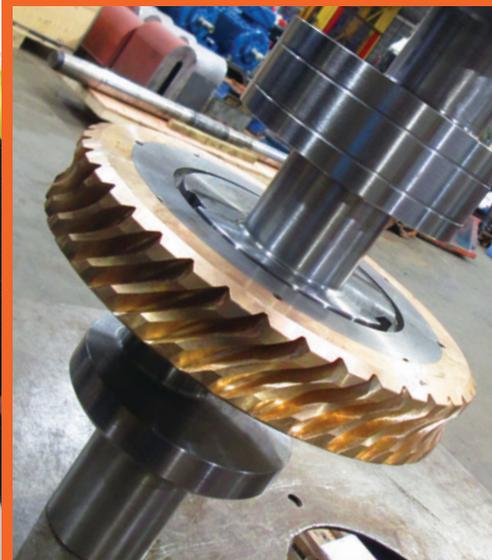


# Journal

ASSOCIATION OF ELECTRICAL AND MECHANICAL TRADES



## INSIDE THIS ISSUE...

Westin Drives' new workshop and facilities.

Goltens Dubai, a one-stop shop for the shipping, offshore, and marine industries.

Anglo Carbon brush up the aftermarket.

Preventing stray current build-up in electric motors.

Motor Specifications for the Nuclear industry.



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# Journal

VOLUME 17 | ISSUE 2

### Front cover photos:

1. AEMT Members at the Falkirk Wheel
2. Cold particle spraying at Westin Drives
3. Pinwheel and worm engineered by Axflow

### ADVERTISING

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## AEMT COMMENT

This year's AGM for the AEMT was held at the Advanced Manufacturing Research Centre in Sheffield. A tour around the so named 'Factory 2050' revealed a fascinating future we could all be heading. The Journal continues to look at innovation, investment, and a celebration of good engineering practices.

Westin Drives has recently benefited from a £1-million investment enabling them to upgrade their facility with new technology such as CNC Machines, and integrating production systems such as 5S.

Goltens Dubai caters as a one-stop shop for the marine and offshore markets, with the bulk of their work coming from diesel engine overhauls for vessels up to 6000 ton. We take a look at their impressive engineering capabilities and turnkey services.

Anglo Carbon, who have a full test and research facility down in Lancing, Bristol, are experts in the dark art of carbon brushes. After a visit to their Pudsey head office, we learn about the bespoke service offerings they can offer AEMT members.

Axflow restores two 50-year-old extruder pumps used in the manufacturing of busbars. Key failings included a sheared crankshaft causing excessive force on the bearing housing resulting in the casting cracking.

George Murgatroyd's brine pump in Middlewich is a legacy of our past salt and chemical industry. The remains are left in bad repair, but with the help of volunteers and a generous engineering community, there could be a chance to restore the site for the benefit of the public and to raise interest in engineering while doing it.

SKF improves the availability and efficiency of a fleet of vessels for the offshore energy industry. The static motor analyser Baker AWA-IV is helping to safeguard the marine motors and generators from potential failure.

Lammers Exico reveals a simple and economical modification to prevent stray current build-up in electric motors. Responding to the expanding energy market, with nuclear set to be the second largest contributor to the grid by 2025, they also look at motor specifications and standards for nuclear industry.

GES Group, whose CEO, Tom Grant joined the AEMT council this year, celebrates its 45th birthday and reveals its secret to longevity as well as launching new products and service offerings.

Finally, we take a look at the ingenious engineering behind the Falkirk wheel, where Scottish members were given an exclusive tour of the maintenance and engine rooms by the principal M&E engineer.

**Thomas Marks**  
*Editor and Marketing Manager*

## INDEX

Westin Drives' refurbished workshop and facilities .....	7
Goltens Dubai, a one-stop shop for the shipping, offshore and marine industries .....	12
Anglo Carbon brushes up the aftermarket with carbon technologies .....	20
AxFlow restores obsolete Trimax pumps.....	25
The Legacy of George Murgatroyd's Brine Pump .....	28
Condition-based maintenance improves fleet availability and efficiency .....	30
How to make a winning Entry to the AEMT Awards 2017.....	33
Major Brands Support Inaugural AEMT Awards .....	34
Preventing stray current build-up in electric motors.....	37
Motor Specifications for Nuclear Engineering.....	38
GES shows off new service offering at 45th birthday bash. ....	40
AEMT Visits the Scottish Canal's Falkirk Wheel .....	43
AEMT AGM.....	45

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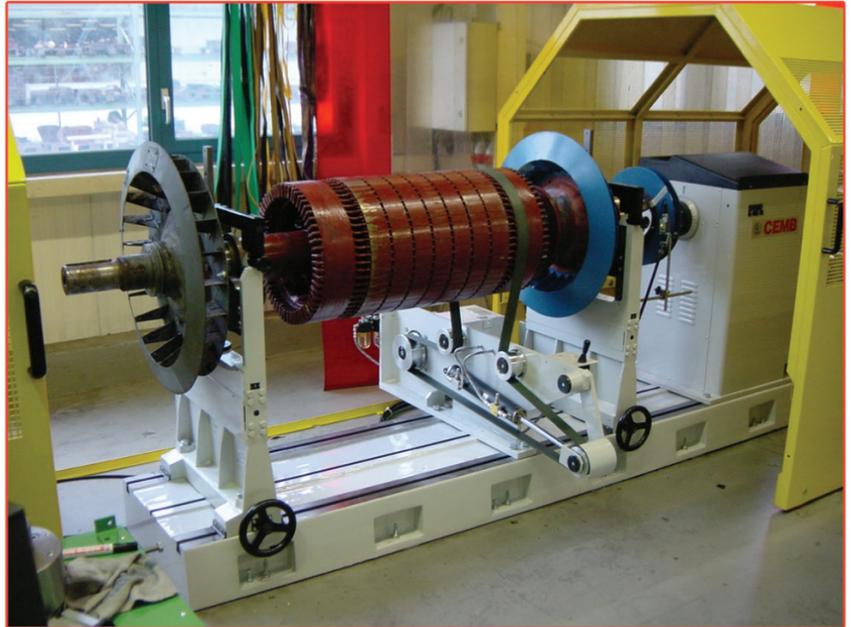
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Vibrometer  
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The image shows a person wearing a hard hat using the N300 portable equipment on a machine. The device is blue and has a screen displaying '1.97'. The background is a blurred industrial setting.

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Copper: Cu-ETP, CuAg0,1

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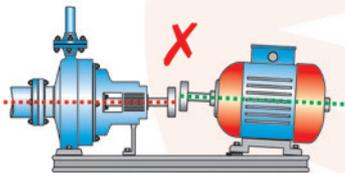
Stats show that poor shaft alignment accounts for as much as 50% of rotating plant failure.

Management buy-in and adopting key maintenance elements, sets the standard toward reducing unplanned plant stoppages.

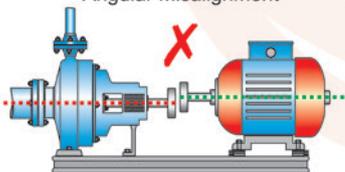
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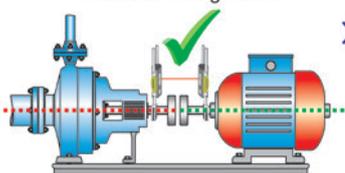
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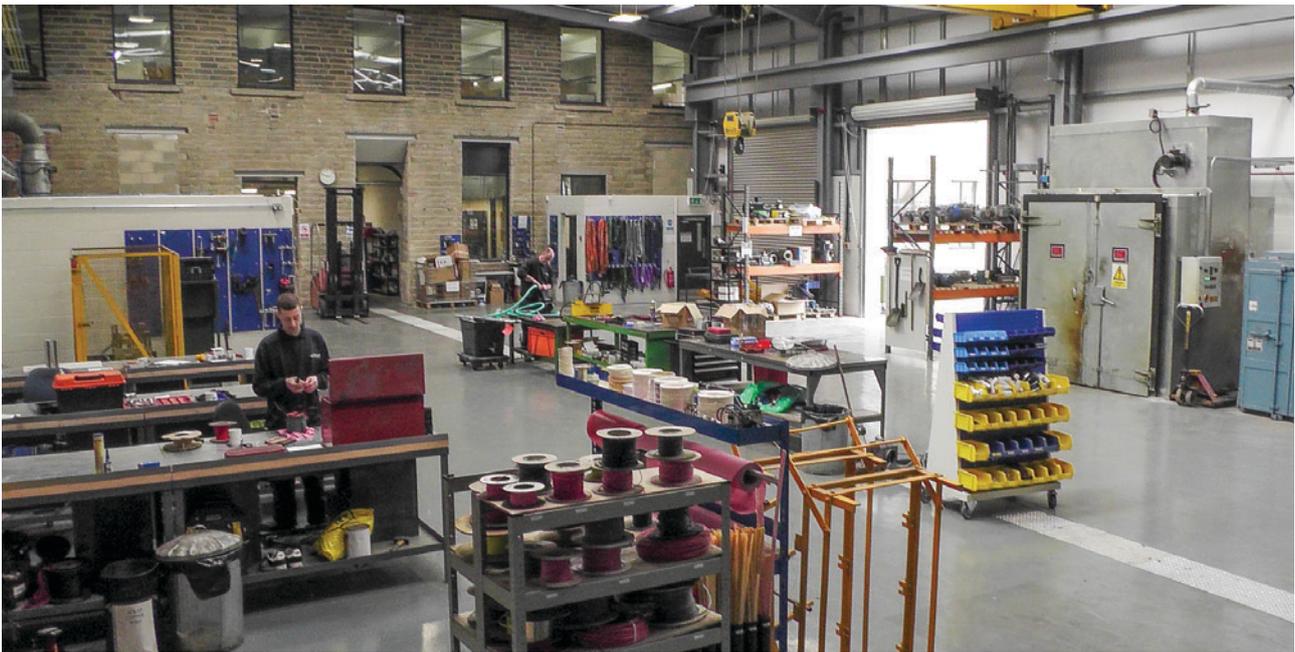
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Westin Drives presents an attractive blend of old and new.

# Westin Drives' refurbished workshop and facilities.

A former textile mill in Huddersfield which played its part in powering the Industrial Revolution is witnessing another revolution. Steve Ashman of Solutions in I.T. spent a day at Westin Drives to discover how it is benefitting from a £1m-plus investment.



**From the outside, Westin Drives presents an attractive blend of old and new. At its heart is Grove Works, a 19th century former textile mill, whose carefully restored stone facade rises above a new, steel-clad service centre. Inside, its rebirth is expressed in a stylish mix of exposed brick and stone, white walls and contemporary furniture.**

This is the new home of the Huddersfield-based electro-mechanical engineering company. A few months ago, as part of a £1m-plus investment, it moved its team, equipment and stock from cramped premises with limited access to this spacious service centre set in a large courtyard.

Westin Drives offers a quality professional rewind and repair service that goes beyond the normal practices of smaller workshops. For example, a

full health check on equipment, as a stand-alone item or part of its primary installation, is provided, no matter what the reported issue. A repair by its engineers is not only guaranteed, but meets the highest industry tolerances.

