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FROM THE EDITOR

Chief scientist Dr Alan Finkel's much-awaited review into the future security of Australia's electricity market has created a lot of debate and discussion.

Dr Finkel's report makes 50 recommendations to ensure reliable and adequate energy supply. When ECD went to press, the federal government had already agreed with all of Dr Finkel's recommendations except the one on a clean energy target. Clean Energy Council Chief Executive Kane Thornton rightly pointed out that these reforms alone are not enough to manage the energy system transition and bring on new investment in low-cost electricity generation. "Private investors are willing to invest in the new generation assets required, but only if policymakers provide clear long-term policy certainty. The flurry of recent policy proposals from state and federal governments risk detracting from the long-term market confidence needed for these investments.

"Having a long-term, market-based and technology-neutral policy in place will be much more effective than the continued ad hoc policy and regulatory change that has resulted in the current energy crisis for Australia."

Change is a common theme throughout this issue. The changing role of the electricity grid, grid management, changes to the wiring rules and battery storage are some of the key topics featured in this issue.

As most of you may be aware, the much-awaited battery standard has recently been released for consultation by Standards Australia. The release date of the standard is not yet clear, so EnergySafety WA has prepared BESS installation guidance for contractors. To get a thorough understanding of your role and responsibilities while installing these systems, go to page 12.

Best regards,

Mansi Gandhi – Editor
ecd@wfmedia.com.au

NEW WIRING RULES ARE COMING — ARE YOU READY?

The new version of the Australian/New Zealand Standard for Wiring Rules is set to be released soon. In the article below, Gary Busbridge*, Standardisation Manager at Clipsal and Chair of the Australian and New Zealand committee responsible for the revision, provides an overview on the changes.

The revision of the Wiring Rules has been a long journey that started way back in 2012. Even as we discussed the revision, many on the committee took the proposals to the electrical industry and openly discussed the proposed changes so that we could garner stakeholder feedback. Much of the feedback was used to support some changes and additions, whilst we argued upon the need and justification for the rest. The committee has been as forward-thinking as possible and has debated many issues, brainstormed possible future issues and reviewed current issues.

Over 2000 Public Comments were received on the draft, and a lot of these comments were found to require a fair amount of research before being put into the Wiring Rules, therefore they were put into amendment one storage. Getting to this stage has taken a lot of work and the new edition of AS/NZS 3000 is set to be released in October 2017.

RCDs

There have been some major changes regarding where and when an RCD is to be installed. In residential installations, all final sub-circuits are to be protected by a 30 mA RCD with no exceptions. Of course, the requirement for three final sub-circuits per RCD and the sharing of multiple lighting circuits across RCDs remains.

In non-residential installations, where there is a plug and socket connection to electrical equipment, the final sub-circuit shall be protected by a 30 mA RCD. Where there is fixed wiring direct to electrical equipment, consideration should be given to protecting that final sub-circuit with a 30 mA RCD. The existing exceptions remain in that where it is more dangerous to expose the final sub-circuit to nuisance tripping, the final sub-circuit can be protected by other means. Further to this, an exception has been added where electrical equipment is required to run continuously, in that case the final sub-circuit can be protected by other means. But all final sub-circuits for lighting shall be protected by a 30 mA RCD. There used to be a reference to "alterations, additions and repairs" but we have removed "additions" as it is an "alteration". Simply put, an alteration means that the electrical characteristics of the final sub-circuit have changed, for instance the addition of a socket-outlet in a new room changes the length of a cable run, and therefore it is necessary to put a 30 mA RCD on that circuit. Whereas, a repair is a like-for-like replacement of a broken or unusable accessory, meaning that the original protection for that final sub-circuit can remain and is not required to have 30 mA RCD protection. And finally, on RCDs, where all the circuit protection is to be replaced on a switchboard then all final sub-circuits from that switchboard need to be protected by a 30 mA RCD.

Medical installations

There are many revised or new definitions and these provide a sound basis for all your discussion about design and installation. Using the definitions means that all parties in the discussion start at the same point. For instance, we have added a new definition "Accessible" and revised the definition of "Readily Accessible" to ensure clarity regarding medical installations and mounting of electrical equipment.

Further improvements to the emergency egress from a switch room have been made, with clearance requirements to one metre from accessible faces of a closed switchboard and 600 mm from open doors or racked-out equipment. The access/egress door from the switch room has also been increased in size. In an emergency, the increase in distances may save lives.

Mains switches

Mains switches are an important part of any installation and it is essential that a mains switch is operated manually and is not controlled by electronic devices. New wording will clarify this aspect. The last thing needed in an installation is for an override of the mains switch by some programmable device. Manual switching could save lives.

What IP rating does electrical equipment need to comply with when exposed to the weather? A zone for external walls has been created to clarify what equipment

can be used where. This zone extends at 30 degrees down from the edge of a verandah or eave to the exterior wall. Any electrical equipment within that 30-degree triangle is deemed protected and does not need an IP rating. All electrical equipment below that triangle requires an IP33 rating as a minimum. Meter boxes are excluded as they have historically been IP23. Any electrical equipment contained within the meter box enclosure does not need an IP rating.

Kitchens, downlights and outbuildings

Kitchens haven't been forgotten, as there is now a 150 mm zone from either side of the cooktop extending up to the rangehood, ceiling or a height of 2.4 m, in which switches or socket-outlets are excluded. Reaching across hot surfaces to access the switches and socket-outlets is now a thing of the past.

Classifications of downlights are to be marked on the product as well as the packaging. This provides information as to where the downlights can or can't be installed. These classifications provide helpful information. A handy hint, look for an "IC" or an "IC-4" classification as these downlights can be used anywhere in an installation.

The outbuilding that we all know and understand, as separated by an area of land, will now be renamed an 'individual outbuilding'. There is a new term — a 'combined outbuilding'. This term is to define a number of structures that are connected on a single concrete slab, such as multiple residential units on a common slab.

Generation systems and electricity distributors' equipment are to be kept out of the zones around pools, spas and water features. It is an unsafe practice and can lead to instances where children use this type of equipment as improvised diving boards.

Electricity generation systems have been updated to the latest revision of AS/NZS 3010.

Safety

Lifts for normal conveyancing are considered to be electrical equipment and have their requirements detailed in Section 4 Electrical Equipment. Those lifts deemed to be emergency lifts have their requirements detailed in Section 7 Safety Services.

Section 7 Special Installations has a section devoted to Safety Services and whilst the detailed requirements have not changed that much, the whole Safety Service section has been revised to enable a user-friendly set of requirements. Using it is as simple as heading to the specific section required, for example supply systems, main switchboard, main switches, fire pumps, fire and smoke detection and alarms, air-handling equipment, evacuation equipment or emergency lifts and all the detail will be in that one set of clauses.

Arc fault

We have added detail about the use of Arc Fault Detection Devices (AFDDs) in an installation. These devices look and feel like a 2-pole RCD/MCB but are there to detect and isolate a final sub-circuit that may have a small arc fault generated from broken strands in a flexible cord, fixed wiring or poor termination. This is a very small current but continual arcing would lead to a fire. They provide excellent further supplementary protection to the RCD and are good for protection of wooden structures and bedrooms. They are not mandatory at this stage. These devices are to be fitted after the MCB and RCD on a final sub-circuit. There is an Appendix O in the Wiring Rules with detailed information on installation.

Switchboards

In Appendix E The National Construction Code, more information has been added on the classification of buildings. Recently, Australia has adopted a new range of switchboard standards, so a new Appendix K has been added. This provides several switchboard guidelines to help the electrician to better understand the specific issues to be addressed in manufacture and verification of switchboards.

Appendix M provides some overview for continuation or reliability of supply, especially in those installations that are concerned with the aged and infirm. Just what would happen to incapacitated persons in a building, if power supply was disrupted? This appendix provides some guidelines for your consideration in design and construct.

Electric vehicles

Electric vehicles are becoming increasingly popular and that means electric vehicle charging stations are becoming a part of the installation design. Appendix P provides guidance on the different types of vehicles and installation of the charging stations.

Recently, Australia adopted an international series of standards on electrical conduits that are similar to the existing series of Australian conduit standards, except some marking aspects. Appendix N provides information on marking variations between the two sets of standards.

DC/DC

Lastly, there is a trend that is occurring in the data centre market with DC power being used to run active electrical components within the centre. Who knows where this will go, but you can bet that there will be more of this pushed towards the residential installations over time. Appendix Q has been added to provide guidelines on what to look for when installing DC wiring systems.

Remember, this is an overview of the major changes and additions and doesn't contain all the detail. When the new wiring rules are published, get yourself a copy and find out just what has changed or added. You may be surprised.

Gary Michael Busbridge has been with Clipsal for over 40 years, after graduating from the University of South Australia in 1973. Predominantly, his responsibility was Design Manager for all Australian Electrical Accessories, including aspects of Data and C-Bus, Export and Industrial design, development, product maintenance and prototyping. Inevitably, this led to involvement with the Standards Association of Australia and membership of committees and working groups from 1998. In his role as Standardisation Manager, he ensures global and regional standards are aligned to the electrical contracting business and electrical accessories manufacture. This also includes relevant IEC standards and applications. In November 2011 he was made Chairman of the EL001 Wiring Rules standards committee.

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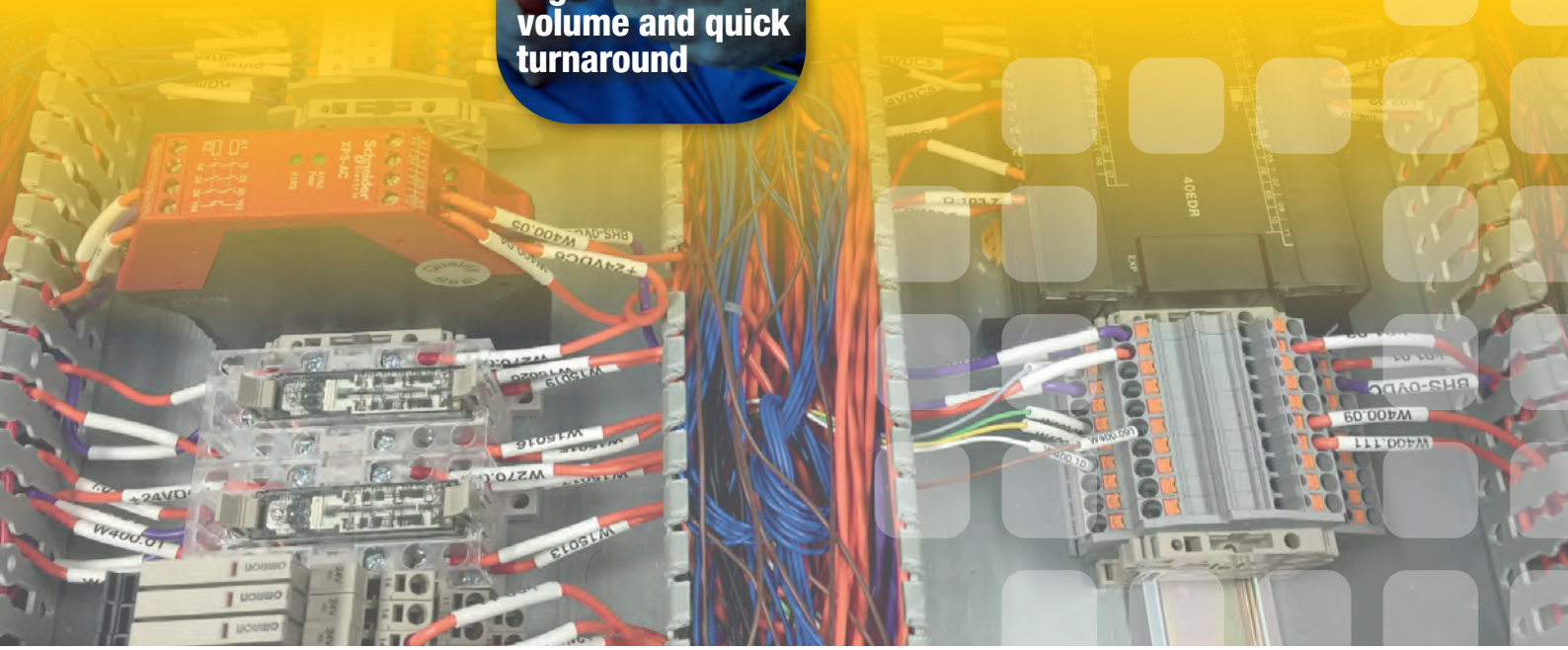

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STICK TO ELECTRICAL WORK WHEN INSTALLING SOLAR PV

Electrical contractors installing solar photovoltaic (PV) panels should only carry out work they are qualified to do, warns Queensland's electrical safety regulator, Electrical Safety Office.

Electrical contractors are licensed to perform a wide range of the electrical work which is often intimately part of the building. This often becomes an issue when installing PV panels. Electrical workers can often be asked to undertake plumbing work as part of a PV panel installation — this is illegal and should not attempted. For example, an electrical contractor may find parts of a plumbing installation need to be relocated before a solar installation can be started. If so, a licensed plumber must carry out the plumbing work, unless the electrical contractor also holds the requisite plumbing licence.

The Queensland Building and Construction Commission (QBCC) allows electrical contractors to install PV systems without a QBCC licence. However, any trade work other than electrical work must be conducted by an appropriately licensed person.

The AS/NZS5033:2014 'Installation and safety requirements for PV arrays' sets out general installation and safety requirements for PV arrays, including DC array wiring, electrical protection devices, switching and earthing, up to, but not including, energy storage devices, power conversion equipment or loads. Electrical contractors must discuss any issues they foresee with other contractors and home owners before beginning the installation. Regulated plumbing work must only be performed by a licensed plumber under the *Plumbing and Drainage Act 2002*. Electrical workers must not work on any plumbing (such as vents) on the roof unless they hold a suitable plumbing licence. This is fined at $1178 per offence.

NEW CHAIR FOR CLEAN ENERGY REGULATOR

The Clean Energy Regulator has appointed David Parker AM as the new chair of the agency.

Parker, who will join the agency from the beginning of July, has extensive experience in economics and public administration.

"As a senior Commonwealth public servant, Mr Parker has had responsibility for climate change policy and a long professional involvement in energy markets and regulatory matters," said acting chair Jody Swirepik.

"He is widely respected across many industries, having worked on some of the country's most critical issues over the last two decades.

"We're very pleased to welcome a strong pair of hands who has a track record of driving effective implementation and managing complex reforms."

The agency also welcomes the reappointment of Anne Brown and Virginia Malley as members of the Regulator for three years.

© Image by Wilhelm Henning

15 MW SUNSHINE COAST SOLAR FARM TO BE FULLY OPERATIONAL SOON

The 15 MW Sunshine Coast Solar Farm in Valdora is on track to be fully operational soon. The council-owned farm is expected to generate savings of up to $22 million, after costs, over a 30-year period based on today's cost of electricity.

Downer was awarded the contract to design, construct, operate and maintain (DCOM) the Sunshine Coast Solar Farm and appointed Trina Solar to supply 57,000 pieces of Duomax PEG14 315 W photovoltaic (PV) solar panel modules.

The farm is built on 24 hectares in Valdora, which is exposed to high winds and extreme weather conditions such as cyclones. To mitigate this, the Duomax module was selected due to its robust mechanical properties that can withstand extreme weather conditions. Its warranty fulfils the 30-year design life planned for the solar farm. The double glass and a frameless design offers reliability and performance. The product is designed to reduce the levelised cost of electricity (LCOE) and achieve balance of system (BoS) savings.

The Sunshine Coast Solar Farm is one of the first projects to be delivered at the 1500 V rating system, said Helena Li, president, Asia Pacific and Middle East, Trina Solar.

The project is said to enable the local Sunshine Coast Council to become Australia's first local government to offset 100% of its electricity consumption across all its facilities and operations from renewable energy.

At its peak, the Sunshine Coast Solar Farm will generate 15,000 kilowatts of electricity from the sun. This will supply power to the local council's administration buildings, aquatic centres, community and performance venues, as well as holiday parks, libraries, art galleries and sporting facilities. The electricity generated over one year is enough to power about 5000 homes.

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OSRAM ACQUIRES STAKE IN PLANTCUBE DEVELOPER

Osram has acquired a stake in Munich-based start-up agrilution. The lighting group holds a strategic minority interest in the company via its venture capital arm Fluxunit.

The start-up has developed a smart indoor growing box, plantCube, that serves as a salad, vegetable and herb garden for the home. Even users without any gardening expertise are now able to greatly increase yield due to a specially optimised LED technology and other innovations.

"Osram, with its lighting and horticultural expertise, can help to improve and enhance agrilution," said Ulrich Eisele, head of Osram's Fluxunit.

