ELECTRICAL CONNECTION

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AS/NZS 3000:2018 FOR SPARKIES

A COMPREHENSIVE GUIDE TO WHAT'S NEW AND WHAT TO DO.

+ ***INSIDE:***

> What are the chargers?

> Firing a client

> Calling out Capstone

neca national electrical and communications association
COMMUNICATION PARTNER

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SHERRIFF ELECTRICAL WHOLESALERS

BIBLICALLY YOURS

By now, every reader of *Electrical Connection* would be well aware that a new edition of the Wiring Rules will come into effect on 1 January 2019. This is without doubt.

What I do question, though, is whether you have actually bought it and read it yet (the legit version, that is, and not the pirated copy that circulated on social media prior to the official launch).

Probably not, right?

I'll be the first to say that reading standards can be painfully dull (no offence to anybody involved with writing standards, of course...). It's just very dry. On top of that, who has the time to cross reference the previous edition to see what has changed?

Well, dear readers, we have come to your rescue. We asked Wiring Rules/EL-001 committee member Peter Vandenheuvel, along with a few of his committee colleagues – Gary Busbridge, Dennis Galvin, Vincent Law and Lindsay Lucas – to explain the changes in an easy-to-follow guide.

Sometimes I think we spoil you too much.

The resulting series of articles can be found starting on page 18 of this edition. It is best read with your copy of the Wiring Rules close at hand. If you haven't already purchased a copy, go to the SAI Global website today and buy it. Visit www.saiglobal.com/wiringrules.

While I would never be one to toot my own horn, in this instance you could say that *Electrical Connection* is like Moses, parting the red sea of Wiring Rules jargon (that's not excessive, is it? I would hate for people to think I'm arrogant. In fact, when it comes to being humble, I am the best at it.).

We hope you can use this comprehensive guide and that it will help ensure you are compliant with the newly ratified Standard.

ONGOING EDUCATION

Interestingly, this brings me to another important topic – continuing professional development (CPD).

Of course, CPD has taken hold in Tasmania and from all reports, it seems to have been a success.

But, did you know that subscribing to *Electrical Connection* could count towards CPD?

In fact, it could be the most affordable way of achieving points towards your total. So, why wouldn't you?

I hope you enjoy this edition and find a lot of useful information in these pages.

Until next time,

Paul Skelton

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:hager

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↑ 20%
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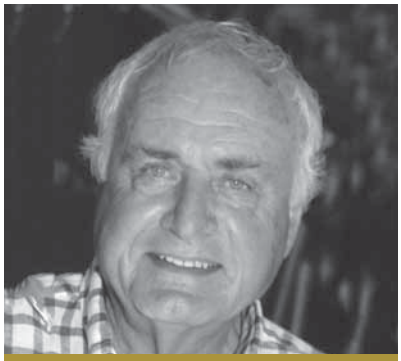

PETER VANDENHEUVEL

Wiring Rules

With more than 50 years' experience in electrotechnology, contracting and switchboards, Peter Vandenheuvel is the principal of Vandenheuvel Consulting. He is a past managing director of Nilsen and former president of NECA. He is a member of the Wiring Rules and Switchboards committees for Standards Australia. He is a fellow of the Australian Institute of Management.

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GARY BUSBRIDGE

Wiring Rules

Gary Busbridge has worked for Clipsal by Schneider Electric for 41 years, most recently as the standardisation manager. Since 1997, he has also been involved with Standards Australia and has held memberships in several Standards committees, including EL-001, which is responsible for the Wiring Rules.

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DENNIS GALVIN

Wiring Rules

Legrand technical director Dennis Galvin is an Australian Industries Group representative of the EL-001 committee responsible for changes to the Standards covering installation requirements.

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BRIAN SEYMOUR

Estimating

Brian Seymour MBE is an industry consultant and author of four books, including *Electrical Estimator's Labour Unit Manual*; *Starting Out*; *Electrical Contracting in Australia;* and, *100 Years Electrical Contracting in Australia*. He conducts regular industry training programs throughout Australia on behalf of the electrical and air conditioning industries, focusing on estimating.