Group managing director Ian Sheppard says: "The last thing customers want is to spend good money for a rewind, only to find that they later have three or four days of lost production through failure of the same component or a related issue. This focus on quality will inevitably be the key to our success."

When Ian joined Westin Drives six years ago it became apparent there was an increasing need for growth on the technical side of the business. The problem was covering it with existing manpower. That challenge has now been met, enabling the company to expand

its range of services to become a one-stop shop for the repair and servicing of industrial machinery and the design and installation of electrical control systems.

## Technical Training for customers

To underline its breadth and depth, recent innovations include the establishment of an in-house Precision Engineering department and the provision of technical training courses. As Service Manager, Michael Limb, says: "It certainly simplifies things if you have one port of call when an issue arises."

Engineers in the technical team offer training to customers to help them recognise why faults occur, understand the benefits of preventative maintenance and enable them to make simple repairs and replacements.



Newly installed XYZ 1020 VMC CNC milling machine, which has the capacity to produce much of the work that was previously contracted out.



Employee receives new work into workshop using tablet device.

Ian admits to an initial problem with this concept: “I thought, wouldn’t training and skill transfer simply make the customer less reliant on our skills as an engineering firm? - but the opposite is true. By offering a programme of education, you are helping your client to work closely with you. You get to understand their needs in detail and that close working relationship gives the client more reason to want to work with you.”

### Oven Facilities

The ground floor offices lead to the airy expanse of the new workshop extension, notable for the two synchronised, ten tonne overhead Street cranes. Here operations are clearly defined. Everything is clean and uncluttered, everything has

a place. The goods-in area has storage for small motors; the large motor area, whose floor has been reinforced to accept deliveries, is serviced by the cranes. In the next bay stand two ovens.

The first oven is used for drying parts after they’ve been washed but its main purpose is for stoving a rewind with impregnation resin. Rewound coils need to be hardened when first sited in the motor and prior to it being energised and this is where innovation has taken over. Historically, varnish would have been used for this process, but here Westin Drives chose to change the process, especially when the advantages of using a less toxic, epoxy resin style product are deemed more effective and green friendly. As technical manager Fraser

Lynch says: “Resin is more expensive but it’s easier to use and safer on the environment: decisions like this will always be made by us.”

Next is the burn out oven, a simple and clean way of removing old insulation, varnish, epoxy, paint and other organic material before the repair takes place. The oven can operate at at 360C to 370C degrees – enough to remove varnish and enamel from the copper without damaging the stator laminations or the dielectric.

Before today’s strict environmental laws, a naked flame would be used for this process, risking damage to the motor’s efficiency. After eight hours of heating and cooling the majority of the motor is placed in a parts washer, an aqueous, non-toxic washing machine that automates the final element of cleaning, allowing technical labour to be used more efficiently elsewhere.

### Rewind Facilities

In the far corner of the service centre stand the rewind machines. They are central to the business and serve the six benches allocated for coil replacement, small repairs and motor building. As part of the company’s commitment to quality and training, each engineer is allocated a complete toolkit and access to a tool wall for all larger communal tools.

## Why this investment in personalised tool kits, and are they common in the industry?

Fraser says: “By having the right, good quality tools to hand, you ensure standardisation of working practices and speed. In the past, like so many others, each engineer would gather tools over a period of time in the industry, but 5S showed us that this wasn’t necessarily the right way forward.”

5S is a system of workplace organisation adopted by Westin Drives as part of a culture shift. Designed to improve productivity, safety and quality, it enables teams to organise the workplace in the most efficient way and its ultimate purpose is to increase customer satisfaction.

The testing area and spray bay complete the circle of repair, an enclosed area incorporating a balancing machine, a cast flat floor for securing the motor under strict tolerances and a range of electrical circuits and specialist cabling enabling the connection of DC and AC motors from the very small to 100’s of kW on a variable 400Hz circuit.

## Stock Holdings

Returning to the mill building, we find a store between the technical services room and the machine shop. Here, everything is boxed and ordered neatly on clearly labelled shelves – more evidence of the beneficial influence of 5S. This sizeable stockholding allows

*“Lenze and Westin Drives offer much more than spares and repairs. Working with the Lenze portfolio which includes PLC controls, visualisation, inverter and servo drives, motors and geared motors, Westin offer complete solutions service for drives and automation. An example is the upgrade of machinery to make it faster, easier to use or more reliable. New control panels can be provided.”*

**Neil Beaumont, Marketing Communications Manager, Lenze.**

engineers to respond to instant demand to get customers up and running as quickly as possible: further evidence of the one-stop shop ethos.

Long standing relationships with WEG for electric motors, Lenze for control systems and SKF for bearings ensure the availability of quality products. These suppliers also bring more than simple distribution opportunities. Each provides accredited engineering programmes to complement the business and its aspirations for quality, all to be documented in ISO9001 and ISO15000, so customers can be assured that work is carried out to the highest standards.

## Precision Engineering Shop

The precision engineering shop is a new addition. As I enter, Matt Phillips, the specialist mechanical engineer, is coating a spindle with metal spray, an impressive process of replacing worn metal with super-heated powder, allowing the item to be returned to its original specification. This is just one modern method of restoration, for the machine shop has the capability to manufacture parts from scratch ensuring a swift turnaround.

The latest arrival to ensure this capability is a CNC milling machine, the XYZ 1020 VMC, which has the capacity to produce much of the work that was previously contracted out. One recent job involved creating an end shield for a motor and various shafts lost to abusive wear. It was turned on the lathe and the key slot was CNC milled to precise measurements, a complex task completed in a short time.

Matt says that detailed drawings are not necessarily required. Customers can come to discuss their needs and have drawings made electronically, or an item can be replicated from the original. In the matter of tolerances, the CNC is programmed to produce the highest specification – three decimal places variation – as laid down in the SKF Rebuilder Accreditation.

## Customer Service

While technical and managerial innovation are fundamental to this company, perhaps its most conspicuous attribute is the attitude to service. Michael Limb says: “Our high quality of customer service is key to Westin. That’s what customers want, somebody who is interested in solving their problems,



Powder cold flame spraying with Rototec.



Part of the workshop including the caged balancing area

## Predictive Maintenance

The company has spent heavily on predictive maintenance equipment for condition monitoring, vibration analysis, thermographic heat source monitoring, coil wear sensors and precision measuring devices. These items can be used before dismantling or repair to identify faults that may cause immediate damage, future failure, or affect the efficiency of a unit. Being open and honest allows engineers to make the right decision for the client and the life cycle of the equipment.

minimising their downtime. The biggest buzz you get is when you fix something. Everybody in the business wins, if you can capture that feeling.”

Michael is proud of his team and of the work they do and of the general enthusiasm about the place. He believes that understanding customers, and being able to deliver what they want when they want it, is the priority. Honest communication is also valued. “If there is something we can’t do, we should not be shy to tell our customers that,” he says. Honesty gives the customer the chance to plan around the issues. Honesty and accuracy are very important.”

Fraser, a hands-on technical manager, is a time-served apprentice who started with Westin Drives at 16. He began his career with seven months of full-time study at KITS, a training centre in Brighouse, as he worked through his NVQ’s 1, 2 & 3. This led to day release while working towards an ONC in Electrical and Electronic Engineering, before achieving HNC standard, which he describes as really hard study work and assessments. Finally, after two years of Industrial Measurement and Control at degree level, he achieved a B.Eng from

Huddersfield University. The person I see today is a confident manager, charged with purpose and ability.

### Does Fraser regard the modern apprenticeship as the way forward?

It seems the circle of training life has already been initiated. A young engineer, Connor Earnshaw, is following a similar route and has shown an aptitude for electrical maintenance which suits the testing and condition monitoring department, an important element of this company. Harry Stansfield is serving his apprenticeship in the workshop and has been with the company for two years and an additional apprentice was due to start in July.

The Westin approach to quality repairs is to offer the customer an insight into the working life of the equipment from every angle. Reported problems are not always the root cause of failure and additional downtime for supplementary repair can aggravate a working relationship. Again, this is where innovation and investment meet to broaden the scope of potential issues that can be investigated.

As part of the SKF accreditation and preferred working practices, Westin Drives customers are assured of far higher achieved tolerances on all repairs, as measurements are made to three decimal places (three millionths of an inch). Fraser insists that when a bearing housing is measured, the position of the shaft and alignment in the piece are guaranteed, ensuring longer and more efficient running time post repair. This is not an industry standard. Previous poor quality workmanship in jobs that arrive at the service centre is instantly noted as in the past repairs by smaller operations have led to premature failure. Cheap, warns Fraser, is not always cheerful.

Westin Drives brings a fresh approach to the industry. Operating from a 21st century service centre attached to a 19th century mill, it combines the best of innovation and tradition. With a laser focus on the customer, it has shed the old mentality of the engineering world to present a bold approach to problem solving. And with capabilities and a drive for quality well above the industry standard, the future of this old spinning and weaving mill is once again assured. ■

*“The new Westin Drives facility has been well thought through for work flow, applying the ‘Dirty In and Clean Out’ approach with proper segregation and control of tear down (dirty) - and assembly (clean) areas. Their new facility in Huddersfield is well equipped to effectively and efficiently handle motor repairs. I look forward to following the success of Westin Drives and thank them for their support of the community of SKF Certified Rebuilders.”*

**Jim Fowlie, Global Manager Certified Programs, SKF**

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# Goltens Dubai, a one-stop shop for the shipping, offshore and marine industries.

There are an increasing number of AEMT Members who can offer specialist services for the marine and shipping industry. Marine grade motors, propulsion systems, ballast pumps, gearboxes, turbines and generators make up a small portion of the plant that require attention from AEMT members. Services on offer range from the replacement of parts and systems to the full turn-key overhaul of a vessel. One member who offers a full turn-key service is Goltens, and one of their sites, found at the Dubai Maritime City (DMC), is an impressive place to visit.



*There are over 50,000 merchant ships trading internationally, transporting in excess of 10 billion tons of cargo. The impact of such a vast industry on the oceans' ecology, and climate change are significant.*

upgrades these ships need to install by 2030 in order to reach their targets.

The 2004 Ballast Water Management Convention has also meant that the ships must not cross-contaminate local ports with the sea water used to ballast the ships. Goltens Green Technologies utilise cutting edge laser-scanning technology in order to install the water treatment systems necessary to comply with the convention.

## World Wide Shipping

Around 90% of world trade is carried out by the international shipping industry. Without shipping the import and export of goods on the scale necessary for the modern world would not be possible. Seaborne trade continues to expand, bringing benefits for consumers across the world through competitive freight costs. Thanks to the growing efficiency of shipping as a mode of transport and increased economic liberalisation, the prospects for the industry's further growth continue to be strong.

There are over 50,000 merchant ships trading internationally, transporting in excess of 10 billion tons of cargo. The impact of such a vast industry on the oceans' ecology, and climate change are significant.