For horticultural applications, Osram supplies lighting solutions that can stimulate and manage plant growth and are designed for cultivating plants in greenhouses or indoor spaces. Osram's LED technology is also used in the plantCube developed by the Munich start-up. The smart home appliance identifies the seeds that have been planted and provides an optimal growing environment by automatically regulating temperature, watering and lighting conditions. This makes it possible to grow herbs, salad and vegetables regardless of weather and climate.

REPOSIT RECALLS SOLAR AND STORAGE SMART METERS

Energy management group Reposit Power has recalled its Reposit Kit including RP115 Meter and Reposit Box.

"In most installation configurations the Reposit Kit does not meet the electrical isolation requirements of the most appropriate electrical safety standard (AS61010.1:2003)," said Reposit in its recall statement.

"Certain components within the Reposit Kit could raise a potential risk of electrical shock to electrical installers or to the end user."

Reposit will contact affected customers directly. The company will provide an upgraded Reposit Kit and installation at no cost to the end user. The removal and installation will be completed by a fully qualified electrician based on approved installation requirements.

AUSTRALIAN-DEVELOPED, ENERGY-SAVING, COLOUR-CHANGING 'SMART' WINDOWS

Australian researchers are developing a window that contains a glass that is able to change its colour and the amount of heat or light it transmits.

Professor Huijun Zhao, director of Griffith's Centre for Clean Environment and Energy, is leading a $1 million research project into a new kind of low-cost, energy-saving 'smart window'. Professor Zhao has been awarded $513,210 from the Australian Government through the Australian Research Council's Linkage Projects scheme to develop the window.

The smart windows are expected to offer significant energy savings by reducing reliance on air conditioning, heating and artificial lighting, according to Professor Zhao.

"Besides residential buildings, this is particularly important for office buildings, hotels and schools where the energy consumption for heating, ventilation and air conditioning (HVAC) and lighting are more than 70% of the total energy consumption," he said.

Professor Zhao in the lab. Credit: Fotomedia.

"The ease of energy exchange through conventional windows can be almost 10 times that of insulated walls and this energy wastage can account for more than 50% of the energy consumed for HVAC, especially during the summer and winter."

With "substantial cash and in-kind support" leveraged from partner organisation Confirmation Australia, Zhao and his team will develop low-cost and scalable synthesis of functional nanomaterials that make smart windows work.

The research project will also facilitate the commercialisation of the new windows by investigating how the new materials can be integrated into the glass manufacturing process to assist Australia's manufacturing industry and environmental sustainability.

"With the advancement of materials science and the Internet of Things, smart windows will be more prevalent and will be important in building automation and energy management. Smart windows can offer several dynamic functions such as self-cleaning, thermochromics and solar-harvesting, and user-controlled functions such as heating, electrochromics and interactive display," Professor Zhao said.

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BATTERY STORAGE — INSTALLATION GUIDANCE FOR CONTRACTORS

EnergySafety WA

Battery energy storage systems are increasingly being installed in electricity distribution networks, homes, remote area power supplies and commercial/industrial installations. Contractors play an important role in these installations and it's important they familiarise themselves with the safety issues associated with these storage systems.

Electrical contractors may be asked to recommend and quote for a BESS or install, commission and test a system designed or selected by others. The BESS may or may not form part of a solar PV installation. It is important they familiarise themselves with the systems and relevant safety requirements prior to doing work on BESS.

Over the last few years battery technology has undergone rapid change, with a range of new chemistries being developed. Current Australian Standards do not cover many critical aspects, creating potential safety hazards for installers, owners/operators and the general public. Standards Australia is developing a new standard (AS/NZS 5139) for battery installations but its release date is not yet clear.

For this reason, EnergySafety WA, Department of Commerce, has prepared the following guidance to alert electrical contractors and electricians to the safety issues associated with BESS. The guiding principle is one of careful design and specification of equipment for each specific installation to achieve the highest practicable standard of 'safety in design'. This is the responsibility of all parties providing the equipment to the customer.

The Clean Energy Council's publication 'Grid Connected Energy Systems with Battery Storage' provides comprehensive requirements for its accredited installers (http://www.solaraccreditation.com.au/installers/compliance-and-standards/accreditation-guidelines.html).

The Australian Energy Storage Council (ESC) also has produced a 'Guide for Energy Storage Systems' (www.energystorage.org.au).

Network operator requirements

Network operators may have requirements affecting selection and installation if the BESS is to be grid-connected. Electrical contractors need to check with the relevant network operator to ascertain all compliance requirements. They may have to submit a preliminary notice to the relevant network operator as a means of ensuring its requirements are known and understood. The network operator may require full technical details of the proposed BESS. Approval from the network operator is required before it will agree to connect. Battery storage may mask a customer's true demand, which can be suddenly imposed on the network if the BESS ceases to operate.

BESS risks

Batteries can be a serious safety risk for occupants and installers if incorrectly installed and operated, potentially leading to electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

> ELECTRICAL CONTRACTORS MUST ENSURE THEIR EMPLOYED ELECTRICIANS HAVE BEEN TRAINED AND ARE FAMILIAR WITH THE PARTICULAR BESS THEY ARE ASKED TO INSTALL OR MAINTAIN.

Various battery types will have different probability of failure and varying consequences of that failure (ie, a different risk profile). Those responsible for the specification and/or supply of the BESS must ensure that an appropriate risk assessment is undertaken for the specific customer circumstances, location, the equipment proposed and its installation. Any business installing a BESS must ensure the safety of workers and customers. The BESS must be installed, commissioned and maintained correctly to ensure this. Electrical contractors may need to train customers so they can operate and shut down their BESS safely. Some customers may have technically competent staff on site but most will not.

Battery types

Many different battery technologies are available for use as a BESS. Some of these have been in use for many years while others have only recently been developed. Some of the common battery technologies on the market are: lead acid; nickel cadmium; lithium ion; nickel metal hydride; sodium ion; sodium sulfur; and vanadium Redox Flow. Each of these has different performance characteristics which must be considered when selecting a BESS to suit a customer's needs.

Manufacturers also offer a few options for BESS, including:

- a pre-packaged battery module (enclosed factory-connected batteries);
- a pre-packaged system (enclosed factory-connected batteries with other components such as a charger control or inverter); or
- a custom-made battery bank (individual batteries installed with other components and interconnected).

BESS selection

A BESS needs to suit a customer's electricity demand profile. Customer installations connected to network operator distribution systems are designed to export power into the grid, while remote area supplies are not. BESS in remote installations may have to be integrated with wind and/or diesel generators as well as solar PV panels.

Competency requirements

Electrical contractors must ensure their employed electricians have been trained and are familiar with the particular BESS they are asked to install or maintain. BESS designers must be competent in electrotechnology and be familiar with such systems, including risk assessment methodologies.

The sketch on page 15 depicts one typical example of a solar photovoltaic installation with battery storage for a domestic dwelling. Many other designs and installations are possible to reflect site-specific circumstances.

Hazards associated with BESS

Installers and owners must be aware of hazards associated with the chosen technology and know how to handle, install and operate the system safely.

Electric shock

Banks of battery cells can deliver a severe electrical shock. There are likely to be 230 V rated parts or other system components operating at hazardous voltages. The battery bank must be electrically isolated while any work is being performed on it or upstream or downstream parts of the system.

Battery terminals must be isolated with secure insulating barriers. Before proceeding, a risk assessment is to be carried out, a safe work management procedure is to be prepared and suitable protective equipment and insulation barriers must be used.

A drawing showing any remote battery bank locations must appear on the main switchboard. Minimum labelling for grid-connected inverter systems are set out in AS 4777.1:2016, which includes requirements for battery storage.

Arc flash

A battery has sufficient energy to cause an arc flash if it suffers a short circuit or fault. An arc flash can have temperatures above

12,000°C, capable of melting metal or causing fires and explosions. Generally, higher battery energy storage capacities have a higher risk of arc flash.

Arcing faults may cause catastrophic failure of battery cell enclosures unless the fault currents are removed quickly by correctly rated electrical protective devices.

Fire and explosion

Most lead-acid batteries generate hydrogen and oxygen when charging. Other battery types also emit flammable gases and need adequate ventilation to avoid an explosion, fire or risk to occupants.

Lithium-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault.

Fire and explosions can result from component failure, a short circuit or loose connections. The chemistry of lithium-ion batteries makes them prone to 'thermal runaway' if they are damaged or overheated by overcharging. Elevated ambient temperatures should be considered by the installer when locating a BESS on a customer premise. Some brands of lithium-ion batteries have superior features intended to prevent the uncontrolled rupture of cells under runaway conditions making them inherently safer.

Hazardous chemicals

Battery casings can degrade or be damaged by impacts. They can also rupture as a result of excessive temperatures and excessive pressure generated from a change in chemical reaction from overcharging or following a short circuit. Electrolyte (fluid or gel) can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion.

Some compounds produced during the failure of a cell can be extremely toxic. The clean-up, decontamination and disposal of damaged equipment may require specialised equipment and skills. Disposal of contaminated items or batteries at the end of their service life usually will require treatment as a hazardous waste.

Standards

Depending on the battery technology used, the following Australian Standards may be applicable:

- AS 3011-1992: Electrical installations – secondary batteries installed in buildings;
- AS 2676.1-1992: Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings – Vented cells;
- AS/NZS 4509.1:2009;
- AS/NZS 4509.2:2010: Stand-alone power systems – System Design; and
- AS 4086.2-1997: Secondary batteries for use with stand-alone power systems – Installation and Maintenance.

Minimum installation requirements

As a reminder, the following key requirements from the Wiring Rules apply:

- All components of the electrical installation must be properly selected and installed for the application (Clause 1.7 of AS/NZS 3000:2007).
- All components of the electrical installation must be installed in accordance with the BESS manufacturer's instructions.
- Installation work practices must be in accordance with the Wiring Rules.
- Wiring systems and cables must be selected and installed in accordance with the Wiring Rules and be adequately protected against external influences, ie, mechanical impact, UV and environmental damage.

> A PROTECTION DEVICE SHOULD BE LOCATED AS CLOSE AS PRACTICABLE TO THE MAIN OUTPUT TERMINALS OF THE BATTERY.

- The short circuit/fault current ratings of BESS are specified by the manufacturer. It is imperative that the overcurrent protection device (fuse/circuit breaker) is adequately sized to cope with such currents.
- Correctly sized DC switches/isolators must be installed to completely isolate a battery from all circuits connected to it during maintenance.
- AC and DC circuits must be properly segregated from each other with the DC circuit labelled.
- All switches must be clearly labelled.
- Adequate signage should be provided with the BESS, including:
  - Signage for grid-connected BESS should be provided according to AS/NZS 4777.1:2016;
  - Signs for stand-alone power systems incorporating BESS should be provded according to AS/NZS 4509.
  - For all other systems, as a minimum the following sign must be provided:
  - A sign indicating that the switchboard has alternative energy sources and showing the BESS location on the premise.
  - A sign indicating 'Danger of battery explosion from open flames, sparks and smoking'.
  - A sign explaining the shutdown procedures for the BESS.
  - Main battery fuses - A battery's fault current is limited only by its internal resistance. If short-circuited, a battery can deliver an extremely high current in a short space of time, in the order of 100 to 1000 times the typical discharge current normally used. This will cause explosive failure of the battery unless circuit protection operates very quickly.

A protection device should be located as close as practicable to the main output terminals of the battery. Any cabling to the location of protective fuses or circuit breakers should be double insulated.

Location

Given their particular risks, some BESS batteries are not suitable for installation in habitable parts of homes or an attached building, while others may be specifically designed for indoor locations such as laundries or garages.

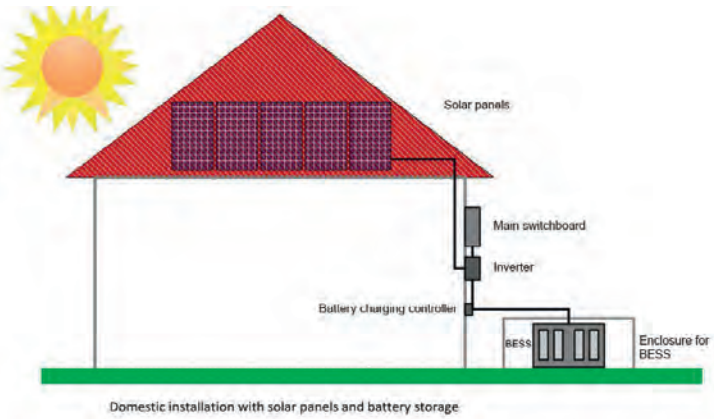
Prior to the selection of the installation location, a risk assessment should be conducted by a competent person familiar with the chosen technology, with due consideration for the consequences of a contingency event. Where batteries are sensitive to operating temperature, particular consideration should be given to this matter in the risk assessment. A copy of this risk assessment should be provided to the customer as part of the equipment documentation.

The manufacturer's guidelines should be strictly followed. A BESS may be mounted on a suitable outside wall (with an appropriate IP rating) or installed in a fireproof and weatherproof enclosure. The fire rating of an enclosure is particularly important if the BESS is to be indoors. Installers must pay due regard to the manufacturer's recommendations about operating temperature

limits, exposure to direct sunlight and avoidance of impact risks. Pre-packaged BESS may include weatherproof enclosures for outdoor mounting and may not need any additional protection.

Enclosures should prevent access by untrained people, children, pets or vermin. The following should be considered when selecting a suitable location:

- Building codes applicable to batteries (national and local) and changes to floor loadings. The National Construction Code (NCC) also has specific requirements for battery installations. Please refer to the NCC for more details.
- If located in an electrical switch room, the room complies with Wiring Rules requirements.
- The location complies with the manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature, which may reduce the performance or life span of the system, or trigger one of the hazards mentioned above. Most batteries have an optimal operating temperature range to achieve their design life and maintain safety. In Western Australia, locations exposed to north- and west-facing aspects are undesirable for BESS installations for reasons of high solar radiation.
- The room or enclosure must be suitably ventilated for the location and the type of BESS.



Domestic installation with solar panels and battery storage

- The enclosure must be capable of containing any electrolyte spills (if applicable).
- Adequately fire-rated walls are used to avoid or delay the spread of fire, should it occur, giving fire authorities time to attend the scene.
- Suitable means of access/egress to the area is provided during installation and for maintenance work.
- The enclosure provides adequate mechanical protection to the BESS.

Testing, verification and commissioning

The BESS must be tested and commissioned in accordance with the network operator's requirements, manufacturer's instructions and relevant standards, including the Wiring Rules.

When the BESS installation is complete, the electrical contractor must submit a notice of completion to the relevant network operator or to EnergySafety for non-grid-connected or remote installations. In either case, the installation may be subject to a safety inspection by an inspector (electricity), who may require access to the BESS owner's documentation package, including the risk assessment. In addition, the electrical contractor is also required to provide an electrical safety certificate to the customer/owner of the electrical installation in accordance with the Electricity (Licensing) Regulations 1991.

Handover must include owner and user training on: how to operate the BESS safely and shut it down in an emergency; the purpose of various safety warnings and lights; and safety data sheets.

Maintenance

The BESS owner's documents must include the maintenance requirements specified by the manufacturer, which should be followed. They must be performed by a licensed electrical contractor unless operating at ELV.

EnergySafety WA, Department of Mines, Industry Regulation and Safety, Government of Western Australia

www.commerce.wa.gov.au/energysafety

All-in-one imaging multimeter

RS Components has announced availability of the DM284 imaging multimeter from FLIR. The device is an all-in-one true-RMS digital multimeter and thermal imager for maintenance engineers, panel builders and electricians. It is suitable for use in the field and especially for those working on commercial electric and light industrial applications or on HVAC systems.

The DM284 combines a high-accuracy digital multimeter with true-RMS measurement capability together with a built-in 160 x 120 FLIR thermal imaging camera. Use of the handheld device can significantly speed up troubleshooting by quickly pinpointing hotspots and visually guiding the user to the precise location of an electrical problem.

A major innovation within this class of professional instrument is the integration of Infrared Guided Measurement (IGM) technology, introduced by FLIR for its range of test and measurement equipment. The integration of IGM brings thermal-imaging camera technology to test and measurement instruments that see daily use in situations and applications in maintenance and HVAC systems on sites and in buildings, where there is a need to measure variable quantities such as temperature together with voltage and current. This means that the DM284 can save time, as well as increasing operator safety by allowing users to identify possible issues in advance and from a totally safe distance, even if the problem is behind a wall, under a floor or in a ceiling.

Offering a specially designed easy-to-read big-digit screen, the DM284 has a simple and intuitive user interface along with various thermal colour palettes including: iron; rainbow; greyscale; greyscale with red hot spot; and greyscale with blue cold spot. In addition, the unit's built-in work lights and laser pointer help users to access areas where there are low levels of light, while pinpointing the location of the problem with the device's thermal imaging capability.

