AEMT

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Association of Electrical & Mechanical Trades

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Front cover photos:
Siemens new offshore repair facility – 84-meter SOV Esvagt Froude.

Copper coils in an SKF certified repairer's motor.

Schleich test unit in construction in Germany.

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AEMT COMMENT

Change, the secret to success?

To adapt and develop to changes in the market are all things we are used to when running a business. These changes come from our voluntary natural impulse to improve on what we are already doing, or involuntary by external influences such as fluctuations in metal prices. In this edition of the AEMT Journal we look at some companies that have learned to adapt through internal or external influences.

Avonmore Electrical near Cork in Ireland are a very successful company, but their success comes from influences that happened from the 2009-10 recession. It forced them to look at their processes in-house and for new markets. They discovered that by following the standards available to all companies, and not skipping corners, actually helped them to improve their business.

In particular, Avonmore focused on specialising in the Ex market, which itself is liable to frequent change. SGS Baseefa looks at why a recent overhaul of the 60079-7 Ex e standard was needed.

Whitelegg are another successful associate of the AEMT who have been quick to flex to changes in the market – their secret to success is down to a 40 year relationship built up with a German technology company; Schleich.

A large company such as Siemens usually are the influence affecting other companies – but in the tumultuous waters of marine wind turbine repair they realised the potential to improve on the ease of access to sites that were initially taking them a long time getting to.

In light of the new repair standard 60034-23 that is due next year, SKF look at the benefits of electrically testing a machine and how it should be a part of every workshop's repair process.

E Bennett Electrical of Stoke-on-Trent is a family business that is celebrating 50 years of supplying industrial electric motors, they share their secret to longevity.

And as we come to the end of our 70th year as a trade association – Tim Marks, secretary to the AEMT shares the speech he gave after our celebratory dinner, looking back on where the association started and its roots in the 2nd world war.

Thomas Marks
Editor and Marketing Manager

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This transformer might well be the most efficient Ecodesign transformer in the world

It's called the Ecodesign, and it's manufactured in-house by Bowers Electricals – the famous family-run Derbyshire business that's been keeping companies across the world ticking over since 1947.

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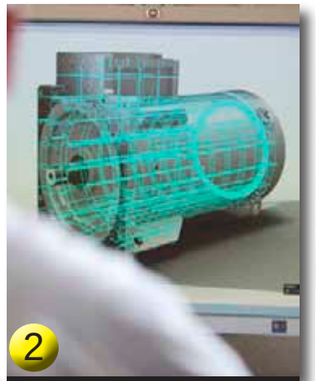

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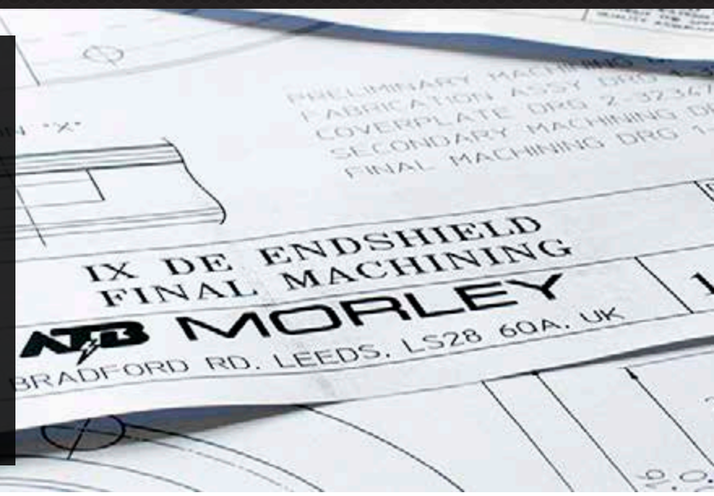

"Thank you for making sure that the new motor was a perfect replacement. Previous (so called exact) replacements took a lot longer to fit and cost the company dearly in downtime."

- Malcolm Grogan, Scottish & Southern Energy

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The VPI plant was installed at Avonmore Electrical at a cost of €500,000 as part of a €3,000,000 5 Year investment plan.

Avonmore Goes Standard to be Different.

Specialising in the minute details of the safety regulations for repairing explosion-proof motors puts Avonmore on track as a successful forward-looking electro-mechanical company.

Like many other firms in the sector, Ireland-based Avonmore Electrical suffered dramatic losses in the ferocious recession of 2009-10.

They were in a tight corner - but decided to fight back by looking for new markets while introducing meticulous attention to detail in their procedures.

The firm has since progressed to consolidate its position as a leading expert in the repair of wind turbines and heavy-duty pumps.

The key to its initial revival was making itself Ireland's only expert in the repair of explosion-proof equipment to be accredited by the British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA). It's a highly-sensitive field: "Ex" motors are used in any area of a factory or plant with the potential to have an explosive atmosphere from flammable substances like gases, vapours, mists or dusts.

For example, making sure that a very thin layer of paint at a maximum of 0.2mm thick, is applied to IIC equipment. This limits the potential build-up of static charge to incendive levels.

Avonmore Electrical Managing Director Derry Sheehan realised that although many companies in Ireland claimed to be able to make valid Ex repairs, none of them actually had IECEx accreditation.

European Union directives relating to explosive atmospheres state that documented maintenance by competent personnel must be regularly carried out.

He decided to take advantage of the scheme developed by the International Electrotechnical Commission (IEC) which was introduced to counter concern within the industry that Ex equipment worldwide was not being repaired to a high enough standard.

Ex motor repairs are strictly regulated and IECEx repair licences are only issued after stringent audits by Ex Notifying Bodies.

Derry submitted a detailed breakdown of his procedures to BASEEFA and welcomed in their auditors in February, 2012.

It was only then that he realised the "tremendous detail" required to report on Ex apparatus.

Responding to the auditors' early feedback that he needed to provide more analysis, Derry welcomed their offer of advice with open arms.

He turned the accreditation process into a true learning curve for his staff, setting up a meeting in the canteen where they could ask questions of the experts. At the same time, a new recording process was adopted, taking in such miniscule detail as the length and thread of bolts and verification with go-no-go gauges.

"The IECEx process really smartened us up," said Derry, who is the Deputy Responsible Person for the Ex repair process. ***"The new ultra-scrupulous approach required extremely detailed records.***

Derry & Jerry Sheehan of Avonmore.

"The IECEx process really smartened us up," said Derry, who is the Deputy Responsible Person for the Ex repair process. "The new ultra-scrupulous approach required extremely detailed records.

"The route to accreditation developed the confidence of our people on the shop floor and after we had obtained the certification the new outlook trickled down through the whole company."

Ex Workshops

More than ever aware of the risk reduction value of the IECEx certification, Derry - who was first trained in Ex Motor Overhaul in 1991 - was quick to pass on the knowledge to his customers.

"We became aware not just of our responsibilities as a repairer but also of those of the users - they are just as responsible," he said.

He set up free half-day seminars entitled "Introduction to Ex Motors" and covering personnel competency, motor nameplates and user obligations.

Two-hour workshop demonstrations of Ex procedures are also offered in the second half of the seminars.

Everyone involved is left in no doubt as to the importance of the regulations.

Ex motors are specially designed and certified to prevent the ignition of the surrounding atmosphere. Repairs have to be carried out to the most meticulous standards because the consequences of an improperly refurbished Ex motor could be disastrous.

There are safety protocols around cable gland installation and the fitment of sealing washers at the cable entry interface, and the temperature ratings of motors.

And it's not just in the oil & chemical industries that explosion risks occur - areas can be deemed hazardous in pharmaceutical laboratories, grain stores, sugar plants, milk powder & fertilizer production lines. Catastrophic explosions have occurred in these industries due to dust.

Aerial view of the premises.

The process of culture change at Avonmore Electrical had already started with the award of two other quality standards - Environmental ISO 14001 covering emissions and waste and Occupational Health and Safety 18001 which was gained in 2010.

Assessors from ABB motor manufacturing facilities from Finland and Italy had been brought in to authorise the processes of equipment and training in the workshop.

With his eye on the future, and newly confident in the rigour of Avonmore Electrical's certified standards, Derry was eyeing up another possible avenue of development for his company - in the wind power sector.

Wind Turbine Repair Facility

Ireland had 1,200 turbines up and running (the number is now around 1,500) and Derry realised the massive potential for the repair and maintenance sector.

He looked at what he would need to do to make his factory capable of meeting the demands - and he had to be sure that investing in new equipment was the right way forward.

Large Pump Repair.

He took a trip to the US to have a look at an established Wind Turbine Repair Facility.

"I had to make sure that installing a Vacuum Pressure Impregnation (VPI) plant was the correct thing to do," he said.

"After visiting the US I was 100 per cent sure I needed to do so."

Vacuum Pressure Impregnation consists of submerging a fully wound rotor or stator in the resin, to give a high coverage of insulation, without any voids or air gaps, through a combination of dry and wet vacuum and pressure cycles.

The VPI process applies resin to windings, providing good heat dissipation and minimising winding vibration. Pressure forces resin into the path of the winding, guaranteeing the bond strength.

The plant was duly installed at Avonmore Electrical at a cost of €500,000 as part of a €3,000,000 5 Year investment plan.

The VPI unit, which ensures superior protection against water and chemicals, is the only one in Ireland and one of only a few in the British Isles.

Alongside specialist knowledge in the spheres of hazardous repairs and wind generator repair, Avonmore Electrical has another core focus, one that also capitalises on its attention to detail.

Dublin's Storm Water Pumps

This expertise proved invaluable in

repairing one of the six storm water pumps which are located in the Ringsend suburb of Dublin.

The normal maintenance practice is for engineers to travel from the UK to overhaul the pumps in situ.
Access to the pumps is via a lift into dry wells, in which the ground-level motors are connected by a long series of spindle shafts around 30 feet long. The engineers regularly change the bearings and mechanical seals, with ancillary maintenance work done locally.

Avonmore Electrical was called in to carry out an investigation on one of the pumps which had developed a vibration following a service.

"We realised that it was out of balance and it was immediately clear that we would have to remove it from the site to perform a dynamic balance," said Derry.

"If it was just a question of overhauling the pump section, the volute could have stayed in situ. But it was clear that there was a high risk when the impeller and shaft were being re-installed that any sort of impact would have broken the mechanical seal.

"So we insisted to Dublin City Council that we would need to remove the volute complete with the pump section and bring the whole pump over to Avonmore Electrical."

