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Operations engineer

OCTOBER 2024

FROM THE SOCIETY OF OPERATIONS ENGINEERS

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Uncovering the latest developments and engineering innovations in predictive maintenance

- A look inside defence manufacturing
- How to best train future engineers
- The rise of variable frequency drives

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Mark Stephenson, deputy chair, BES

Embracing the AI revolution

In an era where technology permeates every aspect of our lives, the integration of Artificial Intelligence (AI) into engineering education stands as a monumental shift. This transformation is not merely about adopting new tools; it's about reimagining the very foundations of how we teach, learn, and innovate in engineering disciplines.

Traditionally, engineering education has hinged on a combination of theoretical knowledge and practical application. Textbooks, lectures and hands-on lab work have been the mainstays of this process. However, these methods, while effective, are often limited by the constraints of time, resources and human capacity. Enter AI, with its potential to revolutionise these paradigms by offering personalised learning experiences, automating mundane tasks and even fostering innovation.

One of the most compelling advantages of AI in engineering education is its ability to provide personalised learning. AI-driven platforms can analyse individual learning styles, strengths and weaknesses – tailoring educational content to meet specific needs.

Moreover, AI can automate many administrative and repetitive tasks that often burden educators. Grading, for instance, can be handled by AI systems, freeing up time for instructors to focus on more meaningful interactions with students. Additionally, AI can assist in managing course logistics, such as scheduling and resource allocation, ensuring that students and teachers can devote more energy to the actual learning process.

However, the integration of AI in engineering education is not without its challenges. There are valid concerns about data privacy, the potential for algorithmic bias and the need for educators to develop new skills to effectively leverage AI tools. It is imperative that as we embrace AI, we also establish robust ethical guidelines and ensure that educators are adequately trained and supported.

The incorporation of AI into engineering education holds potential to transform the way we teach and learn. By providing personalised learning experiences, automating administrative tasks,and enabling innovative educational practices, AI can enhance the quality and accessibility of engineering education. As we navigate this frontier, it is essential to address the accompanying challenges thoughtfully, ensuring that AI integration benefits all and paves the way for a brighter future in engineering.

The fact that this article was produced entirely using AI by entering 'In around 400 words, write a thought-provoking editorial article about the use of AI in engineering education' into a search engine, certainly gives us some food for thought!

URLs in *Operations Engineer* magazine

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Mission statement

Whether testing a pump, lubricating wire rope or monitoring environmental emissions, operations engineers inspect, maintain and repair equipment across a range of industries.

The mission of *Operations Engineer* magazine is to:

- Improve readers' understanding, knowledge, skills and competencies in operations engineering
- Promote the advancement of science, technology and practices in this field; and
- In so doing, promote safety, efficiency and environmental sustainability in operations engineering to benefit the wider community.

ABB plant moves to energy-efficient manufacturing

ABB has reportedly achieved annual energy savings of 530MWh and a reduction of 160 tonnes in carbon dioxide equivalent (CO_2e) emissions at its Belo manufacturing in Brazil.

The savings follow implementation of sustainability initiatives, including the installation of solar panels, solar water heaters, LED lamps and skylights and frequency inverters. The facility has also deployed ABB Ability Energy Manager for the metering, control and optimisation of energy consumption.

ABB's Belo plant, located in Contagem, produces around 42,000 poles a day for the manufacturing of NEMA residential circuit breakers. These miniature circuit breakers protect homes from the potential risks caused by overcurrent or short circuit events. The site is part of the ABB Mission to Zero program, which supports the company's commitment to reduce Scope 1 and Scope 2 greenhouse gas emissions by 100% by 2050. Driven by local teams, sites focus on improving efficiencies through energy generation, management and storage using ABB's technologies and third-party integration.

The new initiatives build on a CO_2e emissions reduction of over 128 tonnes in 2023 due to green energy purchase. A further reduction of 34 tonnes was achieved following the installation of solar panels, upgrading heating, ventilation and air conditioning equipment and the installation of enhanced frequency inverters on equipment in the moulding and stamping areas.

Energy consumption was reduced by approximately 420MWh a year by adding energy frequency inverters in two main production areas with high energy use. The installation of solar panels is estimated to have contributed approximately 220MWh of on-site generated renewable energy a year.

Schneider launches training programme

Schneider Electric has launched its training programme for the UK and Ireland (UK&I) in a bid to unify specialist academies, courses and digital campuses into an offering. The move is in response to the skills gap in engineering and the role that training plays in addressing the complexities with digital transformation.

The programme covers everything from artificial intelligence (AI), the automation of machinery and equipment, to innovations in power and energy management and safety standards and regulations.

Schneider Electric Training will provide customers, partners and engineers with a single point of access to the vast array of training options and resources available. These resources cover Schneider Electric solutions, industry-focused courses and professional accreditations.

It will be delivered via several specialist academies for in-person courses and a digital campus offering on-demand courses for Continuing Professional Development (CPD) via the mySchneider portal.

Two academies are already up and running, with three more due to be launched by the end of the year.

The Safety Academy in Telford offers a range of Schneider Electric and professional training courses to ensure the safe operation of electrical equipment and site safety, including Competent Person certification and City & Guilds assured Authorised Person training.

The Automation Academy in Coventry offers a comprehensive curriculum covering Schneider Electric's automation portfolio. It is designed to take students from basic product understanding through to advanced programming of both legacy and current technology, including programmable logic controllers, variable speed drives, human machine interfaces, motion control and robotics.

In brief

Jernbro, a Swedish provider of industrial maintenance, has acquired Veltec in a move that will allow it to expand its reach across Scandinavia. The acquisition will ensure that customers will benefit from a broader range of services and solutions that meet the demands of modern industrial operations. It also strengthens capabilities across diverse industries such as petrochemical, steel, mining, food and beverage, pulp and paper, automotive, metals manufacturing, pharmaceutical, energy, water and sewage, maritime infrastructure, and chemical sectors. The combined team will operate from more than 35 locations throughout Sweden, Norway and Denmark, delivering industrial services, support decarbonisation projects and improve operational performance.

Fluor has signed a contract with RoPower Nuclear for Phase 2 front-end engineering and design (FEED) work at its small modular reactor (SMR) facility in Doicesti, Romania. The project will utilise NuScale Power's SMR technology to generate carbon-free power, marking a milestone in Romania's advancement of clean energy initiatives. "We are pleased to continue our role in supporting this important project to deploy the next generation of nuclear power to produce clean and reliable baseload electricity for Romania and Europe," said Pierre Bechelany, president of Fluor's LNG & power business.

NSK has announced the sale of Neuweg Fertigung, its German subsidiary based in Munderkingen, to British investor Stephen Lord. The Munderkingen plant, which specialises in the production of small quantities of rolling bearings, will be run independently but will continue to work with NSK. Within the global NSK network, it has since concentrated on the flexible production of rolling bearings in smaller quantities - primarily for the agricultural machinery industry, but also for mechanical engineering. New CEO, Lord, who offers extensive experience in international management, said: "Our aim is to build on the strong foundation of NSK and utilise the heritage and technical excellence of the Munderkingen plant to expand our global reach."

In brief

Independent midstream operator **North Sea Midstream Partners** (NSMP) has signed a lease for Aberdeen's Marischal Square development to be closer to its customers. The new office will initially be home to NSMP's Aberdeen team, with space to regularly host colleagues from London and Norway. Sayma Cox, NSMP CEO said: "Investing in our new flagship home at Marischal Square will provide a collaborative space for our team, customers and partners as we continue to provide the critical infrastructure that supports the UK's energy security and bring forward energy transition projects." NSMP owns nearly 600km of gas pipelines in the North Sea which are said to be capable of supplying up to a quarter of UK gas demand.

The **British Pump Manufacturers Association** (BPMA) has welcomed three companies into its membership as part of its commitment to the pump manufacturing industry. Innomotics is a Manchester-based company that designs and manufactures motors and large drive systems. Suffolk-based Bruynseels specialises in the manufacturing and logistics of finished metal castings for pressure-bearing applications. UK Flowtechnik is a supplier of flow control and measurement solutions. Finally, UK Flowtechnik serves a range of industries from its base in Nottingham, ensuring optimal performance and efficiency in fluid handling systems. Its expertise in flow technology is expected to enhance BPMA's knowledge base.

Rainbow Dynamics has appointed Frazer Watson vice president, where he will spearhead UK business strategy. He will also work with Rainbow's European and US-based integration partners. Prior to joining Rainbow Dynamics, Watson held senior management roles with several companies in the sector, including iFollow - Movu Robotics. Rainbow Dynamics' founder and CEO, Alfred Chen, said: "Frazer Watson is an experienced leader and he will bring focus to our strategy of establishing Rainbow Dynamics' innovative robotic solutions at the forefront of the vitally important UK logistics market for many years to come."

Study: VFDs on pumps save energy

A study has shown how much energy can be saved in mines by applying variable frequency drives (VFD) control technology to its pumping systems.

Specialists in reciprocated pumps, RMI Pressure Systems, compared three of its emulsion pump sets at work in two mines in the north of Shaanxi province in China. While one mine was operating a full fixed speed system (with no VFD) and a full VFD system, the second mine was operating a single VFD system. The energy consumption of these three different systems could, therefore, be compared directly.

The study showed that an upgrade from full fixed speed to either single VFD or full VFD systems would lead to savings in energy costs – ranging from 10% to 20%. Using data from each mines' SCADA system, the study considered the on-load time and off-load time of each of four RMI emulsion pumps at each underground mine site, as well as the times during which the pumps were non-operational. During on-load time, flow is sent to the roof supports, while in off-load time the flow is diverted back to the tank – as demand at the roof supports has been satisfied. An average power consumption value was calculated over 15 days for each pump system, which delivers hydraulic fluid power to critical mine roof support infrastructure.

Based on an operating condition of 24 hours a day and 365 days a year, the total kilowatts consumed per year was calculated, as well as the cost of that power – using the current cost per kilowatt of electricity. When comparing the energy consumed by the full fixed speed pumps with that consumed by the full VFD pumps, an energy cost saving of over 20% was revealed.

The study also pointed to energy cost savings of more than 10% when comparing the full fixed speed to the single VFD system. Similarly, if a mine upgraded from a single VFD to a full VFD system, the energy saving could be almost 12%.

Apart from the direct energy savings, the RMI VFD control technology facilitates a more sympathetic operation of the pumps by increasing the electrical current gradually as the pump starts up and overcomes inertia. By avoiding pressure spikes that jolt the equipment, VFD control technology can also reduce the maintenance required and extend the life equipment.

Veolia increases solvent recycling

Veolia has expanded the solvent recovery capacity at its Garston, Liverpool, facility to 86,000 tonnes a year in order to meet the growing demand for more sustainable industrial products.

Effective recycling of these used solvents, waste paint thinners, and solvent-based paint will create new products as an alternative to virgin solvents so that they can be used again in industries including pharmaceuticals, semiconductors, paint, agrochemicals and cement manufacture.

As part of Veolia's new strategic plan GreenUP, this solvent recovery process is expected to save an estimated 172,000 tonnes carbon dioxide equivalent (CO_2e) in greenhouse gas emissions each year, compared to virgin resources.

Waste materials are processed at the site to regenerate them into recycled products that can be reused displacing virgin materials in the supply chain. The facility uses various distillation technologies to separate residues from the wastes and further separate solvent mixtures into products that are suitable for industrial customers.

The plant also produces several types of fuel. A distilled product fuel is used instead of natural gas to power the site's steam boilers, reducing the energy required from gas by 10,000≠MWh per year. Other by-products from the process are sent to Veolia facilities to be manufactured into alternative fuels for use in the cement industry, helping to decarbonise this industry and reduce the reliance on fossil fuels.

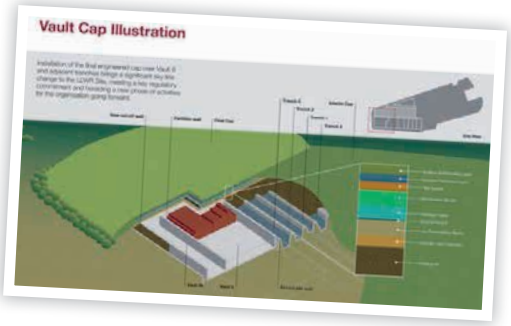
Radioactive waste disposal update

Work has begun on the next phase of operations to close the historic trenches and vaults that are located at the Low Level Waste Repository (LLWR) site in Cumbria.

The disposal of low level radioactive waste at the Repository began in 1959, with waste being placed in lined trenches at the site, which is positioned near Drigg, West Cumbria. Disposal techniques evolved during the late 1980s and early 1990s which resulted in the construction of highly engineered concrete vaults for future disposals. This resulted in a more modern approach to the treatment and safe disposal of low level nuclear waste in specially designed metal containers, which were placed in the engineered vaults at the Repository.

