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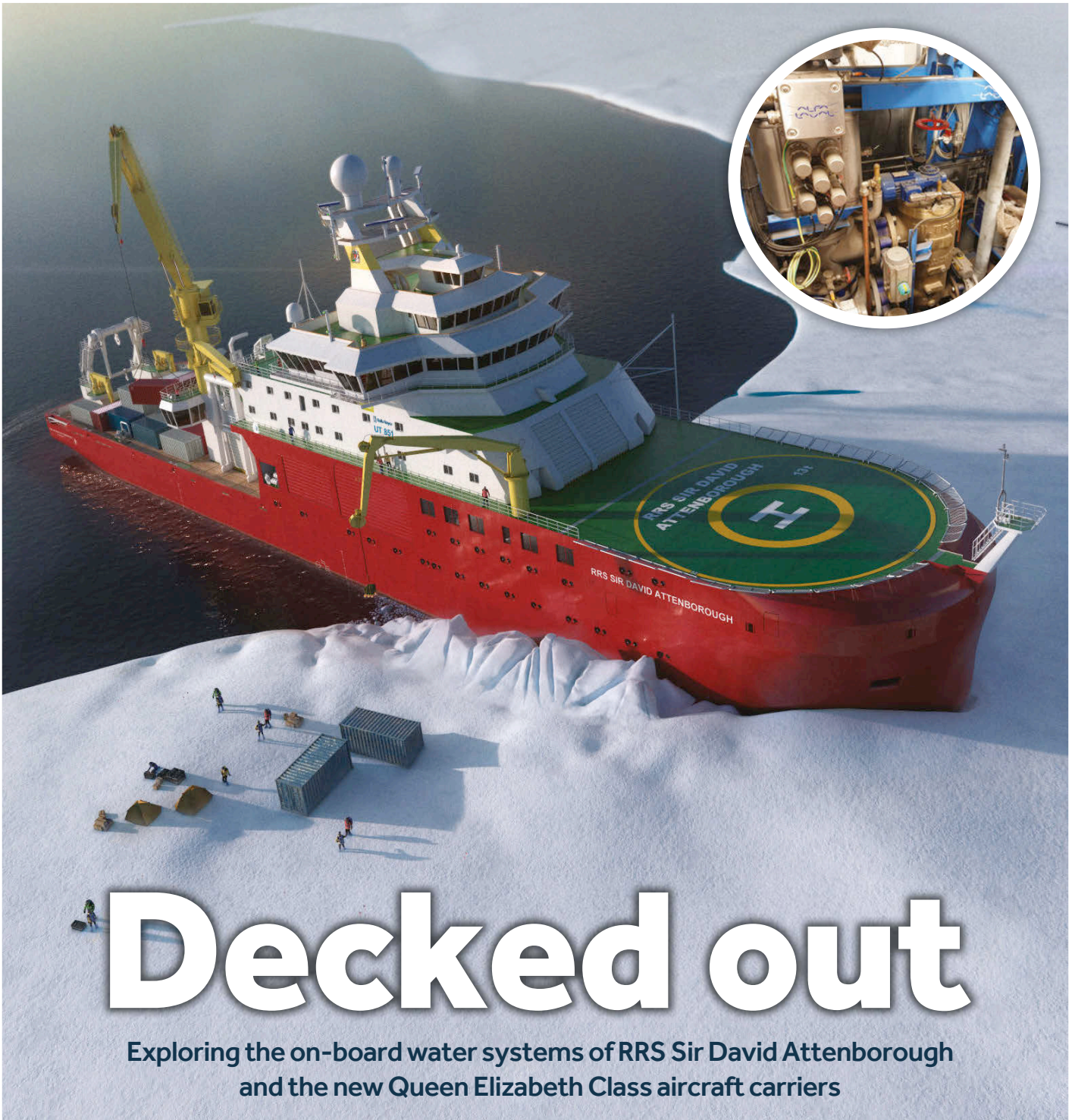
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ISSUE 16 | FEBRUARY 2020

FROM THE SOCIETY OF OPERATIONS ENGINEERS



Decked out

Exploring the on-board water systems of RRS Sir David Attenborough
and the new Queen Elizabeth Class aircraft carriers

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pipe welding work?

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boilerhouse energy

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courses explored

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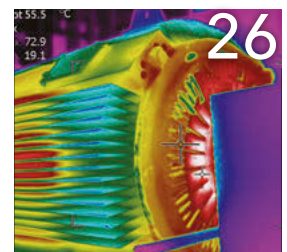
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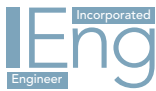
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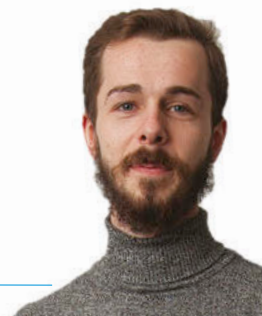
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Mission statement

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.


Floating cities

The November 2019 issue of *Operations Engineer* featured an interview with new SOE patron Sir John Parker, a near 60-year veteran of industry who started his career in shipbuilding.

Among other comments, he said: "Ships have every engineered system; they are floating cities. They have their own electricity, their own sewerage system, their own hot and cold water and their own accommodation. Providing it all is a huge mass of systems engineering."

That comment, in truth, has inspired the cover story of this issue, which looks at the on-board water systems of different vessels, including RRS Sir David Attenborough (SDA). This research ship will be used for months at a time by scientists who are researching oceans, ice and atmosphere. It is fitting then that RRS SDA is also taking its environmental responsibility seriously through a ballast treatment unit.

The implementation of this system follows the International Convention for the Control and Management of Ships' Ballast Water and Sediments (www.is.gd/ikitug), which entered into force in 2017 and introduced global regulations to control the transfer of potentially invasive marine organisms. They can have devastating consequences on local ecosystems, altering and degrading the environment, and negatively impact native species and people.

Onshore facilities adhere to a range of environmental regulations and standards, so a convention for vessels surrounding the transfer of marine organisms is most welcome. If we're to protect our planet, we must take environmental protection seriously, and it is great to see that RRS SDA, like many other vessels, I'm sure, is playing its part and adhering to standards. 

URLs in *Operations Engineer* magazine

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An artist impression of the University of Sheffield AMRC North West facility

AMRC Lancashire facility gets the green light

Planners at South Ribble Borough Council and Ribble Valley Borough Council have granted permission to the University of Sheffield's Advanced Manufacturing Research Centre (AMRC) to build and equip a £20m facility at the heart of the Samlesbury Aerospace Enterprise Zone – one of four zones that makes up the wider Lancashire Advanced Manufacturing and Energy Cluster.

The new 4,500m² facility, which will have a focus on light-weighting technologies, battery assembly and vehicle electrification, is being built with capital funding provided through the Lancashire Enterprise Partnership (LEP)'s Growth Deal. It will include, among others, machine tools, additive and hybrid manufacturing, automated assembly, robotics, and autonomous manufacturing processes and systems.

In addition, a £2.5 million revenue grant from the European Structural Investment Fund (ESIF) matched with £1.6m from the High Value Manufacturing Catapult, will secure the creation of an R&D team that will aim to enhance the manufacturing base of Lancashire, working with manufacturing

companies and their supply chains.

Dave Petley, VP for research and innovation at the University of Sheffield, says: "The new facility in the North West will be the catalyst for manufacturing growth, supporting the supply chains in the region to drive up productivity and attract inward investment to create a sustainable future for advanced manufacturing in the region."

Currently operating from interim facilities provided by the University of Central Lancashire (UCLan) in the centre of Preston, the growing University of Sheffield AMRC North West team is already working with more than 65 small and medium sized manufacturing firms from across the region, as part of its mandate through the ESIF funding to enhance the regional economic base and its supply chains.

Melissa Conlon, commercial director for University of Sheffield AMRC North West, adds: "The University of Central Lancashire has been a great support. We are working on a number of collaborative R&D projects with a number of key stakeholders to drive forward advanced manufacturing across Lancashire."



Hiab offering in Northern Ireland

On-road load handling equipment specialist Hiab has strengthened its offering to customers in Northern Ireland and the border counties with the addition of MAW Engineering as an authorised Hiab sales and installation partner.

IMH opens facility at the Port of Blyth

Industrial and Marine Hydraulics (IMH) has opened a new facility at the Port of Blyth, UK, that is equipped to provide on-site service and inspection operations.

IMH was founded in 1983 and supports customers with hydraulic engineering expertise in a wide range of sectors, including oil and gas, subsea, offshore and onshore renewables, nuclear, and automotive. Companies on the port – which is situated on the coast of Northumberland, North East England – will be able to tap into hydraulic solutions, inspection and service capabilities provided by IMH, including flushing rigs and testing equipment.

IMH engineers will be joined at their new facility by MJR Controls, which provides E&I control systems that complement IMH's hydraulic solutions, as well as Ferschl, a specialist hose supplier.

Customers can also benefit from IMH's capabilities in design, manufacture, installation, component supplies, consultancy and training, which are delivered through its head office in Middlesbrough, UK.

Martin Lawlor, chief executive of Port of



Blyth, says: "We're delighted to welcome IMH to its new facility at the port as we recognise its expertise and experience will enhance our own offering to the offshore energy sector."

James Griffiths, MD at IMH, adds: "Port of Blyth is rightly considered as one of the UK's leading offshore energy support bases, and its development over the past few years means that it is playing an increasingly important role in the marine, subsea and offshore sectors. The port has attracted a number of high-profile companies and it's very exciting for IMH that we can now serve the port's users, and act as their on-site hydraulic engineering resource."

Pictured: IMH group photo with Martin Lawlor and Port of Blyth representatives

Amey looks to AR for 'unflushables'

Amey is to use a new augmented reality (AR) app to help fight 'unflushables'.

The public services provider has partnered with ClicksandLinks, a supplier in the AR field, to develop the app, which will be piloted across its Severn Trent contract.

The app shows householders how flushing the wrong items can block their drains and sewers. Sewer operatives can 'overlay' a typical sewer network on a customer's property or surrounding area on their Android mobile phone. The app then runs animations that mock-up how 'unflushable blockages' are formed – in real time.

Previously, operational teams have issued print-based guidance informing customers of what should, or should not, be put down their drains. However, Amey is now hoping that the app will be an effective way to increase customer understanding about the impact unflushables have on the water network, and help to prevent future blockages.

Ben Hawkins from Amey's innovation team, says: "This app is the first of its kind and demonstrates Amey's commitment to using new technology, in increasingly tech-reliant times, to help our customers visualise and solve these issues."



New calibration lab for Atlas Copco

For the purpose of delivering complete audit traceability and measurement assurance to its manufacturing customers, Atlas Copco Tools & Industrial Assembly Solutions has opened a new calibration laboratory at its UK



headquarters in Hemel Hempstead.

Accredited by the United Kingdom Accreditation Service (UKAS), the laboratory aims to enable calibration of its customers' tools and torque measurement equipment to ISO 17025. UKAS accreditation, it adds, covers BS7882 for torque measurement device and ISO 6789 for handheld tools.

Calibration work is undertaken in a temperature and humidity-controlled environment by approved technicians. The laboratory expands Atlas Copco's tool and service portfolio by providing a single point of contact for calibration of its own and third-party measuring equipment to the ISO 17025 standard.



Siemens helps Hallé go green



Siemens is helping the Hallé orchestra cut its costs by 35% through energy reduction.

It has created an integrated digital solution to make Hallé St Peter's, the historic recording and rehearsal venue in Manchester, energy efficient.

The new £4.3m three-storey extension, known as The Oglesby Centre, includes sensors (pictured, left) that monitor and automatically adjust temperature, air quality and lighting to achieve optimal room conditions. This will look to lower energy consumption in every room in the new building to reduce operating costs by up to 35% and lower CO₂ emissions from the building.

Meanwhile, Siemens' Green Leaf controls can notify the room user of unnecessary energy consumption to encourage them to actively save energy.

As part of the project, Siemens has also installed its fire monitoring device, Cerberus Pro, and a new CCTV security system. These systems are linked into Siemens' digital building management system (BMS), Desigo.

Desigo, which can be controlled using portable devices (main image), also future proofs the historic St Peter's building by using open communication protocols that can connect to third party devices – not just Siemens products – and is Internet of Things (IoT)-ready.

Robin Phillips, Siemens Manchester site director, says: "For more than 20 years, Siemens and the Hallé have worked closely together to find new and innovative ways of

partnering on projects that present the links between engineering and music.

"With tens of thousands of people visiting the venue each year, the Hallé needed an intelligent system which responds to changes in the building in real time and is easy to control. The technology we have installed allows the building to talk, tell us how it feels, if it is under stress, what it is missing.