The 2015 Paris Agreement has put pressure on shipping companies to

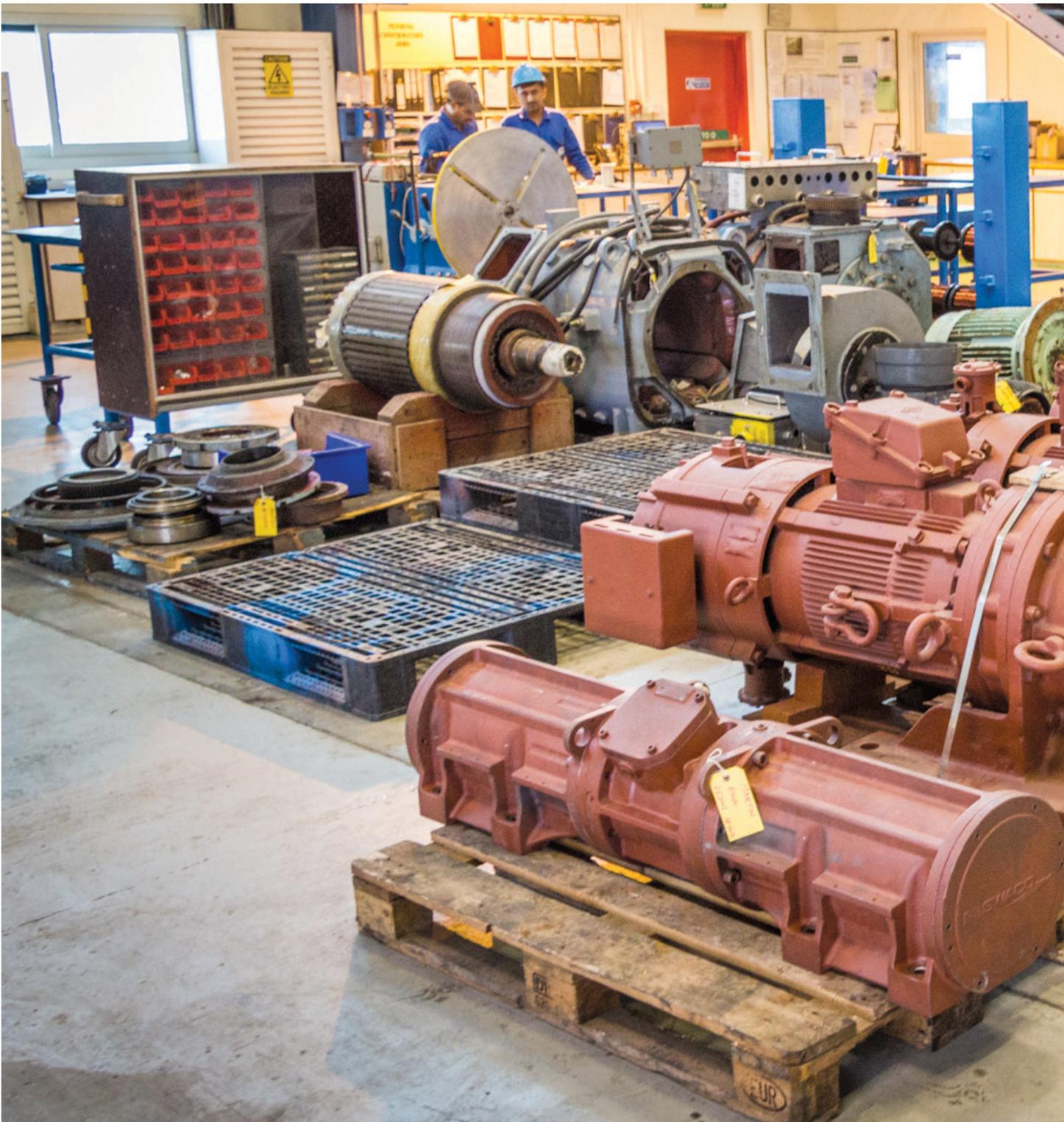
reduce emissions of CO<sub>2</sub>, sulphur and nitrogen oxides. This major pressure point on the shipping industry has meant that companies such as Golten are able to take advantage of the equipment

## Goltens Dubai

Approaching DMC you are aware of the immense engineering capability of the manmade island Goltens Dubai shares with Dubai Dry Docks, another member of the AEMT, plus many other Marine based engineering companies.



Roy D'Souza, Regional Sales Manager, at his Desk at Goltens Dubai



*Six Ex Motors in the rewind workshop ready for delivery to an offshore rig.*

Going through security you pass docks crammed with ships and rigs, such as anchor handling & supply vessels, well stimulation vessels, and drilling rigs. To your right are the ship lifting systems belonging to Dubai Drydocks that can haul up to 6000 ton vessels from the water.

Upon arrival, I'm introduced to Roy

D'Souza, the Regional Sales Manager for Goltens Dubai. His office looks out straight onto the docks where a rig is moored up for service. Trained as a Mechanical and Marine engineer, he served his time on board vessels travelling across the globe, but with the calling of a young family, eventually opted to settle into office life at Goltens Dubai in 2003.

Roy hasn't looked back since starting; "Goltens is a great company to work for. It's a family-owned business, and we are very well looked after" he explains.

It was established by founder Sigurd Goltens in New York in 1940 to meet a growing demand for diesel engine repair and spare parts, the company quickly became a leading in-situ machining and



engine repair specialist, a position it has held for over seven decades.

Recognising the need to be where his customers needed service, Golten sought to expand his company's presence to a global audience enabling the provision of service "Around the clock – around the world".

*Recognising the need to be where his customers needed service, Golten sought to expand his company's presence to a global audience enabling the provision of service "Around the clock – around the world".*



Goltens have one of the largest VPI tanks in the Dubai region.

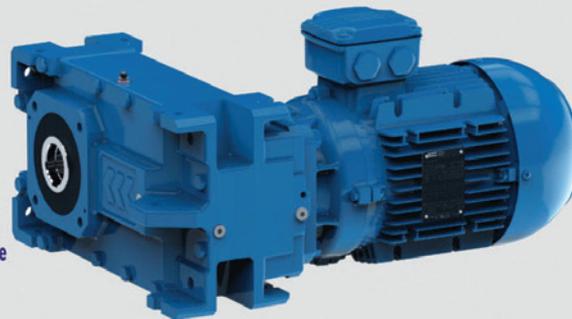


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Today, realising Sigurd’s goal, Goltens operates as a one-stop shop to the marine and shipping industry to over 25 locations in 15 countries.

### Dubai Operations

Roy goes on to explain that “sharing the DMC island with Dubai Drydocks means that Goltens can make use of their lifting capabilities. Most ships coming in for service are support vessels for the larger offshore rigs and platforms, such as anchor handling tugboats, supply, and crew boats.”

Every two and a half years these ships have an intermediate docking survey followed by a full 5 year survey, which means hauling them out of the water for inspection.

The footprint of the Dubai facility is enormous – it has to be in order to provide the turn-key servicing of these moored vessels, in one location, and with minimum subcontracting. It offers



Thomas Kurien, HSE Advisor, beside the company's three quality systems for ISO 14001, 18001 & 9001

a huge range of skills, engineering capabilities, and stock.

As vessels continuously become more advanced, Goltens works closely with engine and equipment manufacturers to update their engineers on the

latest technology. Having highly skilled personnel with close relations to suppliers enables Goltens to provide quick retrofit packages, and turnkey systems for propulsion, power generation, and automation control.

*(continued next page)*

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The impressive machine shop at Goltens Dubai.

Their core business comes from marine diesel engines, from which they will be working on the engine parts, turbochargers, and fuel equipment.

This is just the bait on the hook, and from marine diesel engines they can go on to work on governors, actuators, controls, turbines, and retrofits. In-situ services such as crankshaft/

journal machining, heat treatment/annealing, large flange facing, laser alignment and metal stitching. Green technology solutions such as ballast water treatment, and sulphur emissions control. Docking and afloat repairs such as hull & tank treatments, welding, fabrication, and HVAC.

*Their electrical, mechanical, hydraulics and automation workshops give them the capabilities to sweep up all the motor & generator rewinds and repairs. Gearboxes, pumps, condition monitoring, or vibration analysis... you name it, they can do it!*

Their electrical, mechanical, hydraulics and automation workshops give them the capabilities to sweep up all the motor & generator rewinds and repairs. Gearboxes, pumps, condition monitoring, or vibration analysis... you name it, they can do it!



Arif Mansoor, Manager of Electrical and Automation

So as you can see, there is very little they can't engineer, but in the essence of speed they also have OEM stock resources ranging from spare engine parts, and motors, to marine grade kitchen units.

All this comes together to create incredible economies of scale for shipping and marine companies, coupled with strategic workshop locations around the globe, makes for a successful company formula.

### Control Systems

Roy is among 1300 employees, many

of whom are on the shop floor, or offshore vessels. Keeping on top of the training, and health and safety of staff is something they take very seriously. With Quality systems 14001 (Environmental), 18001 (Health & Safety) and 9001 (Quality Management) in place, there is a lot to manage.

Thomas Kurien, HSE advisor, explains how such effective systems are managed; "Every week all the management call together a Toolbox Talk. This focuses on production topics, and reminders on health and safety. It means that the management are very much aware of what is happening on the shop floor, and therefore able to manage the personnel effectively and safely."

The toolbox talk incorporates a full risk assessment; where are they going, what dangers are they likely to meet, and how can they mitigate them. Any new procedures that come up can be added to the corporation's Quality Health and Safety Manual, an extensive resource for all employees. For example, a new job comes in requiring the opening of a vault door – all the procedures and safety checks will be logged for future reference. Any time there is any incident it is quickly brought to

the management's attention, so it can be learnt from. Once understood, it is brought to the wider company's attention (as a Safety Alert), and the incident recorded.

### Workshops

Having met with Roy and Thomas, it is Arif Mansoor, Electrical & Automation manager, who gets to show off the plants facilities. We only covered half the site, but from what was shown, it's clear that a lot of the work can be managed themselves.

Reaching the rewind workshop 6 gleaming red Ex motors are lined up ready for shipping to an offshore rig. Apart from the normal maintenance, repair, overhauling services, the rewind workshop is a fully equipped facility for the rewinding of high and medium voltage (up to 11kV) motors and generators. They have a combined lifting capacity of 16 ton, and one of the largest VPI tanks in the region.

Their most impressive workshop spans the length of the warehouse, with an impressive array of machining and reconditioning tools for handling the enormous piston heads, crankshafts and cylinder heads that come of the diesel engines. ■



*Anglo Carbon provide a wide range of carbon brushes and associated spares for electric motors.*

# Anglo Carbon brushes up the aftermarket with carbon technologies.

The dark art of understanding carbon brushes is best left to the experts. The AEMT visited Anglo Carbon near Leeds to understand more about the family company, and their expertise in conducting electricity. Kevin Wray, MD of Anglo Carbon, along with siblings Susan and Karen, met with us and elaborated on their focus of the rotating electric machines market.

Since 1959, when the company was formed, the business has grown into a successful company employing over 25. In the late 80s they hit a landmark moment when they decided to invest in a materials research and production factory in Lancing, West Sussex. This opened up the southern market to them, and strategically placed them for an overseas market also.

