

AEMT

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Journal

Association of Electrical & Mechanical Trades



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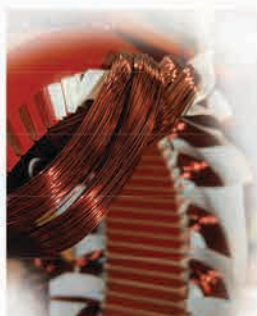
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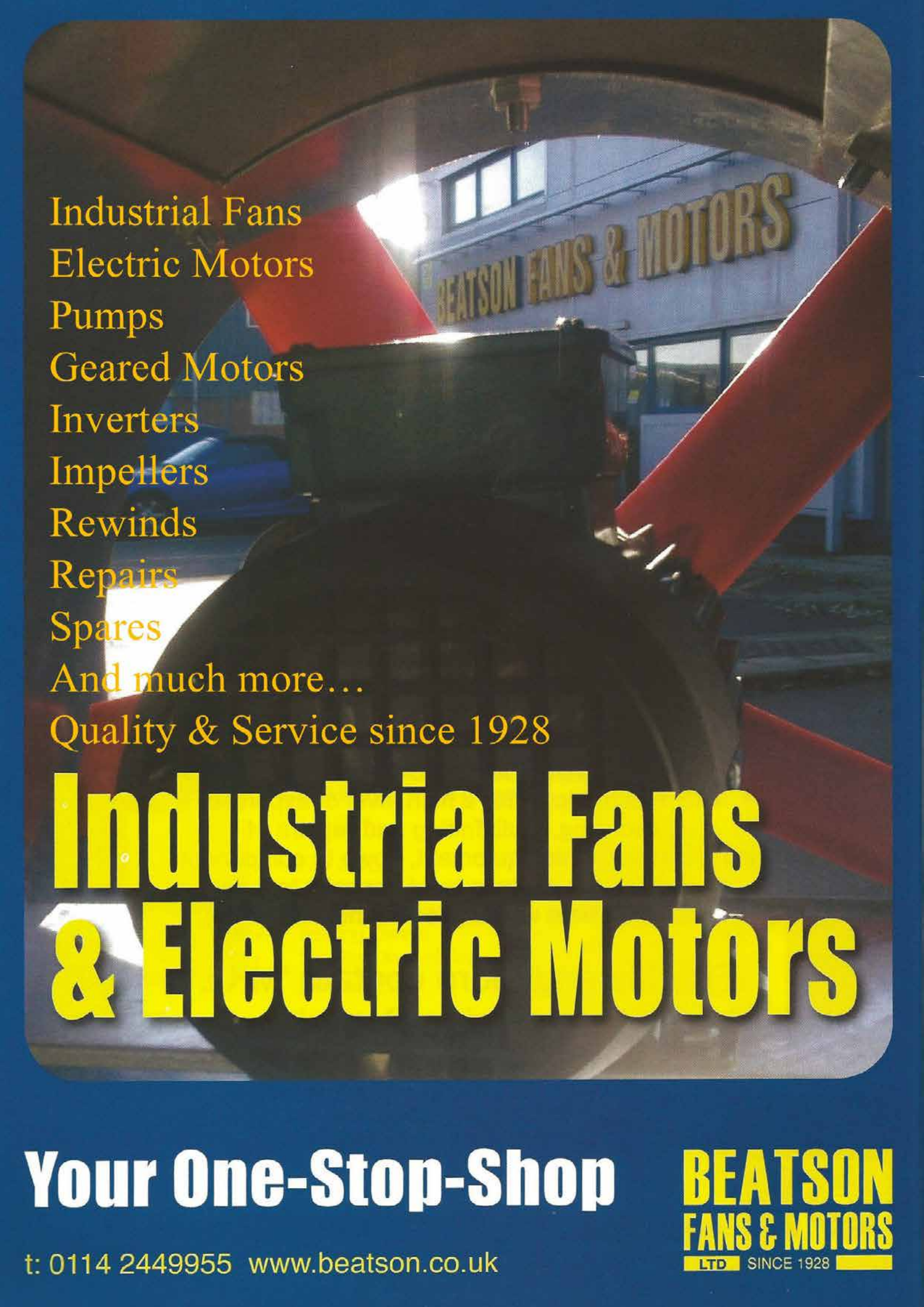
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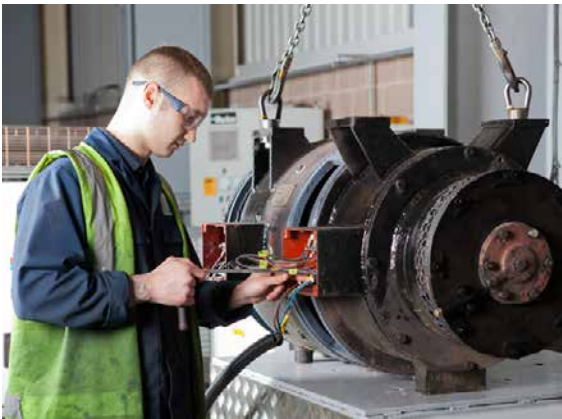
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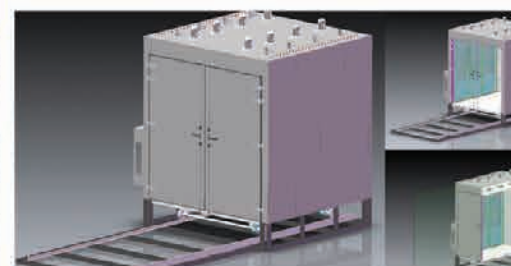
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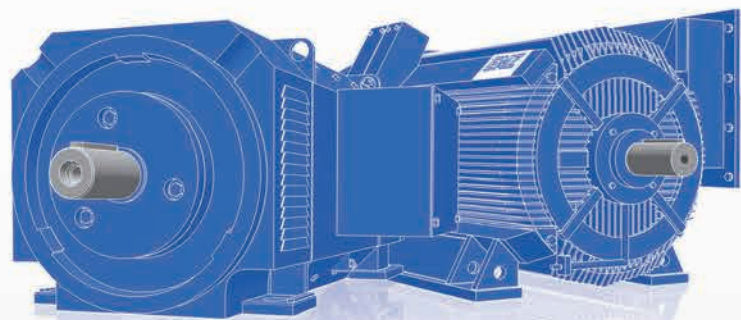
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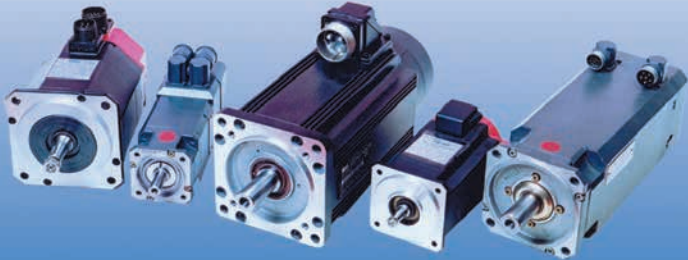
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Journal

VOLUME 14 | ISSUE 1

Front cover photo:

One of 15 new KSB Boiler Feed Pumps on test, of the type to be supplied to Saudi Arabia. This 30 million Euro order is for the YANBU3 combined power and desalination plant.

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AEMT COMMENT

Change: How important it is in business and in life.

This journal incorporates case studies of AEMT members that have managed tremendous growth and change over the past few years. Even the AEMT Journal has been updated, together with the new AEMT website, and rebranded yearbook.

Perhaps the most dramatic changes are occurring at Parsons Peebles. They are making major investments in their future growth internationally in the specialist market of High Voltage machines. Quartzcoil part of Quartzelec have also moved premises and invested heavily in a state of the art High Voltage Coil production facility. Sulzer are also investing in the latest design technology to upgrade their submersible pumps to new efficiency and reliability levels, and the work of their offshore teams just demonstrates the levels of service that members go to, to ensure that a customer receives exceptional service.

At the same time manufacturers and distributors have reached another milestone in the eco-directives in Europe as IE3 begins to become mandatory.

As the emails die down towards the end of the year, hopefully there is a little more time to plan and think about the changes for 2015. Hopefully it will be a good year full of confidence although with very low oil prices, who will benefit, and how much will countries and oil companies have to cut back.

I hope that you enjoy the new AEMT journal, and if it inspires you to tell us about the achievements of your company, please send me the details or a press release. All the latest news and details are also on our website at www.aemt.co.uk.

From all of the team at the AEMT, we wish you the very best seasons' greetings, and a prosperous new year.

Tim Marks.

Editor and AEMT Secretary.

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Time to celebrate 20 years of ATEX

On March 23rd 1994, ATEX hit the headlines. The ATEX Equipment Directive 94/9/EC on Hazardous Area Equipment was released, and became mandatory in July 2003. Here, Tim Marks, secretary of the AEMT, considers the effect that ATEX has had during its first 20 years.

The birth of the European Directive on Atmosphères EXplosibles was formulated so that it would be adopted into the legal system of each member of the European Community. The ATEX name was derived from the first two letters of the French words for explosive atmospheres. The ATEX Directive was to ensure that any 'ATEX' equipment manufactured or sold in the European Community complied with this directive. Once a product had been tested and approved in one of the many notified bodies laboratories, such as Baseefa in the UK and PTB in Germany, then it could be sold anywhere in the 'common market' area. In the UK the embodiment of the ATEX Directive came into law with the introduction of DSEAR.

So how successful has it been, and does everyone now fully understand it?

In meeting its aims ATEX has been very successful, and improved the safety in Hazardous areas considerably, however it is still a complex and specialist field. The manufacturers, and test houses understand the complexities of the

protection concepts, but many users are reliant on specialist companies to supply, service, and maintain their Hazardous Area Equipment. In this way companies generally comply, but do not always understand why.

The AEMT has trained a large number of member companies internationally to be specialists able to repair and maintain hazardous area equipment. It operates an International Ex Register of Companies that are trained and equipped to service ATEX and other hazardous area equipment to IEC standards.

There were two ATEX directives:

- ATEX 95 which is the equipment directive 94/9/EC, which I will concentrate on here. It is for the manufacturer of electrical and mechanical equipment to conform to.
- ATEX 137, the workplace directive 99/92/EC is to ensure best practice health and safety protection for employees working in potentially hazardous atmospheres, which became mandatory in July 2006.

These are not laws, but are to be embodied into the legal system of each member country. They are not standards, and standards have had to be updated to ensure that manufacturers and users can use the latest relevant European and international standards to comply with the requirements of ATEX. The ATEX documents are available to download free of charge from the European Commission's website at: http://ec.europa.eu/enterprise/sectors/mechanical/files/ATEX/direct/text94-9_en.pdf

Certainly ATEX has been successful and has stood the test of time, but after 20 years it is due to be updated and will be repealed on 20 April 2016. On that date the new updated version Directive 2014/34/EU comes into effect. Although the changes appear relatively minor, the fact that 94/9/EC is being repealed is creating concern among the notified bodies. It looks as though certificates referring to ATEX 94/9/EC may not be able to be updated once it has been repealed. There is also consultation as to whether offshore equipment should come under the new ATEX directives,

which could create problems for drilling companies using American equipment. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOL_2014_096_R_0309_01&from=EN

But enough of the paperwork, how did ATEX come about and what is its history. This goes back just over a 100 years. In 1913 at Senghenydd Colliery in North Wales 439 miners were killed in a disastrous explosion in the mine. The enquiry felt that the explosion of firedamp and coal dust had been caused by the sparks from the electric bell system the miners were using. Two bare wires going through the mines were bridged with a metal object to sound the bell.

The enquiry led to the development of the first British Standard BS229 for Flameproof equipment, first published in 1926. This standard for the Flameproof, FLP, and ex d designs remained in force, with an update in 1957, all the way through to 1971. Considering these machines are now around 50/60 years old it is surprising how many still crop up, and as long as a risk assessment feels that the motors are safe in the location in which they are being used, then they can still remain in service. The Ex d machine became suitable for use on the surface as a Group II machine, as opposed to Group I for underground mining.

In America and Canada similar machines are known as explosion proof. The Ex d machine is still the favoured machine for Zone 1 areas, and is now often used with an Exe increased safety terminal box. The Germans favoured the Ex e machine concept of increased safety with no arcs and sparks, which is now a recognised form of protection to comply with ATEX in a Zone 1 area.

