Electrical Review

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April / May 2020
Volume 254 | No 4
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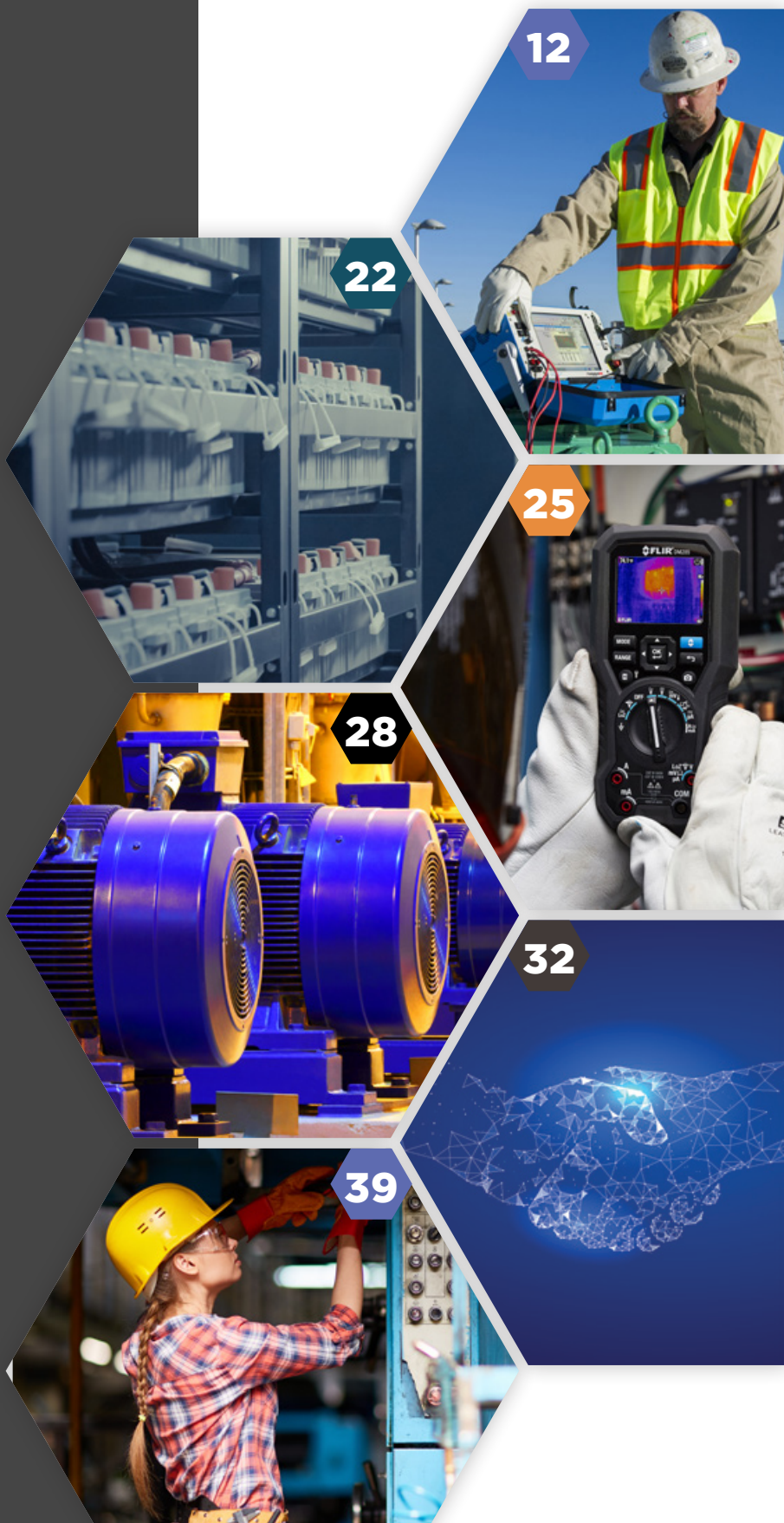

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EDITOR'S COMMENT

Having made the decision to combine both our April and May issues in light of the general chaos incited by Covid-19, I sincerely hope this will be the last issue that coronavirus touches. Perhaps slightly optimistic, but I'm going to go with it.

This virus hasn't only affected people the world over, but seems to have infected every facet of our daily lives. This is an incredibly trying time for many, financially, mentally and even physically. I just want to say that no matter what your situation, if you feel crap, overwhelmed or you're not sure what to feel, that's okay.

You do not need to 'find yourself', write a novel, become a fitness guru or any of the other smorgasbord of things we 'should' be achieving. Putting undue pressure on ourselves at a time of great unrest, where for many a work-life balance no longer exists, in my humble opinion is utter madness.

You cannot pour from an empty cup, and I'd like to reiterate the 'be kind' mantra, not only in relation to others, but most importantly, ourselves. Stay safe people.

Claire Fletcher, Editor

Printing by
Buxton

Paid subscription enquiries:
subscriptions@electricalreview.co.uk
SJP Business Media
2nd Floor, 123 Cannon Street
London, EC4N 5AU

Subscription rates:
UK £221 per year, Overseas £262

Electrical Review is a controlled circulation monthly magazine available free to selected personnel at the publisher's discretion. If you wish to apply for regular free copies then please visit: www.electricalreview.co.uk/register

Electrical Review is published by

SJP business media

2nd floor,123 Cannon Street
London, EC4N 5AU

abc Average net circulation
Jan-Dec 2018 6,501

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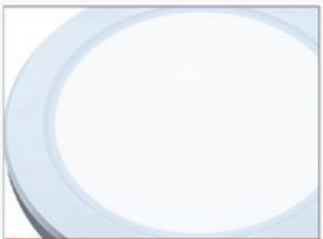

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News

JTL names Electrical Apprentice of the Year in London

JTL, national training provider for electrical and heating and plumbing apprenticeships, has named Middlesex-based Callan Baker as its Electrical Apprentice of the Year in the London region.

Callan's victory was announced following a successful apprenticeship with London-based firm, TClarke PLC. He was recognised by his training officer for his progress both academically and practically, and has been awarded with a £100 cheque and glass trophy.

Callan has also now been shortlisted to represent London against seven other regional electrical winners at JTL's National Awards, which will take place in Autumn.

LIA surveys effects of the coronavirus on the lighting industry

The Lighting Industry Association (LIA) has surveyed its members to establish the effect of the current lockdown on the lighting industry.

Currently, 89% of members reported their business remained open in some form with the most operative functions being sales (95%), dispatch (90%) and accounts (87%).

The average capacity lighting businesses are running at is around 45%. Approximately 44% of staff are currently furloughed and only 4% reported that they had made any redundancies as a direct result of the coronavirus lock down.

Many companies (69%) are reporting difficulties in obtaining raw materials or components with a variety of reasons, down to late deliveries, shortage of shipping capacity and slow return to manufacturing capacity in China among the most common.

The LIA also asked if members had attempted to access the various government support schemes and 47% reported positively; however, many had experienced difficulty owing to the portals not being fully ready or lack of support from banks.

On the subject of credit, 38% reported that their customers had either asked for or had simply taken extended credit with others reporting late payers deducting early payment discounts outside the qualification period.

On a more positive note, 71% of LIA members reported having a recovery plan in place ready for the removal of lockdown measures.

SECTT REASSURES INDUSTRY ABOUT ELECTRICAL APPRENTICESHIPS

The Scottish Electrical Charitable Training Trust (SECTT) has reassured the industry that electrical apprenticeships and training are in safe hands following the introduction of a range of emergency measures during the Covid-19 pandemic.

As well as offering ongoing help and guidance to all apprentices, SECTT is working closely with the Scottish Joint Industry Board (SJIB), SELECT and colleges across Scotland to support the collective efforts of employers and colleges throughout the current crisis.

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ELECTRICITY NORTH WEST SUPPORTS SPECIALIST FIELD HOSPITAL

Engineers from Electricity North West have supported the creation of the region's first specialist field hospital, the NHS Nightingale Hospital North West.

NHS Nightingale Hospital North West has been built to help with the coronavirus outbreak in the region. Based at Manchester Central Conference Centre, the hospital, now open, will have capacity for up to 750 patients.

CICV Forum reveals impact of coronavirus on Scottish construction companies

Cashflow has completely dried up for nearly 80% of firms in the construction industry in Scotland, according to businesses which responded to a survey carried out by the newly-established Construction Industry Coronavirus (CICV) Forum.

More than half of firms who took part in the new poll also said they are owed vital monies from public and private sector clients, with invoices now overdue.

As a consequence of the current pandemic, more than two-thirds of all companies who took part in the survey said they have furloughed staff, over a third are shut completely, while more than a quarter currently have staff and sub-contractors in self-isolation.

The survey analysed responses from 377 construction companies across Scotland, ranging from electricians, builders and plumbers to surveyors, architects, roofers and joiners.

ABB and employees donate to the International Committee of the Red Cross

As part of its ongoing measures to support Covid-19 relief efforts, ABB has joined forces with the International Committee of the Red Cross (ICRC).

The ICRC is an international humanitarian organisation with Swiss roots, specialising in providing emergency response and is at the forefront of fighting the pandemic in places of armed conflict and other situations of violence.

It is part of the Red Cross and Red Crescent Movement, which has been working with communities around the world to increase preparedness and resilience since the Covid-19 outbreak started.

ABB will make an initial contribution of CHF one million to the ICRC Covid-19 effort and thereafter ABB Group will match 1:1 all donations made by its employees around the world.

The money will be used to provide infrastructure for healthcare centres, sanitation infrastructure, and crucial items such as soap and masks.

"As a global company, we have a responsibility to help society get through this crisis. With this action, we will be supporting some of the world's most vulnerable people in fragile communities," said ABB CEO Björn Rosengren.

STORING WASTE LAMPS AND ELECTRICALS DURING THE CORONAVIRUS CRISIS

For organisations providing essential services during the coronavirus crisis, Recolight has announced help with storage of additional waste, while the Environment Agency has published guidance for sites that may exceed their permits during the current lockdown period.

The Recolight Network for dropping off small quantiles of waste lamps and luminaries is temporally closed. This may result in some waste containers reaching capacity. In such situations, Recolight can supply an additional container to allow the safe storage of additional waste.

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GOSSAGE

Mystic Meg from down under

I have to conclude that the Deputy Prime Minister of New South Wales, John Barilaro, is a remarkable clairvoyant. He has announced unequivocally on Australian media that Rolls- Royce is set to build up to 15 new small-size nuclear reactors in Britain over the next nine years.

Strange this. Just 18 months ago, according to the ***Financial Times***, Rolls-Royce was preparing to shut down altogether its R&D project to develop small modular nuclear reactors, unless the British government agreed to an outrageous set of demands and subsidies.

Granted the Johnson government has bunged them a few million to keep the R&D going. But there is as yet no sign of anything being oven-ready to come to the marketplace, let alone 15 up and running.

But there remain some rather disturbing connections between small reactor projects and nuclear weapons proliferation. And Rolls-Royce does offer up one of the most glaring examples.

Part of the company's current sales pitch to the British government includes the argument that a civil small-reactor industry in the UK "would relieve the Ministry of Defence of the burden of developing and retaining skills and capability" for its weapons programme. It may be true. But it is not really Atoms for Peace, is it?

The (In) Famous Five

Knowing how keen many are to switch electricity providers in order to pick up a marginally lower fuel bill, I have a sad warning for you.

Were you contemplating moving your account to Enstrogen Ltd? Or Daligas Ltd? Or to Symbio Energy? Or Entice Energy Supply? Or even Northumbria Energy? If you were, I am afraid each of these companies would have to refuse to supply you.

The regulator OFGEM got so cross that all five of them have been banned from signing up any new customers at all.

What have they all done to become subject to such draconian wrath? The answer is that they have all failed to do something that, ever since November 2017, they have been increasingly vigorously instructed by OFGEM to do. And that is to sign up with the Data Communications Company.

Failure to do so has meant that none of these five suppliers are installing any so-called "smart" meters at all, and certainly not those of the vaguely useful SMETS-2 variety. And it means that, if any of the existing customers of any of these Famous Five should be foolish enough to be seeking to leave them for another supplier (perish the thought!), any earlier SMETS-1 smart meter in their premises would then simply cease functioning.

So cross is OFGEM that each company has been warned that, if they don't do as they are told, it will "consider further enforcement action" – which could possibly "result in their licences being revoked."

It's deja vu all over again

There was much rejoicing at the Carbon Capture & Storage Association at the announcement in last month's Budget that the Government would be making £800 million available over the next five years. Its director, one Luke Warren, was full of warm congratulations to the Chancellor for recognising at last the potential of such technologies.