Nuclear Waste Services (NWS), which manages disposal of the UK's low level radioactive waste, is working on the final capping of legacy disposal trenches and vaults, which are now ready for permanent closure.

Capping is a key part of the disposal lifecycle and work is now starting on the Southern Trench Cap Interim Membrane (STIM) which will involve placing a new membrane, or protective layer, over the legacy disposal trenches up to 10m thick. It will also include placing other construction materials to progress towards the final cap.



The introduction of the STIM will provide an engineered protective cover over the waste that has been disposed of in the trenches and vaults. Specifically, it comprises of layers of material to permanently protect people and the environment.

Civil Engineering firm Graham Construction has been awarded a four-year contract and will start work this month, with major works commencing in February 2025.

Alongside this, NWS has also completed the design of the final cap, the enabling works and the rail transport arrangements that are necessary for procuring, importing and emplacing thousands of tonnes of materials, whilst complying with the conditions imposed by the Planning Authority.

Hitachi chooses Roboze technology

Hitachi Rail is to receive technology and engineering services from Roboze in Naples, Italy – and Washington County, Maryland. Roboze is a company specialising in additive manufacturing for high-performance materials.

Hitachi Rai will use the Roboze Argo 500 solution to operate its factory in Naples, Italy, and rail factory in Washington County, Maryland.The solution enables Hitachi Rail to implement industrial 3D printing technology, using materials such as ULTEM 9085 and Carbon PEEK for the production of spare parts for its trains.

According to Hitachi Rail, the railway industry faces the challenge of availability and costs associated with the production of spare parts. Roboze's additive manufacturing technology offers a concrete solution to this problem, enabling more cost-effective production compared to traditional machining methods.

With the implementation of the Argo 500 solution, Hitachi Rail can now replace traditionally machined metal parts, reducing costs and delivery times. As part of the deal, Roboze will provide consultancy services to Hitachi Rail in the US and Italy.

Hitachi Rail will soon open its rail car factory in Washington County, Maryland. The $70m factory is set to deliver the new fleet of 8000-series railcars for the Washington Metropolitan Area Transit Authority as its first order. By partnering with Roboze, Hitachi Rail will be able to harness its 3D printing solution to produce prototypes and railway spare parts.

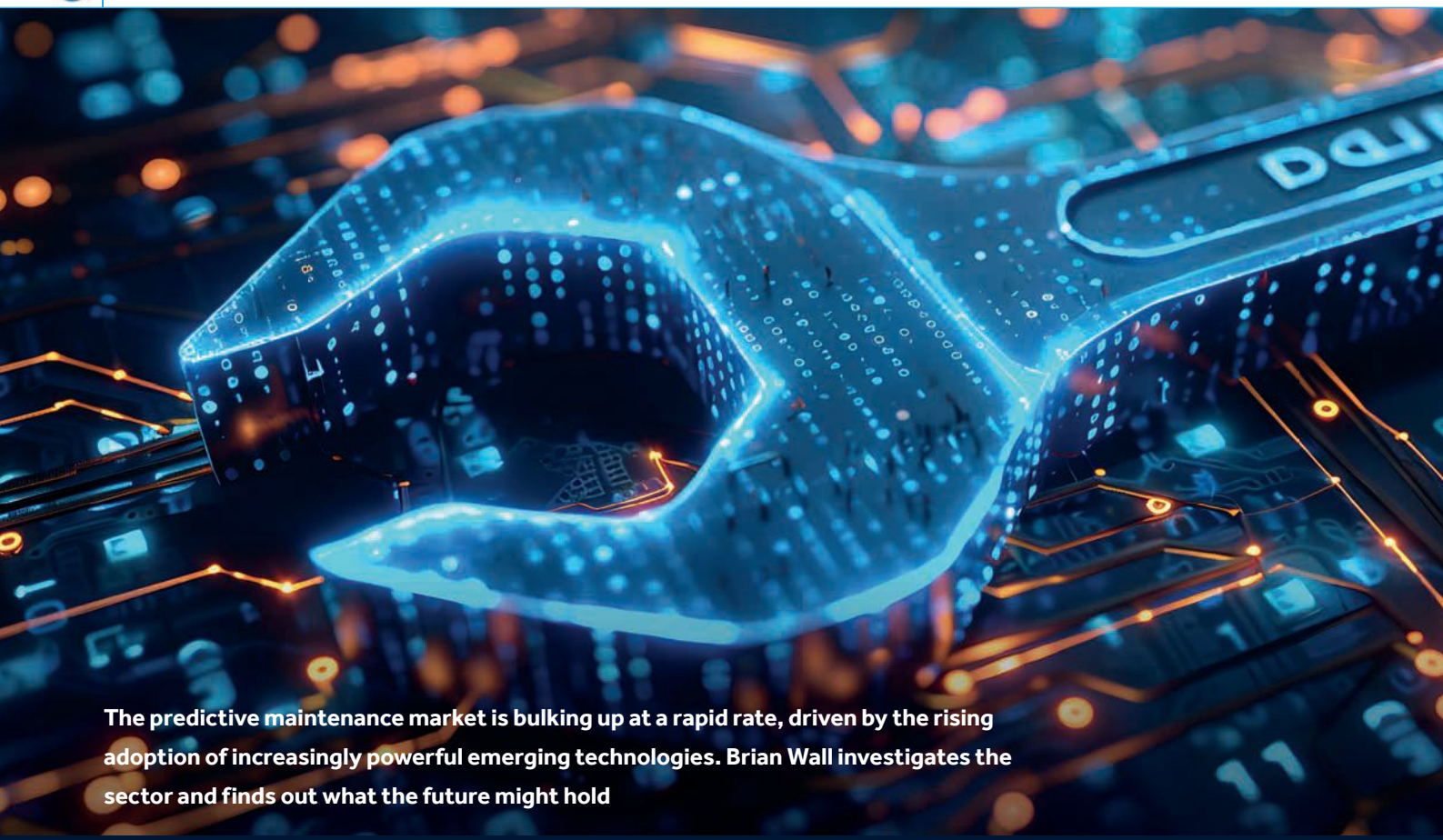
"The partnership will enable us to harness 3D printing to improve operational efficiency and reduce costs for producing prototypes and railway spare parts," said Luca D'Aquila, CEO Hitachi Rail Italy.

In brief

Lhyfe has joined forces with onshore wind developer OX2 and green fertiliser company Velarion to create a hydrogen-based industrial cluster in Ånge municipality in Sweden. This project, situated in Grönsta just north of Torpshammar, will combine wind power with green hydrogen production to generate carbon-negative neutral products. OX2 is developing a wind farm in Marktjärn, Torpshammar, with a planned annual production capacity of 1.4 TWh. According to the project, this green electricity will power the hydrogen production unit that Lhyfe plans to install in Torpshammar with a capacity of up to 100 tonnes of green hydrogen per day. Lhyfe produces green and renewable hydrogen through the electrolysis of water at production units powered by renewable energy.

Vinci Facilities has appointed BPD Zenith to implement and deploy a new Maximo Application Suite (MAS) system, with mobile solution, and associated services. BPD Zenith, a company specialising in Enterprise Asset Management (EAM), works with several clients in the facilities management sector. Vinci Facilities selected BPD Zenith's MaxiCloud solution, powered by IBM's Maximo Application Suite. The contract also includes implementing BPD's Fingertip mobile solution to support operatives in the field with the real-time updating of work orders and integration with SFG20, the industry standard for building maintenance.

Wiferion, a provider of wireless energy systems, has appointed Kamil Buczek as head of application engineering, where he will contribute to the development of application support. His responsibilities will include advising, training and supporting global sales teams, partners and customers to ensure effective implementation and problem solving. Buczek has experience from various specialist and management positions. At IABG, he was a measurement technician in the space simulation department and was responsible for the implementation of areas such as test preparations, maintenance budgets and system development projects.



The predictive maintenance market is bulking up at a rapid rate, driven by the rising adoption of increasingly powerful emerging technologies. Brian Wall investigates the sector and finds out what the future might hold

A show of **strength**

Predictive maintenance (PdM) is big business – and getting bigger. What's propelling it upward at such a rapid rate? Several factors, it would seem, including: the rising adoption of emerging technologies for gaining valuable insights into industry's maintenance challenges; the growing influence of machine learning and artificial intelligence.

Predictive maintenance is certainly witnessing several innovative trends – and predictive analytics is one reason why, allowing organisations to leverage advanced algorithms and Machine Learning (ML) techniques to analyse vast amounts of unstructured data that can identify patterns and trends indicative of their equipment's current state of health. By harnessing such power, businesses can anticipate maintenance needs, optimise resource allocation and mitigate risks associated with unexpected failures.

PRODUCTION GAINS

"Manufacturers are adopting advances in sensing, AI and machine learning (ML) to boost profits and cut production times," says Peer Schumacher, head of electronics manufacturing solutions, Panasonic Connect Europe. "AI and ML enable smarter production processes with predictive maintenance, improved quality control and automated decision-making."

These advances are not just about keeping up with the competition, he adds – they're about making smarter choices that keep machines running smoothly and prevent costly breakdowns. "At Panasonic Connect Europe, we're using AI and ML in our production machines and management software solutions to help our customers transform their Surface Mount Technology (SMT) manufacturing. These technologies are helping us implement predictive maintenance, improve quality control and automate decision-making, all of which contribute to more efficient production."

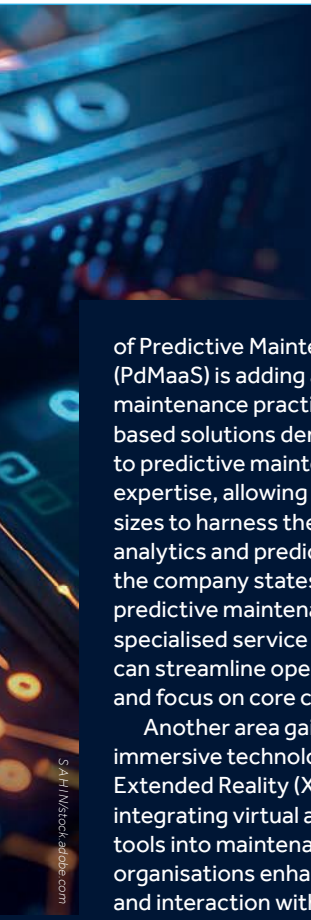
The company's latest predictive maintenance tool, APC-5M, is like "having a crystal ball for your production line", states Schumacher – with 'APC' standing for Advanced Process Control, while '5M' considers the variances of huMan, machine, material, method and measurement.

Another exciting development, he says, is how AI helps track real-time movements of conveyor systems, heads and axes in the company's SMT equipment. "Think of it as a machine with a sixth sense, which learns from past operations to better manage maintenance efforts and alert manufacturers to any abnormal conditions before they escalate."

Integrating AI and ML into SMT manufacturing is a huge leap forward for the industry, he adds. "It not only speeds up time-to-market, but also cuts production costs and boosts product quality. As manufacturers continue to adopt these technologies, we can expect even more innovations that will push the boundaries of what's possible in electronics manufacturing."

AN EXTRA GEAR

According to Sensemore, which specialises in optimising machinery performance and reliability, the advent



of Predictive Maintenance as a Service (PdMaaS) is adding an extra gear to maintenance practices in 2024. "Cloud-based solutions democratise access to predictive maintenance tools and expertise, allowing organisations of all sizes to harness the benefits of advanced analytics and predictive algorithms," the company states. "By outsourcing predictive maintenance functions to specialised service providers, businesses can streamline operations, reduce costs and focus on core competencies."

Another area gaining traction are immersive technologies, such as Extended Reality (XR), it adds. "By integrating virtual and augmented reality tools into maintenance workflows, organisations enhance visualisation and interaction with equipment. XR technologies enable immersive training, remote assistance and virtual simulations, empowering maintenance teams to identify issues, troubleshoot problems and perform inspections with unparalleled precision and efficiency."

Focusing in on the demanding landscape of oil and gas operations, for example, Sensemore identifies several advantages that predictive maintenance delivers.

"Predictive maintenance empowers companies to anticipate potential equipment failures before they occur, enabling them to schedule maintenance activities during planned downtime. This proactive approach minimises the risk of unexpected breakdowns, reducing both downtime and the associated repair costs." It also enhances asset reliability and availability by identifying and addressing potential issues before they escalate into major failures.