In America the Ex e concept has only recently been recognised. Ex n or non-sparking enclosures are suitable to meet ATEX requirements in Zone 2 areas. Other protection concepts such as ex p, ex i, ex o, ex m, etc. all had existing standards and were also suitable for use in the appropriate ATEX zoned areas. Only Ex ia and Ex ma are suitable for Zone 0 areas, where an explosive atmosphere may be expected to be

present all of the time.

The above Protection concepts were already well recognised when ATEX was introduced, however the introduction of ATEX focused minds on standards to protect workers in areas of combustible dusts. This is surprising when coal dust was recognised as a major part of secondary explosions in the 1913 disaster at Senghenydd Colliery.

In September 1921 more than 500 people were killed at a BASF fertiliser plant in Oppau in Germany. With the secondary explosions from dust disturbed by the first explosion, the devastation caused by dust can be catastrophic. As such it is strange that the first standards for combustible dust equipment came in, in the late 1980s and 1990s, and became much higher profile in Europe through the adoption of the ATEX Directives. This now means that fertiliser plants, grain silos, sugar plants, flour, wood dust, and many other processes using natural and organic products have to take account of the risk of a dust explosion. The dust from certain metals such as Aluminium, bronze, and zinc, have also led to some major plant explosions.

ATEX also covers the electrostatic sparks. The spark that caused the Hydrogen Balloon of the German Hindenberg airship to explode into a fireball when docking in May 1937 in New Jersey, this caused 35 deaths ending the era of the passenger carrying airships.

Finally ATEX included problems caused by mechanical items, such as the heat caused by failed bearings, and materials that may cause a spark, such as fans making contact with fan covers, or creating an electrostatic spark if plastics are used, the mechanical parts of a conveyor system and so on. It has long been of concern to electricians that they are fitting an electric motor designed not to exceed a T3 surface temperature of 200° C in an area with kerosene as a potential source of ignition, and yet some mechanical plant close by may be operating at what may be well above the safe operating temperature. ATEX requested Cenelec in Europe to come up with standards for the mechanical concepts for equipment

such as pumps, gearboxes, conveyors, etc. These Cenelec standards in the EN 13463 series were introduced from 2001 onwards to ensure that these mechanical items were also safe to use in Hazardous Areas. In a stroke this has more than doubled the amount of equipment that needed to be ATEX compliant, and regularly inspected.

So has ATEX been a success?

Undoubtedly it has gained a great deal of credence and is now the favoured choice of equipment worldwide for the oil industry outside the USA and Canada. One will never know the number of lives that it has saved, but accidents still happen, and the cost of the accidents can be huge.

At Buncefield the failure due to poor maintenance of a float control valve resulted in no deaths, but damage estimated at more than a billion pounds. Without a spark, it would not have been such a major disaster. The spark was possibly caused by a generator outside the zoned areas and was a very expensive spark. BP has put aside a 70 billion dollar fund to compensate for the Deepwater Horizon failure in the Gulf of Mexico in 2010, pictured above. An expensive spark making a mechanical failure and leak much worse.

ATEX has been very worthwhile and although primarily introduced to create a common market for Hazardous Area Equipment of a universal high standard, it has also meant that any equipment coming from outside Europe cannot be used in Europe unless it also has been tested to comply with the ATEX Requirements. For this reason it is rare to see American UL equipment being used in Europe, but then the USA will not allow Ex equipment into America unless it complies with UL or FM. So a bit of tit-for-tat, and commercially it must be considered a great success. We will never know the number of lives it has saved, but the European safety records for safety in mines etc. are much better than countries outside the ATEX area.

So happy birthday to ATEX, one very positive benefit to emerge from the European Union. ■



Quartzelec's meet strong international demand for their ATEX certified and uncertified terminal boxes.

With an ever growing number of high voltage machines now being manufactured and sourced internationally, customers need to ensure that the terminal boxes comply with IEC international safety and manufacturing standards – particularly if they are being operated in potentially hazardous environments. This has made upgrade units, which are typically implemented as part of the commissioning process, extremely popular.

Quartzelec's superior range of electrical supply terminal boxes typically cost around £3,500. They are fabricated using quality steel plate to an extremely high engineering standard by Quartzelec's fabrication and welding business TS Metals. The boxes are then transported to their Sheffield facility where the terminations are fitted and then finished in a grey semi-gloss, two-pack epoxy finish. The Quartzelec range includes certified and uncertified

main and neutral terminal boxes, suitable for up to 15kV applications. Over the past year their sales have more than quadruple.

Hazardous Area, Phase segregated, Phase insulated (BEAMA/CEGB) with weatherproof protection enclosures are included in their range of terminal boxes. They can be used in hazardous area applications with all the necessary ATEX certifications in place to Ex e and Ex n standards. Gland plates are

supplied, blank, or drilled and tapped, to suit any cable glands, and warning plates are fitted as standard. The terminal boxes are suitable for over-spraying in any colour and available with stainless steel fasteners.

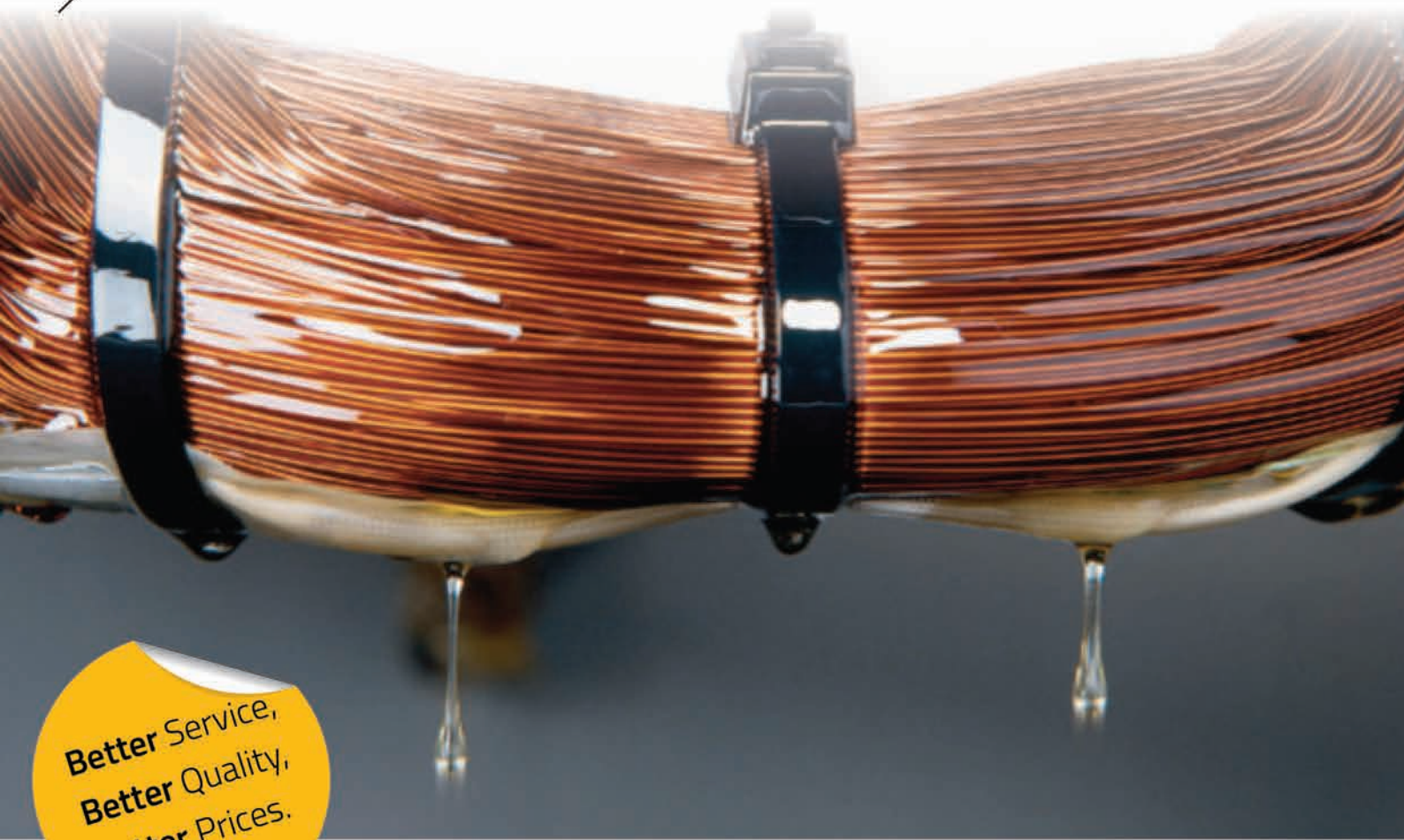
Matt Brown, the General Manager of Quartzelec Sheffield added "The cost of designing, testing, and gaining the required ATEX certification is often prohibitive for some manufacturers. Our terminal boxes have all the necessary accreditations in place, which is proving popular, and sales are growing. We have an excellent reputation for both safety and quality, and our long and illustrious heritage means that customers recognise, appreciate, and value our terminal boxes and enclosures."

The Euromold triangular ATEX certified Ex e and Ex n terminal boxes have a maximum rating of 1250A, 15kV (uncertified) and 11kV (certified). The terminal boxes are fault tested to 43.8kA for 0.25 seconds and the Euromold connectors at >50kA for 1.0 sec. They are IP67 rated for outdoor applications with a 5mm blank steel gland plate as standard. The wide variety of options also includes external pressure relief and partial discharge monitoring coils.

The phase segregated terminal box has a maximum rating of 11kV, 810A (uncertified) and 545A certified. They can be supplied either with tails, jointed in the sealing chamber and compound filled, or direct, without a joint in the sealing chamber. These boxes are also designed to a high level of protection from dust and water at IP67 for outdoor applications.

As the terminal boxes are available separately and are manufactured to original equipment standards, they are also suitable as replacements for both hazardous area and non-hazardous area applications. With their own separate Atex certificate they can also be used to upgrade or replace corroded terminal boxes on machines being maintained or repaired. ■

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Marking up a new 8 tonne HV stator before inserting the coils.

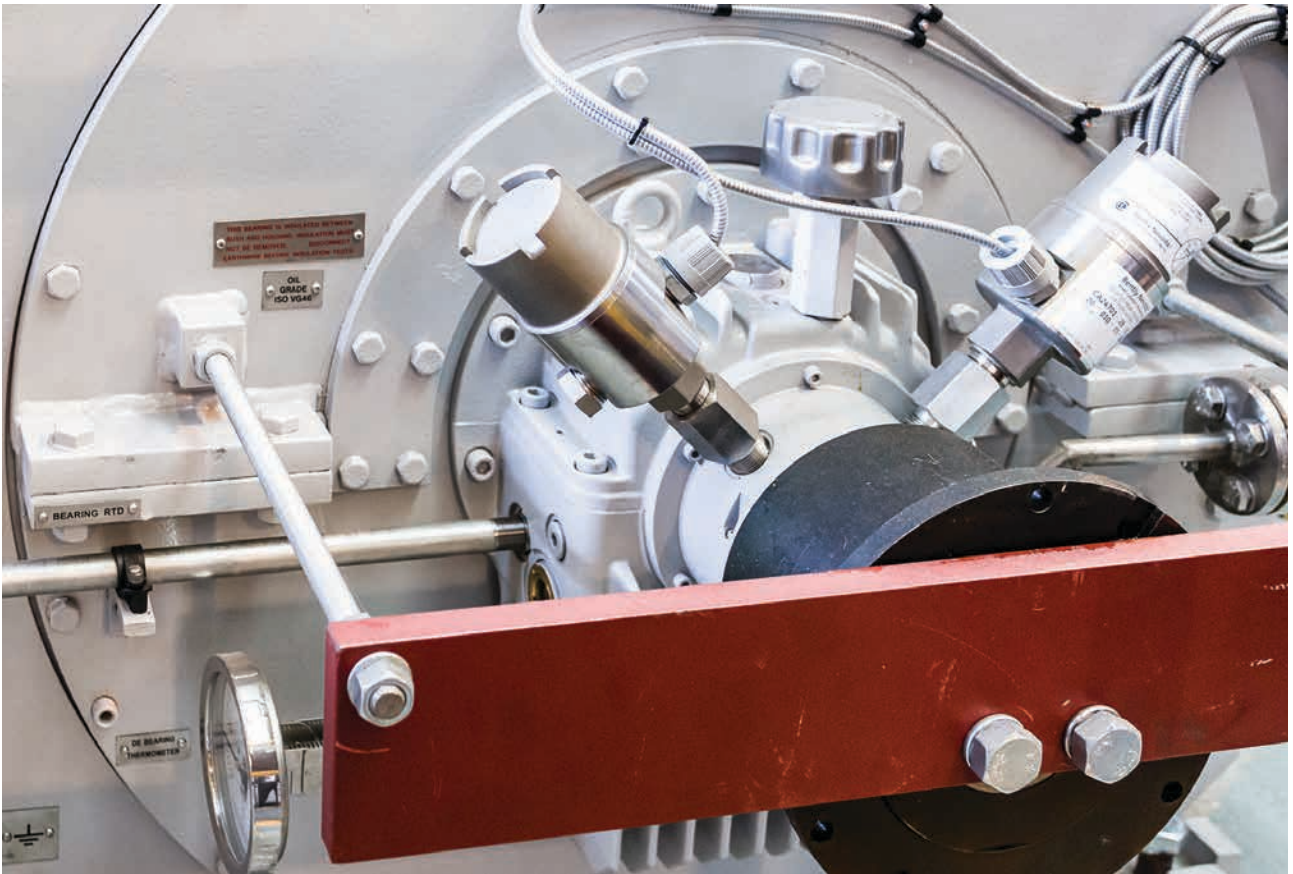
Parsons Peebles, with significant investment backing, is on course to become a significant world player.