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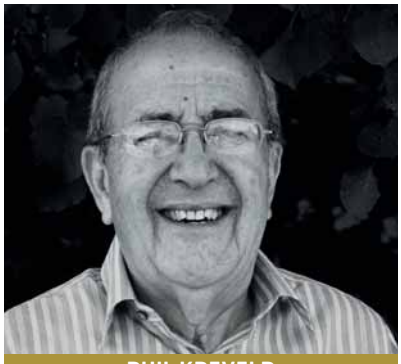

PHIL KREVELD

Let's Get Technical

Phil Kreveld is an energetic energy writer and electrical engineer. He has worked in electrical, electronic and scientific instrumentation, including relay testing power and power quality analysis, in Australia and the US. Phil is also quite an adept artist, regularly showing his paintings in galleries around Victoria.

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JAMES TINSLAY

Apprentices

James Tinslay is a consultant and engineer with some 40 years of experience dealing with the electrical contracting industry. He is an ex-CEO of NECA - an organisation he has worked with since 1988 - and is a current director of NECA Electrical Apprenticeships and Standards Australia. He also runs his own consultancy firm, JCT Advisory.

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SENATE COMMITTEE CALLS FOR OCCUPATIONAL LICENSING REFORM (SORT OF...)

Back in 2013, the then-newly elected Abbott Government scrapped the planned National Occupational Licensing Scheme.

Since then, the subject has largely been forgotten (except, of course, by those who worked on the committee only to see their work turn to dust).

But supporters of the concept of national recognition may once again have something to crow about, thanks to the Federal Government's Senate Committee report on the effects of red tape.

An interim report, tabled on 15 August by the Senate Select Committee on Red Tape, has made four key recommendations to government and forms the view that occupational licensing is a barrier to market entry, which prevents some people from practicing their chosen trade and should only be imposed with strong justification.

The Senate Committee is chaired by Senator David Leyonhjelm (when he isn't being sued by his fellow senators), with other members coming from all sides of government.

Throughout the process, a number of industry stakeholders entered submissions on behalf their sectors, including the plumbing industry.

While a final report has not yet been delivered, industry is calling on the Government to move forward with the proposals that assist contractors to work more freely and with reduced costs and expenses.

If you're up for the read, you can find the Senate Select Committee on Red Tape's interim report at https://bit.ly/2PaefRw.

If you can't stomach that, allow us to summarise.

The four key recommendations include:

1. That the Council for the Australian Federation, in close consultation with relevant stakeholders, renews its efforts toward occupational licensing reform, with a starting presumption against licensing.
2. Subject to its retention, that occupational licensing be based on specific, measurable outcomes and the identification of best practice models for occupations throughout Australia.
3. The expansion of automatic mutual recognition based on the objective of increasing labour force mobility.
4. The Council for the Australian Federation (CAF) commissions a study into the health and safety benefits of occupational licensing, to strengthen efforts toward reform.

Given the history of national licensing in Australia, we strongly recommend tempering any potential excitement or relief that you may draw from this announcement.

Upon reading the report, *Electrical Connection* asked the folks at the 'Red Tape Office' as to what we might expect to happen from here. The response was as follows:

"The Red Tape Committee's inquiry into the effect of red tape on occupational licensing is part of an overarching inquiry into the effect of red tape.

As such, the committee does not intend to table a full report on occupational licensing reform. Instead, the committee intends to examine red tape policy and processes, drawing on examples from areas in which red tape continues to exist (such as occupational licensing).

The committee is to present its final report on or before 3 December, after which the committee will cease to exist."

All we can say to that is "*Yes, Minister!*".

KYABRAM-BASED SPARKY WINS MIDDY'S SMALL BUSINESS AWARD

A Kyabram-based contractor has won a Middy's Small Business Award and a $5,000 cash prize.

Brady Electrical, owned by William Brady, services the local community of Kyabram and the neighbouring towns in Victoria. Since its inception in 2015, when William and his apprentice worked from his backyard shed, the team has grown to four, with a new apprentice set to start in January next year. Although the company has shown graceful succession over the past four years, it has also felt the recent economic slump, restricting cashflow and upscaling capabilities.

Winning the Middy's Small Business Award has provided some much-needed relief for the company and the cash prize will be put towards necessary maintenance for tools and office improvements.