Left: ***Peer Schumacher, Panasonic Connect Europe: integrating AI and ML into Surface Mount Technology (SMT) manufacturing is a huge leap forward for the industry***

Left: ***Panasonic provides turnkey solutions for manufacturing challenges***

"Predictive maintenance is certainly witnessing several innovative trends – and predictive analytics is one reason why"

PUT TO THE TEST

Which technologies are empowering predictive maintenance? One predictive/preventive measure now to the fore is ultrasonic testing. This involves the use of high-frequency sound waves to detect potential and actual flaws and defects in equipment components, such as pipelines, valves and storage tanks. By capturing ultrasonic signals and analysing their amplitude and frequency, operators can identify leaks, corrosion and other integrity issues before they escalate or where they are most likely to become serious issues.

Among the tools that are tried and trusted is vibration analysis, assessing as it does the condition of rotating machinery, such as pumps, compressors and turbines. By measuring vibrations and analysing frequency spectra, operators can detect abnormalities indicative of impending equipment failure, such as imbalance, misalignment or bearing defects. Equally notable is thermal imaging technology, which enables the detection of abnormal temperature patterns in equipment, signalling potential issues, such as overheating, insulation degradation or electrical faults.

We have entered a new era where AI and ML algorithms, with their ever-growing complexity, are enabling more accurate failure predictions to be calculated. However, for all the hype around AI and ML, there are other major influencers at work where predictive maintenance is concerned. Take Edge Computing, for example. This is rapidly gaining prominence, allowing the capture, processing and analysis of data at the farthest reaches of an organisation's network: the 'edge' itself.

"This allows organisations and industries to work with urgent data in real time, sometimes without even needing to communicate with a primary datacentre and often by sending only the most relevant data to the primary datacentre for faster processing," says Microsoft. "This spares primary computing resources, like cloud networks, from being glutted with irrelevant data, which lowers the latency for the entire network."

An oil drilling rig operating in the middle of the ocean is one example. "Sensors that track information like drill depth, surface pressure and fluid flow rate can help keep the machinery on a rig running smoothly, and help keep workers and the environment safe. To do this without slowing down the network unnecessarily, the sensors send only the data about critical maintenance needs, equipment malfunctions and worker safety details over the network, and this makes it possible to identify and react to issues in close to real time."

Meanwhile, the integration of IoT devices and cloud-based platforms is expanding, facilitating remote monitoring and maintenance. These trends promise to add even greater impetus and direction to predictive maintenance, enhancing equipment reliability and operational efficiency to levels not previously attainable. oe

Protecting itself is a big part of any major nation's economy and attracts a huge focus, especially when the global geopolitical landscape appears unstable. Tom Austin-Morgan reports on some of the major challenges facing manufacturing in the defence industry

A strong defence

The UK's defence industry, which is essential to both economic stability and national security, is now dealing with issues that affect its manufacturing capabilities. The most urgent of these are the intricacies in its supply chain and a skills shortage that is thought to represent 10,000 jobs across industry.

The industry's particular requirements, regulations and complexity set it apart from other industrial sectors. Defence manufacturing often involves the fabrication of highly specialised and technologically sophisticated equipment – such as military vehicles, aircrafts, naval ships and armament systems. Strict safety, reliability and performance requirements apply to these items, necessitating a strict adherence to regulation, certification and legal requirements.

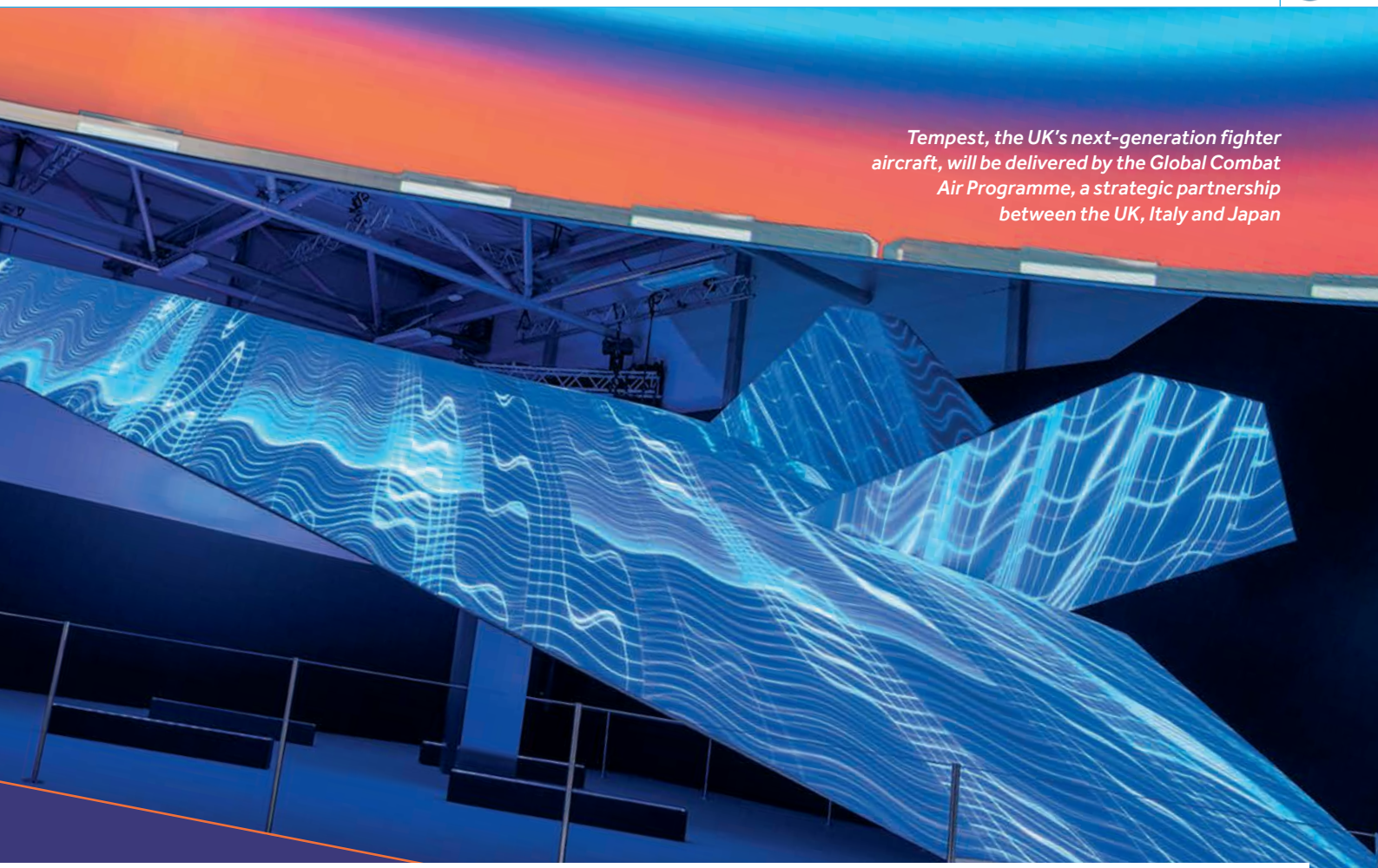
In addition, government policies, fluctuating budgets and geopolitical events all have an impact on the defence industry. Because of these factors, manufacturers operate in a dynamic and frequently unpredictable environment, requiring high degrees of flexibility and adaptability.

For example, the effects of Brexit impacted the sector and turned the UK into a third-party nation for any EU R&D investment programmes. These projects are tendered to EU nations first and a third-party nation only gets involved if there is no solution within the EU. This is a relationship that is beginning to be rebuilt, especially with the new Government looking to secure a UK/EU Defence Security Co-operation Agreement.

"We need programmes that the government will commit to for the long term," states Samira Braund, defence director, ADS Group – the national trade body for aerospace, defence, space and security. "Under the last government it has been feast and famine."

Braund explains that government contracts typically require a certain number of a products to be built which only provides manufacturing, production, resources and skills for a set period before stopping production again. "Then, when they want industry to ramp up, it's very difficult because we might have lost the skills from that sector or manufacturing areas, and therefore you're potentially taking skills from other sectors which ultimately damages the broader ecosystem."

Unlike commercial manufacturing, where demand and supply can be forecasted with relative certainty, the defence industry must constantly adapt to changing threat landscapes and evolving technological requirements. "The MOD is currently mapping supply chain bottlenecks to see where they lie



Tempest, the UK's next-generation fighter aircraft, will be delivered by the Global Combat Air Programme, a strategic partnership between the UK, Italy and Japan

and where we might be able to provide some resilience," she says. "Working with international allies, such as the recent agreement signed with Germany, gives the opportunity to build resilience in the supply chain by developing security cooperation agreements that will harness the relationship and be equally beneficial to both parties."

SUPPLY CHAIN COMPLEXITIES

The intricacy of the UK defence industry's supply chain is one of its biggest problems. The defence industry depends on a wide range of suppliers, from small, specialised companies to major global conglomerates. Although this variety fosters innovation and increases resource availability, it also adds a degree of complexity not seen in traditional industrial industries.

Dependencies and lead times can pose serious problems when a broad range of suppliers is used. Numerous highly specialised components needed for defence manufacture may only be available from a small number of vendors, occasionally even from outside the country. This makes it possible for any disturbance to have a domino impact across the whole manufacturing chain, regardless of the cause – political unrest, trade restrictions, or logistical problems. Requirements for specific materials and components often have lengthy lead times, which can compound delays and make it challenging to stick to production timelines.

In addition to the logistical challenges, the defence supply chain is highly controlled to guarantee security and adherence to national and international legislation. Strict criteria must be met by materials and components used in defence production to guarantee their suitability for use – and suppliers frequently must go through stringent screening procedures to guard against security lapses and preserve the integrity of defence capabilities. These specifications raise the bar for supply chain management complexity and demand a high level of supervision and coordination.

However, Braund adds: "Security is one of the UK's biggest strengths. When we partner with international allies, especially outside of our traditional EU partners, we take them on the governance journey, the learning and understanding of what needs to be adopted and why – and the rigour that sits behind that to bring other nations up to the standards that the UK has adopted."

Effective inventory management is crucial in defence manufacturing, where the cost of components and raw materials can be higher than in other sectors. This is often due to the specialised nature of the materials used, such as advanced alloys, composites and electronic systems.

"A lot of our members are companies that might be headquartered overseas," says Braund. "Depending on the requirements components may flow through the UK supply chain, EU, or US supply chains. This is why the SME community is really important and why we hold our 'meet the buyer' events with the large defence primes so they have visibility of what's created in the UK.

"It's really important, when we're contracting with UK partners, that we're looking at UK prosperity, UK jobs, UK IP creation so that the supply chain only falls outside of the UK when either there's a bottleneck or the solution doesn't exist."

To help with this, the MOD has created a supply chain mapping tool with the capability to map down to

The defence industry hopes that projects such as Tempest, which will be operated by the Royal Air Force, will help plug a skills gap

Tier 3 and in some programmes to Tier 4 to identify risks and areas of fragility. The software imports data from a range of external sources, suppliers and internal information, providing a 360° view of the supply chain from the financial health of a supplier to its environmental and social governance (ESG).

If risks are identified, action can be taken to support those vulnerable companies with a unique capability within the supply chain that cannot be delivered by other suppliers. It also provides information on where suppliers are based and to track the social, economic, and environmental impact of projects.

> **"Working with international allies, such as the recent agreement signed with Germany, gives the opportunity to build resilience in the supply chain"**

SKILLS GAP

The skills gap in the UK defence industry represents another formidable challenge. The industry currently employs around 164,000 people, but it is facing a shortage of approximately 10,000 skilled workers. This shortage is driven by several factors, including competition for talent with other high-tech industries.

"We are only going to reduce that gap if we have a demand signal for long term investment," admits Braund. "We also need to build up the attractiveness of defence and demonstrate that defence is a sector that is worth investing in.

"There's a broader public attraction piece that the new government needs to address around Homeland Security," she adds. "Unless the government invests in the long term which, due to budgetary pressures, it doesn't look likely, we're not going to fill that skills gap."

A skills campaign is set to begin within the next six months, according to Braund, to attract new individuals into the defence sector from academic institutions or from other sectors with transferrable skills. This campaign will promote the unique benefits of a career in defence manufacturing, such as the opportunity to work on cutting-edge technologies demanded by Tempest, the UK's next-generation fighter aircraft, or programmes to do with space, as well as contributing to national security.

"The generations coming through are looking for experiences, not jobs for life," Braund states. "The exciting programmes such as the Global Combat Air Programme (GCAP) and AUKUS will give the opportunity to move across three nations. So, rather than taking a year out to go travelling, you could go on a graduate scheme that supports AUKUS and have rotations in all three nations. It's about coming up with innovative ways of attracting people into the sector."

The Global Combat Air Programme is a strategic partnership between the UK, Italy and Japan to deliver Tempest, which the Royal Air Force will operate.

AUKUS is a trilateral security partnership between the UK, the USA and Australia to secure the Indo-Pacific region. The three nations are cooperating on key defence capabilities, including submarine technology and advanced capabilities such as artificial intelligence and quantum technologies. "The risk with AUKUS is that we lose skills from the UK because Australia is more attractive to work in," says Braund. "We want interchangeable skills."