I do hope the starry-eyed Mr Warren didn't chance upon an interview broadcast by ITV on Budget night with Alistair Darling. He was you may recall the Chancellor of the Exchequer, all those years ago under Gordon Brown. And he too commended Mr Sunak for announcing that "the time has come for CCS." And said he agreed with him.

But then Mr Darling went on to point out that "I announced £1 billion for a competition to stimulate CCS 15 years. But it still hasn't happened. Because no one has yet managed to do it."

Not only was Mr Darling's recollection spot on, but his announcement was also greeted with warm congratulations, for recognising at last the potential of such technologies, by the then boss of the Carbon Capture & Storage Association. As Mr Darling wryly observes now, "The easiest thing to do is to announce these things. The really difficult bit is to deliver them."

Atomic slackers

How many people are currently working in the UK in the nuclear industry? Being a simple chap, I had thought that such a number would be easily established, at least within a few hundred or so. But not so.

Try exhibit one. Prospect is the trade union which maintains that it represents those working in nuclear energy. According to the union's deputy general secretary, Sue Ferns, "at present, the nuclear industry supports around 60,000 highly skilled jobs." Actually, I was just as interested in the semi-skilled and unskilled number. But here we have a pretty solid number. Or do we?

Exhibit two comes from a government energy minister. Answering a Parliamentary Question on October 24, 2018 on employment levels in the nuclear industry, Richard Harrington, the then energy minister at BEIS, explained that, since 2015, the Government has used the industry-recognised dataset for jobs in nuclear: The Nuclear Workforce Assessment (NWA).

He continued, "The Nuclear Skills Strategy Group (NSSG) – of which the Government is a member – conducts a labour market intelligence gathering exercise across the sector to produce the NWA, which is used by the sector to inform employers' recruitment practices. The latest NWA, published in July 2017, estimates there are currently 18,700 Full Time Equivalents (FTEs) employed in fuel processing and generation." In other words, less than one-third of the number that the trade union prospect is claiming.

But wait. Is even that number correct? If so, nobody has told the Government's Office for National Statistics (exhibit three). It maintains that right now there are just 12,400 full-time direct jobs in the UK in nuclear energy reprocessing and generation. So, the correct number is either 12,400. Or 18,700. Or 60,000. Take your pick.

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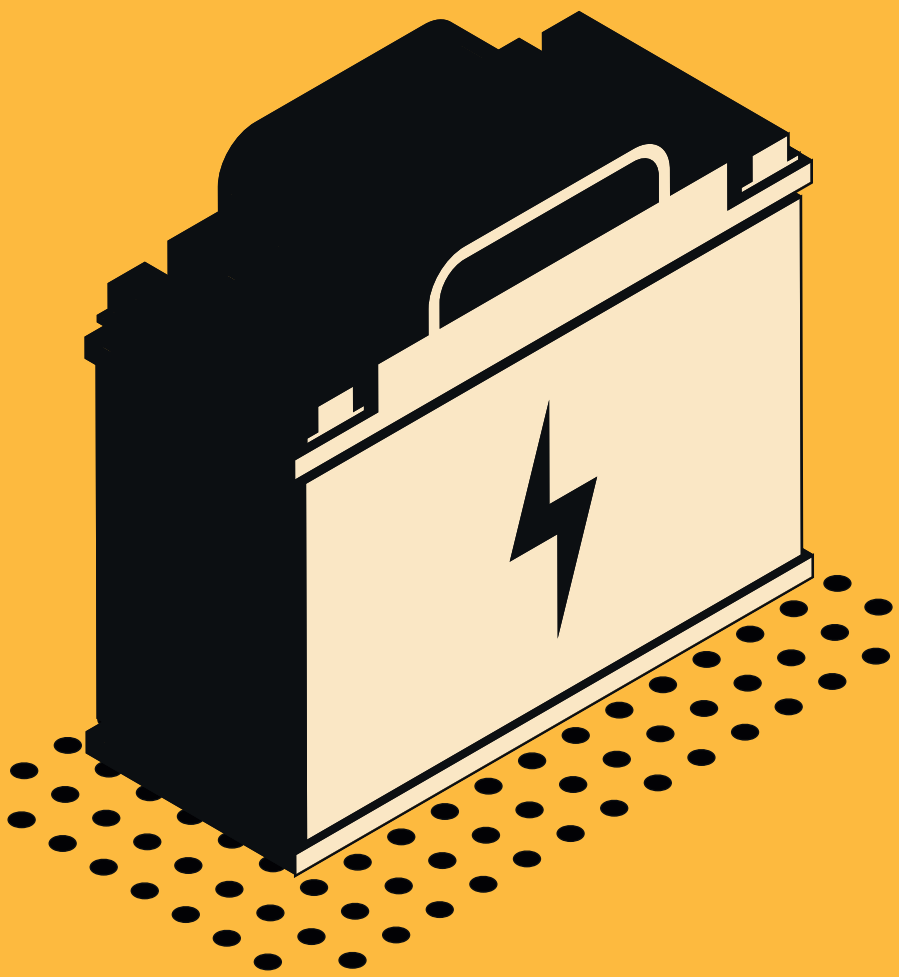

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Motor insulation test voltages: How high is too high?

Confusion sometimes exists in relation to choosing the most appropriate test voltage and test method for a particular application. Here, **Megger** examines the options for motor testing.

There are many options for testing insulation, and Megger supplies an extensive range of testers for such applications, from 50 V to 15 kV insulation testers, through VLF and AC Tan Delta test sets to diagnostic Dielectric Frequency Response instruments and, under the Baker brand, specialist motor testing equipment up to 40 kV.

When testing motors, it's important to keep in mind that they are complex electro-mechanical devices with a complex set of failure modes and related diagnostic options. We will look at the failures of motor electrical/insulation systems, how to manage the life of motors by adopting an appropriate test regime and the concerns that are sometimes voiced about the 'high' voltages used for surge testing.

A test regime designed for a particular facility must first consider how maintenance efforts can be optimised for the various motors in use. Permanent continuous monitoring using, for example, the Baker NetEP system may be selected for the most critical motors. By monitoring a wide range of parameters, including the current and current spectra, the NetEP can pick up many issues that may be developing – from broken rotor bars to saturating supply transformers. The system generates a series of 'Watch', 'Caution' and 'Warning' flags to facilitate planning of maintenance actions.

On-Line testing – that is, testing while the motor is running – can also be carried out on an as-needed basis with a portable on-line monitor like the Baker EXP4000. These on-line techniques, of course, cannot tell you about all types of incipient faults. Indeed, when warnings are given, a full diagnosis may require complementary off-line testing. In addition, off-line tests are often used on their own in a planned maintenance regime that takes motors off-line for testing and other maintenance activities at appropriate intervals. Compared with on-line tests, off-line tests provide different insights into the motor's condition; the two approaches to testing are, therefore, complementary.

Off-line testing operates by applying a stimulus of some kind to the motor and measuring the response. This is similar to a doctor asking you to cross your legs and then tapping you on the knee to see how your leg kicks up. This quick check enables a doctor to evaluate your spinal neurological response – it's not about checking your particular skill in literal knee-jerk reactions!

Go/no-go tests are an invaluable part of every maintenance regimen. Options include insulation resistance, leakage current, polarisation index and step voltage testing, and there are few who would argue against the benefits of these core electrical tests. However, these tests will not reveal one of the most common early initiators of motor faults: inter-turn insulation breakdown. To detect such a breakdown, it is necessary to use a surge test. Unfortunately, this is the area where some confusion has been generated in relation to the 'high' voltages involved.

In a surge test, a short-duration test current with a fast rise time – typically around 100 ns – is generated and applied to the motor coil. The test equipment captures the coil's response, which takes the form of a decaying oscillation – or 'ringing transient'. If the motor coil were in air,

the pulse would be travelling at almost the speed of light and the voltage would be evenly distributed across the coils. But in a motor, the coil is not in air, it is wrapped around a steel core, and so the pulse travels much more slowly.

In fact, it will typically take the pulse 100 ns to travel from one coil-turn to the next, which is equal to the rise time of the pulse. The result is that the pulse produces a significant voltage difference between adjacent turns of the coil, something that it is impossible to achieve with any other test technique. The surge test will, therefore, reveal turn-to-turn insulation weaknesses.

A bad turn will short and this will be shown by a jump in the ringing frequency of the coil (it becomes in effect a 'different' coil at this point in the test). Large frequency jumps can be clearly seen on the tester display, but the instrument's software also uses mathematical analysis to reveal anomalies that are less easy to spot by eye.

For a motor in normal operation, which has not endured significant electro-mechanical thinning of the insulation, the surge-test voltage is far below the dielectric strength of the insulation.

To come back to the analogy of the doctor hitting your knee with a little rubber hammer: if that test was being carried out with a proper steel-headed claw-hammer, and the doctor was built like Arnold Schwarzenegger, and Arnie wasn't paying attention and just took a full swing at your knee, maybe you would be right to be worried about having your knee hit with a hammer. But you know that, in real life, that's not how things are.

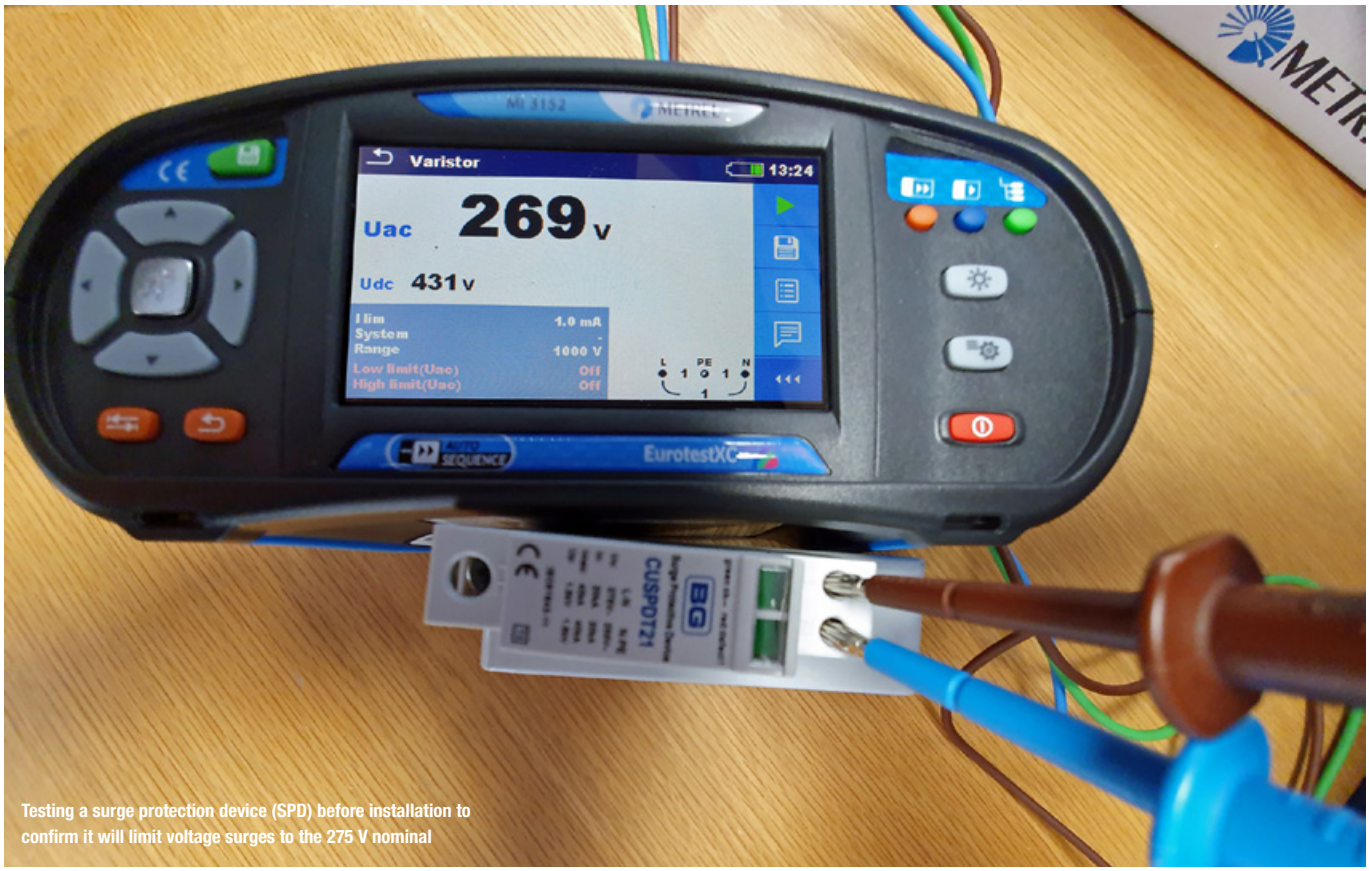
And it's the same with a surge test generated by a Baker DX tester. It applies a voltage and rise-time to enable you to see the inter-coil response, but with a signal controlled in voltage, time and energy, so that the impact on the motor is similar to the spikes that the motor receives as a result of typical power-system variations during everyday operation.