Recently members of the AEMT were invited to see the Parsons Peebles facility and were very impressed by what they saw. With over a hundred years under its belt, it is good to see Parsons Peebles thriving with the energy, and expansion plans, that would be a credit to a much younger company. In recent years it has gone through a number of owners, but still retains its long heritage and over the past century has supplied machines all over the world. As well as servicing and maintaining these older machines, it has now found a niche market supplying bespoke high voltage machines, particularly to the off shore and on shore oil and gas market.

The company was originally founded in 1898 by David Bruce Peebles in Leith, just outside Edinburgh, in Scotland. In 1969 the company merged with Reyrolle Parsons of Newcastle and became Parsons Peebles. This merger included the former GEC Birmingham factory of CA Parsons. In 1989 the company became part of Rolls Royce Industrial Power, and in 2000 they relocated from East Pilton to their current site in the Royal

Dock Yard at Rosyth, Scotland. With records for over 11,000 machines since 1960, and a large number still in service worldwide, their name is well represented worldwide. They are still able to provide spare parts from the specifications and drawings that they have for most of these machines, including Bruce Peebles, Parsons Peebles, and NEI Peebles.

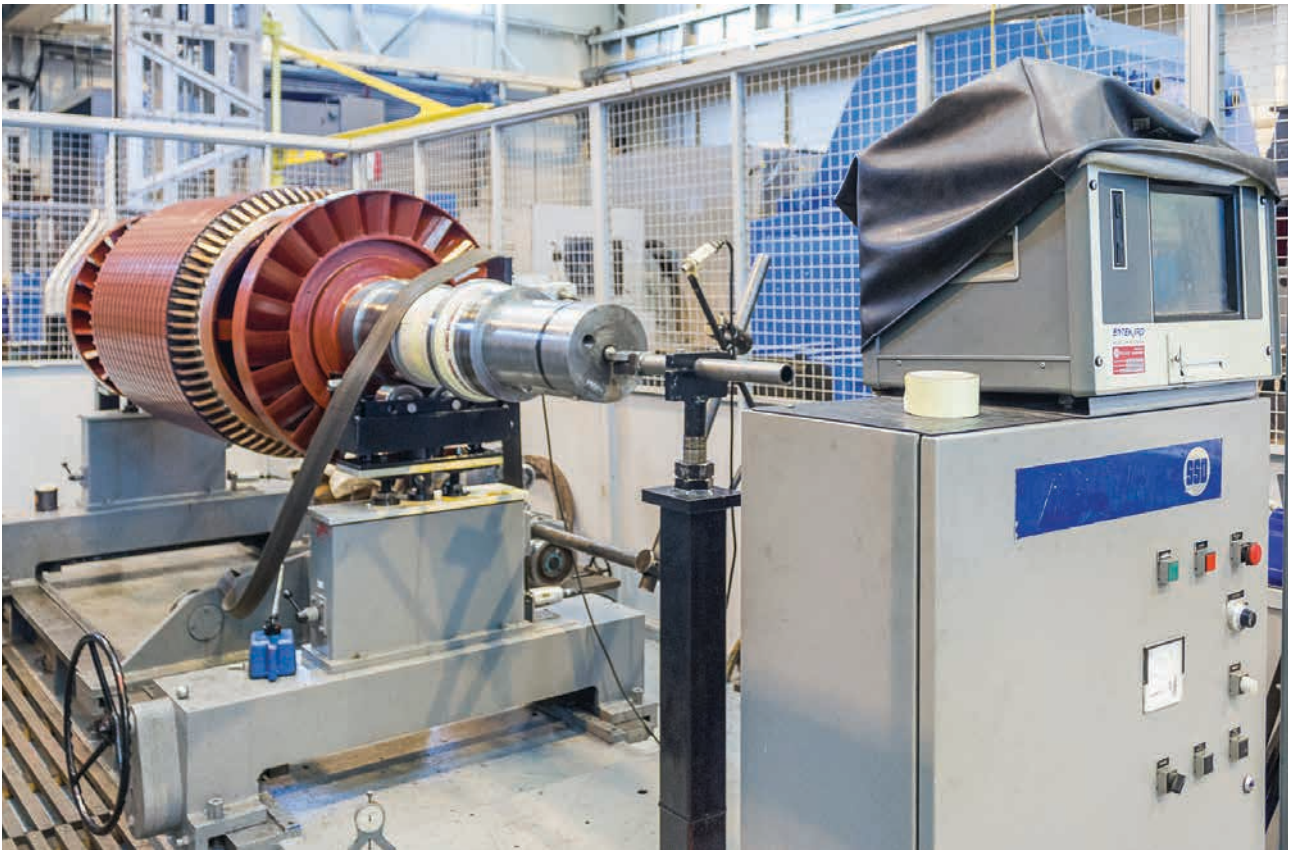
In April 2005 Parsons Peebles became part of Paterson Quarries, who with their engineering expertise, began to turn round the fortunes of Parsons Peebles before selling it to Clyde Blowers Capital in 2013. This company is owned by Jim McColl and was responsible for purchasing Weir Pumps off Weir for £45 million in 2007, the business was developed into Clyde Union Pumps and finally sold to the SPX group for £750 million in



Bently Nevada Sensors fitted.



A machine with three temperature sensors and dials.



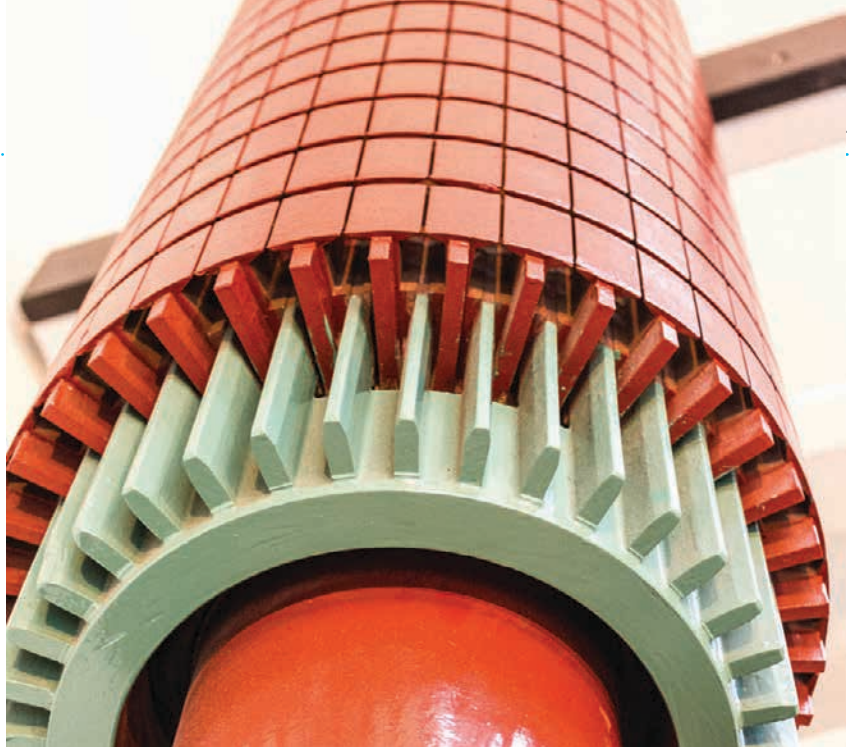
The 10 tonne IRD balancing machine.



Their 60 tonne Craven lathe capable of handling up to 7 metres in length.

December 2011. Clyde Blowers Capital also owns David Brown Gear Systems and the US based Energy Services International (ESI) and has other engineering companies in its portfolio. Clyde Blowers Capital understands engineering companies, and is proud of its Scottish heritage. It has a clear vision to invest in Parsons Peebles to help it grow substantially in the Oil and Gas, power sectors, and expand its potential in other sectors of industry. Shortly after the takeover, it became clear that Clyde Blowers had planned for major investments in people, plant, and premise, to enable Parsons Peebles to develop its product range, manufacturing systems and capacity, and ensure that they could maintain a rapidly growing customer base with a first class service.

On the wall of the workshop is a chart showing the vision that Clyde Blowers has for Parsons Peebles, it is headed: "£250 million by 2017- Specialist Machines and Superior Service". In any other company this statement would be ridiculed, but Jim McColl has proved that he can catapult engineering companies into another zone. He certainly achieved similarly spectacular growth with Weir pumps in just 4 years.

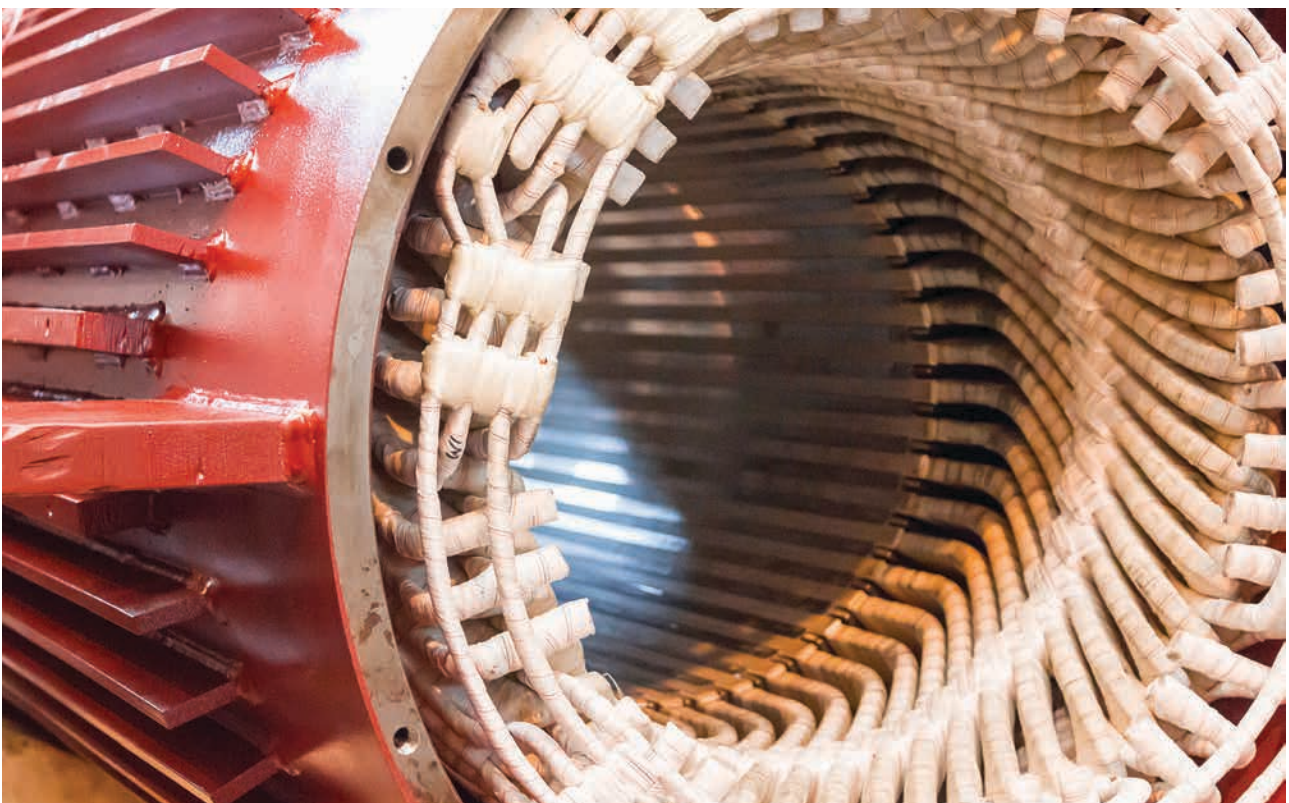


A new rotor made by Parsons Peebles.