The transfer to a factory setting was a key factor because examination of the plant revealed extensive wear on the

"We built up the cast-iron volute with stainless steel, resulting in an increased efficiency by 12 per cent from previous," explains Derry.

leading edge of the volute casing. Around two inches had been worn away at the point where the impeller passes the discharge port, resulting in two inches of flow recirculating back into the pump.

Over a discharge span of three feet, the missing two inches were resulting in a highly inefficient process.

"We built up the cast-iron volute with stainless steel, resulting in an increased efficiency by 12 per cent from previous," explains Derry.

Dublin City Council were delighted with the result, impressed that a pump that had been discharging at 2,100 litres per second was now pumping at 2,400 litres per second.

Avonmore Electrical was immediately called in to look at a second pump.

With heavy-duty jobs like the Dublin Pump on the increase, there's been a marked shift in the nature of Avonmore's contracts.

Where orders were once in a ratio of 80-20 of small jobs to large, the figures have been reversed in favour of an 80-20 predominance of heavy jobs.

Repairs are carried out to a variety of pumps including Submersible Wet Well and Submersible Dry Well Sewage Pumps, Vacuum, Geared and Drainage Pumps, Air Blowers and Positive Displacement Pumps.

It's a familiar sight in Roskeen, County Cork, to see low loaders stacked with heavy equipment delivering to the 65,000 square-foot workshop space at Avonmore headquarters.

Workshop Overhaul

To cope with the inflow, the workshop area is being restructured and transformed away from its previous "herringbone" system where each employee had their own bench and work area.

Following the installation of two overhead lifting gantries, each with two hooks capable of lifting up to 10 tonnes, the workspace is now open plan.
One of the three previous workshops has been decommissioned and is now fitted with a High Bay Racking System for storage of motor parts when they are not in the maintenance process.

Avonmore Electrical has come a long way since it was founded by Derry's father, Jeremiah Sheehan, 14 miles away in Millstreet in 1958.

The first factory - with a workspace of just 5,000 square feet over two floors - was situated at the geographical centre of Munster.

The location was chosen because of its proximity to 32 creameries which formed the early customer base along with the sectors of cheese and powder milk manufacture, chocolate crumb and casein production and grain milling.

With auto electrical service also in the original mix, the customer base was gradually widened over the ensuing years to include meat factories, limestone quarries and the steel and mining industries.

By the time the move to Roskeen took place in 1989, the local authority, pharmaceutical and manufacturing industries and power generation suppliers, together with the steel and fertiliser sectors, were also among the customers.

The entire Roskeen factory was custom-built by Avonmore Electrical's own staff. It's that spirit of ingenuity, enterprise and attention to detail that have enabled the company to become one of the leading service and repair facilities on the present-day industrial scene.

The success of the firm has also been

Volute Leading Edge Refurbishment.

due to its ability to seize opportunities as they arise.

After achieving success with the installation and repair of pumps for water supply and sewerage it was an audacious move to widen out into heavy industry.

As its involvement with the coal and gas-fired power industry took off in the 1990s, Avonmore's ability to handle heavy plant flourished.

Its engineers quickly gained expertise in repairing high tension power station motors and CHP generators.

It's clear that the electric motor repair facility remains at the heart of the business - motor rewinding across a wide range is crucial to their profile.
But branching out to include Explosion-Proof Motors, Submersible Pump Motors and Wind Generator Repairs has been a master-stroke.

Along the way the professional profile has kept growing - members of the Association of Electrical and Mechanical Trades (AEMT), members of the Electrical Apparatus Service Association (EASA), National Standards Authority of Ireland (NSAI) certified ….

Derry sums it up in a simple, eloquent phrase: "We went down the standards route - and we found reasons to differentiate ourselves from our competitors." ■

To ‘eb’ or not to ‘eb’, SGS Baseefa answers the question.

First published in HazardEx September 2015 issue

With the publication of IEC 60079- 7 Edition 5 in June (and the subsequent publication of the EN version), we have seen the largest transfer of technical requirements between Ex standards since the decision to integrate the general requirements for both gas and dust atmospheres in a single standard, IEC 60079-0. Ron Sinclair of SGS Baseefa looks at why the changes took place, and how it has been achieved.

Historically, with the notable exception of intrinsic safety, all Ex Protection Concepts had a single level of protection, and the installation standard (IEC 60079-14) gave an indication of which hazardous area zones each concept could be used in.

We had just a single protection concept, Ex n, which alone was suitable for installation only in Zone 2. The origins of the requirements given for Ex n in IEC 60079-15 came from a number of disparate sources (many of them older UK standards such as BS 5000-16 for motors and BS 4533-50 for luminaires) and did not always sit well together.

Just over ten years ago, the IEC TC31 standards committee decided that the ATEX Directive had one significant positive advantage over the way that the 60079 series of standards marked the protection concepts. The ATEX Categories (1, 2 or 3) gave a unique overall indication of the level of protection provided by equipment which was, by then, more and more likely to involve a combination of protection types from different standards. The result was the definition of a unique Equipment Protection Level (EPL) that could be allocated to each item of equipment. This was particularly valuable for equipment mounted through vessel walls, where the single item of equipment was mounted in two zones.

Once the EPL system was in place, the logical development was to create different levels of protection in standards other than just 60079- 11 for Ex i. Ex ma, mb and mc followed quickly and then the requirements for Ex nL (energy limitation) were moved from 60079-15 to create Ex ic. 60079-31, Dust Protection by Enclosure, which had three levels of protection ‘ta’, ‘tb’ and ‘tc’, from its first edition.

Since the bulk of 60079-15 concerned equipment which did not spark or have a hot surface in normal operation (Ex nA), the logical step was to call this Ex ec and move the requirements into 60079-7. The decision to pursue this path was taken four years ago and the maintenance team (MT) for 60079-7 have been wrestling with this since then.

Once ‘ec’ is in position, equipment previously marked Ex e becomes ‘eb’.

The first problem that hit the MT was that a few requirements for Ex nA were more severe than the equivalent requirements for Ex e. A typical example is where 60079-15 addressed issues related to bearing seals that were not addressed in 60079-7. Other requirements, which were similar, were expressed in different ways. Therefore what was originally envisaged to be a simple exercise turned out to be more complicated and required additional time. However, the principle adopted for the exercise was to make the minimum changes to the requirements for either Ex e or Ex nA in order to ensure a minimum level of disruption for the manufacturer, but still produce a document that was technically consistent for the new levels of protection: Ex eb and Ex ec.

Although this was far from a full technical review, it became necessary to make a few changes for consistency and, additionally, some updates related to “technological knowledge” (the phrase used in the ATEX Directive) were introduced at the same time.

Clearly the one change that affects all equipment is the change in marking:

- A straightforward motor might change from Ex nA IIC T3 to Ex ec IIC T3 Gc
- A straightforward plastic junction box might change from Ex e IIB T6 to Ex eb IIB T6 Gb

If you want to see a list of every technical change, it can be downloaded free as part of the IEC 60079-7 preview file from the IEC Webstore. But possibly the most important changes are:

- Terminal block insulation pre-conditioning now applies to all terminals, not just rail-mounted types (for ‘eb’ only)
- Testing of ballasts for discharge lamps now includes the lamp failure condition (for ‘eb’ and ‘ec’). This particularly picks up the situation where the ballast is protected ‘eb’ but the lamp is protected ‘db’
- It is now prohibited to mark empty component enclosures on the outside with the Ex ‘marking string’ (for ‘eb’ and ‘ec’). This aligns with the latest requirements for empty flameproof enclosures and was introduced to try to prevent the misunderstanding that the component marking allowed direct installation.

Although not listed as a change (because it is a clarification of the existing requirement), it is now absolutely clear that Ex eb cannot be used as a protection concept for LED light sources, whereas Ex ec may be used. ■

Protection by Increased SafetyIEC 60079-7:2015

Ex nA → Ex ec

Ex e → Ex eb

Ex nA IIC T3 → Ex ec IIC T3 Gc

Ex e IIB T6 → Ex eb IIB T6 Gb

Whitelegg/Schleich a partnership forged over 40 years.

The synergy and success of the partnership between Sussex based Whitelegg Machines and the traditional German based company Schleich is based on a relationship that has developed over 40 years.

Schleich's Facility for producing it's advanced test technologies covers 5,500m2 and has enough space to develop concepts through to production.

In the beginning, before Whitelegg Machines became the company it is today – its founder, Frank Whitelegg sub-contracted out work to the Dorking Foundry where Colin Dawson had begun working back in the 1950's – this is the first time the two should meet, but the fate of the company wasn't sealed quite yet. Later the foundry would start working solely for Whitelegg who would acquire the workshop in 1990 under the ownership of Colin.

Meanwhile, Colin went to work in Germany and Switzerland for a couple of years in the early 60's. On his return he joined Whitelegg in the drawing office and later in the experimental department, where he worked on automatic in-slot stator winding machines. These machines were leading the market at the time and Whitelegg sold several of them to Siemens in Germany as well as many more to outfits in various countries for Black & Decker electric drills.

Schleich and Whitelegg's relationship starts in the mid-70s when an agency for the new automatic Schleich Winding Machines, was acquired by Whitelegg. While on a visit to Dortmund with Scheiing (through which Schleich's coilwinders were sold), Colin was introduced to a young student, Martin Larhmann, who is now a senior Managing Director of Schleich.

A few years later Whitelegg introduced a new type of motor tester with an oscilloscope called the Motatest. It was designed to locate faults using very high frequencies. The unit became very popular with sales in the UK and through agents in the USA.

By the early 90s Motatest had been through various iterations and become a compact portable device. A smaller version came out called the Minitest which proved to be very popular also, however the TV Tubes used in the testers went out of production, so there was a problem...

Schleich were able to step in and help Colin out. While agents for Whitelegg, they had been developing their own digital testers which surpassed the need for TV Tubes.

The partnership has grown significantly over the years as both companies have developed. At Whitelegg, Glyn Dawson, the current Managing Director, represents the fourth generation of Whitelegg/Dawson involvement and, in Germany, Martin Lahrmann's son Jan Philip joined Schleich's company management in 2008.

Both companies have been growing in recent years and together they are intending to expand their future cooperation – one avenue is to decentralise Schleich's calibration service and to offer this service locally by Whitelegg instead.

