things but the adoption was poor," he said.

Dr Erkoyuncu said: "The UK is one of the world leaders in research, but in taking that research, adopting it and implementing it, its record is not great." He was aware of examples of research done in the UK being picked up and implemented by other countries.

The general feeling was that the long-term benefits derived from such initiatives was not at the level it should be. Dr Geake thought this might be another manifestation of the UK attitude of being hesitant about anything new and original. "It's a terrible pity but there we are," he said.

A wider spectrum

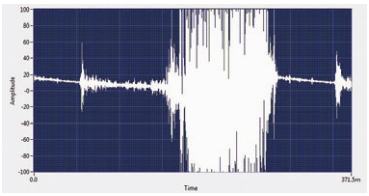
Developments in instruments and software mean that ultrasound analysis can play a key role in detecting and diagnosing mechanical and electrical failures. **Chris Hallum**, UE Systems regional manager for the UK & Ireland, explains.

Ultrasound is no longer limited to leak detection. Advances in instrumentation and software have given users the ability to accurately diagnose electrical conditions such as corona, tracking, and arcing. In mechanical inspections bearing faults, pump cavitation, and valve problems can be pinpointed. In both cases, the ultrasound naturally emitted by the mechanical or electrical process is detected, analysed, and translated into an audible sound signature that the user can listen to as part of the process of diagnosis.

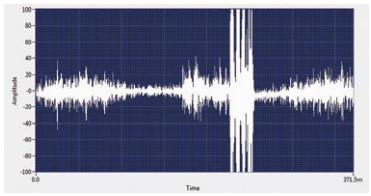
Mechanical inspection

Reciprocating compressor valves are very noisy and produce a lot of extraneous vibration. Because ultrasound is highly directional, it is possible to differentiate between sound emitted by different sources and isolate the one that is relevant to the object being inspected. This means it is possible to listen to and view the sounds of such noisy valves in real time, and to determine when a valve is leaking.

How would you imagine the sound of a "good" compressor valve? As it opens and closes, there will be a definite pronounced clicking. What about a bad valve? Below are two examples of recorded ultrasound signatures of reciprocating compressor valves, viewed in the time series in spectrum analysis software.



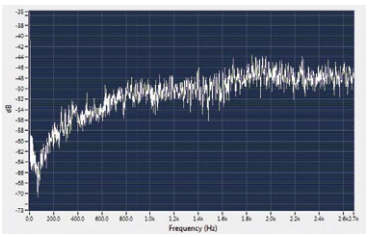
Bad compressor valve



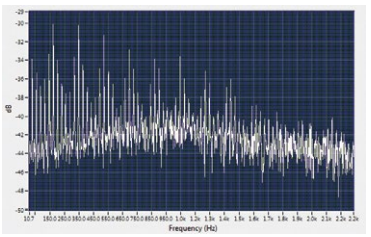
Good compressor valve

The good valve shows the valve open for a very distinct and short time, after which it closes quickly. The faulty valve is open for a much longer time.

Below is another example, comparing two motor and pump combinations from a group of eight. The pump motors were 60hp items.



Pump 3 MTR OB (Good)

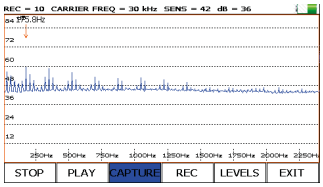


Pump 4 MTR OB (Bad)

Both decibel readings and sound files were recorded. The screen shots above show a comparison between the readings for pumps 3 and 4.

Notice the difference between the two. Both motors are operating under the same conditions, but the Pump 4 observation has a very different spectrum from Pump 4. If you were listening through the headset of the ultrasound instrument, you would hear a distinctly different sound.

Another image captured from Pump 4 by the ultrasound instrument is shown below. Notice that distinct 175.8Hz harmonics are detected.



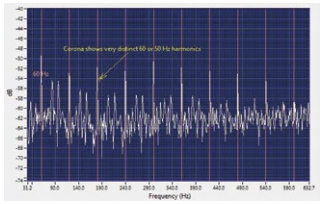
Pump 4 MTR OB from ultrasound instrument

The spectrum analysis software used has a built-in bearing fault frequency calculator. If the user enters the speed (in rpm) and the number of ball bearings, the software will calculate inner and outer race ball pass frequencies, and cage frequency. For this motor, the speed was 1750rpm and the number of bearings was 10. The software calculated the expected inner race fault frequency would be 175Hz – the same fault harmonic detected on the ultrasound instrument.

Electrical inspection

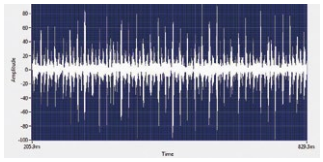
The application in which ultrasound use has increased the most in the last few years is electrical inspection. Ultrasound can be used to listen for electrical conditions such as corona, tracking, and arcing. Each anomaly has a distinct sound, and can easily be identified and confirmed through the use of ultrasound imaging.

Corona, the ionisation of air surrounding an electrical connection above 1000V, is heard via the ultrasound instrument as a steady, uniform, static sound. Looking at the recorded ultrasound of corona in spectrum analysis software, very distinct and evenly spaced peaks or harmonics can be seen.



Corona (Fast Fourier Transform)

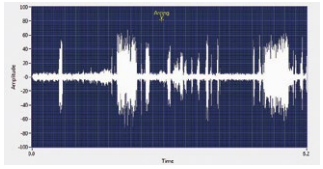
The harmonics appear every 50Hz, or 60Hz in the US, the same as the supply frequency. You can also see frequency content, peaks within the peaks, between the harmonics. Being able to detect corona with ultrasound is particularly helpful because the phenomenon typically does not produce sufficient heat to be detected by infrared..



Tracking (Time series view)

In electrical inspection, the well-defined 50Hz or 60Hz harmonics will diminish as the condition becomes more severe. The example below is from a recorded sound file of tracking (in which conductive tracks are formed by carbonised dust, which can lead to a short circuit). Typically, it has a more distinct continuous frying and popping sound. Also notice the greater amplitude, indicating a more intense sound compared with corona.

The loss of uniform harmonics is even more evident in the analysis of arcing. Here, the electrical discharge becomes more erratic and has sudden starts and stops.



Arcing (Time series view)

In summary, airborne and structure-borne ultrasound instruments have become a perfect complement to infrared and vibration analysis tools, and many engineers would consider ultrasound a must-have technology for any maintenance and reliability programme.

chrish@uesystems.com

Revamped centres broaden services

Condition monitoring evolved as an add-on to the company's repair activities

Condition monitoring forms part of a comprehensive offering from Brammer Buck & Hickman's engineering service centre network. By **David Fowler**

Industrial supplies specialist Brammer Buck & Hickman has added condition monitoring to the range of services it offers. The new service forms part of an expanded portfolio being provided through the company's chain of engineering service centres.

Three centres, at Leeds, Glasgow and the flagship Wolverhampton site, were officially launched in November. A centre at Maidstone is to be formally inaugurated in March, and a fifth in Cardiff, to cover south Wales and south-west England, is planned.

The Wolverhampton centre is also home to the company's new Product Proving Centre, where state of the art CNC machines are available to allow Brammer engineers to advise and assist customers in optimising manufacture of precision components (see box).

Brammer Buck & Hickman began offering condition monitoring as an optional add-on with its industrial equipment repair business. In a partnership with specialist Vibrotech, built up over the last year, it now offers a more sophisticated range of services including vibration monitoring, ultrasonic testing, thermography and oil analysis. In addition the company can undertake air leak audits, and laser shaft and coupling alignment.

Brammer began repairing industrial gearboxes at sites in Leeds and Birmingham (later moving to Wolverhampton) during the 1980s. It later diversified into pump and compressor repair and elastic motor rewinds. Then following customer demand it added removal and replacement of the equipment to be repaired, re-commissioning and checking alignment and belts.

Brammer Buck & Hickman head of engineering Andy Batey says with the advent of lean manufacturing, companies no longer have the staff to undertake such work themselves.

He says: "Skills are being lost to the industry. From repairs to condition based monitoring, we're replacing that with a full solution here."

Explaining how the condition monitoring service arose, he adds: "Once we've repaired something, we monitor it here and produce a report for the customer to say that on the test bed, this is what we found." The item is then monitored again when reinstalled, to check its performance is the same. "We would then offer to come back in a year to check whether it was still OK, and this could be extended annually."

The partnership with Vibrotech allows a more comprehensive service to be offered. Vibrotech director Antony Barnes says: "We support Brammer Buck & Hickman to give a complete package. We're very good at finding the problem. They are very good at fixing it."

For example, in vibration analysis Brammer Buck & Hickman would carry out a detailed frequency analysis, recording frequency responses and amplitudes, enabling it to pinpoint a problem to a precise location, such as being in the inner or outer race of a bearing.

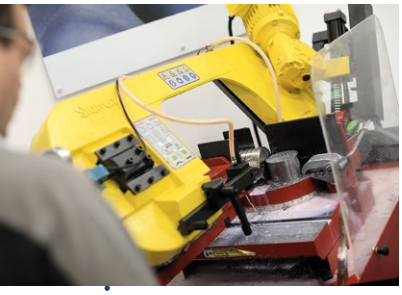
Mr Batey says: "Rather than data going into the cloud, we're more hands-on. Our staff explain their report to the customer, and point out if the data suggests a machine is likely to fail." With the cost in lost production of failure of a critical component such as a drive potentially running into millions of pounds, customers welcome such advice coming from an experienced engineer, he continues.

"If we find a problem we always propose a solution," he adds. "If we find £1,000 worth of air leaks, we will also propose £200 worth of fittings to solve the problem."

Typically, a Brammer Buck & Hickman engineer will visit a customer's plant to undertake monitoring, and will return to discuss the results. "Customers prefer to see the same engineer every time," said Mr Batey. "In that way we build up a relationship."

Customers can tap into the knowledge and experience of The company's experts in these and other areas, including advice on minimising repair downtime and on process and efficiency improvements, through the company's network of 49 branches nationwide.

www.brammer.co.uk



Product Proving Centre

Another innovation at the Wolverhampton site is the Product Proving Centre. Equipped with a range of CNC machines from Haas, and an Autodesk CAD package, the centre will be able to investigate the production of precision components. The intention is to assist and advise customers in finding better and more efficient ways of manufacturing components, away from the pressure of the shop floor. Simon Pearson, Brammer Buck & Hickman category manager for machining, says: "This centre gives us the capability to bring a component back here and re-engineer it."

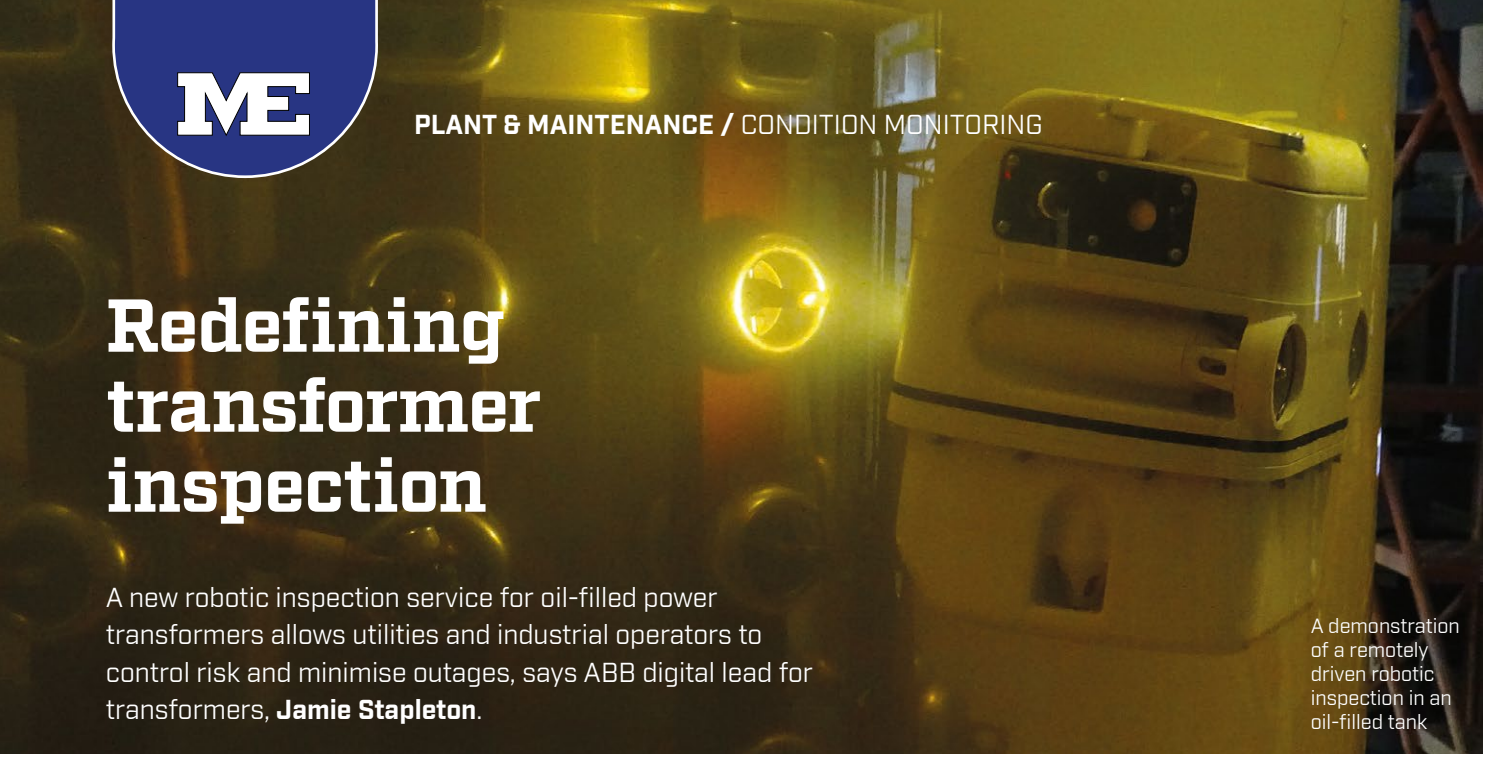
Typically the customer would be expected to supply a CAD file and the material from which it is made. Brammer Buck & Hickman would seek not just to demonstrate the optimum cutting and machining paths but also advise on workholding and the best cutting fluid to use.