She points to welding as an area in the UK where there is a big skills gap. However, Australia has an abundance of welders, therefore there is an opportunity for Australian welders to come and work in the UK. The trade-off would be that the UK is able to provide engineers to work in areas in Australia where they are experiencing a skills gap. Braund says that this kind of equitable skills transfer is something that happens more commonly in the defence sector than in other sectors.

"On the GCAP, each partner brings different qualities and requirements that complement each other which is seeing the UK work with Italy and Japan in the design and concepting through the exchange of knowledge to address common challenges," she reasons.

International programmes such as these are key to managing production issues, says Braund, adding that there are likely to be more in the future. However, from a skills perspective, it's early days and though there are huge benefits they are only just starting to be recognised.

The UK defence sector has potential for innovation and advancement despite constraints related to skills shortages and complex supply chains. Through prioritising the improvement of workforce development, supply chain resilience, and modern manufacturing technologies, the sector can effectively manage current difficulties and maintain its position as a crucial and resilient part of the UK economy and national security framework. oe

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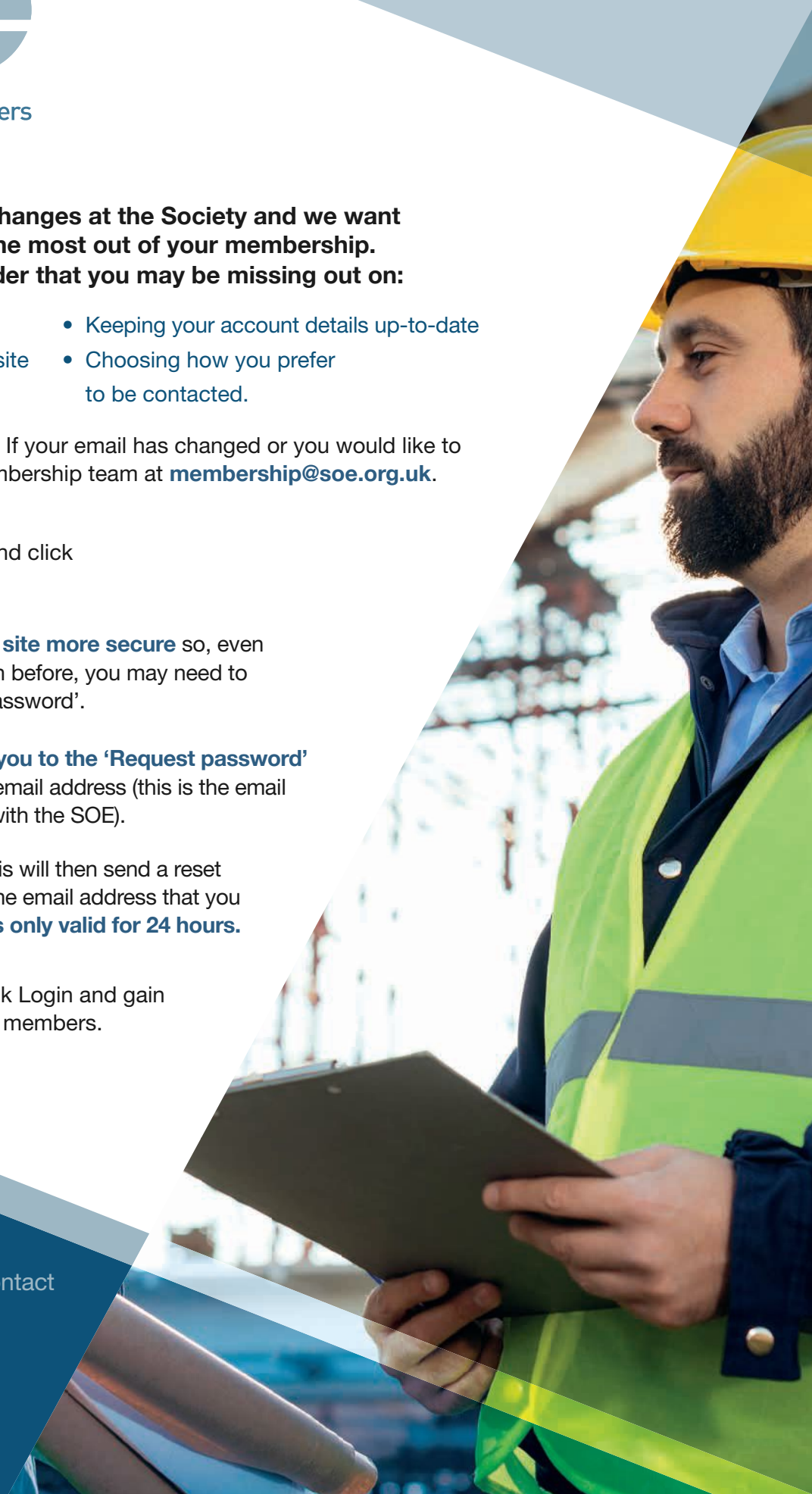

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An expert in variable frequency drives explains to Louise Davis how future-focused solutions can help industry tackle its sustainability issues while also saving considerable costs

In the driving seat

According to Kes Beech, technical manager at Invertek Drives, in the realm of electric motors and drives technology, the overarching trend right now is for maximising energy efficiency. "This drive for efficiency is fuelled by both economic and environmental considerations, and variable frequency drive (VFD) technology is at the heart of enabling this shift," Beech states.

He reports that Invertek is witnessing a surge in demand for VFDs with advanced features such as regenerative braking (which captures and reuses energy that would otherwise be wasted). Additionally, Beech says he's noticed growing interest in drives that are capable of seamless integration with smart energy management systems, allowing for real-time monitoring and optimisation of energy use. "We're also seeing increasing adoption of VFDs in sectors traditionally reliant on fixed-speed motors, such as HVAC and water or wastewater treatment. This reflects a growing recognition of the substantial energy and cost savings that VFDs can deliver," he explains.

Invertek is actively responding to and enabling these trends through continuous innovation, says Beech. "Our latest Optidrive models boast improved efficiency levels, enhanced communication capabilities and smarter control algorithms – all contributing to greater energy savings and a reduced carbon footprint," he explains. "Additionally, we're investing considerably in our future capabilities. A planned new innovation centre, coupled with an expanding team of talented engineers, highlights our commitment to staying at the peak of VFD technology development."

> **"Our latest Optidrive models boast improved efficiency levels, enhanced communication capabilities and smarter control algorithms – all contributing to greater energy savings and a reduced carbon footprint"**

SAVINGS PLAN

Discussing the benefits of his firm's approach for end users, Beech says he believes that Invertek is at the forefront of demonstrating how VFD technology is pivotal in achieving cost savings and supporting environmental sustainability across industrial applications globally. More tangibly, what these benefits translate to in real-world applications is

Left: ***The Optidrive family has been designed to maximise efficiencies in the applications it's used to control***

Below: ***Invertek's Optidrive range is enabling the trend for maximising energy efficiency***

Left: ***Invertek describes its recently launched Elevator Core product as "the next generation of elevator motor control"***

potential energy savings of up to 50% in certain applications, such as pumping and fans/ventilation – a benefit that directly impacts the bottom line for businesses.

"Furthermore, the smoother starts and stops facilitated by VFDs minimise mechanical stress on the equipment, leading to reduced wear and tear. This results in extended equipment lifespans and decreased maintenance costs, adding another layer of financial benefit," Beech notes.

An additional advantage is the precise speed control through VFDs enables process optimisation, leading to increased productivity and potential cost reductions across various industrial operations.

Beech is also keen to point out that the merits of VFDs go beyond financial savings. "The environmental sustainability aspect of VFDs is equally important," he emphasises. "The reduced energy consumption resulting from optimised motor control directly contributes to lower greenhouse gas emissions, playing a vital role in combating climate change.

"By enhancing the efficiency of motor-driven systems, VFDs empower industries to decrease their overall carbon footprint and advance towards a greener future," he adds.

In terms of specific products, Beech says that the company's Optidrive VFD range "embodies these principles of efficiency and sustainability". Its advanced algorithms and power electronics ensure optimal energy utilisation across diverse applications."Easy integration features simplify installation and operation, making energy savings readily achievable," he explains. "The robust design and comprehensive protection mechanisms ensure long-term, reliable performance, minimising waste and resource consumption."

RANGE REFRESH

The Optidrive range relies on continual R&D inputs on both the hardware and software sides to ensure that each generation delivers greater energy efficiency in the systems it controls. "Our current range – particularly the Optidrive Eco VFD – has been meticulously designed to maximise efficiencies in applications such as pump control," explains Beech.

Beyond solutions for the precise control of electric pumps, Invertek has also developed the Optiflow system.

Right: ***An Indonesian coffee roaster opted for Optidrive E3 VFDs to control its gear motors***

"Optiflow enables multiple Optidrive Eco drives to work together seamlessly, optimising flow and energy use across an entire system," Beech details. "Imagine four pumps working in concert – the first Optidrive Eco acts as the master, intelligently controlling and commanding the other three drives, adjusting their speeds and run times based on real-time demand. This is crucial in scenarios with fluctuating water requirements. Instead of a system of constantly running pumps, Optiflow allows for dynamic adjustments, ensuring energy is only used when and where it's truly needed.

"A key advantage of Optiflow is its self-contained nature," he continues. "There's no need for external PLCs or additional control devices. The entire programme resides within the Eco drives themselves, requiring minimal setup from the user. The system leverages the internal PID function of the Eco drives for intelligent control based on consumer demand. The result is a continuous, optimised output flow with no overshoot, reducing mechanical stress and ensuring savings on wear and tear and downtime."

CONVEYING EXPERTISE

When conveyor specialist InterQuip needed a VFD capable of withstanding the tough environments its systems operate in while ensuring operators could easily control the motion of the products, it identified the Optidrive E3 with NEMA 4X/IP66 enclosures as the ideal match. The E3 is a compact, robust and reliable drive that is easy to set up, commission and use.

"We were impressed with the durability of the Optidrive E3, particularly with the outdoor rated enclosure," says Karl Davies, managing director of InterQuip. "We must ensure our products are reliable and robust for our customers, so the components must match this."

Following extensive field trials, Davies reports: "The E3 units underwent successful testing and are now being used by customers in a range of applications. We've been very pleased with their reliability and durability."

CASE IN POINT

When asked for examples of real-world applications of Invertek's drive technology, Beech says that two recent case studies showcase how much of a difference VFDs can make. "The first project involved T.A. Handte Ibérica, a leading provider of industrial smoke, dust and gas extraction and filtration solutions. The company aimed to create a versatile and adaptable control solution for its diverse range of filtration systems, including wet scrubbers and cartridge filters," he explains. "Invertek Drives Ibérica, proposed the Optidrive Eco VFD with integrated PLC functionality as the ideal solution. The VFD offered a combination of precise motor control, customisable logic programming and diverse I/O capabilities, addressing the company's key challenges."

Beech says that, according to the happy customer, the implementation of the Optidrive Eco VFD with integrated

Left: ***The Optidrive Eco VFD proved to be the ideal solution for filtration expert T.A. Handte Ibérica***

Below: ***The Optidrive Coolvert is Invertek's latest high-performance drive. It has been designed specifically for BDLC compressors, heat pumps***

PLC "revolutionised and enhanced" the filtration systems, delivering numerous benefits in terms of performance, operation, safety and cost savings.

The second success story involved the application of VFD technology at a coffee roaster in Indonesia. "Coffee roasting hinges on meticulous control of temperature and airflow. Accurate control of gear motors enables consistent and high-quality coffee roasting across cafes, roasteries and industrial settings," says Beech. In this project, Optidrive E3 VFDs stepped in to precisely control the speed of the gear motors powering the rotating bean drum, motor blower and cooling agitator. "They ensure each batch achieves the desired roast profile with consistency. This creates exceptional drink quality, roast after roast, ensuring the roaster's reputation for excellence," reveals Beech.

THE BIGGER PICTURE

An interesting knock-on effect of deploying Invertek's drives is that they can extend their energy-saving capabilities to other applications as well. Beech explains: "For instance, they can precisely adjust the electric motor control of fans or HVAC systems, ensuring accurate airflow for temperature and humidity regulation. Again, this translates to energy usage only when necessary, rather than constant full-speed operation.

"Overall, the trend towards energy efficiency is clear and compelling across diverse applications in almost all industry sectors," summarises Beech. "At Invertek, we're dedicated to not only keeping pace but also driving this trend forward through innovative VFD technology and a steadfast focus on sustainability."