Schleich's Facility

Nestled into the foothills of western Germany, near Dusseldorf, is Schleich's state of art facility. It produces high quality and advanced test technologies and they are well known for their coil winding machines.

Since the launch of the MotorAnalyzer (Whitelegg's Motatest) in the mid-80s they have found themselves at the very forefront of developing testers for windings and analysers for electric motors.

Their facility boasts an impressive 5,500 square meter space where they have enough room to design, develop and produce the hardware and software required for the test equipment. With all this taking place in-house from one location, it makes their customer service an excellent experience.

If there is ever a fault with a Schleich machine, instead of packing up the equipment, which can be an expensive job in itself, and delivering it back for service; a Schleich engineer can look at a mirror system in-house and walk technicians through the repair process over video phone. This means repairs can easily be achieved within hours rather than weeks and months. The layout of the automated GLP test system circuit boards in the photo demonstrates the clear and easy layout when a remote fault finding may be needed.

The large-scale production facility enables the production of nearly all components for the test systems, for example, the measuring and electronic cards are all produced using a reliable and ultra-modern in-line surface-mounted-device (SMD) technique. Test box covers, contactors, holders for test objects or robot grippers are produced with CNC machinery.

The recently implemented production islands for one-piece-flow-production of Schleich testers has evolved to make the process as smooth and consistent as possible. Special compartments for parts, as seen in the photo below, are barcoded and numbered, so when running low can easily be re-ordered. Computer screens help with the production process, where technicians can leave production notes for each unit and find answers to queries. The process is all part of the reliable, consistently high-quality production of Schleich products that Whitelegg has come to rely upon.

Schleich have been certified to DIN EN ISO 9001 since 1998, so quality has been ingrained for many years.

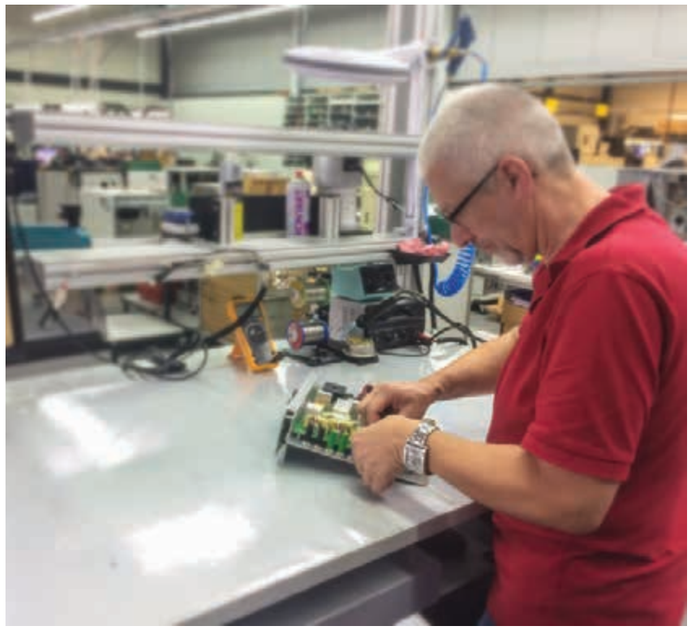
Easy access circuit boards on this automated GLP test system.

Schleich's Testing Solutions

The Schleich modular concept means that several test methods can be combined and integrated into one tester, providing completely bespoke solutions.

For motor refurbishment and repair, testing is key to guaranteeing the quality of the repair both before and after dismantling the machine. To follow good practise and the latest IEC

The One-Piece-Flow-Production units have evolved to become very efficient.



Dynamic MotorAnalyzer for online testing.

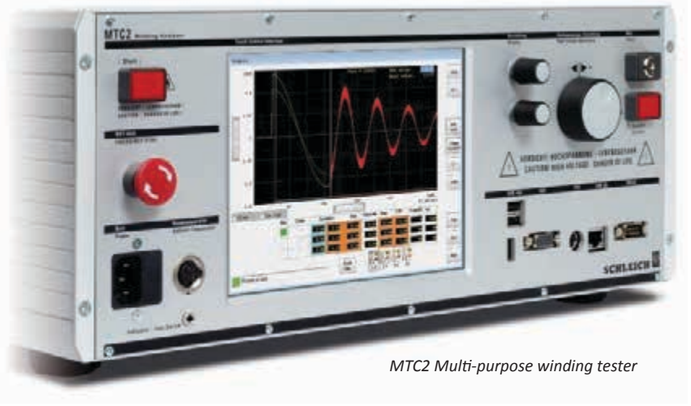
standards many test methods can be integrated:

- Surge voltage test
- Insulation resistance test
- Resistance test
- HVAC testing
- Partial discharge test
- Bar to Bar test for DC machines
- Squirrel cage faults testing

The MTC2 is a multi-purpose winding tester, which comes with Surge and Insulation Resistance tests as standard, but with Schleich's modular concept, it's possible to include all tests mentioned above. No other tester currently offers such a variety of applications and it is perfectly placed to enable workshops to precisely analyse coils, stators, armatures and all other kinds of windings.

The MTC2's partial discharge test uses 4 measuring points including a neutral point. With this special technique the motor can be inspected in-depth and faults can be located that otherwise would not have been detected.

Recently it has become good practice to dynamically analyse a motor with live testing. The Dynamic MotorAnalyzer is designed to access the motor´s power cables. By doing so the electric parameters can be measured quickly and accurately and, from these, the relevant mechanical parameters are calculated. Fault finding is made much easier and specialist knowledge by the operator is not needed. The equipment is well placed for preventative maintenance and can be used not only for fault finding, but to calculate annual costs. This can be particularly useful for presenting to customers and demonstrating the savings that can be made by upgrading their equipment.



MTC2 Multi-purpose winding tester

"The continuous efforts, and the innovative strength of Schleich have meant they are at the forefront of this technology, meeting the requirements of the future specifications for repair and productions."

With the imminent release of 60034-23, The repair, overhaul and reclamation of rotating electrical machines, electric motor testers such as these will become standard in repair facilities. The continuous efforts, and the innovative strength of Schleich have meant they are at the forefront of this technology, meeting the requirements of the future specifications for electric motor repair and production facilities. ■

Successful removal of Old Bedford SB Pump at Stillingfleet Water Pumping Station.

Working on behalf of the Ouse & Derwent Drainage Board, pumps supplier AxFlow has installed two new submersible Bedford pumps at the Stillingfleet water pumping station and overhauled the two pumpsets removed from service. The pumping station was originally constructed by British Coal in the early 1990's when mining subsidence lowered the ground level and prevented water in this low-lying area draining away by gravity into the nearby beck.

"Earlier this year the Drainage Board detected that the moisture readings within the pump linings were a cause for concern," reports Mark Redgrove, AxFlow's Technical Support Manager. "Although the pumping station is equipped with two 800mm rising main storm and two 600mm rising main dry weather pumps, the Drainage Board recognised that they could not have two pumps down for a prolonged period so two new submersible Bedford pumps were ordered. We were called to remove the old Bedford SB pumps and install the new pumps."

Logistically, it appeared to be a straight forward remove and replace job with scaffolding being erected inside the wet well and a crane being used for removing and replacing the two affected storm and dry weather pumps. However, installing scaffolding was a non-starter and it was decided that a man riding basket would have to be suspended in the wet well. This made it necessary to have a second crane because there was no chance of lifting the pumps and having a man in there at the same time. According to AxFlow, it was a bit of a logistical problem and challenging trying to get both the man riding basket and pump into the same space with two crane jibs.

"...as soon as the bolts were removed from the discharge flange of the first pump, it tried to fall into the wet well. The pump was standing on three feet on a concrete platform in the wet well and with the removal of some of the bolts the weight of the pump tries to pull it away from the discharge flange so it was necessary to leave some bolts in place. The larger pump weighed 4 tons and the smaller 2 tons."

"Our plan was to remove the old flange bolts and pumps and reconnect the new pumps to the existing pipework with new bolts," continues Redgrove. "However, as soon as the bolts were removed from the discharge flange of the first pump, it tried to fall into the wet well. The pump was standing on three feet on a concrete platform in the wet well and with the removal of some of the bolts the weight of the pump tried to pull it away from the discharge flange so it was necessary to leave some bolts in place. The larger pump weighed 4 tons and the smaller 2 tons." Another pressing problem was that the wet well was leaking. "When we stopped the pumps the water rose up to the level of the man riding basket so one pump had to be kept running to keep the level down," says Redgrove.

The job of removing the old pumps and installing the new pumps took AxFlow three days to complete. However, that was not the end of the project, following the refit, AxFlow were asked to take the old pumps to their Huddersfield Service Base for inspection. Redgrove continues: "We now have the pumps at our base and having stripped them down. We found that they were in pretty good condition, even after 25 years. However, some oil and water had got into the motor windings, but this was not a major cause for concern. We looked at replacing the usual components that can be subjected to wear, including bearings and mechanical seals and washed out the stator windings and reassembled the pumps. The impellers were in good condition as they clearly had a relatively easy life, even though they are in a high profile pumping station and over the years had been subjected to high levels of continuous operation."

The two pumps still operating at the Stillingfleet pumping station will be removed when time allows and be replaced with the two overhauled pumps at AxFlow's Huddersfield workshops. ■

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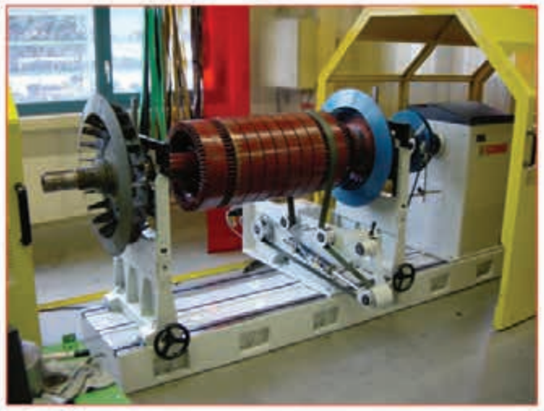

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Thanks to their special design, Service Operation Vessels (SOV) are able to safely and efficiently reach offshore wind power plants, even in rough seas. The latest technology, such as stabilisers and low-vibration engines, is employed to make the newest generation of SOVs especially safe, reliable and comfortable. Technicians can stay on the SOV for several weeks at a time, thereby increasing working hours by up to 50 percent by reducing the time needed to go back and forth from shore.