If the company's proposals are approved its application engineers would go to the site to set up the customer's machine tools and train the operators If necessary.

The service is free, with the aim of strengthening relationships with customers and the incentive, said Mr Pearson, that "we would have the opportunity to supply equipment and consumables if we demonstrate value".

Redefining transformer inspection

A new robotic inspection service for oil-filled power transformers allows utilities and industrial operators to control risk and minimise outages, says ABB digital lead for transformers, **Jamie Stapleton**.



A demonstration of a remotely driven robotic inspection in an oil-filled tank

It's now possible to retrofit sensors for non-invasive condition monitoring of oil-filled transformers – but it's still essential to carry out periodic visual inspections. These enable operators to identify the exact location or severity of a fault or check an asset's condition after a lightning strike.

However, a traditional visual inspection can require taking a transformer out of service for three or more days. The process involves disconnecting the transformer before draining it down and storing its insulating oil. After it has cooled, a technician climbs into the interior to inspect and photograph it. The support of a confined space entry team and an oil handling team is needed.

A TXplore pilot uses a gaming-style controller to navigate the robot inside a transformer

The robotic approach

Recognising that operators want to maximise availability and minimise risk, ABB developed the TXplore robotic inspection service. This uses an autonomous "swimming" robot controlled by an electronic-game-type handset via a wireless link. It enables technicians to carry out a full inspection without draining the oil or exposing anyone to risks inside the oily and fragile interior.

As a result, it's possible to return a transformer to service within a day. The service also reduces the risk of damaging the transformer, and the risk to the environment of mishaps during oil handling.

The robot is designed to capture clear images and video and transmit them live over a wireless link so that they can be shared, almost in real time, with experts anywhere in the world. Utility engineers and transformer experts can observe the transformer's condition remotely and request additional images and photos for a closer look at components such as bushings, leads, tap changer, core top, core support and insulation.

Compact size

Measuring only 18 x 20 x 24cm, the robot can get close to components and access hard-to-reach areas. A smooth casing and wireless connectivity reduce the risk of snagging on internal components. Multiple on-board cameras capture images from different angles.

The robot takes account of the fact that manufacturers have used many different types and formulations of oil over the years. Its buoyancy can be configured for mineral oil, or ester-based or silicone fluids. In addition, although transformer oil often becomes darker over time, testing has shown that the robot's bright LED lights can pierce through even the darkest oils.

The service can be used in transformers that may contain PCBs (polychlorinated biphenyls), a toxic product that was discontinued in 1987. If pre-testing of the oil identifies the presence of PCBs, ABB will make arrangements for licensed disposal of the materials used to clean the robot – and ABB will clean the robot scrupulously after every inspection.

The only limiting factor is that there must be an opening on the top of the transformer large enough for inserting the robot.

Oil integrity

It is essential to preserve the integrity of transformers and their insulating oil. For this reason, ABB's multidisciplinary team carried out extensive validation of the robot and its subsystems. For example, prototypes were tested for leakage for more than 96 hours under various temperature and pressure conditions. In addition, spatial and depth navigation were tested thoroughly, as was stability, to guarantee the quality of images. Stroboscopic testing showed that no gas bubbles form on the propellers.

The prototype was even tested in heavily contaminated oil from a field transformer before being cleaned and placed in fresh oil, showing that that fresh oil is unaffected if the correct cleaning procedures are followed.

A North American utility was the first to use the service in summer 2017 on a 50-year-old transformer, showing that a full inspection can be carried out with oil in place. Since then, ABB launched the service globally at the Hanover Fail in 2018 and has a fleet of TXplore robots globally, with one available to operators in the UK.

For more information, contact Johnny Sanchez,
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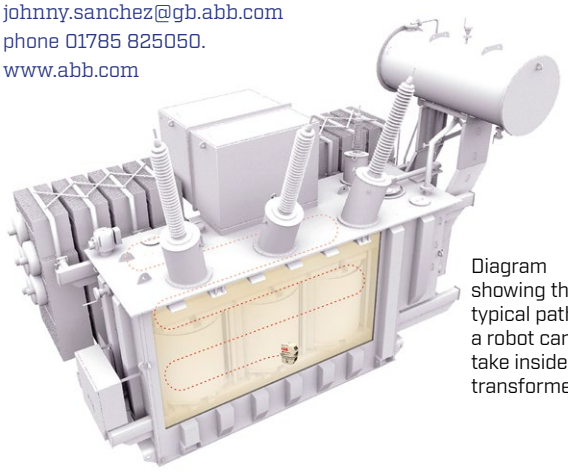


Diagram showing the typical path a robot can take inside a transformer

Feel the heat

Every organisation that uses pumps seeks to maintain their performance and optimise efficiency. Corroserve pump manager Simon Cappleman explains why thermodynamic pump monitoring is accepted as providing the most accurate measurement of pump performance.

The thermodynamic method of monitoring pumps is based on the first law of thermodynamics. That is, the increase in the internal energy of a thermodynamic system is equal to the amount of heat energy added to the system, minus the work done by the system on its surroundings., In basic terms, the energy losses in the pumping process result in a temperature rise in the fluid.

On site live thermodynamic pump monitoring showing probes inserted into tapping points on pipeline.

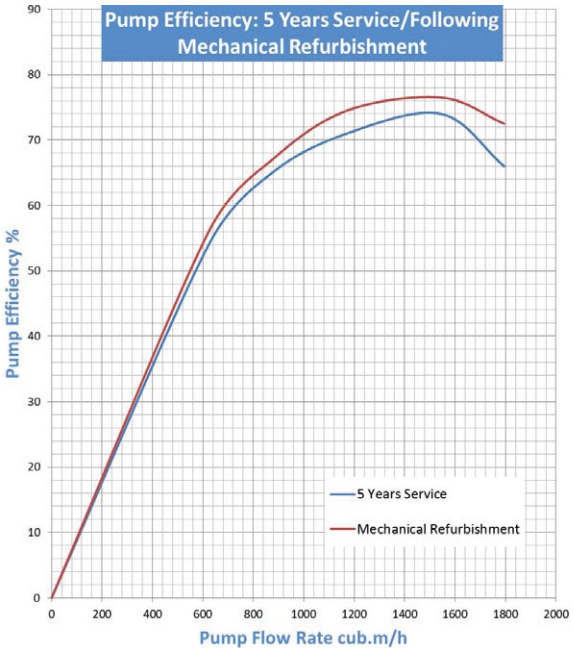
The concept of the centrifugal pump is based on Bernoulli's principle that there are three forms of energy in a fluid system – potential, kinetic and pressure. Kinetic energy and potential energy are the thermodynamic properties of the fluid system and the two energy quantities of heat and work are required to account for real world conditions.

The thermodynamic method for pump testing requires the following data: temperature of the pumped fluid at pump suction and pump discharge; suction and discharge pressure; motor input power and motor efficiency. To measure the energy losses dissipated as heat, corrections are applied for the specific heat and density of the pumped fluid.

To use the technique in practice, Corroserve's test engineers use the client's monitoring system to take readings from a fully open discharge valve until any fluctuations in temperature have settled out. The engineer will then continue to take readings for a predetermined amount of time at set points of the discharge valve until the valve is fully closed. This allows the pump curve to be mapped from the fully open to fully closed position of the discharge valve. The pump curve is then compared with the original test curve of the pump, when any losses in performance or increase in absorbed power will signify signs of wear.

As running clearances open up between the wearing parts of the pump, the leak paths for the pumped fluid increase, resulting in lost efficiency. A thermodynamic monitoring system detects and records these losses more accurately than other test method. During the test a filter can be adjusted to take readings from every 2 seconds up to every 3.3 minutes. This allows the system to achieve a steady reading of ΔT (temperature differential). ISO standards recommend a fluctuation of ΔT less than or equal to 5mK/min.

Corroserve uses the latest thermodynamic pump monitoring equipment to monitor the performance of any Class C industrial centrifugal pump over its working life. The degree of accuracy of the test for centrifugal pumps is to ISO 5198 part III (formerly ISO 2548).



Comparison of pump efficiency against flow before and after refurbishment of a five-year-old pump

The mathematical basis of the software only allows centrifugal pumps to be tested by this method.

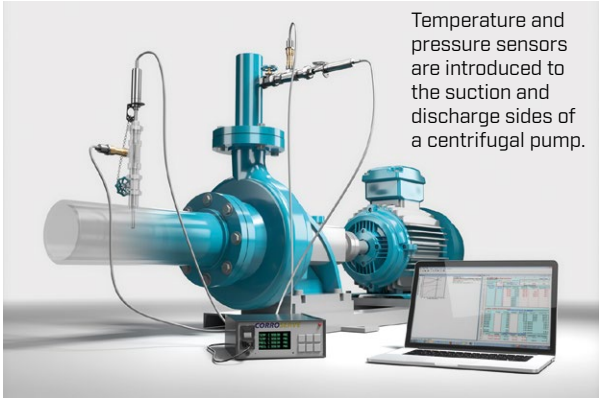
The monitoring equipment measures pressure, temperature and power input. This information is used to calculate flow, which eliminates the need for a flow meter. As a result, tests can be carried out on equipment with only short lengths of straight pipe – two diameters – at the suction and discharge. Conventional testing methods require a length of straight pipe equal to at least five diameters.

A TPM data sheet is provided to the pump user: this can be compared against the original manufacturer's test results when the pump was new. A report is issued showing what efficiency gains could be expected following manipulation of the impeller and after the application of an energy-saving protective coating, Fluiglide.

A vibration test and sound readings are also taken to check for rotor imbalance, bearing wear and cavitation. The user can then make informed decisions about refurbishment and the optimum time for any work to be carried out. The financial investment in testing will be quickly recovered in savings made by reduced energy costs from running a more efficient pump.

Corroserve's dedicated pump division provides a comprehensive service covering refurbishment, re-manufacture, modification, coating and improved efficiency to many types of pump.

simonc@corroserve.com | *www.corroserve.com*



Temperature and pressure sensors are introduced to the suction and discharge sides of a centrifugal pump.

Principles that endure

Does reliability centred maintenace still have a role in the age of the internet of things? **Sandy Dunn**, managing director of consultant Assetivity, believes its underlying principles continue to make it relevant

When reliability centred maintenance (RCM) first came on the scene, it started a major shift in the way that people thought about preventive maintenance and the way that they went about developing preventive maintenance programmes. With its roots in the aviation industry of the 1960s, it may be tempting to think that RCM has "had its day", and is no longer relevant in the age of the industrial internet of things (IIoT) and predictive analytics.

However, RCM contains some underlying concepts and lessons that remain just as relevant today as they always have, and RCM itself is continuing to evolve to meet the challenges of the digital age.

Three fundamental principles

While there are a number of "standards" for RCM – with differing levels of prescription regarding the decision-making process for preventive maintenance task selection – all these standards and processes have, at their heart, three key principles that I believe are universal and will prove to be timeless, regardless of the advent of newer technologies.