At the time of the takeover Parsons Peebles had increased their turnover steadily to £5 million, so this is quite a meteoric target, and one which all the staff are well aware of. An initial part of this expansion was to ensure continuity, reliability, and a quick turnround for the supply of high voltage coils. Shortly after this decision, Clyde Blowers Capital purchased Preformed Windings in July 2014, which rapidly ticked this box. Although a separately held company, it will ensure the supply of High Voltage

coils to Parsons Peebles. Preformed Windings are imminently embarking on an investment of over £2M which will see their capacity increase hugely to meet demand for their high quality coils to Parsons Peebles, other motor manufacturers and the rewind market. The company already produce the laminations that they require for new machines for replacement stators.

Troy Saunders, Operations Director at Parsons Peebles, started as an



A wound stator.

apprentice at the company, at the time of the purchase he commented “The acquisition and investment by Clyde Blowers Capital is allowing us to expand our operations at Roysth, which is home to one of the most comprehensive test facilities in Europe, and focus on international growth, as well as securing the future of the business for generations to come.”

On entering the factory the changes since the takeover, were immediately noticeable, everything is now very ship shape, clean and well lit, and there was an abundance of recently completed large machines waiting to be delivered to their customers. The company had already begun part of a major planned expansion. They plan to expand their market for specialist machines globally, and also have an international service capability. Having seen the way that Clyde Union Pumps was built up, it will be no surprise to see other companies added to Parsons Peebles, so that Clyde Blowers Capital achieve their ambitious goals.

Parsons Peebles produce a variety of special and bespoke High Voltage machines, especially for the UK offshore

North Sea market. Their understanding of maintaining reliability in the harshest of operating environments continues to win them many orders. They produce 4 pole generators up to 50MVA for use with steam and gas turbines, as well as combine heat and power plants. Their synchronous and asynchronous motors go up to 25MW with specialist machines up to 52 poles. They specialise in low noise, and low starting current machines at around 2.7 times full load current. Their machines are fitted with the Peebles keyed-bar cage rotor construction, avoiding problems with bar breakages and ensuring a long and reliable life.

Their units can be adapted to fit in unusual and unique applications, and are often reverse engineered to replace machines that are discontinued, or facing long lead times from other manufacturers. With an established machine base in the oil and offshore industry, a large number of their machines are certified by BASEEFA as ATEX and IECEX compliant, they also have GOST-R certification for Russian requirements. Many of the machines they produce are pressurised machines and they carry out the purging and

pressurising as part of the certification tests. The Rosyth Facility covers 8,300 square metres with a main bay lifting capacity of 63 tonnes. The Rosyth Royal Dockyard is the yard where the two new aircraft carriers are being built, and Parsons Peebles have won some substantial contracts for these carriers.

For industrial applications they produce machines for cement, mining, pulp and paper, rubber, and with applications for water pumps, fans, mills, grinders, and compressors. For marine they produce propulsion thrusters, and dewatering pump motors.

One big advantage that they have retained is an excellent test facility capable of load testing machines at 50Hz and 60Hz and up to 8MW/35MVA with voltages up to 13.8kV. This was recently upgraded and overhauled including refurbishing the 40MVA Kramer Drive used for load testing generators and motors. They have added a chilling plant capable of handling 2000 litres per minute for water cooled machines, as well as the gearbox cooling. The dedicated oil system can handle 70 litres of oil per minute.



A large machine mounted onto the test bed for a load test.



Drop-in replacement motor designed to fit site space envelope and terminal points.

The test bed is able to test Induction Machines at 2 pole speeds using the differential gearbox and at four, six, and eight pole speeds using the additional reduction gearbox. This gives a maximum rating of 3,300 volts of 3MW, and 7.5MW at 6,600v, 11,000v, and 13,200 Volts at 50 Hz and 6,600v, 11,000v, and 13,800 Volts up to 8MW at 60 Hz. They also measure temperature on vertical machines and slower speed machines by the superposition method.

The vibration recording system has been upgraded, so that they are able to record and analyse vibration, balance on rotor end planes, and take a digital copy for future analysis with Bently Nevada ADRE equipment. They also have an IRD balancing facility able to handle rotors up to 10 tonnes, with additional trim balancing carried out on test. As they produce a range of low noise level machines with special features, it is important that they can test the level of noise produced by machines on test. They have always been focused on green energy as well. They were the main electrical contractor for the first 5MW UK Hydro Electric scheme at Cym

Dyli in North Wales in 1904, which they later upgraded to 10MW in 1987. It is still operating well, although it is now controlled from Dolgarrog, the other side of the Snowdonia mountains. They are proud of their Scottish engineering expertise and have designed and built Hydro-generation plants from 1 megawatt to 25MW as far afield as Thailand, Indonesia, and from Canada to South America, New Zealand and Africa. They are continually refurbishing existing systems and carrying out design evaluations.

Parsons Peebles also have a long history in pumped storage schemes. They have records for four pumped storage schemes in the UK. The schemes are at Festiniog, Dinorwig, Foyers, and Cruachan. Cruachan, which was opened in 1965, was the first reversible pumped storage scheme to be built in the world and consists of four 100 megawatt units, which are now remotely controlled from Glasgow. These plants provide peak time generation incredibly quickly. The generators are kept spinning with air, so that when there is a spike of demand they can add their generation capacity to

the grid within just 30 seconds. The pony motor is then used to pump the water back up to the reservoir when demand drops. Parsons Peebles have recently reverse engineered the 7MW Pony Motors for the Hydro Generator and built/tested 2 replacement units. There are plans to build more pumped storage and Hydro Power stations in Scotland.

Hydropower is probably as green a method for producing power as any, however they are also involved in wave power and wind farm projects, and could well see some of their projects in these areas come to the fore.

There is no doubt that Parsons Peebles has its future well mapped out for major changes over the next few years. The company has been getting ready for major expansion, and the purchase of Preformed Windings by Clyde Blowers Capital earlier this year was the first part of that plan. However how they hit their global and international aspirations will be interesting. They have tremendous managerial and financial backing, so expect great things from them over the next few years.

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Axflow's dream job: One hundred and forty four rusted bolts!

When Mark Redgrove of Axflow was called in to look at a leaking Armstrong Vickers impounding pump at Tilbury Docks it was a challenging, but very satisfying task.

The Port of Tilbury has long been London's major and greenest port. Shipping enters and leaves the docks through the large lock gates at high tide from the River Thames. The water level is maintained at around 10 metres within the dock, to cope with the rising and falling tides. At each high tide the water level inside the impounding dock is raised to meet the shipping and operational requirements. The level is maintained by four 57.5" vertical axial flow Vickers Armstrong pumps installed during a major refurbishment of the docks in the mid 1960's; over the years they have served the dock extremely well. At any one time three pumps are used, pumping up to 6,000 litres/second of abrasive sea water for two hours either side of each high tide.

During planned maintenance, engineers noted a noise from the No.2 impounding pump, which became a cause for concern. A thorough inspection revealed that in addition to this problem the pump was leaking from the bottom casing and not running at its full capabilities. To resolve both problems the pump was shut down and advice sought on whether to repair or replace the pump.

Mark Redgrove, Technical Support Manager at AxFlow, pump distribution and repair specialists, called in to look at the problem. It was decided to completely remove the 40 tonne pump, including the lower rising mains. Mark recounted: "Removing the pump did prove to be quite a challenge for us, as the majority of the 144, 1¼" bolts, had rusted solid. We removed the pump and sent the 40 tonne unit by low loader to our Huddersfield workshop, who undertook a full strip-down and examination of the fifty year old pump. This revealed considerable wear to several of the major components, with the lower rising main and wear rings being the most in need of repair".



The 40 tonne reconditioned pump and motor back on the low loader heading for Tilbury Docks.

The lower rising main was very badly eroded, so it was decided to make a new pattern and cast and machine a completely new component. The upper and lower bearings needed replacing, and both wear rings were replaced. The lower wear ring was missing altogether and the upper wear ring was also severely eroded and corroded. Fortunately the main shaft could be re-used and this was cleaned and dressed.

Other work involved replacing the cutless rubber bearings, skim-machining the muff coupling sleeves, and making new couplings. The lower part of the Outlet Guide Vane casing at the upper wear ring was badly corroded, making it necessary to machine it back to cast and refit a replacement piece. The spigot for the lower tunnel tube was also broken, which was machined back by 10mm to reintroduce the spigot and a new 10mm longer tunnel tube was cast and machined. In spite of the wear shown by many of the components and the aggressive nature of the seawater being pumped, the impeller was found to be in relatively good condition.



Running smoothly: the reconditioned 50 year old pump manufactured by Armstrong Vickers at their Elswick works in the 1960's.

The size and extent of wear to the pump was a challenge, however in those days pumps were built to last. It is now re-installed in the impounding station and running smoothly, and should be good for a good number of years yet. ■

AxFlow's Website: www.axflow.co.uk
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Submersible Pumps engineered to the highest efficiency levels.

Today's wastewater is a challenge for pump designers, because of the high content of solid materials. Pumps have to be specifically engineered to avoid clogging, and advances in impeller technology have enabled a high resistance to clogging, even with difficult solids content. With the new ABS XFP range, Sulzer now offers a complete product line for the reliable pumping of wastewater, which was also the first submersible pump range that met the IE3 premium-efficiency standard.

The removal and treatment of wastewater in the modern urban infrastructure has never been more demanding. Today most municipal wastewater is transported using the Wet Pit Submersible Pump as by far the most common solution. Water conservation trends and controls are driving towards increased density of entrained solids as water consumption per capita sinks in most EU countries. At the same time, the solid and fibrous content in wastewater has become increasingly problematic.

This has led to higher maintenance costs for wastewater systems, customer dissatisfaction, and even legal claims. Residents of Brooklyn, in New York, recently filed a \$5 million damage claim against a well known sanitary products manufacturer because of their clogged pipes and sewers.

The engineers have worked hard to keep ahead of these trends. They continue to improve pump hydraulic design and build on a solid foundation of knowledge in wastewater pumping. This stretches back to the 1960s, when pump designers at Sulzer/ABS recognized the advantage of the single-channel impeller for pumping water containing fibrous materials. Several patented innovations were introduced, of which the most significant was the Contrablock™ system. This was based on an adjustable spiral wear plate acting in conjunction with an open single-vane impeller. The key advantage of this system was the prevention of fibre or rag build up in the back leakage gap, which significantly reduced pump blockages. It could be argued that this



The Sulzer ABS XFP submersible sewage pump. The first submersible sewage pump range to meet the IE3 efficiency standards.

technology has been the cornerstone of the success of Sulzer/ABS in the municipal wastewater market over the past five decades. During this period, the single-vane impeller has evolved in terms of performance, reliability, manufacturability, and coverage.