A GOOD EXAMPLE

Discussing environmental considerations, Beech says that Invertek Drives' commitment to sustainability goes beyond product innovation. "The company leads by example, implementing initiatives such as the installation of photovoltaic cells at our global headquarters in Welshpool, UK and the use of electric vehicles throughout our fleet," he details. "Additionally, the global assembly cells (GACs) used in the assembly and testing of our Optidrive VFDs, use a regenerative braking system. This allows each GAC to capture and recycle energy that would otherwise be lost. This proactive approach to reducing our own energy consumption and environmental impact reinforces our dedication to a sustainable future."

A pioneer of electrification explains to Louise Davis why a sea change in mindset surrounding industrial processes is necessary if manufacturers are to continue providing the world with the products and materials it needs

An industrial revolution

Given that he is not a politician, Joonas Rauramo, CEO of Coolbrook, spends a surprising amount of his time on lobbying activities. Rauramo is in no doubt that a revolution is needed; he just needs to encourage various parties to catch up with his way of thinking. The transformation Rauramo is calling for concerns industrial processes and he believes that electrification – which broadly refers to replacing CO_2-emitting processes with alternatives that run on electricity alone – will prove to be the enabler here. "The need for a revolution in industrial processes stems from the urgent challenge of climate change and heavy industry's contribution to global greenhouse gas emissions," begins the green-tech expert. "Sectors such as steel, cement and petrochemicals are foundational to modern society but are also among the most carbon-intensive, responsible for nearly a quarter of all global emissions. As global demand for these materials continues to rise, the traditional reliance on fossil fuels for heat generation becomes unsustainable."

For Rauramo, the solution is clear: "Electrification offers a transformative pathway to decarbonise these processes by shifting from fossil fuel-based energy sources to renewable electricity," he states. "This transition not only reduces emissions but also enhances

Left: ***To develop its technology, Coolbrook is operating a RotoDynamic technology pilot plant at the Brightlands Chemelot Campus in Geleen, the Netherlands, in the heart of the petrochemical industry***

efficiency and scalability. Technologies such as our RotoDynamic Heater (RDH) can achieve the high temperatures required for industrial processes using renewable electricity instead of fossil fuels, with up to 95% energy efficiency. By electrifying these processes, we can maintain the production of critical materials while moving towards net-zero emissions, ensuring both environmental sustainability and economic viability."

DYNAMIC DETAILS

As well as the abovementioned RDH product, Coolbrook has also developed the Roto Dynamic Reactor (RDR). These technologies work via what is effectively a reverse turbine, where gas is heated to a supersonic velocity and then rapidly slowed in a diffuser to subsonic velocities. The initial product development began a few years ago and Rauramo reports that his team has considerable strides in advancing the commercialisation of these technologies.

"We have finalised the design of our first commercial RDH product, capable of reaching temperatures up to 1,000°C and a thermal power of 10MW," he confirms. "We have completed large-scale pilot demonstrations at our facility, which confirmed the RDH's ability to achieve these temperatures and powers with 95% energy efficiency. These results are a major milestone, validating the technology's potential to cut global industrial CO_2 emissions by a third (two giga-tonnes)."

The company is now evaluating the technology's integration into operational environments with its partners, including the likes of Shell, Sabic, Braskem, Ultratech Cement, CEMEX and JSW. "These collaborations are crucial as we move towards large-scale deployment at customer sites. Full commercial rollout is expected by 2025,

"The need for a revolution in industrial processes stems from the urgent challenge of climate change and heavy industry's contribution to global greenhouse gas emissions"

Above: ***In 2023, the pilot's first phase successfully demonstrated RDH technology's capabilities for industrial use in high-temperature process heating***

Right: ***Joonas Rauramo, CEO, Coolbrook***

marking a significant step towards widespread adoption of our technologies across multiple heavy industries," reveals Rauramo.

CONCRETE EXAMPLES

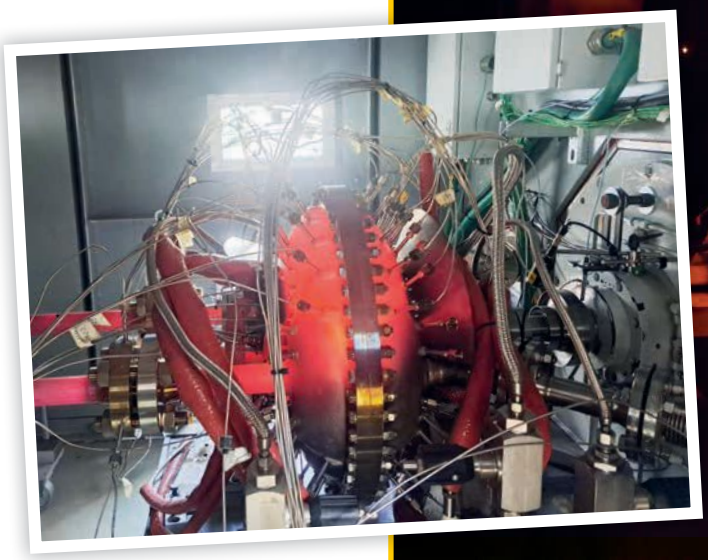
Coolbrook's cement-sector partners illustrate that this is one industry ripe for innovation and where Rauramo expects a good deal of business to come from. But what other industries also stand to gain by going electric? "Beyond the cement industry, the steel and petrochemical sectors are two prime examples where electrification can make an impact," Rauramo feels. "In the steel industry, RDH technology can be used across different production processes (eg. blast furnace, direct reduction of iron or recycled steel production). In blast-furnace based processes, preheating of combustion air and providing heat for coke production are traditionally reliant on fossil fuels and have enormous carbon footprints. With technologies such as the RDH, these processes can be electrified, achieving the necessary temperatures using renewable electricity. This shift drastically reduces the industry's reliance on fossil fuels and cuts down CO_2 emissions, while also improving process efficiency and stability."

In the petrochemical industry, the production of olefins such as ethylene and propylene requires high temperatures and is a major source of CO_2 emissions. According to Rauramo: "RDH can electrify this process, using electricity to achieve the same high temperatures needed for steam cracking without burning fossil fuels. This not only reduces emissions but also considerably improves product yields and reduces operational costs."

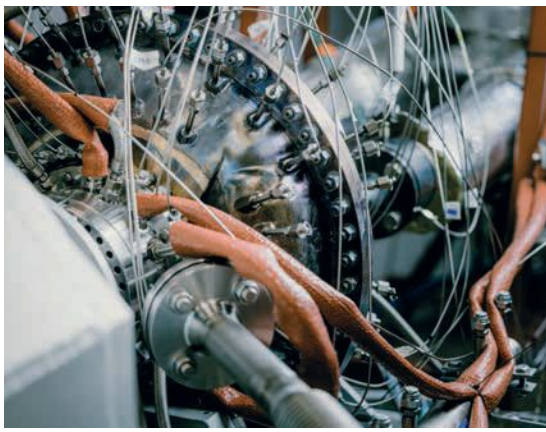
The benefits of electrification across many industries are clear if yet relatively unproven – and Rauramo acknowledges that achieving his desired revolution will require patience. "Our approach to electrification recognises the practical realities faced by industrial manufacturers," he reasons. "It's not feasible to shut down operations entirely to switch over to new technologies; rather, the transition needs to be gradual and strategic. This is where hybrid setups become incredibly valuable, allowing companies to integrate new electric technologies alongside existing systems, reducing emissions step by step while maintaining production continuity."

Rauramo says that both of Coolbrook's solutions – the RDH and the RDR – have been designed with this flexibility in mind. They can be retrofitted

Right: ***The steel industry is a prime example of a sector where electrification can lead to enormous benefits***



Above: ***The successful pilot means that the technology can move forward to industrial-scale projects at customer sites***



Right: ***Coolbrook says that the RotoDynamic Heater (RDH) is the only technology in the world able to reach high-temperature heat, up to 1,700°C, powered by electricity and without burning fossil fuels***

Left: ***The RotorDynamic Reactor (RDH) has been designed to enable a hybrid approach and can therefore be retrofitted into existing plants***

into existing plants, operating alongside traditional fossil fuel-based systems in a hybrid model. "For example, in steel manufacturing, the RDH can be used to preheat combustion air or scrap metal, which reduces the energy demand on fossil fuel burners," he explains. "Over time, as confidence in the technology grows and as more renewable electricity becomes available, these electric systems can gradually take on a larger share of the energy load, moving the industry closer to full electrification."

A hybrid approach not only minimises disruption but also allows manufacturers to optimise the return on investment by progressively reducing fossil fuel dependency and lowering the cost of decarbonisation per tonne of material produced. "This strategy ensures that the transition to a net-zero global economy is both feasible and sustainable in the long term. Governments and industries need to set ambitious long-term targets and act upon them in a decisive manner and RotoDynamic technology is there to support the required change," emphasises Rauramo.

RISK VERSUS REWARD

Developing strong technology is one thing, but selling and marketing it to industries that are either completely against any form of downtime (i.e. most manufacturing operations) or are slow to adopt new technologies (e.g. cement, aggregates) is another. But Rauramo is confident that widespread adoption will soon follow the initial deployments. "Our technology is based on advanced turbomachinery concepts that have been refined over decades. Given the strong positive business cases we have identified in multiple industries, we see that our partners and customers are increasingly willing to take on additional risk to achieve these benefits." Elaborating on this, Rauramo adds: "Our plan is to start from use cases where the downtime risk is either limited or can be effectively mitigated. In practice, this means using our technology outside of the continuous process, such as in drying of materials, or by retaining existing burners on the equipment to ensure continuous operation."

Could legislation be another enabling factor here? Rauramo feels it might: "Currently, there are areas in the world where electrification already offers a strong positive business case – such as low electricity price, significant cost for CO_2 emissions, and green electricity grid mix," he says. "In these areas, we believe electrification will take place regardless of regulatory changes. However, in areas where these conditions are not yet met, regulation will be crucial. For the world to reach the targets set in the Paris agreement, it is essential to pass legislation that lowers electricity costs, increases the share of CO2-free power, and imposes meaningful costs on emissions."

In the meantime, Rauramo is happily observing that multiple industrial players – "leaders in their respective fields" – are now willing to become forerunners in decarbonisation efforts alongside Coolbrook. And with an eye on the longterm benefits, he also remarks that, "The early adopters share our view that being a leader in decarbonisation efforts, and taking a calculated risk, can also create competitive advantage and prove to be a clear market differentiator further down the line."

WHAT'S NEXT?

When asked about the next stages of his electrification revolution, Joonas Rauramo begins by saying that Coolbrook is committed to starting a clean, new industrial era. "For us, this means achieving higher temperatures and greater thermal capacities. We are advancing the development of our next generation RDH, which can tackle the most demanding applications in our target industries. This product will be available soon. Simultaneously, we are continuing to develop RDR into a commercial product for the petrochemical industry".

And he reports positive signs coming from outside his own company, too. "Our partners, along with our broader target industries, have shown great interest in utilising our technology as a key enabler of their complete decarbonisation," he says. "We have completed tens of feasibility studies indicating the clear advantages our technology offers to our customers. The industry is eagerly awaiting the full commercial readiness of RotoDynamic technology. We are currently anticipating the first units to be operational in 2025."

Ben Warren, team leader of SPP Pumps' Future Cell training programme, looks at how considered and well-invested training programmes can overcome the skills shortage and provide engineering opportunities to both apprentices and existing employees

Shortage solutions

The skills shortage in engineering services is very real and is hitting hard in some sectors of the economy. In particular, the Engineering Construction Industry Training Board (ECITB) has highlighted a number of workforce challenges facing the water treatment and oil and gas sectors due to an ageing workforce. An estimated 19.5% of engineers currently working in the UK are expected to retire by 2026. Ensuring that the UK's future engineering needs are met is going to call for investment in skills among the next generation of engineers. While industry bodies such as Engineering UK and others are calling for clear and properly funded STEM skills plans, many commercial organisations are boosting the skills of their own employees through innovative training programmes.

SPP Pumps is combatting the skills shortage challenges with its 'Future Cell' initiative. This training area is aimed at both apprentices and existing employees who want to reskill into an engineering role or simply take the opportunity to learn from experienced colleagues.

Designed, planned and implemented by SPP's machine shop team, Future Cell's initial objective was to provide apprentices, as well as employees who wanted to retrain in engineering, an opportunity to extend their knowledge and skills through a series of challenges; working on real life pumping products and projects.

Investing over half a million pounds in specific equipment and developing learning programmes, the project was designed with a practical focus, ensuring that participants would gain hands-on experience, and recognised qualifications, through work-based operations in a fully equipped operational machining cell.

INVESTING IN THE FUTURE GENERATION

Because training is not limited to apprentices only, more experienced employees who want to retrain into engineering roles or expand their machining abilities are also able to benefit.