"I am really excited about this because we've got a half-completed building and it looks horrible," says William.

"But, I can see the vision of what it is going to look like when it's finished. This money is going to be a massive kick-start. It has blown me out of the water; it was really, really unexpected.

"I deal with a lot of different wholesalers. I may have a few different wholesaler accounts for various things, but Middy's really are there to help the local contractor out. That is the biggest reason as to why I put the majority of my business through them."

NECA AND MEA CEASE NEGOTIATIONS

Negotiations between the National Electrical and Communications Association (NECA) and the Master Electricians Association (MEA) exploring better ways to represent the electrotechnology industry as a single entity have now ceased.

NECA president Alan Brown says, "This is a missed opportunity for electrical contractors, our industry stakeholders and our long-term sponsors."

Alan adds that NECA will continue to focus on delivering improvements to its members and its long-term sponsors across Australia. As the peak industry association, NECA will maintain its efforts in delivering positive outcomes for the industry.

ELECTRICAL

SAFETY RECALL

Eaton Industries Pty Ltd - Quicklag ELQ Earth Leakage Circuit Breaker (RCBO)

AFFECTED MODELS:

Current Rating	30mA 1 Pole	10mA 1 Pole	100mA 1 Pole	30mA 2 Pole
10A	ELQ110C3TW	ELQ110C1TW	ELQ110C10TW	ELQ210C3TW
16A	ELQ116C3TW	ELQ116C1TW	ELQ116C10TW	ELQ216C3TW
20A	ELQ120C3TW	ELQ120C1TW	ELQ120C10TW	ELQ220C3TW
25A	ELQ125C3TW	ELQ125C1TW	ELQ125C10TW	ELQ225C3TW
32A	ELQ132C3TW	ELQ132C1TW	ELQ132C10TW	ELQ232C3TW

Affected models were sold nationally from April 2004.

HAZARD: A non-compliant material has been used in the manufacture of a component, and when operating under short circuit conditions the product may express ionised gases through the exhaust port which may result in conditions creating a fire risk.

WHAT TO DO: Building owners, managers and electrical contractors should check switchboards or loadcentres for potentially affected RCBOs. The affected models can be identified by the presence of a green test button, as shown in the above image. Products without a test button or with a white or an orange test button are not impacted by this recall. Further guidance on how to identify an affected model are available at www.eatoncorp.com.au/elqtw-r

If your RCBO is an affected model, contact Eaton at the contact details below to arrange for a replacement RCBO to be installed onsite at no charge.

CONTACT DETAILS: Please direct all inquiries regarding this recall to:
Phone: 1800 870 851
Website: www.eatoncorp.com.au/elqtw-r

LASER HEADS TO ROTORUA, NZ FOR LASERCON 2018

Franchising of service businesses around the globe continues to grow as more and more SMEs discover the benefit of accessing robust business systems that streamline operations and keep a finger on that all important profitability.

The most identifiable brand in the home service sector throughout A/NZ is the Laser Group, which has over 250 plumbing and electrical members.

The motivation for many to join a franchise group is, they admit, that while they are good tradespeople, they lack the business skills, experience and necessary guidance to take their hard work to the next level.

Some of the more important aspects of franchising are the continuing development of a common business culture, back-of-office systems support, sharing of knowledge and experience, as well as identifying new business opportunities that members can share in.

Connection Magazines was recently invited to attend LaserCon, Laser's annual get-together of its franchisees, which took place in Rotorua, NZ.

While the Laser-badged flotilla of vans and utes are a common sight around Australia's suburbs and regions, what is not so obvious is the creation of the business system and experience staff who manage the central operation, which among numerous other activities, run such events. Laser has no company-owned territories/stores like many of the food franchise groups do. So the head office is 100% focused on their individual franchise members.

What Laser does have is a lot of intellectual property and a business system that operates across the group.

Until late 2017, the Laser Group business itself was privately owned by management; however, the organisation is now part of a global operation called Belron, which operates a range of service businesses across 30 countries.

The best known of those here is O'Brien Glass.

Belron invests in well-run profitable businesses with growth opportunities and Laser fit that criteria.