Principle one – We don't do maintenance for maintenance's sake. We do it to avoid the consequences of failure.

The purpose of preventive maintenance is not to avoid equipment failures. Instead, It is undertaken in order to avoid the consequences of those failures. This wide-reaching principle leads us to understand:

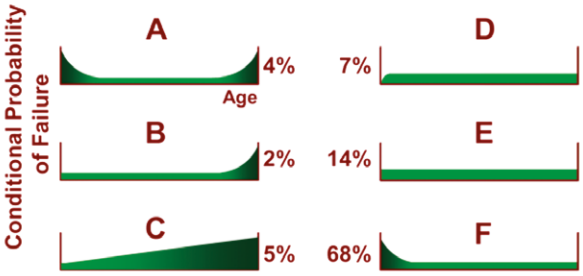
- That it is quite possible (and may be optimal) to have different preventive maintenance tasks for identical equipment operating in different areas of a given plant, depending on their operating context and consequences of failure
- The value of condition-based maintenance. Predicting when something is about to fail does not prevent the failure – but it does allow you to avoid or mitigate the consequences of that failure (normally by conducting a corrective maintenance activity before the item fails in-service).

Principle Two – To be effective, the preventive maintenance programme must be aimed at addressing failure modes – the causes of equipment failure.

It is necessary to understand the underlying causes of failure in order to make sure that a preventive maintenance programme is effective. Once again, identical equipment operating in different conditions may have different causes of failure.

Principle Three - Most items don't wear out

The work performed by Nowlan and Heap when developing RCM indicated that most items do not wear out. They found that there were six failure patterns, and the proportion of components that they studied that complied with each failure pattern is illustrated below.



The results of the study generated a paradigm shift in the way engineers think about equipment failure. If items do not wear out, we cannot prevent failure by replacing them at a set point.

Indeed, in the majority of cases (failure pattern F), fixed time replacement makes things worse. So it is necessary to understand the underlying failure pattern that is associated with the cause of failure in order to identify the most appropriate preventive maintenance action.

RCM, IIoT and predictive analytics

The three principles outlined above are, I believe, timeless and universal. However, some other elements of RCM and its application will need to evolve in the context of IIoT and predictive analytics algorithms.

First, while RCM has always embraced the analysis of available reliability data in its decision-making process, it does not require this data. One of its strengths is that sensible decisions can often be made in the absence of extensive data.

However, the advent of IIoT means that much more (and better quality) data will become increasingly available to RCM analysts and teams for their use. In my experience, few RCM practitioners effectively use this data as an input into the decision-making process, and the quality of decisions suffers as a result. Many RCM practitioners will need to become much more familiar with the mathematical and statistical aspects of reliability analysis than they currently are.

Second, as mentioned earlier, RCM has led to a much greater focus on condition-based (or predictive) maintenance as a strategy for avoiding the consequences of equipment failure. In a traditional RCM approach, failure modes are assessed one at a time; for each failure mode, if a condition-monitoring task is feasible, a single "condition" is identified to be monitored – for example, vibration, noise, oil condition, and so on. However, with the advent of IIoT and predictive analytics algorithms, a number of conditions can be monitored simultaneously, and various combinations of these conditions could be the trigger that instigates a corrective action.

At present, traditional RCM decision diagrams do not explicitly consider the use of continuous asset health monitoring, how to determine the alarm points resulting from multi-variate regression models or those based on machine learning, or how to determine the required response times for any ensuing corrective action being initiated in response to an alarm generated by one of these models. RCM decision processes will need to evolve to incorporate and embrace this new reality.

Conclusion

In my view, RCM, and the three core principles embedded in it, remain vitally important for determining the optimum preventive maintenance programme for a given item of equipment in its present operating context – especially when dealing with simpler, non-heavily instrumented equipment.

As regards its application to equipment fitted with real-time equipment health monitoring sensors – particularly if the data from these sensors is used to power sophisticated predictive analytics models – it has some conceptual application, but in practice may need further extension and development to deal with these emerging technologies.

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Join the digital manufacturing revolution

A combined high-level conference and trade exhibition, the Industry 4.0 Summit **(to be held on 10-11 April in Manchester)** aims to educate manufacturers in developing their own industry 4.0 strategy, as well as providing a great platform to see the latest technologies and demonstrations, seek advice and finance from government, meet industry associations, and to network with over 2,000 attendees from 40 countries.

The summit has managed to attract a stellar line-up of speakers since its launch in 2017 from industry, government and academia. The latest speaker line-up includes EEF, Siemens, Made Smarter North West, Millers Oils, BAE Systems, Mondelēz International, EDF, Capula, and Ford, to name a few.

Since industry 4.0 has an impact right across the manufacturing spectrum, the event has attracted attendees from the aerospace, food and drink, automotive, nuclear and pharmaceutical industries. A key focus for this year's event is inviting more small and medium companies to participate and to get a better understanding of industry 4.0, as well as debunking some of the jargon associated with the subject. There are plenty of free-to-attend seminars for SMEs to enjoy and gain knowledge to help them start their own digital journey.

Bosch Rexroth has returned as headline sponsor for the third year in a row, a testament that the organisers hope shows that the event is able to deliver the right audience to engineering companies.

Siemens will also be attending, with a large stand and sponsorship of the Open Technology Forum area, a free-to-attend feature designed to help smaller companies get a better grasp of 4.0. Intel returns once more and will be hosting two days of free to attend internet of things workshops.

In the exhibition hall, attendees to the free Expo will be able to see a broad mixture of smart technologies from automation, robotics, AR/VR, cyber security, 3D printing, big data and other relevant areas.

The organisers have secured the support of companies across the 4.0 spectrum including automation companies such as Festo, ifm, Grundfos, Panasonic, Atlas Copco, Werma & Beckhoff.

For more details please contact Gary Gilmour on 01642 438225 or at info@industry40summit.com – or visit www.industry40summit.com

The M&E Guide to Grease

Bob Wood, technical engineer at Total Lubricants, explores the fundamentals of lubricating grease.

The word "grease" comes from the Latin word "crassus" meaning "fat", which effectively describes its consistency.

It is believed that around 500BC the ancient Egyptians were among the first to develop a real grease by combining olive oil with lime (calcium), which acted as a thickening agent.

The purpose of grease lubrication

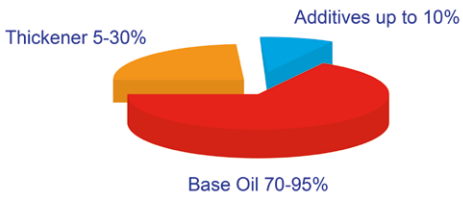
A lubricating grease is a semi-fluid to solid lubricant containing a thickening agent and additives.

There are three core principles of grease lubrication: the grease works its way into the cavities around a bearing; the thickener holds the oil in the lubricating zone; and the grease shears, delivering a slow release of oil into the path of the rolling elements.

The purpose of grease in industrial applications is to lubricate moving parts while retaining its performance properties under extreme temperatures and pressures.

Industrial applications where grease may be used include roller bearings, open gears, enclosed gears, centralised systems, wire ropes, slides and seals.

In most applications, the original manufacturer will recommend a grease or an oil for its machinery. If a bearing needs both cooling and cleaning, an oil may be recommended. However, if the location is difficult to access and cooling is not needed, a grease can be used.



Grease constituents

Grease constituents

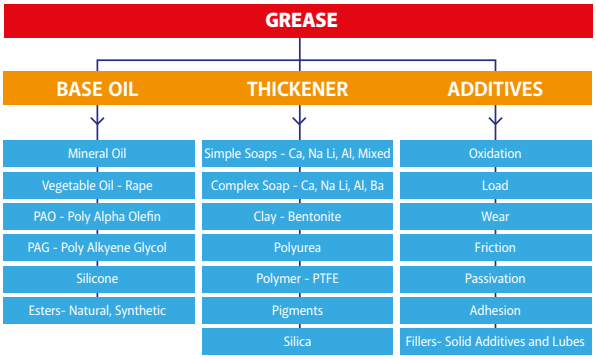
There are three constituents of a lubricating grease: a base oil, thickener and additives.

Grease is typically made of 70-95% base oil. The base oil used in most greases produced today is mineral oil, because it is cost-effective and performs well in industrial applications. Synthetic oils are used as the base oil in some lubricating greases where high temperatures are experienced, as well as in biodegradable greases.

A thickener is added to the base oil and this gives the grease its consistency. Whereas oils are classified according to their viscosity at different temperatures, greases are graded according to their consistency, measured by NLGI number, at 25°C.

The thickening agent can be soap-like and is often referred to as a sponge that holds the lubricant, which, on squeezing, releases the oil.

Thickeners include metal soaps (calcium, sodium, lithium or aluminium), complex metal soaps (calcium complex, sodium complex, lithium complex, barium complex or calcium sulphonate complex). Thickeners that may be more suited to very high temperature operations include bentonite clay, silica and polyurea.



The type of thickener that is added to the oil affects the properties of the grease – see table below.

Thickener	Dropping point	Upper Temp Range	Other
Hydrated calcium	95-100°C	60°C	Excellent water resistance
Anhydrous calcium	140°C	100°C	Excellent water resistance
Lithium	180-200°C	120(140)°C	Good water resistance Good working stability
Aluminium	120°C	150°C	Good water resistance Rarely used in Europe
Calcium complex	>250°C	140°C	Excellent water resistance Good extreme pressure and anti-wear Good pumpability
Calcium sulphonate complex	>300°C	180°C	Good corrosion protection Good extreme pressure Absorbs water
Polyurea	>260°C	180°C	Reduction of vibration Reduction in energy consumption Extended lubrication interval
Lithium complex	>250°C	150-160°C	Generally used in lubrication points experiencing higher temperatures than ordinary lithium grease
Aluminium complex	>250°C	160°C	Excellent water resistance Incompatible with other thickeners
Clay	>300°C	200°C	High temperature performance

Typical thickener properties

Finally, additives are used to improve specific performance properties. For example, antioxidants may be added to reduce oxidation, thereby extending the life of the grease. Extreme pressure (EP) additives may be added to increase load-carrying capacity.

Advantages and disadvantages

Grease has both advantages and disadvantages compared with oil. Advantages include: grease stays in place because of its consistency; it seals out dirt, functioning as a sealant to prevent leakage and keep airborne contaminants out. It offers a high temperature range; lower coefficients of friction; water resistance; and noise and vibration damping. It is resilient – it copes well with neglect.

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ROUNDTABLES

Roundtables offer you the opportunity to be the exclusive sponsor of a topical debate of high interest on a key market area at an event which brings together around eight key individuals from the sector.

M&E is looking to host a series of roundtable debates, bringing together senior figures from across the industry to discuss emerging mobility trends and issues that affect the sector and society as a whole.

Topics of interest include:

- Made Smarter – industry digitalisation
- Skills and Recruitment, the impact of automation
- Cybersecurity and Industry 4.0
- Smart Factories
- From Condition Monitoring to Predictive Maintenance
- Asset Management

If your company would like to host a roundtable and see a write-up published in a future issue of M&E, contact:

Commercial Director, Fawad Minhas 01892 553149
fawad@maintenanceandengineering.com
Business Development Manager, Colin Campbell 01892 553143
colin@maintenanceandengineering.com

Some semi-fluid greases can be used in some oil systems to avoid leakage that may happen with an oil.

Disadvantages compared with oil are that grease does not remove heat; it does not clean; it cannot be filtered; and it needs replenishing frequently.

Grease performance testing

Various laboratory tests are conducted to measure the performance of grease.

Consistency is rated by the cone penetration test, in which a cone of standard weight is placed on the surface of a level cup of worked grease at 25°C. The cone is allowed to sink into the grease under its own weight for five seconds and the depth to which it sinks is measured in tenths of a millimetre. The penetration measured is rated according to the National Lubricating Grease Institute classification scale, where 000 is very fluid at room temperature and 7 is much more solid.

Another important measure is "dropping point": this is the temperature at which the oil separates out of the soap to flow through the orifice in a small metal test cup. However, it should be noted that the dropping point is only an indication of the upper temperature limit at which the grease retains its consistency, not the maximum temperature at which the grease may be used.

NLGI number	Penetration
000	445-475
00	400-430
0	355-385
1	310-340
2	265-295
3	220-250
4	175-205
5	130-160
6	85-115
7	40-70

The NLGI scale

The performance properties of the grease, including extreme pressure resistance, can be measured using the four-ball scar and weld load tests, as well as the Timken OK Load test, which can give an indication of how the grease will perform under heavy loads. The SKF EMCOR bearing test gives a good indication of how the grease will perform in a bearing contaminated with water and sea water.