Of Turbines & Men

Boarding a new ship is always an exciting experience, and the offshore service operation vessel Esvagt Froude was no exception. This nautical innovation significantly enhances offshore service and maintenance operations for wind farm projects, particularly those located far from the shore. **Text by Onno Groß, photos by Claus Sjödin**

A ship on an assignment at the offshore wind power plant Borkum Riffgrund in the German North Sea.

The offshore wind industry plays a key role in the global energy mix. Today, more than 30 gigawatts are planned for installation globally, with more to come. Offshore innovation is one of the strengths of market leader Siemens. "We are the first and the most pioneering company in this field and the only company offering an integrated solution throughout the lifetime of the wind turbine," says Mark Albenze, CEO Global Wind Power and Renewable Service, based in Orlando, Florida.

"We currently have the largest wind power plants in commercial operation, and we collect and analyse enormous amounts of data that can lead to future evolutions in design and provide for operational flexibility. We also have a very long history of servicing wind turbines. It's a full life cycle approach, which is part of our core business, and we are sharing this knowledge with our customers." For offshore wind farms, the latest Siemens solution is a brand-new custom-designed service operation vessel (SOV), which sets a technological benchmark.

In the Harbour

Near the beach of Esbjerg in Denmark, a group of four huge men sit staring stoically out to sea. Made from white concrete, Mennesket ved Havet ("Men at Sea") by Svend Hansen is a remarkable, 9-meter sculpture that honours the long history of the country's most important North Sea port. On a day in mid-February, however, a dozen people gathered on top of a shipping office building, staring not out to sea but toward the pier at a rather distinctively shaped ship. The arrival of the brand-new, 84-meter SOV Esvagt Froude, constructed by Havyard Ship Technology in Norway. This opened a new chapter for Esbjerg, which today is famous as the "wind industry port." With its peculiar design and high crossbow, its large windows, and its sophisticated deck structures, it certainly stood out among the cargo ships in the vicinity. René Wigmans, Head of Maritime and Aviation Solutions at Siemens Service Wind Power,

The Ampelmann system also offers the perfect addition to the special seaworthiness of the SOVs: It compensates for wave motion, making access to the wind turbines possible even during storms. With standard vessels, access was only possible up to swells of 1.5 meters.

was one of the first on board. "The vessel is ground breaking for our service and for the scheduling of maintenance," says Wigmans. "It will be positioned within the wind farm for weeks at a time, which will allow our technicians to literally 'walk to work.' Another key benefit with the unique access features on this new vessel, we can significantly reduce weather downtime, which in turn increases efficiency. We can make sure that we are able to deploy technicians safely and transport them comfortably to the turbines. Additionally, we use the vessel as an independent warehouse in the wind farm. All this innovation and effective use of resources can lead to greater value for our customers."

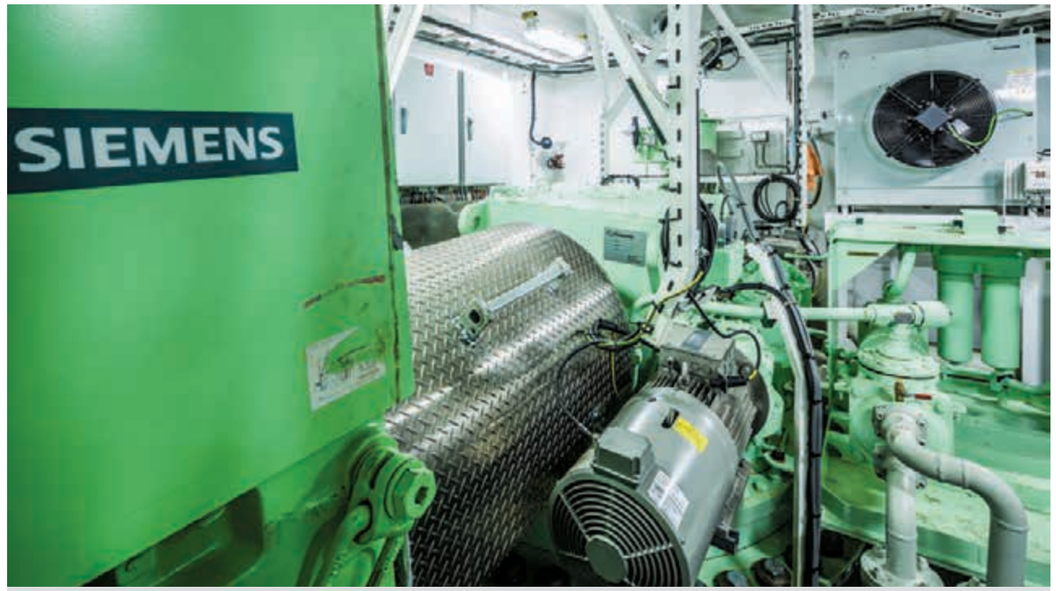
The contract for the SOV Esvagt Froude – named after William Froude (1810–1879), an English naval architect who helped lay the first transcontinental ocean cable – was signed with the Danish shipping company Esvagt back in 2013. While the raw hull of the ship was built in Turkey, final assembly was done in the shipyard of Havyard Ship Technology in Norway. The company has extensive experience in building special vessels for the oil and gas industry, but this one was unique in its own way, as it required meticulous planning and a lot of technical know-how. "The further the service area lies from the shore, the more you have to come up with solutions," explains Søren Thomsen, CEO of Esvagt. "The ship has many new features, such as the engine system, and it will certainly heave and sway much less, which will help the people on board substantially."

Inside the Esvagt Froude

The Havyard ship design with its prominent inverted bow and large stern decks serves to achieve higher speed and calmer motion in rough seas. The high front is further characterised by an asymmetric glass-surrounded bridge and big cabin windows, which is reminiscent of a research vessel. But more than half of the ship is dominated by a huge afterdeck with cranes, and space for the Safe Transfer Boat Wind 1 as well as two other specialised Esvagt Froude boats. In the superstructure decks up front, modern corridors run through four decks with comfortable cabins, and various stairways lead from the engine rooms up to the top bridge. Beneath the afterdeck is an impressive storage hall with as much as 430 square meters of space and storage capacity for six standard 20-foot containers. This is the heart of the ship's body: here are the workshop rooms, dry rooms for special equipment, and a transport elevator for moving the heavy spare parts up to the main deck. Since around 1,000 spare parts are required to service in an offshore wind power plant, a vast number of them have to be held for annual maintenance. Previously, any missing spare part had to be picked up in a small crew transport vessel, a trip of several hours.

The Wind Farm Office

On the port ship decks, the wind farm control room is situated where the logistics and systems are operated from. Here, big windows offer a close view of the wind farm once the ship arrives in its service area. The control room is packed with computers, Wi-Fi equipment, and direct communication channels to the bridge. "The SOV is a long anticipated missing part of the puzzle in offshore maintenance logistics," says Ingo Bischof, Siemens Project Manager Offshore Service for OWP Butendiek in the North Sea. The wind farms are operated and controlled remotely from the main office in the city of Brande in central Denmark. But once spare parts and maintenance duties are on the agenda, the SOV comes into play. "Managing a wind farm



The Diesel-electric engine of the vessel propels the SOV Faraday at up to 14 knots (around 26 kilometers per hour) into the open sea. The electric power is supplied by Siemens Generators.

requires sophisticated service planning, and with the SOV, we can deliver that efficiently and accurately," says Bischof. "At present, North Sea offshore wind farms consist of up to 80 turbines, and we expect 30 minutes of approach time between turbines. With the SOV, we can reduce travel time to and within the wind farm by up to three hours a day. We can transfer technicians more safely to the installation and back, and we can work in more adverse weather conditions than was previously the case." The ship's crew uses a simulation tool to calculate the optimal paths within a wind farm, which will reduce travel time and save costs. That is why all eyes are on the new SOV.

The Gangway

Another important feature of the ship is the gangway, which allows for safe passage to the turbines even under harsh conditions and with significant wave heights. The gangway was built by Ampelmann, an innovative Dutch company from Delft. Instead of a moving cockpit, the Ampelmann system features a gangway platform that stays stable while the ship underneath heaves and sways.

In reality, it looks like a fire ladder built on six insect-like legs. While the ship moves under this structure, the motion sensors and positioning controls of the Ampelmann system stabilise the platform and its 25-meter gangway automatically. One million crossings to offshore structures have proven this to be a safe technology. The system's name "Ampelmann" refers to the green man in walking motion featured in German pedestrian lights, signalling that it is safe to cross the road.