The family Company, now in its third generation, works well together; all three

siblings have grown up in the business and know it intimately. The dynamics between the trio shows a close, yet distinctly professional relationship.

Recent investments in CNC machinery and robotics have automated stages of the manufacturing process to increase production. They also have presses ranging from 1.5 tonne to 300 tonne to create materials for an array of applications.

## Niche market offerings

Anglo Carbon's success has been born very much from its niche market offerings, and service levels. Their customers vary significantly, with applications ranging from micro brushes for prosthetics to large brushes for power generation.

The crux of carbon brush technology comes from the markets that demand the most when it comes to reliability and the longevity of a brush. In traditional

power stations, for example, the cost of any downtime is astronomical. For this reason, the durability of a brush is critical for the upkeep of the facility. In transport; whether it is trains or trams, servicing is a costly exercise. For hard to reach places, such as oil rigs, offshore windfarms, or high-altitude applications, where maintenance is difficult or awkward, then a durable brush technology is required.

Their research centre in Lancing has developed ways to vastly increase the durability of brushes for these applications; and in doing so extending a product's working life.

Brushes are normally made in batches catering for high volumes down to bespoke one off urgent orders. This is what gives Anglo Carbon the flexibility required to cater to niche markets. The bespoke offerings mean that one day they could be creating brushes for military applications, and the next for electric motors running in the 45°C heat of the Arabian desert.

Their materials include copper graphite, natural graphite, resin bonded materials, silver graphite,



*The composite range of RT brushes for wind turbines has advanced hybrid structures and composite materials, which provides outstanding performance and reliability.*

carbographite and electrographite. These materials cover a broad spectrum of operational duties and cycles. Once installed, they address many electrical, high speed, atmospheric, noise, radio frequency interference, and many other performance related problems that may be experienced.

### R&D in Lancing

As well as producing the raw materials the facility also operates as a research and development centre, test centre and is a registered reclamation site (to extract rare materials from old brushes). The facility employs industrial chemists and material scientists who



*Anglo Carbon head office is located in Waterloo Mills, in Pudsey, Leeds, testimony to the steel and textile industries which the company originally served in the 1950s and 60s.*



Anglo Carbon's bespoke service offering allows the stamping of your company name onto a brush to encourage continued service contracts for the life of the equipment. All brushes are RoHS compliant, meaning they are safe for landfill at the end of life. However, their Lancing facility also has a reclamation facility for precious metals.

have been very successful in developing bespoke materials to satisfy customer requirements.

In such a competitive market, the investment in research and development has led to the development of a range of materials that offer extremely low resistances, enabling greater levels of current carrying capacity, or a reduction in size and cost. As an example in a brush material containing about 60% silver the

research and development team have managed to produce the same resistance and power output using only 22% silver.

It is a similar story with copper; the research team have managed to produce a copper grade with a similar resistance to the silver equivalent. Looking at the table below highlights the similarities. A 64% silver brush has specific resistance of 0.5  $\mu\Omega$ , whereas the copper equivalent made up of 70% copper has a

specific resistance quite similar at 0.32  $\mu\Omega$ .

It would be fair to say; the world of carbon brushes can get quite technical, quite quickly! With so many different operating environments being taken into account such as; altitude, humidity, durability, resistance, etc. it's easy to get bogged down. But the table below demonstrates that cheaper alternatives are now being made available for both the lower and higher end of the market.

### Specific Resistance Table

		Metal Content	Density gm/cc	Specific Resistance $\mu\Omega$	Kg/sq. cm	Comments
Silver	SG1	85%	5.5	0.07	360	
	SG2	79%	4.8	0.11	440	
	<b>SG3</b>	<b>64%</b>	<b>3.7</b>	<b>0.5</b>	<b>275</b>	
	SMF1	60%	4	0.26	300	High Altitude
	SG4	50%	2.9	1.2	200	High Speed
Copper	MG12Y	95%	6.4	0.06	660	
	MG14Y	90%	5.95	0.07	460	
	MG2	85%	4.95	0.14	290	
	<b>PG35</b>	<b>70%</b>	<b>3.75</b>	<b>0.32</b>	<b>310</b>	<b>High Speed</b>
	MF5	59%	3.4	1.3	230	High Altitude
	PG12X	53%	2.85	2.5	275	
	MF3	40%	2.83	2.2	230	High Altitude
	MF9	35%	2.7	1.9	230	High Altitude
Graphite	PG16	23%	2.07	11	140	
	PN20	N/A	1.4	11	75	High Speed
Carbon	PN6	N/A	1.7	18	70	
	7E	N/A	1.65	25	260	

### Service offering for AEMT members

A look at Anglo Carbon's new website shows how diverse the fields and applications are for carbon and graphite products. Mixed with the skillset of members - there are plenty of opportunities available for both members and Anglo Carbon to work together.

They currently stock around 130 different types of carbon graphite, so for any given application a solution can be readily available. Reverse engineering a product is not uncommon. If a customer has installed a motor not quite being put to use as intended, then issues might occur such as brushes sparking, or wearing down too quickly. Anglo Carbon can reverse engineer brushes to suit the actual application motors are being used for. A next day service is available, and upon request Anglo Carbon are able to stamp customers brushes with their name or part number



Left to right; Steph, Susan, Karen And Kevin.

code. Once the brushes are fitted and the motor repaired – then hopefully the service centre can enjoy a share of the aftermarket for motor spares. Joint site visits are also available, and

a member of Anglo Carbon can join a customer on a site visit as an expert – this could help solve a problem on the spot, and ensure a proactive relationship with your customer. Alternatively, the

Anglo Carbon technician can perform a site survey and setup a referencing system for you or your customer, so the next time an order is made, it is as quick and simple as possible. ■

### Brush Orders:

The decades of experience built up at the company, has given them an acute knowledge of brush applications. To be certain of the material makeup an analysis can be made from a sample sent in, or a brush grade can usually be found stamped on the brush.

More often than not though, it is possible to call in with two pieces of information to hand:

- your equipment’s nameplate details
- and the size of the brush box.

From here, it’s possible to either supply a like for like replacement, or recommend a better alternative.

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Fig 1. The Trimax pump assembly as received at Huddersfield.

# AxFlow restores obsolete Trimax pumps

An urgent call was received by Axflow from a customer with a breakdown of a fifty year old extruder pump, which made busbars. Busbars are essential components within power transmission systems and traditionally are made from copper because this material delivers high levels of conductivity. However, it is not the lightest of materials nor is it the cheapest. Where weight and cost are critical factors in applications such as electrical power distribution, renewable energy, electrical inverters and components for the aerospace, railway and marine industries, solid copper busbars are not the ideal solution.

One alternative that offers 60% lower weight, 40% cost reduction and 60% lower surface resistance compared to copper conductors is the copper-clad aluminium (CCA) electrical conductor, better known as the Cuponal™, manufactured by Bruker Hydrostatic

Extrusions. The Cuponal™ consists of a solid core of electrical grade aluminium with a pressure bonded seamless outer layer of high conductivity copper. The manufacturing process involves hydrostatically extruding copper and aluminium billets from which the

busbars are manufactured.

The process developed by Hydrostatic Extrusions at its UK plant in Perth, Scotland, is far from new, being several decades old. In spite of its long history, it remains the only method of delivering



Fig 2. The pump internals were badly worn.



Fig 3. A new pinwheel and worm had to be made.

performance parameters that cannot be attained by any other extrusion process. Hydrostatic extrusion uses oil at high pressure around the billet to effect the extrusion, this eliminates any friction between the billet and press container. In the case of Hydrostatic Extrusions, the oil used is vegetable oil and this is delivered by two high pressure reciprocating pumps. Their performance is absolutely critical to the entire process. The Holden & Brooke T50 Trimax pumps apply 1500 psi pressure to the main ram using the castor oil as the hydrostatic medium.

### Problem

Just how critical the pump's performance is to the extrusion process became very clear when the No 1 pump suffered a catastrophic failure. This may have been caused by a closed discharge valve in the system (Fig. 1). Fortunately, the process system included a second pump, enabling production to continue. Replacing the damaged pump was deemed a priority as two pumps provide system resilience, but this was far from being straightforward. The Holden & Brooke Triplex pump was obsolete.

Stuart Elliott, Managing Director, Hydrostatic Extrusions takes up the story. "The press is basically a huge hydraulic ram which pressurises the extrusion container. Once the empty container is loaded with the working metal pieces for extrusion the hydrostatic fluid is pumped at high pressure into the closed container. The oil continues to be pumped into the container until the pre-determined pressure in the container is achieved. The extrusion ram is then applied and the pumps are taken off duty until the extrusion process is completed. In terms of operation, the two pumps are run all day, and over the five decades in which they have been in service they have proved to be very effective, requiring very little maintenance work."

Hydrostatic Extrusions' initial thought was to find an alternative manufacturer's pump, but finding a pump that delivered a low flow and high pressure that matched the performance of the original models specified proved too difficult and costly. The alternative was to look at the feasibility and costs of getting the pump repaired and this led to AxFlow's

Huddersfield Service Base being called in for advice. "We responded to Hydrostatic Extrusions' enquiry by despatching one of our Scottish-based sales engineers to take a look at the pump and prepare a report," explains Tom Cooper, AxFlow Service Base Manager. "It was in a very poor state of repair (Fig. 2) and needed some serious work if it was to re-enter service and perform to the customer's requirements. However, we considered that extensive repair work, which included making completely new components, was possible. We prepared a full report supported by extensive photographs, the associated costs and a timeframe in which the work would be carried out, and this was accepted by the customer."

The report identified many key failings, the crankshaft had sheared, causing excessive force on the bearing housing resulting in the casting cracking. Both items had to be completely replaced. In addition, the pinion wheel was damaged so the pinion wheel and worm shaft had to be replaced as a

*The process developed by Hydrostatic Extrusions at its UK plant in Perth, Scotland, is far from new, being several decades old. In spite of its long history, it remains the only method of delivering performance parameters that cannot be attained by any other extrusion process. The functional principle of hydrostatic extrusion uses oil at high pressure around the billet to effect the extrusion, which eliminates any friction between the billet and press container.*

pair (Fig.3). The conrod bearings were badly worn and had to be replaced. One of the crankshaft bearings was seized on to the crankshaft meaning that both the crankshaft and the bearing had to be replaced. AxFlow's final recommendation was to replace all the seals, packings and gaskets as well as the taper roller timken bearings for the worm shaft.

"We estimated that the pump could

be rebuilt to the original operating specification, pressure tested before spray painting and dispatched for refitting and commissioning in eight weeks, comments Tom Cooper. "The repair and rebuild was completed within eight weeks and since commissioning, the pump has run perfectly. The customer was so satisfied with the job that we have now taken delivery of the second pump for repair and maintenance." ■

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# The Legacy of George Murgatroyd's Brine Pump.

Industrial Heritage and Archaeology are fast becoming popular topics in many communities up and down the country. They are the legacies of our past, representations of the industries that once supported our families and created our towns and cities.