"It also functions discreetly behind the scenes, without compromising the performer or audience experience or the integrity of the design. It has been fantastic to be able to bring together our experts in our Building Technologies and Smart Infrastructure division to create a safe, comfortable and highly energy efficient building."

Hallé chief John Summers adds: "By reducing the building's energy use, we can play our part in meeting the challenge of climate change while reducing operating costs, so more resources can be dedicated to nurturing future generations of talent."

Siemens installed the technology ahead of the building's official opening in November. Hallé St Peter's joins a list of cultural buildings that have partnered with Siemens on upgrading their BMS, including Museum Victoria in Melbourne, Australia, and Wales Millennium Centre in Cardiff.

Pictured, left: Kath Russell, Hallé's director of development, and Siemens' Robin Phillips, in the Victoria Wood Hall at Hallé St Peter's

United Utilities renews FM contract

Facilities management provider EMCOR UK has been awarded a four-year extension to its total facilities management contract with water company United Utilities – effective as of April 2020 and lasting until the end of March 2024.

Following a five-year collaboration, EMCOR UK will continue to provide total facilities management services for United Utilities, including asset forward planning, data management and IoT, security, cleaning, catering, energy services and maintenance.

A key driver of the contract renewal has been EMCOR UK's introduction of new technologies. Its device-level energy monitoring solutions, for example, now provide insights into energy consumption, with live data helping to achieve greater efficiencies. In addition, EMCOR UK installed sensors and uses visualisation tools in order to monitor environmental conditions, such as temperature, humidity, CO₂ and space utilisation.

Simon Varo, EMCOR UK account director for United Utilities, says: "Our partnership with United Utilities is a special one, so we are



delighted to extend it into the coming years. As a customer, they are always open to new, innovative methods, which has enabled us to instil a highly collaborative way of working. This has allowed us to create a solid basis to support them in reducing costs, driving energy efficiencies, ensuring reliability, and ultimately, delivering a great service to their customers."

Letter to the editor

The article titled 'Increased range' in the December 2019 issue of *Operations Engineer* (www.is.gd/ifulij) made the claim that the plant's process "supplants carbon, which would have been released from fossil fuels with carbon that has recently been captured, when the food was grown. It may, therefore, be regarded as carbon neutral". It appears that this claim is the basis for the article only listing the components of the gross reduction of CO₂eq emissions the plant achieves, rather than the net reduction. Here, the net reduction is the gross reduction of CO₂eq emissions achieved, less the plant's own CO₂ emissions.

I would agree that the plant can be regarded as carbon neutral. This is because of the plant's sustainability credentials arising from its fuel being carbon from within food waste. Food waste is renewable and therefore not a

finite resource, so making it a sustainable fuel. Increasing the level of sustainable generation, from the perspective of not using finite resources, is to be encouraged.

It seems questionable to assume that, if a plant's fuel source can be classed as carbon neutral, its CO₂ emissions can be ignored. Fundamentally, the plant is emitting CO₂ and therefore is contributing to the increase in greenhouse gases in the atmosphere. The plant's contribution to lowering greenhouse gases is its net reduction of CO₂eq emissions as describe above. To only list the gross savings of CO₂eq risks creating unachievable expectations of CO₂eq savings, with the consequential adverse impact on lowering the levels of CO₂ in the atmosphere.

Ian Jackson CEng FSOE FIPlantE

Bitrez joins EPSRC composites hub

Polymers and chemicals manufacturer Bitrez has become an industrial partner of the Engineering and Physical Sciences Research Council (EPSRC) Future Composites Manufacturing Research Hub (CIMComp).

Led by the Universities of Nottingham and Bristol, the hub is a £10.3m investment by the EPSRC to engage academics from across the UK to deliver a step-change in the production of polymer matrix composites. It is supported by four High Value Manufacturing Catapult Centres and backed by 18 industrial partners from the composites sector, offering a further £12.7 million in additional support.

Based in Standish, Wigan, Bitrez manufactures synthetic resin, catalysts and curing agents for a variety of companies across the globe in aerospace, rail, automotive, oil and gas, nuclear and renewable energy. The partnership will see Bitrez collaborate with academic and industrial partners to support the development and delivery of the next generation of high performance, affordable composites, which meet both regulatory and sustainability demands.

Pictured (l-r): Professor Nick Warrior, director of EPSRC's Future Composites Manufacturing Research Hub, and Paul Jones, MD of Bitrez





Ship shape

From the advanced polar research vessel RRS Sir David Attenborough to the new £6.2 billion Queen Elizabeth Class carriers, on-board water systems are playing a vital role at sea

By **Brian Wall**

RRS Sir David Attenborough (SDA), one of the most advanced polar research vessels in the world, is about to transform the way British Antarctic Survey (BAS) conducts its science. Representing the pinnacle of marine research technology, the £200 million vessel, under construction at Cammell Laird Shipyard, Birkenhead, is scheduled to undergo sea trials later this year. With a crew of 30, and accommodation for 60 scientists and support staff, SDA will be able to navigate the oceans for up to two months at a time.

Why is this vessel so important? Because, through long-term shipborne research investigations, BAS scientists will be able to advance their study of the combined impacts of global climate-

driven change and commercial fishing on polar marine ecosystems. This vital work is informing the development of conservation and ecosystem-based management strategies, while helping to shape government policy.

With a complement of up to 90 people on board at any one time, there is enormous reliance on the performance of the vessel's on-board water systems to provide for a multitude of needs – and dynamic positioning (DP) sits at the heart of this. DP is a key factor on many vessels at sea, with an automated heading and position control system ensuring the safety of personnel and equipment. SDA will actually operate at a higher level, being a DP2 vessel, which means the ship and its systems have been designed in such a way that there is complete redundancy,

boasting a number of duplicate systems, including two operating consoles and two DP monitors. In effect, the port and starboard sides are mirror images of one other.

"The seawater cooling system, for example, consists of a high sea suction either side and a low sea suction/ice chest in mid-ships," says second engineering officer Carrie-Anne Harris (pictured, right). "In normal operation, the cross connection would be closed, with each side operating independently. However, in an emergency, the cross connection can be opened to supply seawater from one side to the other. The high sea suction is used in shallow waters, such as in port, while the low sea suction/ice chest is used when the vessel is underway."

THE ICE FACTOR

Bearing in mind the SDA's primary operating locations, with polar temperatures and the risk of icing up of the sea chests, a low sea suction/ice chest has been designed with a weir in the middle to prevent any ice taken in entering



“The vapour is cooled and condenses into distilled water, which is then pumped to the freshwater tanks” *Carrie-Anne Harris, British Antarctic Survey*



the pipework. Should ice ingress become an issue, the chest has been fitted with 30 bar compressed air blowing to agitate and break up the ice, averting blockage.

“For low temperatures and in emergency conditions, there is a sea bay on either side of the vessel,” adds Harris. “These double-bottom tanks, filled ready for use, allow heat recirculation in the seawater while operating in very low temperatures, as the ‘heated’ water will return to these tanks, rather than go straight overboard as is normal practice. In an emergency, such as the sea suction becoming blocked by an ingress of ice, the sea bays can be used for cooling the main engine’s jacket water, ballasting the vessel, firefighting via hydrants and hoses, and also as a source for freshwater production.”

There are two independent freshwater production systems on board: one is a reverse osmosis plant and the other a freshwater generator plant. The latter uses the circulating hot water to boil off the seawater. This is achieved at around 85°C by creating a vacuum in the generator unit by means of an ejector. “The seawater enters the bottom of the unit [where it reaches boiling point] and then the vapour rises to the upper section of the unit,” Harris explains. “There, the vapour is cooled [by seawater] and condenses into distilled water, which is then pumped to the freshwater tanks. The saline/brine solution remaining is then pumped back into the sea. This unit has the capacity to produce around 30m³/24h – sufficient to keep up with consumption on board with a full ship of 90 persons and have some left over to refill the tanks.” Maintenance on both plants is carried out on a condition monitoring basis, or time basis, whichever is sooner.

PRESSURE POINTS

Should the pressure differential increase across the reverse osmosis plant, or the production quantity drop, it is likely the membrane has become fouled by mineral scale or biological matter. If caught quickly, the membrane can be cleaned in-situ, reducing downtime, with an alkaline cleaning solution circulated through each stage individually. The freshwater generator can also be cleaned internally in-situ; again, reduced production will be an indicator that the unit has become fouled.

Meanwhile, oil-fired heaters and exhaust gas economisers heat the water that is pumped to the various compartments via fan heaters, keeping the ballast, freshwater and wastewater tanks from freezing, while also providing air conditioning for accommodation and lab spaces. “Again, for redundancy, the system can be isolated down the middle, separating the port and starboard sides, should a problem arise,” states Harris.

“There is an oil-fired heater on either side, which can be run independently or together. They will be used as a

back-up to the exhaust gas economisers.” Each of the four main engines is fitted with an exhaust gas economiser. These utilise the wasted heat from the exhaust gas to heat the circulating hot water, removing the need for further fuel to be burned for this process.

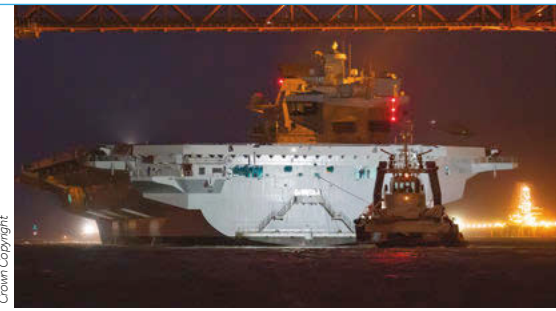
BALLAST SYSTEM

With the SDA’s priorities being logistical support and scientific research in the polar regions, there is often a need to carry large, heavy and unusually shaped cargo, such as vehicles and scientific equipment. This can cause difficulties in loading the ship with the weight distributed evenly. This is achieved by pumping seawater into the various tanks split up around the 27 ballast tanks. But there is a downside. “Increasingly, there has been evidence of biological contamination around the world, due to ships’ ballast waters. Introduction of invasive marine microbes, plants and animals has already had devastating consequences to some local ecosystems.”

As a result, IMO (International Maritime Organization) introduced the Ballast Water Management Convention in 2017. In order to comply with the convention, there is a ballast treatment unit (pictured, below) on



The ballast treatment unit on RRS Sir David Attenborough



Crown Copyright

personnel), and deployments typically lasting nine months, the aircraft carriers' crews require a dependable and consistent supply of pure water on demand, whenever and wherever they are across the globe.


To meet this need, a £1 million reverse osmosis system (pictured, left) draws in seawater. High pressure is then applied to the salt water, pushing it through a semi-permeable membrane.

Due to the size of the salt molecules, only smaller water molecules can pass through, transforming it into freshwater at a rate of 175m³ per day.



FIRE SAFETY

The highest levels of fire safety standards are also vital, as commissioning manager Gary Butterfield confirms: "During the system trials, which took place on the forward mooring deck, we were able to demonstrate to the Naval Fire Authority, Lloyds Register and Maritime Capability Trials and Assessment that the firefighting system meets the design specification for the flow and pressure of the foam. This confirms that the system produces enough foam through the pipework and nozzles, and that the system will produce the correct concentration of Aqueous Film Forming Foam and seawater."

Operating Joint Strike Fighter Lightning II jets and several helicopter types, the QE Class carriers are used across the full spectrum of military activity, from waging war to providing humanitarian aid and disaster relief. Just as it was once stated that 'an army marches on its stomach', none of this would be possible without an adequate supply of freshwater on board for drinking, cooking, showers, washing and general ship husbandry. 

board the vessel.

When pumping seawater into the ballast tanks, or when pumping the water from the tank back to the sea, it will pass through the treatment unit. This consists of a filter to remove larger particles and organisms. The water then goes to a UV reactor where a bank of ultra-high intensity UV lights kill or sterilise any remaining organisms.

"The maintenance for this unit is much more frequent," confirms Harris. "After each ballasting operation, while still in the same ecological zone or in international waters [200 Nm from the base line], the unit can be cleaned in place. The UV reactor is filled with a biodegradable cleaner, which is circulated for around six hours.

"The unit is then flushed with freshwater and filled to prevent scaling, and algae growth, for example. This will avoid the risk of any residual untreated water being discharged in a different ecological zone."

The ballast treatment unit can be bypassed, so that, in the event of an emergency, the vessel can be ballasted or deballasted.

CARRYING THE DAY

Equally, life for those on board the two new Queen Elizabeth Class aircraft carriers – total cost £6.2 billion – can be challenging enough, without concerns over the plentiful availability of freshwater for those on board. Each of the 65,000-tonne carriers – HMS Queen Elizabeth (pictured, above right) and HMS Prince of Wales – provides the armed forces with a four-acre military operating base, which can travel up to 500 miles per day to be deployed anywhere around the world.