Specifying grease

It is important to select the right type of grease for a particular application, which can be done by checking the indications from the properties on the grease's data sheet.

In theory, most greases will lubricate a bearing, but the difficulty arises when the bearing is subject to harsh environmental conditions such as heavy or shock loading, slow or very high speeds, dirt, water, cold or heat. It is therefore essential to use a grease that will be able to withstand such severe conditions.

Technical guidance should be sought from a grease manufacturer or a bearing manufacturer if there is any uncertainty.

To give some examples:

For high speed bearings, particularly in fans and blowers, it would be good to use a polyurea NLGI 2 grease with a thin base oil, because this provides good lubrication but also damps vibration and reduces noise.

For general purpose lubrication, in wheel bearings for example, a lithium NLGI 2 EP grease could be used.

For high temperatures, for example in heavily-loaded bearings, a bentone molybdenum disulphide grease could be used.

Calcium sulphonate complexes are very useful where EP, anticorrosion and water washout is needed, particularly in the steel industry, for example.

Method of application

How the grease is dispensed depends on the application. A handheld grease gun may be used, where a greaser puts the correct shot of grease into a moving bearing at regular intervals.

To get to hard-to-reach areas, small grease dispensers may be used. These may be powered by battery or gas and dispense the required amount of grease at scheduled times.

Electrical grease dispensers that pulse a specific amount of grease into the bearing at a certain time are widely used in factories instead of manual greasing. Large systems can use grease tote bins that supply factories through grease dispensing units.

If a grease gun is being used, a NLGI 2 or 3 grease would be suitable, whereas a NLGI 0, 00 or 000 would be the recommendation for a centralised lubrication system.

General considerations

The amount of grease required, for example in bearings, depends on the rotational speed. In a typical medium-to-high speed bearing the grease should fill about a third of the free space. In slow-moving, heavily loaded applications, more grease will be needed.

If the bearing is overpacked, when it rotates it will centrifugally throw out the grease into the housing. If it is too full, it will generate heat which will oxidise the grease, harden it, and allow the oil to leak out.

It is more efficient to lubricate little and often, so it may prove cost-effective in the long run to invest in a higher quality grease, as this will help to extend the intervals between re-lubrication.

Maintenance staff should also seek to rationalise the number of different grades they require and keep these to a minimum. A streamlined grease inventory will create less confusion.

The NLGI grade is just the starting point in understanding a grease's consistency and this, together with other information about the grease's properties and performance, are normally found on the product's technical data sheet.

Compatibility

Care needs to be taken when mixing different types of grease. If they are incompatible, the soaps could react with each other and release the oil. If a new grease is introduced, it is essential to make sure it is compatible with the one already being used.

Finally, with the number of grease compositions available, it is important to select the right type for a specific application. The cost of grease itself is negligible compared with the cost of repairs and lost productivity if it is not suitable for the application or if it is not replenished adequately.

www.total.co.uk/businessproducts/industrial-lubricants.
01977 636303 | email: lubesorders@total.com.

Total greases

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MULTIS EP range – multipurpose extreme pressure greases, will cover most applications

MULTIS Complex EP range – for higher temperature operating systems

Speciality

Anti-seize (SPECIS CU) – an anti-seizing copper grease for threaded assembly under severe corrosion conditions and high operating temperatures

Track roller – lithium semi-fluid

Constant Velocity (CV) joint grease – lithium EP plus solid lubricant

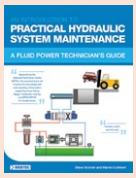
CERAN – based on calcium sulphonate complex thickener; providing outstanding resistance to water, wear, and load and mechanical stability

BOGE launches SOLIDscrew

BOGE Compressors has launched SOLIDscrew, a new generation of oil lubricated compressor aimed at automotive and light industrial operations. SOLIDscrew is priced very competitively and, yet still offering BOGE's 'Made in Germany' reliability and UK stock availability. Mark Whitmore, general manager at BOGE says, "Customers tell us that a low capital purchase price, immediate availability and reliability are the most desirable factors for this size of compressor. We've been able to meet their needs with the SOLIDscrew compressor, offering value for money but still using BOGE's proven technology and reliability." Stock of all compressors and service parts are available from BOGE's UK warehouse in Huddersfield, with next day delivery available.

t: 01908 533253 | info@4cm.co.uk
www.boge.co.uk

Webtec launches guide for engineers new to hydraulic fluid power maintenance



Webtec has launched *An Introduction to Practical Hydraulic System Maintenance*, a new guide for all fluid power technicians. Co-authored by industry experts Steve Skinner and Webtec managing director Martin Cuthbert, this invaluable tool is aimed to help educate technicians and engineers new to hydraulic fluid power maintenance and hydraulic engineers. This excellent starting guide is now available from Amazon, costing £34.99, featuring over 240 pages and 200 colour illustrations and has been endorsed by several organisations including the British Fluid Power Association, Institution of Mechanical Engineers, National Fluid Power Centre, British Valve and Actuator Association and the CEA.
www.webtec.com

Forecast of snow and ice makes salt spreading a priority

With ice and snow likely to settle over the next couple of months, Newtown-based forklift attachment company **Contact Attachments** is working with customers across the UK to ensure they are fit to operate effectively throughout winter.
The company provides a range of forklift compatible and pedestrian-operated salt spreaders and gritters. These include the 190kg capacity Forklift Towable Salt Spreader – helping those with warehouses, large sites and depots to keep them safe for staff and free from potentially hazardous ice and snow – and the 50kg capacity pedestrian-operated salt spreader which is ideal for smaller applications including car parks, driveways, walkways and access areas.
www.forklift-attachments.co.uk
sales@forklift-attachments.co.uk | 01686 247092.

Material removal can be twice as fast

Chicago Pneumatic introduces its next generation of Industrial vertical grinders, the CP33 Series with 7" & 9" and 6" Cup Wheel options, setting new high standards of operator safety and productivity. "We are excited to make the grinders available globally so metalworking professionals can benefit from this best-in-class tool that offers the highest levels of quality," says Lucas Bryk, global product marketing manager – material removal. "These tools are ideal for many applications in the Industrial/MRO sector and are equipped with powerful governed motors, 3.7 hp for CP3330 and 4.5 hp for CP3340. They can achieve a superior material removal rate and a reduction of completion times, delivering a fast return on investment."
www.cp.co.uk
www.cp.com/en-uk/tools/news-events/product-news/cp3330-cp3340-powerful-vertical-grinders-worldwide

World's fastest 640 × 512 IR camera now available through UK distributor

Camera manufacturer **FLIR** and Thermal Vision Research (TVR) are now able to supply the FLIR X6900sc, the world's fastest commercial infrared camera at a full 640 x 512 resolution, direct to the UK market. The X6900sc blends all the features of a high speed visible camera with FLIR's advanced thermal camera technology to produce an extremely fast frame rate of 1000 frames per second, at temperatures up to 3000oC, as well as superior resolution and sensitivity. Designed for scientists, researchers and engineers, suitable applications for the X6900sc range from ballistic testing to chemical interactions, car crash tests to air friction in aviation.
0333 200 4667 | www.thermalvisionresearch.co.uk

Denso™ Steelcoat™ protects Ayr pipe crossing

George Leslie Ltd recently carried out a contract for Scottish Water to remove sections of an existing coating and carry out non destructive testing on a pipebridge near Ayr. After the testing was complete these areas were protected with the **Denso** Steelcoat 100-400 System. Having examined the system applied to the test areas, Scottish Water then decided that as scaffolding was already in place they would take the opportunity to wrap the whole section of pipe, which crossed the River Ayr. Denso Steelcoat 100-400 System consists of Denso Hi-Tack Primer, Denso Profiling Mastic, Denso Hi-Tack Tape, Denso Ultraseal Tape and Denso Acrylic Topcoat. It is designed to provide long-term corrosion protection with minimal surface preparation, therefore making it ideal for use in remote areas where prevention of contamination to the surrounding environment is important.
t: 0208 670 7511 | mail@denso.net | www.denso.net

Borger pump passes acid test

At an amine recycling plant, a **Borger** rotary lobe pump has been introduced to add sulphuric acid to an important neutralising process. The new Borger pump has replaced a screw pump that had reoccurring problems with its sealing system. A sodium sulphate solution (created by the reaction between caustic soda and the sulphuric acid contained in the amine sulphate) is pumped to one of two storage tanks – with sulphuric acid mixed in on the suction side until the solution reaches a pH value of 7. With air quality control requirements of high importance, the plant specified that the Borger rotary lobe pump be set to 8 bar. If the pressure drops below 5 bar, a pressure switch turns off the system. The medium pressure is restricted to a maximum of 3 bar by a pressure transducer, which ensures a minimum barrier pressure of 2 bar above feeding pressure.

www.boerger.com/en_UK/start

Earth leakage is just one parameter

With the 18th Edition's increased emphasis on earth leakage and associated problems, electricians are being encouraged to get a dedicated clamp-meter. However, **Metrel**, the provider of innovative test solutions, thinks this is a wasted opportunity. That's why its earth leakage clamp meter, MD 9272, includes a range of power quality functions too, and for no more cost. These include energy efficiency measurements such as W (real power), VAR (reactive power), (VA) apparent power, power factor and harmonic distortion.
The Metrel earth leakage clamp meter offers true RMS readings, maximum, minimum and data hold functions and the ability to measure currents as high as 100 A.
01924 245000 | brendan.beaver@metrel.co.uk

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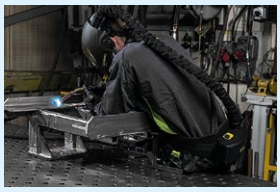
Air handling, distribution, filtration, generation, hire

Breathe easy: New ESAB PAPR provides heavy duty protection

For heavy-duty protection from fumes and particulates when welding, gouging and grinding, **ESAB Welding & Cutting Products** introduced the new ESAB PAPR (powered air purifying respirator) system at EuroBLECH 2018. Compatible with a range of helmets, the robust ESAB PAPR weighs a comfortable 1kg and features a P3 filter and pre-filter to remove particulates. The latest control technology allows the operator to adjust air flow between 170 and 220 l/min to suit the environment and application.

As an extra measure of safety, it incorporates both visual and audible alarms to alert the operator in the event of a blocked filter or low battery.



esab.com

Babcock Wanson launches UK's first BOAS Cat 5 training for coil boiler operators

Babcock Wanson has announced the launch of the first Boiler Operation Accreditation Scheme (BOAS) Cat 5 training course for coil type steam boiler operators, in conjunction with the Combustion Engineering Association (CEA). The new course will cover a range of important safety and operational issues, and can be completed at Babcock Wanson's Hertfordshire works or on the customer's site. The training is assessed through a multi-question exam produced and marked by the CEA who will issue a certificate and ID card to successful candidates, valid for five years. A one-day course is offered for steam generator operators, or a three-day course for engineers/managers.

020 8953 7111 / info@babcock-wanson.co.uk

Radar or ultrasonic? Now there's a real choice

Most non-contacting level and flow measurement applications suit ultrasonic measurement perfectly. However, in situations where the material being measured is hot, or the environment is very electrically or acoustically noisy, where very high accuracy is needed or in applications where you want to measure through a plastic tank, radar has the edge. **Pulsar** offers interchangeable radar and ultrasonic transducers that work with its standard range of controllers – you can choose the right technology without compromising control protocols. Whether you are measuring volume, monitoring flow by level or velocity, or controlling pumps, Pulsar offers the perfect answer.

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PLANT & MAINTENANCE /
ADVERTORIAL

Pattonair transforms warehouse with high output LED lighting from Goodlight

Market leading lighting supplier LED Eco Lights has announced that Pattonair, a global aerospace and defence supply chain provider, has reduced lighting energy costs by 40% by replacing the fluorescent tubes at its 3,400 m² European hub in Derby with long life, energy efficient G5 LED Battens from its Goodlight range.

The installation in April has directly resulted in a 40% reduction in kilowatt hours. Pattonair expects this figure to rise throughout the winter months, but it is spot on target with the original forecast. The G5 LED Battens have been surface mounted throughout Pattonair's low-level warehouse and suspended in the inspection and kitting areas.

Pattonair carried out a company-wide environmental review to assess the most effective way to reduce energy costs and ensure its carbon footprint was as low as possible and LED lighting came out top. Following a site survey, Goodlight LED lighting was chosen to supply and install low energy, high performance LED lamps to replace the outdated, energy hungry fluorescent tubes. Chris Snowden, HSE manager for Pattonair said: "Installation of the new lighting solution for our facility was efficient and did not interrupt operations. Service from LED Eco Lights was professional at all times."