When testing motors, it's important to keep in mind that they are complex electro-mechanical devices with a complex set of failure modes and related diagnostic options

In conclusion, a surge test should form part of the diagnostic toolkit of every motor maintenance and facilities management professional, who can be confident that a fault found by doing this test has avoided a probable unplanned failure and plant shut down. What's more, surge testing is actually recommended by many motor test standards.

Three into one goes easily

In the last twenty years, electrical installation testers used by contractors and electricians around the nation have changed completely. Despite the reservations of times gone by, **Mark Johnson** of Metrel UK Ltd explains why today, it's beneficial to put all your eggs in one basket.



Testing a surge protection device (SPD) before installation to confirm it will limit voltage surges to the 275 V nominal

Back in the day, the average contractor would have three testers: a loop tester, an RCD tester and a combined insulation and continuity tester, typically lunch box shaped and yellow in colour. Suddenly loop testers had to contend with operating through RCDs, giving birth to the much-loved D-lock version of the non-trip test.

Everything was simpler then including the electronics in the testers, but even so they were less reliable. There were all-in-one testers around then, but customers resisted them saying, "with three testers, one can go for repair or calibration and I can carry on working". Yes, they were right about repair, but they forgot they usually had all three testers calibrated at the same time.

There were some manufacturers who combined the RCD and loop tests into one machine as they used much the same circuitry. This had a limited success around the time Part P was added to the building regulations, but now that has waned, and the kits have been withdrawn.

Despite the early objection to "having all your eggs in one basket", end-users have been swayed by the financial logic of a single multi-function installation tester. And their electronic design and reliability has improved by leaps and bounds in recent years. So why pay for three knob and case sets and three LCD screens when you can buy one, and calibration costs are only slightly more than a single instrument calibration?

Convenience is a key factor, the multi-function tester means that when testing you have all the test kit you need with you, so you do not need to go back to your van, or keep an eye on the testers you are not using.

Originally multi-function testers were box-shaped with a portrait layout, some had handle extensions on the side and they used custom monochrome LCD displays. But now they have generally evolved to a bean-shaped landscape aspect, making them more comfortable to hang around the neck in use. The best testers now use full-colour dot-matrix

Help screen for the power quality set up on a Metrel multi-function tester

Making light work of on-board results storage using the graphical memory manager to represent the installation under test with a Metrel multi-function tester

screens that can display large amounts of information, such as results and test parameters at the same time. It goes without saying that rechargeability is a must.

All multi-function testers offer the same basic tests; some perform them more competently than others and some extend the range of tests in that test group. For example, a basic tester may measure voltage between two probes, while a more sophisticated tester will, when the three connections are made, display voltages between each probe, and the phase rotation.

Basic machines offer just two insulation tests, 250 V and 500 V, whereas a more useful tester will extend the range from 50 V to 1,000 V so that insulation testing can be started at a lower voltage to prevent damaging any vulnerable components that may have been left in circuit. A really good tester will also offer a voltage ramp test to confirm that surge protection devices operate at their nominal voltage.

Turning to low ohms, or continuity, all testers have to test at 200 mA for certification purposes, but premium devices offer a lower current option between 7 mA and 15 mA for generally checking the connections during installation, prolonging the battery life. The 7 mA test current also guarantees a continuity test can be performed through an RCD. Additionally, some can do automatic forward and reverse continuity.

Earth loop impedance testing is another key function of the multi-function tester. A high current loop test for unprotected circuits and Ze measurement is normal, but only the better multi-function testers will display the value of the components that make up the impedance result, resistance and reactance at the same time. It is quite normal these days to have the prospective short-circuit current value calculated (though one should be aware of whether a nominal or measured voltage is used for the calculation) and displayed at the same time. Some testers still have a different switch position and require an extra loop test to be performed for a PSCC value.

Non-trip loop tests are available on all machines these days; they all use a three-wire connection with the exception of the two-wire test from Megger. Non-trip tests all use different algorithms to produce the result. The algorithms are all patented, consequently they are different, and they produce different measured results, giving more or less repeatability. Repeatability of the test is generally how users judge their acceptability.

The algorithm of some manufacturers suffers inordinately from RCD up-lift, where the reactance of the coil in the RCD affects the final measurements and they have built into their premium testers what they call a confidence meter to overcome the problem.

With the advent of EV charging equipment, there is a new limitation on the non-trip test, the ability to loop test without tripping not only the 30 mA a.c. RCD but also the 6 mA d.c. protection. Only an elite few can achieve this.

That brings us to RCD testing in its own right. These days all but the very cheapest multi-tester offers all the required tests – ½ In, In and 5 In as individual tests and an auto-RCD test – but ramp tests are less common, though they are really useful for diagnosing nuisance tripping. Having the ramp test included in the auto-RCD test is rare despite its usefulness. Many users prefer the idea of having all the results and test parameters displayed on a single screen rather than having to scroll through the results. It makes it quicker to identify the passes and fails.

It seems the longer the list of RCD types that the machine tests the better. With the advent of increasing amounts of EVSE installation and testing work, machines that will automatically take you through the procedure testing both 30 mA a.c. RCD and the 6 mA d.c. protection and successfully perform a loop test too are few and far between.

Many users prefer the idea of having all the results and test parameters displayed on a single screen rather than having to scroll through the results

The point of a multi-function tester is to save users time on the job and back in the office. Over the years, many testers have been designed to store test results on board, but until recently none have been practical or able to completely remove pen and paper from the process on-site. This is because memory management did not reflect the circuits and boards users were working on, and the labelling of circuits and the adding of comments was impossible. The new dot-matrix, touch-screen testers have changed everything; it is easier to build a representation of the drawing one is working to, and to post results to each location. Downloading and uploading to a PC running the certification software is then done most effectively through a wired connection.

Over the years, the multi-function tester has essentially become a computer, capable of performing electrical tests.

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Striking the right balance

Selling surplus energy to a transmission system operator (TSO) is an important source of income for many operators of renewable energy systems. However, as **Paul McClean** of embedded monitoring system specialist eMS explains, this income can be usefully augmented – provided monitoring requirements are met – by delivering balancing services, such as fast/firm frequency response (FFR).

TSOs like Eirgrid and SONI in Ireland, and National Grid in Great Britain, face a dual challenge. They must increasingly accommodate energy from non-traditional sources, but they must also satisfy their obligations to ensure the stability of the networks they operate and to maintain supply frequency and voltage within prescribed limits.

These challenges are not new, but they were easier for TSOs to meet when almost all energy was produced by generating plant, over which they had considerable – if not complete – control. Today the picture is very different. In 2017, renewables accounted for 29% of total installed generating capacity on the island of Ireland. The figure for Great Britain was around 28%. These percentages are growing, so relying solely on traditional generating plant alone to ensure grid stability is no longer possible.

For this reason, TSOs are now encouraging operators of renewable energy sources, energy storage facilities and companies with standby power plants to help maintain the stability of the supply system by providing "ancillary services". These include offering a fast response to frequency dips by bringing additional generating capacity online. The TSOs pay energy source operators for providing these services. The payments include an amount for making the facility available and an additional amount when the service is provided. Payments depend on the amount of power offered, the time it is available for, and the speed it can be brought on line.

These payments make providing ancillary services an attractive option, but life is never completely straightforward, and there are a couple of caveats. The first is that TSOs are usually only interested in signing up larger energy suppliers – typically with

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generating capacity of 10MW or more. The second caveat is that the TSOs lay down stringent requirements for the energy supplier's monitoring systems.

To satisfy the first caveat, energy suppliers can work with an aggregator that combines the capacity of several small suppliers to reach a TSO's minimum. The second caveat may seem onerous, but it is in fact perfectly reasonable because without monitoring, TSOs can't confirm that they are receiving the ancillary services they're paying for!

The details of the monitoring required differ between the various TSOs, but information is readily available online. For Eirgrid and SONI, the relevant document is 'DS3 performance measurement device standards for fast acting services', while for National Grid it is 'Frequency response monitoring (ancillary services business monitoring).' These two sets of requirements have much in common.

They both stipulate that the monitoring system must provide data acquisition and data storage facilities, as well as network connectivity. The system must monitor and record parameters such as voltage, current, apparent power, real power, reactive power, power factor and frequency. It must offer high accuracy and the measurements must be precisely timed. For data delivery, however, requirements differ. SONI and Eirgrid want data in a defined layout using CSV format, whereas National Grid requires direct access to data via a webserver built into the monitoring system.

How can operators of renewable energy sources meet these monitoring requirements to enjoy extra income from providing ancillary services? Fortunately, well proven web-enabled multifunctional monitoring systems with all of the necessary facilities are now available, and the best of these have been confirmed as satisfying the stipulations of Eirgrid, SONI and National Grid. In fact, the systems do even more. The data they record and analyse is a powerful aid for optimising plant operation, determining supply quality, analysing performance under normal and fault conditions, and for fault finding.

What can users expect from a monitoring system?

It should be physically compact and robustly constructed. It should accept inputs from standard current and voltage transformers, and it should feature powerful analytical facilities to generate the derived parameters required by the TSOs. Further, as TSO requirements will undoubtedly continue to evolve, provision for customisation is essential.

The system should provide consistently high accuracy in acquiring, analysing and recording data, and the data storage media should be static, non-volatile and offer large capacity. Measurements must be precisely timed, which is best achieved by using GPS data to synchronise the timing of the monitoring system. Finally, the system must support the TSO's favoured data delivery method.

Offering ancillary services is a valuable source of additional income for energy providers and the key to unlocking these benefits is flexible and dependable high-performance monitoring

Ancillary services are of enormous value to TSOs in helping them to maintain the stability of the supply grid while meeting statutory requirements for supply voltage and frequency. Offering ancillary services is a valuable source of additional income for energy providers and the key to unlocking these benefits is flexible and dependable high-performance monitoring.

This is readily achievable, but to guarantee success it is vital to consult with an experienced supplier that fully understands the often complex issues involved, that offers proven technology and that provides solutions tailored to meet the exact requirements of each application.

Meet the new MPD 800 from OMICRON

Introducing the new MPD 800 universal partial discharge (PD) measurement and analysis system from OMICRON.

OMICRON's new MPD 800 includes two input channels for partial discharge measurement and gating

This latest product represents the next generation of the company's innovative MPD PD testing technology, which is based on 20 years of MPD customer experience, feedback and an expanding list of requirements for PD testing. Established hardware and software features have been enhanced and new time-saving functionality has been added to make the MPD 800 the most complete, accurate, and flexible solution available for PD testing in a wide range of applications.

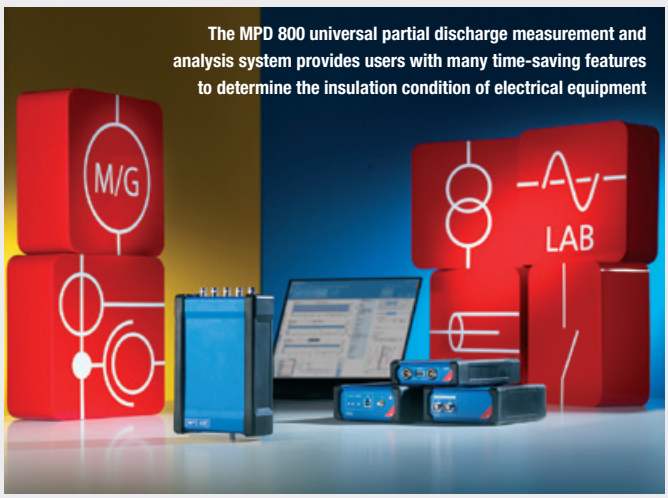
Standard-compliant PD testing

The MPD 800 system performs IEC and IEEE standard-compliant PD measurements and analysis for routine and type testing, factory and site acceptance testing (commissioning), as well as repair testing and trouble-shooting in the field.

With very high measurement accuracy, the MPD 800 system enables users to reliably detect, localise and assess the risk of potentially failure-causing PD activity in the insulation of various electrical assets and components. These include power transformers, rotating electrical machines (motors and generators), power cables, switchgear, and industrial drives, as well as bushings, insulators, capacitors and busbars.