Two new CNC machines with remote monitoring and wireless probing help enable trainees to develop key programming and machining skills while

Left: ***Apprenticeships are an essential part of the future engineering workforce in the UK***

producing critical pump components. Success of the initial three month project proved the value of such an approach and secured further investment in equipment, with a state-of-the-art Electric Discharge Machining (EDM) tool recently been added to the programme.

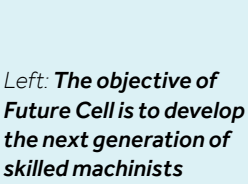
And, with the purchase of three conventional machines, trainees are given the opportunity to become proficient in the underpinning knowledge essential to CNC machining and production engineering. In addition, a bespoke quality area in the machining cell gives apprentices the capability to inspect both their own and others' work to both SPP's and broader industry standards - essential for safe, high-quality operations.

Future Cell was launched late 2023, and within its first three months had exceeded its six-month productivity goal.

PEOPLE AT FUTURE CELL'S HEART

A large part of the programme success was ensuring that the project leader had personal experience of being an apprentice. I joined SPP Pumps at 16 as a mechanical engineering apprentice and benefiting from outstanding training to become a multi-skilled machinist. As a result, I was selected to lead the Future Cell programme, for which I was humbled.

In 2013, after successfully completing my apprenticeship, I took up a role within SPP Pumps' machine shop – taking every opportunity to learn new skills, including additional responsibilities and further developing my leadership skills. It was



Left: ***The objective of Future Cell is to develop the next generation of skilled machinists***

only through this career opportunity that I realised the level of diligence and application needed to progress. Rather than it going to my head when named as the Rising Star at the Pump Industry Awards (PIA) by the British Pump Manufacturers Association's (BPMA), it increased my belief and determination that it was possible to train the next generation of engineers and promote opportunities that a company such as SPP can offer young people.

As its name suggests, Future Cell has a clear objective to develop the next generation of skilled machinists. With the help of other experienced members of our team, we aim to offer a versatile training environment covering all key machining disciplines, while producing high quality components and reducing sub-contracting costs.

SPP invested in me at an early age and gave me the opportunity to learn invaluable skills. We've created a structured training plan that ensures all apprentices cover the essential skills. We identify individuals' strengths and weaknesses and tailor their training accordingly, ensuring they gain the necessary knowledge and confidence to make technical decisions to help optimise the process' capacity and productivity.

We are keen to raise the aspirations, employability and opportunities among local young people, as well as the wider community. Future Cell provides a golden opportunity for young men and women interested in engineering – and specifically the pumping sector.

BENEFITS THROUGHOUT THE SKILLS NETWORK

The machining team has been engendering excitement and interest in engineering to the local community through primary school visits, secondary school careers events and scouting engagements. Together with STEM, the highly successful Future Cell initiative is the most recent investment in SPP's wider project to address and hopefully head off the future skills shortage.

With provisions for all ages often featuring discussions around imagining a world without pumps, the team has sought to increase understanding that a career in the engineering, and more specifically the pumping industry is available and rewarding.

> **"Ensuring that the UK's future engineering needs are met is going to call for investment in skills among the next generation of engineers"**

Left; ***Author Ben Warren (left) imparts some of his wisdom to a new recruit***

Protect and survive

Stewart Robinson MIET MInstMC, principal engineer and functional safety expert at TÜV SÜD, asks, 'how electrically safe is your machinery?'

Safety is one of the biggest and most important issues facing machinery owners today – and the electrical element is an essential consideration for keeping machine operators and maintenance personnel safe. Electrical safety is a set of rules and precautions that protect against potential electrical hazards. The regulations are designed to guard against electrical risks such as arcing and electric shocks. Due to the enormous influence that electrical components have on the reliability and quality of a product, machinery and processing equipment must meet several legal safety criteria.

Following the UK's exit from the European Union (EU), the actual process required for manufacturing compliant products has not changed from a legal perspective. As the EU Directives are transposed into national law, the UK already has a legal system in place that applies. EU harmonised standards have therefore simply been carried across as UK designated standards in order to maintain a single model.

The key standard for safety of electrical equipment of machines in Europe and the UK is BS EN 60204-1:2018 – Safety of machinery. This standard is published by the International Electrotechnical Commission (IEC) and done so in parallel, with some specific changes, by CENELEC (European Committee for Electrotechnical Standardization).

The machinery industry has been using this standard for many years, however it is somewhat complex. I have highlighted a few key aspects below.

The standard applies to electrical, electronic and programmable electronic equipment and systems to machines not portable by hand while working, including a group of machines working together in a co-ordinated manner. It therefore provides requirements and recommendations relating to the electrical equipment of machines which includes, but not limited to, enclosures, isolators, colour coding of actuators and documentation.

KEY CONDITIONS

The standard requires that electrical live parts be located inside enclosures or suitably insulated to provide protection against a human having direct contact with them. Any enclosures should only be able to be opened under one of three conditions:

- A key or tool must be used to open it
- Before it can be opened, live parts must be automatically disconnected
- Opening without the use of a key or a tool and without disconnection of live parts shall only be possible when all live parts are protected against direct contact to at least IP2X or IPXXB (see standard IEC 60529).

Electrical equipment and machinery must be explicitly tested to ensure the highest levels of safety in a facility

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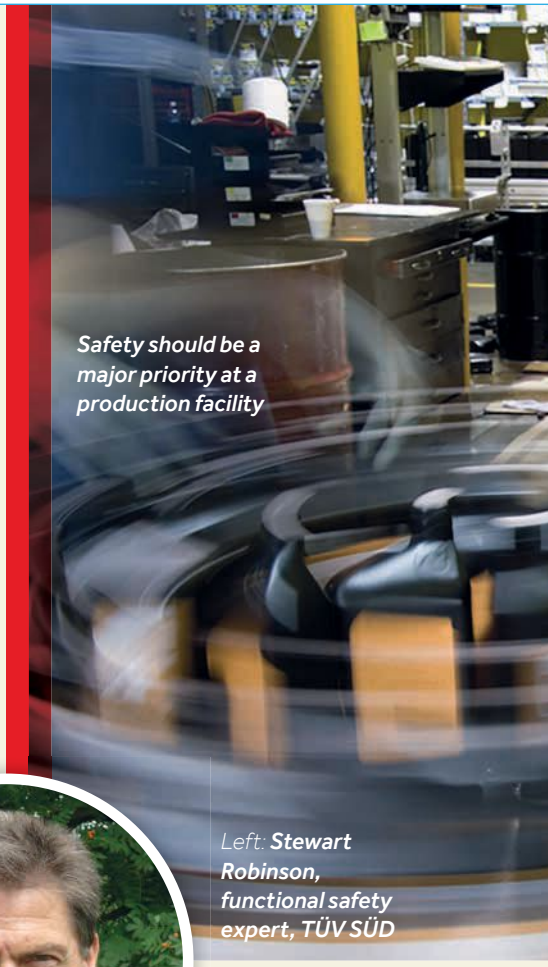


Safety should be a major priority at a production facility

Left: ***Stewart Robinson, functional safety expert, TÜV SÜD***

It is recommended that enclosure doors are no wider than 0.9m and have vertical hinges that have an opening angle of at least 95°.

Electrical operating areas (e.g. switch rooms), which allow a person to fully enter, must be provided with means to allow escape. Doors for such areas must have a clear width of at least 0.7m and a clear height of at least 2.0m. In cases where equipment is likely to be live during access and conducting parts are exposed, the clear width shall be at least 1m. In cases where such parts are present on both sides of the access way, the clear width shall be at least 1.5m.

The normative requirements for Electromagnetic Compatibility (EMC) is given without much detail. However, a detailed informative Annex H is included, which should be helpful to machine builders because it describes practical measures that can be used to reduce the effects of electromagnetic influences. Detailed guidance is also contained in specific EMC standards e.g. the IEC 61000-6 series.

The requirements for a 'supply disconnecting device' (an isolator) are described. An isolator is a manually actuated control device used to switch off the supply of electrical energy to all or a part of an installation where a risk of electric shock or another risk is involved. An isolator must be provided for disconnection of each incoming supply and for each on-board power supply. The standard also allows for the operating means for a supply disconnecting device, that is not intended for emergency operations, to have a supplementary cover or door for protection against environmental conditions. This is because if the operating means (the handle) of an isolator is exposed, it could suffer from degradation due to environmental conditions or have mechanical damage. The requirements relating to isolators are listed in Clause 5 of EN 60204.

SUPPLY ISSUES

The terminal for the external protective conductor must be in the same compartment as the incoming supply not simply "in the vicinity". Also, for the breaking capacity of the supply disconnecting device, the calculation must consider motors supplied by inverters or similar devices (power drive systems).

Supply disconnecting devices are also often provided for the purpose of isolating electrical equipment (Clause 5.5) instead of simply 'devices for disconnecting...'. This is because while there has always been a distinction between 'isolation' and 'disconnection', it has not always been easily understood. This addition therefore helps with clarification.

> **"Due to the enormous influence that electrical components have on the reliability and quality of a product, machinery and processing equipment must meet several legal safety criteria"**

Isolation is a "procedure to securely disconnect and separate a machine from all hazardous energy sources" (source BS 14100).

Measures for protection against electric shock are also described. The measures are for protection against direct contact (basic protection) and for protection against indirect contact (fault protection). This is followed in the standard by measures for the protection of equipment.

Equipotential bonding (earthing/grounding) is a basic provision for fault protection, so the standard also describes detailed requirements for protective conductors.

Control functions are the subject of clause 9 of the standard. Basic functions are included but there are also additional functions described. For example, clause 9.3.6 considers the 'suspension of safety functions and/or protective measures', with specific requirements for mode selection to deliver clarification and emphasis. This is important because selection of a different operating mode may have an impact on the risk. For example, when a guard interlock is bypassed to allow operation for maintenance or setting purposes.

Clause 10 of the standard includes colour coding and marking requirements for actuators. Also, unless otherwise agreed between the machine supplier and the user (the details of which is covered in Annex B of EN 60204-1), machine status indicator lights should be colour coded, with each colour identifying a specific status.

An example of the use of specific colours in Section 10.2 'Actuators' is reserving the red/yellow colour combination for 'emergency operation devices'. It also reserves the colour yellow '...for use in abnormal conditions, for example, in the event of an abnormal condition of the process, or to interrupt an automatic cycle.'

IS YOUR MACHINERY COMPLIANT?

Clause 17 of the standard outlines what technical documentation is required to demonstrate compliance. This includes information relating to a machine's electrical installation, operation, and maintenance, which can be in the form of drawings, diagrams, charts, tables and instructions.

While verification can be done at different stages throughout the design and development lifecycle process, even at the end of it, it would be better to do this as early as possible during design. As verification is intended to assure the conformity of a product, it is more cost-effective for faults to be identified and rectified during design, rather than waiting until the final machine is produced.

The extent of the verification that is required is made clear in the specific product standard that relates to each different type of machine. However, where there is no such dedicated standard, EN 60204-1 requires that it must always include:

- verification that the electrical equipment complies with its technical documentation
- in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2
- functional tests

EN 60204 often requires only a self-declaration against the conformance process. However, this does depend on the type of machine. For example, if EN 60204 was used for the presumption of conformity of an Annex IV machine, the electrical parts would still be included in the 'special procedures' required.

The complexity of EN 60204, coupled with the potential lethal consequences if electrical safety is incorrectly administered, means that compliance is not a process that machine users can afford to get wrong. However, the development of a practical checklist is a useful approach that will help ensure all relevant considerations have been covered.

OTHER REQUIREMENTS

Alongside the specifics of EN 60204, there are several global directives for electrical equipment and components with which machinery must comply.

The Low Voltage Directive (LVD) (2014/35/EU) ensures that electrical equipment falling within specific voltage ranges provides a high level of protection for European citizens and takes full advantage of the single market.

The Machinery Directive consists of a comprehensive set of health and safety regulations that machinery manufacturers must declare they have complied with to sell their products in the EU. For the UK market, the Supply of Machinery (Safety) Regulations 2008 continues to be in alignment with the EU's Machinery Directive. These are closely linked and require compliance with the LVD (The Electrical Equipment (Safety) Regulations 2016 in the UK) and the ATEX Directive (UKEX in the UK). The latter of these regulates the requirements for equipment that is used in potentially explosive atmospheres. Alongside these, the EMC Directive (Electromagnetic Compatibility Regulations 2016 in the UK) aims to control electrical interference between different devices, and compliance with it is mandatory.

This means that all electrical equipment and machinery must be explicitly tested, certified or marked. With so many electrical components, it is vital to test electrical safety and ensure compliance with the complex array of relevant standards and regulations.