**In an age of austerity it is sites like Murgatroyd's, all over the country that are paying the price. Slowly but surely communities are taking back control of their own industrial heritage, saving them for future generations to understand the impact that these machines and processes played in everyday lives. It is also important that connections with the modern industrial world are understood to measure just how far we have advanced in technology and explore what is to come.**

George Murgatroyd had a dream of setting up his own Salt and Chemical business; 128 years later the brine shaft he had dug is nationally important... why? Because the rock salt he found started an industrial chain reaction of inventions, chemical advancement and technological achievement known throughout the world.

In 1977 it was known that the pumps and brine shaft were the only surviving example of a technology which was once in widespread use by the inland salt industry throughout the 19th Century and the first half of the 20th Century. This technology was not particular to Cheshire and similar pumps were once used at Salt works in Staffordshire and Worcestershire. The industrial archaeological value of the site is enhanced by the fact that the brine pumps remain installed in the original 'hand dug' brine shaft above which stands the original timber maintenance gantry. An integral part of the deep well pumps is below ground level in the shaft. Any attempt to separate the various parts of the installation would destroy its overall integrity. While a conserved salt works is linked to a particular technology and age, the brine pumps celebrate the brine which has made the salt making and chemical industry possible.

Middlewich Heritage Trust was formed in 2015, with support from Historic England, the Trust will take over an asset transfer of the 'Murgatroyd's Brine Pump' site from Cheshire East Council which is:

- A Scheduled Monument
- On the Historic England Building at Risk Register.
- Has a full associated Archive
- It is not at presently accessible by the public, even though the collection as a whole is a rich resource for the town.

The Trust has supported and worked alongside Middlewich Town Council, Cheshire East Council and Historic England on emergency repairs to the Brine Pump site, which was grant funded. The £117,000 project was completed in March 2016.

The Trust holds an extensive collection of drawings, photographs, film, documents,



artefacts and oral archives relating to the Murgatroyd Company, thanks largely to George Twigg’s research. Due to this and the help of George and his former work colleagues we now have a full picture of the history of the site, development details and also how Murgatroyd’s fitted into the greater ‘salt and chemical’ trade of the UK.

### What exactly do we need help with?

- Finish refurbishment of timber gantry
- Installation of new windows and doors

- Replacement of derelict brine tank – (During the stabilisation works, the brine storage tank on the pump-house roof was found to be beyond repair, and was removed. This tank formed part of the scheduling and, as such, Historic England will expect it to be reinstated).
- Stabilisation of the brine shaft
- Restoration of one of the pumps to operational condition
- Restoration of Motor Control Panel to exhibition standard

- Reinstatement of electricity supply
- Restoration of Transfer pumps to exhibition standard
- Provision of display cabinets / housing for Transfer pumps
- Site Interpretation
- Education package (to include all educational establishments)

For more information on our project or how to get involved please contact [middlewich.heritage.trust@gmail.com](mailto:middlewich.heritage.trust@gmail.com) or call 01606 833434. ■

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# Condition-based maintenance improves fleet availability and efficiency.

Analysis of marine electric motors and generators by SKF Electric Motor Condition Monitoring Services is helping an offshore engineering services provider optimise the performance and reliability of its rotating equipment.

**Subsea 7 is a seabed-to-surface engineering, construction and services contractor to the offshore energy industry. The company's operations include installing and maintaining the umbilical cables, risers and flowlines that connect oil and gas wells to floating production platforms. Much of the time sensitive work is done in water depths of up to 3,000m, with arduous sea and weather conditions.**

The work calls for highly specialised assets, so Subsea 7 operates some of the most modern and advanced offshore service vessels and remotely operated vehicles (ROVs) in the world. Its fleet includes many high-performing

pipe laying and heavy construction vessels and versatile support ships for construction, diving and remote intervention activities.

Operating in such harsh environments places a premium on the reliability of those vessels and their equipment. Failure of a critical asset while at sea could jeopardise the vessel's schedule. At the same time, the company needs to keep the time required for planned maintenance and overhaul activities tightly under control, so the vessels can spend more of their time working on projects around world.

In its continual efforts to maximise

performance, Subsea 7 is moving from time-based overhauls to a condition-based maintenance strategy for a number of critical assets in its fleet. By monitoring the behaviour and performance of equipment, engineers aim to ensure that equipment overhaul and replacement activities are carried out at the optimal frequency, maximising vessel performance and availability.

As part of this new strategy, regular static testing is carried out on a number of critical electrical machines in its fleet. Those assets include the generators and thruster motors used to keep vessels in the correct position over the work site. The electrical testing services are

provided by SKF, using the SKF Static Motor Analyzer Baker AWA-IV.

The SKF Static Motor Analyzer Baker AWA-IV performs tests on motors while in a static, or powered-down state. Static electrical testing can provide early warning of developing issues in electrical machines, allowing timely intervention before problems occur, minimising impact on operations and vessel availability. Among other things, the technique can be used to identify corroded or loose connections, contamination and water ingress, or winding and ground-wall insulation weaknesses that could reduce efficiency, impair performance or lead to premature motor failure.

A sequence of tests is conducted to analyse the winding circuit, and the dielectric strength of the insulation between windings and earth, as well as turn-to-turn and between phases. For example, studies have shown that 80 per cent of the electrical failures in motors begin with a failure of the thin insulation around individual wires in their coils. As this insulation degrades, the inrush of voltage during motor starting and stopping can cause arcing, further degrading the insulation and creating a conductive carbon path that will eventually lead to a short circuit and complete failure. A special test known as a surge test is used to detect weak turn-to-turn insulation before a short occurs.

Testing at Subsea 7 is conducted while vessels are docked for other scheduled maintenance activities. The generators installed on vessels can contain up to five separate windings, and each undergo a comprehensive series of tests to determine the overall health of the machine.

Subsea 7 and SKF have collaborated to design and tailor the service and solution to deliver the maximum value to their operations during tight overhaul schedules. This includes documented preparation instructions and a review of the equipment profile and test procedures in advance of each planned overhaul.

Any early identification of a pending issue or deterioration in equipment

performance allows engineers to intervene during the scheduled maintenance period to prevent future problems. This means the fleet can operate with complete assurance that its electrical equipment will deliver optimum performance.

Regular testing is also helping the company improve its overall understanding of asset performance and reliability says Julien Manach, DP, Electrical & Control Systems Group Lead at Subsea 7.

“By performing electrical condition monitoring on both new builds and existing ships in service we can build up a picture of changes in equipment health and performance, plan maintenance and, if necessary, take action before a major breakdown occurs.”

“Both marine and construction equipment is often located in areas which are difficult to access or perform in-situ repairs. Therefore, the earlier a developing fault is detected, the more effective the operational intervention can become, averting a possible failure, reducing both the risk of vessel downtime and cost.”

“Over the last year we have developed a good relationship with SKF. The SKF Static Motor Analyzer Baker AWA-IV has been used successfully on board several vessels and SKF’s expertise helped to predict several failures which were repaired during planned maintenance periods, removing the need for vessel downtime or expensive third party mobilisations offshore.” ■



## SKF Static Motor Analyzer Baker AWA-IV

- Reduces electric motor maintenance costs
- Maximises motor and machine uptime
- Prevents unexpected motor failure and resulting losses
- Extends motor life and improves motor efficiency
- Improves motor and machine maintenance programmes



# Awards 2017

Wednesday, November 29th, 2017

Doubletree by Hilton Hotel, Coventry

## Introducing the inaugural AEMT Awards 2017...

*The Awards will bring together the entire electrical and mechanical trades sector in a global celebration of business and professional excellence.*

*Recognising the achievements of both individuals and companies operating within this important industry sector.*

Entries are now being sought for any company, product, application or individual involved in the supply installation, service, maintenance and repair of industrial machinery technology such as electric motors, drives, pumps, fans, gearboxes, generators, transformers, switchgear and ancillary equipment.

To enter please visit [www.aemtawards.co.uk](http://www.aemtawards.co.uk)

The 2017 'Call for Nominations' are now open, so be sure to visit the AEMT Awards website to review the seven award categories and decide which ones you will be entering!

### EVENT CALENDAR

NOMINATIONS  
OPEN

**08**  
March

NOMINATIONS  
CLOSE

**18**  
August

JUDGING  
SESSION

**07**  
September

WINNERS  
ANNOUNCED

**29**  
November

### 2017 Partners





# How to make a winning Entry to the AEMT Awards 2017

If you don't enter; you can't expect to win. In other words – what have you got to lose by entering for an AEMT award? The awards have been designed to celebrate and promote the best of the electrical and mechanical trades sector. Starting to make your entry now will give you plenty of time to make a well formed and considered entry.

**Choose a category to nominate yourself, or partner company, or individual, and make yourself aware of the questions. Don't rush your answers, and spend time over the application form. Save your entry for later.**

There's nothing worse than clicking the submit button and then realising you neglected to include a crucial piece of winning material. Don't worry - it's not over! We've specifically designed the [www.aemtawards.com](http://www.aemtawards.com) entry forms,

so that this can never happen. Once your entry has been submitted you will receive an email confirming the receipt of your nomination. At the bottom of the email will be a link to edit your form. You can tweak and change your form until you are convinced you are giving yourself the best opportunity to win – the only rule is your final submission has to reach us by the 18th of August. Below we outline ten pieces of advice to help you make your award entry a winning one.

1. Preparation is key. Read the criteria carefully and allow yourself plenty of time to develop a well-thought-out entry. Don't get caught out by the deadline.
2. You can enter more than one category. Increase your chances of winning and enter for as many applicable awards as you can: But ensure that you tailor your entry to each category – as each award has unique criteria.
3. Make sure clients give you the thumbs up. Collaborate with your customer on the testimonial or endorsement. Customers also receive promotion through the ceremony and PR, so the benefit is twofold.
4. Answer the questions properly and write persuasively. Set out clear and concise benefits of your entry – don't just write a 'stream of consciousness'.
5. Banish all Salesy and PR jargon. By writing in clear, plain English, the judges will love your entry even more, avoid jargon and explain uncommon abbreviations.
6. Use attachments wisely. You may attach documents to support your entry but they should be limited to useful information that will help the judges to understand the impact of your work. However, the essential

elements of the entry must be kept within the word count of the appropriate text field – we won't be able to accept entries on an attached PDF, unless it is a supporting endorsement or testimonial. Supporting documents should be compressed into a zipped folder to make uploading of multiple items possible.

7. Judges are looking for strong evidence to back up your claims. Collect good data and show it off! Even if the project is new, an estimate or a projection of the benefits is important. And if an installed project has given "25 per cent more energy efficiency" for instance, tell the judges what the increase relates to – compared to its predecessor, to rivals, to the relevant standard etc.
8. Read through the criteria and double check that you are meeting all the requirements. For instance, categories are aimed specifically at new technologies, techniques, or services developed within the last year or two.