Multi-channel PD measurements

The MPD 800 measurement device includes two fibre-optic input channels for either synchronous, two-channel PD measurements or a single-channel PD measurement plus a gating channel to reduce surrounding interference without the need for an additional device.



The MPD 800 universal partial discharge measurement and analysis system provides users with many time-saving features to determine the insulation condition of electrical equipment

The MPD 800 system can be easily expanded with up to 20 measurement devices connected via daisy chain with fibre optic cables supplied by OMICRON to perform synchronous, multi-channel PD testing at several distributed measurement points. The MPD 800 system software provides users with a convenient overview of all connected devices and the PD measurement data for each measurement channel.

Customisable user profiles

Users can define individual test specifications, including calibration and measurement settings, based on applicable international standards for specific types of PD tests and test objects, and save them as profiles for current and future use.

In addition, users can decide which of the available PD measurement and analysis software features they need for a PD measurement, hiding those they do not need at any time for individualised PD testing and reporting. These capabilities make PD testing and analysis much more efficient and easier for users at all skill levels.

The importance of PD testing

Insulation faults are a major cause leading to the eventual breakdown and failure of electrical equipment. Therefore, it is crucial that the insulation condition is verified throughout equipment lifecycles.

Partial discharge is both a major cause and a very reliable indicator of developing insulation defects in electrical equipment. Regular PD measurements allow users to detect and analyse PD activity in the insulation system and to assess the risk and plan maintenance accordingly before major damage or a breakdown occurs.

OMICRON has several years of experience in the field of PD measurement, analysis and monitoring, on both medium-voltage and high-voltage electrical equipment, with customers in the asset manufacturing, power utility, industry and service/repair sectors worldwide.

For further information, please visit: www.omicronenergy.com/mpd800

Ole Kessler
Product Manager

Get your hands on MPD 800 – for fast and easy partial discharge testing

Our new MPD 800 universal partial discharge (PD) measurement and analysis system represents the next generation of our innovative and widely-used MPD PD testing technology. New time-saving functionality has been added to make it the most rugged, flexible and reliable solution available for detecting PD activity and assessing the risk of insulation failure in a wide variety of electrical equipment. The multi-language and user-configurable software is also fully compatible with existing MPD 600 devices.

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OMICRON

Positive steps to lengthen battery lifespan

Riello UPS technical services manager **Jason Yates** explores the often unsung heroes of UPS systems – the batteries – and outlines the steps site operators should take to reduce the risk of premature failure.

Without a well-maintained battery system that'll perform as and when required, an uninterruptible power supply is practically useless.

Despite the rise of alternatives such as lithium-ion, the majority of UPS systems today still use sealed lead-acid (SLA) batteries, also known as valve regulated lead-acid (VRLA).

Such cells are big and heavy because of their low energy-to-weight and energy-to-volume ratios. But they do deliver high surge currents. That means they're ideal to provide instant backup during a mains failure or to power up a generator.

Difference between 'design life' and 'service life'

Most SLA batteries have either a five or 10-year design life. In effect, a 10-year battery will last for 10 years, assuming perfect operating conditions.

However, there's no such thing as "perfect" conditions. There are too many factors, such as operational temperatures, that impact on a battery's lifespan.

That's why EUROBAT (Association of European Automotive and Industrial Battery Manufacturers) guidelines state a battery reaches its end of service life when capacity falls below 80% of the original figure.

It's recommended you replace 10-year design life batteries in years seven or eight. This takes into account all the factors that can reduce lifespan and provides a safe enough margin for potential failure.

There's an equivalent performance drop-off in five-year design life batteries, which is why they should be replaced in year three or four.

UPS batteries tend to follow the well-known "bathtub curve of failure", namely there's a relatively high but decreasing number of early failures caused by manufacturing defects, then a constant low level of random failures during the normal UPS working life. Finally, there's a dramatic increase – known as wear-out – towards the end of working life.

Batteries can account for more than 98% of critical UPS failures at the latter stage.

Factors affecting battery lifespan

Temperature

High temperatures tend to be the most common cause of premature UPS battery failure. The higher the temperature, the quicker the chemical reaction, which increases water loss and corrosion. SLA battery capacity is based on optimum operating temperatures of 20-25oC. Service life will halve for every 10oC temperature increase. Note that short-term temperature fluctuations have little effect on battery lifespan.

Frequency and depth of charge

Each battery has a finite number of discharge and recharge cycles. Each discharge slightly reduces the battery's capacity. Partial discharges have less of an impact than full ones.

Operational voltages

Overcharging batteries above the manufacturer's recommendations produces excessive hydrogen and oxygen gases, which will cause batteries to dry out. Undercharging can result in sulphate crystals forming on the

plates. These harden over time and reduce battery capacity.

Ripple current
AC ripple generated by the UPS rectifier, charger or inverter is a big cause of overheating, which speeds up the deterioration of the battery poles and eventually leads to premature failure.

Poor storage of unused batteries
Even unused UPS batteries automatically discharge small amounts of energy. So if you're holding batteries for a prolonged period before use, it's recommended to top them up every few months and store them at a maximum temperature of 10oC.

Incorrect battery application
UPS batteries deliver high rates of energy for a short time, typically a few minutes. Other batteries, for example backing up switchgear or telecoms, can provide several hours' autonomy. Using a battery designed for telecoms with a UPS system won't perform as well as one manufactured specifically for that task.

Common conditions that limit battery lifespan

Grid erosion
Several conditions will reduce battery life. First of these is grid corrosion, which occurs in a battery that has been in service longer than its expected lifespan. Normal chemical reactions in the battery cause corrosion, such as shedding lead from the plates.

Sulphation
Sulphation is common in stop-start battery applications like a UPS. It happens when the battery doesn't get a complete charge and results in sulphate crystals forming at the plate terminals and within the electrolyte. The condition increases internal resistance, leading to a longer charging cycle. As long as the degree of sulphation isn't too high, you can recover batteries by charging them at a higher current for around 12 hours.

Dry out
Dry out or water loss is caused when overcharging increases the concentration of acid in the electrolyte and leads to a decline in capacity over time.

Thermal runaway
Another condition is known as thermal runaway, where an increase in battery temperature, in turn, releases energy that causes a further rise in temperature. That's because the heat inside the battery can't escape through the safety vents of the sealed cells, causing increased temperature around the outside of the battery, causing a similar knock-on effect within the battery.

Short circuits
These take place when the paste on the positive electrode becomes porous and leads to a loss of contact between the electrode and the grid.

Top mossing
Inaccuracy during the initial battery design process, such as poor alignment of the separators and plates, can result in a final condition, known as top mossing. That's where a crystalline moss forms, which can result in the cell self-discharging.

Steps to prevent premature battery failure

The good news is there are several steps you can take to maximise the service life of UPS batteries. Proactive battery maintenance, monitoring and testing are paramount.

At the bare minimum, batteries should be manually monitored at the individual cell level at least annually. Basic physical tests cover the inspection of terminals for corrosion, looking for any leaks, cracks or swelling, and tightening inter-cell connections.

More advanced support comes in the form of battery monitoring systems, which record measurements such as the number of cycles, float voltages and cell temperatures.

There are also several types of test which can help determine whether a battery is approaching its end of service life.

High temperatures tend to be the most common cause of premature UPS battery failure. The higher the temperature, the quicker the chemical reaction, which increases water loss and corrosion

Impedance testing
Firstly, impedance testing is a non-intrusive method to build up a "history" of each cell which makes it easier to identify any signs of weakness. It doesn't require batteries to be taken offline, but it only gives a broad indication of their general condition.

Discharge testing
Also known as load bank testing, this is much more thorough as it tests the batteries under normal and peak load conditions. It does require the batteries to be taken out of service, at the worst-case for several days, but usually for less than 24 hours.

Partial discharge testing
This offers something of a middle ground. This discharges the batteries by up to 80%, reducing their availability, but they should be fully available again within eight hours. If there's an emergency meaning the UPS needs to run off batteries, it still has 20% capacity to fall back on.

Battery care systems
Most modern UPS systems now incorporate battery care systems that automatically test the cells at regular intervals, protect against ripple currents and offer a range of recharge methods.

What else can you do?
Try and keep UPS batteries at their optimum operating temperature of 20-25oC. This might mean installing air conditioning if the batteries are internal to the UPS or stored in the same room. Of course, with larger installations, you could house the batteries in a separate temperature-controlled room, while the UPS and other IT equipment runs in a separate space, often at a higher temperature.

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Getting warmer

John H. Waggoner, senior instructor at FLIR's Infrared Training Centre, highlights why infrared thermal imaging devices make sense for electricians.

Heat is a byproduct of operating any sized electrical circuit. Most problems in electrical systems display themselves in terms of heat. Electricians must be able to classify a circuit as normal when the load is on, or identify when it is abnormal and identify the issues that presents – finding hot spots that need attention.

In recent years, new infrared thermography – also called thermal imaging – has come on the market. The non-contact method includes cameras that help electricians and service technicians find and solve problems quicker and more safely. The newest cameras combine both thermal imaging and electrical measurement features in one inspection, troubleshooting, and diagnostic tool that speeds up the process and provides much better information on which to base repair work.

Methods for inspecting and analysing electrical systems

In the past, the only way electricians had to inspect and analyse electrical systems was with hands-on testing – usually done after turning off the power to make sure it was electrically safe. Electricians typically go in with testing equipment and tools to connect test leads to determine if there are any issues. Many used contact measurement techniques featuring thermocouples, which produce a temperature-dependent voltage that can be interpreted to measure heat.

With these traditional inspection and maintenance methods, electricians cannot see all the possible issues, but instead must rely on guesswork, checking out connections one by one. This method does not guarantee that heat-related conditions will be solved, because turning off the power removes the load. One can measure if a circuit is overloaded,

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but when the power is off it is not always possible to know for sure if the problem in the circuit was fixed.

In recent years, electricians also began using spot radiometers: small hand-held non-contact devices that can be pointed at a target to obtain a temperature measurement. Radiometers provide acceptable measurements within certain limits, but no visual imagery is available.

A step up from direct measurement and spot radiometry is thermal imaging, which detects infrared energy emitted from an object, converts it to temperature, and displays an image of temperature distribution, called a thermogram. Since infrared radiation is emitted by all objects with a temperature above absolute zero, thermography makes it possible to see the environment with or without visible illumination.

Thermal imaging provides electricians with a far higher ability to analyse, recommend, and diagnose. With thermal imaging, one can use a camera on a circuit breaker to determine if connections are loose, if there is too great a load on the breaker, and if there are any issues with the breaker contacts. Electricians can find the problem, fix it, then go back with the thermal camera and take an image to verify that the work done has actually solved the problem. In the past, it was very difficult to assure customers that work done had really fixed the problem. Now electricians frequently provide their customers with "before" and "after" imagery.

A wide range of electrical equipment can be inspected with thermal imagers, including transformers, switchgear components, breakers, fused disconnects, non-fused disconnects, conductors, terminations, contactors, control wiring terminations, buss duct (open and enclosed), distribution and branch circuit breaker panels, and motors.

Benefits and advantages of thermal imaging

In effect, thermal imaging allows electricians and electrical technicians to picture heat that the eyes cannot see. This has three main benefits. First, it is a non-contact approach, so electricians do not have to actually touch electrical equipment to determine if the heat is within normal operating temperatures or has moved into abnormal temperatures.

Second, electricians can use thermal cameras as a visual tool to demonstrate to customers the severity of electrical problems. Infrared cameras produce an image of a target that is similar to visual photographs. Many also produce a visual image that can be placed next to the thermal image for a side-by-side comparison. This helps the electrician show customers the exact location and nature of potential faults.

The third benefit is that thermal imaging can be performed in real-time. Over the past decade, video-capture technology for infrared cameras has greatly improved. This allows electricians to observe and analyse electrical equipment as it heats up and begins to operate, as it operates under normal conditions over time, and as the target cools down. There is also the ability to watch fast-moving targets, as the recording speed, or frames-per-second (FPS), has improved. Cameras that record at higher frame rates allow the user to observe targets that are changing temperature rapidly, or those that are moving very fast. The equipment now allows us to see that fast transition of temperatures or fast transition of the targets.

Key application areas for thermal imaging

Thermal imaging is used in three general application areas. Utilities rely on it extensively for medium and high voltage equipment (overhead lines and connections), and for substation equipment (breakers, switches, transformers, capacitors, and voltage regulators), to name a few. Thermal imaging is also used for voltages below 1,000 volts, largely for enclosed equipment that supports industrial and commercial operations.