"As with any large facility, there is a requirement to maintain a habitable and safe environment for the people employed and living within," says Martin Douglass (pictured, above), engineering director at the Aircraft Carrier Alliance and chief engineer of the Queen Elizabeth Class aircraft carrier programme. "The issue with any vessel, especially one designed to remain independent of port support for protracted periods, is that providing the basic needs can prove a challenge."

With a ship's company of around 700 and overall manning of up to 1,600 (when including air group and other embarked



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Joining plastic pipe

High-density polyethylene (HDPE) is the polymer used for water and wastewater pipes. In thicker formulations, the same material is also used for buried gas lines. Sections can be joined together under heat and pressure, and there are machines to do this using electrofusion and butt-fusion

By **Jody Muelaner**

The use of plastic pipes is growing in many applications, from chemical plants to lining metal pipes in the oil and gas industry, as well as the more established transporting of water and gas for the utilities sector.

Leaks in these pipes can result in significant cost and environmental damage. Most leaks occur at joints, meaning that improving the quality of plastic pipe welds is the primary way that leaks can be avoided in the future. And plastic pipe weld inspection is now becoming part of the specifications for new installations and routine maintenance, meaning that there will be a growing demand for qualified inspectors.

The two types of weld used for HDPE pipe are thermofusion and electrofusion.

The former, also known as heat fusion, is normally used to directly join sections of pipe, also known as butt-fusion. The latter is used to join pipe to fittings, such as branch saddles and tees.

Both are fusion welding techniques, meaning the two parts being joined are heated to melting temperature, allowing the material to mix before it solidifies.

In all types of plastic pipe welding, it is essential that there is no water in the vicinity of the weld. This is to ensure that the correct fusion temperature is achieved and also to prevent voids that can be caused by steam formation. In new installations, dewatering may not be a major consideration, but for repairs and insertion into existing networks, however, dewatering may require considerable effort.

BUTT-FUSION WELDING

Butt-fusion welding is the preferred method of joining sections of pipe. Butt-fusion welding of plastic pipes is covered by ISO 12176-1. In the process, the ends of two sections of pipe are heated using an electrical resistance heating plate, and, once the fusion temperature has been reached, the ends are brought together with a controlled pressure.

Although weld beads are formed during welding, these do not add strength and can therefore be removed. If the weld beads are removed, then the welded joint also causes no disturbance to fluid flow. Because no fittings are required, butt-fusion welding is also a cost-effective way to join sections of pipe.

The butt-fusion welding process has the following steps:

- 1)** The sections of pipe are first clamped into an axial press. This is used throughout the process to hold the pipes in alignment, to prevent ovality, and to generate the axial pressure required at each stage in the process.
- 2)** Next, the ends of the pipes must be prepared by scraping to ensure a good contact with the heating plate and with each other. At least 0.3 mm must be removed to ensure that the outer oxidised layer of plastic is removed. A





Butt-fusion welding see the ends of two sections of pipe heated and brought together via controlled pressure

hold the fitting or the pipe in alignment.


One advantage of electrofusion welding is that compact ECUs can be used for in-trench joining. Attaching a butt-fusion welding machine to pipes within a trench may be considerably more difficult. Electrofusion welding of plastic pipes is covered by ISO 12176-2.

PIPE WELD INSPECTION

The established quality assurance methods for plastic pipe welds are to first record the welding parameters used and then perform a combination of visual inspection, and a short-term hydrostatic pressure test.

These methods must be supplemented by destructive testing of sample welds using the same welding parameters. In this approach, the primary method of inspecting plastic pipe welds is visual inspection. This requires a good knowledge of the different methods of welding plastic pipes, as well as the types of defect which can occur.

The established approach is inadequate because only surface defects can be detected by visual inspection and practical sample rates mean there is a low probability of detecting defects during destructive testing. For a more rigorous evaluation of pipe welds, ultrasonic inspection equipment may be used. This is able to identify initial flaws in the weld, such as particulate contamination, lack of fusion, cold fusion and under-penetration. Mechanical damage such as fatigue cracking may also be detected.

The Welding Institute (TWI) has a team of plastic welding experts, based in a purpose-built plastic welder training facility in Middlesbrough, UK. They have been delivering training in plastic pipe welding for over 20 years and are now also offering courses in pipe weld inspection. This includes both visual inspection and the use of their proprietary ultrasonic inspection method PolyTest. 

scraping tool is inserted between the ends of the pipes. The axial press is then used to press the pipes against the scraping tool as it rotates.

3) Once cut square and flat, the ends of the pipes are cleaned using a grease-free cleaner, such as alcohol. They should not be touched after cleaning.

4) An electrical resistance heating plate is then positioned between the ends of the sections of pipe. It is important to check that the plate has reached the correct temperature by taking temperature readings at multiple positions. The axial clamp is used to press the ends of the pipes against this plate for a specified period of time.

5) To form the weld, the heating plate is removed and the molten ends of the pipes are pressed together until they solidify, forming a joint.

6) If required, the weld beads can be removed using a special scraping tool.

Butt-fusion welding is enabling the use of plastic pipes in applications that were previously reserved for steel. For example, a large outfall pipe is currently being constructed on Vancouver Island (example pictured, p14). It has an outer diameter of 7.5 feet, and it extends 1.2 miles out to sea. Outfall pipes of this type have historically been steel, despite

issues with corrosion in salt water and risk of cracking if there is movement, such as seismic activity. The ability to butt-fusion weld HDPE pressure pipe now makes it possible to replace steel. This gives significant benefits in terms of reduced maintenance, resistance to corrosion and ability to withstand earthquakes. The pipe used is part of the Agruline series, produced by Agru America, using a HDPE, PE 100-RC.

"This is considered a homogenous weld, meaning the strength of the weld is the same as the strength of the pipe," says Melissa Grace, vice president of Agruline. "The joint is also leakproof, which is another benefit of the HDPE pipe solution."

ELECTROFUSION WELDING

Electrofusion is used to join special fittings that have electrical heating coils integrated into them. The fitting is clamped in position and an electrofusion control unit (ECU) is then connected to the coil, supplying a current that generates the heat to form a fusion joint.

Bar codes on the fittings provide the ECU settings required to form the joint. However, separate scraping tools must be used to prepare the section of pipe before the fitting is attached, and additional clamps may be required to



Protecting nature



Water companies need to adopt efficient ways of reducing phosphorus levels in water, in order to banish harmful algae from rivers and lakes

By **Graham Ward**, sales & marketing director at chemical dosing solutions provider WES

Water companies are under pressure from all corners – environmentalists, the public and legislators – to tackle eutrophication, the over-enrichment of waterways by mineral and organic nutrients from sources such as run-off of agricultural fertilisers. The main culprit is phosphorus, in the form of mineral phosphates, resulting in excess growth of algae and other plants. Freshwater algae are simple plants divided into many microscopic species; planktonic algae (or phytoplankton) can clog waterways, while filamentous algae may form thick, floating mats.

Algal blooms deprive submerged plants and creatures of sunlight, and ultimately suffocate them. In daylight, they generate oxygen through photosynthesis. However, they consume it during respiration at night, reducing it to levels where some animals cannot survive. Eventually the algae die

and are decomposed by bacteria, further stripping the water of oxygen, and killing fish, invertebrates and plankton.

Some algal blooms also produce toxins that can be lethal to any animals that drink the water. Contact with these toxins can cause skin irritation and other symptoms in humans. Health may also be damaged by toxins that enter the food chain.

Communities are concerned by these dangers, by the impact on wildlife and the loss of recreational and amenity value in affected habitats. Many waterways and lakes do not meet strict standards set for nutrient levels under the UK's Water Framework Directive. It seems inevitable that water bills will rise, as extra purification efforts are needed to solve the issue.

AMP7, the water industry's Asset Management Period for the years 2020–2025, demands stringent phosphorus removal. Larger sites must improve, while many small sites, which previously had no

need for chemical dosing, must introduce it. Many smaller sites have little or no historical data on which to base dosing specifications, so will require testing. Installing dosing systems in the confined space of small sites is also likely to be challenging.

Meanwhile, industry regulator Ofwat's latest price review, PR19, challenges companies to deliver more efficient, cost-effective solutions than their current framework designs allow. It insists that customers receive better value for money, with better services but no increase in bills. For this reason, water companies are under pressure to make improvements, but without spending too much.

RIISING EUTROPHICATION

Phosphorus reaches our waterways from several sources. As already stated, these include run-off of agricultural fertilisers (artificial and organic), as well as animal waste from fields, human waste from sewage systems, and detergents from household drains. Waste discharged into waterways – from various industries – also contributes to higher phosphorus levels and increased eutrophication.



Without action, the potential for eutrophication will grow – and is likely to be compounded by climate change. Heavy rain and flooding are becoming more frequent, while summers are becoming hotter and drier. Higher phosphorus concentrations in water during drought periods, together with higher temperatures, will boost algal growth.

Chemical treatment involves dosing the water with metallic salts, such as iron sulphate or calcium carbonate, that react with dissolved phosphate to produce solid precipitates. The precipitate can be removed using a separation process such as clarification or filtration.

This method can be combined with biological treatment using anaerobic and aerobic digestion. This promotes the growth of anaerobic and aerobic bacteria, which feed on soluble phosphates and remove them from the water. The bacteria, and the phosphorus they have consumed, are then separated into the resulting sludge. When used in combination, digestion usually comes first. Chemical treatment then reduces phosphorus to a lower level (below 1.0 mg/L).

Before chemical treatment and

digestion, larger phosphate-containing particles can be removed by processes such as sand filtration and solid settlement. Afterwards, phosphorus can be further reduced by passing the water through a membrane filtration system.

SANITISING TREATMENTS

These phosphorus removal techniques should not be confused with sanitisation, where the aim is to kill undesirable organisms rather than remove the pollutant. Prior to human consumption, water tends to be chlorinated. This kills harmful bacteria and any algae present and continues to disinfect after it leaves the plant. Chlorinated water should not be released directly into natural waters. The chlorine and its by-products would also kill microscopic life forms that form part of a healthy ecosystem. Doing this would also feed phosphorus into the waters, if this method is used as an alternative to phosphorus removal.

UV irradiation and ozone treatment also kill microorganisms, but do not adversely affect life forms downstream. Again, they do not remove phosphorus.

When planning chemical treatment at a site whose dosing needs are unknown, such as smaller sites, testing is required. Jar tests are of limited value, as they give only a snapshot of the conditions. Instead, operators need to gain a full picture of the upper and lower dosing limits. This can be done economically by hiring a dosing rig.

The smallest, simplest packaged systems for this purpose consist of a dosing device and an intermediate bulk container (IBC) of chemical. Larger options include a self-contained system within a waterproof enclosure with a 1,000-litre storage tank and a dosing device. For extra size and functionality, there is the option of a containerised system with storage tank, duty and standby pumps and a local control panel. With this type of equipment, tests can be run in real-time over a typical hire period of four to 12 weeks. The levels established in these situations usually


require very low dosing flows, often down to 0.1 L/hr.

LONG-TERM SOLUTION

Once dosing needs are known, a long-term solution appropriate to the site can be supplied. Specifications usually start with 1,500 litres of storage, giving enough capacity to refill from an IBC without having to interrupt dosing. The system would normally include a fill point panel, pipework, a set of duty and standby pumps, and a control system.

Components are installed within a suitable enclosure, chosen from a range of options. They vary from a rotationally moulded model to a fabricated bund with a GRP (glass-reinforced plastic) weatherproof kiosk and walk-in enclosure. WES' larger packages fit the footprint of a 20-foot shipping container. Depending on the operator's needs, designs are available to accommodate storage tanks of any size up to 5,000 litres. For the largest sites, a 10,000-litre option can be made available (example pictured, below). Space for extra pumps can also be added.

Complete chemical dosing set-ups can typically be bought or hired, complete with storage tanks, bunds, filling and safety systems, pipework, connectors and control features. Components are pre-assembled and pre-tested to cut installation time. Hired systems can be ideal for dealing with urgent needs, short-term increases in demand and scheduled shutdowns. They also help to conserve capital expenditure.

Eutrophication is a blight on our natural waterways. However, it can be managed by applying appropriate phosphorus removal techniques. 





Fighting floods

There are a range of products and equipment that can aid in flooding scenarios – before, during and after they happen. OE highlights some examples currently on the market

By Adam Offord

Anyone that lives in the UK knows that the weather can be more unpredictable than the England football squad at a major tournament.

Unfortunately, this means that businesses, facilities management teams and landowners, as well as residents, can be caught unawares as to the dangers and damage that rain can bring – floodwater.

Met Office data released in December highlighted the mass rainfall experienced by England in autumn (www.is.gd/ejajit). It found that rainfall records were broken for South Yorkshire, Nottinghamshire, and Lincolnshire, with the previous records set in 2000, while England as a whole had its fifth wettest autumn.