9. Ask someone else, such as a colleague, to look through your entry before you submit. It can be helpful to ask someone who was not directly involved in the work you are entering – because, like the judges, they will not have intimate knowledge of the entry, so they may be able to suggest ways to clarify the details. You can share the form you are working on easily – just click on the 'save for later' link at the bottom of the form.
10. Stop before you submit! And double-check that you have fulfilled all the applicable fields and elements of the form and provided all the evidence that the judges need. If you get stuck then call Thomas Marks at the AEMT on +44 (0)1904 674 895, or email [awards@aemt.co.uk](mailto:awards@aemt.co.uk).

### Closing date for entries

The closing date for all entries is 5.00pm on Friday 18th August 2017. So for those wanting industry-wide recognition for a job well done, be it for technical innovation or application know-how,

for environmental consideration or commitment to training, they should make a note of this important date. It is completely free of charge to enter the awards, but the promotional value associated with being selected as a finalist is worth many hundreds of pounds. And for those individuals and companies who become one of the seven winners, the promotional benefit is even greater.

### Further details

The gala awards dinner will be staged on Wednesday 29th November at the Doubletree by Hilton in Coventry. For more information, please visit the website [www.aemtawards.com](http://www.aemtawards.com) or call the event producers, Touchwave Media on +44 (0)7785 290 034. ■

# Major Brands Support Inaugural AEMT Awards

Operated by the Association of Electrical and Mechanical Trades (AEMT) and produced by Touchwave Media, the AEMT Awards will for the first time acknowledge the skill, effort and sheer dedication of the people and businesses serving this large sector of industry.

**The awards ceremony itself will be staged on Wednesday 29th November 2017, at the Doubletree by Hilton Hotel in Coventry, and with the support already gained it looks set to be a wonderful evening of reward and celebration. With the endorsement of each category by a brand leader in the sector, well deserved industry-wide recognition will at last be given to those businesses, large and small, which are excelling in their endeavours.**

Strong industry support  
Commenting on its sponsorship of the awards, Marek Lukaszczuk, European & Middle East Marketing Manager at WEG UK said, "WEG are very keen to promote

industry in the UK and by supporting this exciting new event from the AEMT, we feel it gives us the opportunity to help establish this association as one of the most active in the UK. Our experience with the AEMT is a very positive one and we are sure this event will cement our relationship and help the industry move forward to tackle the challenges of the future."

Matt Fletcher, Managing Director of Fletcher Moorland added, "We're supporting the AEMT Awards, because it's a great way to bring people together. It highlights the industry by showing off the best of the best."

Speaking of TEC Motors' engagement with the awards, UK Sales Manager, Martin Knott said, "We are still relatively new to the industry and class ourselves as a bit of a rising star. We are happy to align ourselves with the need to get more young people into the industry and fill the knowledge gap among our customers."

Ian Atkinson, Publishing Director of Plant & Works Engineering concluded, "With the ongoing necessity for businesses to adopt better maintenance practices to take advantage of the onset of the smart manufacturing era, the inaugural AEMT Awards will undoubtedly help raise the profile for this critical sector and give

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**AEMT Awards 2017**

much needed foresight and awareness of the opportunities and solutions available. Plant & Works Engineering is delighted to be supporting the Awards as an official media partner, which reflects our proud maintenance engineering history.”

These views were underpinned by Gary Downes, Managing Director of Solutions in IT, and President of the AEMT, who said “We thought it would be good to put something back, and help service engineers promote their services. Personal endeavour, technical innovation, engineering advancement and commercial acumen will all be acknowledged and celebrated through this new awards programme”.

### Award categories

The following seven categories make up the 2017 awards programme:-

- Technical Innovation of the Year, Product – sponsored by DFA Media
- Technical Innovation of the Year, Project – sponsored by Solutions in IT

- Environmental Contribution Award - TBA
- Industry Supplier of the Year – sponsored by Fletcher Moorland
- Contribution to Skills & Training Award – sponsored by WEG UK
- Rising Star Award – sponsored by TEC Motors
- Lifetime Achievement Award – sponsored by AEMT

Call for nominations  
Entries are now being sought for any company, product, application or individual involved in the supply, installation, service, maintenance and repair of industrial machinery technology such as electric motors, drives, pumps, fans, gearboxes, generators, transformers, switchgear and ancillary equipment. Individuals can put forward entries for themselves and their own company, or they can nominate others that they know merit recognition. The online entry process couldn't be easier, so anyone wishing to play their part in highlighting engineering excellence should visit the AEMT Awards website – [www.aemtawards.com](http://www.aemtawards.com).

### Closing date for entries

The closing date for all entries is 5.00pm on Friday 18th August 2017. So for those wanting industry-wide recognition for a job well done, be it for technical innovation or application know-how, for environmental consideration or service and repair, they should make a note of this key date.

It is free of charge to enter the awards, but the promotional value associated with being selected as a finalist is worth many hundreds of pounds. And for those individuals and companies fortunate enough to be announced as one of the seven winners during the charged atmosphere of the gala awards dinner, the promotional benefit is even greater.

### Further details

For more information, visit the website [www.aemtawards.com](http://www.aemtawards.com) or contact the producers, Touchwave Media by phone on 07785 290034 or by email at [andrew@touchwavemedia.co.uk](mailto:andrew@touchwavemedia.co.uk) ■



# Elmo Rietschle



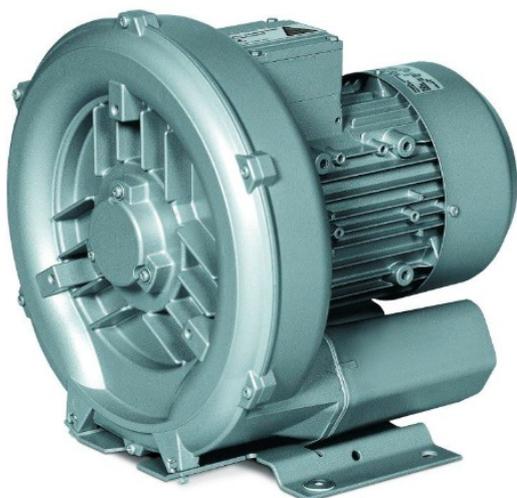
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## Elmo Rietschle

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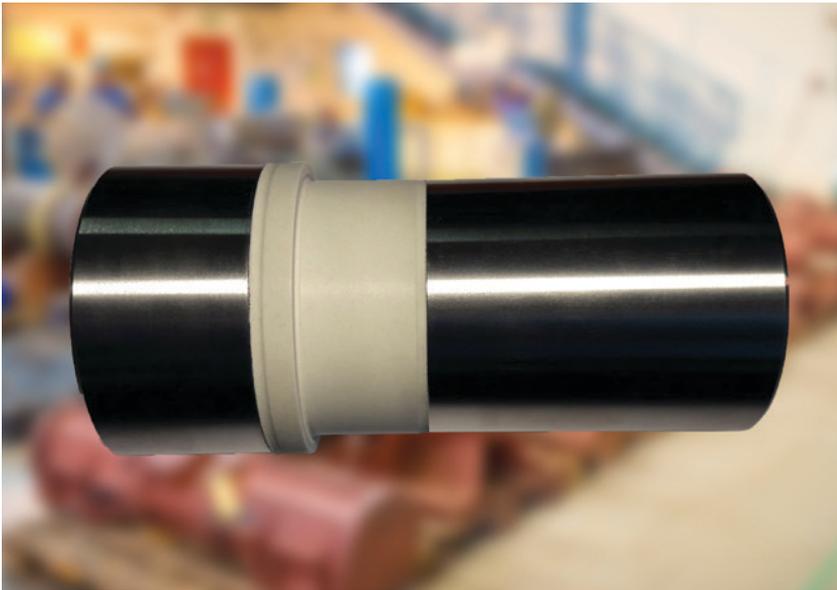


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Lammers Exico's approach of insulating the shaft rather than the bearing is proving cost effective, practical and popular.

# Preventing stray current build-up in electric motors

When a motor is in use it is possible for the shaft to become electrically charged, which can be dangerous and also cause internal damage to the motor. Many solutions to this are expensive and also add significantly to the total lifetime running costs of the motor.

**Jerry Hodek, Managing Director of leading Lammers Exico Ltd. looks at the details of this often overlooked phenomenon and reveals his company's simple solution.**

It seems that more and more motors are becoming electrically charged when they are running. In fact this has always been possible and one of the main reasons for the increase is the growing use of electronic variable speed drives in conjunction with motors.

Drives operate by changing the motor's supply voltage from its normal sinusoidal wave form into an asymmetric form, which can lead to charge build up across the motor's internal components. Therefore, it is fair to say that drives can cause this problem, but we should also

note that they do not always do so.

It is also important to recognise that there are several other possible ways the problem can arise. Other common causes of circulating currents passing through the shaft, and hence bearings and frame, include magnetic asymmetry, electrostatic discharge and capacitive coupling between the stator windings and rotor. These are all independent of one another, so of course they may be present separately or simultaneously.

Less common causes of charging include supply voltage imbalance, unbalanced circulating currents in the parallel circuits of a three-phase winding, non-insulated through bolts in the rotor or armature, eccentric rotation due to inaccurate centring of the rotor, residual magnetism

in the shaft and undetected short circuits in the rotor or stator cores.

Such unexpected internal voltages within the motor can lead, over time, to damage of various motor components. Left uncorrected, they will reduce the operational efficiency, smooth running and working life of the motor.

Often the first sign of a motor charging problem is a rattling noise coming from the main shaft bearing, which is often indicative of impending bearing failure. Inspection of the bearing may reveal pitting or fluting of the races and discolouration of the rolling elements and/or races. Related to this, the lubrication may have darkened in colour.

Pitting is probably caused by the build-up and sudden discharge of very high voltages, an effect similar to spark erosion machining. Fluting is probably then caused by mechanical resonance vibration set up as the ball or roller bearings repeatedly pass over the lips of the pits. Discolouration is due to micro-cratering, which is most commonly found in motors used with drives.

Addressing the causes of motor charging is difficult, as many of them are often based on tiny inaccuracies of tolerances within the motors. While it is possible for motor manufacturers to reduce these during production and assembly, once the motors leave the factory and are in the 'real world' they may be roughly handled, mounted inaccurately or become worn due to asymmetric loading.

So a better solution is to look for ways to disrupt the flow of stray currents around the body of the motor. In theory this is easily achieved, simply by using an electrically insulated bearing on the non-drive end of the motor's shaft.

However, there are two problems with the insulated bearing solution. The first is that an insulated bearing is very significantly more expensive to buy than a non-insulated one of comparable size and performance. Naturally this extra cost has to be passed on to the purchaser of the motor, and it is an unavoidable truth that the motor market is very price conscious and buyers may

not appreciate the price/performance benefits of an insulated bearing motor.

The second problem is that the expected effective working life of an insulated bearing, while long, is nothing like as long as that of an electric motor. Therefore the insulated bearing will need to be replaced, probably a couple of times, during the life of the motor. There are considerable costs associated with removing a motor from its driven machinery, dismantling it, replacing the bearing, then reassembling, testing and

remounting the motor. (Further, to the cost of this engineering effort, it may be necessary to add the cost of lost production or operating time.)