Development of a new impeller technology

Early designs in the development of a new impeller technology were based on basic geometries that could be defined and drawn in 2D, and reproduced by pattern makers to enable the manufacture of high quality impeller castings. Although these early versions were reliable and robust, their hydraulic efficiency was relatively poor compared with multichannel impellers. Typical maximum hydraulic efficiencies achieved were in the range of 50% to 55%. During the 1970s and 80s, following the first global energy crisis, it was recognized that the single-channel impeller needed a design upgrade to improve hydraulic efficiency whilst maintaining the already established reputation for high reliability in solids handling. The combined skills of hydraulic designers and patternmakers were used, and an improved range of impellers covering 1.5 kW to 7 kW was introduced. Although results were good, with hydraulic efficiencies improved to 60% to 70%, there was only limited optimisation achieved, due to the large prototype workload requirement. The complex 3D vane shapes also presented a major challenge in foundry casting methods and machining. Especially difficult was the task of achieving an acceptable level of unbalance in the asymmetrical casting to allow dynamic balancing on the final machined impeller.

However as these challenges were overcome, large volumes were produced in serial production up to 2010, when the old AFP range was replaced with the current XFP range.

The XFP submersible sewage pump utilizes clogging resistant impeller technology and offers one of the market's highest levels of efficiency within its design.

Advances in Design methods.

There were advances in design methods with the advent and adoption of 3D CAD modelling in the late 90s combined with new hydraulic design skills. It became possible to extend the single-channel Contrablock design up to 22 kW in a DN200 pump. Methods for achieving dynamic balance in the CAD model were developed, and the lead times for the release of new designs to production were dramatically reduced.

During the next decade (1998–2008), a major collaborative effort with universities was undertaken to improve the understanding of the behaviour of the single vane impeller with respect to efficiency and anti-clogging. Several PhD research projects were sponsored with the goal of capturing, codifying, and improving design methods. For the first time, CFD simulations were used to analyse the flow behaviour in a single-vane impeller, and significant advances in understanding pulsation, velocity, and pressure distribution were achieved. Methods for measuring and benchmarking the anti-clogging properties of wastewater pumps were also developed around this time.

The original test methods were used for marketing and customer demonstration purposes, but were of little value in

showing the design improvements. A “blockage index” ranking has now been established to compare all wastewater pump types. This index is based on a statistical analysis of pass/fail events in a repeated test procedure carried out in a specially constructed test rig. High-speed digital video imaging procedures have been established to observe and analyse blockage events inside the pump. This technique enabled Sulzer hydraulic engineers to optimize impeller and wear plate geometries. The support of an in-house rapid prototyping service for impellers and hydraulic components was essential in permitting rapid development of the prototypes.



Using dedicated 5-axis high-speed CNC milling machines, it is now possible to produce working prototypes of impellers from 3D CAD models within 24 hours.

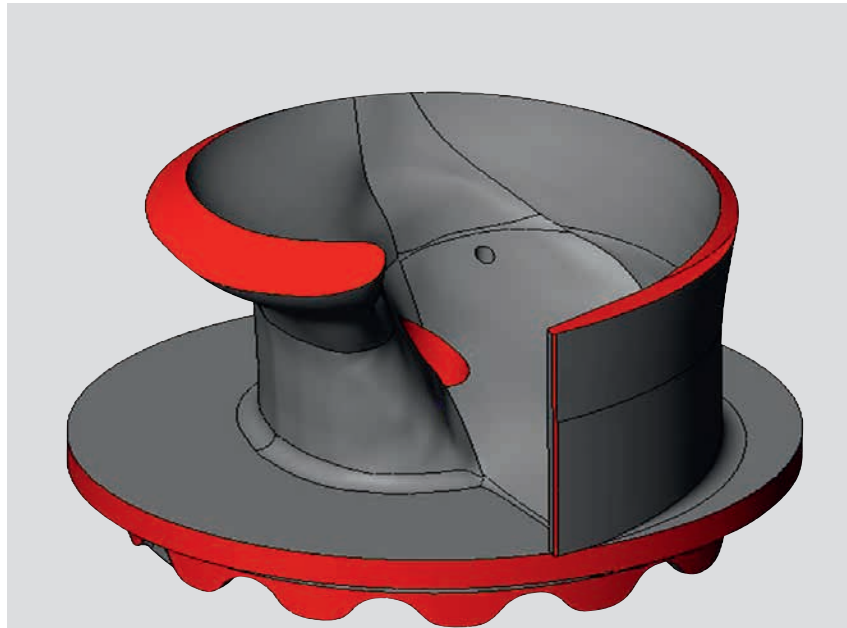
Improving hydraulic efficiency
With the knowledge and tools provided by this research, a major upgrade of the AFP wastewater pump hydraulics became possible.

At the same time, eco-design legislation was driving the electric motor industry to higher levels of efficiency, and the availability of IE3 premium class motors was becoming an economic reality. The combination of these two advances in technology has led to the complete redesign of the AFP wastewater range. The design target of being equal to, or better than the market leader across the pump sizes, in terms of total efficiency and anti-clogging behaviour was achieved.

The new XFP range was launched in 2009, and the complete range was finalized in 2011 from PE1 to PE6 (1.5 kW to 350 kW). Although major improvements have been made in terms of hydraulic efficiency and anti-clogging reliability using new design tools and methods, there are still more opportunities for improvement. In the coming decade, the focus will be on the use of advanced optimization tools such as mode FRONTIER® to achieve the maximum hydraulic efficiency for the single-vane impeller. This work will be closely linked and integrated with the use of advanced CFD tools to simulate the behaviour of liquid that contains fibres or rags. The need for prototyping will be reduced considerably, but all designs will still need to be verified using laboratory tests and real life field tests. The results will establish optimal vane features to prevent rag build up and pump blockages.

As the 2020s approach we can expect to see more significant improvements in the XFP wastewater range. www.sulzer.com/XFP-pump

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The Contrablock™ impeller system

The problem with single channel impellers is that they only have one large passage for the pumped liquid.

In Sulzer's Contrablock impeller system, objects of at least 75 mm can pass freely through the impeller.

However, it is not enough to consider only the size of the solids because their shape and material are also relevant for pump design.

Modern wastewater increasingly contains long fibrous materials, such as synthetic cloth from tissues, wipes, and dishcloths used in household cleaning. Such material tends to get caught and build up on the leading edge of the pump's impeller vane.

Because of this Sulzer has designed an impeller vane with a specially profiled leading edge. The profile increases in thickness along its length and forces rags down along the leading edge. This way the rags re-enter the fluid and leave the impeller without clogging.

Today the Contrablock Plus series includes multivane as well as single-vane models.

Their unique blockage resistance is now available for pumps from 1.3 kW (1.8 HP)/DN80 (3 inches) all the way up to 400 kW (536 HP)/DN400 (16 inches).



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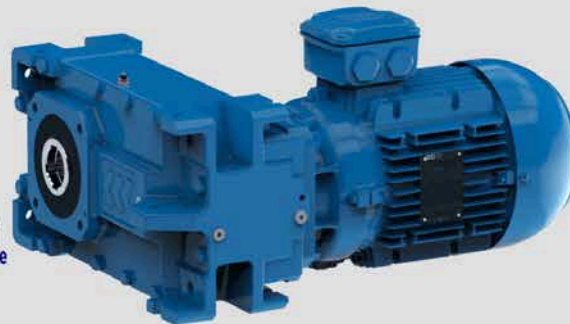
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A Giant Challenge in the North Sea.

As exploration continuously moves to deeper waters and more distant locations, Floating Production, Storage, and Offloading (FPSO) facilities are becoming more and more common around the world. These huge vessels are several hundred metres long and, accordingly, have machines of enormous size and weight.

A North Sea Floating Production, Storage, and Offloading (FPSO) facilities Vessel.



When it comes to replacing such a machine, the service teams are often challenged to find unconventional solutions. The Falkirk Service Centre, located close to Edinburgh, specializes in offshore work. It is a large electro-mechanical service facility with 65 employees, 30 of whom are fully certified for offshore work. Much of the service work completed here is from oil production platforms, drilling platforms, FPSO units, drill ships, etc.

Recently, the Service Centre in Falkirk expanded into an adjacent property and developed a storage facility for motors. Sulzer created a new 2000 square metre purpose-built workshop and storage complex to hold, maintain, and keep over 150 spare machines in a state of readiness for various customers. The customers remain the owners of all this rotating equipment. The motors and generators range from a few kW to 12 MW, with some of the largest weighing over 30 tonne. The Sulzer Service Centre can offer a rapid replacement service for key assets, if they cannot be repaired in the required time frame. The spare machine can be brought out of store, checked over with a no-load test if necessary, and then dispatched to the customer. The range of valuable services provided by the larger Service Centre includes replacing machines, conducting investigations, and performing repairs on failed machines.

In early 2013, Sulzer's Service Centre in Scotland, received an emergency call from an FPSO in the North Sea. A 9 MW motor that drove a gas compressor had failed to start. With these facilities Falkirk offered the best solution to ensure that a problem on an FPSO was solved in the shortest possible time, nevertheless it was a huge challenge. The vessel that had sent them a call was 250 metres long and operating in the harsh seas west of Shetland. In that part of the North Sea, the waves can be higher than 30 metres, and the wind speeds can reach over 90mph (40 m/s). The ship has an impressive capacity to produce 140,000 barrels of crude oil and 100 million standard cubic feet of gas per day.

Problems identified:

Sulzer engineers soon discovered that the motor had suffered a major failure and determined an on board repair was not feasible. A suitable spare motor was available in their storage facility and needed to be inspected, readied, and installed as an emergency replacement. This was achieved within 3 days, however the removal of the failed motor became the major challenge.

Because the FPSO was still in production and had to stay on station, the failed machine needed to be lifted onto a

supply ship and brought ashore for repair. An initial assessment of the scope of work identified that the motor weighed 20 tonnes and was too heavy to be lifted from the FPSO in one piece. The long reach required from the crane to the machine made it unfeasible. To overcome this problem the rotor had to be withdrawn from the stator, so that it could be lifted off in two parts, and stay within the maximum safe lift limit of 10 tonnes. It was clear that this would be a difficult operation, so the Sulzer engineers decided to perform a trial removal on the spare motor to identify whether there were any unforeseen

difficulties. In so doing they discovered that the high voltage connections inside the stator had been configured in such a way that the rotor could only be removed axially in one direction. This direction was opposite to the direction that had been assumed looking at the layout of the deck area on the FPSO, and there appeared to be insufficient space to do this.

Customized solution

The Sulzer team had a number of meetings with the customer's engineers



The rotor of the 9 MW machine being removed on board the FPSO in the North Sea by Sulzer engineers, using the special support frame manufactured by their service centre in Falkirk.

to identify a solution that would not involve cutting away parts of the main structure. The solution they devised was to design and manufacture a frame that would act as a trolley, which would be specially adapted to grip the bearing. The frame would be as short as possible and be designed to take the full rotor weight. To guarantee a trouble-free manoeuvre, a trial run was performed in the workshop. Engineers marked out an area to duplicate the deck area on the FPSO with obstructions in the same places. This whole process was successfully completed within four weeks, during which time the production on the vessel was able to continue. The trial run in the workshop ran without a hitch, and during the actual run on board, the rotor was successfully removed using the lifting equipment. The machine was then reassembled and lifted onto a supply ship. The installation of the replacement involved performing the same operations in reverse. Everything went as planned, and even the weather was good for the time of year (winter).