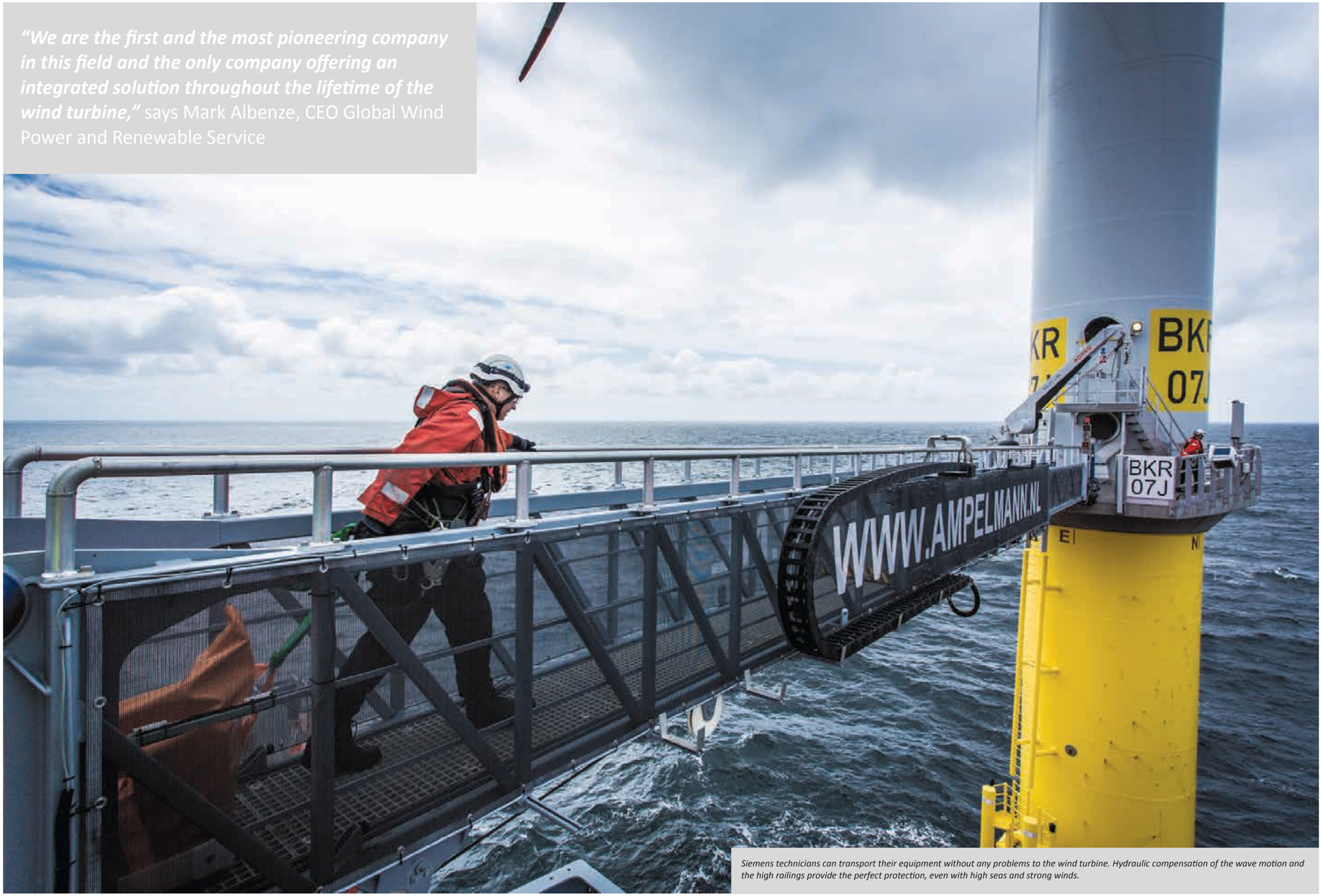
In the Bowels of the Ship

But manoeuvring offshore demands more than a stable gangway. That is where the Siemens Blue Drive System® comes into play. It is located in the engine room, far below the water level, where the sound of the diesel engines have an almost calming effect. The engines are fully operated by computer terminals and come with a range of benefits, as Kristian Ole Jakobsen, COO of Esvagt, explains. "One feature of the Blue Drive System is that it saves fuel, reduces emissions, and makes propulsion and the power system as efficient as possible. Our diesel generators can run on low revolutions per minute, which saves fuel, just like in a car when you take your foot off the pedal. This is significant, because in the wind farm, the ship has to stay on the spot for a long time. In addition, the Blue Drive System accesses each motor separately, so we have a high margin of safety should one motor fail." Further interesting features of the vessel lie under the waterline: There are two propulsion units with contra-rotating propellers in order to facilitate a better water flow. Beside the two bow thrusters for going sideways, there is a retractable Azimuth engine in front. A stable dynamic positioning system and active roll damping ensure perfect steering.

At Sea

The SOV Esvagt Froude's reliability will be tested during the installation of a new UK wind farm. Later in 2015, it will be in charge of long-term service and maintenance at the Baltic 2 wind farm. Its sister vessel, the SOV Esvagt Faraday, will start its working life in the North Sea wind farm Butendiek. "Looking forward, we are interested in maximising the predictive and preventive maintenance tasks as opposed to reactive maintenance," says Mark Albenze. "So to be even more efficient, we remotely translate data into operational recommendations for the SOV based on each wind turbine's condition. And the SOV has the right features to bring this proactive idea to life." ■

"We are the first and the most pioneering company in this field and the only company offering an integrated solution throughout the lifetime of the wind turbine," says Mark Albenze, CEO Global Wind Power and Renewable Service



Siemens technicians can transport their equipment without any problems to the wind turbine. Hydraulic compensation of the wave motion and the high railings provide the perfect protection, even with high seas and strong winds.

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The benefits of electrical testing as part of an effective machine inspection program

In Certified Programs, we are focused on machine inspection, and machine health, not just the typical vibration monitoring/PdM process, because we need a more complete picture of machine behaviour in its production environment. As with annual medical checkups to ensure predictable health care in people, machines also need wellness checkups. Tim Thomas, Business Development Manager/Senior Applications Engineer for the SKF Machinery Health centre in Fort Collins, CO (USA), provides another look at this topic from an entirely new dimension – that of the electrical testing of electric motors within the machine inspection program and the motor rebuilding and testing arena. Tim has extensive experience in motor rebuild, instrument design, and applications engineering for electric motor repair and testing.

Industrial plants and manufacturing facilities depend heavily on the health and performance of mechanical and electrical equipment for business success. Maintenance of that equipment is increasingly important as plants grow older and equipment advances in age. Today the replacement of machinery is often postponed in favour of recondition-renovation strategies, which can require equipment to remain in service longer than perhaps it should. This practice is prompting many organizations to pursue maintenance strategies that include real-time evaluations of rotating equipment (i.e. motor/machine systems). Such evaluations allow maintenance technicians to assess the condition of machinery while it is in service and make informed decisions about plans for replacement, repair or continued use of a given motor or machine.

Published research studies have purported that as much as 75 percent of all motor failures can be predicted with a thorough vibration analysis program.

The problems that commonly cause equipment failures can be categorized into one of two areas: mechanical or electrical. Published research studies have purported that as much as 75 percent of all motor failures can be predicted with a thorough vibration analysis program. It is true that bearing problems, along with other mechanical issues such as shaft misalignments or misapplication of lubrication, account for the majority of premature equipment failures. However, even with the finest vibration program, a number of predictable issues get missed or overlooked with the use of vibration analysis alone. As much as 25 to 30 percent of all rotating equipment failures are electrical, not mechanical, and can only be detected by electrical testing equipment and methods. Current estimations indicate that more than 80 percent of non-mechanical motor failures result from motor insulation breakdown, and the state of insulation can't be evaluated with vibration analysis equipment. Power quality issues and several load-related problems are also undetectable when vibration analysis is the only test method applied.

"Asset management," "Condition Monitoring," and "Predictive Maintenance" are among the many terms in use today to describe motor and machine maintenance practices, but they all share common goals: the achievement of reliability, efficiency and safety! This has led to the evolution of modern machinery inspection techniques. All operations need equipment to function properly when needed, and to operate safely and efficiently. The majority of plants and facilities today are working to integrate these objectives into overall plans or strategies tailored to a given organization's needs. Maintenance strategies of plant and facility personnel responsible for safety and reliability depend on their unique organizational requirements as well as their respective industry standards. Maintenance strategies have historically fallen into one of three basic categories, which, although discussed hundreds of times in thousands of engineering offices, will be reviewed in short here, primarily in context of motor health:
corrective,
preventive and
predictive, or condition-based.

Corrective maintenance

Corrective maintenance is driven by the concept of a motor or machine being allowed to run until it fails. In corrective mode there is little if any effort to prevent failures, which, of course, tend to happen at the most inopportune (and costly) times. Organizations that work in a corrective maintenance mode often carry large inventories of replacement motors and machinery, and trained staffs of electrical and mechanical personnel on hand to respond quickly to any failure-induced downtime. The consequences of this strategy should be carefully

considered, and include lost revenue due to unscheduled downtime, repair costs (which could be more than five times those incurred when planned repairs are made), and safety issues. Corrective maintenance may make sense if it is part of a comprehensive program wherein it is applied to small, insignificant motors that are cheap and easy to replace, and have little or no effect on either safety or operation of the facility.

Preventive maintenance

The oldest and most widely-used maintenance strategy in place around the world today is known as preventive maintenance (also known as "time-based maintenance"). In fact, even a predictive or condition-based program has roots in the preventive framework, because the assessment inspections must be scheduled and planned. This strategy relies on the concept that planned, periodic reconditioning of motors will prevent most unplanned failures, and on the surface it appears to make perfect sense. This strategy has, however, some significant flaws that should be considered and fully understood before commitment. To begin with, the strategy might well be called "fix it even if it isn't broken." Research has shown there is very little if any correlation between a motor's service life and when it is expected to fail. Given two identical motors powered by the same voltage bus, under identical loads, and running the exact amount of time, they will not fail at the same time. One will always fail before the other. Some motors will fail before the scheduled recondition date and others will be in perfect working order long past the planned service interval. Removal of motors for the mere reason they have been in service a certain period of time is an assumptive (as opposed to fact-based) maintenance strategy, and can be unnecessarily costly.

To begin with, motors are often over-repaired during their life. Treated properly, most motors should last twenty years or more, so removal every two, three or five years makes little sense, especially when one factors in the costs of lost production, electrical and mechanical staff labour, transportation and repair shop charges each time a motor is pulled for "repair."

To complicate matters further, once a motor is pulled and is in the motor repair facility, new problems with the motor can be introduced. Mechanics may "allow" the rotor to "drag" on the stator windings and thereby weaken the turn insulation or even cause shorted turns.

Perfectly good bearings could be replaced with cheaper bearings of a lesser quality. Some repair shops use a sandblasting process to clean the stator, which often leaves residue and particulate contaminants in the windings that later cause thermal and chemical degradation of the insulation. Some procedures will actually roll the edges of the laminations, which can create shorts.

If preventive maintenance is chosen as a maintenance strategy, the most important considerations should be the quality and capabilities of the motor repair facility (or facilities) selected to support the strategy. On-site inspections should be performed with knowledge and attention to detail before the choice of a shop is made. Does the shop have separate clean up, winding, painting, assembly and testing areas protected from each other? Are the bearings they use stored in a clean, dry and cool storage room? Does the shop have the proper burn-out and curing ovens? And, most importantly, does the motor repair shop have adequate test equipment in use by trained and competent test personnel, and do they test according to AEMT/EASA Good Practice Guide to Maintain Motor Efficiency, ISO, and other approved standards?

It is getting more common for rebuilder companies to provide onsite services and are uniquely placed in their competence around electrical testing as well as mechanical testing covering the analysis of vibration, lubrication, thermography, ultrasonics and acoustics. Rebuilders are best placed to offer holistic view of any motor or electrically driven asset.

Some preventive measures may be necessary and should be considered as a part of a successful maintenance strategy. Premature bearing failure and physical contamination are examples of conditions that warrant preventive maintenance.

Predictive, or condition-based maintenance

Predictive maintenance, also known as condition-based maintenance, is characterized by routine testing with as many tools (e.g. trend monitoring) as possible. This is the "fix it only when it needs fixing" strategy. The cost to implement a complete predictive maintenance plan is almost always offset by success at detecting and locating problems before they result in premature failures.