Goodlight supplied Pattonair with G5 LED Battens which deliver very high levels of light output, offering up to 110 lumens per watt. The G5s are rated to IP65 and provide protection from dust, ice, heat and corrosion. They are a direct drop-in replacement for standard 2ft, 4ft and 5ft fluorescent tubes and are available in daylight, natural and warm white colour temperatures. Housed in a sleek body, and IP65-protected, the G5 maintains an attractive appearance for front-of-house as well as being robust and durable in work areas. The lamps come with a five-year warranty and have a lifespan of 50,000 hours.

Commenting on the success of the project, Saima Shafi, sales & marketing director at LED Eco Lights says "We are delighted to support Pattonair with their conversion to LED lighting. Our Goodlight range ticked all the boxes – efficiency, maintenance reduction, ultra-long lifespans and value for money. Another project delivered without fuss, to budget and on time."

LED Eco Lights was founded in 2006 and celebrates 11 years as an award-winning LED lighting manufacturer. Its Goodlight™ LED lamps and luminaires provide a comprehensive range of LED solutions for commercial, industrial, amenity, leisure and hospitality environments. LED Eco Lights offers a team of technical experts to guide customers through every stage of the upgrade process, including lighting design services, funding solutions and installation. LED Eco Lights also offers its Bright Goods range of vintage-style decorative LED filament bulbs.

Sophia Burr, marketing manager, LED Eco Lights, Unit 7, J4 Camberley, 15 Doman Road, Camberley, Surrey GU15 3LB, Tel: 01276 691230. Email: sophia@ledecolights.com. Web: www.goodlight.co.uk

ME

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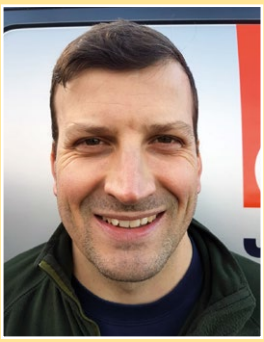
maintenance & asset management

Reducing emissions and improving boiler efficiency through modern burner technology



Pete Nicholls
Technical manager,
JBC Industrial Services

ABSTRACT

Never before has burner technology been as important as it is today. Meeting environmental regulations such as the new EU Medium Combustion Plant Directive and reducing greenhouse gases are challenging.

The demand for cleaner air means that industry needs to take a careful look at its combustion assets and plan for the future.

Any company operating a combustion plant from 1MW thermal input and up to 50MWth will fall under MCPD legislation.

Analysing emissions need not be an arduous task and, in most cases, the use of a modern burner will result in a more efficient system, achieving substantial cost savings and a short payback period.

Introduction

The Government has implemented legislation to force companies to take action on emissions. The MCPD requires anyone with a boiler generating around 1.3 ton/hr of steam or more to monitor and manage their emissions under permit. In summary, any company operating a combustion plant from 1MW thermal input and up to 50MWth will fall under Medium Combustion Plant Directive legislation (including CHP plant and diesel generators).

Typically, more efficient combustion and a reduction in emissions favour energy efficiency, resulting in substantial cost savings with payback in as little as 18 months.

The most important assets in industrial combustion are the burner and boiler combination, and with advances in technology the modern burner has many features that enables it to outperform old equipment. New technology not only supports compliance, it aids efficiency, energy loss reduction and ultimately reduces costs, allowing businesses to be more competitive overall.

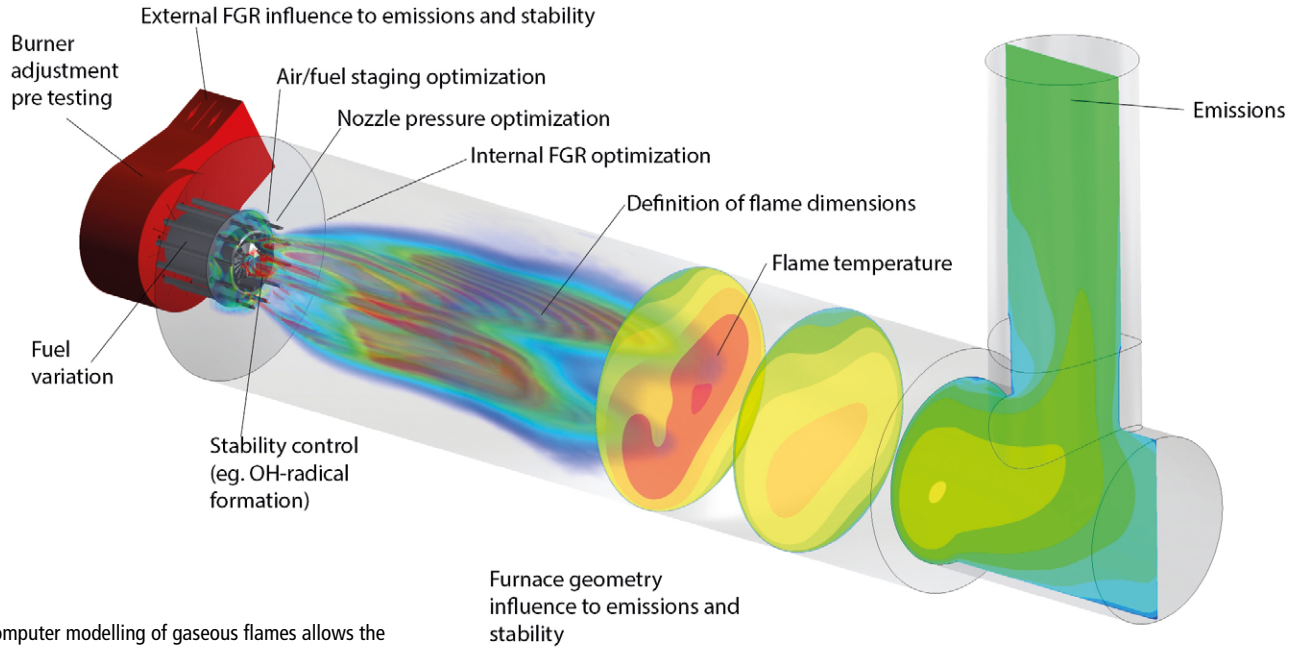
A regular burner service ensures the efficient and reliable operation of a boiler through its lifecycle.

The benefits of a modern burner

One of the main advantages of modern burners is the ability to achieve a high turndown ratio of typically 9:1 (more in some cases). Hysteresis losses associated with mechanical drive systems are eliminated. Furthermore, effective mixing of gas and air within the burner head, variable speed drives added to motors, digital combustion controls and oxygen trim systems all work together to complement each other. This combination of technology allows the burner to operate at maximum efficiency at all rates of firing with minimum flue gas emissions.

The importance of turndown

Turndown on burners is critical for a variable load. By use of turndown, the energy input can be regulated to match the energy output (or site demand) without the need for stop/start conditions. The most efficient way of running a boiler is to keep the burner firing for as long as possible, if not actually shutting down at all. This reduces the cooling effect due to purging and component wear caused by frequent start-ups, and, more importantly, allows a quick response to sudden changes



Computer modelling of gaseous flames allows the effects of energy-saving equipment to be predicted.

in load, minimising potential issues with low water level and lockout due to slow response.

It is possible to achieve up to a 10:1 turndown ratio by using an Oilon burner together with an Ecosafe digital controller (a JBC product) coupled to a variable speed drive which modulates burner fan speed, rather than opening and closing a mechanical damper and a fan motor constantly running at full speed. This returns larger savings in power consumption. The Ecosafe digital controller maps the modulation band so that it is possible to ensure that all hysteresis (present in any mechanical linkage system) is eliminated from the drive, from high to low fire, which in turn ensures the burner is firing at peak efficiency throughout the complete range.

The Medium Combustion Plant Directive

The proposal was originally published by the European Commission in December 2013 and forms part of the new Clean Air Package, introduced to help member states reduce their emissions and meet revised ceilings being negotiated under the NEC Directive. It will plug the gaps between plants covered by the European Ecodesign Directive 2009 and the Large Combustion Plant Directive, and sets emission limit values for NOx, sulphur dioxide and dust.

The requirements also include the measuring and reporting of carbon monoxide in low air quality zones. Specifications for any new plants will need to meet the criteria.

It is estimated that over 15,000 plants in the UK will be affected and will be required to comply with emissions limit values. It is anticipated that 75% of those will be between 1-5MW and regulations will affect boilers (80%), engines and gas turbines.

From 20 December 2018, all new plants must be registered and have permits from the Environment Agency, and test emissions to show compliance with the ELVs. Existing plants above 5MW have until January 2024 to register, but must comply with ELVs by January 2025.

Existing plants below 5MW must be registered and tested for emissions by January 2029 and have until January 2030 to comply. It is worth noting that if burners are replaced and potentially exceed 50% of the original asset value of a package boiler, the MCPD may define it as a new asset under the regulations.

Emissions released in combustion

The main pollutants released by a natural gas flame are carbon monoxide and oxides of nitrogen (NOx). Carbon monoxide is colourless, odourless and tasteless and can be toxic to humans and animals in concentrations above 35ppm. It is formed in flue gases due to factors such as lack of oxygen, a cooler furnace flame temperature, too short residence time inside the furnace, exaggerated air/fuel staging and insufficient mixing.

Oxides of nitrogen comprise mainly nitrogen monoxide (NO) and nitrogen dioxide (NO_2). NOx is the most strictly regulated emission in burner applications because of the serious damage it can cause to the environment. This includes acid rain, smog and ozone formation (a potent respiratory hazard near ground level).

NOx emissions are derived from three possible sources: nitrogen present in the atmospheric air used for combustion; fuel-bound nitrogen in liquid and solid fuels (but not gaseous fuels); and gaseous fuels which contain nitrogen-based compounds such as ammonia and hydrogen cyanide. In natural gas combustion, only the nitrogen in the combustion air needs to be addressed. In light oil combustion, fuel-bound nitrogen

will influence the total emission level, and in heavy oil combustion fuel-bound nitrogen will play a dominant part.

Formation of NOx emissions

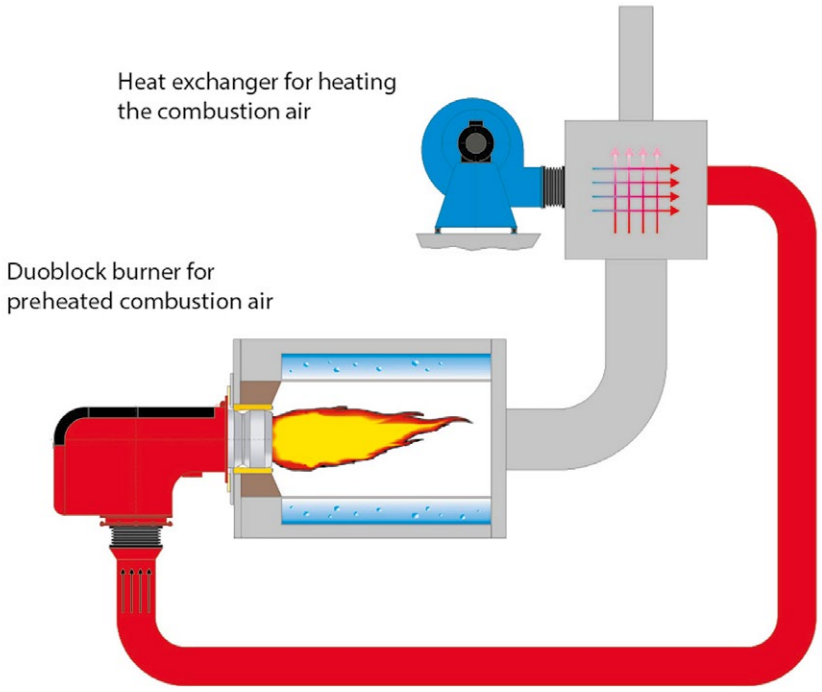
NOx is formed in two ways, thermal NO formation and prompt NO formation.

Thermal NO formation: The bounding energy of the N_2 molecule is so high that combustion air oxygen (O_2) cannot break it in normal combustion conditions.

Formation of NO happens as a result of the reaction path actuated by a single atom O-radical or, when residual O_2 is decreased, an OH- radical is operates as an oxidiser.

The amount of generated O- and OH-radicals is exponentially proportional to flame temperature, thus resulting in high temperature dependency for the whole process.

Studies show that NO formation is not significant below 1400°C, but in temperatures above 1600°C it is by many times the dominant formation mechanism.



Installing a heat exchanger to pre-heat combustion air will improve efficiency.

Prompt NO formation is a result of nitrogen reacting with hydrocarbon radicals to create hydrogen cyanide (HCN) which through further reaction paths oxidises to NO. It is only relevant in the flame reaction zone when the combustion is not yet complete and the required hydrocarbon radicals are available. In conventional burner applications, the prompt NO contribution to the total emission level is no more than 5%. In low NOx-applications, where the flame is relatively cool, the prompt NO contribution becomes more relevant and should be taken into account in the burner combustion performance design.