Rotorua gave franchisees the opportunity to learn more about Belron and to chat face-to-face with the chief executive, who was visiting from France.

The annual LaserCon conference ran for three-days and was preceded by a 100+ person working-bee that repaired a community project called St Chads Charitable Trust. At each annual LaserCon, the attendees do similar community work that provides a local community legacy and helps get the franchisees reconnected.

There was full participation at various business sessions and workshops where highly sought-after speakers presented on a range of topics including technology and its role in the future, disruptive innovation, self-improvement, motivation and mental health.

Attendees were also given the opportunity to assemble in country specific groups to discuss marketing strategies as well as sharing discussions with a range of major suppliers who participated in an accompanying trade exhibition.

It wasn't all hard work as ample time was set aside for all attendees to take in the sights of Rotorua, including Maori culture, the mud pools, hot springs and traditional food.

And of course there had to be a networking event at nearby Hobbiton, in the theme of *Lord of the Rings*.

To finish the conference, a much anticipated awards night was held, which Laser Group director Steve Keil describes as the most important aspect of the conference.

"While the awards night might start off like most other industry award nights, they're exceptionally important to members because we're very serious about the criteria we use. It's quite evident in the speeches how important Laser is to them and their business, so it's great to acknowledge excellence in our member network."

LaserCon 2019 will take place in Melbourne in June.

The annual LaserCon conference was preceded by a 100+ person working-bee that repaired a community project called St Chads Charitable Trust.

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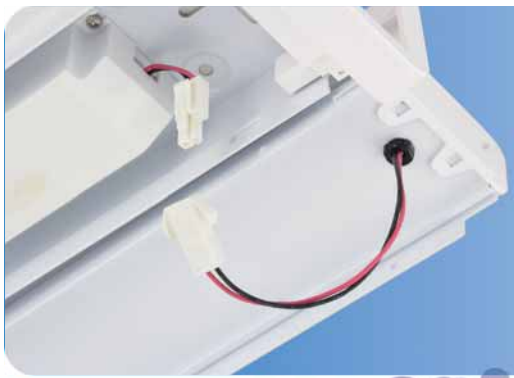

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Lighting Council AUSTRALIA MEMBER

www.energeticlighting.com.au

PROTOP POWER SUPPLY

The PROtop series of high-end power supplies have been designed to meet and exceed some of the most demanding requirements found in industry. Featuring Dynamic Current Limiting (DCL) technology, the PROtop power supply can reliably trigger DC circuit breakers with a top boost reaching 600%, while in addition, it can deliver peak overload reserves from milliseconds to seconds ensuring powerful motor starting with ease. Introduced in this series is a built-in O-Ring MOSFET redundancy capability. This allows for true N+1 redundancy without requiring any external diode modules, reducing wiring complexity and saving precious cabinet space. Efficiencies up to 94.5% reduce power losses significantly which allows for minimal heat dissipation in the cabinet and allow for a more compact design. industries where a high level of reliability is required, PROtop provides a MTBF of >1,000,000 hours which ensures a long life cycle of greater than 10 years.

Weidmuller
www.weidmuller.com.au

LEGRAND GALAXY

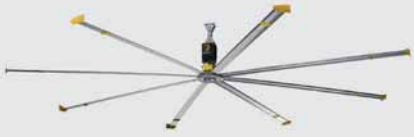
Put simply, Galaxy is an emergency lighting monitoring system for smart buildings. Manufactured in Australia, it is specifically designed to streamline the process of testing emergency lighting.

Legrand began development with market research, many customer interviews and market surveys which showed customers wanted something that was easy to design and install, flexible usability, versatile, user-friendly and is smart device-enabled with remote connectivity.

The result is a system that is cost-effective and easy to install, robust, intuitive and flexible to operate. Galaxy is poised to be used in hospitals, offices, education facilities, shopping centres, carparks, sport centres and stadiums.