And last year, like most years, also saw several incidences of flooding across the country. In November, for example, South Yorkshire village Fishlake became submerged after the River Don burst its banks (www.is.gd/ovivok).

Fortunately for facilities management teams, businesses, and landowners facing flood water scenarios, there are a variety of products and services available to help deal with the problem. Selected products and solutions follow.

DOORS & BARRIERS

Typically, when flooding is predicted, residential and business properties can be seen with sandbags stacked against doors and windows. One alternative option, however, is flood defence doors.

OE reported last month that environmental and risk reduction specialist Adler and Allan has partnered with steel door and physical security solutions provider Bradbury Group to supply and install its range of flood security doors to businesses in the UK. Specifically designed to meet the needs of the utility sector, the M2MFL range is said to provide an ideal solution for unmanned and critical locations where both security and flood protection measures are required.

According to the Bradbury Group, the range has a designated maximum water depth of 840 mm, and doors are available as outward opening single, leaf and a half, or double doorsets, with fixed side and/or top panels.

Another company that offers products to mitigate flooding is The Flood Company in West Yorkshire. For commercial properties, it offers the Buffalo Barrier (pictured, top inset) and the Buffalo Steel Flood Door (pictured, bottom inset).

The barrier, it says, has been factory

tested to BS PAS 1188-1:2014 and is available in any length and up to 1600 mm high. Said to provide flood control with easy deployment, the barriers are ideally suited for loading bays, commercial buildings and driveways.

The flood door, meanwhile, has been designed to offer protection against both flooding and unauthorised entry in a hard-wearing commercial environment, while also being tested to full-height flood protection and PAS 1188 standards, with self-close engage, single and double door designs available. Key features are said to include a threshold height of 80 mm and replaceable and serviceable Buffalo flood seals. The steel flood doors are ideally used for external applications and suitable for warehouses, store rooms, electrical substations and retail outlets.

The Flood Company is also looking to launch the Buffalo Airbrick this month, which aims to replace a standard airbrick by allowing greater air flow to minimise the impact of conditions such as dry and damp rot. Under flood conditions, the self-activating floating seals automatically to prevent floodwaters from entering the building.

PUMPS

When floodwaters happen, businesses and landowners typically have to work with the relevant authorities in dealing with the clean-up. This is where the flood pump can





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come in handy. Xylem Water Solutions UK is one provider of such a solution. Among its products are Flygt and Godwin portable drainage pumps.

Last year, *OE* reported how the company provided pumps to drain water from a reservoir. The move was in response to an emergency situation aiming to prevent the collapse of a damaged dam wall above the town of Whaley Bridge in Derbyshire (www.is.gd/lisuqu). While this wasn't specifically a 'flooding' scenario, the pumps were still used to move tonnes of water, with five 55 kW 2250 Flygt submersible dewatering pumps drawing water out of the reservoir at a rate of 250 litres per second (pictured, above). As well as installing the submersible pumps, the team set up six large diesel pumps and numerous smaller ones.

DEHUMIDIFIERS

According to Aggreko, a provider of mobile modular power generators, temperature control and energy services, an often-overlooked part of flood incident management occurs after the water has been pumped out of affected buildings. Water that isn't visible – that is, soaked into materials such as wood, plaster and paint – can prove just as damaging in the long term.

"Once flooding has occurred in an industrial environment and the floodwater

has been pumped out of the building, many people can be forgiven for thinking the final step is to assess the damage and replace the equipment," says Ryan Stanley, sector development manager for temperature and moisture control at Aggreko. "In the past, we have seen many building and facilities managers heat the flood-affected premises to aid the drying out process. However, this can in fact impair [the restoration of] water-affected materials, resulting in further damage that can be expensive to resolve."

Additional damage, such as mould growth behind the walls, can also occur, placing the health of the building's occupants at risk, he explains. So, how can these hidden issues be overcome? By utilising dehumidifiers (example pictured, above right), he says: "Dehumidification should occur in any industrial setting after a flooding incident, as it ensures the surrounding air is dried appropriately and unwanted high moisture levels are eliminated."


"An important step for any facilities and building manager after a flooding incident occurs is managing moisture levels by

drying both rooms and equipment in a controlled environment."

THERMAL IMAGING

Another tool used to find water damage is the moisture meter. However, while these devices are easy to operate, according to Rob Raymer, strategic business development manager for premium products at Flir Systems, hunting down the source of moisture leaks can be tedious. "For significant moisture remediation, neither a simple moisture meter nor a thermal camera is sufficient alone, but together they improve effectiveness, limit costs, and ensure peace of mind," he says.

One advantage is said to be the ability to record and share thermal images – helpful for insurance purposes. Another is the ability to pinpoint cold spots. Among Flir's products is the MR176 infrared guided measurement moisture meter, an all-in-one moisture meter and thermal imager.

Raymer concludes: "Combining the benefits of thermal imaging and moisture meters ensures no water damage is left undetected. With both systems in play, rapid source detection and damage determination become easily reachable remediation goals. Together, these tools improve remediation effectiveness, ensure savings, and help customers and contractors feel peace of mind that water damage can be located and treated." 



Engineering report gives warning

Governments must step up their preparations for a minimum sea level rise of one metre this century and be planning for up to three metres, according to a report (www.is.gd/uzapar) from the Institution of Mechanical Engineers. 'Rising sea levels: the engineering challenge' warns that technical, logistical and economic factors mean that much infrastructure is located on the coast or on tidal estuaries, and when coastal flooding happens at these facilities, supplies of energy, food, medicines, goods and services are put at risk.

It warns that, even with the knowledge that these facilities are of central importance to economic well-being, there is little evidence that owners and operators have awareness of the challenges of future coastal flooding or are making the investment necessary to implement adaptations or build resilience.



Identify and rectify

Rising energy costs have created an atmosphere of uncertainty for many UK businesses. Correctly identifying and accounting for potential energy losses could help save money on fuel bills

By **Darren Silverthorn**, national controls and metering specialist at Spirax Sarco

Energy costs have the potential to be considerably high and could limit growth potential. It's easy to understand how a business can spend so much on energy costs when, in my experience, our engineers have routinely identified that boilerhouse managers tend to believe that they

are operating at an efficiency level 15% higher than they actually are. This is likely due to them not having complete visibility of their boilerhouse components.

With economic uncertainty dampening the abilities of businesses to compete in a domestic and global market, companies are under increasing pressure to reduce operational costs. With this uncertain atmosphere in mind, energy managers can often find themselves tasked with identifying the efficiency of the boilerhouse in order to remedy this situation.

In my experience, the means of monitoring energy in most boilerhouses can quite often be limited. This can, therefore, translate into a limited knowledge of overall boilerhouse performance, with facilities often unaware of where energy losses could be identified.

Indeed, it is frequently the case that boiler operators will be making use of the burner efficiency to indicate the overall efficiency of the boilerhouse. What they may be unaware of is that this method does not highlight all of the potential energy losses that can occur due to factors such as dirty heat transfer surfaces, carryover, radiation losses and excessive boiler blowdown rates.

By making use of burner efficiency for overall boilerhouse efficiency, boiler operators may be overestimating the performance of the system. They would gain a better understanding of their boilerhouse by metering all of the energy entering the boiler – both fuel and feedwater – and comparing this with the useful energy exiting the boiler in the steam.

This type of monitoring was once only possible by investing heavily in building management systems (BMS) or supervisory control and data acquisition (SCADA) software systems. Monitoring in this way was a costly means of measuring energy use and could be prohibitive for smaller businesses. The upfront investment in such systems





was not a cost-effective means of measurement, as they only log non-compliant operations as opposed to providing the 'why' that exists behind that data. This is critical for those who operate the boiler; as without it, they could find themselves failing to observe where energy costs could be reduced, and efficiency improved.

As has already been identified, boilerhouse operators tend to overestimate the performance of their energy systems. As such, it could transpire that energy losses are greater than first anticipated, resulting in increased fuel costs to account for creeping losses via the flue, radiation, distribution, flash, blowdown or condensate. Take manual blowdown, for example. If it is insufficient, it can cause scaling, which may result in rising energy costs. On the other hand, excessive manual blowdown can increase water usage – another undesirable outcome.

Using historical trending of plant data, it is possible to better understand the fuel consumption, feedwater usage, steam production, condensate return and blowdown volumes of the boilerhouse. Logging the amount of condensate being returned to the

boiler's feedwater system, for instance, enables boiler operators to accurately manage the water treatment plant output and better identify potential opportunities to increase fuel efficiency and reduce associated fuel, water and effluent costs.

THE PATH TO SUCCESS

Yet data analysis is only a first step; while teams may be accustomed to some level of distribution loss, the true numbers can only be discerned with a monitoring system that provides a complete overview of the system.

Spirax Sarco's B850 boilerhouse energy monitor (pictured, left),

for example, offers a means of measuring the overall boilerhouse efficiency, based on measured inputs from the fuel, feedwater, steam output,

condensate return and blowdown. Cost-conscious boiler operators

can utilise this data to make improvements in the efficiency of their steam system – yielding energy savings and reductions in the financial expenditure of the business.

With the right data in-hand, operators and teams can systematically improve the steam system to limit the energy losses at multiple points. Take

for instance water treatment and boiler water conditioning. This has significant potential for improving overall energy efficiency and lowering the total cost of ownership of plant.


Treatment can help to prevent the build-up of alkaline deposits on heat transfer surfaces. Without treatment, these deposits could form layers that act as a barrier against effective heat transfer, reducing the energy efficiency of the boiler dramatically. For example, a deposit layer just one millimetre thick could lower system efficiency by around 10%.

There are also several other areas around the full boilerhouse system where losses can be found, such as the economisers, flue-gas shut-off dampers and blowdown heat recovery. Equally, where there are losses, there is scope for efficiency savings. To achieve this, boilerhouse operators can help themselves and their businesses by making use of intelligent monitoring systems.

BACK IN THE GAME

UK businesses may continue to suffer from weakened competitiveness due to rising energy costs and an increasingly uncertain economic environment. Yet these businesses could reduce their operational costs by monitoring the energy performance of their boilerhouse.

By cutting the costs of this energy, businesses could find that they are able to save money on their fuel bills. The rigorous monitoring of the energy performance of the boilerhouse provides the foundations for cost-saving and reductions in fuel consumption.

The future is uncertain enough, but the finer detail of the operator's steam system doesn't have to be – with an energy monitoring system, losses can be quickly identified and rectified to put a stop to excess waste. 



Boilerhouse efficiency guide launched

To explore this subject in more detail, Spirax Sarco's Darren Silverthorn has recently published a guide on the core challenges with traditional boilerhouse energy measurement and areas for improvement. 'A guide to identifying the true efficiency of your boilerhouse' aims to support operational management teams by highlighting areas for improvement that could be made to enhance efficiency and reduce the money spent paying for energy. It is available at: www.is.gd/utalov



The bulk of boiler failures are due to problems with water. Poor feedwater chemistry can lead to scale deposits, sludge and corrosion in boilers and pressure vessels with potentially catastrophic failure as a result. For boilers, water chemistry is critical

Polishing up on feedwater

Costly boiler repairs can be minimised with precise control over feedwater chemistry

By David Appleyard

Almost all of our water, sourced from rivers, lakes and bore holes and delivered to our taps, is perhaps best described as a chemical soup. Gases from our atmosphere, such as carbon dioxide and oxygen, mineral-forming elements like calcium, magnesium and silicon, and metals such as iron and manganese, all swirl through every typical domestic, commercial and industrial supply.

For the boiler and steam-generating applications commonly found in industry and commerce, this chemical loading in feedwater can have a dramatic impact on performance. Poor control of water quality increases the likelihood of deposition, carryover, and corrosion.

For boiler operators, maintaining finely balanced water chemistry is, therefore, key to longevity, lower servicing costs and better thermal efficiencies for steam plant equipment. A wide range of chemicals are added to boiler feedwater to inhibit scale and corrosion, scavenge oxygen, balance the pH and mobilise sludge, for example.

THE RISKS

Water is an effective ionic solvent and it dissolves many of the materials it comes into contact with. Besides those already established, water also typically contains suspended solids and may even contain effluent from industrial, farming or water treatment processes (see also pp16-17).

Water quality and the materials dissolved or suspended within it is also dependent on a host of environmental factors, such as the local geology, the temperature, and the pH. Furthermore, though groundwater is more consistent, other naturally-found water sources contain different materials whose proportion may change by season, and during storm events or dry spells.

The consequences of poor water quality control in boiler applications can be dramatic. Typical dissolved minerals, such as calcium carbonate from limestone, calcium sulphate from gypsum and magnesium sulphate salts, are relatively insoluble in water and tend to precipitate out during boiling. Furthermore, under higher temperatures, these minerals can

precipitate out directly onto the metal of the boiler tubes as hard, insoluble, impervious scale. A mixture of different mineral deposits, rust and other contaminants, inevitably scale and sludge builds up as the dissolved solids come out of solution.