The third category, the newest level of application, is the residential market. Home inspectors and electrical service and HVAC service companies have started to purchase and use thermography for troubleshooting and inspection of residential electrical systems. The growth in this market is due to IR cameras becoming more affordable over the past decade.

Thermal imaging equipment available to electricians

There is a wide range of thermography equipment for electricians, varying from low resolution cameras costing £300 to high resolution cameras costing more than £30,000. The difference among thermal imaging resolutions affects how close one needs to stand to image a target, and the different accessories available for viewing and adjusting the camera and measuring temperature.

At the low end, one can simply select an attachment to a smartphone (both iOS and Android), with some devices containing an 80 x 60 pixel resolution long wavelength infrared (LWIR) camera. Higher-end thermal imaging technology can produce up to 1024 x 768 pixel images. Dynamic focus control, continuous autofocus, and a user-friendly interface with an ergonomic design and rotating optical block make it easier to do numerous inspections in one day and to scan at difficult angles.

Since infrared radiation is emitted by all objects with a temperature above absolute zero, thermography makes it possible to see the environment with or without visible illumination

Another option that has recently come on the market are meters that combine thermal imaging with electrical measurement features in one inspection, troubleshooting, and diagnostic tool. These new meters can take voltage, current, and millivolt drop measurements while also taking an infrared image with the same device.

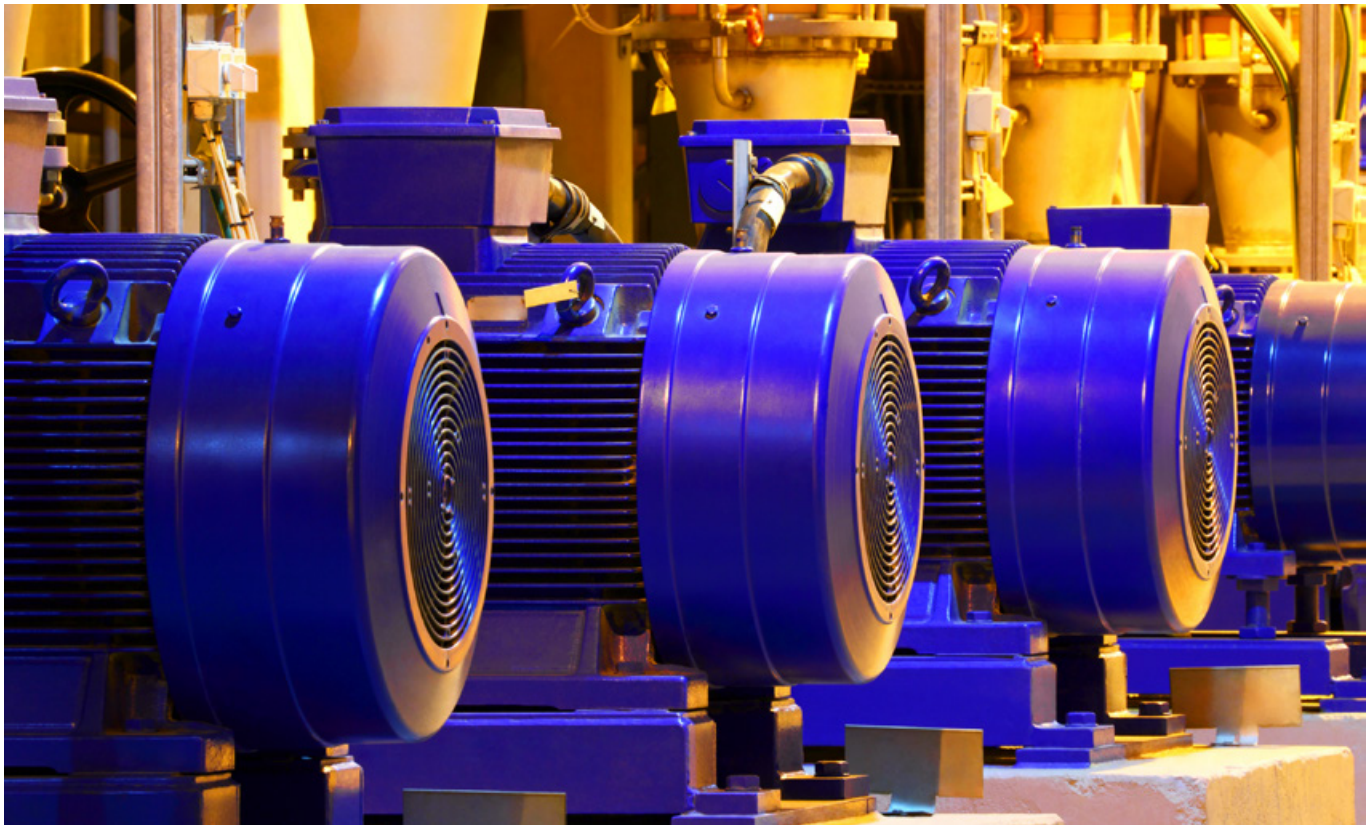
This offers more information for an electrician or technician to make a determination, provides images to confirm the electrician's diagnosis, and offers proof showing where the problems are. Combining several tools into one reduces the total amount of time it takes to diagnose issues and increases a technician's speed. It also makes the technician more skillful at troubleshooting, repair, and maintenance work.

Thermal imaging solves real problems

Thermal imaging has been used all over the world to diagnose and solve electrical system problems. The main image of this article shows a large junction box where one conductor was hotter than the eight others. Using the thermal imaging camera, technicians located it not in the box, but 45m back. It would not have been possible to locate this serious issue any other way.

Motorise your energy savings

It's almost impossible to think of a business that doesn't use electric motors. In industry, they power the manufacturing processes, and in virtually every commercial building they drive the systems that provide a comfortable working environment. Motors also use a lot of energy. According to the Carbon Trust, a 2.2 kW motor typically costs around £2,300 a year to run. This makes energy efficiency of motors a key concern for every business owner and manager, says **Julian Grant** of Chauvin Arnoux.



It's widely reported that motors consume around half of all electricity used worldwide, and that they account for more than two-thirds of the electricity consumed by industry. The actual figures vary a little according to the source, but that really doesn't matter. The take-home lesson is that, whatever business you happen to be in, you're almost certain to be spending a lot of money on electricity to power your motors and, in addition, the energy they consume is adding to your carbon footprint. These are two excellent reasons to look at motor efficiency, but how do you go about it?

Paradoxically, the first step doesn't even involve identifying the individual motors on your site. Instead, it's to monitor the electrical supply, ideally using a portable energy logger (PEL). Two important things to look for are voltage imbalance between the phases and poor power factor. A voltage imbalance of just a few percent will reduce the efficiency of every motor on your site, so it's well worth identifying and correcting. The corrective action may, for example, involve redistributing single-phase loads between the phases so that the phases are loaded more equally.

I won't go into detail here about power factor, but in summary, the power consumed by a motor (apparent power) is made up of two components: active power and reactive power. You pay for both, but only the real power does useful work. The ratio of the active power to the apparent power is known as the power factor, and the nearer this is to 1.0, the less money you're spending on useless reactive power.

If a site has a poor power factor, relatively inexpensive equipment can be installed to bring it nearer to 1.0 and cut energy costs. Power factor correction can also be provided for individual motors, although this is usually only worthwhile with large motors, and for groups of motors that usually operate at the same time.

With phase imbalance and power factor out of the way, it's now time to look at the energy saving opportunities associated with individual motors. Start with your biggest motors first, because this is where you're likely to be able to make the biggest savings. It will often be worth installing a PEL either temporarily or permanently, as this will provide a lot of useful information. The log will, for example, show exactly when the motor was running, which is important because a good way to waste energy is to leave the motor running when it's not needed – during tea and lunch breaks, for example.

Data from the PEL will also let you work out whether the motor is oversized. This is a significant issue because the efficiency of a standard induction motors falls as the load on it decreases and, below about 50% of its maximum loading, its efficiency will be decidedly poor. So, if the log reveals that the motor spends its whole life lightly loaded, it might pay for you to fit a smaller replacement.

The PEL, particularly if you leave it in place for a while, will additionally provide you with invaluable baseline data about the power consumed by the motor, which you can later compare with the consumption after you've made improvements to make sure that you're achieving the gains you expected.

Next, look closely at how the motor is controlled. If it has simple start-stop control – that is, it's either running at full speed or stopped – you may well be able to make big savings by fitting a variable speed drive (VSD), especially if the motor is driving a fan or a pump.

Fan and pump systems have to be designed to cope with worst-case conditions. A fan in a building climate-control application must, for example, be able to move enough air to keep the building cool on the hottest day of the year. On every other day of the year, it is shifting too much air and so throttles and dampers are included in the system to reduce the airflow. But with simple start-stop control, the motor still runs at full speed using just as much energy on a cool day as it does on the hottest day!

A much better solution is to fit a VSD so that the speed of the fan is automatically adjusted to give the actual airflow required at any particular time. Assume that this means the fan runs at 80% of full speed for most of the time (which is by no means unusual), the energy it uses is reduced by 50%. Even if it's only that 2.2 kW motor mentioned in the introduction, this is a saving in energy costs of over £1,000 per year, so the cost of fitting the VSD will be very soon recovered.

In fact, for those who act quickly, there is even a government incentive for fitting approved VSDs. This is the Enhanced Capital Allowance (ECA) scheme that allows the whole cost of purchasing and installing the VSD to be offset against corporation tax in the year that the work was carried out. Fast action is need, however, as the scheme ends for new product purchases within the next couple of months. You'll find more details on the website of the Department for Business, Energy and Industrial Strategy.

There's just space left for a few words about intrinsic motor efficiency. Motor efficiency is classified in line with the IEC 60034-30 standard that was introduced in 2008 and updated in 2014 as IEC 60034-30-1. The motor efficiency classes are designated IE1, IE2, IE3, IE4 and IE5, with IE1 the least efficient and IE5 the most efficient. All AC induction motors placed on the market in the EU since January 1 2017 have had to either meet the requirements of IE3, or of IE2 if they are equipped with a VSD.

The motors you already have may be in a lower category, so is it worth replacing them? The answer is almost certainly no. The more efficient motor will cut your energy bills, of course, but probably not by enough to offset the cost of the new motor over a realistic timescale. The situation is somewhat different, however, when a larger motor has failed, and the choice is between having it rewound and replacing it. Each case will need to be decided on its merits, but in these circumstances, installation of a new high-efficiency motor may well be justified. It's worth noting that such a replacement may be covered by the ECA scheme discussed in relation to VSDs.

Start with your biggest motors first, because this is where you're likely to be able to make the biggest savings

Just one small word of caution. The vast majority of motors in use today are induction motors, but to achieve ever higher efficiencies, motor manufacturers are now offering new types, including permanent magnet and reluctance motors. If you are contemplating replacing an older motor with one of these, it is essential to confirm the compatibility of the control system and, if one is fitted, the VSD.

Whether you previously knew it or not, a large part of your electricity bill is almost certainly for energy consumed by motors. A little time spent measuring and monitoring the performance of your motor estate can therefore pave the way for very significant savings, which you will be able to quantify and confirm by continuing your monitoring after putting in place your energy saving measures!

Top of the class

When it comes to building management, increasing concerns surrounding climate change are causing young people's attitudes to shift. Here, **Karl Walker,** market development manager at Beckhoff, and **Jamie Finnan,** managing director of TR Control Solutions, explain how students can now take more responsibility for managing the energy efficiency of their own schools and colleges.

It is often argued that school education only teaches you how to pass exams, but not how to deal with real life issues when you become an adult. Learning about volcanoes, the history of our country and foreign languages of course plays an important part in forming a bigger picture of how life on earth works, but when it comes to everyday living, such as applying for a mortgage, running a household and paying bills many of us have had to learn 'on the job'. But could this be changing?

With the rise of the Internet, and in particular social media over the past decade or two, we have access to more news, images and opinions than ever before, and the effect this has had on society is perhaps demonstrated best by the current crop of school and college students. Thanks to modern technology, students now have the opportunity to manage the energy performance of their own schools and colleges, something Beckhoff has been involved with through its work with ecoDriver from TR Control Solutions.

Perhaps if we give students the trust, responsibility and, crucially, the tools to positively affect the environment they occupy, they will learn the skills to make a big difference in the long term

ecoDriver BEMS is an interoperable supervisory control solution which provides a transparent 'single pane of glass' view of a building's systems. The ecoDriver gateway integrates with building control systems and sensors and securely transfers building operation data to the ecoDriver cloud service. By analysing a building's energy consumption against its control strategy, ecoDriver BEMS can identify anomalies in a building's operation, modify as appropriate so that the building operates within its 'sweet spot' and maintain the optimised performance level to retain savings.