Legrand
www.legrand.com.au

POWERFOIL X3.0



Powerfoil X3.0 is Big Ass Fans' strongest and most powerful industrial fan, and is purpose-built to tackle the harshest environments. Featuring a patented system of aerofoils and winglets, the fan's aerodynamic design provides maximum durability and cool operation. Powerfoil X.30 uses a nitrogen filled, hermetically sealed NitroSeal Drive gearbox, meaning nothing is getting in there, ever. Designed to take the guesswork out of the fan's operation, the fan's Optional SmartSense technology automatically adjusts the fan's speed based on temperature changes and programmed preferences for year-round comfort and energy savings. With its 15 year non-prorated warranty, Powerfoil X3.0 is guaranteed to provide lasting durability and airflow.

Big Ass Fans
www.bigassfans.com.au

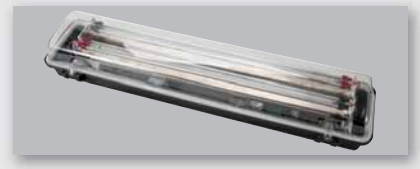
ABB-SECURE@HOME

ABB has announced its ABB-secure@home intrusion and alarm system that offers protection both inside and outside the home via effective infra-red detection. The system also offers door and window monitoring, as well as safeguarding against fire and flooding.

ABB-secure@home has been designed to be user-friendly and integrates with ABB's existing home automation solution and door entry system, ABB-free@home. The central unit works in tandem with ABB-free@home and can be used to manage and monitor all of a building's safety and security functions. This includes setting and disabling the intrusion alarm, either with the ABB-WelcomeTouch panel or remotely via the MyBuildings portal, through a PC or mobile device.

ABB
au.abb.com

NHP CORTEM EXEL-L



NHP has announced its Cortem EXEL-L series of emergency LED lights are certified to Australian Standard AS 2293.3 *Emergency escape lighting and exit signs for buildings Part 3: Emergency escape luminaires and exit signs*. This means the series meets the new National Construction Code (NCC) requirement that emergency lighting be designed in accordance to AS 2293.

The EXEL-L series of emergency LED lights now come with photometric classification data (C0 and C90 values). This provides guidance in the lighting design process and also passes the stringent charge/discharge requirements of AS 2293.

NHP is also currently undertaking compliance testing to AS 2293.3 for the company's extensive range of hazardous area LED lighting products.

NHP Electrical Engineering Products
www.nhp.com.au

FUJIKURA 70S+

Fujikura has released its new range of splicers, made up of the 70S+, 70R+ and 62S+ models.

The new splicer range features the addition of Bluetooth capability to wirelessly communicate parameter settings with a smart device. With a six second splice time and nine second heat/shrink time, Fujikura claims that its 70S+ model is the fastest splicer on the market.

The 70S+ offers programmable features, such as an automated wind protector, and independently programmable sheath clamps that aim to reduce splice time and increase productivity. The 70S+'s battery life provides 200 splice/heat cycles and long-life electrodes that provide up to 5,000 splices.

An economical alternative to the 70S+, the 62s+ uses a conventional wind protector and tube heater design.

All three splicer models feature fuse connect compatibility, a large monitor, built-in instructional videos, and a fully-ruggedised design that is shock, dust and rain proof.

AFL Global
www.aflglobal.com

S-CLICK DIN RAIL TIME SWITCHES

The S-Click smart series is the first line of full-featured DIN rail time switches with integrated Bluetooth low energy wireless connectivity designed for user convenience.

The new range of German-manufactured digital and analogue time switches features large screw terminals, better suited for stranded conductors over DUO FIX spring terminals. A complete range of presence detectors are also available. Choose from a ceiling-recessed flush-mount PIR in either one or two channel variants, a two-channel surface-mount PIR, a high performance PIR with a 30m detection range, or a dual tech sensor featuring ultrasonic and PIR combination. They are also available in black.

S-Click
www.sclick.com.au

HIOKI CT6904

The new Hioki CT6904 AC/DC current transformer delivers high accuracy performance over a measurement band 40 times broader than legacy models.
It provides a 500A rms AC/DC nulling current transformer with wide frequency band and ultra-low phase errors.

The CT6904 uses nulling technology in Hioki's sophisticated AC and DC current sensor with 4MHz (±3dB) measurement wide band frequency range; ±10ppm linearity; ±0.02% rdg. (±0.007% f.s.) basic measurement accuracy and 120dB (100kHz) High Common-Mode Rejection Ratio (CMRR).