In semiconductor production, high precision is essential. A critical stage is the lapping of the blanks, which ensures a uniform thickness. In order to continuously monitor the wafer thickness, white light interferometers are ideally suitable, says Glenn Wedgbrow, business development manager at Micro-Epsilon UK

Through thick and thin

Many process steps are required before semiconductor chips can be made from silicon. First, slices around one millimetre thick are cut from a crystalline silicon ingot, which are then lapped. This gives them the desired thickness and surface quality. Only then can semiconductor chips be manufactured from the wafers using further processes.

With modern lapping machines, the surfaces can be processed with extremely high precision. Silicon wafers require surface inaccuracies in the nanometre range. To machine the surface, a mixture of liquid and cutting grains is placed between the lapping disc and the wafer. Material is removed and the surface smoothed as the lapping disc and the wafers rotate against each other around different axes. The thickness of the wafer must be measured in order to achieve the required accuracy in terms of surface quality and thickness.

One measuring method that enables thickness measurements with accuracies in the nanometre range is interferometry, which is based on the wave nature of light. If two waves are superimposed, constructive interference can occur when wave crest meets wave crest or wave trough meets wave trough.

INTERFEROMETRY IN INDUSTRY

As a metrological method, interferometry uses a light beam that is split so that the two partial beams travel different paths. The partial beams are then superimposed and the resulting interference is observed. If the length of one of the two partial beams now changes, this is visible in the interference pattern. If this length changes by half a wavelength of the light used, there is a complete change from constructive to destructive interference. If the method is to be used for thickness measurement, the two beams can interfere with each other, which is reflected by the front and back of the layer.

WHITE LIGHT INTERFEROMETERS

Interference works with monochromatic light, for example, from a laser. When the measured length is changed, the interference pattern alternately changes from light to dark. However, in principle, interferometry also works with white light. The only important factor is that a coherent light source is used. Superluminescent diodes (SLDs), for example, are suitable for white-light interferometry. These combine

In the manufacture of semiconductor wafers, thickness and surface quality must be accurate to the nanometer in order to ensure the required quality

Left: ***The white light interferometers for wafer thickness measurement each consist of a compact sensor and a controller***

the advantages of laser diodes and conventional LEDs. SLDs have a high output power and a broad spectrum.

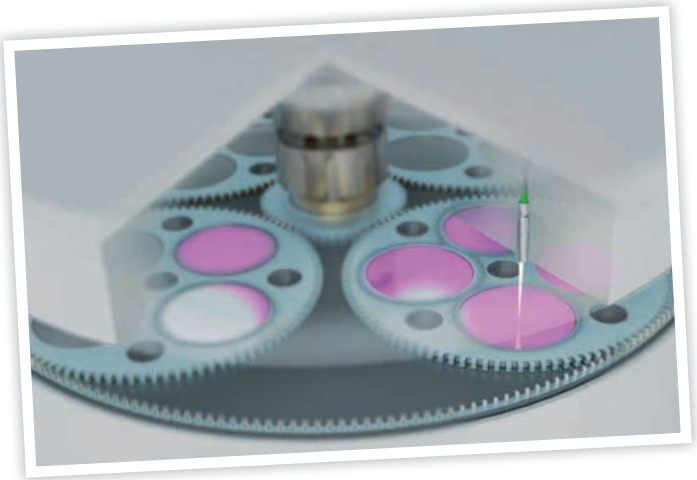
Micro-Epsilon offers interferometers that operate using SLDs. The light beam is split, the partial beams pass through the two paths and then interfere. For the measurement, the interfering light is first split into its spectral components and then imaged onto a sensor line that records the entire spectrum. A Fourier transform is then performed to evaluate this signal. The individual peaks in the frequency spectrum then represent constructive interference, resulting in the difference between the two paths. If the two partial beams are created by reflection on the front and back of a transparent material, the thickness can be determined to a very high accuracy.

"One measuring method that enables thickness measurements with accuracies in the nanometre range is interferometry, which is based on the wave nature of light"

NEW DEVICES FOR SEMICONDUCTOR WAFERS

Micro-Epsilon has had white light interferometers in its portfolio for several years. However, the existing devices had to be fundamentally redesigned for use in wafer production. The background to this is the optical transparency of the silicon wafers, which is only high enough to be suitable for interferometry in a wavelength range around 1,100 nanometres. At these wavelengths, both undoped silicon and doped wafers provide sufficient transparency. The challenge in designing the new interferometers was selecting the right components. In addition to new SLDs with the appropriate wavelength range, new gratings and a suitable detector array had to be used that are suitable for this wavelength range. The transparency of the silicon makes it possible to measure the thickness of wafers from 0.05mm to around 1mm. As transparency decreases with doping, the maximum measurable thickness is reduced to around 0.8mm for highly doped wafers.

The white light interferometers each consist of a compact sensor and a controller, which is housed in a robust, industrial-grade housing. The active temperature control included in the controller ensures high measurement stability. Micro-Epsilon offers two different device types for use in the thickness measurement of wafers. A high degree of protection is required for integration in lapping machines so that the sensors are not affected by the mixture of liquid and cutting grains used. With this type, both the sensor and the controller unit comply with protection class IP67. However, thickness measurement can also be used in other stages of semiconductor production, for example, quality control.



Left: ***White light interferometers measuring wafer thickness in the machine lapping process***

PRODUCT LAUNCH PROGRESS

The new range of interferometers from Micro-Epsilon for measuring the thickness of wafers have already been extensively tested in reference projects in the semiconductor industry. In the lapping machines, the devices measure reliably even when there is liquid with the cutting grains on the wafer surface. The cleanroom variant uses Micro-Epsilon's own cleanroom technology, which enables cleanroom-compatible packaging of the components, for example.

The IMS5420-TH white light interferometer opens up new perspectives in industrial thickness measurement of monocrystalline silicon wafers. Due to its broadband superluminescent diode (SLED), the IMS5420-TH can be used for undoped, doped and highly doped SI wafers. In wafer thickness measurements, the IMS5420-TH impresses with an excellent price/performance ratio.

The white light interferometer achieves a signal stability in the sub-micrometer range. The thickness can be measured from a distance of 24mm. The measuring system is therefore ideally suited for inline measurements.

The measuring system is available as a thickness measuring system or as a multi-peak thickness measuring system. The multi-peak system measures thicknesses of up to five layers, for example, wafer thickness, air gap, films and coatings.

Sulzer supports wastewater treatment project

Sulzer provided submersible mixers to plant near Naples, Italy, that are expected to cut energy costs by up to €45,000.

Elisabetta Sardi, area manager at Sulzer, explained: "We suggested the use of our XRW 400 submersible mixers. These deliver an effective processing of wastewater and are equipped with premium efficiency IE3-equivalent, sensorless, permanent-magnet motors that are controlled by variable frequency drives.

"This means that they can

adjust their speed to suit the real-time environmental conditions rather than maintaining a set speed at all times. As a result, it is possible to reduce energy use whenever possible, delivering significant benefits when it comes to operational costs and environmental performance."

In practice, the use of conventional solutions with IE3-equivalent, three-phase, squirrel-cage motors could reduce energy costs by €8,000 at the plant. Conversely, the XRW 400 series could slash such expenditures by more than five times, delivering savings of up to €45,000. Even more, the presence of drives supports self-cleaning functions, enhancing the service life of the mixers in such challenging applications while reducing downtime, maintenance activities and their associated costs.

Council continues renewable power production

Durham County Council equipped its former landfill site at Coxhoe with generators that produce electricity from the methane biogas created by decomposing waste.

The volume and quality of biogas available at the site have changed over time – especially as the landfill has been closed for several years. This means the existing configuration of the historic power generators struggled to provide the reliable, efficient power as they did when the landfill was open and regularly refilling with waste.

Analysis of the volume and quality of gas produced at the site confirmed that the current configuration of four 1MW generators was no longer suitable. Continued use of the generators would not only have meant unreliable production, but a potential shortened lifespan of the generators and increased servicing and repair costs, which could lead to generator downtime. This downtime can cause biogas to divert to the site Flare, combusting the wasted gas and creating unwanted carbon dioxide emissions.

Instead two smaller units were specified – a Cat 400kWe and Cat 600kWe, reciprocating power generators (CG132B-08 & CG132B-12) to replace two of the 1000kWe power generators. These would be able to cope better with the

lower volume and more unpredictable quality of methane. This was backed with the same Finning maintenance and support package to troubleshoot issues before they cause unplanned downtime.

Durham County Council can now benefit from more consistent running times and outputs in their work to reach net zero.

Mike Curry, environmental systems manager for Durham County Council, said: "We were very happy with the solution Finning provided, and the assurance that the maintenance and support package maximises uptime from the generators. We are now considering whether to add a further 600kWe unit given how well our current generator has coped with the methane produced at Coxhoe."

Burket control vales help UK brewery

Burkert provided its Element range of pneumatically actuated continuous control valves to help a UK brewery secure productivity.

Burkert's Element range of pneumatically actuated continuous control valves addressed the limitations of the previous equipment.

Kieran Bennett, industry manager, food, beverage, chemical and petrochemical at Burkert, explained: "These valves are fully sealed and feature air recycling technology, which prevents ingress of ambient air, chemicals and contaminants. The clean dry air used to pressurise the actuator is fed back into the spring chamber via a pilot valve, which helps to prevent internal contamination and corrosion. This ensures a long service life.

"A contactless position control system eliminates wear and clogging issues. The piston actuator is smaller and lighter, while offering better compatibility with brewing processes than competing diaphragm designs. Users can expect 0.1% accuracy over seven million cycles, more than three times longer than conventional alternatives. An LED digital display on top of the valve also provides key process information to operators."

The Element valves feature a stainless steel exterior for ease of cleaning and inherent chemical resistance. The design is said to ensure no purchase for bacteria or contaminants. Combined with ingress protection ratings up to IP67, the design is ideal for production environments with regular washdowns. The system installed at the brewery included digital leakage alerts, as well as intuitive read-outs for flow, temperature, pH levels and operating pressure.

Autonomous vehicle to monitor waterways

The Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB have developed an autonomous surface vehicle capable of surveying bodies of water.

The precise surveying of water bodies is demanding. TAPS, the Fraunhofer IOSB's semi-automatic direction finding system for rivers and lakes, is able to perform this task both under and above water. The autonomous vehicle, which measures approximately 2 x 1.5 x 1m, travels along the relevant waterway and automatically avoids obstacles, whether stationary or moving. At a speed of two knots - which corresponds to around 3.7km/h - such a mission can last up to 20 hours. For visual mapping of the shore areas, TAPS has two cameras attached to a mast, each pointing to starboard or port and whose fields of view do not overlap. Due to their high resolution, the cameras allow a visual inspection of relevant infrastructure, such as quay walls, as well as 3D modelling of the shore area based on the recorded image data.

"We use an automated system for intelligent image capture. As soon as one or both cameras are focussed on a predefined area of interest, image recording is started. The vehicle's own movement is also used to store only image data that is recorded from different angles and therefore offers added value in terms of content," explained Boitumelo Ruf, expert in photogrammetry in the autonomous robot systems research group at Fraunhofer IOSB.

GNSS (global navigation satellite systems, such as GPS) and IMU (inertial measurement unit for position determination) data serve as the basis for determining the position and orientation of the TAPS platform.

EuroChiller reduces energy costs for Polypipe

Polypipe Building Services is reportedly saving up to £36,000 a year in electricity costs thanks to a process water cooling system at its polymer pelletising plant in Aylesford.

The new cooling system was designed and installed by Isocool and incorporates free air coolers manufactured by Eurochiller, both of which are part of the Atlas Copco Group.

Polymer production at the Aylesford site uses two-stage mixers (hot and cold). The polymer is blended at an optimum temperature of over 100°C before passing into a cold mixer for rapid cooling to 50°C. Once cooled, the polymer is then pumped to dry blend silos, pelleted and extruded into shape. Each batch takes approximately eight minutes to process. Polymer production of this scale requires cooling water at a constant temperature of 15°C and a flow rate of 80m³/hour. This equates to 200kW for each chiller.

To improve efficiency and reduce energy consumption, Polypipe Building Services decided to upgrade the chiller plant to a new 'free air' system. This means that when the ambient air temperature falls below a set temperature, the chillers switch off and use the outside cool air to chill the water.

Isocool designed, specified and installed a new cooling system to address the confines of the existing plant room.

"For this project, we used a combination of Eurochiller products and third-party equipment to address the space restrictions and deliver the cooling levels that the application demanded," said James Cowen, Atlas Copco regional sales engineer - process cooling solutions.

Jungheinrich donates forklift truck

Jungheinrich UK has donated a counterbalance truck that will enable the Rebuild Site to do even more to support Cumbrian construction's circular economy.

The Rebuild Site is a community interest company that is encouraging the construction industry to dismantle rather than demolish so that used, excess and nearly-new materials can be used in community projects.

Loading and unloading materials was a challenge for the Rebuild Site. The new counterbalance truck replaces an ageing forklift that had caught fire.