Beckhoff's solutions deliver the gateway technology used to connect a variety of building control services with the ecoDriver BEMS solution. Building control services often supplied by different vendors and manufacturers tend to grow and change over time using a variety of communication interfaces and protocols.

These systems are rarely integrated; for example HVAC, DHWS and lighting controls will generally be independent of each other. Beckhoff's interoperable technology can integrate with existing building controls and securely transfer data to the ecoDriver IoT cloud service using the lightweight MQTT messaging protocol.

Locally, Beckhoff technology utitlises numerous communications protocols including BACnet, Modbus, M-Bus, DALI and KNX to name a few, thus providing a supervisory control layer which normalises and centralises services within the ecoDriver BEMS platform. Beckhoff's expandable technology also provides the backbone for growth with the option to add more building controls and physical IO.

Climate crisis

One of the biggest, or possibly the biggest, news items over the past couple of years has been climate change. In a recent BBC interview, legendary broadcaster and naturalist Sir David Attenborough stated, "The moment of crisis has come". Those words from a renowned expert carry significant weight however old you are. Add them to the actions and messages of Greta Thunberg, who has captured the imagination of many young people with rousing speeches to world leaders imploring them to reduce our emissions, and it is inevitable that action will be inspired in one form or another.

In February last year school pupils across the UK staged an organised 'strike' in a bid to urge the government to do more to tackle the threat of climate change. But there comes a point where strikes and organised marches are not enough. Perhaps if we give students the trust, responsibility and, crucially, the tools to positively affect the environment they occupy, they will learn the skills to make a big difference in the long term. In some schools, this is already taking effect.

School project

ecoDriver has been working with schools for 15 years, and with tighter budgets there is increasing pressure to find cost savings wherever possible. A common view is that the cost of utilities is ring fenced within school budgets, e.g. "that is what it cost last year, therefore we need to budget the same +10% for this year, so savings need to come from elsewhere".

This needn't be the case, ecoDriver has delivered savings of between 10-51% on school energy consumption. In one example, the school's actual energy consumption was three times higher than the building design estimate. There was no visibility of consumption profiles for the local premises team, and the BMS schedules, setpoints and exceptions had not been configured correctly.

To resolve these issues, automated main meter data capture and

reporting was integrated using ecoDriver, which subsequently allowed energy profiles to be displayed, reviewed and modified accordingly. A systematic approach to energy reduction was also implemented, which enabled the local premises manager to modify schedules and setpoints. The result was a 41% energy saving in less than four months.

But it is not just about reducing the cost of energy. With their futures at stake, students are becoming the most engaged and focused group when it comes to understanding the need for a significant reduction in CO2 emissions. To give them the responsibility of running their building efficiently, ecoDriver makes a school's energy consumption visible to students in easy to understand charts, building layouts and reports, which empowers these young 'eco warriors' to do what they can to reduce waste. It also stimulates ideas and opportunities for the schools to reduce waste further.

Perfect harmony

Returning to the earlier point about schools teaching students about real life situations, by handing them the responsibility of looking after their school's energy performance they are gaining valuable life experience at an early age that will prepare them well for their future careers.

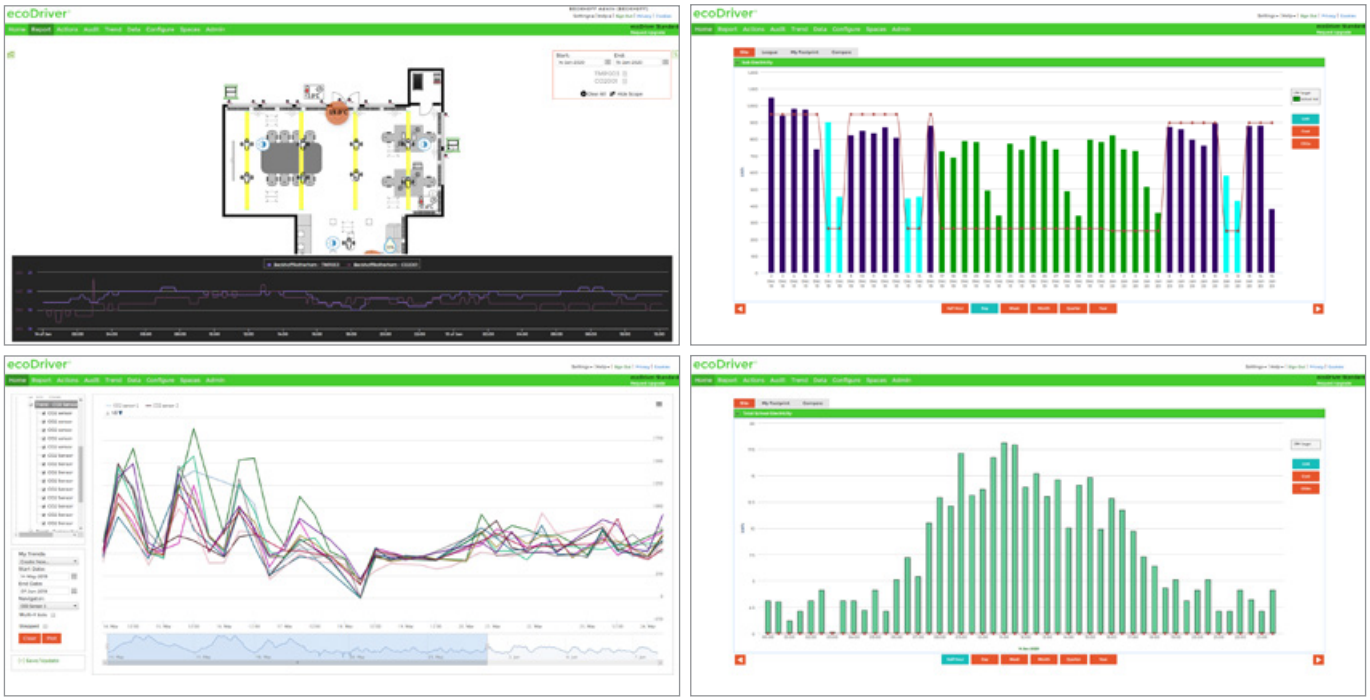
This is a view shared by Richard Dunne, a former headteacher who founded the Harmony Project in 2018. The Harmony Project recognises the impact of human activity on the natural world, and humankind's increasing disconnection from nature. Education is one of the sectors in which Richard has applied Harmony and he believes that by rethinking environmental education so that it is at the heart of learning, schools can encourage their students to actively engage with pressing environmental issues at the same time as teaching them valuable life skills.

Richard says, "For the most part, sustainability in education is seen as an add-on. It might be presented as a one-off environmental day or eco week. It will almost certainly be presented outside of the formal curriculum. It may engage the interest of a good many students, but the mere fact that it is not integrated into the broader curriculum means that the opportunities to link learning together are unlikely to be explored."

By rethinking environmental education so that it is at the heart of learning, schools can encourage their students to actively engage with pressing environmental issues

He adds, "We need to find ways to bring learning together around purposeful projects and give students a lead role in showcasing the outcomes of their research and the issues they want to address through this process."

So, are the days of parents nagging their teenagers not to leave their bedroom lights burning when they go out finally over? Perhaps we are seeing the start of a generational revolution different to anything we have seen before. With the technology now available to them, today's students really can play a leading role in managing their own environment at a local level, and this will have positive repercussions on a regional, national and even global scale now and into the future.



When two become one

Alex Emms, operations director at Kohler Uninterruptible Power, looks at how a UPS and generator can complement one another to form a complete standby power solution.

Operators of any data centre with mission-critical loads must ensure uninterrupted power under all circumstances. However, while the UK Power Network's electricity network is built to withstand the intense storms that can affect any part of the country at any time, extreme weather can affect overhead power lines. Accordingly, although the organisation has emergency plans and engineers ready to deal with situations as they arise, data centres should also have their own plans in place.

Such plans must include provision for power cuts lasting several hours or possibly days, as well as those of just seconds' or minutes' duration. This in turn calls for an on-site generator to back up the UPS, as all battery autonomies are finite, and susceptible to being exceeded by a sufficiently extended blackout. Additionally, there is no point in having battery autonomy that is not matched by air conditioning that can maintain safe operating temperatures for the UPS throughout the blackout.

The first step is to recognise that UPSs and generators complement one another in operation, and the second is to ensure that they synchronise smoothly and safely when the power fails.

The UPS is the front line

If a data centre is regarded as mission-critical, it will almost certainly have an online UPS. During normal, 'mains OK' operation, the incoming power flows through the UPS rectifier and inverter components before reaching the load. This means that the load is continuously protected

from mains-borne noise, surges, spikes, brownouts and any other aberrations, as well as short-term power cuts safely within the UPS battery autonomy. Under these circumstances, the UPS is providing full protection without support from the generator, which remains on standby.

However, if the UPS control system detects that an ongoing blackout is becoming a threat to its battery autonomy, it could signal the critical load, allowing it to shut down gracefully within the remaining autonomy. Alternatively, if losing the data processing resource is not an option, the UPS must start interacting with an on-site generator.

The UPS's role is then to maintain the supply until the generator can start, stabilise and take over seamlessly as the power source. Assuming the generator has been correctly sized for the application, the UPS will accept it as a 'mains replacement' for recharging its battery and supplying the critical load until mains power is restored. This period can be indefinite, subject only to continued availability of fuel for the generator.

The generator as a standby power source

To correctly specify an optimally matched UPS/generator power protection pair, it's necessary to look more closely at the generator characteristics and requirements.

The generator converts stored energy – fuel – into electrical energy. It comprises the fuel itself, an engine to develop mechanical energy, and an alternator to convert the mechanical energy into electrical form.

The engine must be well maintained with an adequate fuel supply at all times. The battery must be healthy enough to assure reliable starting on demand, while coolant and oil levels should be regularly checked.

To ensure the generator performs reliably as a power protection component, it must be correctly sized as well as matched to the UPS

The engine drives an alternator, which converts mechanical power into an alternating supply of typically either 230V single-phase or 400V three-phase in the UK. This output voltage's amplitude and stability is controlled by an Automatic Voltage Regulator (AVR) while the frequency – usually 50 Hz in the UK – is determined by the engine speed. Engine speed and supply frequency are set by a governor, which regulates the fuel supply to the engine; more fuel increases speed and frequency.

Both mechanical and electronic governors are available. Mechanical governors, although lower cost than electronic types, are less responsive and provide less stable engine speed and voltage frequency regulation. An electronic governor counts teeth on the alternator's flywheel as it rotates and regulates the fuel flow accordingly. Electronic governing is highly responsive and offers very stable speed and frequency regulation; accordingly, it is usually specified for any standby generator intended for pairing with a UPS system.

A UPS standby generator should have a mains-powered engine water heater and battery charger. It must also communicate when it starts and stops in response to mains supply failure and subsequent restoration. This is usually handled by an Automatic Mains Failure (AMF) panel that includes the necessary signals. Fig.1 shows how an AMF panel is used with a generator as part of a protected power installation.

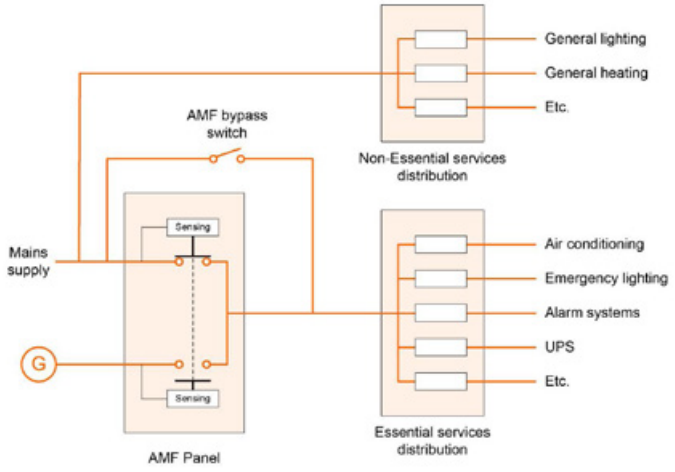


Fig. 1: Typical protected power installation with AMF panel, mains failure detection and changeover

To avoid the AMF starting the generator for every short supply aberration, it is usually set to operate only if the mains fails for an extended time of typically two to 10 seconds. Similarly, the AMF should not stop the generator and switch the UPS back to mains supply immediately after it is restored; the reconnection may be part of the utility company's fault location procedure or the result of an automatic breaker operation. The fault may still exist, causing the supply to be disconnected again almost immediately. Accordingly, most AMF-controlled generators are set to continue to supply power for at least two minutes after the utility supply is restored.