Reduction of CO and NOx

Complete carbon monoxide burn out could be promoted by altering the conditions that help to form it. However, CO formation conditions are often in conflict with NOx formation conditions (so reducing one will encourage formation of the other). Variables which will promote CO and NOx reduction are choosing a larger boiler or adding more residual oxygen. Unfortunately, burner manufacturers are unable to do this and there are some downsides, such as associated investment and operational costs. Instead, burner manufacturers set out to find an optimal balance between CO and NOx formation.

Optimal balance conditions depend on a variety of circumstances such as fuel and furnace properties, and with correctly designed burner adjustments the flame is able to conform to the changing furnace conditions.

Emission reduction methods – NOx

Air and fuel

Using air and fuel distribution, air and fuel staging or internal flue gas recirculation (using recirculated flue gas as a diluent to reduce flame temperature) will achieve an NOx reduction of approximately 40-60%, depending on the method.

NOx reduction by external flue gas recirculation

For this method, the required components are a combustion manager suitable for FGR applications, a flue gas damper with actuator, a temperature transmitter, a flue gas inlet adaptor, an oxygen sensor and a recirculation pipe provided by the client.

Electronic fuel/air ratio control system

Accurate burner control will result in substantial fuel savings. This method is by far the most efficient and encompasses burner control and security functions, fuel/air ratio control and fan motor variable speed drive control. Its additional functions are boiler cold start protection, boiler temperature limitation, a PID controller for capacity control and O_2 control with an O_2 module. It will allow results to be seen, as it communicates with external systems and is supplied with a fuel flow meter and combustion efficiency calculator.

O_2 control and variable speed drive

Using the electronic fuel/air ratio control system will reduce O_2 levels from 4% to 2%, which corresponds to roughly 1% higher efficiency.

To demonstrate this, a 10 ton/hr steam boiler without O_2 control or a variable speed drive, running 18 hours a day on natural gas and at a power level of 6ton/hr, would have an efficiency of 87.5% with an O_2 level of 4%. Its gas consumption would be 8,071 m³/day or 2,421,300 m³/year.

The equivalent steam boiler with O_2 control and a variable speed drive would have an efficiency of 88.5%, with gas consumption of 7,635 m³/day or 2,394,000 m³/year.

Substantial savings would also be made by the variable speed drive on the electricity consumption of the fan motor, reducing it from 89,100 kWh/year to 41,700 kWh/year.

This would equate to a combined saving of £10,200 annually.

Other ways to save energy

Installing a heat exchanger for heating the combustion air will give 4% higher efficiency when combustion air is preheated to 100°C. Also, liquids and gases which had previously been considered waste have been used as combustible fuels, with many processes having

side streams for this purpose, such as for biogases in breweries.

It is also possible to fire two gases simultaneously. For example, biogas plus LPG or natural gas will fire at a simultaneous firing capacity range of 10-100%, and the start-up of a burner can be achieved by either LPG or biogas.

Case study – food manufacturer

A new burner with digital combustion control replaced an old mechanical burner with a mechanical linkage in a food production process. Installation of energy saving equipment was part of the scope. The site required the decommissioning and stripping down of the old structure and the installation of a new Oilon burner with an Ecosafe digital combustion control system, including an O_2 trimming system giving up to 7% fuel saving. Following on from this, an economiser was installed to gain a further improvement of around 5.92%.

The reduction in gas cost at the burner, calculated on 80% overall boiler efficiency, 8,000 hours annual operation at maximum continuous rating, and a gas cost of 2.2p/kWh gives a substantial saving of £38,124.

Case study – hygiene product manufacturer

The site required the decommissioning and stripping down of the old, obsolete burner which was installed on the three-pass steam boiler rated at 20,000 kg/hr, and the installation of a new Oilon burner with Ecosafe digital combustion control.

The new Oilon dual-fuel fired burner achieved a turndown of up to 8:1 on gas, with operating NOx levels below 100mg/m^3, compared with the old system which only had a turndown of 3.5:1 on gas, and operated at high O_2 levels towards the bottom of its modulation range.

By reducing excess oxygen levels from 8% to 3.5% at low fire where the burner operates for the majority of time, fuel savings of 2% were achieved.

JBC has invested time and resources in order to advise its customers on how and if MCPD affects them and what their options are. For help, advice and updated information on MCPD contact *info@jbcmail.co.uk*, putting "MCPD Advice" as the subject header, or contact 0113 220 3830 and ask for Matthew Schofield/Pete Nicholls.

For a food manufacturer, a new burner with digital combustion control and energy saving equipment including an economiser reduced fuel use by nearly 13%

A new burner allowed a turndown of 8:1 at a hygiene product manufacturer, improving efficiency at low firing rates.

A cost-effective option

If you need extra capacity to cover maintenance, temporary peaks in demand, or for the longer term, hiring could be the solution says **Michael Rutter, Byworth Boiler HIre sales director.**

Byworth Boiler Hire was the first to offer portable boilers for hire 40 years ago. Its range of British-manufactured steam and hot water boilers is constantly in demand over a wide range of industries from food manufacturing to petrochemical plants.

Byworth provides steam and medium temperature or low temperature hot water boilers for both long term and short term hire. Short term hire can be particularly beneficial to cover annual inspections, maintenance and peak seasonal loading.

Alongside other industries, the healthcare sector has seen the benefits, and since Byworth's first major hospital contract in 2005, the company has expanded its hire provision to the healthcare sector across the country.

In healthcare, constant steam provision is vital to day to day operation. In many cases hospital sites require multiple boilers to maintain security of supply, and Byworth Boiler Hire's ability to provide modern, efficient plant has led to continued success, not just in providing cover but also in fuel savings. Over £123,000 of savings were made within 12 months of a pair of new Yorkshireman dual fuel hire boilers being supplied to provide an installed capacity of 11,000kg/h at Kettering General Hospital. A third 6000kg/h boiler is taken during the winter months.

Hire boilers are often essential during periods of major facilities works, to provide cover during the project. At a leading Liverpool hospital, the main boilerhouse had to be shut down, so a pair of Yorkshireman dual fuel boilers rated at 6000kg/h and 7000kg/h were supplied and commissioned in May 2017, with a further two 6000kg/h boilers arriving on site in July 2018 to give extra cover for the next phase of the project.

Industries that have ageing plant can use the hire approach even for long-term boiler solutions. Byworth's project management team works with the client's in-house engineers to specify and design purpose-built boiler plant rooms including

all ancillary feeds, fuel and blowdown tanks and water softening equipment. The plant rooms can be in containerised format or, increasingly, in purpose-built prefabricated boilerhouses, but both will provide a true turnkey project with minimal site work: just position, connect to services, commission and go.

Full training is available to make sure that critical operations go uninterrupted, and should there be any teething troubles Byworth's experienced team of boiler engineers throughout the UK can quickly provide full support. Remote boiler monitoring can be offered with long-term contracts, helping to maintain efficiency and performance.

As more companies choose the cost-effectiveness of hiring, Byworth's fleet of over 150 hire boilers continues to be increased, upgraded and maintained for maximum continuity and efficiency. Hiring a Byworth boiler, which combines the latest manufacturing techniques with outstanding quality control, provides an unparalleled level of reliability and service.

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Keep dust in its place

New techniques such as segregation have made controlling and preventing the spread of dust more effective, with benefits for safety and for product quality, says Dustcontrol UK managing director **James Miller.**

Extraction at source plus the use of segregated areas can eliminate dust as a problem in workplaces.

One of the biggest challenges facing the engineering industry is preventing dust migration, especially in large-scale premises where excess dust is prevalent.

Using heavy-duty machinery in such environments can create and encourage the spread of hazardous dust, which presents significant health and safety as well as product quality issues.

Airborne dusts are of particular concern in manufacturing, not only because they can greatly increase the risk of product pollution in the food, aeronautical, automotive and composite engineering industries (to name but a few), but also because they have the potential to affect the health of people working in those industries.

Being exposed to and breathing in high levels of fine dust, often invisible to the naked eye, can lead to widespread occupational lung diseases such as pneumoconiosis, while also significantly increasing the chance of developing other dust-related diseases, such as cancer, asthma, allergic alveolitis and irritation, as well as a whole range of non-respiratory illnesses. Overexposure to hazardous dust for a prolonged period can even cause permanent disabilities and death.

It is therefore essential that efficient measures are adopted for the protection of the workforce and the quality of products, while adhering to the relevant health and safety regulations.

All companies are required to adhere to the Control of Substances Hazardous to Health (COSHH) Regulations 2002, which set out workplace exposure limits (WELs). These limits are legally binding, and businesses must make sure they abide by the limits contained in the Act.

Deeper understanding

As a deeper understanding of the harmful properties of dust is gained, businesses are taking measures to control and confine areas in the workplace where excessive dust is created, and using at-source extraction techniques to minimise the release of airborne dust in the first place, with centralised vacuum systems for cleaning up.

The sectioning-off of a specific room involving dust-producing processes allows other areas of the site to work unhindered. The air in the room itself can then be cleaned more easily because of its smaller volume.

Containing the release of airborne dust in a designated area prevents its spread throughout the workplace, creating the safest possible working environment.

It is crucial, though, to manage the sectioned-off areas to ensure the complete safety of those using them, where high concentrations of dust can be created within small spaces because the dust can no longer dissipate. These areas must be managed with a combination of high-quality dust extraction solutions.

Through the innovation of attaching power tools to extraction units via hoses or nozzles, businesses can remove dust as an issue altogether by capturing it comprehensively at the point of its production. The loading on secondary air cleaners is reduced, making cleaning less onerous, and potentially reducing the prevalence of Atex-rated zones.

Background air cleaning equipment with HEPA-13 filters can then be used as a complement rather than a first line of defence. Within the sectioned-off areas simple techniques of using negative pressure (so that air can flow in but not out) can further prevent migration to other areas, helping to maintain a clean, healthy working environment.

Overall, introducing smaller, more efficiently-sized areas which are used solely for dust-producing practices, and introducing efficient dust extraction techniques, can effectively control and contain the spread of dust, while creating a safer working environment.

Dustcontrol UK has a wealth of experience in helping businesses control and prevent the spread of dust in the manufacturing, engineering, food processing, construction and demolition industries, through providing dust extraction solutions and centralised vacuum systems to fit client requirements.

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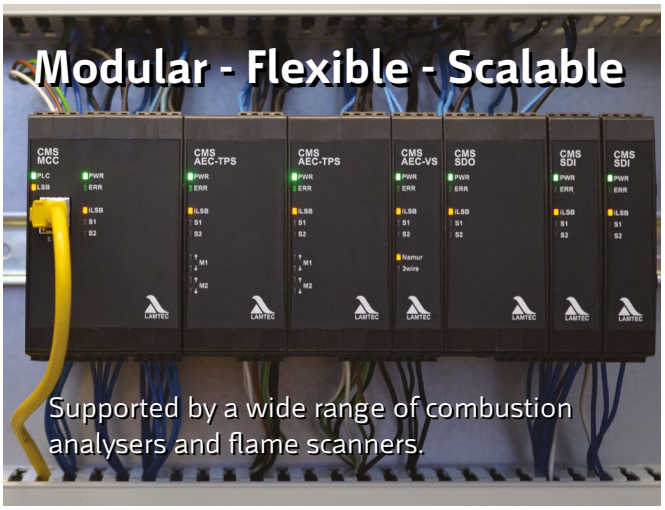

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Merging maintenance and energy management strategies

For the effective management of resources, merging operational strategies such as maintenance and energy consumption can prove beneficial, says **Mike Loughran**, Rockwell Automation chief technology officer for the UK & Ireland

Energy management and maintenance are not traditionally connected, but equipment performance and energy consumption programmes can work together to effectively maintain machines and optimise energy use.

To merge these two strategies, finding common ground is key, and this comes down to predictive monitoring.

Rather than just reacting, plant managers who implement predictive strategies can actively examine equipment to check a machine is in good health. For energy management, active monitoring can help optimise consumption. As any manager understands, inadequately maintained equipment is a major cause of energy waste. Combining the strategies can substantially reduce overall operating costs and boost productivity.

Why a predictive programme makes sense for energy

When viewed as a production resource, energy can be managed as effectively as raw materials, equipment or other production assets, leading to decreased costs and increased productivity.

The process for creating a predictive strategy for energy management follows the same three steps as any maintenance programme: monitor, analyse and control. Once all three steps have been taken, manufacturers will start to sustain gains.