The DM284 offers a total of 18 measurement functions, including true-RMS, VFD mode for motors and drive controllers, low impedance (LoZ) measurements and non-contact voltage (NCV) detection. The device also comes with high-quality test probes and a Type K thermocouple input. Highly versatile and rugged, the handheld unit has been drop-tested and is IP rated for splash and water resistance. It can also be used with the flexible clamp option.

RS Components Pty Ltd

au.rs-online.com

Low harmonic drives

The Allen-Bradley PowerFlex 755TL drives from NHP expand the portfolio of the PowerFlex 753 and 755 AC drives, offering low harmonic solutions along with precise motor control. The drive is designed to mitigate harmonics using active front-end technology and an internal harmonic filter.

Harmonic distortion created by an electrical piece of equipment will have negative impacts, such as motors running at higher temperatures, leading to increased repair and replacement costs; circuit breakers tripping erratically; interference in communications; and improper operation of sensitive control equipment. Beyond the facility, harmonic power distortion may cause problems for commercial or residential neighbours on the electrical grid. As a result, the user may be required to conform to standards for low harmonic distortion at a point of common coupling (PCC).

The drive is designed to meet and exceed local standards like IEEE 519 in terms of maximum allowable percentage of the total harmonic distortion (THD). In addition, the device can correct power factor to reduce energy-related expenses. The combination of lower harmonics and power factor correction reduces the need to oversize one's electrical power equipment.

NHP Electrical Engineering Products Pty Ltd

www.nhp.com.au

Optical loss test set

The Fluke multi- and singlemode (CFP-Q-ADD) OLTS modules for a DSX-5000 (Versiv), available to rent from TechRentals, measure fibre-optic attenuation, length and propagation delay. Includes built-in visible fault locator (VFL) and provides Tier 1 certification at 850, 1300, 1310 and 1550 nm in 3 s (for two wavelengths). A set reference wizard ensures correct reference settings and eliminates negative loss errors.

Features include automatic pass/fail analysis to industry standards or custom test limits; interchangeable power meter adapters available for various connector types to enable the most accurate 1-jumper reference method; dual wavelength measurement capability on a single fibre; and encircled flux compliant as required by ANSI/TIA and ISO/IEC.

TechRentals

www.techrentals.com.au

Wire-to-wire connectors

TE Connectivity's SlimSeal miniature connector series features a press-to-release spring latch that ensures secure mating. The IP67 sealed wire-to-wire connectors are impervious to dust and are waterproof up to depths of 1 m, making them suitable for outdoor lighting and other high-humidity applications.

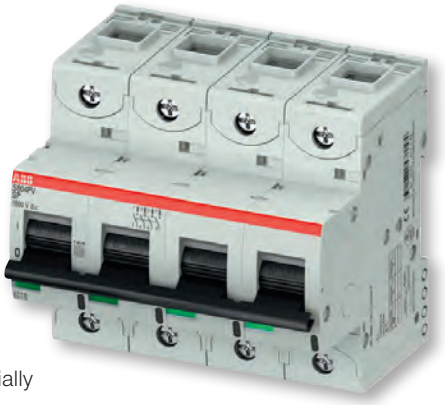
Available with two and three positions, these connectors have a space-saving compact design and preassembled seals to cut assembly time. The connectors come in four different colours (black, red, white and grey) to make identification and assembly easy.

Depending on the version, TE's SlimSeal series accepts 18 AWG (0.75 mm^2) wires (maximum current rating 5 A) or 20–22 AWG (0.52–0.33 mm^2) wires (maximum current 3.5 A). Voltage rating in all cases is 400 VAC max. Operating temperature range is -40 to 105°C. The housings are made of a polyamide with a UL 94 flammability rating of V-0.

TE Connectivity

www.te.com

High-performance string protection MCB



The ABB S800PV-SP high-performance string protection MCB provides string protection up to 125 A and 1500 VDC with Icu=5 kA in accordance with IEC 60947-2 and Annex P.

The MCB S800PV-SP is specially developed for use in photovoltaic systems. It is designed to provide reliable protection for PV modules and lines against reverse currents from defective strings and AC regenerative feedback due to defective inverters. The high demands of PV systems have been taken into consideration in the development of the S800PV-SP.

Main benefits include selective string shutdown even under load; remote shutdown using working current and low-voltage trips possible; high ambient temperatures; and an extensive range of accessories.

Main features include safe disconnection of all poles; polarity independent; and fast remote-controlled operation with S800-RSU remote switching unit.

ABB Australia Pty Ltd

www.abbaustralia.com.au

Wi-Fi air expert module

The VeEX MTTplus-900 Wi-Fi air expert module is a complete and compact tool for Wi-Fi networks discovery, surveying, optimisation, performance testing and troubleshooting.

VeEX's Wi-Fi air expert provides the tools for reliable and repeatable installation procedures that go beyond RF layer analysis. It provides complete performance testing that measures the end user's experience under traffic load.

The air module for the MTTplus platform is equipped with 802.11ac Wave 1 3x3:3 Wi-Fi capabilities to discover the network's access points, clients and channels. It surveys coverage problems with signal noise levels and utilisation tracking. A dedicated spectrum analyser assists in the troubleshooting of Wi-Fi and non Wi-Fi interference affecting performance and the V-Perf function provides traffic download/upload test to a wired Ethernet responder to evaluate the Wi-Fi network's capacity under load.

Key features include: supports detection and connection to 802.11a/b/g/n/ac devices; discovers the network and lists access points, clients and channels in table and graphical format; AP detailed capabilities discovery including SSID, BSSID, channels, security, supported data rates, signal and noise levels, co-channel and adjacent APs and associated clients; survey coverage problems with signal and noise levels tracking; analyse channel usage by utilisation and number of APs; discover associated and non-associated Wi-Fi clients present in the network; locate rogue APs and clients with directional antenna; one-button auto-test evaluates the health of the Wi-Fi network with analysis of security, coverage, interference, top talkers and connectivity with configurable AP list; connectivity testing with DHCP connection to APs; verify network performance with TCP/UDP throughput testing; supports 802.11ac and 802.11n throughput testing; optional Ethernet 10/100/1000-T and 1000-X ports to verify end-to-end throughput performance; optional directional antenna to locate and track a specific AP or client; optional dual band 2.4 and 5 GHz spectrum analyser to easily discover and identify Wi-Fi and non-Wi-Fi interference; optional built-in GPS on the MTTplus mainframe to record the location of the test being performed; and optional built-in camera on the MTTplus mainframe with automatic bar/QR code to record tested environment and network devices for future reference.

TelecomTest Solutions
www.telecomtest.com.au

6A shielded modular patch cords

The SkinnyPatch 6A S/FTP modular patch cords from Siemon deliver category 6A shielded performance with a reduced diameter for improved pathway fill, airflow and increased flexibility in high-density data centre environments.

With a 28 AWG stranded copper construction that enables a smaller cable diameter of 5.5 mm, the modular patch cords offer a tighter bend radius for easier cable routing and enhanced cable management to facilitate moves, adds and changes in tight spaces.

The overall smaller diameter provides pathway savings in racks and cabinets while maximising airflow for improved equipment reliability. At the same time, the S/FTP shielded construction of these cords delivers good transmission and enhanced alien crosstalk performance over UTP cords, making them suitable for high-density patching areas in 10 GBASE-T switch-to-server applications. The cords exceed ANSI/TIA-568-C.2 and ISO/IEC 11801:2002 performance standards as confirmed by Intertek, an independent third-party test lab.

Siemon Australia
www.siemon.com.au

Tools organiser system

The VELCRO STAYHOLD is a modular cargo organiser system. The system is designed for use in a car boot wherever and however the users want to hold whatever they need to carry. Users can use a single organiser to keep items firmly in place or use a combination to create adjustable storage spaces.

The product combines plastic brackets and straps with a few strips of VELCRO brand hook fastener tape to create a versatile and flexible system. The hook strips grip onto the carpet of the boot and stay put until removed at the end of a trip.

Velcro Australia Pty Ltd
www.velcro.com

Spectrum analyser

Anritsu has introduced the Spectrum Master MS2760A family, the world's first ultraportable, millimeter wave (mmWave) spectrum analysers that operate up to 110 GHz, according to the company. They can verify high-frequency designs, including those used in 5G and E-band applications. The MS2760A analysers leverage Anritsu's patented state-of-the-art NLTL Shockline technology to more efficiently advance technology development. In addition to 5G and E-band, the MS2760A significantly improves test procedures and lowers the cost-of-test in other fast-growing mmWave applications, such as 802.11ad/WiGig, satellite communications, electronic warfare and automotive radar.

The MS2760A is truly pocket sized, but claims to have industry-leading dynamic range, sweep speed and amplitude accuracy. Its ultraportable size enables direct connect to almost any DUT, eliminating the need for lossy, expensive cables or antennas.

The MS2760A is available in six versions with frequencies ranging from 9 kHz up to 32, 44, 50, 70, 90 and 110 GHz. It measures only 155 mm high x 84 mm wide x 27 mm deep.

The MS2760A is suitable for use in the lab, on the manufacturing floor and out in the field. It provides benchtop level spectrum analyser performance in the palm of your hand. Anyone making basic spectrum measurements can benefit from the size and affordability.

Anritsu Pty Ltd
www.anritsu.com

Changeover switches

Hager's modular 63 A manual Changeover Switches have a three stable position (I-O-II) allowing users to control two power supply sources.

The switches can be fitted into any standard DIN rail mounted enclosure. The design is compatible with all other Hager modular devices, such as MCBs and RCCBs. The switches come in both 2- and 4-pole versions, for single- and three-phase applications. The incoming side must be protected against short circuit and for isolation with an appropriate MCB 63 A minimum 4.5 kA curve C. The switches comply with AS/NZS IEC 60947-3 and feature a convenient centre-off position.

Hager Electro Pty Ltd
www.hagerelectro.com.au

RCBO PROHIBITION NOTICE AMENDED

The Victorian technical and safety regulator Energy Safe Victoria (ESV) has imposed additional requirements on the supply of RCBOs designed or marketed to be permanently fixed to household or similar electrical wiring in Victoria.

Suppliers must undertake additional testing and verification to ensure their products still operate satisfactorily if there is a defect in the installation or if the product has been installed incorrectly.

These requirements are listed in Additional testing and verification requirements for RCBOs.

Amended prohibition notice

ESV has amended its prohibition notice on the supply of RCBOs (known as RCDs) to provide more time for industry participants to adjust to the new regime.

The regulator's investigation into RCBOs was instigated by a fatality in August 2016 in which it was found that a commonly used RCBO failed to operate. In April, ESV issued a prohibition notice to halt the supply of certain types of RCDs which testing showed had the potential to fail under certain circumstances. While the likelihood and frequency of such an event was low, ESV took the view that the issue was best addressed by halting the supply of these particular RCDs.

After consultation with industry, ESV has agreed to allow manufacturers a further 12 months to produce new models of RCDs that meet ESV's strict standards. The revised prohibition notice will come into effect 1 July 2018. Any products that do not meet these new requirements will be prohibited from sale.

Several models of RCDs currently satisfy ESV requirements. A register of these RCDs will be published 1 May 2018.

ESV has identified two situations where 240 V can be present on the load side of an RCBO when it is in the open position:

- The device is installed in the opposite orientation to the one indicated by the manufacturer.
- The RCBO is installed in the correct orientation; however, there is a defect in the installation downstream from the device and there is 240 V present on the load terminals when the device is in the 'off' position.

ESV's investigations have shown that some constructions of electronic and all electromechanical RCBOs are not affected by the situations listed above.

Why wait to make the switch?

ABB's RCBO is compliant.
Are yours?

ABB's RCBO type DSN201, with the option to connect supply from the top or bottom, is not affected by the prohibition notice served by Energy Safe Victoria. Why wait for the prohibition notice to come into effect? Future proof your business today by using ABB RCBO's, found at your local electrical wholesalers and distributors.
Find more information at **www.abb.com/lowvoltage**

All-in-one optical and service test platform

The VeEX TX300s-100G module, with the latest technology in pluggable physical interfaces, complements the TX300s Platform, extending its testing range to 100 Gbps. Compatibility with the companion TX320sm option offers a complete 64 k to 100 G test solution in a compact portable package.

Installation, commissioning, monitoring and maintenance of Ethernet, OTN and SDH/SONET networks is simplified thanks to a combination of intuitive features and powerful test functions. Fast troubleshooting and comprehensive analysis of transmission problems can be performed using its common graphical user interface.

Novice users benefit from the easy-to-use GUI, while experienced users will appreciate an array of advanced features such as OTL/PCS, CAUI-4/XLAUI Lane BERT, service disruption, overhead monitor/control, tandem connection monitoring, protocol capture/decode, BERT and throughput test.

Module highlights include CFP4 interface for 100GE and OTU4 applications; QSFP+ for 40GE, OTU3, STM-256/OC-768, and STL256.4; external clock interface; 150 ppm clock offset generation; and soft LED indicators.

Key Ethernet features include 40 Gbps and 100 Gbps Ethernet testing; optical lane BERT and CAUI-4/XLAUI lane BERT; PCS Layer Testing with Skew generation/monitoring; multistream testing up to 32 independent streams; IEEE 802.3ah, ITU-T Y.1731, IEEE 802.1ag, MPLS-TP OAM support; Q in Q (VLAN stacking), MPLS, MPLS-TP, PBB, EoE support; MAC flooding; RFC2544 and V-SAM (Y.1564) testing; service disruption measurements; IPv4 and IPv6 traffic generation; BERT and throughput testing at Layer 2 and Layer 3; smart loopback mode for Layer 2 and Layer 3; one-way-delay latency measurement (GPS assisted); line rate packet capture with Wireshark decode; and error and alarm injection.

Key OTN testing features include OTN testing for OTU3 and OTU4; complete multistage mapping/multiplexing; Ethernet over OTN; advanced multistep Map/Mux with SDH/SONET/PDH/DSn test payloads; service disruption measurements; tandem connection monitoring; overhead monitoring and byte decoding; terminate, payload through and line through test modes; per-lane optical power and frequency measurements; external clock reference interface; and histogram analysis.

Key SDH/SONET testing features include mapped into OTUk payload; STL256.4 with SDH/SONET; STM-256 and OC-768; advanced multistep Map/Mux with PDH/DSn test payloads; service disruption time (SDT) and automatic protection switching (APS) time measurement for all mapping and multiplexing levels; and test payload multiplexing down to VC11/VT1.5 and internally generated PDH tributaries.

Key CFP4/QSFP+ support features include optical lane BERT; PCS layer testing with skew generation/monitoring; transmit and receive optical power measurement; and module status display.

TelecomTest Solutions
www.telecomtest.com.au

Clamp tester

The Hioki CM3286-01 Cat IV (600 V) auto-ranging, Bluetooth-compatible clamp tester measures leakage current and mains current to 600 A, voltage to 600 V, single- and three-phase balanced power, energy, reactive power, power factor, phase angle, frequency and total harmonic distortion for current and voltage.

The IP54-rated tester clamps up to 46 mm diameter conductors. A dedicated app to acquire measurement data on a smartphone or tablet is available, allowing reports to be automatically created from measurement data in the field. Supported devices include: Android SMART model, iPhone5, 3rd generation iPad and iPad mini.

Power Parameters Pty Ltd
www.parameters.com.au

LED high-bay luminaire

The FlexPak LED high bay luminaire comes with wireless control. It is quick and easy to install and commission.

The luminaire is available in 8000, 13,000, 17,000, 23,000 and 31,000 lm, all with a constant lumen output feature and a choice of wide beam and very wide beam optic.

With single-suspension mounting especially suitable for refurbishment, the luminaire offers features and performance for flexible use in a classic round high-bay shape. All luminaires are suitable for single-point suspension. A chain suspension clip can be ordered separately; alternatively, a cord suspension is available in 1, 2 and 5 m lengths.

For ceiling mounting stirrups are available, including tilt adjustment. The luminaires are also available with an innovative radiofrequency node to connect with remote IP65 sensors.

Thorn Lighting Pty Limited
www.thornlighting.com

the complete billing package

Tenant Smart Metering made simple

Monitor up to 3 tenants with one compact device
NMI/Pattern Approved for billing purposes
Up to 75% space saving for cost effective installation
Unparalleled Accuracy - Class 0.5S - Better than a traditional Class 1 meter
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Suitable for electricity, water and gas usage
NEM 12/13 data generated via eXpertPower
Integrated architecture for residential, commercial and industrial tariffs
Value added support providing market growth with customer satisfaction

Phone: (02) 4774-2959
www.satec-global.com.au

SATEC
Powerful Solutions

Gas leak detector

The Fluke Ti450 SF6 gas leak detector combines a high-quality infrared camera with an SF_6 leak detector that visually pinpoints the location of SF_6 leaks without shutting equipment down. The product lets utility crews include it as a normal part of their maintenance routine, letting them conduct both infrared and gas inspections whenever and wherever necessary. The pistol-grip device makes diagnoses of issues point-and-shoot convenient, even in hard-to-reach or high overhead locations. Technicians can monitor leaks more frequently, allowing maintenance to be scheduled at a convenient time. The leak detector can also be used to quickly verify that the repair was fixed.