Rebuild director Emma Porter said: "I emailed every forklift manufacturer I could find and Jungheinrich replied saying 'we might be able to help'. When I got a call to say our counterbalance truck was in the workshop, I realised this was actually happening.

"We've got a poster in the office that says 'there's nothing as powerful as an idea that's found its day'," added Porter. "I think that's why The Rebuild Site works, but for it to work well we need the support of so many people: the construction industry, our brilliant volunteers, our partners - and now Jungheinrich. It's going to make such a difference – and not just with the loading and unloading; it will allow us to divert more materials from going to waste and enable us to make much better use of our space."

Stepper drives boost industrial automation

Moons' Industries has introduced a generation of AC Pulsed Stepper Drivers that are said to meet the increasing demands of factory automation and similar industry applications.

The new SRXAC Series is claimed to offer features and benefits. For example, Versatile Voltage Support is expected to ensure single-phase 85-265V AC input with maximum current options of 4.5A, 8A and 12A. This means they are ideally suited to a range of applications which demand various torque requirements. Additional features combine to provide user-friendly configuration such as a Type-C interface, which helps to simplify tuning.

Additionally, the drivers meet the demand for enhanced performance because they offer higher continuous torque output at up to 1200rpm.

The configuration process has been streamlined, allowing quick set-up of parameters such as sub-division, speed, running current and idle current via a 16-bit DIP code. For customised settings, users can connect through the Type-C interface to modify and save parameters using Moons' configuration software.

The SRXAC series supports both pulse (-S) and speed (-V) modes offering users flexible control methods to suit a wide range of application needs.

The speed mode increases the options for acceleration / deceleration and can also be tailored through software adjustments.

The SRXAC series is suitable for factory assembly lines, logistics conveyor belts and the food industry.

Elgi expands its EQ Series range

Elgi Compressors Europe has expanded its portfolio of direct drive screw air compressors from 11-22kW with new 30-45kW units and pressure versions up to 15.5 bar g.

The EQ Series is expected to provide reliability to manufacturing plants with relatively lower-duty cycles that traditionally use small belt-driven air compressors. In line with Elgi's customer-centric approach, the EQ 'Elgi Quest' Series is built for customers requiring reliable compressed air at improved flows.

The Elgi EQ 11-45kW is engineered to meet the needs of small- to medium-sized industrial customers, including vehicle service centres, general manufacturing and wood and metalworking industries.

With the new 15.5 bar g version, the EQ 11-45kW models are now capable of meeting the requirements for applications such as laser cutting of metals.

Suitable for operating in dusty and humid conditions with an ambient temperature rating of up to 50°C, the EQ Series is said to deliver compressed air at improved flows.

Niccolò Casini, director of product management at ELGi Compressors, Europe, said: "Our customers have already seen significant benefits from our EQ Series screw air compressors, elevating their businesses with reliable compressed air, peak efficiency and substantial cost savings. Responding to market demands for more industrial-grade compressors, we are now expanding the EQ Series from the current range of 11-22kW, adding more powerful 30-45kW units."

Fluke to combine tech with Augmentir

Fluke Reliability has entered a partnership with Augmentir to improve maintenance, repair and operations (MRO) for industrial customers.

The partnership will see Augmentir integrate its connected worker platform with Fluke's artificial intelligence (AI)-powered enterprise asset management solution.

Augmentir is a connected worker solution, providing a suite of AI-powered connected worker tools that help industrial companies deliver skills management, training and collaborative digital workflows by digitising and optimising frontline work processes.

Fluke enables customers to adopt a connected approach to their reliability strategies, bringing together hardware, AI-powered software, services – and its eMaint platform within one workflow. The solution can help customers shift from reactive to predictive maintenance strategies, assessing the health of their assets and using the AI diagnostic engine, which means customers can predict faults up to six months in advance.

The partnership enables maintenance and operations departments to engage in integrated digital operations on the plant floor. Augmentir is claimed to boost efficiency with digital tools that reduce onboarding and increase productivity.

Fluke Reliability chief technology officer, Aaron Merkin, said: "Our ethos has always been to simplify processes for the end-user. With a growing skills gap and aging workforce, we know the workers of tomorrow are best supported with technology that helps them get the job done quicker and more efficiently. Augmentir's connected worker platform supports workers with that in mind, utilising AI technology that complements our own."

Augmentir co-founder Russ Fadel added: "We know that there's a growing need for digital support for workers across manufacturing operations. Augmentir's solution is aimed squarely at solving manufacturing's biggest challenge: the skilled labour crisis - helping operators onboard workers faster, enabling targeted reskilling and upskilling of their current staff, and supporting workers with individual guidance."

Ystral rolls out continuously operating disperser

Mixing and dispersion specialist Ystral has extended its portfolio with the launch of Ystral Coflow, a continuously operating power wetting and dispersing machine.

The inline dispenser is said to be suitable for a range of applications in different industries.

With the Ystral Coflow, powdered solids are inducted, mixed and dispersed into liquid streams in a controlled way and in proportion to quantity via volumetric or gravimetric solid dosing systems. The powders and liquids are combined in a premixing zone, fine dispersion then occurs via a rotor-stator system, whereby the dispersing tools can be designed with different slot widths depending on the application.

"The product then experiences an increase in pressure via an inducer installed between the premixing zone and the rotor-stator zone", said Uwe Klaumünzner, expert process and application engineering at ystral. "This change in pressure then causes separation of the air that was introduced with the powder, thus a lower residual air content in the product. In addition, this inducer is used as axial pumping stage, to be able to also process more viscous products and then pump them from the dispersing stage."

The focus here is on products that are produced in large series or are to be manufactured in perspective in large volumes. If post-dispersion is required, an inline dispersing machine can be installed downstream of the Coflow. In the chemical industry, Ystral Coflow, for example, is suitable for the production of adhesives, coatings, polyester resins or silicone sealants. Among others, in the food sector, the continuously operating powder wetting and dispersing machine is the suitable solution for pre-products for dough production, milk and milk substitute products, as well as the production of edible collagen shells, mayonnaise or dressings.

Azane gets approval in principle

Azane Fuel Solutions has received approval in principle from classification society DNV for its Ammonia Release Mitigation System (ARMS).

The approval comes as Azane Fuel Solutions continues to develop technologies to safely handle ammonia as a fuel on board ships and builds on the company's expertise within ammonia bunkering solutions.

The Azane ARMS is connected to the vessel's fuel and engine systems. It gathers the ammonia releases from these systems and ensures that any ammonia emissions from the ARMS to the surroundings stay below the required thresholds, thus carrying out the function of protecting the vessel's crew and the environment from harmful concentrations of ammonia.

DNV's approval demonstrates Azane's ability to develop ammonia fuel handling technology. It adds to DNV's approval in principle for the company's floating bunkering terminal in 2022 and a safety permit for an ammonia bunkering granted earlier this spring.

Steinar Kostøl, vice president projects& products, said: "Efficient ARMS technology is a critical enabler for the wider adoption of ammonia as a marine fuel, as we expect this to become mandatory equipment for all ammonia powered vessel. When developing our bunkering solutions, we looked for a way to minimize the maintenance required for the ARMS. We wanted a more dependable solution for such a critical component. The result is a technology that neither requires a liquid or the burning of residuals, making our solution more robust, more reliable and easier to integrate with different vessel designs."

Anglia now offers C&K Switches

Anglia Components has expanded its portfolio to include a range of electromechanical switches and interconnect solutions from C&K Switches.

C&K was acquired in 2022 by Littelfuse, a franchise supplier partner of Anglia – and the distributor was awarded full access to the C&K portfolio.

John Bowman, marketing director at Anglia, said: "We are extremely pleased to be able offer the C&K switch and interconnect range to our customer base. C&K is one of our industry's most respected names and stands as a byword for product innovation and quality. The addition of the C&K product line also strengthens our already excellent relationship with Littelfuse."

Added Lisa Ehramdjian, European channel manager at Littelfuse, said: "Anglia is one of our key supply chain partners already, so we know they will do an excellent job designing in C&K switches and interconnect products and we are delighted to continue development of our business with them."

C&K delivers electromechanical switches. Standard products include tactile, rocker, toggle and micro-switches, and the company is also able to customise switches to meet customer requirements for haptic touch, look, sound and other features.

ACCIDENT REPORT

A selection of recent plant-related investigations by the Health and Safety Executive

Two recent incidents caused by inadequate supervision and risk assessments each resulted in the death of a worker, while a third was seriously injured.

Firstly, two companies have been fined after a self-employed engineer from Sheffield was crushed to death by a machine.

Premier Engineering Projects Ltd, of Industry Road, Carlton, Barnsley, South Yorkshire, was fined £28,000 – and M&M Mobile Crane Hire Ltd, of David Road, Colnbrook, Slough, was fined £48,000.

The Health and Safety Executive (HSE) investigation found the incident was avoidable and Russell Hartley would still be alive had this work been planned, managed and monitored to a sufficient standard.

Hartley had been hired by Premier Engineering Projects Ltd to replace machinery at a materials recycling facility on Twelvetrees Crescent, Bow, London.

The 48-year-old led a group of four engineers tasked with replacing a Trisomat screen, known colloquially as a 'flip-flop', on 24 February 2020, when the incident occurred.

The flip-flop, a machine that sorts different sizes of waste, was fixed within a metal structure at height in a bay at the site.

The crane, supplied by M&M Mobile Crane Hire Ltd, was first used to lower the flip-flop from its position at the site.

Hartley then took over using a telehandler. With the flip-flop resting on the telehandler's forks, the machine began to go further down the bay.

The flip-flop became jammed in the bay when Hartley attempted to reverse the telehandler.

The crane was then used again to lift the flip-flop off the telehandler, which, unknown to the workers, had its forks slightly raised above ground level.

As the crane moved towards the telehandler, the flip-flop toppled forwards off the forks and crushed Hartley. Another worker, who was standing on the flip-flop at the time, was thrown off the machine but escaped serious injury.

The HSE investigation found that two contractors, Premier Engineering Projects Ltd and M&M Mobile Crane Hire Ltd, failed to ensure the safety of those involved in carrying out the replacement of the Trisomat screen. The work being undertaken was not properly planned, supervised or carried out safely, while the assessment of the risks arising from the work was both unsuitable and insufficient. Hartley was working with nine other engineers, also hired by Premier Engineering Projects, as well as three workers from M&M Mobile Crane Hire Ltd at the site.

Elsewhere, Veolia ES (UK) Limited of Pentonville Road, London, was fined £3 million after one man died and another seriously injured while decommissioning a North Sea gas rig.

Stephen Picken, 62, and Mark Kumar were working for Veolia ES (UK) Limited at an onshore facility in Great Yarmouth.

Both men were working as demolition operatives also known as "top men", undertaking the decommissioning and dismantlement of offshore structures.

On 17 October 2019, the two workers were removing an overhanging piece of metal pipework (known as a skirt pile), weighing in excess of 27 tonnes, from a jacket - a structure placed in the sea designed to support oil and gas rig platforms - when it gave way. The pile struck the mobile elevating work platform (MEWP) containing the men, throwing them to the ground about 12m below.

Picken died at the scene and Kumar suffered serious life-changing injuries.

An investigation by HSE identified serious failings with the planning and the risk assessment, which did not adequately cover the planned works. Shortcomings in supervision of the incident were also identified. The company did not risk assess the skirt pile being removed as it was considered low risk. As a result, there was no cutting plan or safe system of work for the skirt pile.

Demolition, dismantling and structural alteration work must be carefully planned and carried out – HSE has guidance (www.tinyurl.com/56f73xet) on this.

After the hearing, HSE inspector David King, said: "This incident, in an emerging industry, highlights the level of controls required to safely demolish what are large, dangerous structures. Veolia did not meet these standards and tragically one life was lost, and another forever changed."

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t: +44 (0)20 7630 1111

e: cenv@soe.org.uk

w: soe.org.uk/cenv

Although the standards are high, SOE makes the process simple

"Becoming registered with the Engineering Council is an immediate statement of competence that is recognised around the world"

John Baxter FSOE FIPlantE CEng CEnv

Society of Operations Engineers

START YOUR JOURNEY TO ENGINEERING COUNCIL REGISTRATION

Members of SOE's professional sectors are eligible to apply for Engineering Council registration. Depending on your qualifications and experience, we are able to offer:

Engineering EngTech Technician

Incorporated IEng Engineer

Chartered CEng Engineer

WHY SHOULD YOU REGISTER?

- Formal recognition of your knowledge and skills
- Improved career and salary prospects
- Validation of your annual CPD

We are also able to upgrade and register those currently holding Associate Member grade who meet the requirements.

Talk to us today:

t: +44 (0)20 7630 1111

e: registration@soe.org.uk

w: soe.org.uk/EngC