Manufacturers need to know how much energy is being used, as well as where and when. Having established that, they need the ability to act on that information.

At the heart of an effective monitoring programme is a network of digital power-monitoring devices that capture and communicate information. Monitored systems provide the foundation for the accurate collecting and reporting of energy data. With this data, plant managers can understand the true base load or fixed portion of energy consumption.

The second step, data analysis, enables plant managers to make better decisions about controlling energy costs, such as by reducing consumption at peak demand.

Energy management software should act as the centralised database for all accessible energy parameters in a plant or over multiple sites. The software will help those on site see problems that might exist and lead them to the proper corrective actions. The same software also allows manufacturers to model their energy profiles by measuring peak demands and power-quality parameters, determining demand patterns and calculating energy costs.

The key to analysing the data relies on an integrated network architecture which allows users to deliver energy information across the enterprise.

Finally, control. As in a predictive maintenance strategy, after analysing the data plant managers can develop their action plan and install automation systems to capture energy savings with a control system. For example, plants that want to maintain a more consistent level of energy use over time can use a load-management system to monitor the electrical consumption of selected equipment, and turn it on and off to minimise peak demand.

How to merge predictive maintenance and energy management strategies

The predictive mindset creates an environment in which plant managers, engineers and operators can work closely with management to create business rules that effectively merge maintenance and energy strategies. By coming armed with data from the plant floor that clearly shows the profitability margins, the two groups can work together to develop a set of effective practices.

By implementing a predictive maintenance strategy and applying that to energy consumption, organisations will see longer-term savings for mission-critical machines. By adding condition monitoring, further operational cost saving can be made.

Merging maintenance and energy management strategies makes business sense and is a powerful way to achieve significant cost of ownership savings on the plant floor.

https://tinyurl.com/rockwellenergymgmt

Case study: **York Teaching Hospital**

York Teaching Hospital NHS Foundation Trust needed to modernise its energy infrastructure, which dated from the 1970s and was reaching the end of its life.

The existing energy system comprised gas-fired steam boilers controlled by an obsolete control architecture. As part of a wider modernisation project, the trust decided to proceed with a SCADA system supplied by Vital Efficienci, based primarily on Allen-Bradley integrated architecture products.

Vital Efficienci worked with Rockwell Automation to develop a bespoke energy management and control solution that would help the trust measure and reduce its energy consumption, while giving Vital Energi Group real-time remote access.

The new system runs on Allen-Bradley CompactLogix L33ER & L24ER programmable automation controllers, running on a fibre EtherNet/IP network served by multiple I/O points and Stratix 5700 managed Ethernet switches. A range of interfaces records data from multiple gas, steam, electrical and heat meters measuring set points. Data, collected every 30 minutes, is recorded in a CSV file and sent out at midnight to Vital Efficienci's head office and to the cloud. Specialist software is used to track savings and compare actual figures against desired set points. Now, a year after installation, the system is achieving the energy savings envisaged in the original design.

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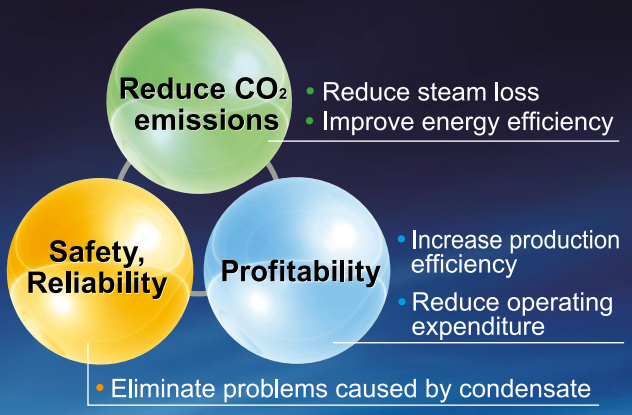

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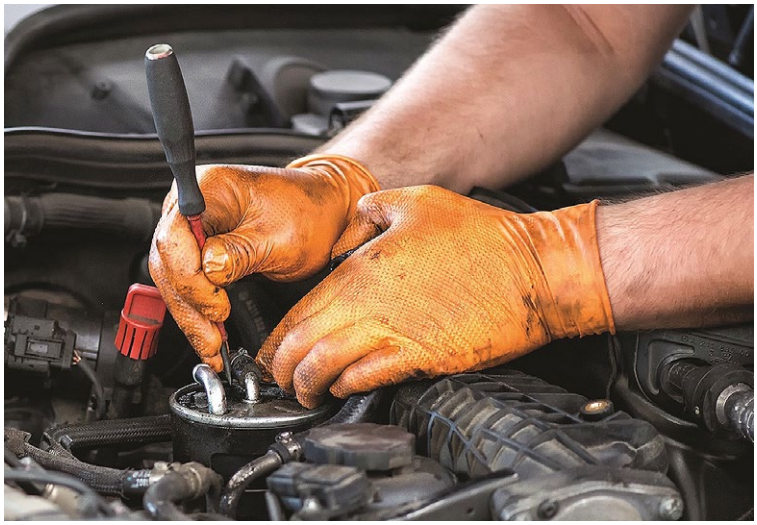
Get to grips with skin disease



Exposure to industrial chemicals remains a hazard that workers must remain vigilant about – especially for the hands. **John Lambeth**, technical manager of single use glove specialist Unigloves, looks at the dangers.

Hands exposed to chemicals on a regular basis are stripped of their natural protective oils. Eventually the skin will lose its ability to repair itself, leading to skin diseases such as dermatitis, urticaria and, in severe cases, skin cancer.

According to the Health and Safety Executive, an estimated 7,000 new cases of self-reported work-related skin problems are recorded annually in the UK.

Workers in the maintenance and engineering sectors are in one of the higher-risk environments for exposure, given the substances commonly used, including oils, greases, de-greasing fluids and metalworking fluids.

Even just having wet hands for long periods will strip the skin of its natural protective oils, greatly increasing the risk of skin disease if this continues unchecked.

Where any skin hazards exist in the workplace, the first step should always be to seek to change working practices to eliminate human contact wherever possible. But in reality this may not be practical or possible. In this case, selecting the right gloves to protect against the chemicals being encountered is essential.

Chronic condition

Most irritant contact dermatitis is chronic. Repeated exposure to many different irritants may result in an accumulation of damage to the skin's cells. The damage is invisible until the point is reached where the skin finally breaks down and dermatitis appears, with symptoms including itchy, burning, red, sore and cracked skin. By then the damage is done. Though the symptoms can be treated, any further exposure to the irritants in question is likely to trigger another flare-up.

Where it has been established that protective gloves are required, key steps should include:

- Providing appropriate protective clothing or gloves
- Making sure gloves are made of suitable materials for the chemicals encountered
- Selecting gloves that are the right size and right protection for the task being done
- Replacing gloves when necessary
- Supplying moisturising pre-work and after-work creams.

Employers should also make sure regular skin checks are carried out to look for the early onset of skin disease.

Selecting the right gloves

When you select protective gloves, base your choice on the work, the wearer and the environment they work in. You will need to identify the substances handled, as well as all other hazards. Consider the type and duration of contact the worker will have – for example, are the gloves being splashed by or immersed in the chemical? You also need to take into account the comfort of the user and the task they are engaged in.

No glove material will protect against all substances, and no gloves will protect against a specific substance forever, so it's vital to know what workers are in contact with.

You will also need to consider whether there are any other risks, such as mechanical hazards from machinery increasing the likelihood of scuffing, snagging, grazes and cuts – and make sure the glove selected can protect against these to the right level.

Glove materials such as Nitrile provide a good balance of chemical protection with strength and high levels of comfort. Glove manufacturers such as Unigloves provide information on how well their gloves perform against different substances. For protection you need to consider three key terms:

- Breakthrough time: This is the time a chemical will take to permeate through the glove material to the inside (without going through pinholes, pores or other visible openings). This tells you how long you can use a glove for.
- Permeation rate: the amount that permeates through. The higher the rate, the more of the chemical will move through the glove.
- Some chemicals can destroy the glove material. It may get harder or softer, or it may swell. This is known as degradation.

Comfort and grip

Gloves should not hamper the task. If wet or oily objects are handled, choose gloves with a roughened or textured surface for good grip.

Gloves that are not completely comfortable are more likely to be taken off during a shift. Get samples of the gloves you've identified and see if workers find them comfortable. It is also important that gloves fit properly, so make sure you provide the right size for each worker.

Get support

If you are in any doubt, seek the support and advice of a glove manufacturer such as Unigloves, who will help you select the right glove through a glove audit and free samples.

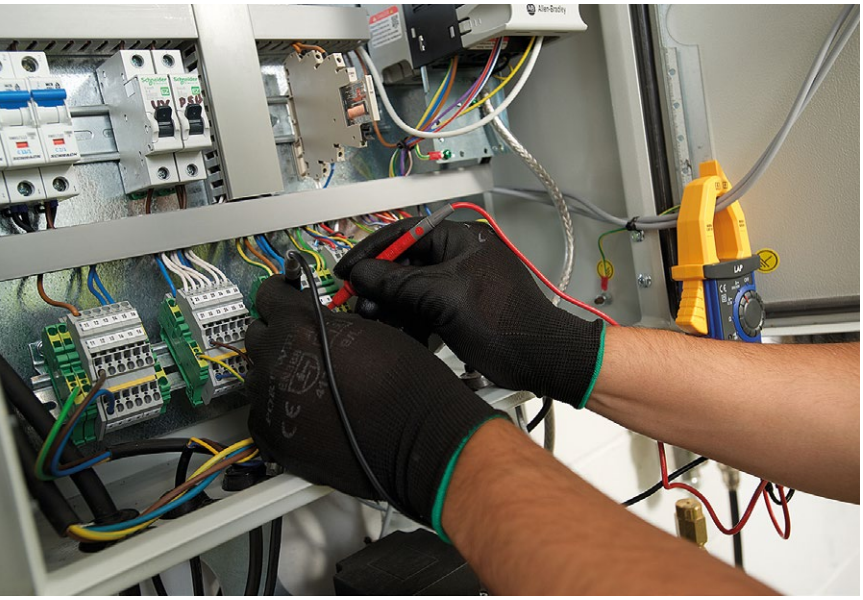
To find out more visit info.unigloves.co.uk/request-a-sample, call Unigloves on 0800 049 6602 or email enquiries@unigloves.co.uk or technical@unigloves.co.uk

EN Standards for gloves

EN 374-2: tests for defects in the glove such as holes and seams, using a water leak and an air inflation test.

EN 16523-1 (formerly EN374-3): tests for permeation of chemicals through the glove by totally immersing it in the chemical.

EN374-4: tests for loss of strength in the glove when exposed to a chemical.



Control your humidity

Companies operating processes where airborne moisture content is critical are discovering the value of Humidity Solutions' innovative remote monitoring service. By **David Fowler.**

Remote monitoring for humidification and dehumidification equipment is being offered by Humidity Solutions as part of its planned maintenance contracts.

The independent humidification specialist has been offering the option for just over a year, and says the service is proving valuable for remote sites and for production processes where environmental conditions are critical.

After sales director Rob Luddington says: "A key driver is that remote monitoring allows you to schedule services when the equipment needs it. Whereas in the past we would service a unit at, say, six monthly intervals under a maintenance plan, with remote monitoring we can adjust the timing based on the hours the unit has actually run." So if a unit runs for more hours in the winter than the summer, timing of services can be adjusted accordingly.

He adds that another driver is the data that is produced. "We're finding customers want data," he says. "If a problem arises with their process they can refer back and see what the humidifier was doing at the time in question." Pharmaceutical processes, for example, may need to be able to validate that production took place within a specified humidity range.

"I expected it to be about optimising service schedules, but the data side is more valued than we expected," says Mr Luddington.

An example application is a malt store – a grain silo in Elgin, Moray. The company's engineering manager is responsible for a number of sites of which this is the only one in Scotland. A 100% relative humidity fog is maintained at the base of the silo. If the process goes out of specification a whole batch of grain worth hundreds of thousands of pounds could be lost. In the past, if any problem arose the engineer would have to go to Scotland to rectify it. With remote monitoring the system "can give complete visibility of what's going on," says Mr Luddington.

Monitoring has been made possible because the cost of technology has dropped significantly, he says. A router is attached to the unit's controller which connects to the internet. Staff at Humidity Solutions' 24-hour service desk can log on at any time to interrogate the unit. If a fault arises an alert appears on screen immediately. Customers also have the option of being notified by email automatically, and data is also stored in the cloud.

An Airtec Hydrosens fitted with monitoring

Mr Luddington says that often there is only a "soft" fault – the unit may have automatically shut down because of the water supply being interrupted, for example. He says: "Often we can reset it remotely, and the machine will then continue to operate normally." By the time the customer receives an email alert and logs in, the problem may already have been solved.