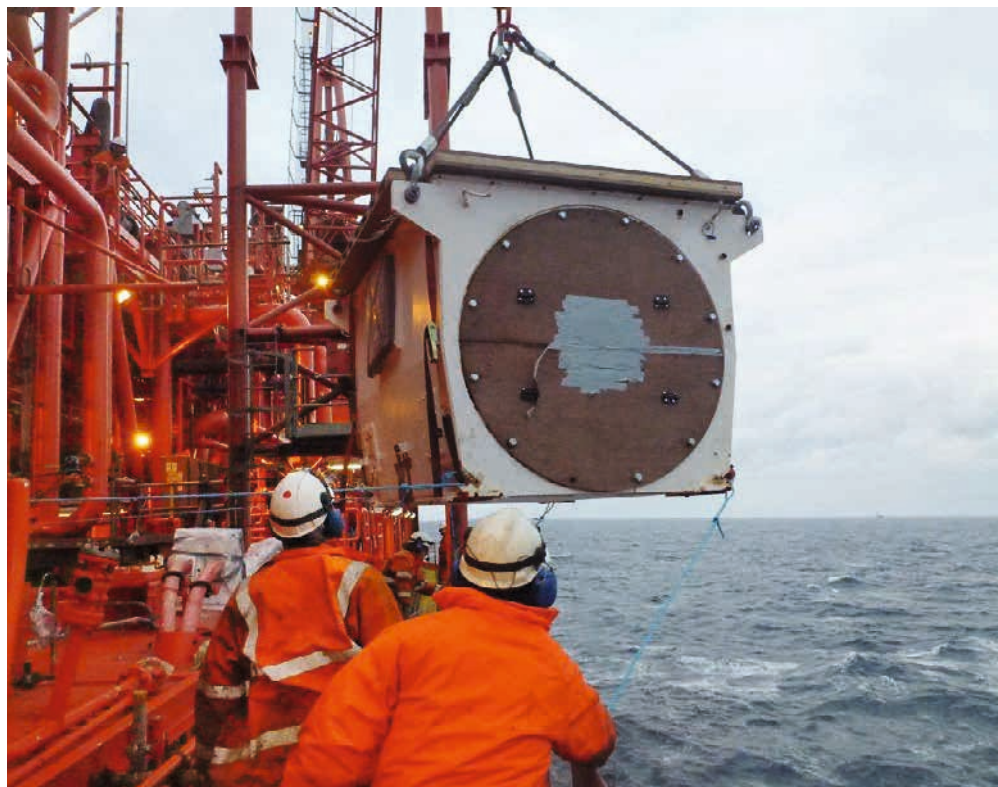
Motor repair

The failure of the motor itself was due to high partial discharge in the end windings. This situation can sometimes be repaired locally if detected early enough, however in this case a full stator rewind was necessary due to the extent of the damage. As the machine was still under warranty from the original equipment manufacturer, it was repaired by the manufacturer and returned to Sulzer's storage facility to replace the spare that had been used.

Normally the rewind would be carried out at Sulzer's Service Centre using modern materials to provide a replacement winding comparable in quality to the original winding. The Sulzer Birmingham Service Centre supplies High Voltage coils for repairs and refurbishments internationally. It keeps a large stock of copper, which is drawn to shape in-house. This enables them to offer a fast turnaround time, typically not longer than eight days. The coils are designed using state-of-the-art methods and materials, which can lead to an enhancement of a machines



The large High Voltage machine on board the vessel.



The stator being lifted off the vessel onto the supply ship, having removed the rotor to make it lighter.

performance. The repaired motor would then be on the Falkirk test bed before returning to stock.

The customer was extremely satisfied with Sulzer's service and that Sulzer had been able to remove the machine from a difficult location quickly and without any damage to either the old or new machine. The Sulzer Falkirk Service Centre continues to store a

large number of high value electric motors and generators. It has received additional business from this client as a result of its first-class solution to this challenging problem.

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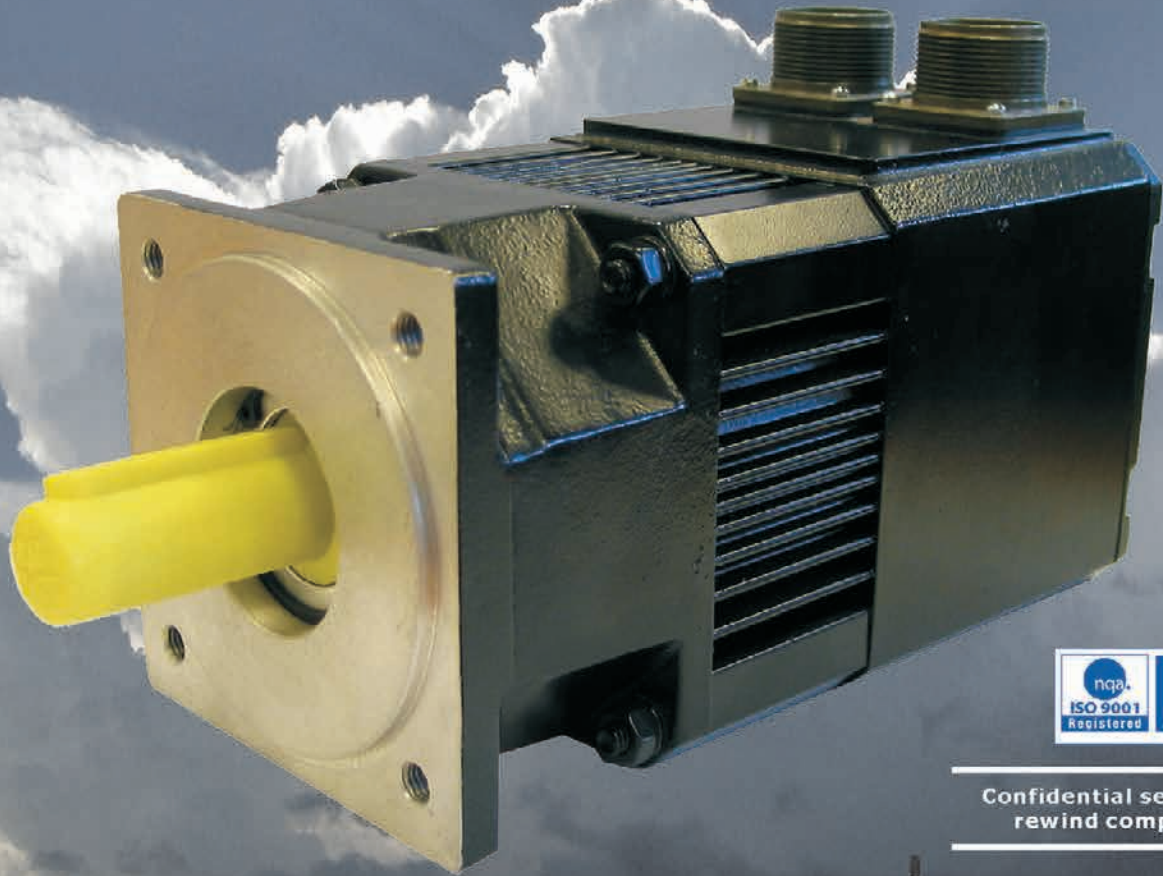
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Efficiency Levels: What happens on January 1st 2015?

The following are the Eco Design Directive Details: The definitions in the Eco-design directives, IEC640/2009 and amended by EU directive 4/2014 on 27th July 2014 for Motors includes the following design requirements:

- Electric, single speed, three phase induction motors.
- Hertz: 50 or 50/60Hz
- Squirrel cage i.e. no brushes, commutators, slip rings, or electrical connections to the rotor.
- Poles: two to six pole (2, 4, or 6 pole.) Single speed only.
- Rated voltage up to 1000v.
- Rated output P N between 0.75kW and 375kW.
- Rated for continuous operation. Capable of operating with an integrated cooling system, at nominal load, without interruption,

below its maximum temperature rise, as per S1.

- Brake motor means equipped with an electromechanical brake unit operating directly on the motor shaft without couplings.
- These Directives shall not apply to means of transport for persons or goods, and design requirements for machines outside the above parameters.

Energy Efficient motors replacing original motors on fans, pumps, and compressors, will have less slip and therefore have a higher maximum speed. This could lead to higher energy usage unless regulated back to the original speed or re-profiling the impellor to compensate. Specialist advice should be considered. Standard energy efficient motors may not be a

suitable replacement for high torque machines, stop start machines, brake motors, low usage machines, and other special fitments or applications.

Rewinds:

A good repair or rewind by an AEMT member using the latest specification winding wire and insulation systems and good quality bearings will maintain, and often improve, the efficiency of a motor within its original rated efficiency level band (see the AEMT EASA Good Practice Guide).












Tolerances for Efficiency Levels:

To comply with the regulation on nominal motor efficiency (η), the losses ($1-\eta$) should not vary by more than 15 % on power range 0.75-150 kW and 10 % on power range > 150-375 kW.

P _N kW	2 Pole			4 Pole			6 Pole		
	IE1	IE2	IE3	IE1	IE2	IE3	IE1	IE2	IE3
0.75	72.10	77.40	80.70	72.10	79.60	82.50	70.00	75.90	78.90
1.10	75.00	79.60	82.70	75.00	81.40	84.10	72.90	78.10	81.00
1.50	77.20	81.30	84.20	77.20	82.80	85.30	75.20	79.80	82.50
2.20	79.70	83.20	85.90	79.70	84.30	86.70	77.70	81.80	84.30
3.00	81.50	84.60	87.10	81.50	85.50	87.70	79.70	83.30	85.60
4.00	83.10	85.80	88.10	83.10	86.60	88.60	81.40	84.60	86.80
5.50	84.70	87.00	89.20	84.70	87.70	89.60	83.10	86.00	88.00
7.50	86.00	88.10	90.10	86.00	88.70	90.40	84.70	87.20	89.10
11.00	87.60	89.40	91.20	87.60	89.80	91.40	86.40	88.70	90.30
15.00	88.70	90.30	91.90	88.70	90.60	92.10	87.70	89.70	91.20
18.50	89.30	90.90	92.40	89.30	91.20	92.60	88.60	90.40	91.70
22.00	89.90	91.30	92.70	89.90	91.60	93.00	89.20	90.90	92.20
30.00	90.70	92.00	93.30	90.70	92.30	93.60	90.20	91.70	92.90
37.00	91.20	92.50	93.70	91.20	92.70	93.90	90.80	92.20	93.30
45.00	91.70	92.90	94.00	91.70	93.10	94.20	91.40	92.70	93.70
55.00	92.10	93.20	94.30	92.10	93.50	94.60	91.90	93.10	94.10
75.00	92.70	93.80	94.70	92.70	94.00	95.00	92.60	93.70	94.60
90.00	93.00	94.10	95.00	93.00	94.20	95.20	92.90	94.00	94.90
110.00	93.30	94.30	95.20	93.30	94.50	95.40	93.30	94.30	95.10
132.00	93.50	94.60	95.40	93.50	94.70	95.60	93.50	94.60	95.40
160.00	93.80	94.80	95.60	93.80	94.90	95.80	93.80	94.80	95.60
200 to 1000	94.00	95.00	95.80	94.00	95.10	96.00	94.00	95.00	95.80
	94.00	95.00	95.80	94.00	95.10	96.00	94.00	95.00	95.80

The relevant directive dates are

Directive Mandatory Dates:	Motors with a Rated kW from	Shall not be less efficient than
16 June 2011:	0.75kW to 375kW.	IE2 efficiency level
27 July 2014:	As Above	Design Amendments as above, and in the amendment chart.
1 January 2015:	7.5kW to 375kW	IE3 Efficiency level, Or IE2 equipped with a VSD. (Variable Speed Drive)
1 January 2017:	0.75 kW to 375kW	IE3 Efficiency level, Or IE2 equipped with a VSD. (Variable Speed Drive)

Before 27 July 2014 this regulation shall not apply to:	After 27 July 2014 this regulation shall not apply to:	
means of transport for persons or goods		means of transport for persons or goods (no change)
motors specified to operate wholly immersed in a liquid		motors specified to operate wholly immersed in a liquid (no change)
motors completely integrated into a product (for example gear, pump, fan or compressor) of which the energy performance cannot be tested independently from the product		motors completely integrated into a product (for example gear, pump, fan or compressor) of which the energy performance cannot be tested independently from the product (no change)
motors specifically designed to operate at altitudes exceeding 1,000 meters above sea level		motors specified to operate exclusively at altitudes exceeding 4,000 meters above sea level
motors specifically designed to operate where ambient air temperature exceeds 40°C		motors specified to operate exclusively where ambient air temperature exceeds 60°C
motors specifically designed to operate in maximum operating temperatures above 400°C		motors specified to operate exclusively in maximum operating temperatures above 400°C
motors specifically designed to operate where ambient air temperatures are less than -15°C for any motor...		motors specified to operate exclusively where ambient air temperatures are less than -30°C for any motor...
or less than 0°C for a motor with air cooling		or less than 0°C for a motor with water cooling
motors specifically designed to operate where the water coolant temperature at the inlet to a product is less than 5°C or exceeding 25°C		motors specified to operate exclusively where the water coolant temperature at the inlet to a product is less than 0°C or exceeding 32°C
motors specifically designed to operate in potentially explosive atmospheres		motors specified to operate exclusively in potentially explosive atmospheres
brake motors, except requirements laid out in Annex 1 points 2(3) to (6) and (12)		brake motors, except requirements laid out in Annex 1 points 2(3) to (6) and (12)

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
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Quartzelec coil shop, de-reeling stands and semi-automatic Roebel line.