The UPS can sense the brief power interruptions during changeovers at both the beginning and end of the blackout, and uses its batteries to prevent these interruptions reaching the load.

Any mains changeover solution should also consider the method used to switch the neutral conductor during the mains failure. It is usual to employ four-pole switching in the UK; short interruptions in the neutral plane are accepted as many sites now have generators and hence four-pole changeover.

Generator sizing

To ensure the generator performs reliably as a power protection component, it must be correctly sized as well as matched to the UPS. In fact, it should be oversized, especially as it usually supports more equipment than the UPS; air conditioning to cool the equipment as well as emergency lighting, communications and alarm systems.

As a 'rule of thumb', 1.5 times the nominal capacity should be allowed for transformerless UPSs, and three times the nominal air conditioning running capacity should be allowed for the air conditioning.

Conclusion

If a data centre is providing a critical ICT resource that has to remain online under all circumstances, then an on-site generator must be provided to back up the UPS if a long-duration blackout occurs. Additionally, for successful operation as part of the power protection strategy, the generator must be carefully matched to the UPS characteristics and sized sufficiently to handle all the emergency power needed during a blackout.

The right fit

Mark Coughlin, applications manager for reserve power at EnerSys, highlights the importance of choosing the right battery for your UPS.

Today's data centres depend on uninterruptible power supplies (UPS) to provide clean, continuous power throughout the facility's entire operational life. While the mains supply is available, the UPS protects the data centre's sensitive information and communication technology (ICT) equipment from any power aberrations appearing on the incoming power feed. If the supply fails, the UPS battery must take over instantly, supporting the load until either the mains is restored, or a generator can be started, or the data centre systems can be shut down safely.

A UPS battery's ability to store energy reliably and efficiently during normal operation, making it immediately available to the load during a mains failure, is critical to data centre security. In this article, we review the key battery technologies currently available, to inform commercial and technical specifiers responsible for battery selection.

We will first look at how data centre evolution is affecting the demands placed on batteries. Then, compare lead-acid, the pre-dominant battery chemistry used within data centres, with Lithium-ion (Li-ion), which has been generating rising interest in recent years. Finally, we will examine why data centre operators should consider advanced Thin Plate Pure Lead (TPPL) technology to optimise their UPS and power system performance.

While Li-ion has been slow to replace lead-acid in data centres, advanced TPPL technology offers the best of both chemistries

The evolving data centre landscape

Data centres today experience rising numbers of power outages and grid fluctuations while, simultaneously, their workload is expanding. These factors increase pressure for 'best in class' technologies and reliable power.

UPS batteries are directly impacted by reduced autonomy times, now typically between 30 seconds and five minutes, compared with historical averages of around 15 minutes. This is because of the shorter times needed to start up generators and switch loads. Fast recharge times are also desirable, quickly readying batteries to support further power outages.

Energy efficiency now concerns all data centres, not just because of costs, but also through pressure to reduce carbon footprint. There is also growing interest in using UPS battery assets for revenue-generating energy storage applications.

Battery technologies and trends

The two UPS backup battery chemistries that currently dominate the data centre industry are lead-acid, which represents over 90% of the UPS market share, and Li-ion, which is attracting increasing interest due to its purported performance benefits and high visibility through its use in electric vehicles.

Compared to traditional VRLA equivalents, Li-ion offers a high cycle life, together with significant size and weight reduction. Li-ion batteries also have high charge efficiency, with excellent partial state of charge tolerance – in fact, partial charge is preferred for long cycle life while operation in float conditions at full state of charge is avoided. Li-ion self-discharge rate is also low, resulting in prolonged storage shelf life. Finally, it has good high and low temperature performance, and no gas emissions.

However, Li-ion has challenges along with its benefits. Despite historical cost reductions, pricing remains a barrier for many users. Furthermore, although space-saving may be important within data centres, weight reduction, which Li-ion batteries offer, is seldom critical. Similarly, the high cycling capability of Li-ion isn't essential to UPS applications, where batteries mostly float at near full state of charge.

While considered a safe technology, any Li-ion solution, unlike lead-acid, must include a battery management system (BMS) to ensure safe charging and discharging. This increases complexity, and requires users to thoroughly understand Li-ion technology. However, the BMS provides built-in diagnostics, which identify most problems and allow minimal maintenance.

Additionally, the MTBF (Mean Time Before Failure) of the electronic components factored into Li-ion calendar lifetime calculations must be considered. 15-year lifetimes are claimed, but service life is not field-proven. By comparison, advanced TPPL, with 12+ years design life, provides eight to 10 years' service life, while traditional VRLA 10-year design life batteries typically provide five to six years' service life.

To fast-charge Li-ion, higher charging capacity, with increased cost, may be required. Also, the charging architecture would often need replacing or changing to support different Li-ion battery charger voltages, so two different UPS rectifier types would be required across a data centre deploying both Li-ion and lead-acid batteries.

For delivery, Li-ion faces legislative shipping restrictions, while lead-acid batteries, including AGM and TPPL, are classified as non-hazardous for all transportation modes. Then, at end-of-life, lead-acid has inherent value, and is about 95% recyclable by a very well-established network of smelters; this possibility, however, is not mature for Li-ion.

TPPL: Optimised performance without the drawbacks

While Li-ion has been slow to replace lead-acid in data centres, advanced TPPL technology offers the best of both chemistries.

As a lead-acid based battery technology, TPPL is reliable, well-proven,

and easy to transport, handle and recycle. Crucially, advanced TPPL technology significantly improves energy efficiency, by providing up to 43% energy reduction compared with traditional VRLA batteries through reducing float current requirements. Further energy savings accrue as it can operate, within warranty, at elevated temperatures, reducing air-conditioning requirements.

Meanwhile, advanced TPPL battery technology reduces data centre vulnerability to multiple mains blackouts, through very short recharge times and time to repeat duty. For example, with 0.4C10 A charging current using fast charge methodology, TPPL can be fully recharged, following a one-minute discharge to 1.6 Vpc, in 2.5 hours, and ready to repeat duty in 22 minutes.

Battery replacement costs are also reduced through low internal corrosion rates, yielding a service life 25% longer than for traditional VRLA. Additionally, storage life is increased from six to 24 months due to low self-discharge rates.

Advanced TPPL technology is used today in many demanding critical applications, including UPSs within data centres. Autonomies of under five minutes are supported.

What of the future?

Lead-acid technology is expected to dominate the market for at least the next few years, although Li-ion activity will continue to grow. In particular, applications requiring high cycling will be seeking advanced TPPL or Li-ion solutions.

Depending on the application, Li-ion could be the preferred battery type. Nevertheless, before opting for Li-ion, a full consideration of the requirements should be undertaken. This should reflect the Total Cost of Ownership, with the benefits and challenges of Li-ion compared against other available technologies, including TPPL.

Irrespective of the technology chosen, battery monitoring systems will become increasingly popular, due to the battery condition visibility and predictive maintenance opportunities that they provide. This will also bring UPS applications into the Internet of Things (IoT) environment, making them visible as components of the larger data centre infrastructure.

The human cost of late payment

Rob Driscoll, ECA director of legal and business, discusses the devastating effects of late payment impacting businesses and individuals across the sector.

Thanks to cross-industry initiatives like 'Mates in Mind', mental health is finally making its way to the top of many contractors' agendas and the links between obstructive payment practices and poor mental health are beginning to surface.

A 2019 survey, aimed mainly at business owners, CEOs and managers, was run by ECA and BESA, in association with the Prompt Payment Directory and 25 other industry bodies.

Shocking statistics

Of all the respondents, over nine in 10 said their business had faced payment issues and nearly two-thirds said they were paid late frequently or very frequently. Nine in 10 also said they suffer an array of mental health problems due to the pressures of late or unfair payment, including stress, depression, extreme anger, anxiety and panic attacks.

"Everybody expects businesses to deal with everyday pressures, but stress and other mental health impacts come from sustained and excessive pressure," says ECA's director of CSR Paul Reeve. "It's absolutely clear from these findings that poor payment is a serious cause of mental health issues across the industry and that the problem, far from being isolated to certain individuals, is commonplace even among top management."

Over four in 10 said that payment issues had strained their relationship with their partner, with 5% saying that it caused it to break down entirely. Four respondents said they had attempted suicide as a result of the effects of late payment.

A destructive chain reaction

The survey also shed light on the concrete business impacts of late payment. More than a quarter said that they had been, or had almost been, brought to the brink of bankruptcy or liquidation as a direct result of late payment.

The most common measure taken by business owners to cushion the blow of late payment to employees was to cut or stop their own pay for a period of time, with close to two thirds having done so. A quarter had delayed or cancelled staff social events, and more than one in 10 had stopped or reduced staff perks such as company phones, cars or health insurance.

Alarmingly, almost one in 10 employers were forced to pay their own staff late – an action which can have devastating effects on employees, who may then miss mortgage or rent payments as well as other vital overheads such as utilities and loan repayments.

"These problems quickly knock on to employees and families alike," adds Reeve. "Findings such as these mean that clients and other buyers need to greatly improve their approach to supply chain payment and it's a sad reflection on the industry that it will probably need legislation to achieve it."

"Systemic payment abuse causes broken lives and even broken buildings, and it must be stamped out," adds BESA CEO David Frise. "The economic damage of these practices is well known but this survey has shed light onto its devastating human cost. Thousands of owners and workers of SMEs have struggled and suffered with this abuse for too long."

What's being done?

The survey supporters are all part of a wider industry coalition pressing government to reform the practice of cash retentions in construction, widely considered to be one of the most unfair and abused payment practices across the industry.

The BESA and ECA, along with other bodies, continue to push the issue of fair payment towards the top of the Government agenda. One example is the active support for Peter Aldous MP with drafting the Aldous Bill, a private members' bill which aimed for the mandatory ring-fencing of cash retentions – some £7.8 billion of retentions money has gone unpaid for the last three years.

The Government must take immediate action on cash retentions and other payment abuse, by legislating for change. Doing so will help to address the serious findings in this survey and actually help construction to achieve its dual aspiration of delivering excellence for clients and being an industry that's attractive to new talent.

Plus ça change...

The construction industry contributes £117 billion to the economy. Simply put, the UK could not prosper, let alone function, without it.

Despite this, construction bears the brunt of every economic downturn and its employees suffer for it. With notoriously low margins and high insolvency rates, payment problems will continue to be endemic in the industry and prevent it from investing in desperately needed skills, technology and growth.

That is, unless a sea change takes place soon.

Red Arrow introduce Discus, the new 'smart' surface mount downlight

Harnessing the unique agility of LEDs, Discus has been designed and engineered with features that deliver energy, labour and cost-saving benefits for both user and installer. The new 'smart' Discus is equipped with a smart, fully adjustable mounting bracket, retaining springs and slide adjustment, ideal for retrofit applications to replace recessed downlights.

With the ability to fit any ceiling cut out between 65mm and 205mm; be mounted onto a suspended or monolithic ceiling; and wall mounted, it makes retrofitting a simpler task, while facilitating direct screw fixing.

The Discus' energy saving level is next generation. In addition to an 18W dimmable version, the range also includes a wattage selectable option with a discreet switch that can set the wattage to 10W, 15W or 18W. As well as saving energy, this switch can adjust the lumen output too, so you can use the same luminaire in any application.

Red Arrow Electrical Distribution • 0114 279 8999
www.redarrowtrading.com

Chauvin Arnoux Miniflex: For flexible measuring and monitoring

Current sensors in the latest Miniflex range from Chauvin Arnoux provide a convenient and versatile way of measuring AC current in single- and three-phase systems without the limitations of conventional current transformers and clamp meters.

The sensors require no direct connection to the circuit under test and are suitable for making individual measurements or for permanent installation in monitoring applications.

Each sensor is in the form of a thin flexible element that operates as a Rogowski coil. The sensor is simply looped around the conductor carrying the current it is required to measure, which means it can easily be used in applications where access is difficult.

The sensor is complemented by an interface module, the output of which is connected to an ordinary digital multimeter with an AC voltage range for individual measurements, or to a power analyser and logger for longer term monitoring.

Chauvin Arnoux • 0192 446 0494
www.chauvin-arnoux.co.uk

Lighting control made easy

Introducing the TF8050 lighting solution software from Beckhoff, a ready-made PLC application library for its PC-based control system.