The infrared camera includes Fluke's LaserSharp Auto Focus, which delivers instant focus on a single target using a built-in laser distance meter to calculate and display the distance to the designated target. The feature enables technicians to precisely target up to 30 m away for infrared readings and SF_6 gas detection, no matter how awkward the position of the target. This makes it safe to measure around high-voltage areas and potentially dangerous areas.

It also features Fluke IR-Fusion technology, which combines both digital and infrared images in one for better clarity. By adjusting the blending of the image, technicians can easily detect then pinpoint the exact location of the SF_6 gas leak.

The product comes with a 2x telephoto smart lens; a tripod holder for mounting to any industry-standard tripod; an eyepiece; a cable; a viewer; batteries and chargers; and a hard-shell carrying case.

Fluke Australia Pty Ltd
www.fluke.com.au

Fibre cabling solutions

Siemon has added a comprehensive Base 8 Plug and Play system consisting of fibre enclosures, modules, adapters, assemblies and jumpers to its existing line of Lighthouse fibre cabling solutions.

The system enables 100% fibre use, eliminating the need for conversion cords or modules, while providing a complete end-to-end Base 8 fibre system for efficient support of current and future 8-fibre applications. It includes Siemon's high-density FCP3 fibre enclosure along with snap-in Base 8 modules that feature three 8-fibre MTPs to 24 LCs to support 10 Gbps applications and MTP adapter plates to support day-one 40 Gbps or 100 Gbps applications.

The system also includes Base 8 MTP-to-MTP trunk assemblies and jumpers for backbone and equipment connections. Available in OM3/OM4 multimode in both standard and low loss, and in single-mode, the system features smaller diameter RazorCore fibre to reduce cable diameter of assemblies and provide a 2 mm-diameter MTP jumper. It includes Base 8 MTP to LC hybrid assemblies as an alternative to modules for support of 10 Gbps. Base 8 MTP-to-LC BladePatch assemblies feature the innovative push-pull latch activation of the BladePatch plug for easy access in tight-fitting areas.

Siemon Australia
www.siemon.com.au

Electrical accessories

The latest range of Clipsal Iconic products will provide new solutions that enhance functionality through innovative connectivity and added convenience.

Deliver smart functionality with in-room configuration and on/off control via the Wiser Room App. This includes electronic switch, 24-hour timer and 24/7 scheduling time clock that automatically adjust for sunrise, sunset and daylight savings. These BLE controlled modular electronic mechs come with the convenience of app configuration.

Simple point-to-point pairing and configuration between smart devices, and no routers or network hardware are required, so it is easy to install.

ControlLink provides multiway switching and dimming capabilities with push-button electronic mechs using standard wiring. Devices, such as switches, timers and time clocks can also be linked for added flexibility and control.

ControlLink mechs communicate with each other and respond depending on the type of unit and how it is programmed. This means that separate loads can now be controlled simultaneously using the same wiring.

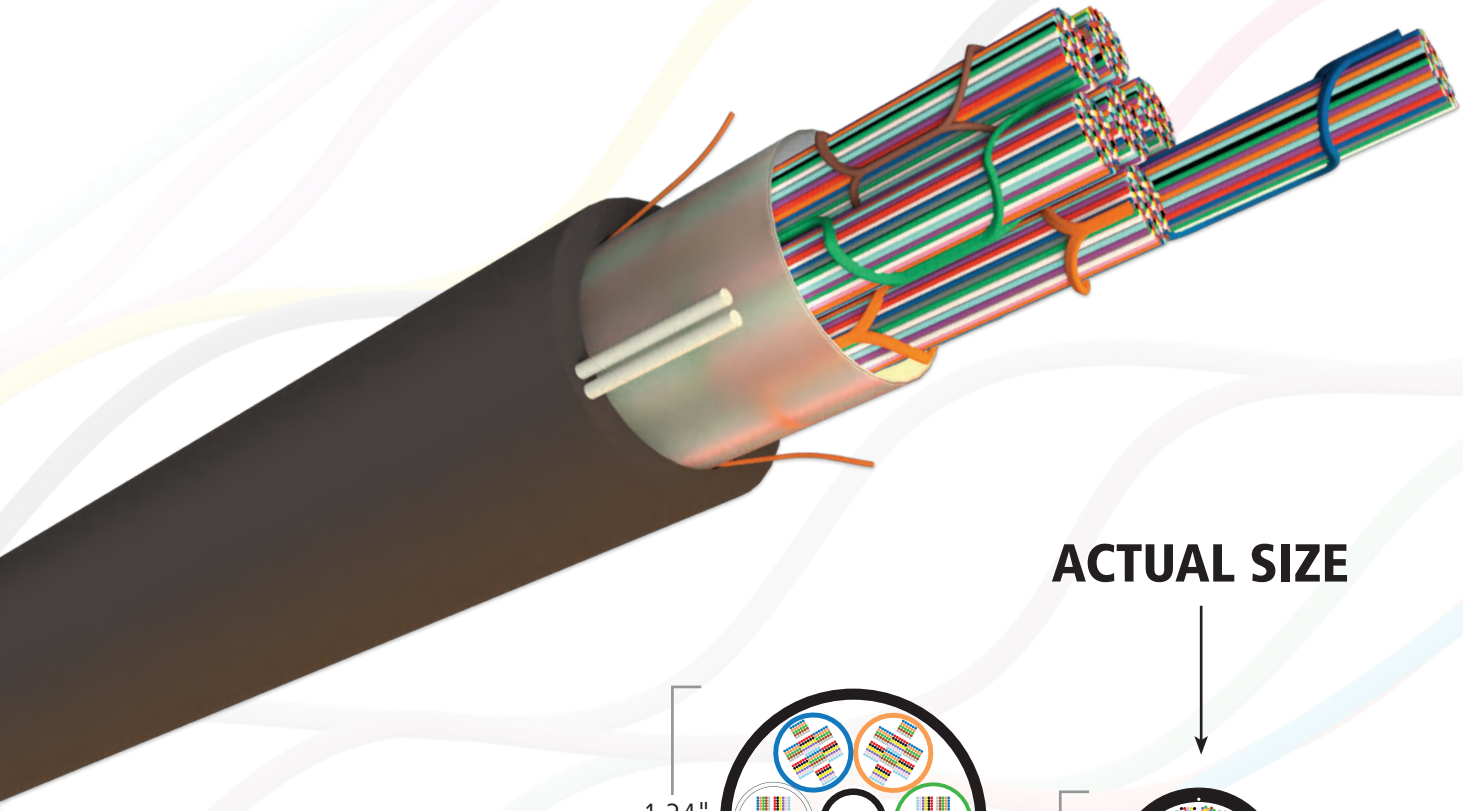
A simple plug-in skin for a Clipsal Iconic twin socket grid delivers stylish low-level lighting with configurable modes of operation.

With smart charging technology, and a total of 4.5 A across 3 USB sockets, and a maximum of 2.1A at each socket, the 3-gang USB charger claims to offer best-in-class performance.

Installation is rapid and easy with inline floating wrapper terminals and a low-profile all-in-one design.

Clipsal by Schneider Electric
www.clipsal.com

WRAPPING TUBE CABLE



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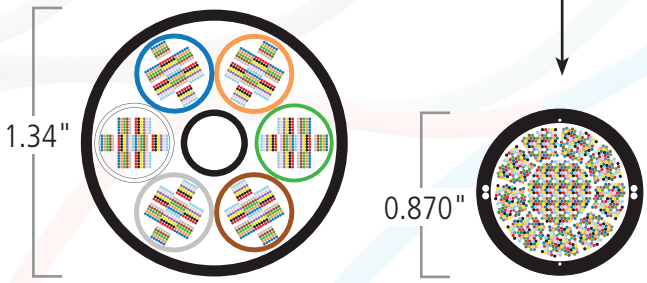

Typical 1728 Fibre
RILT Construction

1728 Fibre
Wrapping Tube Cable (WTC) with SWR®

Doing more with less

AFL's Wrapping Tube Cable (WTC) with SpiderWeb® Ribbon (SWR) is a true game changer. The unique construction of the ribbon fibre makes it easier to work with compared to traditional ribbon fibres, saving installation and splicing time. SWR is easily bunched together allowing more fibres to be used in a smaller space. With AFL's WTC, you can now run 1728-ribbon fibre cables in the same duct that would usually hold a traditional 864-ribbon fibre.

These are not exaggerations. Let us show you the difference our new WTC with SWR can make for you.

AFL

www.AFLglobal.com
1300 232 476

Smart energy meters

SATEC's meters are feature rich encompassing time of use (TOU) tariff functions, demand capabilities, communications for automatic meter reading (AMR), import and export of power, data logging capabilities, real-time clock (RTC), disconnect/reconnect capability, read and write in registers for remote control, communications for the internet of things (IoT) as well as reprogramming and analysis of data for forensic investigation.

SATEC's EM133-AR with four-quadrant measurement and interval data logs meters record energy or other electrical measurements at 15, 30 or 60 min intervals, or other defined intervals of time, providing date/time stamp of recorded data. The meters incorporate event logs providing additional information and date/time stamping for analysis in the event of problems such as voltage outages or reprogramming by unauthorised personnel.

The EM133-AR smart meter provides as standard two pulse inputs for water and gas measurements with recording for daily, weekly, monthly and quarterly for energy readings. It complies with both NMI and NEM market metering requirements ensuring fit for purpose for Type 2, 3, 4 installations and Type 5 and 6 installations upon request. Communications include RS485/Modbus as standard, with optional Ethernet TCP/IP module which can be added in the field for future communication (IoT).

SATEC (Australia) Pty Ltd
www.satec-global.com.au

Suspended light

Dyson Cu-Beam Duo suspended light is a combined up/down light with full, flexible illumination control. It alters to suit changing needs throughout the day.

The Cu-Beam suspended lights feature heat pipe technology, which creates an effective cooling system — meaning each light uses a single high-power, high-efficiency chip on board LED. This single light source, combined with a custom-designed lens, delivers optically efficient, precisely controlled illumination.

The luminaire is supplied with a customised driver, with additional heat sinks and high-grade capacitors. Other features include: custom-engineered rectangular and toroidal optics, with adjustable trim shutters for optimum framing and glare control; and full flexible control of upward and downward light, with the ability to split and dim the light via addressable dimming solutions.

In addition to the Dyson Cu-Beam Duo suspended light, there are two additional products in the range: the Dyson Cu-Beam uplight and the Dyson Cu-Beam downlight. The Dyson Cu-Beam uplight is a suspended uplight with an ultrawide distribution of powerful illumination. Using a custom-engineered bubble optic lens, it casts a wide pool of light across the ceiling. This eliminates hotspots and allows a short drop height, creating soft, ambient light throughout the room. It is suitable for lighting open spaces, such as atriums, foyers and offices.

The Dyson Cu-Beam downlight is a suspended downlight with a controlled pool of powerful illumination. Using a custom-engineered lens and employing precisely calculated optical geometry, it takes a single light source and creates a targeted pyramid of light over a task area. It is suitable for lighting task surfaces, such as meeting tables and office desks.

Dyson (Lighting division)
www.dyson.com.au

DC-DC uninterruptible power supply

Omron's S8BA series of DC-DC uninterruptible power supplies (UPS) is designed to produce a steady 24 VDC output for industrial-purpose computers (IPC) and controllers. Designed to work with the S8VK-S series switch-mode power supply, the combination will work in a wide range of temperatures from -40 to 70°C.

The S8BA can be DIN rail mounted and uses push-in plus terminals for quick and effective connections. It features audible alarms and test buttons to perform self-diagnosis and can provide power for over an hour without mains (depending on load and capacity of the unit).

The S8BA is available in various models for 120, 240, 360 and 480 W and conforms to UL standards for overseas export. It features lightweight lithium-ion batteries for their compactness and efficient industry-grade life expectancy of 10 years (replacement battery packs are available). In addition, it is equipped with three sets of communication interfaces including USB, RS-232C and I/O ports. This permits recognition of interlock shutdowns with an industrial PC or controller.

Omron Electronics Pty Ltd
www.omron.com.au

SOLAR INSTALLERS: TOP TIPS TO GROW YOUR BUSINESS

With around 4500 accredited installers in Australia, the solar panel industry has become a saturated market, making it more important than ever for solar panel installers to know how they can differentiate their business offering from others.

Here are some tips from LG Electronics' solar division on how installers can add value to their business proposition:

- Discuss with the client their needs, budgets and any other considerations to determine an appropriate solar panel system based on their requirements. Are there plans to renovate or extend the residential dwelling? When are the peak times of energy usage in the home?
- Ensure a seamless process with extensive support pre- and post-installation. For many customers, solar panels are a big investment. This makes it incredibly important to ensure the customer feels comfortable with how the project will roll out, the associated costs, time frames and any other considerations. It's also a good idea to communicate with clients in real time so they are aware of even the most modest changes to the project. By building trust and a positive experience, clients are more likely to refer family and friends.
- Only recommend quality products that are manufactured by reputable brands and backed by comprehensive warranties. Look to highly efficient solar panels made with new technologies that can adapt to future needs (such as a growing household). There are many products on the market manufactured with old technologies and while these may offer a lower upfront cost, they are not as energy efficient.
- By opting for quality components, the installer will also receive support from the manufacturer should product issues arise. Australian consumer law stipulates that installers must provide remedies — by offering repairs, replacements or refunds — when the manufacturer is no longer available to support the product. Too often faulty solar panels have resulted in installers fulfilling customer warranty claims, leaving them with out-of-pocket expenses.
- Some clients may consider themselves handy or want to keep costs down and want to install solar panels themselves. For safety reasons, only contractors with a building or electrical class of licence should mount solar panels on rooftops as per the manufacturer's instructions. It's a good idea to remind potential customers that many manufacturers often won't honour warranties or rebates if the solar panels are installed on a DIY basis. For example, the Australian solar rebate of approximately $3500 for a 5 kW system can only be fulfilled if the system was installed by a Clean Energy Council registered designer or installer.

LG continues to invest heavily in the Australian solar market. Offering consumers and commercial customers peace of mind, LG recently introduced a 25-year manufacturer's warranty for its NeON R range.

LG Electronics
www.lge.com.au

GRID MANAGEMENT IN THE AGE OF RENEWABLES

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Driven by legislation and the underlying climate concerns, renewable energy penetration is on the rise. The increased usage of renewable power generation creates new challenges for the electrical grid, system control and the existing power generation facilities.

More and more renewable power generation sources are connecting to the power grid. The power output of many of these sources can be highly variable and their fluctuations have to be compensated for by flexible grid-support plants. In contrast to traditional power generators, grid-support plants are subject to frequent starts and stops, as well as rapid load cycling. As is confirmed by studies of real-life loading cycles in grid-support duty, the key factor that must be taken into account in the design is the increased number of thermal and speed loading cycles. Improving the design of the alternator, so it can withstand additional stresses, is fundamental to the reliability (see Figure 1).

Power plant load cycles

Traditionally, alternators are operated at rated conditions and constant speed over long, uninterrupted periods. This has determined the design principles and dimensioning of alternator structural parts. Grid-balancing operation entails rapid alternation of operation and standstill periods — resulting in a much higher number of starts and stops (as shown in Figure 2). In principle, the difference between the traditional and grid-balancing generator is the number of loading cycles and the steepness of the load change.

Modern generating sets can get from zero to full speed in 30 s and to full load in 5 min; stopping time from full load to standstill is 1 min. The plant shown in Figure 3 had nine starts and stops over a six-day period, averaging to 500 annually. In practice, the number of cycles can be even much higher.

Loading profiles

In general, the warming and cooling of alternator parts is not even and their thermal time constants differ. This transient anisotropy is the main contributor to thermal stress and makes the analysis of thermal cycles demanding.

To analyse and simulate thermal behaviour, two different load profiles — derived from the real site described above — were selected (as shown in Figure 4). These examples provide a maximum number of load/standstill cycles, which also gives a maximum number of thermal loading cycles for evaluation (Figure 4a), as

THE ONLY WAY TO RELIABLY INVESTIGATE THE FATIGUE STRENGTH OF THE STRUCTURAL DESIGN IS TO PERFORM A RESPONSE ANALYSIS FOR THE WHOLE GENERATING SET.

well as a temperature gradient between the winding and core that is close to its maximum value (Figure 4b).