Quartzelec's new coil shop is an impressive, "state of the art", investment in High Voltage Coil manufacture.

It is always interesting to visit a member after an interval of a few years, and particularly if they have moved into new premises. This is especially true of the recent AEMT visit to Quartzcoil part of Quartzelec, and the presentation that Mick Richmond, their technical design manager for insulation systems, gave to members present before the visit. The AEMT members were first welcomed to the previous facility in 2004, and then after they moved in 2009, however the recent visit was a quantum leap from the progress between the last two visits. The company have not only invested a substantial amount in a new headquarters and workshop in Rugby, but also invested in a state of the art High Voltage Coil manufacturing facility.

Quartzcoil has had many renowned owners over the years, which is now very much to their benefit. The enviable list of previous owners has left them with archives of the original specifications for a large number of High Voltage Machines.

Their heritage started with BTH in 1896, and through various takeovers including machine manufacturers Metropolitan Vickers, AEI, and English Electric, all of which were absorbed into GEC. The next merger created GEC Alsthom, which was floated off to become Alstom.

Then with a number of management buyouts it passed through Cegelec, and Clarich, to become part of Quartzelec in 2007.

This list of mainly British and French machine manufacturers sent machines to all corners of the world, and Quartzelec still has the original designs and insulation specifications for many of these machines, which means that accurate measurements may not be required by the customer for the above machines, when ordering a set of coils from them.

Over the last ten years they have moved premises and their equipment four times, however the last move to their new premises, must be a dream come true. Quartzcoil now have a large bay in the brand new Quartzelec Head Office and Repair facility on the edge of Rugby. The complete premises has a floor area, with offices, of just under 100,000 square foot, and is totally carbon neutral.

For this final move most of the bulky old heavy machinery, which had long passed the end of its expected life, has been scrapped and been replaced by



The Vincent 4 metre Coil Loop Winder.

new state of the art equipment. They are now able to supply coils for virtually all applications including

- AC Stator bars from 2 pole to 70 pole, 100 to 18,000V up to 6 metres core length.
- AC Stator coils in all formats from 100 to 16,000V up to 4 metres core length.
- AC field coils including salient pole strip on edge.
- Two pole turbo generators field coils.
- DC coils and bars from 100 to 2500V.
- DC mainpole, composites, and compensating windings.

Having inherited the world leading insulation technologies developed by GEC and Alstom, they continue to develop their insulation systems in partnership with insulation manufacturers. They offer Resin Rich Systems for the Service and Repair market, for which they have references up to 330MW, 18kV, 2pole and multi-pole industrial and hydro machine coils.

The Resin Rich Mica Tape main insulation system is suitable for factory wound coils with full impregnation, site

Having inherited the world leading insulation technologies developed by GEC and Alstom, they continue to develop their insulation systems in partnership with insulation manufacturers.

wound with no processing, as well as site wound with a final thermal cycle. The components of the Resin Rich system, are adapted to each application, and have the advantages of today's modern high performance insulation systems. For stator coils the insulated conductor generally consists of mica taped conductors, with film backed mica tape as the main insulation. The stator coil end winding insulation is film and glass backed mica paper tape with end winding sealing tape of pigmented glass, polyester or film tape.

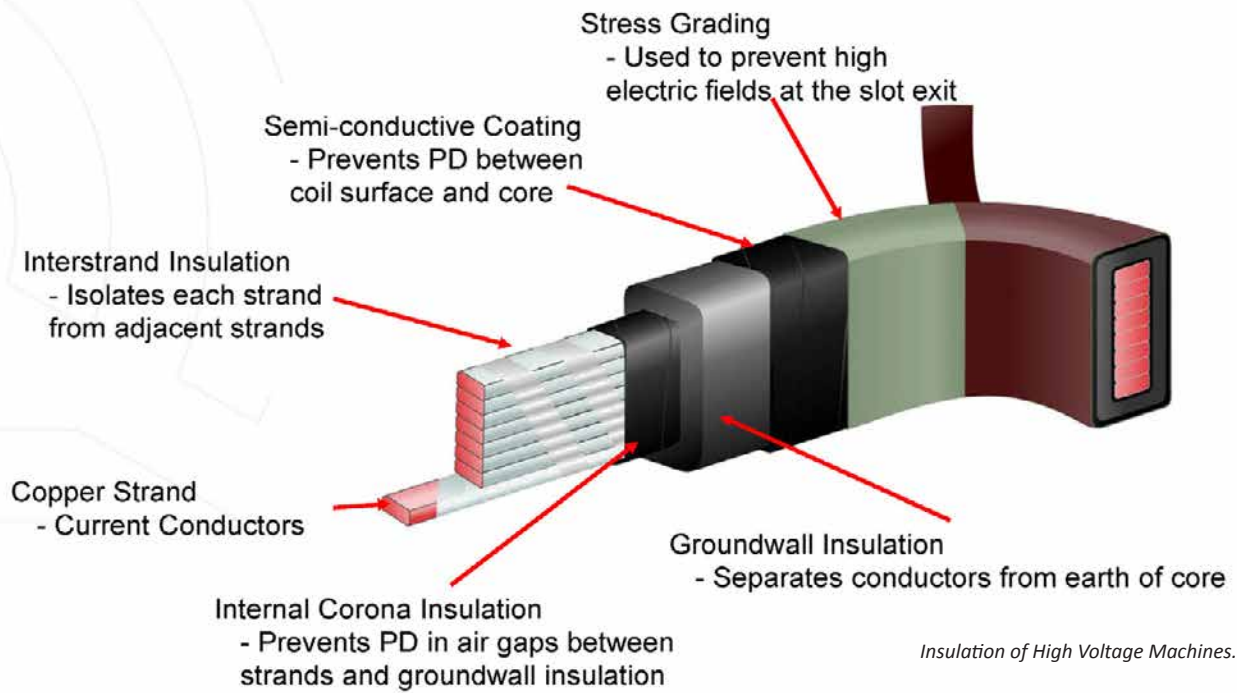
They use graphite impregnated polyester fleece tape for the slot corona shield, and silicon carbide impregnated polyester tape for slot exit stress grading. For stator bars the insulated conductor

is Enamel and Daglass with glass backed mica paper tape as the main insulation. They also manufacture Roebel stator bars using a conductive mastic putty filler.

The new semi-automatic Roebel line incorporates conductor stripping and cutting facilities, with 360 and 540 degree Roebel transpositions. Their Global Vacuum Pressure Impregnation (VPI) systems are mainly supplied to original equipment manufacturers up to 50MW, 15kV.

These use mica tape main insulation, and a choice of insulation systems as preferred by different manufacturers. They include glass and film backed tapes, and catalysed or non-catalysed resin systems.

Insulation of High Voltage Machines



The Vincent Universal Coil and Bar Former to automatically shape the HV coils.

Quartzcoil have just introduced aluminium formers for manufacturing two pole turbo generator bars. These state of the art formers are now possible using a mathematically correct "3D" model, which guarantees the correct shape and pitch of the bars. The end winding and bar end consolidation is done with MF induction heating on the former.

To check the shape and pitch of the manufactured stator bars, a dummy core is manufactured to check for the exact fit and tolerance. These dummy cores are now often manufactured from steel for accuracy, as opposed to the wooden formers previously utilised.

A major investment has been the new Vincent Coil Loop Winder, which is NC controlled for 100% repeatability. It can manufacture loops up to an impressive 4 metre loop length fed by 24 drum de-reeling stands and automatic turn taping capability during looping.

It is supported by a state of the art Vincent Universal Coil and Bar Former, which is also NC controlled for 100% repeatability, and capable of shaping diamond, flat and open coils as well as rotor bars up to the maximum 4 metre length. It has cut down the time required to manufacture and turn round an order for stator coils dramatically. Once fully shaped, the coils are checked for accuracy in the "dummy" stator former.

Insulation tape is applied by the semi-automatic Ridgway BCT machines. These fascinating machines are quick to set up, quick to use, and provide reliable lapping of the insulation tape. They are used on bar sections from 110mm x 30mm using 20mm or 25mm tapes. The existing coil presses have also been updated with electric platen components which have allowed a 50% reduction in the press cycle time, meaning reduced lead time and cost. The product dimensions and electrical test results are consistently to specification.

All coils are tested to the required standards using

- Tan Delta up to 50kV to BS EN 50209
- Partial Discharge testing using PD tech Deltamax, or Quartzelec



Insulation tape being applied by the semi-automatic Ridgway BCT machines.

Lifeview to BS EN 60270

- Impulse Inter-turn testing up to 60kV with a 0.2s wave front to BS EN 60034 15
- High Voltage withstand/ breakdown test up to 100kV to IEEE 1553 and IEEE1043.
- 1000 Hz field coil inter-turn test.
- Thermal Cycle testing to IEEE 1310.
- Designs to withstand NEMA wet tests.

With a major investment of well over £1.25 million in state of the art equipment and procedures, Quartzelec have created a world class coil manufacturing facility, which is bound

to impress any prospective clients. They have seriously looked at ensuring that their coils are manufactured with 100% repeatability, for accuracy, consistency, and reliability. They have also created a much more efficient manufacturing process for High Voltage stator coils and bars and are now able to meet the fastest possible turn-round times that some customers may require and at competitive prices. ■

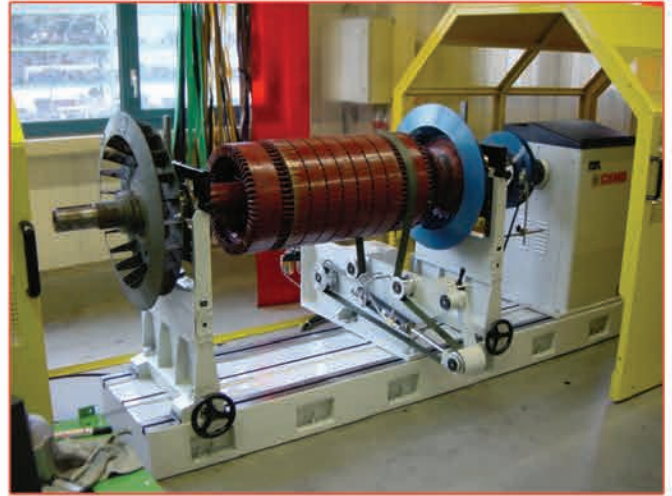
Quartzcoil: www.quartzelec.com/rotating-machines-coil-manufacture.html

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One of Fairline's Luxury Motor Cruisers.

Fairline Boats praise Bowers.

When Fairline Boats underwent a major revamp of their business they turned to the Bowers Group when making changes to their manufacturing process which required a new power supply at their main factory. Fairline Boats make a range of the world's most luxurious high-end motor yachts.

Two arms of Bowers, (Bowers Electricals and Bowers Projects) teamed up to carry out the contract, which included the supply and installation of a new Bowers low loss distribution transformer at Fairline's base in Corby, Northamptonshire. The companies worked alongside the local distribution network operator (DNO) to arrange for the new High Voltage connection and all the contestable and non-contestable works.

During the project, a new DNO substation base was built, along with two GRP enclosures which were kitted out with metering equipment and bespoke high voltage switchgear.

Key to the whole scheme was a new 11kV to 433V distribution transformer, designed and built by Bowers' highly skilled engineers to the BS EN 60076 standards at their Derby headquarters. This energy-efficient and compact steel-core transformer, was chosen for the job because of its low losses. It has been housed in a specially constructed substation on the perimeter of the

factory site. Bowers Projects carried out all of the installation, the HV and LV cabling, and creation of earth matrix.

The new system has already begun reducing the business's carbon footprint and generating electricity savings.

Fairline's Senior Project Engineer, John Husk, explained why Bowers were brought in: "We have three factories in Corby that were built in the 1980's and we decided to bring about a major change to the way we manufacture the boats. Now, one factory is used for the furnishings, another for the moulding including the wet processes, liquid resins and white gel finishes and so on, and the third factory is where the finishing takes place."