Offering easy configuration, control and monitoring of DALI/DALI2 devices, TF8050 is de-centrally scalable and supports limitless DALI lines each with a combination of up to 64 ballasts and switching devices. Fast functional changes, address changes, system expansions and cross-DALI line groupings can be carried out without operational interruptions.

Based around the 'human-centric' control concept, TF8050 provides simple, programless configuration of complex lighting systems. With features such as colour temperature control, daylight control, constant light regulation and scheduler/holiday setting, a web browser is all that's required to configure, define functionality and commission the system. Alternatively, configuration can be achieved via an Excel spreadsheet which provides a secure way of backing up and restoring lighting projects.

TF8050 supports the latest generation of DALI2 sensors, including motion and Lux sensors from the likes of Steinel and BEG.

Beckhoff • 0149 141 0539
www.beckhoff.co.uk

EBDHS-B32-SR-MP detector provides groundbreaking levels of detection

The new EBDHS-B32-SR-MP PIR detector from CP Electronics has been engineered to provide the automatic control of SR (sensor ready) Philips Xitanium SR LED drivers. Designed for luminaire mounting on high bay/high level luminaires up to 20m in height, the EBDHS-B32-SR-MP is an increased performance PIR presence detector developed specifically for lighting control in areas with demanding spaces and increased mounting heights, making it ideal for warehouse applications.

The unit is programmable and adjustable to produce an exceptionally accurate detection beam. With a groundbreaking detection range of up to 40m at a 15m mounting height, the sensor also boasts an accurate and uniform sensitivity throughout the detection range due to a specially designed five pyro layout to cover a 360 degree detection pattern. Commissioning and maintenance is also simplified due to the external optics design (photocell and IR transmitter) which improves presence detection and IR transmission, making it faster and more precise.

CP Electronics • 0333 900 0671
www.cpelectronics.co.uk

KNX lighting controller for DALI from Elsner Elektronic

Elsner Elektronik has introduced the KNX DALI L4 bc 16 A lighting controller, capable of controlling four DALI channels by broadcast command, with the ability to switch off each channel via a relay.

Staircase light switching, scenes and colour control in the RGB(W) and HSV colour spectrum are just some of the possibilities of the KNX actuator.

The actuator has four channels, each for up to 64 DALI devices. The devices of a channel receive a broadcast command, this means that they are all dimmed or switched together.

This type of control is particularly suitable for buildings and halls where luminaires are switched in rows or groups, but also for small DALI systems.

In both cases, broadcast control proves to be advantageous because maintenance of defective luminaires can be carried out without DALI knowledge. Individual luminaires can also be replaced without having to be re-addressed.

Elsner Elektronic • (+49) 07033 309450
www.elsner-elektronic.de

C.K Strengthens popular range of insulated T-handle hex keys

Following recent market research and valuable feedback from professionals, C.K has introduced more product sizes to its already popular insulated T-handle hex key (4mm) range.

This includes the innovative C.K five-piece insulated T-handle hex keys set (T4422 SET – 3, 3.5. 4, 5 and 6mm), plus two of the most frequently used insulated T-handle hex key sizes 3mm (T4422 03); and 3.5mm (T4422 035), which can be purchased separately.

C.K's five-piece insulated T-handle hex keys set (T4422 SET) comprises the most requested insulated T-handle hex key sizes in one handy set (3, 3.5, 4, 5 and 6mm). Ideal for those needing a range of sizes to complete their work. The set is: VDE approved; features premium quality S2 steel blades, tempered and hardened for exceptional strength and durability; and a dual component, ergonomic handle for ease of use.

Carl Kammerling • 0175 870 1070
www.carlkammerling.com

C.K Japanese pry bar 10in (T4312): The professional's tool bag essential

Designed to complete a multitude of tasks quickly and effectively, C.K's new premium quality Japanese Pry Bar 10in (T4312) also conveniently slots into any tool bag for easy transportation.

Hot forged from a carbon steel alloy and hardened for exceptional strength and durability, this superior Japanese pry bar features a 46mm wide tip for precise removal with minimal damage of mouldings, skirting boards, cavity wall nails and is also perfect for quickly prising apart floorboards and other materials.

Precision engineered to offer maximum torque and leverage, the C.K Japanese pry bar combines optimum performance and superior durability, with a solid construction built to withstand pressure and wear.

Ideal for a multitude of tasks, whether electrical, building renovations/DIY work, or for industrial applications, the C.K Japanese pry bar (T4312) is set to become an essential addition to any professional's tool kit.

Carl Kammerling • 0175 870 1070
www.carlkammerling.com

Omicron's new CPC 100 accessory performs reliable stator core measurements

When combined with Omicron's CPC 100 multi-functional electrical testing device, the new Stator Core Measurement Upgrade Option allows you to perform reliable electromagnetic imperfection testing (also known as stray flux measurements) on the stator cores of rotating electrical machines. The test is performed in order to detect interlamination imperfections that can eventually cause overheating and damage in the stator cores of motors and generators.

A complete offline testing solution

Using this complete measurement solution, the stator core is energised with a small percentage of nominal flux and the stray flux is measured on the surface along the slots. The solution's measurement sensor automatically moves along a rail that is mounted on the inside of the stator core, and scans the surface below for possible defects, thus saving valuable testing time. The solution's intuitive software generates on-site reports with a single mouse click.

Omicron • 01785 848 100
www.omicronenergy.com

Scolmore's antimicrobial wiring accessories – helping to fight infection

Scolmore's antimicrobial wiring accessories – Mode, Mode Part M and Polar – are all manufactured using Urea Formaldehyde, which has similar inherent properties to antimicrobial additives that inhibit the growth of infectious diseases. When independently tested, all products achieved a 99.99% kill off rate across all four types of the strains of bacteria – MRSA, E-Coli, Salmonella and Klebsiella Pneumonia.

Mode is a range of contemporary, white wiring accessories and is the company's best-selling wiring accessories collection to date. Mode Part M is a range of visually contrasting wiring accessories, in anthracite grey, that comply with current Building Regulations Part M.

Polar is a premium range of bright white electrical accessories, which was developed to meet the demand for a different accessory colour. All products within the ranges are covered by a 'No Quibble Guarantee' against any fault in materials or manufacture experienced at any time within 20 years of the date of supply.

Scolmore • 01827 63454
www.scolmore.com

Ovia adds DALI dimmable LED driver

Scolmore Group company, Ovia, has introduced a new range of 240V Universal Dali dimmable constant current LED drivers to its commercial lighting offer.

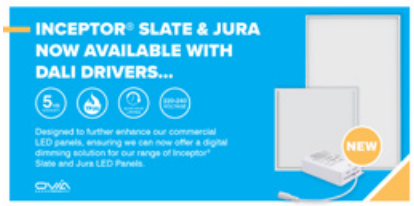
These new products are designed to enhance Ovia's commercial LED panel offering and means that Ovia now offers a digital dimming solution for its Inceptor Slate and Jura LED panels.

The DALI dimmable LED drivers are available in 29-48W and 38-69W variants to maximise their potential across a range of applications.

The DIP Switch component will be supplied pre-set to a specific configuration, with the option to be manually reconfigured to any one of the range of specifications available by following the instructions printed on top of the driver.

With the new DALI drivers compatible with Inceptor Slate and Jura, contractors now have a digital dimming option available across premium and economical LED panels, providing them with products to suit a range of projects.

Ovia • 01827 300640
www.oviauk.com



New additions to ESP's best-selling Aperta door entry range

ESP has expanded one of its best-selling products – the Aperta EZTAG door entry system. EZTAG3 is a sleek keypad and proximity reader, designed to provide a compact, durable and convenient solution for a wide variety of access control applications.

Offering straightforward installation and commissioning, and with simple self-contained programming, EZTAG3 is an IP65-rated weatherproof combined access control keypad with proximity tag or pin code activation, accommodating up to 1,010 key tag holders or pin numbers.

A new black keypad is also being introduced for the EZTAG3PRO Kit, which offers a complete door entry system in one handy and convenient box, and comprises:

- EZTAG3 proximity door entry keypad
- 10 proximity tags
- Electromagnetic lock
- Boxed power supply – with optional backup battery
- Push to exit button or mushroom button
- Emergency break glass

ESP • 01527 515150
www.espuk.com

Red Arrow's Rhombus revolution

Suitable for the majority of applications where recessed panel luminaires are installed, Red Arrow's Rhombus offers a cost-effective, innovative solution. Delivering high quality, flicker-free lighting, contractors and end-users alike can experience even illumination and a solid, reliable performance well in excess of many inferior edge-lit panels.

While nearly all competitively-priced panels on the market are edge-lit, this available technology rarely offers the best efficacy. Equipped with established optics technology and new, high efficiency 100lm/W LEDs, Rhombus delivers optimum light quality, with a flicker-free driver as standard. Plus, with an anti-yellowing diffuser, Red Arrow's innovative back-lit LED guarantees a longer life, improved appearance and evenly illuminated spaces.

Designed to fit exposed T-Grid ceilings, Rhombus has a lifetime of 25,000 hours and a dimmable driver is also available. Rhombus has been built with no compromise on quality for applications where cost is a prime consideration.

Red Arrow Electrical Distribution • 0114 279 8999
www.redarrowtrading.com

Not for girls?

In this Q&A **Elina Siokou,** head of product integration at P2i, tells us her story and explains why jobs in typically male dominated environments aren't all about manual labour.

Let's start at the beginning, what do you do and how did you get into the industry?

I am a senior principal surface scientist and head of product integration at P2i Ltd. I studied physics at the University of Patras in Greece and specialised in surface and materials science during my PhD at the Department of Chemical Engineering at the same university. I worked as a postdoctoral researcher at CNR Rome and the Technical University of Eindhoven.

In 1997, I was granted a two-year Marie Curie Post-Doctoral Fellowship and became a research associate at QMW College, University of London. This was followed by a one-year Marie Curie Return Fellowship which funded my research in Greece at the Institute of Chemical Engineering Sciences, where I ran the Surface Analysis Laboratory. In 2000 I became a permanent researcher at the same Institute, where I stayed until 2012.

In 2012 I moved to England and have worked at P2i ever since. I have been applying my experience and skills in the exciting field of functional nano-coatings development for water protection of electronic devices.

What's it like working in such a male dominated environment, was it/is it welcoming?

The manufacturing industry is traditionally male dominated. This has its origins in the times when manufacturing was considered to consist of hard manual work and long hours in a factory environment. More than that, women would not consider manufacturing as a career path, especially in technical roles, due to the general stereotype that they couldn't progress in a male-dominated field.

In recent years, examples of successful women in the manufacturing industry are increasing and more young female scientists are attracted to technical roles, discovering that they can be fun and rewarding.

This is a slow change but real. Companies are gradually abolishing their male-oriented culture.

Non-technical positions such as human resources, marketing and communication managers, are those to be filled first by female candidates but the technical demographics are changing too. Women are now chasing responsibilities in more operational and technical jobs, such as production, research, and many others.

Are manufacturers making a conscious effort to try and increase female/male balance in the industry?

Yes, we see changes, but the steps are very slow. Women are slowly integrated into industrial professions, even top management positions. Today, industries are making a real effort to communicate their job offers and their desire to integrate women into their various professions. Young women are now choosing to commit themselves to scientific and technical training courses aiming for a career in the manufacturing industry.

The quickest changes happen in manufacturing industries where a small cluster of women has already been formed in the technical sector. The formation of this small cluster is the rate determining step. Women first enter discreetly, but although things are certainly moving too slowly, they are less and less contested in their functions and their skills are recognised.

According to Allison Grealis, president of Women in Manufacturing Research, when companies are more diverse, and when there are more women at the leadership table, those companies are more profitable.

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What role models in the sector are there for girls who are considering a career in the industry?

Personally, I appreciate and admire women with the vision and determination to achieve their goals, without compromising their personal life. Women think differently, offering a different, multidimensional point of view and innovative solutions. This is our competitive edge.

I am inspired by women like Veronica Brake, vice president of operations, performance materials at BASF. She belongs to my generation, which means that she started her career in a male-dominated environment and she is now leading a huge team across 18 operating facilities in the USA. I fully agree with her motto: 'get a mentor and be a mentor' – I find mentorship invaluable for a successful career in the fast paced manufacturing sector.

Another inspiring example is Mary Barra, CEO of General Motors. I like her story because she started as a quality inspector on the assembly line and in 2014, she became the first female CEO of a major global auto manufacturer.


EMPLOYEE OF THE YEAR
2019
2020
2021
2022
2023
2024
2026
The most important part of your Data Centre deserves recognition
data safe XE
EnerSys
Power/Full Solutions