Analysis of the thermal cycles

It is expected that the thermal stresses are mainly generated in the windings and the core region of the alternator. The prediction of thermal stresses requires that the temperature distribution can be simulated. The thermal conductivity of copper is excellent and that of steel is good. Thus, the largest temperature gradients are in the electrical insulation layers between the copper–copper and copper–steel joint surfaces. The temperature difference between these parts defines thermal stress in an alternator. A thermal network method was applied to predict the transient thermal behaviour of the active parts of an alternator, such as the stator. In the case with several consecutive short loading/idle cycles, the temperature difference between the winding and core can vary by as much as 10 to 25 K during the load cycles (Figure 5a). Where there is a longer full-load period reaching close to maximum operating temperatures, the temperature difference between the winding and core can reach 30 K (Figure 5b).

As the stator coils are bonded to the slot walls due to the impregnation treatment and cannot move freely, internal stresses are generated in the insulation layers, which can lead to cracking if appropriate measures are not taken.

Analysis of the speed cycles

Usually, the origins of alternator vibrations are the reciprocating forces of the combustion engine. A four-stroke internal combustion engine creates excitation forces on full and half harmonics of the rotational speed. The generating unit is so complex that only numerical simulations can predict the vibration behaviour with the required accuracy. The only way to reliably investigate the fatigue strength of the structural design is to perform a response analysis for the whole generating set. The vibration design of continuously operating alternators is based on the avoidance of main resonances. Due to the high number of starts and stops, fatigue design of grid-balancing applications requires analysis also for start and stop cases.

Implications for alternator design

Based on the thermal and speed-cycle analysis, as well as experience from other high cyclic generator and motor applications, there are several parts in the alternator that must be carefully considered when designing reliable alternators for grid-balancing applications.

Insulation and winding system

As discussed above, winding and insulation are detrimentally affected by thermal cycling. Experience has shown — and analysis has confirmed — that global vacuum pressure impregnation (VPI) gives outstanding characteristics to the whole stator and rotor (laminated steel core and windings).

In the development process, the verification of the system by testing is always important. In a typical thermal cycling test procedure, several sets of test bars are heated in an oven to different temperatures and cycle times. The test bars are then exposed to mechanical stress on a vibration bench, to humidity and finally to voltage testing of conductor insulation and main insulation.

Figure 1: The alternators in grid-support plants must be designed to accommodate the thermal and mechanical stresses caused by the need to ramp up and down in response to variable renewable generation on the grid. Shown is power generation equipment with separate generating units at the Kiisa power plant in Estonia.

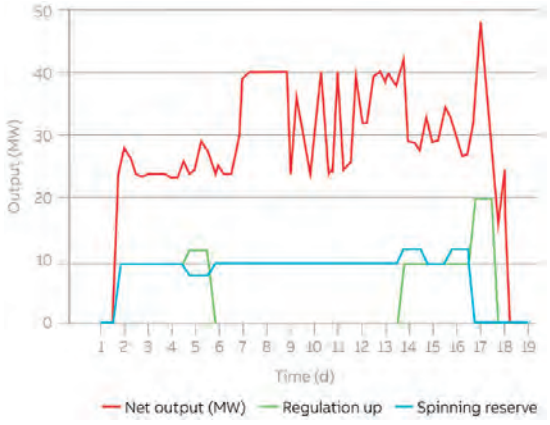


Figure 2: The measured balancing power of a combustion engine-based plant over an 18-hour power production period.

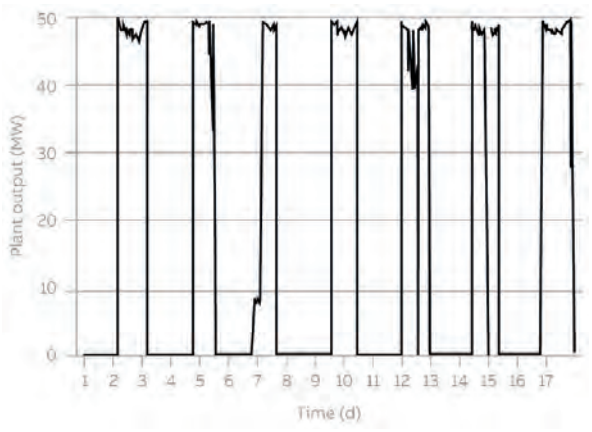


Figure 3: Power production of a plant over one week in August 2013.

Test cycles are repeated until a certain number of test bars in each set fails voltage testing. The lifetime is then calculated from the test results of each set using the so-called Arrhenius rule (See Figure 6). Successful tests have been recently performed for the impregnation system in use.

End windings

End windings, along with their support construction and connections, are exposed to thermal cycling and vibrations caused by acceleration, deceleration and frequent grid switching.

The vibration of stator end windings is of major concern in large electric machines. Particularly in two-pole machines, the natural frequencies of winding ends tend to decrease to close to the twice-line frequency (100/120 Hz). Thus, in these machines special support structures are needed in order to increase the winding end stiffness and natural frequencies. However, in multipole alternators the winding ends are inherently short and the natural frequencies sufficiently high without any additional support structures.

In the development and design of the end winding construction a set of modern methods is used, including 3D finite element analysis (FEA). This method is used for the calculation of forces together with static and dynamic response.

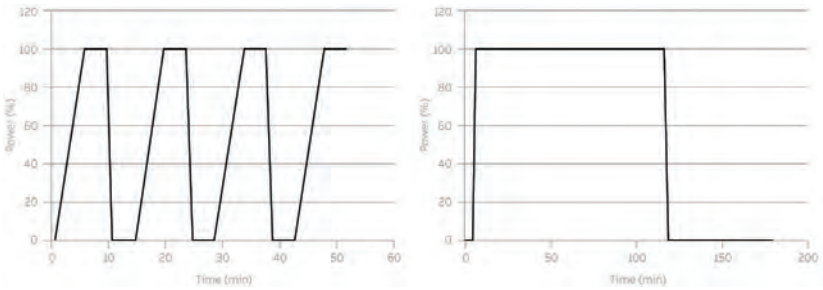
The construction and design of the end winding support system with global VPI gives very good characteristics given existing forces and stresses. This means that the end winding design of medium-speed grid-balancing alternators is robust and resilient against vibrations. Operation at underexcitation (consuming reactive power) causes thermal stresses in the core-end region. In the case of medium-speed alternators (high pole number), this effect is less severe thanks to the smaller coil width and more favourable flux distribution at the end region.

Frame

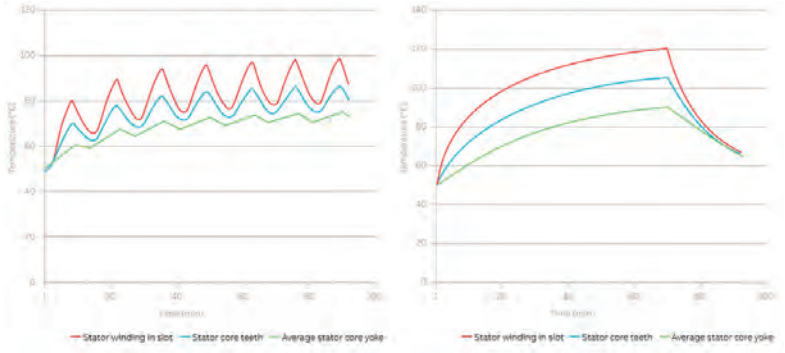
The frame of the alternator is mounted on the common base frame together with the combustion engine. The design of the alternator frame is determined significantly by the vibration excitations of the engine transmitted to it by the base frame. This leads to a slightly more robust frame design compared to alternators mounted on a concrete foundation.

The alternator frame design is determined by fatigue resistance. The ability to design reliable alternators, and still have a cost-efficient frame structure, requires thorough knowledge of the dynamics of the whole generating set. A response analysis (numerical simulation) of the whole generating unit is the key to success here.

The fatigue stresses can be simulated during the start-up and shutdown periods. Based on the calculated stress histories, the fatigue life can be evaluated by conventional methods and the critical structural details can then be modified to resist the fatigue loads. Ultimately, this approach ensures that the alternator frame reaches the desired lifetime without any fatigue failures.



Generator loading profiles used in the thermal cycle analyses. Figure 4a (left): Repeated ramp-up from zero to full load for 5 min, then 1 min ramp-down to no-load, with 5 min standstill period. Figure 4b (right): Rapid ramp-up in 5 min to full load staying at full load for 2 h, followed by a rapid ramp-down in 1 min to no-load.



Predicted stator temperature of an alternator (20.8 MVA, 13.8 kV, 60 Hz and 514 rpm). Figure 5a (left): At maximum thermal cycle frequency, the temperature difference between the winding and core varies between 10 and 25 K, peaking after the first cycle. Figure 5b (right): At maximum thermal cycle amplitude, the temperature difference between the winding and core reaches a level of 30 K.

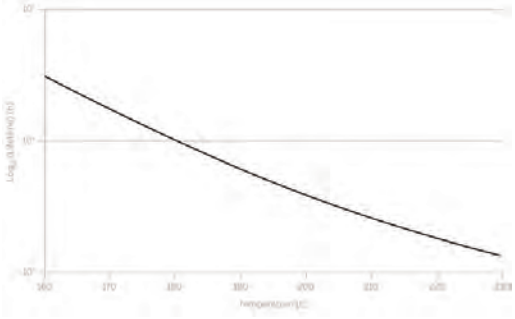


Figure 6: Example of the verification test results for winding insulation lifetime.

Rotor and bearings

Regarding rotor design, medium-speed alternators are always subcritical. This means that the first flexural critical speed of the rotor is above the rated rotational speed of the alternator. The rotor does not cross any flexural critical speeds during the cycling loading, thus giving freedom to rotor and bearing design. This is a clear advantage over higher speed alternators (eg, two-pole design).

The thermal cycles have effects on the rotor similar to those on the stator. The prevailing principle of rotor design is to retain the contact between the components over the temperature cycles — thus avoiding the resin mechanical fatigue. Moreover, the bearings are equipped with a jack-up system, enabling a very large number of starts without any wear.

Good design ensures long life

The age of variable renewable generation means that grid-balancing generators must endure a much larger number of thermal and speed cycles than traditional generating units. The design of the grid-balancing alternator requires particular attention for reliable operation. However, with an optimal design, alternators will be able to withstand these new, greater stresses and deliver high reliability over very long lifetimes.

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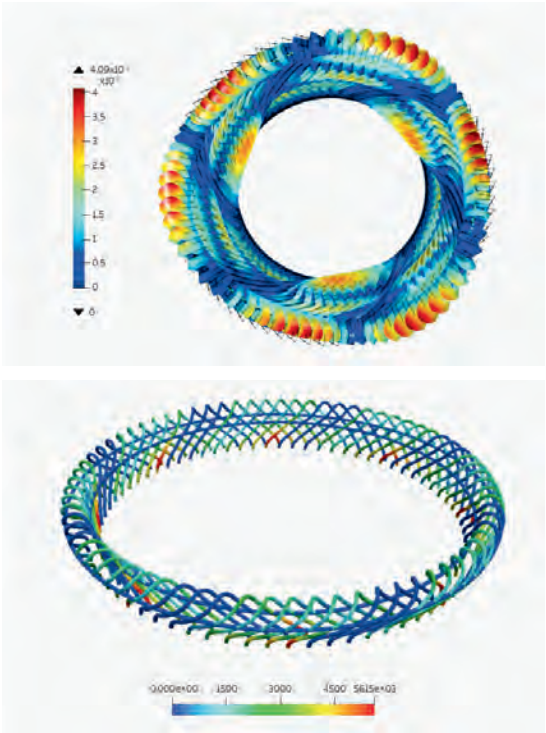

Figure 7.

System architecture for mining

Schneider Electric's EcoStruxure for Mining, Minerals and Metals is a system architecture and platform that leverages digital technologies and the IIoT. It allows companies to connect, collect, analyse and act on data in real time to improve safety, efficiency and sustainability.

EcoStruxure integrates innovation at three levels: connected products; edge control; and applications, analytics and services.

Field devices with embedded intelligence, such as sensors, circuit breakers, meters, variable speed drives and process instrumentation, provide the link to real-time data that is essential to higher-level control and decision-making.

Real-time and run-time control systems are connected to field devices and collect data from them, analyse current conditions against goals and past performance, and make autonomous control decisions to improve process performance. At the heart of the edge control layer is the Modicon M580 Ethernet PAC (ePAC), the automation controller that uses open Ethernet standards to enable process efficiency, flexibility and cybersecurity.

At the highest level of the EcoStruxure architecture, sophisticated problem-solving and analysis is performed on an enterprise-wide basis to optimise business operations and maximise results. On this level, Schneider Electric provides a portfolio of software and associated services.

Schneider Electric

www.schneider-electric.com.au

Power quality analyser

The Hioki PW3198 power quality analyser is available to rent from TechRentals.

With simple one-button operation, the analyser can record voltage, current, pf, f (Hz), kVA, kVAr, kW, harmonics (THD and individual to 50th order), flicker (IEC6100-4-15) and inrush current. Transient overvoltage can also be measured up to 6 kV peak at 2 MSa/s.

This unit meets the CAT IV safety standard and international standard IEC 61000-4-30 Edition 2 Class A. It is supplied with analysis software (Hioki 9624 PQA-HiVIEW) for reporting, compliance and record management.

Other features include: four isolated voltage channels rated CAT IV/600 V RMS AC or DC; 2 GB memory; total energy, tariffs, max demands, transient, and sub-cycle disturbances; 3x fixed 1000 A AC CT, 4x flexible 500 A/5000 A CT, and 1x 200 A AC/DC CT.

TechRentals

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Modular test platform

The VeEX MTTplus platform provides a compact, powerful and cost-effective modular test toolkit for today's wide range of evolving test needs.

The platform addresses the challenges of communication service providers to increase efficiency and productivity. The flexible test platform lowers operational and capital expenditures associated with handling multiple technologies required to address today's access, business, Carrier Ethernet, transport and core services.

Available test modules include MTTplus-260 SHDSL test module option, MTTplus-320 multiservice test module option, MTTplus-410 fibre-optics test module option and MTTplus-520 AnyDSL test module option.

Platform highlights include modern, modular test platform with a growing range of available test modules covering legacy and modern access (copper and fibre), FTTx, metro, Carrier Ethernet and transport technologies; application-oriented GUI; multitechnology: xDSL, fibre optics, teleprotection, Datacom, DSn/PDH, SONET/SDH, OTN, Ethernet, fibre channel, CPRI/OBSAI; expand test functions with a growing list of test modules; futureproof cost-effective platform; the optional MTT carrier module brings forward compatibility to popular MTT test modules, protecting the original investment and facilitating easy transition; GUI familiarity across different test modules and other VeEX products reduces learning curve; test set connectivity via USB, Ethernet, Wi-Fi and cellular; four USB ports (3 x USB A and 1 x micro-USB B); fast and efficient test result transfer to USB memory stick; built-in GPS option; built-in camera option for job site documentation, QR and bar codes; small package and lightweight; field replaceable battery pack; and large LCD touch screen and ambient light sensor.

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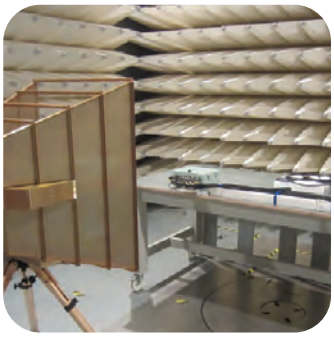

Austest Laboratories offers the most comprehensive and publicly available EMC, Environmental, Electrical safety and Telecom product testing in Australia and New Zealand. As an INDEPENDENT testing and certification company, we assist manufacturers, importers and exporters in gaining access to local and international markets.

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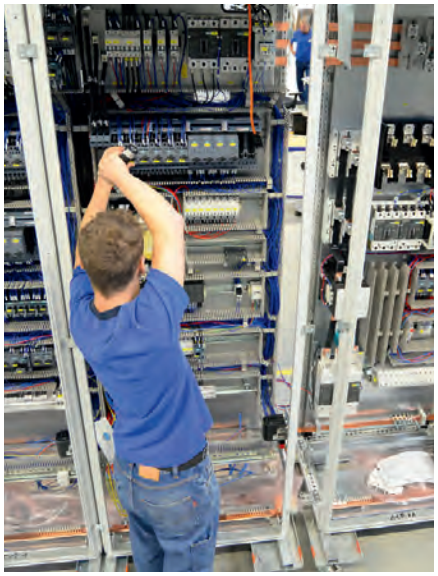

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Three-phase power quality and energy analyser

The Fluke 435 three-phase power quality and energy analyser is used to locate, prevent and troubleshoot power quality problems in three- and single-phase power distribution systems. It is available for rent at TechRentals.