However, Lammers Exico has adopted an alternative solution which effectively stops stray current circulating in the motor while avoiding the need for an expensive insulated bearing. Their answer is to apply insulation under the shaft at its non-drive end. This prevents the creation of a viable electric circuit while allowing the use of standard

bearings and shafts, thus avoiding significant extra cost.

With the increasing use of variable speed drives across virtually the whole range of driven plant and machinery and ever-more scrutiny of life time costs, the need to reduce stray current problems in motors is increasing. Lammers Exico's approach of insulating the shaft rather than the bearing is therefore proving cost effective, practical and popular. ■

## Motor Specifications for Nuclear Engineering

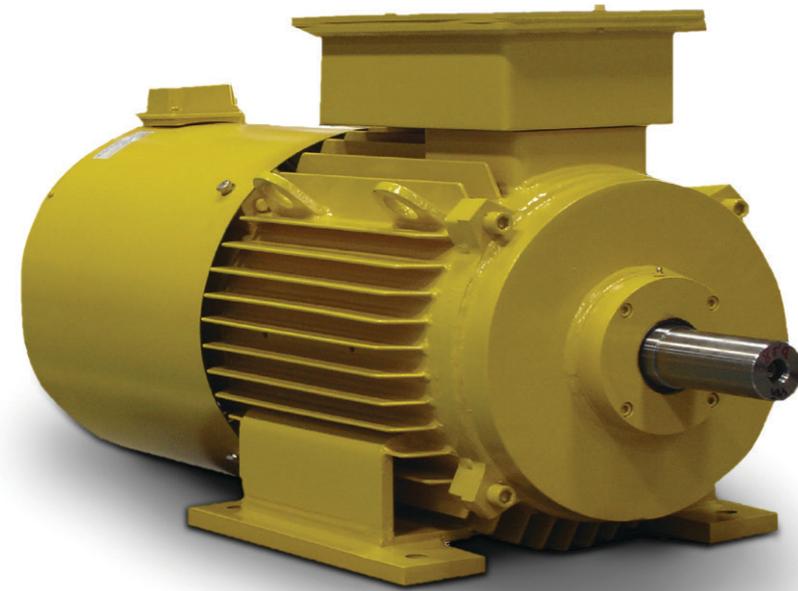
Maintenance and repair procedures in most industries require specific standards to be met when repairing or replacing equipment. When these tasks are being carried out in a nuclear power plant, the specifications can be quite unique and demand an altogether higher level of expertise.



**Lammers Exico sales director Lucie Hodkova looks at considerations for the specification of electric motors for applications in nuclear power plants.**

In 2016 the UK government approved the building of a new £18bn nuclear power station at Hinkley Point in Somerset, signalling a new era of power generation for the country. Nuclear is now expected to be the second biggest contributor to the grid after renewables by 2025. With coal powered stations expected to be phased out by the mid 2020s and reliance on gas fired power stations greatly diminished, there is much riding on the success of nuclear.

Several additional nuclear power plants are also in the planning stages, with the UK's existing reactors getting towards the ends of their operational lives and all but one scheduled to be retired by 2030. In the meantime there is an ongoing requirement to upgrade the likes of steam turbines, valves, coolant pipes and control systems in the existing reactors to ensure their continued safe operation. In an industry where safety is critical, correctly specified components are a key focus.



Component specification, of course, follows stringent regulations, regardless of whether they will be employed in nuclear or non-nuclear duties within the power plant. In both areas, electric motors play critical roles, including actuator and valve control in containment rooms, various pumping, ventilation, filtering and hoisting applications, low head safety injection pumping systems, emergency feed water system pumps, and containment heat removal system pumps.

So what sort of specification criteria should engineers consider when looking at electric motors, either as part of a new reactor design or as part of ongoing maintenance procedures and upgrade processes? Clearly motors should be designated as Nuclear Class, and rated as seismically safe, but what does this mean and how is it assured?

To provide the highest levels of specification of motors for the nuclear industry, Lammers Exico works with nuclear class motor specialist Obeki. Certified to UNE 73401:1995 GES/ UNES for Quality Assurance in Nuclear Facilities by Spain's Asociacion Espanola de Normalizacion, the company's motors are relied upon across the globe in a host of nuclear power industry applications, both for the replacement of existing motors and for new developments or new plants under construction. It has a better understanding than many of the

key requirements for motor specification within the industry.

The first point to be considered is what safety class the motor needs to meet, according to whether the motor is within the conventional island or the nuclear island. Systems that are important to safety are classified in the UK as Class 1, Class 2, and Class 3. Within this classification, Class 1 systems are specific to safety, while Class 2 and Class 3 are designated as safety-related. Under-specifying could have significant safety implications, while over-specifying for a given application represents additional cost.

Lammers Exico supplies seismic class motors for all systems important to safety, as well as standard class motors for those systems either designated as not important to safety or non-classified. For motors used in safety classified areas, quality control is paramount, and suppliers should be able to demonstrate that specific key tests have been performed, not only to the finished motor but also to almost every component during the manufacturing process.

Seismic class motors should carry a range of approvals, including manufacture to client-approved procedures. Seismic testing should be fully detailed, with notes on how seismic resistance has been determined by analysis, by testing

on a vibration table and by comparison with previously-qualified motors according to procedures accepted by the end user. For Class 1 motors, users should expect a detailed final report.

Suppliers should also have a good understanding of radiation and its impact on the materials of construction within electric motors. As a matter of course, they should be able to demonstrate full traceability of materials sources and specifications, with certification as required. Any special radiation requirements – such as resistance to radiation through the use of special insulation or copper rotors – should be noted by the supplier.

Further, suppliers should also be able to provide details of painting following client-approved procedures. This might include initial cleaning and sand-blasting of surfaces, specified numbers of layers of paint, with details on the paint material, the thickness of each layer and its drying time.

Taking all these considerations into account, users should have the confidence – backed up by full certification – that electric motors meet requirements for thermal ageing, mechanical ageing, irradiation ageing, electromagnetic compatibility and seismic/vibration conditions.

Working closely with Obeki as well as with nuclear industry customers, Lammers Exico is able to deliver the highest level of assurances that motors supplied for nuclear reactor applications will meet all safety and reliability requirements.

The motors meet all of the upgrade requirements of systems integrators tasked with keeping the UK's existing nuclear power plants safe and efficient right to the end of their operational lives, while meeting the highest specifications for new developments and new power plants under construction. ■



# GES shows off new service offering at 45th birthday bash.

GES Group welcomed their customers, key members of industry, and special guests to their 45th Birthday Bash, held at Mossley Mill, Newtownabbey, on Thursday 11th May, 2017.

The Birthday Bash celebrated 45 years in business for the Group, as well as showcasing their significant investment in training and people development, equipment, and infrastructure in recent years, including the £300,000 investment in their purpose-built Mallusk facility, and their recent Bronze Award win in the Training Journal Awards "Best Change Management"

programme, where they faced stiff competition from companies such as Dell, O2, and Transport for London.

Invest NI's Director of Advanced Manufacturing and Engineering, Bill Montgomery, welcomed guests to the Birthday Bash. He said:

"GES Group is one of Northern Ireland's

home-grown success stories, employing over 80 people across their two sites in Ballymena and Mallusk, and investing heavily in training and up-skilling to develop Engineers for the future. It is important to recognise and celebrate small businesses such as GES, who create valuable employment opportunities within our communities, as well as servicing the blue-chip and multinational

organisations that call Northern Ireland their home.

I'd like to take this opportunity to congratulate Tom, David, and the rest of the Management Team, as well as all of GES Group's employees, for achieving real growth for the organisation, and for not only surviving for 45 years, but thriving for 45 years. I wish you the best for the future."

GES Group CEO, Tom Grant, shared some personal and entertaining stories about the company's history, ensuring the audience were in high spirits with his witty recollections, before company Managing Director, David Moore, brought us up-to-date with the company's recent achievements, as well as officially launching GES Group's new product and service offerings:

### Static Var Generators and Active Harmonic Filters

GES Group have partnered with innovative power quality solution experts, Sinexcel, as the sole UK and Ireland distributor for their products, which are capacitor-free, and use a 3-level topology. Tenders have been submitted for projects in France, the US, and Canada.





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### Energy Storage Solutions

Battery storage can be used in a variety of applications, including renewable generated storage, to increase capacity, or to draw down from the grid during off-peak times, to be released during periods of peak demand. GES have partnered with Sinexcel to bring Energy Storage Cubes to market.

### Servo Motor Repair Centre

the company have made significant investment over the past 2 years in launching the first Servo Motor Repair Centre in Ireland at their Mallusk facility.

### Sanergrid Oil Filters

a bolt-on to their maintenance and service offering, Sanergrid filters are spill containment solutions for sub-stations

and transformers. Quick and easy to install, they do not require electricity.

GES Group's unique structure enables them to deliver a holistic power and energy management solution for customers, and their award-winning and forward-thinking approach to innovation and change means they stay ahead of the competition, ultimately benefiting their customers and partners.

GES Managing Director, David Moore, commented:

"The 45th Birthday Bash was no doubt a milestone for GES Group. Some of our employees have been with us since the very beginning in 1972, and with the significant growth and development we have worked very hard to achieve,

particularly in the past 5 years, we felt it was important to acknowledge and celebrate our success.

The next phase of our Company's growth and development plans are very exciting. We are exploring new markets and opportunities, we are continuing to invest in our employees, and we are using innovative thinking to not only prepare for change, but to embrace it and use it to our advantage. Our first 5 Year Strategic Development Plan resulted in 57% growth from 2010 to 2015, and a 28% increase in employee numbers across our business. The 2020 Strategic Development Plan is underway, and we are making fantastic progress. We are looking forward to the next 45 years of business - there is much, much more to come from GES Group."

The Birthday Bash celebrations were rounded off by BBCs Mentalist, David Meade, who dazzled the guests with a little mind reading during a session titled Mind Your Business, which used psychology and human behaviour to explain (and help us improve) our decision making, sales, and persuasion skills.

An excellent day was had by all, and we would like to take this opportunity to thank our customers and partners, not only for attending the event and making it such a success, but for their continued support. ■



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1. GES Team celebrating 45 Years.
2. David Moore, GES Managing Director, Tom Grant, GES CEO, David Meade, and Bill Montgomery, Invest NI.
3. GES Group Birthday Bash.
4. GES Group's 45th Birthday Bash.
5. David Moore, GES Managing Director, with Doreen McClelland, Deputy Mayor of Antrim and Newtownabbey, and Tom Grant, GES CEO.
6. David Moore, GES Managing Director, Audrey Wales MBE, Mayor of Mid and East Antrim, Tom Grant, GES CEO



AEMT members were able to gain an exclusive audience with the Principal M&E Engineer for the Falkirk wheel then taken on a tour of the wheel's engine and maintenance rooms.

# AEMT Visits the Scottish Canal's Falkirk Wheel.

For the Scottish meeting in May this year, AEMT members were able to gain an exclusive audience with the Principal M&E Engineer for the Falkirk wheel. After being guided through the more technical aspects of the engineering behind the wheel and the connected canals, members were taken on a tour of the wheel's engine and maintenance rooms.