As the scale deposits are often insulating materials, build-ups and blockages can cause overheating of boiler tubes and other elements. This in turn can increase the impact of thermal fatigue stresses and accelerate corrosion. Such deposits also restrict efficient heat transfer, reducing boiler efficiency and increasing fuel consumption.

Periodic blowdowns in boilers are a typical mechanism employed to reduce sludge, for example, but are costly in terms of energy used. This needs to be balanced with the risk of carryover, which increases as deposits accumulate. It is extremely important to control the level of total dissolved solids within the boiler feedwater.

As Mark Bosley, technical director at SUEZ Water Purification Systems, explains: "It's non-negotiable. You really do have to get the right water chemistry otherwise your boiler is just going to fail



95%

Poor or inadequate water treatment has shown to be the cause of more than 95% of all boiler failures, according to guidance document 'BG04 - Boiler Water Treatment' from the Combustion Engineering Association and ICOM Energy Association (www.is.gd/erubum)

at some point.”

Higher concentrations of precipitated solids and other materials can cause carryover, in which the steam is contaminated with boiler water solids when bubbles or foam appear as these materials increase in concentration. Contaminants like oil or high loading of dissolved naturally-occurring organics, for example, can increase the propensity for foams to develop. They can be introduced into boiler feedwater by pumps or other hydraulic equipment or direct from the feedwater supply. This can be a particular problem in applications that use so-called 'clean steam', that needs to be sterilized or, in power generation applications where deposits on a turbine's blades could be catastrophically damaging.

Reactive oxygen is also a significant issue for boiler operators. A glass of water at room temperature can contain around 10 ppm (parts per million) of dissolved oxygen. As the temperature increases, the solubility of oxygen decreases, and in boiler conditions the availability of free oxygen is a gift to the gods of corrosion. It can lead to oxygen pitting, where oxygen micro-bubbles start to come out of solution and cause local corrosion at the surface of the metal boiler tube. The oxygen pitting eventually eats through the tube, producing holes and a tube failure.

FEEDWATER TREATMENT

After being used in a typical boiler process, the steam is passed through a condenser to be reintroduced to the boiler feedwater, and any losses are made up with new water. This so-called make-up water is initially filtered to remove suspended solids, organisms and similar contaminants before a number

of further process are undertaken to ensure it meets the required standard. Both the quantity of impurities and the nature of the impurities are key considerations in ensuring appropriate water quality standards are met, but factors such as the volume of make-up water required and the particular operating pressures and temperatures of the boiler concerned are also critical factors in determining boiler feedwater quality.

Indeed, high-pressure boilers have a different criteria for water quality compared to low-pressure boilers operating at/under 30 bar pressure. The chemistry of water is somewhat different in a boiler that's running at pressures of hundreds of bar. In such cases, practically all impurities must be removed, typically using technologies such as reverse osmosis, deionisation and electrodeionisation. For low-pressure boilers, simple sodium-based water softeners will be sufficient in many applications.

A boiler will typically run up to certain cycles of concentration. Sludge dispersant chemicals like hexametaphosphates, which keep minerals in solution, have to be added to keep the sludge moving so that it can be expelled during blowdown operations.

The pH of unconditioned steam is around 4.4; it is quite acidic because of the amount of carbon dioxide that's in the water. Poor pH balance can rapidly accelerate corrosion. Bosley explains: "If it's not clean steam, it is typical to put in pH conditioners like AME and hygrozyme, which are volatile and float around in the steam."


With final polishing to remove materials like silica, it is possible to develop quite a big chemical process on boiler feedwater pre-treatment.

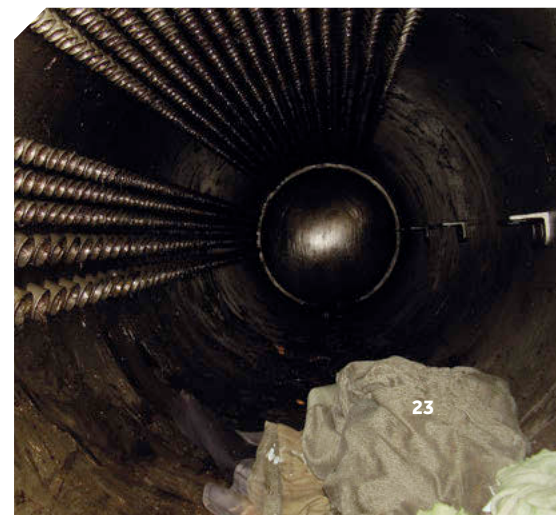
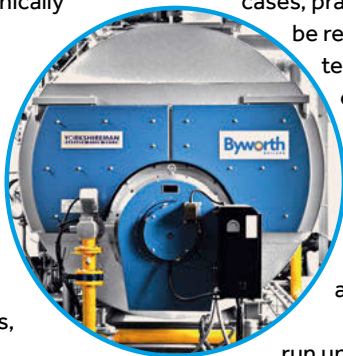
However, in a typical small or medium enterprise that employs just a few dozen people, a large-scale and expensive water treatment facility is not a practical proposition.

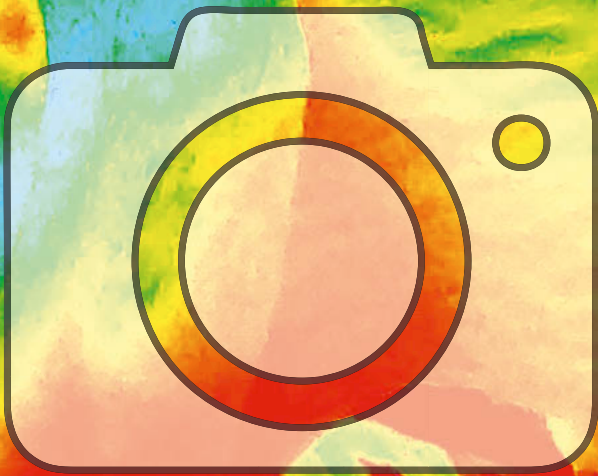
Nonetheless, recognising the importance of maintaining good feedwater quality, a number of companies and trade bodies have launched training courses to ensure that boiler operators have the required skills. Earlier this year, Deep Water Blue in partnership with Human Focus International launched an online boiler water treatment course for shell boilers, coil boilers, steam generators, and hot water boilers, for example.

Many other companies also offer similar courses on industrial boiler water treatment designed for boiler plant operators, plant managers, maintenance and engineering contractors, and water treatment specialists.

Ultimately, boiler feedwater quality issues such as scaling, corrosion and deposition can affect the reliability and longevity of a boiler, pushing up the costs of servicing and maintenance. It can also impact on the quality of the steam, as well as result in higher fuel costs associated with lower thermal efficiency.

Operators of high-pressure boilers are well aware of the importance of good feedwater quality, but even in less demanding low-pressure applications, suitable feedwater treatment is critical to addressing scale, corrosion and deposition challenges in order to optimise costs and efficiency. 





Oh snap!

OE's editor and thermal camera novice Adam Offord visited Flir Systems to test its product range and user-friendliness

When it comes to industrial inspection and maintenance, personnel will typically have a range of equipment and software at their disposal, depending on the job at hand. Thermal imaging cameras may be one of those items, helping to monitor and diagnose problems. Items of plant or building systems, for example, generate heat, and thermal imaging cameras can observe that heat to identify issues, such as energy loss, damp (see pp18-19), and machine misfire or overheating.

OE travelled to Flir Systems' West Malling facility in Kent in January where Infrared Training Centre (ITC) manager Jon Willis, who has been at the company for nearly 20 years, spoke about five different devices – the Flir One Pro, C2, E8-XT, E95 and T840 (details on each device can be found on p25). (Note: Thermal imaging devices are also available from other manufacturers, including Fluke, Satir and Seek Thermal).

USER-FRIENDLINESS

As someone that had never touched a thermal imaging camera before, the author was keen to test the devices' user-friendliness on a demonstration unit.

However, it became clear during the

visit that all of them – regardless of their price, specifications and features – were as user-friendly as each other. The user interface of each device was responsive, giving access to different functions and settings, such as colour palettes and image history. The interface of the Flir One is simply that of a smartphone, while the interface of the other devices share similarities.

The cameras were also easy to hold, despite their ranging weight and size differences. Image quality and additional features were obviously different across the range because they're all aimed at different markets, but each device was simplistic enough to understand and use effectively.

It is also worth noting the built-in MSX (Multi-Spectral Dynamic Imaging), a technology that enhances the clarity of thermal images by adding in visual details in real time.


NOW WHAT?

As Willis pointed out, "anyone can take an image", but it's what you do with it and how you interpret it afterwards that counts.

And that is where the difficulty of thermal imaging lies. Not with the physical camera devices or their usability, but with the interpretation of the infrared images afterwards. Willis explained more, via Flir






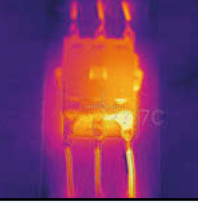
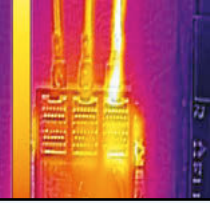
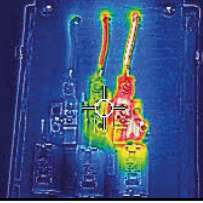
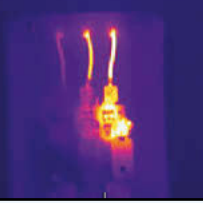
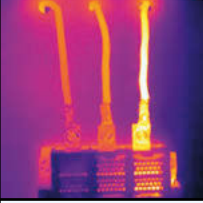
Tools, a thermal analysis and reporting software that allows users to import, edit, and analyse images, and turn them into PDF inspection reports. Within the software, users can thermally tune levels, change colour palettes, and adjust parameters, among other options.

"We've got things like emissivity, reflected temperature, distance and atmospheric temperature," he said. "All of these parameters really relate to what we are looking at and the environment that our target is in, and it is up to the person using the camera to set these parameters. So, this is where the scientific side of the training comes in." Emissivity, for example, is the efficiency with which an object emits infrared radiation, compared to a perfect emitter (or a so-called blackbody, which has an emissivity value of 1). It is important to set the right emissivity value, or the temperature measurements will be incorrect.

So, taking thermal images is the easy bit. The analysing of those images and understanding the different terminologies thereafter is the tricky part and that is where thermography training can help users out. 

Turn over to pp26-27 to find out more about the range of infrared training courses on the market



DEVICE NAME	FLIR ONE PRO (ANDROID/IOS)	FLIR C2	FLIR E8-XT	FLIR E95 WITH LENS	FLIR T840
DEVICE IMAGE					
THERMAL IMAGE EXAMPLE					
DEVICE FOR (AUDIENCE)	Gadget fans	Building, electrical and mechanical applications	Building, electrical and mechanical applications	Steel mills and other applications	Electric utility and other thermography professionals
DEVICE SIZE	34(H) x 67(W) x 14(D) mm	125(L) x 80(W) x 24(H) mm	244(L) x 95(W) x 140(H) mm	278 (L) x 116(W) x 113(H) mm	140(L) x 201(W) x 84(H) mm
DEVICE WEIGHT	0.035kg	0.13kg	0.575kg	1kg	1.3kg
THERMAL RESOLUTION	80 x 60 pixels	80 x 60 pixels	320 x 240 pixels	464 x 348 pixels	464 x 348 pixels
OBJECT TEMPERATURE RANGE	-20°C to 120°C	-10°C to 150°C	-20°C to 550°C	-20°C to 120°C / 0°C to 650°C / 300°C to 1,500°C	-20°C to 120°C / 0°C to 650°C / 300°C to 1,500°C
COLOUR PALETTE OPTIONS	Nine	Four	Three	Six	Six
FOCUS OPTIONS	Fixed	Fixed	Fixed	Continuous; one-shot laser distance meter; one-shot contrast; manual	Continuous with laser distance meter (LDM); one-shot LDM; one-shot contrast; manual
FIELD OF VIEW	N/A	41° x 31°	45° x 34°	24° x 18° (17 mm lens) / 42° x 32° (10 mm lens) / 14° x 10° (29 mm lens)	24° x 18° (17 mm lens) / 42° x 32° (10 mm lens) / 14° x 10° (29 mm lens) / 6° x 4.5° (70 mm lens)
DISPLAY	Smartphone. Saved as 1440 x 1080	3-inch 320 x 240 pixel colour display	3-inch 320 x 240 pixel colour LCD	4-inch 640 x 480 pixel touchscreen	4-inch 640 x 480 pixel touchscreen LCD with auto-rotation & viewfinder
MSX	Yes	Yes	Yes	Yes	Yes
TIME LAPSE	No	No	No	10s to 24 hours	10s to 24 hours
MICROPHONE	No	No	No	60s recording	60s recording
MORE INFORMATION	www.is.gd/buketa	www.is.gd/zagini	www.is.gd/bumope	www.is.gd/ulaxow	www.is.gd/gurusi

Note: OE has left out the cost of each device as pricing varies across each model/lens type available, as well among distributors



Staying focused

There are a wide range of infrared training courses on the market, from general introductions to specialist and sector-specific instruction

By **Toby Clark**

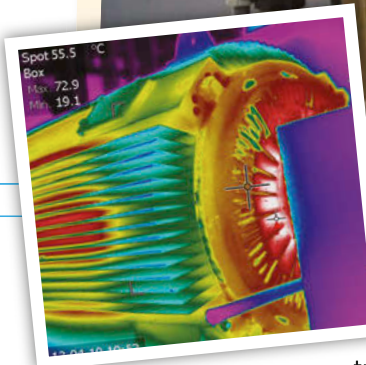
Thermography – taking pictures of heat sources using an infrared (IR) camera – is a powerful tool for diagnosing problems in equipment, detecting sources of heat loss and more. While IR cameras are becoming much cheaper and more sophisticated (see also pp24-25), operators still need training to get the best out of the equipment and to interpret what it says.