The analyser introduces a unique energy loss calculator which provides the ability to monetarily quantify energy losses through the Fluke patented unified power measurement algorithm. This technology measures and quantifies energy losses due to harmonics and unbalance issues, and allows the user to pinpoint the origin of energy waste within a system.

The 435 has a waveform capture of 100/120 cycles (50/60 Hz) of each event that is detected in all modes, and the automatic transient mode captures 200 kSa/s waveform data on all phases simultaneously up to 6 kV. The 435 is also Class-A compliant with the IEC 61000-4-30 standard.

Features include energy loss calculator, power inverter efficiency, Class-A compliant and 600 V CAT IV/1000 V CAT III.

TechRentals

www.techrentals.com.au

Optical fibre ducting raceway

The Warren and Brown Technologies (WBT) optical fibre ducting raceway is an Australian-made solution designed for managing, routing and protecting fibre-optic cords between termination equipment, patch panels and fibre-optic splicing cabinets or frames.

The solution is suitable for use in telecommunications exchanges, data centres and other network environments. WBT ducting raceway items conform to the following standards and requirements: ISO 9001 Certified Quality Management System by NCS International; UL2024A standard; ROHS requirements; and GR-63 Core Earthquake test compliance. Featuring fire-retardant plastic, it is UL94 rated and halogen free.

Warren & Brown Technologies

www.wbtnetworks.com.au

Solar panels

The LG NeON R 60-cell solar panels deliver up to 360 W power (20.8% module efficiency), making them suitable for home owners who want to get more electricity within a limited roof space.

The multiribbon busbar technology hidden at the rear of the module, under the backing sheet, lowers electrical resistance and increases panel efficiency, giving more power per panel, and provides a more uniform look to the panel.

The panels have received certifications for salt mist corrosion to maximum severity 6 and ammonia resistance, and can be installed confidently right up to the coastline.

LG is using an anti-reflective coating on the NeON R glass as well as on the cell surface to ensure more light is absorbed in the panel and not reflected.

With a reinforced frame design, the panels can endure a front load of 6000 Pa, which is the equivalent of 1048 kg in weight over the size of the module. The rear load/wind load of the module is 5400 Pa, which is said to be more than twice the wind load resistance of standard modules (2400 Pa).

LG Electronics

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Industrial network switch

The Allen-Bradley Stratix 2500 lightly managed switch provides the security, resiliency, segmentation and bandwidth-optimisation benefits of a managed switch without the need for extensive configuration.

When installed straight out of the box, the industrial Ethernet switch can prioritise critical industrial network traffic. It also can be configured for application-specific needs. Manufacturers can use this flexibility to futureproof their operations by deploying the switch out of the box and scaling it up to a lightly managed switch as their needs evolve.

As a lightly managed switch, it is said to exceed the capabilities of an unmanaged switch by monitoring and optimising traffic flow and providing diagnostic information to help minimise downtime. It also can support up to 64 VLANs for logical segmentation, which helps reduce total cost of ownership. In addition, port security allows users to disable ports or control end-device connectivity based on the media access control address.

The switch uses embedded Cisco technology and is part of the Rockwell Automation Integrated Architecture system. This helps ease network configuration, management and support while optimising integration with the enterprise network.

Rockwell Automation Australia
www.rockwellautomation.com.au

Contractor lockout kits

The Cirlock contractor lockout kits have been put together especially for commercial tradespeople and contractors working on various sites. The different kit sizes available will enable the worker to lock out/tag out most common energy sources. This includes electrical as well as gasses and high pressure.

The kit is packed with all the lockout equipment needed — universal lockout for miniature and moulded case circuit breakers, a universal lockout for fuse holders, multifunction cable lockout device, lockout hasp, safety lockout padlock as well as danger and warning tags. It also includes a 240 V Plug and hose lockout device, and the Little Book about Lockout/Tagout. It is all contained in a convenient carry bag with zipper and belt hasp for easy storage and transport.

Custom-made lockout kits are also available. Features include more than 8 size options to choose from; contractor lockout kits for electrical; contactor lockout kits for mechanical; combination valve/electrical lockout kits; and carry bags, belt bags, waist bags and toolbox accessories are available.

Cirlock
www.cirlock.com.au

TCP TESTING

Transmission Control Protocol (TCP) turns the 'best effort' nature of IP networks into reliable communication services. Tests are, however, needed to ensure optimal performance.

Communication is essential for the modern society and its enterprises. Many enterprises cover a large geographical area with a number of remote branch offices that also need to be included in the enterprise communication network to get access to applications and services needed for their business.

To ensure they get the performance and quality they need, enterprises typically sign a service level agreement (SLA) with a service provider for their communication through the service provider's network. The SLA will be based on layer 2-3 parameters and contains worst case values for parameters like bandwidth, latency, packet jitter, frame loss ratio and availability. The service provider can verify that the SLA requirements are met using RFC 2544 and Y.1564 test methodologies. However, even if the tests show that all criteria are fulfilled, the enterprises may complain that they get less bandwidth than expected or that they experience long response times from the applications they use. The reason for the complaints will in many cases be non-optimal configuration of the layer 4 TCP. TCP is the de facto standard way of interconnecting hosts over the internet.

TCP turns the 'best effort' nature of IP networks into reliable communication services by adding mechanisms, which guarantee that data sent over a network will actually be delivered to the recipient in the right order. To achieve this, TCP needs to buffer the data at both the sending and receiving end of a connection. If these buffers are dimensioned incorrectly, customers may experience bandwidth or response time issues. Even though end-to-end TCP connections typically is handled by equipment managed by enterprise IT departments, the service provider will often get complains about degraded network performance in case of TCP layer problems. Therefore, the service providers will benefit from having tools to test and verify the network's TCP performance and discuss the TCP issues with the enterprises.

In RFC 6349 the Internet Engineering Task Force (IETF) has defined a "Framework for TCP Throughput Testing", providing a methodology for testing sustained TCP Layer performance. In addition to finding the TCP throughput at the optimal buffer size, RFC 6349 presents metrics that can be used to better understand the results. With RFC 6349 service providers can document their network's TCP performance to their customers.

TCP

TCP is a transport protocol carried over the Internet Protocol (IP) — together the two protocols are often called the TCP/IP protocol stack. The TCP is a host-to-host protocol; its scope is to provide a reliable process-to-process communication in a multinetwork

environment. Where IP provides no guarantee that sent packets are actually delivered to the intended recipient in the right order, TCP detects these problems, retransmits lost data, removes duplicated data and rearranges out-of-order data. TCP provides reliable, ordered and error-checked data delivery between applications communicating through an IP network. Many applications like the World Wide Web, email and file transfer use TCP, and with many users on a network accessing these applications, the number of concurrent TCP connections in the network can be very high. Applications that do not require reliable data delivery can use the connectionless user datagram protocol (UDP), which provides reduced latency and reliability.

TCP is a connection-oriented protocol and includes connection establishment and closing phases. Data received from higher protocol layers are divided into segments with sequence numbers and sent through the network. The receiving end must acknowledge the segments; if the sending end does not receive the acknowledgement (ACK) within a certain time frame, the segment will be retransmitted. TCP sequence numbers are 32 bits long; a sequence number is assigned to each byte sent. When a packet containing a TCP segment is sent, the TCP header will include the sequence number of first byte in the segment. ACK packets include the next sequence number expected by the receiver.

Buffers — or windows — are used at sending and receiving ends to avoid throughput reduction. For each connection, TCP maintains a Congestion Window (CWND), limiting the total number of unacknowledged segments that may be in transit (or be 'in-flight') end to end. If the CWND is too large the network may be congested ie, receive more data than it can handle and it will drop some of the data. This will lead to retransmissions, which will reduce the effective TCP throughput. Therefore, algorithms have been defined to avoid undue congestion by adjusting the size of the CWND. The algorithms will increase the CWND size until packets are lost and then find a lower CWND size for the connection. The original TCP congestion avoidance algorithm was known as "TCP Tahoe", but later many other algorithms have been defined (eg, TCP Reno, TCP New Reno, TCP Vegas, FAST TCP and TCP Hybla).

The sending part can send all the contents of the CWND without receiving any ACKs. When ACKs are received the related part of the CWND is released and can be used for new segments.

RFC 6349

The RFC 6349 "Framework for TCP Throughput Testing" provides a methodology for testing sustained TCP Layer performance. In addition to finding the TCP throughput at the optimal buffer size, RFC 6349 presents metrics that can be used to better understand the results.

RFC 6349 testing is done in three steps: identify the path maximum transmission unit (MTU); identify the baseline round-trip time (RTT) and the bottleneck bandwidth (BB); and perform the TCP connection throughput tests. However, before starting the TCP tests, RFC 6349 recommends that layer 2/3 tests are conducted to verify the integrity of the network. This may be manual measurements of throughput, loss and delay. This can also be done with RFC 2544 tests (although RFC 2544 was not intended for use outside a lab) or Y.1564 tests.

Together with the TCP throughput measurement, RFC 6349 presents metrics that can be used to better understand the results, including: the TCP Transfer Time Ratio; the TCP Efficiency Percentage. These metrics must be measured in each direction.

RFC 6349 based TCP throughput testing and stress load testing is supported by Xena Networks test solutions. To generate test signals with stateful TCP traffic for throughput testing and for generation of a very high number of concurrent TCP connections the Xena Networks testers supporting layer 4-7, XenaScale and XenaAppliance are suitable. Testing at lower layers like RFC 2544 testing is supported by the XenaBay and XenaCompact test chassis equipped with relevant test modules.

Conclusion

Incorrect dimensioning of buffers for the layer 4 TCP may mean that customers experience performance degradation even though service providers can prove that their layer 2/3 IP network operates in accordance with a service level agreement (SLA) signed with the customer.

RFC 6349 provides a methodology for testing sustained TCP Layer performance. In addition to finding the TCP throughput at the optimal buffer size, RFC 6349 presents metrics that can be used to better understand the results. The Xena layer 4-7 test solutions XenaScale and XenaAppliance together with the layer 2-3 test solutions XenaBay and XenaCompact support powerful TCP testing based on RCF 6349. In addition, XenaScale and XenaAppliance support extreme RFC 6349 testing with millions of concurrent TCP connections.

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Switches, sockets and smart devices

Clipsal has added new products to its Iconic range of switches, sockets and smart devices.

The latest additions include Bluetooth Low Energy (BLE) mechanisms that deliver smart functionality with in-room configuration and on/off control via the Wiser Room App. The BLE mechs feature point-to-point pairing and configuration between smart devices and require no routers or network hardware, so they are easy to install. All settings are stored on the device and the time clock can automatically adjust for sunrise, sunset and daylight savings.

ControlLink provides multiway switching and dimming capabilities with push-button electronic mechs using standard wiring. Devices can also be linked for added flexibility and control. Night Walk is a motion-activated, plug-in skin night light that provides peace of mind to users with a soft white LED glow. Also included are a 3-gang USB charger with shelf that delivers fast charging of tablets, smartphones and other USB devices, a 4-gang slim GPO that can fit dual twin USB chargers and four GPO sockets.

Clipsal by Schneider Electric
www.clipsal.com

Smart meters

The Kamstrup Multical range of smart energy meters is designed to measure water and thermal energy use in large residential and commercial buildings.

The Multical 602 is an all-purpose energy calculator for heat and cooling together with almost any kind of pulsed flow sensor and with 2 or 4 wired temperature sensor pairs.

Used together with Kamstrup ultrasonic flow sensor Ultraflow, even more advanced functions are available. On account of its pinpoint accuracy, the meter registers precise consumption throughout the whole lifetime of the meter. The meter is maintenance-free and has a long lifetime, which guarantees minimum yearly operating costs. The Multical 602 is used for heat, cooling and combined heat/cooling measurement in all water-based systems with temperatures from 2 to 180°C for heat and 2 to 50°C for cooling.

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www.aquip.com.au

Chillers

Mitsubishi Electric Australia has launched a range of inverter-driven chillers to the Australian market. The e-series modular chiller range is designed to answer the need for controllable, energy-efficient cooling and heating, with reduced plant size and a host of benefits.

The e-series chiller (available in heat pump and cooling-only modules) uses two DC inverter-driven scroll compressors in each 90 kW module, taken from the VRF (variable refrigerant flow) sector, to deliver a capacity range of 8–100%. The models deliver high levels of efficiency, with the ability for units to operate on their own or in tandem with others.

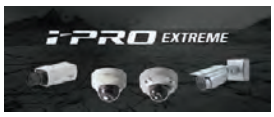
The shape and modular design of the series mean that the system can be constructed with up to six individual units connected together, to provide a capacity of between 90 and 540 kW. The use of U-shaped heat exchangers offers a greater surface area and also means that the units are narrower than conventional systems.

The 90 kW modules can be positioned next to each other in a row, with up to six units using the same inbuilt internal header. For larger systems, it is also possible to have double rows of the units with a gap of only 900 mm service space.

The series achieves quiet noise levels, which is increasingly important in inner city locations. These low noise levels are achieved through both the construction and design of each unit as well as the component technology within each chiller, which is also easily integrated with new and existing systems using BMS control.

Mitsubishi Electric Australia
www.mitsubishi-electric.com.au

Surveillance technology platform



Panasonic has launched its next-generation i-PRO Extreme surveillance technology platform, a native end-to-end H.265 system designed to maximise the performance and video surveillance systems whilst protecting against cybersecurity threats.

The platform will be rolled out across Panasonic's cameras, recorders and video management software (VMS) in 2017, delivering enhancements in image quality, data compression and security, and embedded intelligence. The platform has been launched in the Australian market in response to the rising need for companies to store more data at a lower cost and reduce bandwidth requirements, which the platform ensures by reducing streaming and storage by approximately 50% over the H.264 industry standard.

The range of cameras provides a secure protection layer and robust authentication to guard against cyberthreats, with a PC-level IP data security suite via Panasonic Secure Communication technology and Symantec Device Certificates.

Panasonic Australia Pty Limited
www.panasonic.com.au

Installer meter

The VePAL CX350s-D3.1 is a portable, all-in-one test solution for legacy analog and digital cable TV networks, supporting SLM, DOCSIS 3.0/3.1, Ethernet and T1 test capabilities.

Platform highlights include robust, lightweight chassis packed with powerful features for demanding environments and test conditions; high resolution colour 7″ touch-screen with graphical user interface; Ethernet LAN management port for remote control, back office applications, and work-force management; fast and efficient test result transfer to USB memory stick or FTP upload via LAN or DOCSIS ports; maintain instrument software, manage test set-ups and channel tables, process measurement results and generate customer test reports using included ReVeal PC software; extend field testing time using interchangeable Li-ion battery pack/s; ability to lock user interface to prevent unwanted human interference during long-term testing; Wi-Fi Wiz with InSSIDer SSID analysis; Wi-Fi spectrum analyser; VoIP and IPTV; digital fibre inspection scope; and optical power meter.

TelecomTest Solutions
www.telecomtest.com.au

LED lamps for urban and high-bay environments

The Philips TrueForce LED includes TrueForce LED Urban, an LED lamp alternative for outdoor luminaires in public spaces, and TrueForce LED Industrial and Retail, a plug-and-play LED lamp alternative for industrial, large-scale retail applications to replace traditional HID lamps.

Philips' TrueForce LED range has a life of 50,000 h and comes with a five-year warranty. The range is said to offer energy savings of up to 75% compared to conventional lamps.

The TrueForce lamps are designed to fit well with existing modern and traditional outdoor luminaires such as post top or bollards. They are available in two versions: a clear lens for applications where the lamp is not visible and a frosted lens for transparent luminaires to improve light output while maintaining an original look and feel.

The Industrial and Retail range is designed for difficult-to-reach luminaires where replacement and installation are especially laborious, such as high warehouse ceilings. It provides the same quality light effects as conventional lamps, such as light distribution and lux levels, that are of critical importance to industrial and retail environments. It provides light instantly, which is crucial for environments where safety and productivity are important. The Industrial and Retail range will be introduced in the second half of 2017.

Philips Lighting Pty Ltd
www.philips.com

Busbar system

Rittal's RiLine Compact busbar systems are designed for control units that require a maximum current of 125 A.

Despite its size, the busbar system distributes power effectively in compliance with all applicable standards. The technology is suitable for small switchgear and controllers, and for direct integration into plant and equipment.

The busbars do not require holders and have end-to-end contact hazard protection. Switching and protective devices can be connected quickly and easily, saving time and effort during engineering and downstream installation.

The system comprises a board with busbars entirely enclosed in covers that safeguard against unintentional contact. A connection can be easily established anywhere along the length of a busbar via a series of access apertures (called the pitch pattern) in the board. Switchgear and control units can be 'plugged in' using a variety of adapters. In addition, an adapter for connection to round conductors is available, as well as a variety of functional modules for motor and power control.