**Steven Berry B.Sc MIET is a contented, and enthusiastic person, whose passion for engineering is infectious. His occupation takes him up and down the Scottish canals, looking after the mechanical and electrical aspects – in particular the Falkirk Wheel, Kelpies, and Helix Park. Much of the work includes power and control systems, mechanical and hydraulic upgrades, and energy saving equipment.**

It's clear that he takes great pride in the work he does for Scottish canals. With the Falkirk Wheel being the central

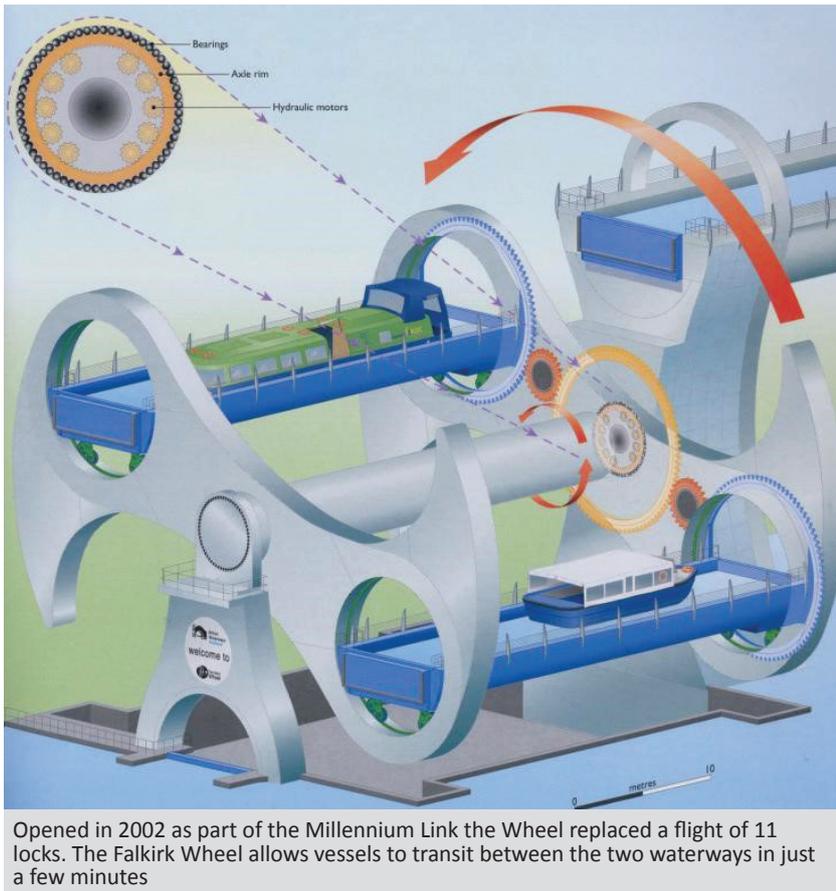
aspect of an £85 million re-investment in the Scotland's inland waterways – he has quite a lot to be proud of. The canals are dominantly a tourist attraction these days, a far cry from the toil they received at the turn of the century. With around 400,000 visitors a year, it brings a crowd – and what a brilliant location to show off the engineering capabilities of Great Britain.

## The Wheel

Opened in 2002 as part of the Millennium Link, a project that restored

Scotland's inland waterways to a navigable state for the first time since the 1960s. The Wheel replaced a flight of 11 locks that once stepped the Union Canal down to the level of the Forth & Clyde over a distance of 1.5 kilometres and took more than a day to traverse. The Falkirk Wheel allows vessels to transit between the two waterways in just a few minutes.

While touring around the wheel in hard-hats and high-vis, members were approached by a keen member of the public, who presumably thought that



we were the most reliable source for information on the wheel. In order to settle a wager with his partner he asked us to clarify the reason for the wheel's unique design. Steven proudly deferred the question to us, after briefing us beforehand on the subject.

The unusual design of The Falkirk Wheel has been described using Scottish and marine architectural terms including a Celtic inspired double-headed axe, the spine of a fish, ribcage of a whale and the vast turning propellers of a Clydebank-built ship, so to answer the man's question - aesthetics. Unfortunately, this was not the answer he was looking for – like most people he was sure there was some sort of an aerodynamic/engineering answer to the wings and he turned about with the skip from his step slightly down trodden.

### Archimedes Principal

If a 200-tonne vessel approached the Wheel, glided onto a gondola and waited a few minutes for the wheel to effortlessly lift the 500 tonne gondola and vessel 35 metres, using only 1.5kw/h, you might question the principals behind the structure.

It took a combined effort between the British Waterways Board, and engineering consultants Arup, Butterley Engineering and RMJM to come up with the final design. The solution: when one of the structure's gondolas is lowered, the opposite one rises, keeping the vast 1800 tonne boat lift in perfect balance as it carries canal barges up in a matter of minutes. The Wheel's gondolas hold 500,000 litres of water each, and great care is taken to maintain the water levels on each side, thus balancing the weight on each arm.

According to Archimedes' principle, floating objects displace their own weight in water, so when the boat enters, the amount of water leaving the gondola weighs exactly the same as the boat. This is achieved by maintaining the water levels on each side to within a difference of 37 mm (1.5 in) using a site-wide computer control system comprising water level sensors, automated sluices and pumps.

### Engine room

The area housing the machinery to drive the wheel is located in the final pillar of the aqueduct, and contains seven chambers connected by ladders. Access

is by a door located at ground level or an entrance halfway up the tower, with a gantry crane to facilitate the installation of equipment.

The ground floor houses the transformers for powering the wheel. The first floor is a standby generator and switchgear; and the second floor houses a pair of hydraulic pumps that drive the hydraulic motors in the chamber above. Power is supplied directly to the axle with 10 hydraulic motors, which also double as brakes. Connected to each motor is a 100:1 gear system to reduce the rotation speed.

### Mechanism

Whilst the weight of the gondolas on the bearings is generally enough to rotate them, a gearing mechanism using three large identically sized gears connected by two smaller ones ensures that they turn at precisely the correct speed and remain correctly balanced.

Each end of the gondolas is supported on small wheels, which run on rails on the inside face of the 8 m (26 ft) diameter holes at the ends of the arms. The rotation is controlled by a train of gears: an alternating pattern of three 8 m (26 ft) diameter ring gears and two smaller idler gears, all with external teeth. The large central gear is fitted loosely over the axle at its machine-room end and fixed in place to prevent it from rotating. The two smaller gears are fixed to each of the arms of the wheel at its machine-room end.

When the motors rotate the central axle, the arms swing and the small gears engage the central gear, which results in the smaller gears rotating at a higher speed than the wheel, but in the same direction. The smaller gears engage the large ring gears at the end of the gondolas, driving them at the same speed as the wheel but in the opposite direction. This cancels the rotation due to the arms and keeps the gondolas stable and perfectly level. ■

# AEMT AGM

The AEMT AGM was held at the Sheffield Advanced Manufacturing Research Centre this year and proved to be another fascinating visit. Members were shown around the brand new Factory 2050 centre, which only opened in April this year, and was already full of advanced robots, cnc machines, and smart technology.

During the AGM, Gary Downes of Solutions in IT took over presidency from Graham Brooker of Wilson Electric, who has now stepped into David Hesketh's shoes as immediate past president. We welcomed two new council members, Tom Beatson

of Beatsons fans and motors and Tom Grant of GES Group, Northern Ireland, and said goodbye to two valued council members, David Hesketh of Bowers Electrics and Richard Bradford of Drummotors and More.

Two honorary members were also made in recognition of their dedication to the AEMT over the span of their careers; David Hesketh and Philip Bourne; both former presidents. ■



1. Gary Downes becomes President, and Graham Brooker becomes Past President.  
2. Anthony Urion of NTN Bearings.

3. Amanda Chadwick of Croner Solutions speaking on employment law.  
4. Jennie Gordon of MGC Systems.



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- 5. Matt Fletcher of Fletcher Moorland, Ian Walker of Rotary Engineering, and Malcom Fletcher.
- 6. David Hesketh presented with his honorary membership certificate by AEMT President, Gary Downes.
- 7. David Ede of Kolmer Electric Motors.
- 8. Shirley Harrison of the AMRC speaking to members.
- 9. The AMRC and Factory 2050 in Sheffield.
- 10. Tom Beatson of Beatsons Fans and Motors and Martin Knott of TEC Motors.



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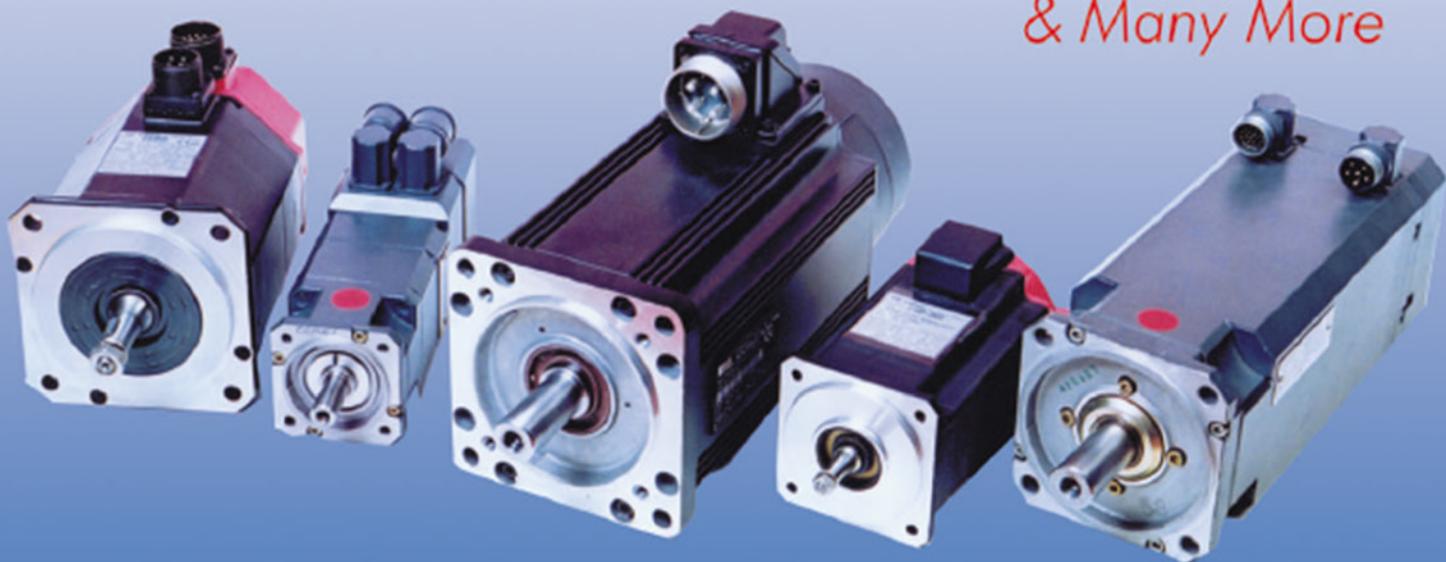
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