When someone asks a physician to diagnose their health, the doctor won't merely rely upon pulse and blood pressure readings to make a diagnosis about a given problem. They have an arsenal of tools and procedures at their disposal to analyse everything from body chemistry, tissue and organ condition, even behaviour. To gain a clear picture of the health of a motor or machine, it is just as essential to routinely use as many tools as possible and look for trends or anomalies in the results with comparisons of data from each discipline. Again, vibration analysis is capable of diagnosing about 70-75 percent of the issues that would cause premature motor failure, and is by far the most important tool maintenance personnel can employ. Vibration studies will often lead to minor corrections that improve both the longevity and the efficiency of a given motor. That being the case, 70-75 percent is still not good enough, because 25-30 percent of the issues that would cause premature and unplanned motor failure would remain unknown or undetected. A combination of static (off-line) and dynamic (in-service) electrical motor testing is needed to detect those issues and avert resulting failures.

"Static" motor testing describes tests performed on a motor when it is not running, or in service. It can be disassembled as in a motor repair shop, stored as in an inventory warehouse or be connected and coupled to its load as long as it is not in powered-on operation. Static testing at industry-accepted standards effectively locates weaknesses within the motor windings before they degrade to the point of shorting, and subsequently cause motor failure.

Motors are subjected to numerous stressors that take a toll on insulation quality over the lifetime of the motor. Mechanical movements at start-ups, thermal stresses and contamination from its local environment all contribute to insulation degradation. What's more, motors routinely see voltage spikes five to six times their nameplate voltage rating at each startup and shut down. These spikes significantly damage the windings over time, eventually leading to arcing and the shorts that result in rapid catastrophic motor failure. This is a big reason why motors should be routinely tested with static motor test equipment, especially at levels they are subjected to in their real-world environment.

"Dynamic" testing describes tests performed when the motor is running under normal operational conditions. Improper voltages, voltage unbalances, overload conditions and other load-related issues can all play roles in reducing the service life of motors. These issues can only be diagnosed and identified through what is known as dynamic motor monitoring and analysis.

The value of static motor testing

Static motor testing works to assess the health of a motor's electrical insulation system, including its internal connections. Field tests performed at an MCC (motor control cabinet, or centre) enables assessments of the cabling and external connections to the motors. Static testing ideally employs a spectrum of tests designed to identify weaknesses in winding insulation, determine where the weakness may exist and how much the insulation has deteriorated to determine if and when repairs should be done. This set of tests includes resistance, megohm, PI, hipot (high potential, or step voltage) and surge test. Each test is performed to assess specific types of motor insulation problems, and each must be performed to gain a complete and accurate assessment of insulation health.

The insulation system of a motor consists of the ground wall insulation, the phase-to-phase insulation and the turn-to-turn insulation. In a typical induction motor the ground wall insulation is the slot liner paper that protects the insulated copper to ground. The phase-to-phase is often a sheet of insulation paper that is laid between the phases. The weakest link in the insulation system is most often the turn-to-turn insulation. This is the enamel on the copper of a random wound motor or the tape found on form coils. This insulation's purpose is to protect from copper to copper (a.k.a. turn-to-turn) failures.

In static motor testing, resistance measurements (or tests) are performed to ensure all internal connections are solid. These should be performed with a digital, low- resistance ohmmeter.

Ground wall insulation can be tested with a megohm meter (affectionately known to some as a "megger") to determine insulation resistance values. A polarization index, or PI test is used to evaluate the elasticity of the insulation. A DC hipot tests is used to evaluate the dielectric strength of the insulation relative to a pre-determined level.

Phase-to-phase insulation can also be tested with some of the same tests mentioned above if the motor is completely disconnected. In most predictive maintenance scenarios, the motor may be powered down but not completed disconnected from its normal operational load, in which case phase-to-phase insulation must be tested in the same manner as the turn-to-turn insulation. Surge tests are used for detection of weaknesses in the turn-to-turn insulation.

Turn-to-turn insulation is the weakest part of the insulation system, and is where more than 80 percent of all electrical failures in motors begin. Each time a motor starts, the resultant voltage

spike and sudden mechanical movement caused by the inrush of the magnetic field degrades the very thin film of insulation on the wire turns. Arcing will eventually occur with each start and stop between the weakest insulated turns. Such arcing may occur within turns of the same coil or phase, or it can occur across phases. Arcing gets progressively worse over time, and often creates a conductive carbon path to develop that will cause a short between turns. Once this short occurs, motor failure usually occurs as swiftly as fifteen minutes after the short! The surge test is the only test that can accurately detect weak turn-to-turn insulation before it becomes a short.

Any reputable motor repair facility will use AEMT/EASA Good Practice Guide to Maintain Motor Efficiency standard and perform all the static tests described. If a shop performs preventive maintenance on a motor and does not perform a surge test, they are prone to warranty repairs for which they were not actually responsible. For example, a motor is sent to a repair shop for timed-based reconditioning, and the shop does a perfect job. The motor is properly cleaned, windings re-dipped in varnish, rotor is balanced, and good quality bearings are installed all in the proper manner. The motor is painted to look like new, but the shop does not perform a surge test. The motor gets reconnected properly and placed back in service—only to catastrophically fail (i.e., become a ruined motor) a mere week later. It's easy to think, "the motor shop did something to my motor!" If they are a reputable shop they will rewind it for you at their own expense. However, it is most likely the turn insulation had deteriorated to a point where a few more startups would be all it could handle. The surge test would have alerted the motor shop to the dire state of insulation weakness and the shop would have given the choice to continue the reconditioning process or to rewind the motor. Most shops would not provide any warranty when they locate weak turn insulation. (Note: there are industry allowances for pin holes in the copper magnetic wire's insulation so it is imperative the surge test is performed to ensure the acceptable quality of the wire.)

Routine static tests and trend analysis provides the critical information needed to make good decisions about when a motor should be removed for repairs or replacement. If weak insulation can be detected before a motor fails, a repair or replacement can be scheduled, effectively eliminating costly unplanned repairs and production downtime.

If a motor is allowed to run to failure, a hole in the laminations can splatter copper in the surrounding area. A repair shop will consequently make the damaged area larger as a result of grinding out the splattered melted copper. However, even the best of shops are unlikely to bring such a motor back to its full potential. It will have a hot spot, be less efficient, and will fail quicker.

The shop is also likely to balance the rotor to a tighter specification than the new motor manufacturer and the final product will be better than new.

If the motor can be removed prior to failure, the motor shop can return a motor as good as or better than it was originally. Shops often use better insulation materials and bearings than the original manufacturer, which will tend to use bulk bearings and standard insulation products. The shop is also likely to balance the rotor to a tighter specification than the new motor manufacturer and the final product will be better than new.

Dynamic monitoring

Many modern motor control cabinets (MCCs) display voltages and currents, but dynamic monitoring provides infinitely more detail. Dynamic test equipment collects voltage and current information, and through a set of algorithms, assesses the quality of the power supplied to the motor, certain issues within the motor and the quality of the load relative to the motor's specifications. State of the art equipment is capable of using collected data to provide torque information. It does so not only as a numeric value but also in a spectrum over a pre-selected frequency range and a virtually real-time torque waveform. Torque provides visibility into the quality of the load, and a number of mechanical issues can be diagnosed with data from the torque spectrum. This often helps distinguish a mechanical problem from an electrical one, and avert the costs of pulling a motor that really had nothing wrong with it.

Rotor bar issues can be easily detected with dynamic test equipment for most induction motor applications. Unlike vibration analysis, which can detect a potential rotor bar issue, dynamic tests can determine the severity and can also trend a problem as it worsens over time.

Power quality issues involve voltage levels and unbalances. Motors do not like low or high voltage, and a minor amount of voltage unbalance could lead to a large current unbalance. Distortion is also a problem that can be detected by dynamic monitoring. Distortion reduces motor efficiency, induces heat within the windings, and can cause bearing fluting. Dynamic monitoring can also locate rotor bar issues often in early stages as well as many other mechanical issues. Operational speed, efficiency, load levels and others are well-defined in data collected by dynamic motor monitoring equipment.

Summary

Machine inspection and motor health programs put the technician in the position of being able to correlate operational indicators and testing procedures that dictate when the motor gets repaired or replaced instead of allowing the motor to control the situation. Predictive, proactive, and modern inspection programs maintenance programs are taking centre stage as the diagnostic capabilities of modern electric motor test equipment gets easier to use and more capable of detecting issues that would cause motor failure. Use of these tools can be the difference between successful reliability programs and prohibitively expensive unplanned downtime and possible safety issues.

The Number of Electric Vehicles is Growing on Land, in the Water, and in the Air

By Gitta Rohling

The Siemens test rig at the new eCar Powertrain Systems Business Unit production and development site in Erlangen enables the handling performance of electric vehicles to be simulated in a range of different situations. This is where Siemens tests the components for its SIVETEC electric integrated drive units.

Some 400,000 electrically powered automobiles are currently on the road worldwide, according to a study by the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW).

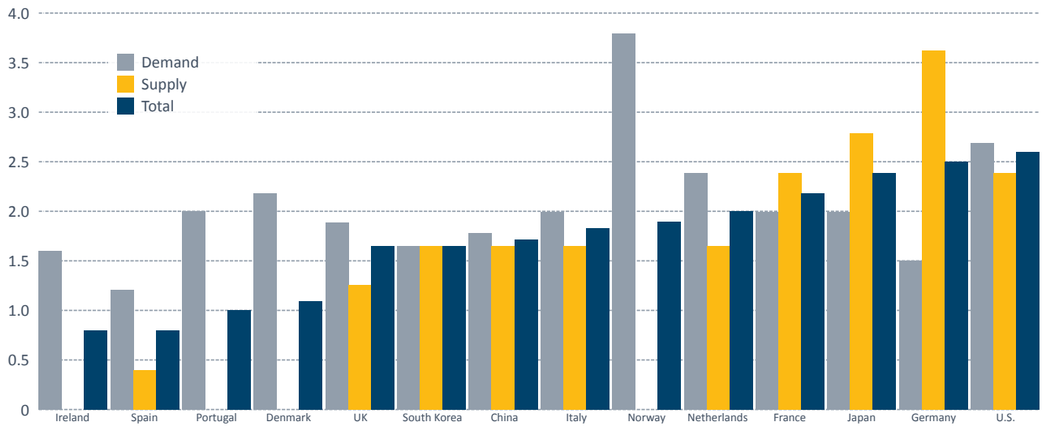
This means that the number doubled throughout 2013. The highest demand for such vehicles was in the U.S., Japan and China. Germany does not rank among the top countries, being in seventh place. Although the number of electric vehicles is still relatively small compared to automobiles with conventional combustion engines, it is expected to increase sharply in coming years. The German government, for example, wants to increase the number of electric vehicles on the country's roads to one million by 2020. And in its "BLUE Map Scenario," the International Energy Agency (IEA) estimates that almost 80 percent of automobiles sold in 2050 will be plug-in hybrids, electrics, or will be powered by fuel cells.