Micky Jackson of East Sussex consultancy and training provider Baseline-RTS says that thermography training is useful in many contexts, from “a design engineer looking at circuit boards, to veterinary medicine, to somebody running a production line,” and that there is more and more emphasis on domestic and building applications. In fact, he adds, a training course is essential for “anyone who’s even thought about using a thermal imaging camera”.

While Jackson says that anybody can get some useful information from an IR camera, “it’s all down to the measurements,” and that training is vital for this aspect. “There are so many variables, and for example a lot of people don’t appreciate emissivity. If you don’t understand the variation of emissivity with angle or the relevance of distance and field of view, you can make mis-diagnoses.”

THERMOGRAPHY INDUSTRY

Of course, you don’t have to do thermographic analysis yourself; there is a small army of specialists equipped and trained to do this, and one consultancy is TI Thermal Imaging, based in Dorking. Its inspections are undertaken by ‘Level II-III engineers with electrical qualifications and extensive building application experience’.



In this case, Level II-III corresponds to the category two and three training programmes set out by Infrared Training Centre (ITC), which have become a de facto standard in the thermography industry. ITC is a US-based operator that provides training and support around the world; although it is the training and consulting division of thermal camera manufacturer Flir Systems, ITC says ‘courses are designed to be vendor neutral’. It has a UK operation, as well as training partner companies, including AVT Reliability, Warwick Test Supplies and PASS Electrical Training Academy (see box).

ITC specifies three levels of training certification (category one, two and three), which are offered by itself, its training partners and other training providers. It is important to note that most ‘Introduction to Thermography’ courses, which take one or two days, do not correspond to the category one certificate.

Most category one courses take four or five full days, and involve some lab-based practical work, as well as theoretical study. ITC says that ‘familiarity with the basic operation of an infrared camera’ is a prerequisite, and that after taking this course, the participant ‘will be able to undertake infrared inspections following written guidelines and to report the

IR training contacts:

This is a short sample list of training providers. More can be found online.

ITC – T: 0173 222 0011 /W: www.is.gd/uxuxul

Baseline-RTS – T: 01580 830 368 /W: www.is.gd/amefeg

PASS Electrical Training Academy – T: 01642 987 978 /W: www.is.gd/ogosuv

AVT Reliability – T: 0161 486 3737 /W: www.is.gd/vatoye

Infrared Training – T: 0151 486 5120 /W: www.is.gd/usomag

iRed Academy – T: 01243 939 307 /W: www.is.gd/gehale



results of this inspection'. A four-day course typically costs around £1,500-1,700 ex-VAT.

Micky Jackson of Baseline-RTS says the ITC-based courses are "fantastic" and that category two is his favourite; it "takes a lot of what is in category one and almost flips it around". This is a 40-hour course that requires a valid category one certificate, and attendees must present a brief case study. The course includes more theory than category one, and ITC says that the successful participant 'is able to provide guidance to category one personnel in the areas of equipment selection, techniques, limitations, data analysis, corrective action and reporting'. Both category one and category two courses comply with the ISO 18436-7 standard (see box, right).

Category three is only open to those who have achieved a category two certificate; according to PASS, it will 'teach thermographers how to establish and manage a successful thermography programme in various applications and different industries'. Unlike the lower levels, it complies with the ANSI/ASNT standards CP-105 and CP-189.

ITC says that its training certification expires by default after five years, and to be eligible for renewal 'you must either use your IR camera for at least 25% of your work, publish a paper on

thermography, or attend another training or ITC conference within those five years. You must submit a form alongside paying a recertification fee. After 10 years, you will have to retake the respective exam again or take the exam of a higher level'.

SPECIFIC


Some training providers offer on-site introductory courses. Baseline-RTS, for example, has a one-day introduction course and a two-day implementation course; these can be tailored to specific applications, and the firm offers follow-up support to help maintain good practice. It will also add on-site help with establishing initial baseline measurements – particularly useful in preventive maintenance.

Many training providers also offer industry-specific courses; PASS, for example, does a two-day 'Introduction to Building Thermography' programme for beginners. iRed Academy offers its own BINDT (British Institute of Non-Destructive Testing) accredited level one and level two thermography courses, with optional BINDT certification for those who

pass. It also offers specialised variants of the courses, such as a five-day drone thermal imaging course that includes the level one training, and a level two electromechanical thermal imaging course for fault-finding and condition monitoring.

At a more specialist level, Infrared Training runs a four-day air tightness testing course, and a three or four day follow-up level two ATT course; due to the specialist equipment required, these courses are based at its own premises. The level two course also requires students to undertake three practical on-site air tightness tests, and to submit these reports and calculations for review.

Conversely, the US-based Snell Group offers some training as online courses, live webcasts or on-demand webinars, including specialist courses in topics such as 'Inspecting In-Plant Electrical Systems', 'Electrical Control Panel Inspections' and 'Infrared for Building Applications'.

Whatever training scheme you opt for, be sure that it is relevant to your specific requirements, or if it is a more general course, that the provider can prove that it complies with industry standards and permits progress to higher levels. 

Industry standards

The most obviously relevant standard in this field is ISO 18436, 'Condition monitoring and diagnostics of machines – Requirements for qualification and assessment of personnel'; more specifically, part seven of the standard (ISO 18436-7:2014) which covers thermography (www.is.gd/ohobax).

Parts one and three of the standard are also mentioned in the description of some courses, but these are more general provisions: Part one (ISO 18436-1:2012) covers assessment bodies and the assessment process, while part three (ISO 18436-3:2012) specifies requirements for training bodies and the training process.

BINDT oversees some of the training certification in the UK. For example, AVT Reliability describes itself as 'an authorised training organisation for BINDT, as per the requirements of ISO 18436'. BINDT also publishes an infrared thermography handbook in two volumes: 'Principles and Practice' and 'Applications'.

The American Society for Non-destructive Testing (ASNT) says that it 'does not publish standards that describe how to perform NDT tasks' but it sets compliance standards, such as ANSI/ASNT CP-106, 'Non-destructive Testing – Qualification and Certification of Personnel' (www.is.gd/ukakom).

Lean equipment reliability

Lean is about eliminating waste from any business process, according to John Saysell, director of training at business improvement consultant MCP Consulting Group. However, when introducing a 'lean-thinking' approach, some organisations pass over the opportunity to improve equipment reliability and the bottom line

Lean, as a concept, has been very well covered over the years. It originated in Henry Ford's Model T automotive processes, for example. Carmaker Toyota introduced the concept of defining the waste that can arise in manufacturing, such as:

- Defects – efforts caused by rework, scrap and incorrect information
- Overproduction – making too much, or too soon
- Waiting – wasted time waiting for the next step in the process
- Non-utilised human potential – skills, talents, and creativity
- Transport – unnecessary movement of product and material
- Inventory – excess product and materials not being processed
- Movement – unnecessary movement by people
- Extra processing – non-value adding activities in the process that are unnecessary.

Lean is about eliminating waste from any business process, not just manufacturing. However, many organisations that introduce a 'lean-thinking' approach to production environments pass over the opportunity to improve equipment reliability and the bottom line. In order to avoid this in your organisation, the following tips may help:

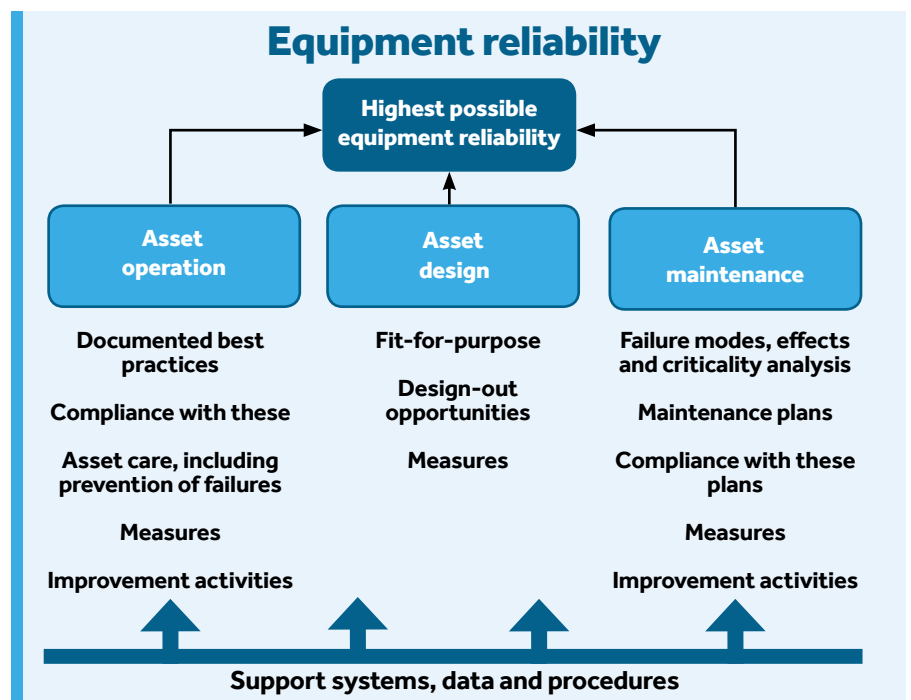
- Use reliable overall equipment effectiveness (OEE) measures. You will be able to understand equipment performance and develop solutions to problems using the knowledge and experience of those closest to the process
- Monitor performance by the hour, day and week, align and calibrate the performance measures and how they are achieved

- Develop a loss management capture process. Record and identify where production time is lost through breakdowns, changeovers and stoppages. Feed this information into your improvement programme and develop strategies to reduce the time lost
- Revisit your maintenance plan, look at the risk to the business and make sure you revise and adapt it as you go
- Spares and their poor availability have a dramatic impact on production. Drive out the waste of waiting by having the right spares available
- Breakdowns happen, so when they do, analyse, improve, and develop counter-measures. Ensure the lessons learned are communicated in production
- Repair the things that you know are not working correctly or not in perfect