If a site visit is needed, it is usually possible to diagnose what is wrong and make sure the engineer takes the right part, avoiding having to make multiple visits.

Parameters including supply air temperature, relative humidity, return air temperature and unit status can be viewed and logged. The communication is made via Modbus protocol and a graphic displays the data.

Other applications, says service engineer Eddie Capraro, include a medical supplies firm making indicator strips for urine analysis, where it is critical to production to maintain humidity between 10 and 15%. Monitoring was also installed for a printing firm, where the humidity is controlled to optimise ink setting and to prevent the paper curling through being too dry. Humidity has to be kept within tolerance or the presses stop automatically. "With remote monitoring we can pick up on anything that's wrong and warn the customer that production is in danger of going out of specification," Mr Capraro says.

www.humiditysolutions.co.uk info@humiditysolutions.co.uk

IIoT and the evolution of automation control systems

Dave Sutton, automation, HMI and connectivity manager at Schneider Electric, explains how the industrial internet of things is allowing companies to take the first steps towards digitalisation with the minimum of disruption

Over recent decades traditional automation control systems have increasingly provided smarter manufacturing methods, improving industrial process efficiency and productivity, while reducing downtime. Reactive maintenance has been replaced in the main by active maintenance, driving down the time and money spent diagnosing, fixing and testing.

As the whole production process becomes more efficient, businesses are wondering where the next wave of improved productivity will come from. Most are banking on data analytics and the industrial internet of things as the next big breakthrough. But the introduction of the technology brings significant considerations, such as how to collect and interpret the data in a secure way.

Existing installed automation control systems are not necessarily equipped, or flexible enough, to take up this challenge. New generation IIoT Node-RED based technology is helping to bridge the gap with low-risk solutions that provide a direct connection between manufacturing data and the cloud, without the need to modify existing automation control systems. This makes it easier for businesses to introduce IIoT technology and see its benefits, in a cybersecure environment.

The evolutionary journey to IIoT

The IIoT is a natural evolution of control systems.

The size, capabilities, and complexity of control systems have increased rapidly in recent decades. The increasing volume of process and machine data in industrial settings is astronomical. By 2020, there will be an estimated 50 billion "things" connected to the internet, and an increasing share of these devices will be industrial assets.

IIoT connectivity provides a common platform to develop new digital services, improving the efficiency and reliability of all sorts of machines and industrial processes, and connecting plant, field and cloud applications. It will be essential to exploit the power of big data and translate it into business value.

The IIoT consolidates data analytics from a range of assets in different locations. It aggregates the data and seamlessly provides analytics at the cloud level, building digitalised smart factories and improving responsiveness.

Traditional systems – barriers to IIoT?

Existing control systems may not be flexible enough to adapt to changing business conditions. Traditional control systems operate with a limited scope of data. Data collected and used from existing control systems is only a small fraction of field data. Data is sometimes difficult to extract, integrate, and comprehend. It's even harder to drive dynamic, actionable intelligence back into operations to improve productivity.

This is where IIoT comes in – but making changes to introduce IIoT connectivity at both the device or operational technology level and cloud or information technology level can present obstacles. Control system applications and programming languages may be challenging. Making changes requires skilled personnel, and may require authorisation, re-testing and re-validation. It can require assets to go out of service while updates are made.

In recent years automation devices have increasingly been connected to web servers, allowing access from browsers. IT software technologies that manage open communication from the plant level, such as OPC, .net and SQL, have become common. This was the foundation of IIoT.

New IIoT technology builds on IT/OT convergence, which involves high levels of cooperation between IT and operational technology groups in charge of monitoring physical devices such as valves and pumps. Open source Node-RED software can simply wire the "things" from the field to the cloud applications without the need to modify existing automation control systems.

Extensive node libraries are openly available from the rapidly growing Node-RED community. This represents a quick, low-risk path to the IIoT.

IIoT Edge Box

Schneider Electric's Magelis IIoT Edge Box, with Node-RED pre-installed, is a robust industrial edge device, requiring no maintenance, and designed to run in harsh environments. It stands alongside (in parallel to) the existing automation control system, minimising plant disruption.

It connects to and collects data from field devices, and provides a wide array of connectivity options, hard-wired I/O, and remote access via Wi-Fi or 4G, plus options including blind box or local operator screen, expansion accessories and operating system options for Windows 10 and Linux. It is natively cybersecure. Node-RED can be configured for one-way communications only, so device data is accessible in read-only mode. IIoT Edge Box also incorporates cybersecurity features such as end-to-end data encryption.

Conclusion

Businesses are demanding integration of IIoT with the entire value chain on factory floors. The Magelis IIoT Edge Box provides a first step towards IIoT and IT/OT integration without the need to change or stop the existing control system. With smarter data, operational efficiency can be improved globally.

www.schneider-electric.co.uk

Node-RED

Node-RED is a tool for integration between automation and IT functions that have traditionally been fragmented by different programming languages and systems. It provides a web-based integrated environment to build and deploy operations.

Originally developed by IBM in 2013, Node-RED has evolved into a simple, open source graphical programming tool for designing the communication data flow from OT to IT.

Thousands of nodes are available ready to use, to get data from connected products, manage communication, and connect to IT systems.

JSP equipment seminars support health and safety professionals

JSP holds educational seminars at its manufacturing headquarters in Oxfordshire dedicated to raising awareness about the importance of personal protective equipment. JSP is a leading manufacturer of innovative 'above the neck' PPE, specialising in head, eye, face and respiratory protection. The next JSP Respiratory Seminar is on 26 February, and looks at how you can protect yourself and your workforce from the dangers of airborne hazards such as silica dust. On 27 February, JSP will host the Head Protection Seminar, looking at protection from hazards on site.
To book on one of these free of charge events simply sign up on ***bit.ly/JSPSafetyEvents***
www.jspsafety.com

Makita introduces brushless LXT rebar tying tool

Makita's first ever introduction of a cordless rebar tying tool is now available, allowing fast, efficient and precise application of rebar tie wire and eliminating manual action.
The new DTR180ZK Rebar Tying Tool is powered by a brushless motor for extended runtime and increased power, and is compatible with both 14.4V and 18V Makita lithium-Ion batteries.
The tool automatically produces double loop ties for a range of construction applications. It is compact in size and weight and can be operated by a single hand operation, in single or continuous action, allowing the other hand to remain free to adjust the position of the rebars.
www.makitauk.com

Collaboration produces specialist baggage handling system for Malta Airport

Hart Door Systems has supplied eight fire shutters to form a specialist baggage handling system as part of Malta International Airport's €12m terminal reconfiguration project. The upgrade is designed to improve efficiency in handling over 16,000 tonnes of cargo and enhance the experience of its 6 million passengers annually. John Loftus, Hart's international estimator, said: "Having once again been chosen as preferred supplier to integrate our door systems to form this specialist baggage handling system, it demonstrates our expertise and reliability in security and fire control solutions, not to mention passenger experience." Hart is highly experienced in airports having supplied safety, fire protection and security solutions to over 40 airports worldwide.

www.hartdoors.com | t: 0191 214 0404

G P Burners launches Facile range of self-regulating burners

Swindon based combustion equipment manufacturer **G P Burners** has launched its Facile range of fully automatic burners. The company claims that the new models are the first self-regulating burners for industrial and commercial combustion applications. They feature smart technology for ease of operation, faster commissioning, optimum performance, energy efficiency and reduced emissions.
Facile burners independently and automatically set up plant parameters such as temperature, pressure and boiler power, and react to ambient variables. The system recognises and adapts to all types of boilers and processes for optimum performance. These characteristics simplify installation and dramatically reduce commissioning time. For the rare occasions when operator intervention is required, Facile units have a user-friendly LCD controller.
During operation, Facile burners have a self-regulating mass flow sensing capability, automatically adjusting fuel and air flow. The ignition point is burner determined and regulated to ensure optimum ignition.
Facile's intelligent technology facilitates remote operation and data monitoring via PC, laptop, tablet and iPhone. Plant performance is constantly monitored and real time alerts are issued promptly, highlighting performance or maintenance issues.
The Facile range includes six LO NOx models and seven standard models, and the company plans to add additional models, with higher power capacities, during 2019.
T: 01793 709050 | info@gpburners.co.uk
www.gpburners.co.uk

Jasic launches two new PFC wide voltage inverters to the MMA inverter welding equipment range

New from global welding manufacturer **Jasic**, is the Jasic Pro-Arc 180 PFC Wide Voltage and the Jasic 200 PFC Wide Voltage MMA welding inverters.

Both models use PFC technology to provide advantages such as energy saving and wide input voltage range (95-265V).

Both technologically advanced IGBT inverters, the models are extremely user friendly and offer reliable and consistent arc performance.

Both welding inverters also offer LIFT TIG functionality making them an ideal choice for maintenance and light fabrication use. Each product carries a 5-year warranty offering the user total peace of mind.

www.wilkinsonstar.com/jasic-welding-inverters

Denso™ corrosion prevention for Wessex Water pipe fitting

A Wessex Water pipe-fitting has recently been wrapped with the Winn & Coales DensoTM P1 System. The project in Warminster was to install a new pipeline to a pumping house, replacing an old existing pipeline which will now be discontinued.

The Denso P1 System was selected as a result of its products meeting the requirements of the CESWI P1 Specification for Water Industry. The corrosion prevention system comprises Denso Paste, Denso Profiling Mastic and Denso Petrolatum Tape.
t: 0208 670 7511
mail@denso.net
www.denso.net

Denso scholarship in honour of group chairman

Denso Australia recently announced its sponsorship of an educational scholarship called the 'Denso Award' for members of the Australasian Corrosion Association (ACA). The award is in honour of Denso Australia's co-founder David Winn OBE and his continued affiliation with the ACA. The ACA actively encourages its members to further their understanding of corrosion mitigation by attending training courses and conferences; contributions from the Denso Award will help cover the costs. The company is making AU$50,000 available over the next five years, with AU$10,000 to be awarded annually to reward academic excellence. Recipients will be selected by an independent panel of judges.
t: 0208 670 7511 | mail@denso.net | www.denso.net

Balmoral Tanks stores up the ideal loading dock solution for purpose-built site from Thorworld Industries

Leading tank design and manufacturing company, Balmoral Tanks, has streamlined its loading operation with bespoke loading dock equipment from **Thorworld Industries**. Balmoral Tank's operations director, Bryan Bentley explains: "Significant growth has resulted in a move to new premises. Prior to this, we'd spent £125,000 over a 12-month period on third party loading services and were keen to reduce costs." Having previously worked with Thorworld, Bentley called upon it again, this time via its sales agent, Darmax . Darmax recommended a ramp and a modular dock system that together would create a flat access point for operatives to reach containers safely, with dimensions suitable for accommodating Balmoral's 3m × 1.5m by 400mm delivery boxes. Bentley concludes, "The new equipment performs perfectly. Already our loading costs have been reduced by 70% and loading time has decreased by half."
www.thorworld.co.uk

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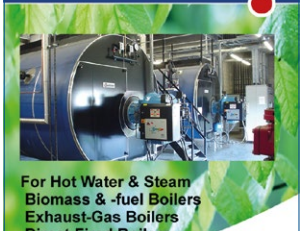

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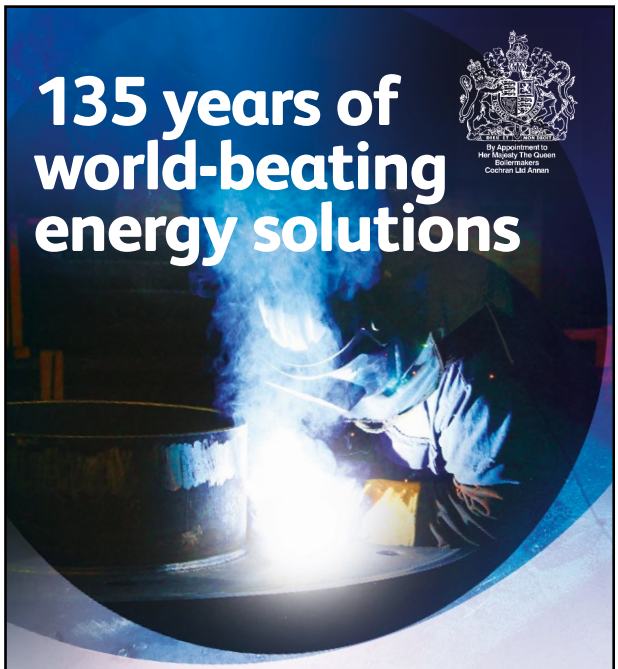

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