The system can be rapidly configured, assembled and installed. The main board and diverse components can be securely mounted without the need for tools. Because the entire system is shielded by covers, users are protected against live parts. This enhances safety for operators and for the system as a whole.

Rittal Pty Ltd
www.rittal.com.au

Cable-pull switch

The Allen-Bradley Guardmaster Lifeline 5 cable-pull switch, from Rockwell Automation, offers an electronic rope-monitoring system to compensate for thermal expansion and cable sag.

The solid-state switch provides constant access to the e-stop function, stopping a machine hazard with a simple pull of the attached cable. The microprocessor-based solution simplifies set-up and allows for more efficient maintenance and troubleshooting. The easy-to-see LED indicators assist in cable tensioning for quick, precise set-up while providing switch status and diagnostics during operation.

Available in diecast aluminum or rugged stainless steel housings with IP66 and IP67 environmental ratings, respectively, the switch helps optimise productivity with diagnostics that can help prevent unplanned downtime. The diecast aluminum model also offers an optional, integrated e-stop button for even greater application flexibility.

Rockwell Automation Australia
www.rockwellautomation.com.au

INFINITY CABLE RULING

LEAVES DOOR OPEN TO DODGY PRODUCTS

The construction industry is estimated to spend over $80m for remediating the faulty Infinity cable but the sole director of company behind the imports has just been fined $18,000 plus $15,000 in costs by the NSW Supreme Court, according to Australian Industry Group Chief Executive Innes Willox.

The relatively minor penalty in the Infinity Cable case, which was reported for the first time today [30 May], should prompt stronger action from federal and state governments to stop the proliferation of dodgy and dangerous building products, Willox said.

"Infinity cables were recalled nationally in 2014 after they failed to meet electrical safety standards due to poor quality plastic insulation coating. Estimates indicate that over 4000 km of faulty cable was installed in 22,000 homes nationwide. ACCC figures show 46% of cable is still yet to be found and removed.

"There is a clear risk that unscrupulous importers of counterfeit or substandard building products will see this fine as a minor operational inconvenience compared with the big profits to be made by undercutting suppliers of up-to-scratch products.

"The case highlights a number of issues that need to addressed. These include:

- At the time, Infinity did not (and was not required to) substantiate conformance from an approved certifier and the word of the manufacturer was regarded as sufficient notwithstanding that they had not made the product previously. While this has since changed with respect to building wire cable, the case highlights the importance of proactive assessment of the adequacy of current requirements; and
- There was no 'cop on the beat' so that the case was only exposed after the intervention of the Australian Cablemakers' Association.

"Australia's building regulatory system needs to send a message to unscrupulous operators that there are consequences for supplying product that does not comply with regulatory obligations. There is a major risk that the low fine in this case, notwithstanding the efforts of NSW Fair Trading, does the opposite.

"Ai Group has pursued the issue of non-conforming product (NCP) since 2013 when we released our industry report *The quest for a level playing field: the non-conforming building products dilemma*. That was followed by a national forum to discuss pathways forward. Ai Group also helped form the Construction Product Alliance to ensure all of industry was engaged in addressing this problem.

"Ai Group is disappointed that the report from the Senate inquiry into non-conforming building product has been delayed. However, we are encouraged with the action of the Qld Government in last week introducing a Bill in parliament to place greater responsibilities on all participants in the supply chain for product conformance," Willox said.

Energy storage system

Magellan's Home Energy Storage System (HESS) converts solar energy into useable power and stores it, allowing users to benefit from solar power at night. This is combined with bidirectional energy management that recharges the battery during off-peak hours.

Designed and built in Western Australia, for Australian weather conditions, the 1.3 m-high HESS is made for durability and has an in-built cooling system designed to protect the battery from the Australian heat. Other benefits include an uninterrupted power supply (UPS) function that allows selected essential power loads, such as refrigerators, lights, computers and TVs, to remain unaffected in the case of a blackout.

The redesigned HESS can still be monitored via smartphone or tablet and be charged from solar panels or the grid. It contains lithium LG Chem batteries.

The product is available in 6.5 and 13 kWh. Energy trading and IoT ready, it is suitable for installation under eaves or in the garage. Its hybrid design means it is capable of solar and grid charging, and it is compatible with existing solar installations.

It includes a powerful 5 kVA inverter; an expandable modular battery design; intelligent energy management; high-efficiency power conversion; an easy-to-use colour touch screen; and easy Wi-Fi connectivity.

Magellan Power
www.magellan-power.com.au

UV cure system

The UJ35 UV cure system by Panasonic utilises LED technology, requires less energy than conventional curing systems and has a lifetime of over 20,000 h. Unlike a lamp-type system that needs to be kept turned on throughout the operation, the LED type can turn UV irradiation on and off as needed. Under certain circumstances, this could extend the LED life up to 100,000 h.

The LED heads irradiate using 365 or 385 nm wavelength UV rays that do not contain infrared rays (heat). This makes them suitable for applications that require high-precision bonding with minimum thermal distortion, such as the assembly of thin plastic components.

The compact body is also equipped with temperature feedback control, providing good performance for bonding and fixing with UV-curable resin. The intelligent control system allows for up to 10 steps and seven different irradiation patterns to be programmed for each of the four LED heads, making one unit useable for up to four individual processes.

Control Logic Pty Ltd
www.control-logic.com.au

Smart outdoor wireless security camera

Andatech has introduced the SolarCam — a solar-powered outdoor wireless security camera — to bridge the gap between consumers who want complete control over their security needs without the hassle of CCTV systems.

SolarCam works as a seamless, self-sustaining security system without the need for wiring, making it suitable for places where normal wiring installation is difficult or challenging. It features HD 720P video recording, motion recording and instant alert capabilities. The device charge lasts up to a month and features a standby time of up to six months.

The product provides a live feed to a connected Android or iOS device and consumers can monitor multiple cameras from different locations. For night or low-light conditions, the IR Night Vision capability delivers clarity for up to 5 m. The IP65 dustproof and waterproof rating makes it suitable for outdoor installation.

Andatech Pty Ltd
www.andatech.com.au

Fibre solution

The SYSTIMAX Ultra Density fibre solution is built to support ultra high-density data centre applications based on LC and MPO connectivity.

The solution combines high density with manageability and ease of making moves, additions and changes. At the heart of the solution are the 2U and 4U UD fibre panels. Each of the panels accepts InstaPATCH 360 Modules or MPO connector pass-through panels, and can be upgraded to add AIM (automated infrastructure management) based intelligence.

Other features include: panel design optimised for pre-term, making moves/adds/changes easier while minimising network downtime; split tray design scales up density quickly and easily without disrupting live channels; tool-less install of rear trunk cables significantly reduces trunk installation time; solid robust 2U/4U fibre panels scalable to 288 duplex LC ports or 192 MPO ports; supports imVision AIM solution with addition of iPatch upgrade kits.

CommScope Solutions Australia Pty Ltd
www.commscope.com

Modular power solution

ABB's MNS-Up integrates uninterrupted power supply (UPS) and switchgear technologies into a single and compact system. The solution is designed for use in critical power applications such as data centres, hospitals and process industries.

It enables users to save up to 10% capital in electrical infrastructure, requires up to 30% less space compared to traditional architectures and can be up and running as much as 20% faster due to reduced installation and commissioning time, according to the company. Specifically developed for data centres and other mission-critical facilities that demand zero downtime, such as international stock exchanges, the solution allows switchgear and UPS modules to be safely and rapidly exchanged without disconnecting power. Responsible energy consumption and facility growth are ensured through planned incremental additions.

MNS-Up's modular design expands in 100 kW steps so that companies just pay as they grow. Each frame of the system can support up to five 100 kW UPS modules. Up to six frames can combine to provide 3 MW of backup power supply. For more power, further systems can be installed in parallel. The company can install MNS-Up in whatever configuration works best in the space available — L-shape, U-shape, straight lines or back-to-back — and all without external bus ducts or cables.

ABB Australia Pty Ltd
www.abbaustralia.com.au

ROAD TO RELIABILITY

Dean Spaccavento, CEO, Reposit Power

The electricity grid is currently going through a transitional period. The rise of distributed power generation is creating challenges as well as opportunities. In the article below, Reposit Power's CEO Dean Spaccavento talks about how networks and customers can work together to achieve a reliable and secure electricity system.

The electricity grid has fundamentally always been about keeping demand equal to supply. Until recently, Australia's electricity grid has always had variable demand and controllable supply — otherwise known as electricity generation. As a result, matching demand and supply has been straightforward. However, with the introduction of distributed renewable electricity and advancements in technology, supply has become variable and unreliable.

When the electricity market is calling for new generation, there is an increasing instability in the grid. It is calling for generation of a particular type — generation that can start and stop very quickly, and generation that is power focused, not energy focused. We no longer need to worry about energy generation. Energy comes from the sky for free and it will continue to come from the sky for free in greater volumes, the problem is that it comes whenever it wants to.

The Australia system is transitioning to a power system — with the value on the modulation of power rather than the provision of energy. This change is a result of our electricity grid transitioning from a top-down centralised fossil fuel system with only a single direction of power to a distributed renewable bidirectional system.

In the mid-90s, the Australian electricity system was deregulated to make our economy more efficient and internationally competitive. Networks were split from generators and retailers. The retailers and generators were encouraged to compete to lower costs. The National Electricity Market (NEM), which manages all trade between generators and retailers, was created.

From 2008, large feed-in-tariffs were offered, solar was heavily subsidised and it also dramatically fell in price. This allowed customers to secure energy from a reliable alternative source. Australia also has an added advantage of abundant solar supply. Data shows that a solar panel installed in Australia generates twice the amount of energy per year compared to a solar panel installed in Germany. In 2013–14, and largely in 2016, a number of battery storage solutions entered the market giving households even more choice.

In addition, from 2010 to 2015 there have been price rises in electricity. The price rises were largely because networks built a lot of new assets. The rise in electricity prices prompted customers to look for alternative electricity sources. In some places, the cost of securing energy from solar and storage is lower than the cost of buying electricity from the grid. This has attracted, and continues to attract, households to use alternative electricity sources and manage their own energy consumption.

What happened to telecommunications in the 1990s is happening to the electricity industry now. The various watershed moments in the telecommunications transition can almost be mapped one for one with those in electricity. All this change has led to the 'internetification' of the electricity grid and is challenging regulatory mechanisms, the culture inside the networks and the way people have previously thought about the grid. All the while the grid moves, physically driven by changing consumer behaviour, an ageing generation and changes in fuel prices.

We are right at the beginning of this transition. We are seeing that the old way, ie, the centralised and reliably controlled supply model, is still working, but it's starting to break down. The transition is an opportunity for us to reimagine how the grid works and to make it a lot more efficient and cleaner. We can modernise the

grid to make it more resilient to single points of failure and more resilient to weather events. It also provides opportunity for new business models to increase the efficiency of the grid. Reposit is one of those businesses. The company provides customers with an option to participate in the transactional bidirectional distributed electricity system. Customers can participate in the wholesale market and earn GridCredits when they sell their stored energy. It's an energy storage and trading system that allows households to compete head to head with big energy companies. They are earned when energy is transferred to or from the NEM or network utilities as required by another grid player.

The transition won't be easy. A major concern of the transition is the speed at which the system is transitioning. If the transition occurs much faster compared to our ability to change the grid, then we are going to have grid security issues. We have already seen security issues in parts of the NEM.

It is also disrupting industry business models. Industry participants must either innovate or see a change of guard. Electricity networks are regulated in a fixed way. The regulation centres on networks investing in capital and assets. This means that they are incentivised to build the network. With the transition to a decentralised system, network management provided by electricity networks is going to become less important. Regulations need to be changed so networks can use decentralised, customer-owned sources of network management while still being able to make a profit. Until these regulations are changed they will be fighting with one arm behind their back to successfully transition their businesses to a new decentralised grid. Several regulation changes have been floated including Option Value and Totex. These are centred on allowing networks to recognise the value of buying services from third parties in a regulated way.

Retailers are fighting an entirely different battle. With the introduction and uptake of solar, they aren't selling as many kWh as before. Batteries have complicated this situation further by letting customers store their excess energy and use it at night. To remain competitive, retailers need to change the way they make money. Making money from taking a margin on selling a kWh is obviously not going to work as there are not as many kWh being bought, and the costs involved in serving a customer are not decreasing. Industry discussion is centred on retailers moving to a service-based model. Instead of charging per kWh, they charge for a service, for example, providing customers with access to wholesale markets or give what they are asking for. The sooner we understand that this is what is required, the sooner we can make more efficient investment decisions to deliver secure, fast, reliable and cheap energy. But it is going to require a period of transition and, I suspect, that transition will take 10 to 15 years.

Reposit Power
www.repositpower.com

LED spot lamps

The Philips Master LED ExpertColor GU10 and MR16 range of LED spot lamps are aimed at premium hospitality and residential spaces where ambience matters.

The lamps answer the need for an LED alternative that provides a light spectrum and effects almost identical to halogen with high-quality dimming. The lamps use a patented light spectrum with advanced phosphor technology and deep dimming. With a customised light spectrum that is said to be over 94% identical to halogen light colour, compared to only about 60% with standard LED lights, the Master LED ExpertColor 2700K spots provide a warm and comfortable ambience.

Philips ExpertColor Technology offers CRI of 97, enhanced rendering of reds (R9>85) and saturated colours, bringing out the true colours and textures in interior decors and furnishings as originally intended by the designer. The minimalist look of the trimless V-groove lens design for edge-to-edge lighting ensures that the lamp fits in with any decor.

The lumen output of 40,000 h is particularly beneficial to the hospitality segment where operations can continue 24 hours a day. Also, it is a retrofit spot lamp ensuring a quick and hassle-free transition to LEDs.

Philips Lighting Pty Ltd
www.philips.com

Torsion-resistant Ethernet cable

Lapp Group has added two high-speed industrial Ethernet cables to its ETHERLINE range, including a torsion-resistant and Profinet-compatible Cat.7 cable.

Both cables achieve transfer speeds of 10 Gbps in a frequency range of up to 600 MHz. This makes machinery and robotics applications suitable where large volumes of data from sensors or high-resolution cameras are common. Both cables have a robust and halogen-free PUR sheath; however, they differ with respect to their internal structures and other properties.

The ETHERLINE TORSION Cat.7 can be twisted by 180° in both directions along a length of 1 m, at least 5 million times. The easy-to-assemble cable does not have any filler, with the cores only held in place with a polyethylene cross separator.

ETHERLINE Flex Cat.7 is suitable for well-stocked control cabinets where space is tight. Due to narrow core cross-sections, the flexible cable has an outer diameter of 6.4 mm and a bending radius of four times the outer diameter. It can be laid next to cables with voltages up to 1000 V or without mechanical protection such as separators.

Treotham Automation Pty Ltd
www.treotham.com.au

Portable cable fault location system

The Megger EZ-Thump is a compact and lightweight portable cable fault location system which is also suitable for HV testing. It is designed for quick, accurate and safe fault-locating operations to greatly reduce customer outage time. It is available for rent from TechRentals.

The unit incorporates a 12 kV Hipot tester, time domain reflectometer (TDR) and surge generator. It can be powered from an AC supply or internal batteries (3 h recharge time provides 30 m of thumping). Surge generator produces a 500 J, 0 to 12 kV at 12 mA pulse. The kit includes the Digiphone Plus pin-pointer with surge wave receiver to locate faults while thumping.

Features include automatic fault-locating procedure; automatic end-of-cable and fault detection; DC testing up to 12 kV with automatic breakdown detection; and quick-step and expert modes.

TechRentals
www.techrentals.com.au

DIN rail mount AC UPS

Phoenix Contact has released the TRIO2G AC-UPS, a space-saving DIN rail mount solution that delivers uninterruptible AC power to critical loads in automation environments.

The device's compact design incorporates a UPS module and battery in the one housing to help save on space and, at just 210 mm wide by 170 mm high, it can be installed quickly and easily. It is either latched onto a DIN rail or wall mounted and comes with push-in connectors.

Available in either 120 or 230 VAC, the UPS features pure sine curve at the output which provides seamless transition, as the battery operation runs in sync with the mains previously used for the supply.

A built-in 3.4 Ah battery offers a maximum of 600 W for 1.5 min. If required, additional capacity can be mounted onto the DIN rail to increase the time to four minutes at full load. The power storage device features maintenance-free VRLA technology.

The TRIO2G AC-UPS also allows remote start-up directly from the power storage, without mains input, and can be operated at temperatures ranging from 0 to 40°C.

LED status indicators allow for signalling and function monitoring. Three digital outputs provide remote monitoring and two digital inputs provide visual indication for remote shutdown and start-up. Wired into the control cabinet, the three signal contacts can be read by a programmable logic controller.