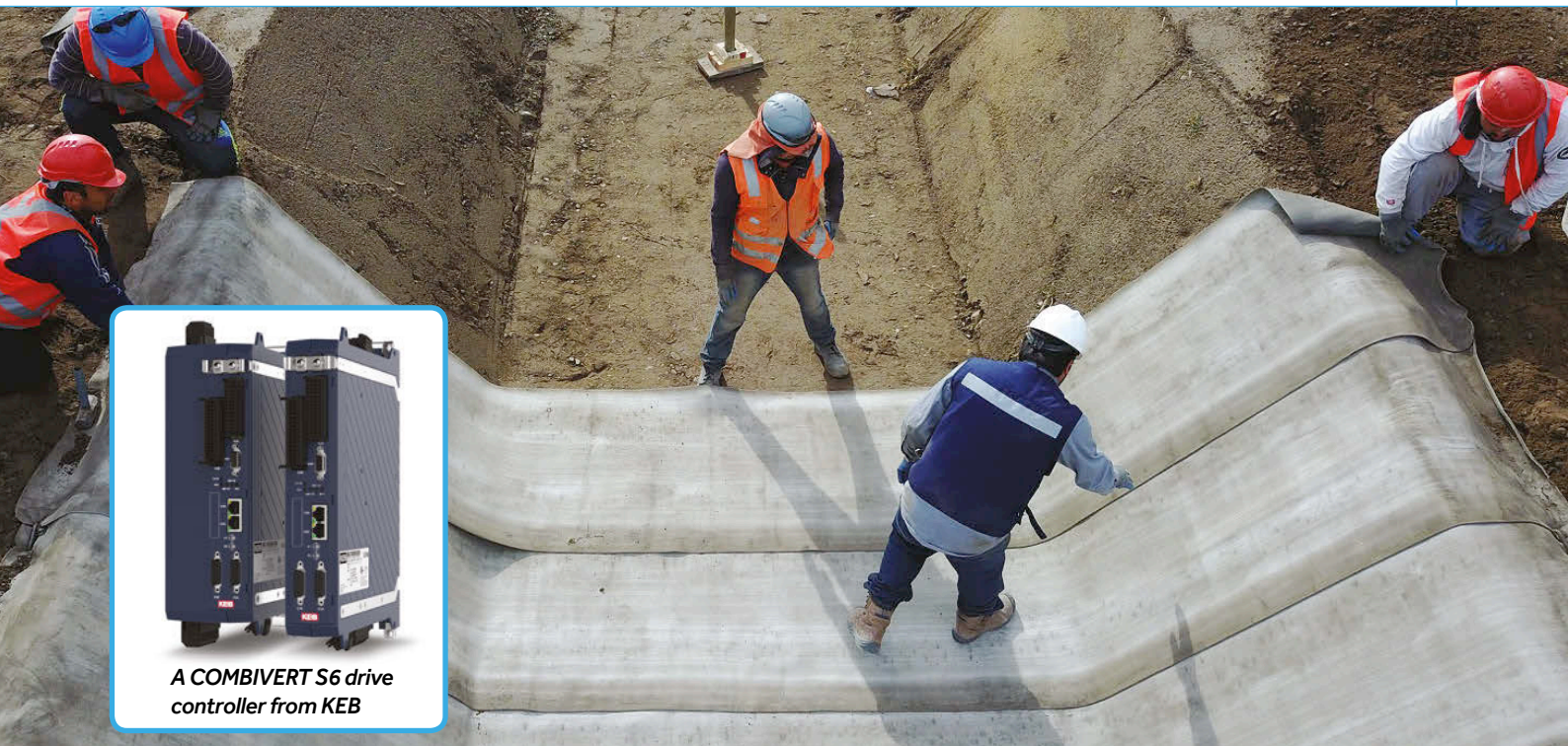
condition

- Make sure operators are using the equipment in a consistent and correct manner
- Operator asset care is a programme that has proven and measurable production improvement returns. Develop the skills and competence of operators so that they carry out basic maintenance and 'set up and adjust' activities. Assign craftspeople to be responsible for specific specialist pieces of equipment
- Finally, develop a culture of continuous improvement in equipment reliability and harness the knowledge and experience of operators and production equipment specialists.

These tips can become components of an equipment reliability strategy, such as the picture below.



Source: Asset Management Information Service (AMIS)



Concrete Canvas chooses KEB drives, controllers and HMIs for new production line

Concrete Canvas has reduced wiring installation costs and has greater flexibility for future expansion plans for machines and additional lines after installing servo drives with integrated functional safety, HMIs and controllers from KEB Automation.

In Spring 2018, the firm, which manufactures a concrete impregnated fabric (essentially 'concrete on a roll'), purchased a new facility in Pontyclun, Wales, near to its original factory in Pontypridd, due to increased product demand. Engineering manager Graham Rose, who is responsible for developing the new production lines at Pontyclun, states that as there was no off-the-shelf machinery available for producing the new product needed, all the design and build work was performed in-house.

"The prototype production line is quite complex," he says. "There are many different machines with parts that need to be moved at different speeds. We therefore started to search for a suitable supplier of drives that could handle this type of application. We needed the drives to be flexible and easily expandable to allow easy, rapid future expansion of the line and individual machines, with as little panel wiring as possible. Another key

requirement was safety, so we wanted drives with in-built functional safety."

After a supplier evaluation process, which included on-site demonstrations, KEB Automation was chosen for its servo drives with FSoE (FailSafe-over-EtherCAT), as well as HMIs, a smart controller and COMBIVIS 6 software that provides a common development platform.

"At present, we have around 10 COMBIVERT S6-A servo drives and some F6 drives from KEB operating on the production line," Rose explains. "The lower-powered drives tend to perform lighter duties, such as transporting the web material, whereas the larger drives control the conveyors and mixers for the cement, the main web forming process section and the centre winding machine, as well as performing general positional and control tasks. Some of the drives are linked so that they operate synchronously, which is critical when controlling line speed set points and the intricate, varying tensions of the web material.

"We use a variety of electric motors on the line, including synchronous and asynchronous induction motors, permanent magnet motors and servo motors. The S6 drives are so flexible that they can drive any type of motor, with or

without encoders, so this was never an issue for us."

Concrete Canvas also installed a C6 smart controller (pictured, inset) to control and manage all the automation and safety programmes. Operators are also said to be benefiting from the use of KEB HMIs, which allow them to alter or control set points on machines, visualise the complete line or individual machines, and to look at key parameters and performance indicators.

The new prototype production line has now been up and running for almost a year. "By installing servo drives with integrated functional safety, we've reduced the wiring, so our installation costs in terms of materials (such as reduced number of safety relays) and time have been minimised," Rose continues. "We also have greater flexibility in terms of future expansion of the line. Any changes or additions can be made using software rather than installing new hardware. We can control the motors with or without encoders using the same drive, giving us even greater options, flexibility and cost savings. We're also about to introduce a new machine with Siemens S7 PLCs. KEB has provided us with a software module that allows data to be exchanged between this and our other controllers."

Robotic spud handler

Morrisons fresh produce depot in Rushden, Northamptonshire, has installed two automated Brillopak crate loading potato cells that are said to be capable of orientating packs quicker than humans.

The UniPaker robotic pick and place cell was engineered by Brillopak in collaboration with the Rushden team. Designed to improve product handling, minimise waste and enhance the presentation of pre-packed potatoes, the robot can load vertical form fill and seal (VFFS) and flow wrap bags into retail crates.

At speeds of at least 75 packs per minute for each cell, the two UniPaker systems cradle bags of potatoes, each weighing from 0.5kg up to 2.5kg, and load them one at a time into crates. The installation has resulted in a 90% labour reduction.

Both UniPaker case loading cells house two Omron Delta robots. Clean, empty crates are fed automatically into both cells by two Brillopak Crate DeStaker systems. Once filled, the crates are stacked and palletised by an end-of-line robotic system.



Mechan delivers traverser and jacks to Network Rail depot

Sheffield-based Mechan has delivered a bespoke traverser and set of 12 lifting jacks to the Network Rail Holgate depot in York.

The 130-tonne traverser was commissioned by Story Contracting to replace a 50-year old unit that was at the end of its useful life. A traverser is used to move rail vehicles in a perpendicular direction to the track.

It has a larger capacity than its predecessor and 145-metre travel distance, to accommodate both the current fleet, as well as future proofing for upcoming upgrades. Sited externally, at the entrance to the maintenance shed, it will be used to move carriages between workshop roads.

Mechan has also designed and built a set of 12 jacks to suit working conditions at Holgate, finishing them to an outdoor specification and altering the base arrangement to include castors for ease of movement.

Lindsey Mills, Mechan's sales manager,

says: "Holgate is an historic rail depot, which brings its own challenges when maintaining modern rail vehicles, but following a series of overhaul schemes and investment in new equipment, like our jacks, it is now well placed to play an integral role in the north's rail services."



MECHANICAL SERVICE SUPPORT

HVAC specialist Ecomech has worked with Edinburgh Airport to provide mechanical services for restaurant, bar, kitchen and toilet facilities at its No.1 Lounge.

East Midlands based Ecomech, a division of LED lighting specialists Ecolighting, worked under main contractors AA Lovegrove to help the airport. 'Comfort cooling', designed to cool spaces and create comfortable temperatures for passengers, was used in the lounge and bar areas and was achieved using diffusion, chilled/LPHW ducted fan coil units and Schako ceiling-mounted swirl diffusers to ensure a low draft installation.

The project also comprised split air conditioning in the server room, general supply and return air ventilation, kitchen extract ventilation and W/C extract systems.

LEDs INSTALLED AT CML PREMISES

EcolightingUK has recently been specified for LED lighting at a 206,350ft² warehouse at Brockton Business Park in Telford for CML, which stores and delivers a wide variety of food products across ambient and chilled temperature ranges.

As part of its continued growth, CML expanded from its 75,000ft² property on the Brockton site, which it leased in 2009, to assume full occupation of the 15-acre business park site in January 2012.

The logistics company decided that it wanted to implement LEDs to reduce its running costs. It needed efficient lighting for its three chill warehouses, link tunnel and packing area. The company chose Ecolighting's Pegasus LED high bay, Sapphire Linear and Altos emergency LED lighting for the installation.

£4.5m
The cost of the
installation project

18 months
The duration of the
project

Furnace project completed by Edwards Engineering



Dougie Davidson, site project manager at Edwards Engineering

Edwards Engineering has successfully completed a £4.5 million project with Superglass Insulation to install a new furnace building at the Stirling-based site – doubling the annual production capacity of glass wool.

The 18-month project, called New Horizon, saw Perth-based Edwards Engineering take on the challenge of installing the new 187-tonne furnace over the top of an existing building whilst it was still in use.

Designed by Architects Space and engineered by CRA Consulting Engineers, the upper part of the furnace was modelled and detailed using Edwards Engineering's 3D modelling system. Edwards also manufactured and installed a large 4m-wide bridge-type walkway, high-capacity wedge-shaped batch silos, insulated ducting and numerous access stairs and platforms.

Edwards Engineering MD Sandy Kirk says: "This was one of the bigger projects of this kind we have worked on and was challenging

both from an engineering and programming perspective. For example, the cladding used was 175 mm thick, rated for two-hour fire protection and had to be installed using specialist machinery and cranes. That meant additional plant and resources were required to maintain the very tight programme.

"As we have our own drawing office and extensive fabrication facilities, we were able to manufacture the elements required at our Perth base and we also acted as the design drawing office for Superglass, providing timely solutions to any issues discovered during the modelling and detailing phase of the work."

Glass wool insulation produced by Superglass is made from up to 84% recycled glass products from post-consumer waste. Mark Atherton, chief production officer at Superglass, adds: "The completion of this project will take Superglass beyond environmental compliance, while allowing the plant to double its output within two years."

Chimney protected

Leeds-based corrosion protection and engineering services specialist Corroserve has completed a contract to protect the internal surfaces of a newly-manufactured mild steel chimney, prior to it being installed at a bio-methane plant on Teesside.

The 1.2m diameter chimney was in three sections – 30m in all. In service, it will be exposed to a range of waste gases, including hydrogen sulphide, so protecting it by lining with a coating system would extend its service life and reduce future maintenance down time.

Corroserve first used abrasive to blast clean all the internal surfaces to remove heavy mill scale and provide the required surface profile for coating. This was followed by the application of multiple coats of Polyglass VEF – spray-applied using Agmec internal pipe spraying equipment. The Agmec pipe sprayer is part of the Corrocoat range. Developed to coat pipe internals from 100-2,000 mm diameter, it uses centrifugal force produced by a spray cup. A fan spray pattern is produced by the multi-axial head. A constant-speed winch draws the sprayer through pipes up to 150m long.





Sensing specialist Baumer partners with MGA Controls

Baumer has appointed control and instrumentation specialist MGA Controls as a process solutions partner in the UK. MGA Controls sales manager Chris Makin says that the agreement means MGA can offer "an even more comprehensive range of products which ultimately results in optimal control and automation systems for our customers".

MENTOR FLT E-LEARNING

Mentor FLT Training has launched its new 'Managing Forklift Operations' e-learning course, which is accredited by AITT and aims to provide a flexible way for supervisors and managers to gain the necessary skills to meet their responsibilities for safe forklift operations.

The course contains content divided into five modules: the importance of good management; how a forklift truck works; safe and unsafe driving; safe non-driving; and managing safely.

Each module includes information and interactive videos, and finishes with a summary and quiz to confirm the delegate's understanding. The e-learning course is available now at www.is.gd/satude.



WEARABLE SCANNING TECH

ProGlove, in collaboration with Samsung Electronics America, has announced a combined product solution to address the growing need for wearable scanners in industries ranging from retail, transportation, logistics, and manufacturing.

The solution consists of ProGlove's Mark product family of wearable barcode scanners and Samsung's ruggedised smartphone for business - the Galaxy XCover Pro - removing the need for workers to return to stationary terminals to conduct business, memorise directions or pick up conventional scanner guns.

Cobot leasing launched by Universal Robots

Collaborative robot (cobot) maker Universal Robots (UR) has launched a new cobot leasing programme in collaboration with DLL, a global vendor finance company.

The new partnership will aim to enable all manufacturers, regardless of size or capital equipment budgets, to reap the benefits of automation without worrying about cash flow and seasonal fluctuations.