Norway and the Netherlands: Using Incentives to Boost Electric Vehicle Sales

The countries with the biggest market share for electric automobiles are currently Norway, at almost 2 percent, and the Netherlands, at 1.1. percent. Those are the latest results of the Electric Vehicles Index (EVI) drawn up by business consulting firm McKinsey. "Norway and the Netherlands are expressly using incentives to boost sales," says Christian Malorny, Director of McKinsey's Berlin office and an expert on electric mobility. "The incentives range from direct subsidies for the sale price to other advantages such as the right to use dedicated bus lanes and free parking in inner cities."

Business consulting firm Roland Berger measures the automotive countries' competitive position on the basis of three indicators: industry, technology, and the market. Japan improved its position in all three indicator indices to the greatest extent. According to Roland Berger, Japan leads the rankings in Industry mainly due to its extensive battery value chain. This is because Japanese automakers have reduced the price of electric vehicles on their domestic market, enabling customers to obtain good value for money.

Traditional Automotive Countries with high Production Volumes which are also Leaders in Electric Mobility



Wide Range of Solutions

Variety of Drive System Concepts

Hybrid (Hybrid electric vehicle - HEV)	The key feature in a HEV is an additional electric motor that supplements the conventional combustion engine. Surplus energy, such as that generated during braking, is stored in a rechargeable battery.
Mild Hybrid	In a mild hybrid, the electric motor merely supports the combustion engine; purely electric driving isn't possible.
Full Hybrid	A full hybrid can travel short distances on electricity alone.
Plug-in Hybrid (Plug-in Hybrid electric vehicle - PHEV)	A plug-in hybrid can be recharged at a power socket. Put simply, a plug-in hybrid is a mixture of a full hybrid and an electric vehicle.
Range Extended Electric Vehicle (Range extended electric vehicle - REV)	A range extended vehicle is powered exclusively by electric motors. The additional combustion engine it's equipped with is used primarily to generate electricity: It charges the battery while the vehicle is moving. As the name suggests, the vehicle's range can be considerably extended as a result.
Battery-operated Electric Vehicle (Battery electric vehicle - BEV)	A battery electric vehicle is powered solely by electric motors that get their electricity from a traction battery.
Fuel Cell Vehicle (Fuel cell vehicle - FCV)	This type of vehicle is powered by an electric motor that gets its electricity from a fuel cell that converts chemical energy to electricity.

Two factors, in particular, are expected to give electric mobility a boost: On the one hand, fuel prices will continue to rise because the availability of oil is finite, while, on the other, the rapid increase in automobile traffic worldwide is a key driver of climate change. Because there is no simple way to achieve electric mobility, manufacturers are working on a variety of solutions.

The world market for Lithium-ion batteries is expected to expand to over $9 billion by 2015

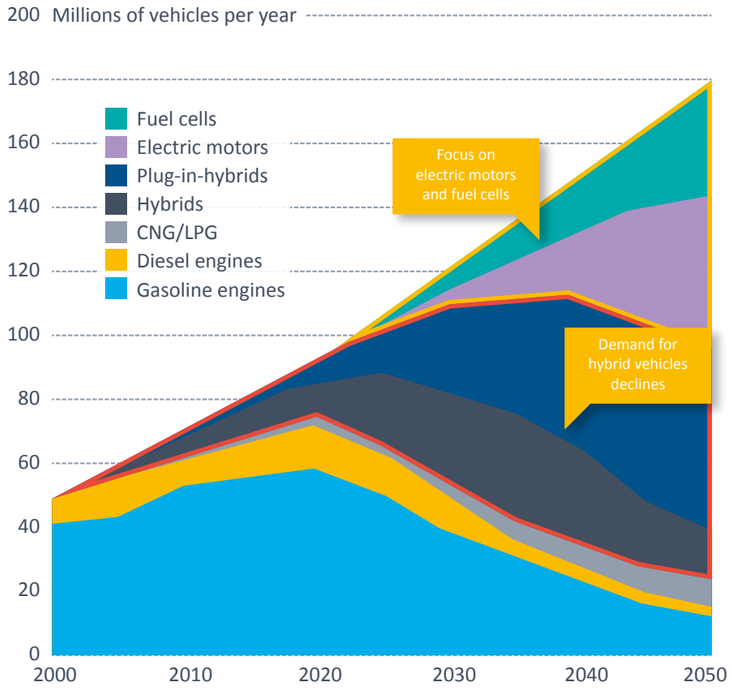
Although the technologies for electric drives, energy storage systems, and network infrastructures are now all available in principle, there is still need for further research, improvements, and networking in many areas. The biggest challenge is to develop high-performance storage systems that are also affordable. Research is being conducted on a wide variety of materials. Lithium-ion battery systems are currently thought to have the greatest potential. The world market for these batteries is rapidly growing, and Roland Berger expects it to expand to over $9 billion by 2015. By then, more than four million vehicles using electrical hybrid or plug-in hybrid drives (xEV) are expected to be put on the road every year. Japan and Korea are leading the way in battery technology. Although China has many manufacturers, the country still lags behind technologically. However, China's battery market is forecast to expand to 259 billion renminbi yuan (RMB; approximately $42 billion) by 2016, according to a study conducted by the market research firm Freedonia Group. China is already the world's leading manufacturer of electric two-wheelers and is investing substantially in "New Energy Vehicles." By 2015, the country's suppliers are expected to control around eight percent of the global market, and the country might even become the world's largest e-mobility market by 2020.

But while the automotive industry has been working on electric drives for many years now, the same could not be said of the aviation sector. However, that changed in 2014 when Airbus launched the fully electric E-Fan aeroplane in March. An Electric aeroplane that Emits Zero Carbon Dioxide

The two-seat aircraft can stay in the air for 35 minutes, and its developers intend to increase the time it can be aloft to one hour. Series production is scheduled to begin in late 2017. The shipping industry is also interested in electric drives. For example, Siemens has worked with the Norwegian shipyard Fjellstrand to develop the technology for the world's first electrically powered car ferry. The electric ship, which will enter service in 2015, emits no carbon dioxide, which is in part due to the electricity mix in Norway. The ferry, which is 80 meters long, is driven by two electric motors, each with an output of 450 kilowatts. Both motors are powered by lithium-ion batteries. The ship's batteries are recharged at the docks between trips. This example shows that the charging infrastructure is a key precondition for the spread of electric mobility. No matter whether they travel by land, by sea, or by air, electric vehicles can effectively protect the climate only if their electricity is obtained from renewable sources. ■

Variety of Drive System Concepts

Drive system technologies on the passenger car market, according to the BLUE Map Scenario of the International Energy Agency (IEA)



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The hidden secrets of 50 years' success in rewinding/reselling

E.Bennett (Electrical) is 50 years old. A most respected company among the industry and certainly one with a long family heritage, we discover the 'secret source' that has enabled E.Bennett Electrical to stay focused on its customers for half a century.

How times have changed over the last 50 years. In 1965, petrol cost just 5.5p per litre (actually about five shillings per gallon). It was the year of the first space-walk and the world's population was less than 3.5 billion. Today there is more than double that number at 7.4 billion people.

1965 was also the year that E. Bennett (Electrical) Company was born when John Bennett set up shop in a lock up garage in Milton. Yet unlike the changing cost of living, technology and the global population boom, E.Bennett (Electrical) has not altered its fundamental business ethos established on day one.

"We go about our business ethically with dignity and morality. We apply good, old-fashioned people skills. We make ourselves available to advise our customers and help them to identify major energy and cost saving opportunities. We evaluate each problem with patience and experience and never offer a knee-jerk reaction. We have not employed an aggressive sales force who attack customers regardless of their existing supply route," explains Sales Manager Richard Kelsall.

That's how the company says it has managed to stay successful, building a business selling and servicing electric motors, drives, industrial gearboxes and controls. The result is an organisation with a solid reputation for supplying quality goods and reliable service at competitive prices to end-users, resellers and OEMs.

"Our customers are mainly resellers and we strive to work closely with them to offer a service that is invisible to their customers. We like to think that we are extremely easy to deal with and offer a seamless service whether our customers are dealing with our office or face-to-face. I think of E. Bennett (Electrical) as the rewinder/reseller industry's best kept secret."

Whether or not the formula is a secret, it does seem to be working because E.Bennett (Electrical) has grown over the years, increasing its customer base steadily to create a business with longevity by the bucketful.

Strong family ties

It didn't take long for the talented John Bennett to gain early success and he was quickly able to move the company from its start-up premises in Milton to a property in Burslem. Growth continued and the company made a short move to larger premises on Reginald Street, Burslem in 1998. During this time sons Nigel, Roger and

Andrew, Nigel & Roger Bennett.

Andrew joined the family business, and since then the company has seen two grandsons also come on board - Nigel's son Samuel who has been at the company for around seven years and Roger's son Joseph, who joined four years ago. Few companies enjoy the continuity and depth of expertise of E.Bennett (Electrical) whose staff in each department has from 10 to 30+ years of experience.

"My father was an excellent salesman who built the business by buying in motors, refurbishing them and selling them on. The business has since developed substantially and we manufacture gearboxes as well as supplying new AC motors and variable speed drives. We provide a full advice service and on-site consultancy for companies to ensure their equipment is installed correctly and runs efficiently," Nigel explains.

The 'quality' message prevails

The company backs its expertise and professional approach with the technical support of leading manufacturers including Brook Crompton, WEG, Danfoss, Wattdrive, Crompton Controls, Bauer, Hansen, Gamak, and Remco. It also carries a substantial stockholding in its warehouse and maintains replacement stocks at customers' premises.