A mini USB port is provided, which can be used to configure the UPS and to command a controlled shutdown of an industrial PC following a defined period of time to avoid data loss, corruption or downtime. For permanent connection to an industrial PC or higher -level controller, a USB cable with a knurled screw connection suitable for continuous connection to the UPS is available.

Phoenix Contact Pty Ltd
www.phoenixcontact.com.au

TACKLING LED UPTAKE CHALLENGES

Australian Smart Lighting Summit

Since last year 80,000 LED streetlights have been installed throughout Australia, and technology trials and pilots are taking place in most major centres.

The Queensland local government has set out to deliver an energy-efficient street lighting initiative master plan which would see the Sunshine Coast become a pioneer in public lighting.

According to Ironbark Sustainability Business Manager Alexi Lynch, more work can be done. The South East Queensland (SEQ) Council of Mayors has undertaken a feasibility study into a regional smart street lighting solution and the Sunshine Coast's Urban Lighting Master Plan is also a step in this direction.

"It's too early to consider the region or the model a pioneer for public lighting, because while there has been a lot of talk and a lot of noise, there haven't actually been any results yet," said Lynch.

Despite this, studies of this nature allow councils to think through the practicalities of managing data and the usefulness of data and control. SEQ councils are currently examining all the options of delivering LED street lighting. This includes negotiating LED tariffs with distribution companies such as Energex.

"Some Queensland councils are now working on real solutions to change to move beyond the talk that has absorbed much of the sector over the past seven to eight years," says Lynch.

On the NSW front, with the state going through council amalgamations, City of Ryde Asset Systems Manager Anthony Ogle said that for the Ausgrid and Endeavour networks, the main issue should be who controls the controllers and receives the benefits, not simply financial energy savings, which is insensitive to amalgamation.

Amalgamations have also afforded opportunities for new Community Strategic Plans (CSP) to bring street lighting and the smart city to the fore. However, collective industry knowledge gaps exist wherein distribution network service providers don't understand the budget, decision or procurement requirements of local government, as well as how to integrate lighting with other council infrastructure and purposes.

Lynch projects that the ratification of the Minamata convention would drive change in low LED uptake regions like Queensland as it transitions from the innovator phase of the technology adoption life cycle to the early-adopter phase. The Minamata convention seeks to protect human health and the environment from mercury emissions. If ratified by Australia, it would see the LED market grow exponentially as councils would be forced to convert to LED.

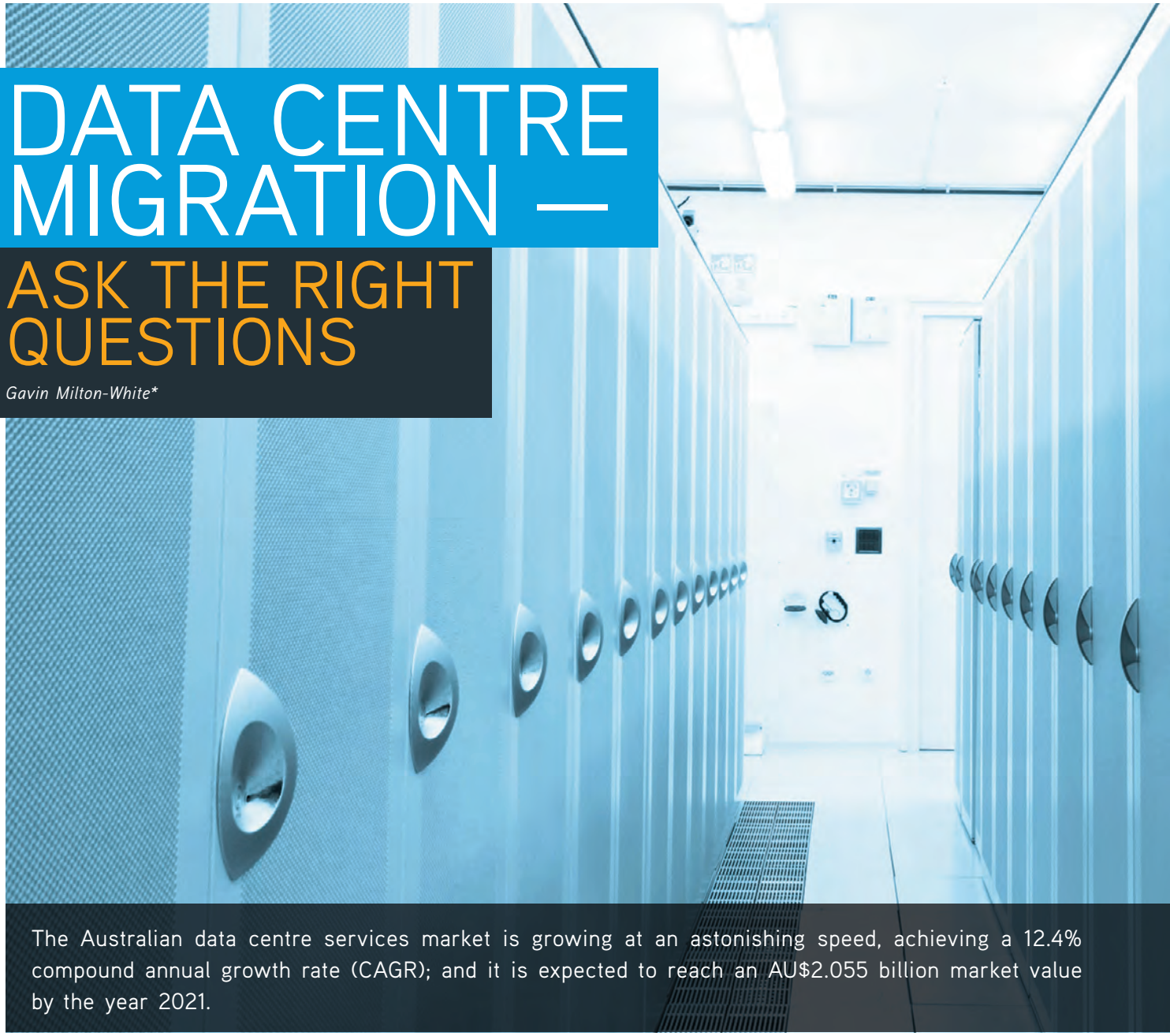
In an Australian first, distribution businesses Citipower and Powercor are now offering a network-wide smart street lighting system for councils. The Melbourne bulk changeover sees thousands of smart city-enabled LEDs installed in partnership with Citipower, including pedestrian and vehicle category lights. Citipower and Powercor are also trialling air quality monitors in partnership with the Environment Protection Authority (EPA) Victoria.

Smart poles and hubs can now be considered for metered as well as unmetered lighting in the future, while new funding opportunities are emerging in partnership with telecommunication companies looking to plug gaps in their networks.

Profiling major street, outdoor, urban and public connected lighting, the 5th Annual Australian Smart Lighting Summit will be held from 13–14 September 2017 at the Melbourne Convention and Exhibition Centre. Delegates will hear from local and international lighting specialists such as Joe Hancock, Principal Streetlight Leader of Florida Power & Light Company (USA), who will profile North America's largest streetlight control network. Both Anthony Ogle and Alexi Lynch are presenters at this year's event.

DATA CENTRE MIGRATION — ASK THE RIGHT QUESTIONS

*Gavin Milton-White**



The Australian data centre services market is growing at an astonishing speed, achieving a 12.4% compound annual growth rate (CAGR); and it is expected to reach an AU$2.055 billion market value by the year 2021.

Heightened demand for cloud computing is one of the main drivers of growth in the market, and we are seeing an increasing number of enterprises jumping onto the cloud bandwagon. While this is great for businesses, data centre operators are grappling with increased bandwidth requirements — growing at 25 to 35% per year, a rate that is predicted to continue on into the foreseeable future. One very visible impact of this growth is the need to support increased bandwidth by migration to higher speeds.

For many enterprises in Australia, the data centre is the lifeblood of the business. Some use it to power their core business, whether in manufacturing or services, while for others the data centre itself is the business. Regardless of how an enterprise uses its data centres, it is almost certain that the speed at which data is accessible determines the organisation's ability to compete and deliver services in the marketplace. Furthermore, customer demands are evolving, with customers today expecting services delivered almost instantly. This translates to a dire need to ensure bandwidth is sufficient to meet demands. Enterprise data centres in Australia that fail to do so will risk being overloaded — leading to increased latency and bottlenecks, which will ultimately impact the enterprise's ability to conduct day-to-day operations.

Having said that, migrating to higher speeds is easier said than done. The discussion surrounding migration to higher line rates is both complex and rapidly evolving. It includes a wide range of decisions that have to be made, including fibre type, modulation and transmission schemes, connector configurations and even cost considerations. The first step towards getting migration right is to carefully consider all aspects and decide what is right for one's organisation. Having said that, here are four of the most common questions we hear from our customers as they plan their migration.

1. 40 G or 25 G lanes?

Until recently, the accepted migration roadmap outlined a predicted jump from 10 G lanes to 40 G. Since the approval of the IEEE 802.3by standard, the industry has begun to shift towards 25 G lanes as the next milestone. This is due to several factors. For starters, migrating directly to 40 G optics is costly, while 25 G lanes enable data centres to maximise their existing 10 G infrastructure. Perhaps more important is that the 25G lane provides an easier migration to 50 G (2x25 G) and 100 G (4x25 G).

2. Pre-terminated vs field-terminated cables?

The ability to quickly turn up networking services has propelled pre-terminated cabling systems to a technology of choice in many data centre environments. By some estimates, the plug-and-play

capability of pre-terminated cables translates to 90% time savings versus a field-terminated system.

In terms of network maintenance — particularly handling moves/adds/changes — pre-terminated systems are estimated to be 50% faster than field-terminated solutions. The value grows as the number of fibre connections within the network increases. Among pre-terminated solutions, MPO/MTP fibre is fast becoming the de facto system for both single and multimode connectivity due to its ease of use and speed, not to mention the high density.

3. Serial or parallel transmission?

As data rates have increased in response to more demanding applications, the market has gravitated to parallel optics. This trend is being supported by the consistent demand for MPO-based trunks, a data centre staple for more than a decade. Using laser-optimised multimode fibre (LOMMF), serial optics can cost-effectively support speeds of up to 10 G. But as the 10 G links make way for 25 G or 40 G, the only option with serial transmission would be to switch to costlier singlemode solutions. Parallel optics, however, provide a more cost-effective solution for 40 G and 100 G Ethernet. The switch to parallel optics is also helping to drive the use of MPO connectors. However, the trend to parallel optics may soon reverse as more technologies — that make better use of individual fibres — are developed. A variety of new technologies such as PAM4 and WDM are expected to help lure more connections back to duplex in the future.

4. Singlemode, multimode or wideband multimode?

The cost of pluggable optics continues to limit the implementation of singlemode fibre (SMF) in data centres. Although new technologies and manufacturing efficiencies are helping to reduce the cost for SMF, the price drop is still not significant enough to justify the high cost of singlemode optics.

Multimode fibre (MMF) continues to offer a more attractive balance of performance, density and cost for enterprise data centres. However, MMF still faces challenges with distance — meaning that as data traffic grows and interconnectivity speed increases, the maximum distance for a communication link tends to decrease. But emerging higher quality components and engineered links can provide the link capacity to support the longer distances and new data centre topologies.

Lately, an improved option that may provide the optimal solution for fibre migration has emerged. Wideband multimode fibre (WBMMF), a new fibre type, has been approved under ANSI/TIA-492AAAE and is expected to be recommended by ANSI/TIA-942-B. WBMMF enhances the ability of short wavelength division multiplexing (SWDM) technology to provide at least a four-fold increase in usable bandwidth while maintaining compatibility with OM3 and OM4 fibres and supporting all legacy multimode applications. By multiplexing four wavelengths spaced in the 850–950 nm region, one strand of WBMMF can increase data capacity by a factor of four.

Robust infrastructure

Ultimately, we can conclude that there are many migration paths to higher speeds and data centre capacity, but sadly no single magic bullet approach. No matter the approach one chooses, the end goal should be obtaining a robust infrastructure; agile enough to respond to unexpected circumstances and flexible enough to scale and integrate tomorrow's game-changing technologies — a complete modular connectivity platform that keeps your network fast, future-ready and cost-efficient.

CommScope provides essential infrastructure that makes communication possible. The company's solutions and services for wired and wireless networks enable high-bandwidth data, video and voice applications everywhere — at home, at work and on the go. Backed by numerous respected brands such as Andrew, SYSTIMAX and Uniprise, CommScope supports customers in more than 100 countries around the world through its focus on integrity, ethics, quality and technical innovation.

**Gavin Milton-White is the Vice President of Enterprise, leading sales across Asia Pacific. Based in Singapore, Gavin is responsible for driving innovative solutions for use in business enterprise, telecommunications, cable television and residential broadband networks. Previously, Gavin held key sales and general management leadership roles with TE Connectivity, Huawei and Avaya. With over 20 years of experience in telecommunications and network infrastructure and a background including that of reseller, distributor and vendor, Gavin believes in delivering a success-driven culture and customer-focused environment by driving best business practices using coaching, common sense, flexibility and team empowerment.*

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OPINION

Keeping electrical workers safe

Simon Mouat, Vice President Energy, Schneider Electric Australia

Safe Work Australia's latest statistics show that the electricity, gas, water and waste services industries ranked fifth worst on the list of worker deaths by industry of workplace in year-to-date 2017.

Working with electricity has always been dangerous, that's the reason we have such rigorous training and licensing standards across the country. While these statistics represent a marginal improvement on the same time period last year, every death is one too many. Whether the energy network is expanding or ageing, keeping people safe during work is the most important part of any electrical company's business — be it their employees, their customers or the public. So what are the latest advancements and how can we use technology to improve safety for electrical workers?

Training tools

Newer and smarter tools and training techniques are being used to reduce human error. There's no doubt that proper training mechanisms help reduce human error and save lives. In Gartner's top 10 strategic technology trends for 2017, the research firm predicted that immersive technologies such as virtual and augmented reality will dramatically transform the way individuals interact with each other and with software over the next five years. We are already seeing a rise in enterprise uptake of this technology for training and safety purposes today. Virtual reality and augmented reality applications are improving safety by providing visual, easy-to-understand, step-by-step directions that can guide operators and field crews through tasks, including displaying energised parts in the equipment.

Simulator-based training, which is already being used in the utility industry, is continuing to evolve and grow in sophistication and scope, particularly with the leaps in virtual reality technology. Virtual reality training, currently being provided in some industries, uses a computer-generated 3D environment where employees can test and train within a realistic, controlled setting. For example, operators can learn to use complex equipment, practice safety procedures, familiarise themselves with the layout of a plant or even simulate dangerous situations (without the consequences of failure) so they can react quickly in a real-life situation.

Sensors and analytics

In the past, businesses have been faced with exponential costs for achieving total control over risks in their electrical networks; thankfully this has changed of late with the integration of modern digital technology. This has been seen at the utility level, where the safety of electrical workers is being improved by breaking down silos. An integration of millions of data points has driven the industry towards greater visibility and better decision-making in order to improve safety of operations. This same digital technology, primarily sensors and analytics, is now being integrated into every aspect of work, by utilities. It not only improves safety, but also boosts security, guarantees interoperability, lowers costs, streamlines operations and saves money for utilities and its customers.

Most importantly, from a safety point of view, the integration of sensors and analytics means that it's easier to identify and analyse patterns of events that lead to accidents, making it easier to prevent, detect and resolve potentially dangerous circumstances before they arise. In addition to the collection of these data points through sensors, advanced analytics are essential to understanding and actioning the data collected.

Intelligent equipment

Intelligent equipment and remote operations allow for better monitoring and safer activities. For instance, smart technology can track energy usage and identify usage spikes that could indicate a public safety hazard. Sensor networks also allow utilities to quickly detect abnormal situations and immediately start containment measures. Operators can be protected using technology that allows them to work from a remote location, for example mitigate arc flash hazards. No matter how well trained workers are, they will always be safer, operating equipment from a distance. While these are only a few examples of modern technology improving safety in the electrical industry, these technological changes are just the beginning.

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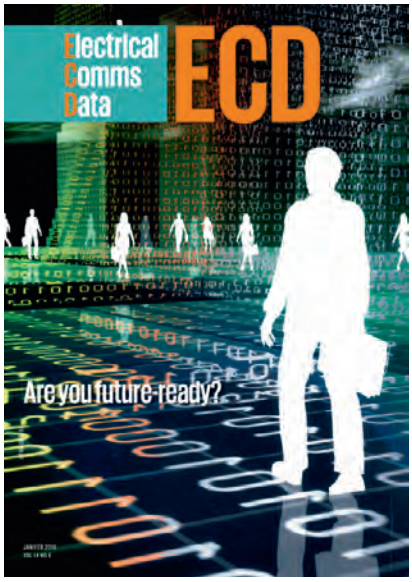

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