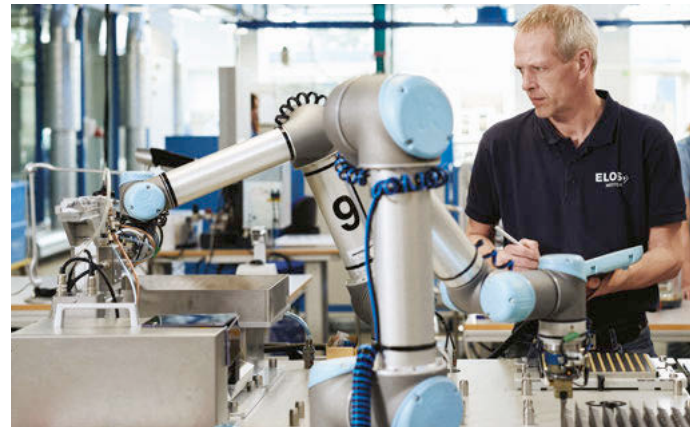
UR CFO Klaus Vestergaard says: "UR Financial Services offers end-users a fast, low-risk and financially-friendly model to accelerate automation in their factories. The partnership makes it easy to upgrade existing cobots, add additional units or test cobots for the first time - and equips end-users to maximize

productivity, quality and profitability, without increasing costs or cash outlay."

DLL offers UR's customers tailor-made financing and leasing. As business needs change, customers will have the option to schedule payments to fit fluctuations in cash flow, upgrade to new

equipment, or add cobots anytime during the contract term.

At the end of the finance term, customers will then have the option to buy the equipment for a fraction of the original cost, upgrade, extend the finance term or simply return the equipment.



Vacuum pump series for robust processes

Atlas Copco has launched the DZS 100-400 VSD+ series of air-cooled, oil-free claw vacuum pumps for particularly harsh applications.

The 'robust' pumps are said to increase productivity in conveying, clamping, drying processes or environmental applications due to their low energy consumption and space requirements, as well as handling of pollutants.

The firm has equipped the three models of the

DZS 100, 200 and 400 VSD+ series with corrosion-resistant materials to make them equipped for harsh application environments.

For this purpose, they also have a durable internal coating and are designed for a long service life, even under robust process conditions.

Other features are said to include uncomplicated maintenance and a newly developed VSD+ App to access parameters.





Southern Manufacturing & Electronics

Southern Manufacturing & Electronics takes place at Farnborough International, Hampshire, from 11-13 February. It aims to showcase new technology in machinery, production equipment, electronic production and assembly, tooling and components, as well as subcontract services across a wide range of industry.

3D-printing among the Carfulan Group line-up

Carfulan Group has lined up a range of machines from across its four businesses (OGP UK, SYS Systems, Zoller UK and Vicivision UK), which specialise in multi-sensor metrology, 3D-printing, tool pre-setting and turned-part measurement respectively.

OGP UK will be displaying the CNC200 – a machine that is said to be capable of supporting a combination of touch probes, micro probes and laser scanners, while SYS Systems will be bringing along the F370 3D printer (pictured), an office-friendly but industrial-grade printer that works with a range of materials and colours to produce complex parts.

Vicivision UK, meanwhile, will demo the M309, an optical



and non-contact measuring machine for cylindrical parts, such as shafts, valves, screws and threaded inserts.

Zoller UK will also showcase its Smile system with Pilot 1 software, which

is said to boast telecentric optics for enhanced performance alongside data transfer options, for the pre-setting and measuring of cutting tools prior to machining work.

Carfulan Group MD Chris Fulton says: "Last year was yet another hugely successful year for our companies, with more high-profile customers choosing to work with us and taking advantage of some incredible developments across our complementary technology portfolio.

"Southern Manufacturing is always an excellent event and we look forward to having many more insightful conversations with those at the coal face of what makes British manufacturing great."



MACHINE COMPONENTS

Elesa (UK), a manufacturer of standard machine elements, will display its range of machine components (pictured, above) – used for production equipment and often incorporated into end products. They include items such as levelling feet, castors, and measuring and alignment (for example, bulls eye levels). With the aim of solving engineering issues and to compliment mechanical products, Elesa also offer a range of electrical machine elements, including indicators and measurement systems.

SPRING TECHNICAL ADVICE

Lee Spring offers a broad range of both ex-stock and custom-made compression, extension, torsion and wave springs, plus custom-made wire form and flat spring manufacturing expertise. Engineers and buyers seeking expertise in spring technology will be able to talk directly with technical experts at Lee Spring at the show.

SWIVEL CASTORS

FATH Components has launched a range of swivel castors with integrated lifting feet that will be on display at the show. In total, 12 models are available, with individual castor/feet units that are rated to carry loads varying from 1kg up to 250kg each. All variants of the castor are said to provide full, 360° rotation combined with a positive lock-in-place lifting foot for secure positioning.

Dustcontrol to showcase extraction kit

Dustcontrol UK is set to exhibit its range of extraction equipment, including fixed and mobile cyclone-based dust extractors and air cleaners.

The DC11-Module (pictured), for example, which comes in several models, is a stand-alone unit for source extraction and industrial cleaning. It has been designed to service up to six normal extraction points or several cleaning outlets at a time and is modularly built, meaning it can be tailor-made to suit any

manufacturing and production environment. Furthermore, the DC11-Module can be fitted with HEPA 13 filters, meaning exhaust air can be safely returned to the work environment.

MD James Miller says: "With more than 800 exhibitors and 9,000 guests from around the world expected to be in attendance, we're looking forward to hosting live demonstrations of our vacuum systems to showcase their impressive dust extraction capabilities."





ACCIDENT REPORT



The Health and Safety Executive

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

VEHICLE MAINTENANCE

Numerous recently have been cases whereby workers have been crushed by vehicles while carrying out maintenance activities.

In December, now dissolved vehicle recovery and repair company Albert Road Recovery and Repair (of Warley Hill Business Park, Brentwood, Essex) was sentenced after a worker suffered fatal crush injuries during maintenance work, only hours after he'd started his new job.

Birmingham Magistrates' Court heard that employee John Glenn was fatally injured on 24 November 2014 when a rigid vehicle fell suddenly from an inadequate axle support prop at Siskin Parkway East, Middlesbrough Business Park, Coventry (main image). An investigation by the Health and Safety Executive (HSE) found that a cable reel drum jack was used to support the vehicle, which was not an appropriate piece of equipment for the task being undertaken.

HSE inspector John Glynn said: "This incident led to the tragic death of John Glenn and occurred within hours of him starting his new job. It was completely avoidable. Not only did the company fail to adequately induct the new starter into their business, it failed to adequately instruct and supervise him on his first day and provided him with completely unsuitable tools

and equipment. Had the company considered the risks properly, they would have had safe systems of work and approved vehicle repair equipment in place."

In another case, a Lancashire man has been sentenced after a father-of-three was fatally crushed while working underneath a double decker bus. Crewe Magistrates' Court heard how, on 14 June 2017, 46-year-old Wayne Lannon, an employee of Brian Finch, trading as F E Coaches (of Moat House Street, Ince, Wigan), was carrying out repairs under a double decker bus in the car park of Chester Zoo. The bus had been supported by a hydraulic bottle jack and Lannon had placed some wooden blocks underneath the stationary bus. However, the bus rolled backwards off the bottle jack, trapping Lannon, who sustained fatal injuries.

An HSE investigation found that the company did not have a safe system of work in place for preventing the bus from moving. The bus parking brake had not been applied before Lannon went under the bus and the bus was not chocked to prevent it from rolling off the jack. Finch also failed to provide training and instructions to Lannon in mechanical work or safe lifting of vehicles, and about the type of repairs that were suitable to be made outside of the workshop.

Finch pleaded guilty to breaching section 2(1) of the Health and Safety at Work etc. Act 1974 and was sentenced to six months custody, suspended for 18 months, and subject to a curfew for 30 weeks. HSE inspector Lianne

Farrington said: "This was a tragic and wholly avoidable incident, caused by the failure of Mr Finch to ensure there were adequate control measures in place, such as chocking the bus, and to implement safe systems of work. Had the company ensured that proper control measures were in place, Mr Lannon would not have lost his life."

HAND INJURIES

Also numerous recently have been cases involving hand injuries in the workplace.

In December, swimming pool covers manufacturer Plastipack (of Wainwright House, Wainwright Close, St Leonards-on-Sea) was fined after a worker suffered a degloving injury when his hand got caught between two power driven rollers of an extruder machine. Brighton Magistrates' Court heard that, on the 21 February 2018, the employee was injured at the company site in St Leonards-on-Sea, when his hand got caught between two power driven rollers of an extruder machine while performing a manual intervention on the machine.

An HSE investigation found that the company had, between 1 July 2012 and 21 February 2018, failed to ensure that the in-running nip point between the rollers of the machine was adequately guarded to prevent access.

In another incident, foundry company William Lee (of Callywhite Lane, Dronfield, Chesterfield), which makes cast parts for the automotive industry, has been fined after an employee had two fingers amputated



“Taking simple measures and monitoring systems of work, could have easily prevented this serious accident” *Amandip Dhanda, HSE inspector*

while attempting to clear a blockage in a moulding machine.

Chesterfield Justice Centre heard that the employee was attempting to clear a blockage of sand in a moulding machine using a length of metal rod at the company site in Dronfield on 28 February 2018. However, the blockage cleared without warning and the employee’s right hand was crushed between the rod and the machine, resulting in two fingers being amputated, and a number of fractured bones.

An HSE investigation revealed that had a suitable and sufficient risk assessment been completed, the company should have identified that there was a risk to employees created by intervention in the machine when blockage clearance was required. Specific procedures should therefore have been created for blockage clearance. The company could then have developed appropriate instruction, training and information related to the task.

William Lee Ltd of Callywhite Lane, Dronfield, Chesterfield pleaded guilty of breaching the Health and Safety at Work etc Act 1974 section 2(1). The company was fined £60,000 and ordered to pay costs of £6,000.

Speaking after the hearing, HSE inspector David Keane said: “If a suitable safe system of work had been in place prior to the incident, the life-changing injuries sustained by the employee could have been prevented.”

Architectural metalwork company Viking Engineering (Architectural Metalwork) (of Park Lane, Basford, Nottingham) has also been fined after an employee suffered a serious hand injury on a pedestal drill. Nottingham Magistrates’ Court heard that, on 21 August 2018, the employee, who was an apprentice, suffered an amputation injury to his right-hand middle finger whilst operating the pedestal drill. His


gloved right hand became entangled on the rotating spade drill bit of the drilling machine resulting in his injuries.

An HSE investigation found that employees were required, by the company’s written system of work, to wear gloves when operating the drill. It had become custom and practice to leave the drill running while repositioning workpieces, which is when the incident occurred. HSE inspector Amandip Dhanda said: “Taking simple measures and monitoring systems of work, could have easily prevented this serious accident”.

FALL FROM TRAILER

W D Cormack & Sons (of Castletown, Thurso), a partnership operating a haulage business, has been fined after a driver fell from a trailer to the ground.

Perth Sheriff Court heard that on 9 February 2016, the employee was securing a load of grain bags on a curtain-sider trailer, at Thormean Granary, Milnathort, when he fell 2.88m from the trailer to the ground. He sustained severe injuries as a result of the fall.

An HSE investigation identified that there was a failure to make a suitable and sufficient risk assessment and a failure to provide and maintain a safe system of work. 



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Digger & dumper safety in focus

Hire Association Europe (HAE) has joined forces with Travis Perkins and other industry partners to set up a working group aimed at improving the safety of digger and dumper operations on construction sites.

Investigations by Travis Perkins have suggested that the risks posed by diggers and dumpers to users and others were a serious industry-wide issue. An accident involving a dumper in 2018 proved the catalyst for the initiative to form the Digger and Dumper Operational Safety Round Table. Overseen by HAE, the association’s members under the umbrella of the Safety Round Table will focus on improving the recording of incidents, reviewing standards, engaging with manufacturers and making the sector aware of issues.

The HAE Technical Health & Safety Group will be responsible for assessing the information gathered to enable the industry to respond to trends, review frequency, and determine the root causes and relevant factors that contribute to incidents. It is anticipated that examining and interpreting data will help the new working group improve safety for those operating diggers and dumpers by suggesting minimum safety standards that all businesses can support, through more awareness, education and training.

The working group also plans regular dialogue with manufacturers, which it says will be key to ensuring that hire suppliers and customers are on the same wavelength when it comes to future equipment design. Frank Elkins (pictured, above), COO at Travis Perkins, says: “Hire companies sharing best practices and initiatives among each other can lead to a best-in-class site handover to ensure operational risks are minimised.”

You may also be interested in OE’s January 2020 dumper safety article, available at www.is.gd/umehil

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