"This physical change has made a huge difference to the way we operate, and, as a result, we had to upgrade the power and utilities at two of the three factories. Due to the increase in electrical demand, we needed a transformer and this was how Bowers came to play their part. They were brilliant – fantastic contractors.

Everything was done in a timely way, their communication was good, and the final installation was excellent."

The Bowers Projects team also arranged all the civil and building works, way leaves and project co-ordination, as well as taking care of all the necessary Method and Risk Assessments and Health and Safety paperwork.

Michael Bowers, Managing Director of the Bowers Group, said: "I was very pleased that we were able to supply this equipment and carry out the work for Fairline Boats. My family owned a Fairline 34 some years ago and we have many happy memories of that time. To visit the factory and see the designs for new models and to be able to watch these fabulous boats being built was quite inspirational. From a business point of view it also gave me great pleasure to see another British manufacturer expanding in the same way that we are."

"We wish Fairline Boats all the very best with their new range of products and all their future developments." ■

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One of the two Archimedes Screw Generators operating at Romney Weir. Next to them on the outside sluice gate is the fish run.

Romney Weir generates Hydroelectric power for Windsor Castle.

The Queen already has another hydroelectric plant in Balmoral and the Prince of Wales employs solar panels and wood chip boilers on his estate, however this is the largest project so far and fits in with a policy by the Royal Household to reduce its carbon footprint, and cut energy bills.

The Royal Household agreed to buy power generated at Romney Weir to ensure an income for the hydroelectric project. This enabled funds to be raised for the Romney Weir hydroelectric project. However success was not a foregone conclusion, and it has taken over ten years for the scheme to come to fruition after previous attempts failed due to problems with alternative technology and funding.

The project has been delivered by Southeast Power Engineering installing a mini power station on the River Thames at Romney Weir to produce sustainable electricity using water driven Archimedes screw generators. The completed design features two WEG

W22 Premium Efficiency IE3 generators being driven by two giant Archimedes' screw turbines via a gearbox to produce electricity, which now powers Windsor Castle.

This scheme was the brainchild of David Dechambeau, Managing Director of Southeast Power Engineering, who has overseen every step of the design and installation process. The power station has now been generating electricity since July 2013 and is in the final stages of completing testing and commissioning. The system consists of two Archimedes screws manufactured by Landustrie, each weighing 40 tonnes, connected to the WEG generators, which are now delivering 320kW/hr at peak flow,

exceeding the original design criteria. The generators were designed and manufactured in Portugal at WEG's dedicated European manufacturing site. They are rated at 185kW each and produce electricity at 400V, which is then fed via a 500kVA transformer to the network. The scheme included the installation of an underground 11,000 volt cable connecting the system to Windsor Castle as well as the National Grid.

When the Archimedes screws need to be started, power is required to start them turning. It is because of this that WEG motors were chosen to be adapted so that they would run as a motor initially and then switch over to power

Hydro-electric schemes are usually associated with giant dams and flooded valleys, so it comes as a pleasant surprise to hear of this innovative scheme to supply power to Windsor Castle.



The WEG W22 motor/generator installation and gear box connected to the Archimedes screw.

generation. As the speed increases, the motor function is changed over to become a generator and the rotation of the screw is maintained by the water. This in turn maintains the generator speed whilst producing electricity.

Hydro-electric schemes are usually associated with giant dams and flooded valleys, so it comes as a pleasant surprise to hear of this innovative scheme to supply power to Windsor Castle. Modern technology has now made it possible to harness the normally placid flow of the Thames. The fall from the 'upstream' Windsor reach of the river, to the downstream reach below Romney is only four feet, that difference in height is sufficient to generate significant electrical power.

Romney Weir is almost unique in that it has more sluice gates than it needs and it never requires all the gates to be opened at once. If they were, the reaches downstream would be unable to cope. In addition there is a constriction at Windsor Bridge, which could not pass that amount of water either. As such a turbine has been fitted to two of the spare weir bays. Although a relatively small project for this size of river, the turbines draw an average flow of 10 cubic meters per second, and a maximum of 14m³/s. The average flow in the Thames at this point is 56m³/s. Romney Weir is one of the largest weirs

on the Thames with 10 sluice gates. Unusually the weir becomes flooded when only 6 gates are open (so that the fall over the weir disappears completely). The river downstream of Romney becomes 'full' and cannot discharge flood water any quicker, and opening the additional 4 gates at the weir does release any more flow from upstream to downstream, or reduce the water level. As the weir has more sluice gates than it needs to discharge even flood water, using 2 of the 4 surplus gates for hydro-generation became possible.

Efficiency was an important factor for this application, because the installation has a fixed Return on Investment (ROI) period. At 96% efficiency the WEG motor/generators represented one of the best solutions for the power transmission design to ensure their six year return target was met. The installation has a minimum guaranteed design life of 50 years and Southeast Power has a 40 year tenancy of the site, so reliability and longevity were also very important considerations; if the screws stop turning then there is no revenue. These machines, whether used as motors or adapted to become generators, satisfy an attractive balance between high efficiency, range, availability and value. When looking at the total cost of ownership for one of these machines over its lifetime, the cost of acquisition typically represents only

1% of the total cost of ownership over its lifetime. In contrast, the associated energy savings provided by premium efficiency motors far outweigh any additional investment in purchase price, particularly in applications where the process operates on a 24 hour basis

David Dechambeau added, "This is a very important project for us, not only because we are supplying the Royal Household, but also as an initial stepping stone for a number of similar projects. It is essential that we install the most efficient and ecologically sound power plant as possible. The work we are completing now will help to deliver future projects using similar technology, as demand for sustainable power understandably increases."

The ecological side of the project goes further than just sustainable power generation with a new 'fish path' being built alongside the weir to allow fish and eels to migrate up the river for the first time in centuries. There is also a lock to allow for navigation. As such it is looking like a very positive project with major improvements for all those with an interest in the outcome of the project. ■

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Hi-Wire offer COGEBI High Voltage Mica Insulation Seminar.

Hi-Wire held a very informative Technical Training Seminar on High Voltage Mica Insulation in conjunction with COGEBI. Hi-Wire are COGEBI’s UK distributor and hold a wide range of their Mica based products. Attending the seminar were delegates from many of the UK Original Equipment Manufacturers and Coil Processing shops.

The seminar commenced with a detailed insight into Mica Tape manufacturing at COGEBI and the properties of Mica as a High Voltage Insulator and it’s applications in our industry.

A presentation on VPI and Resin Rich main wall and overhang tapes was given by Zdenek Bezdek, of COGEBI detailing the advantages and disadvantages of using accelerator tapes.

He also gave a detailed guide to traction tapes demonstrating a “Best Practice” for coil taping and detailing the pitfalls that come from poor tape quality and poor taping application.

An introduction to the various conductor tapes that are used in the

industry including “resin rich tapes” and “hot melt adhesive systems” was given by Dr Zoltan Timoranski of COGEBI describing in detail the “coil stack” consolidation processes and the testing parameters that formed coils should undergo.

A short introduction to Flat Wire Production at the Hi-Wire Huyton facility was presented by Dominic Johnston detailing the range of products that they produce.

The conform extrusion line produces rectangular, trapezium, and irregular shaped round and hollow conductors in copper or aluminium strip from 2.0mm x 1.0mm right up to 26.0mm x 6.50mm. Their taping lines offer a wide range of insulation options combined with

a 1 – 2 day turnaround on “Express Orders.” The lines can build up to 16 layers of insulation in one pass. The range of coverings includes Nomex, PET Mica, Glass Mica, Polyester film, Varnish Glass, Daglass, Kapton, and standard and thermally upgraded Kraft paper.

The tour of their facility included a “hands on” rotor bar taping demonstration, which gave all delegates the opportunity to get a feel of the tapes and the recommended taping methods.

**Contact: www.hi-wire.co.uk
www.cogebi.com/high-voltage-products**



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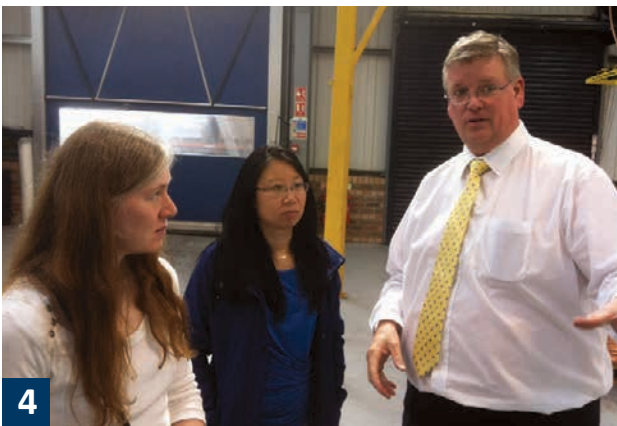
1. The Conform extrusion line for strip rectangular copper production.
2. Thorsten Sennewald, Cogebi Sales Manager / Product Line Manager for High Voltage Insulation Products.



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- 3. Five lines of insulation taping machines, since the HV seminar the first of 3 new taping lines has been installed and also a new Glass / Daglas Line.
- 4. Mike Edwards at the Hi-Wire, Huyton Facility with Dr Natalie Feng of Sulzer, and Gill Makepiece of Brush.
- 5. The large reels of wire drawn off into the conform extruder to be converted into the required rectangular strip.

- 6. Mike Edwards of Hi-Wire with Hodi Mirafsari from Houghton International and Gill Makepiece of Brush.
- 7. Stephen Cox (Quartzelec Swansea), Zoltan Timoranski (Cogebi) watch Mick Richmond (Quartzelec Rugby) taping, with Stuart Whitfield also helping.

AEMT Conference.

It was great to see such a wonderful turn out for the “2015 and beyond,” the AEMT’s conference looking at future developments in motor efficiency. A good mix of around 75 associates and members attended, encouraging trade, and listening to some excellent talks from Dr Hugh Falkner of Atkins, David Clegg from Quartzelec, and Tim Dawson from IHS.

After a productive hour or so with the floor open to visit the exhibitors’ stands, Hugh Falkner started with a fascinating introduction to the European eco-design program with regard to energy efficiency and the electric motor market – giving the bigger picture to the decisions made by Europe for mandatory adoption into all European Government’s legal framework and policy.

Tim Dawson, director of industrial automation research at IHS, then took to the floor to present a fascinating look into the predicted global growth

of the low voltage motor market. Encouragingly, after two flat years, the market and revenues are set to grow again, with legislation in many countries encouraging the use of more expensive and more efficient IE2 and IE3 motors. David Clegg of Quartzelec then presented his company’s view on the past, present, and future market for servicing LV motors and High Voltage Machines. This has been backed up by their major investments in premises and equipment at their new Rugby Head Quarters, and High Voltage Coil manufacturing facility Quartzcoil. Dr Hugh Falkner came back to expand

on the information given throughout the morning. He presented very interesting findings from the Copper Development Association on research into the use of copper rotors in induction motors. After which he presented the technology options being used by manufacturers to achieve IE4 and even potential IE5 machines. The full list of presentations are available to download through the events ‘past events’ section of our website, and we encourage you to pay it a visit. You will also find the full selection of photos from the day.



1. Bruce Bessinger with Colin Dawson behind their Whitelegg Display.
2. AEMT President David Hesketh with Gary Downes of Solutions in IT and Graham Brooker of Wilson Electric.
3. David Rausi of Anstee & Ware with AEMT Secretary Tim Marks.







- 4. Ian Welsh and Phil Deane of ATB Morley.
- 5. Lorraine Farrell of Grants Electrical with Tony Ruane of SKF.
- 6. Mark and Matt Robinson behind their WES Display.
- 7. Matt Fletcher of Fletcher Moorland with Richard Hale of Deritend.
- 8. Muhammad Maroon and Kevin Cullum of Siemens.
- 9. Ronnie Moore and Lorraine Farrell of Grants Electrical.
- 10. Ian Walker of Rotary with Andrew Papka of Preformed Windings.
- 11. Speaker David Clegg behind his Quartzelec Display.
- 12. Tom Beatson of Beatsons with Lucie Hodkova.
- 13. Dr. Hugh Falkner of Atkins Presenting.
- 14. Chris Birks of AEV with Mike Edwards from Hi-Wire.

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