"With our extensive stock we can provide a 24/7 service for customers including standard products and even specialist items. We can very quickly obtain any electrical motor, drive or control not currently in stock if required. We have implemented a stock checking application that our key people can use to access our stockholding at any time and from anywhere to ensure we are able to respond to our customers with the motor they need, when they want it," says Richard.

As in many industries, E.Bennett (Electrical) has in recent years seen a rise in foreign manufacturers entering the UK market to offer lower priced products. The company tackles the challenge head on by promoting the benefits to customers of high quality products backed by dependable support.

"We differentiate in the market by selling only top quality, fully supported products – we live and die by that. For example, we maintain our support expertise by ensuring that we keep fully up to date with our suppliers' technical and business conferences and training programmes," Richard explains.

"In the past we have seen some customers being lured away by the lower prices of motors imported from Asian makers. Almost invariably these customers come back to us having suffered problems and a lack of back up from the original suppliers."

To enable it to become even more highly focused on its reseller customers, E.Bennett (Electrical) has outsourced areas of its business that it sees as being non-core. Logistics is a prime example. Whereas a few years ago the company had a small fleet of delivery vehicles, nearly all that function has now been outsourced, improving the flexibility of delivery to customers and simplifying logistics management for a more efficient and reliable service.

Poignant 50th anniversary event

E. Bennett (Electrical) celebrated its 50th anniversary earlier this year by organising a golf day for its customers, suppliers and business associates. There was also a serious side to the event which raised around £250 for the charity Breast Cancer Now.

"Our mother, Eunice, died after suffering breast cancer

Sam & Joe Bennett.

and my wife, Catherine, has suffered and recovered from the disease, so it is a cause dear to our hearts," says Roger Bennet. "Catherine is a very keen fund raiser for Breast Cancer now and we were pleased to be able to help through our charity golf day."

(In case you have been wondering where the 'E' comes from in the company name it is the initial of company founder John Bennett's wife Eunice.)

The continued family involvement in the business is critical to the ongoing success of E.Bennett (Electrical). "We are highly motivated to satisfy our customers in order to grow the business. The family members are all dedicated and very hands on – we all help each other in our jobs and get things done efficiently. The next generation family members are eager to push the business to the next level, so now we are looking forward to a further 50 years of success," concludes Andrew. ■

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AEMT to AEMT – 70 years as a trade association.

Speech given by AEMT Secretary, Mr. Tim Marks after the Celebratory Dinner.

Firstly my warmest thanks for being here tonight to celebrate the 70th anniversary of the AEMT.

I have been asked to give you a very brief history of the birth of the AEMT and the formation of its values which form the core strength of the membership today.

In 1934: Laurie Bowers of RF Winder, the father of David Bowers, wrote an article about the low trading standards and ethics in the Electrical Traders Industry, who purchased, reconditioned and sold used electrical power plant.

The industry had gained a very poor reputation amongst its customers and he wanted to form an association to raise the standards of the industry. In those days he received virtually no support, which he put down to “avarice and lack of trust”.

Five years later the second world war started and much of the productive plant and many factories were owned by the Ministry of Defence, and its subsidiary the Machine Tool Control (MTC). Supplies of Electrical and Mechanical plant were controlled by a series of licences and permits. This concentrated the effort on war work and survival, and in the words of William “Ted” Lawton it was frequently described as an Engineers War, however in many respects it was more accurately an “Electrical Engineers War,” which played a vital and outstanding part in almost every phase of the struggle.

During the war the companies who were to form the AEMT were in great demand by the government departments to ensure that the wheels of industry were kept turning and that equipment from bombed, flooded, and burnt out factories were quickly brought back into use again no matter how severe the damage was. The ingenuity of these companies and technical skill to redesign and make do and mend became legendary. It became common place to repair machines that were distorted with molten copper and only the iron casing and steel from the laminations remaining. It was due to the skilled craftsmanship and dogged determination of these companies that machines were put back into service in the shortest possible time so that the war effort was barely interrupted.

In the war there was a waste not want not attitude, and in the office of Ian Beatsons there is a photo of a circus elephant being used by Thomas Ward in Sheffield to haul a cart laden with iron and steel. There was no work for it in the circus.

Towards the end of the war the government put out a white paper to dispose of vast stocks of surplus equipment which were no longer required, this including electrical machinery. Delivery of electric motors was taking up to 12 months and required a licence, but this was about to change with a massive flood of equipment to be released on the home market by tender and auction. The manufacturers lobbied the government through BEAMA to release the equipment only through manufacturers, and this concerned the traditional electrical traders, who fought it and won their first battle.

On January 1st in 1945 WE “Teddy” Lawton of the Industrial Electrical Co. of London gathered together two or

three other traders, and arranged a meeting of 14 companies at The Holborn Restaurant in The Strand in London on 6th February 1945. Amongst these founding companies were Laurie Bowers from RF Winder, Dearlove from Fyfe Wilson, and representatives from Dynamo and Motor Repairs, which became part of Lewis DMR, then Wyko and now Eriks, Midland Dynamo, now part of Sulzer (Dowding and Mills), Bob Joseph from Midland Electrical Installation Co. (MEI) now part of Deritend, and Smiths of Carlisle, and Grants of Glasgow.

These companies had “winding wire and burnt insulation coursing through their veins”. Why did they all gather together and reach agreement to form an association, which may limit their previous freedom to trade as they pleased. In the words of one of the companies, “To be frank, it was life’s strongest driving force, fear.”

The government were about to release huge quantities of equipment onto a product starved market. The Association of Electrical and Machinery Traders was formed with Teddy Lawton as the first Chairman and driving force.

His efforts enabled the early members to purchase vast quantities of machinery keeping only a fraction of the amount for himself. This equipment also formed a huge buffer for the companies, who reconditioned equipment when they were quiet to place into stock and sell later on.

The members changed from traders to repairers, and the name of the Association was changed in 1950 from Traders to Trades, and later in 1995 Machinery was changed to Mechanical. However one of the early members, John Hope, reworded the AEMT even more to stand for an Active Enthusiastic Membership in the Trade.

It was not until 1967 that Associate Membership was introduced, having been previously turned down in 1963.

A friend of Teddy Lawton, John or JT Morgan, a solicitor, became the first secretary, who apparently was also a raconteur, comedian, and general entertainer.

I wish he was here today! But he passed away on January 1st 1961 to be followed Charles Allan until 1982, and then Tony Harman for the next ten years.
This brief history has come from the scant records that we have, and in the words of the first secretary John Morgan, records are like a bikini, what they reveal is fascinating, but what they conceal are the vital statistics.

They initiated and encouraged trust, co-operation, and friendliness between the traders and repairers in the industry. To put it in the words of the day, it was all about “Dropping in for a Noggin and a Natter and comparing methods and new ideas”.

Little did they realise that what they began over 70 years ago would be benefiting so many companies on an international scale today.

And what about the next 75 years.
It is good to see so many companies starting this part of the journey in such a healthy condition, all have struggled at some stage but are now fitter leaner and financially secure, and none have been born with a silver spoon in their mouths. We have many that are leading companies in the room today. So the future is very much in your hands and it has never looked so promising. Companies have largely diversified away from just repairing electric machines and are now on site, repairing pumps, electronic drives servo motors, condition monitoring, and ex inspections and repairs.

The future looks as promising as I have ever seen it. ■

AEMT 70th Anniversary Celebration Dinner.

2015 has marked 70 years since the end of the 2nd World War, and with it the glimmering hope of future trade that sparked the conception of our trade association, the then known association of electrical machinery traders. With respect to those electrical engineers who worked hard to keep wheels turning in factories and industrial establishments of all kinds; AEMT members came together to enjoy a celebratory feast with the AEMT and a look back at how our industry looked throughout the war years.

In reflection of their long standing membership to the association, 70th anniversary plaques were handed out to several members including, AEV, Beatsons Fans and Motors, Brook Crompton, Deritend, Elantas via Wire Electric Supplies, Engineering Carbon Products, Fletcher Moorland, Rewinds & J Windsor, Rotary Electrical Machinery, & Whitelegg Machines.

For a full selection of photos from the day including photos of the plaques being presented, please visit the past events area, to be found under the calendar drop-down menu of the AEMT website. ■


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1. *AEMT Secretary, Tim Marks with Jim Fowlie of SKF.*
2. *Mike Smith of Deritend speaks to Chris Lawton of Brook Crompton.*
3. *Karl Dalton and Mike Herring of SKF.*
4. *Liz Dawson of Whitelegg and Simon Swallow of Rotary Engineering.*
5. *Mark Robinson of WES with Trevor Rice and Gemma Worgan of Deritend.*
6. *Dr. Martin Killeen of Loughborough College with Colin Dawson of Whitelegg.*

AEMT Conference – The Pursuit of Excellence in Service Centres and Workshops.

The AEMT conference examined how workshops and service centres can keep up with the pace of change in a much evolved market place. Recently, education has become a focus point and with skilled labour getting harder & harder to find, the well prepared workshop becomes more and more important.

Dr. Martin Killeen of Loughborough College gave an overview of what the future of apprenticeships will look like for rotating electrical machine technicians. New apprenticeships will be governed by Trailblazer groups of employer companies.

Talks were also given my AEMT associates; SKF gave a brief overview of their training modules and Mike Herring talked about analysing motor current signatures. Later we were honoured to be presented on the findings of Dr. Bernhard Fruth's research into HV Partial Discharge; his company Quartztech specialise in condition monitoring equipment for this application.

After lunch two more companies looked at how they were adapting to the ever evolving industry. Wire Electric Supplies gave updates on their company outlook and Rotary showed off their innovative new design language being rolled out in their new workshop equipment.
All presentations from the day can be found in the past events section to be found under the calendar drop-down menu of the AEMT website. You will also find the full selection of photos from the day. ■


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1. AEMT Members listen to Dr. Martin Killeen Speaking.
2. Dave Donoghue of Drummotors and More with Jim Fowlie of SKF.
3. Dr. Martin Killeen of Loughborough College Speaking.
4. Steve Ashman of Solutions in IT with Mark Davies of CEMB Hofmann.
5. Michael Wooldridge and Samantha Turner of NTN Bearings with David Rausi of Anstee & Ware and Thomas Marks of AEMT.
6. Dennis Rawle of Graphalloy with Kevin Robinson of Deritend.
7. Tony Ruane of SKF talks with Steve Ashman of Solutions in IT.

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