Power Parameters
www.parameters.com.au

EASYSPOOL

Nexans Olex has unveiled its way of simplifying cable handling and installation – EASYSPOOL.

Designed and engineered in Australia, EASYSPOOL makes life easy for electrical contractors. A special arm design allows easy loading of spools; it removes the need to physically carry spools on forearms; it's easy to move; it works as an A-frame for wiring so you can pull up to six cables at once; and it is collapsible and compactable for easy storage.

Not only can electricians get their job done quicker, but more importantly, EASYSPOOL improves WHS by limiting manual handling.

EASYSPOOL comes with a removable TrustOlex toolbox. A 3-wheel accessory kit is also available for purchase.

Nexans Olex
www.olex.com.au

BRILLIANT NEWTON

The Newton 3-in-1 aims to keep bathrooms toasty warm and properly ventilated. The Newton replaces Brilliant's Majestic bathroom mate.

The Newton is available in a two globe model for small to medium bathrooms with a maximum ceiling height of 2.4m, and a four globe model for larger bathrooms.

Both models feature an energy-saving LED reflector globe, 275W infra-red heat globes, and an exhaust fan. To improve illumination, wattage has been increased to 9W (four globe model).

Brilliant Lighting
www.brilliantlighting.com.au

BOOKS IN THIS IMAGE KINDLY PROVIDED BY ROY SANDS

AS/NZS 3000: WHAT HAS CHANGED?

In the following series of articles, EL-001 committee member and industry consultant **Peter Vandenheuvel** runs a fine-tooth comb through the latest iteration of the Wiring Rules.

We live in a world of constant change, most of which is incremental and improves existing methods or work practices.

This also involves keeping up with changes in product design and people's lifestyles.

However, sometimes changes occur that are more disruptive and not as readily accepted.

The Wiring Rules have mirrored change since they were introduced through an act of parliament and published in 1931. Since then, the prescriptive 'how to' model first developed by a 60-person drafting committee has been regularly fine-tuned as electrotechnology and lifestyle changes required.

As the year 2000 was approaching, there was opinion in the industry that the prescriptive model was too restrictive and stifled industry innovation.

So, when the development of the first combined Australian and New Zealand Standard was proposed there was a desire for a more outcome-based Standard.

The result – the AS/NZS 3000:2000 edition – proved to be one of those more disruptive changes that was not as readily accepted as hoped.

Although there was perceived benefit, based on substantial industry feedback, much of the omitted prescriptive content needed to be restored.

This led to publishing AS/NZS 3000:2007 to satisfy required outcomes and prescriptive detail.

To separate the outcome-based and prescriptive parts, the Standard was split into two parts: Part 1 became outcome based and Part 2 prescriptive.

Part 1 has a single section, Section 1; Part 2 has Sections 2 to 8. Both parts are in the one document.

The considerable changes in emerging technology, electrotechnology products, work practices and lifestyle requirements have resulted in the development of AS/NZS 3000:2018, which has now been published.

To optimise its user-friendliness, users should be aware of the many '2018' user-friendly aspects (the user 'go-to' features):

* word-searchable in PDF;
* layout and arrangement similar to the 2007 edition;
* all substantial changes listed in the preface (from p2 on);
* table of contents with an extra level of detail (from p9 on);
* list of tables (from p20 on);
* list of figures (from p23 on);
* all substantial changes from the 2007 edition identified by a red asterisk * in the margin; and,
* a 'word or terminology' searchable index at the back (from p578 on).

If you know the topic you are looking for is in a table or figure, or is described by a certain word or term, your first go-to is the list of tables, list of figures or the index – and continues from there.

All current users are advised to archive their 2007 copy immediately and use the 2018 edition exclusively. It will be mandated in many jurisdictions by the end of December 2018 (six months from being published).

Also, you are urged to get up to speed with the changes as soon as possible, particularly new requirements (above all, those applying to your typical work types). Study these articles, the list in the preface and identify the changes by the * margin markers. You may avoid considerable rework.

It is much quicker, cheaper and less stressful to do a quick search.

The articles in this issue of *Electrical Connection* are set out as Sections 1 to 8 in page order. All you need do is get your AS/NZS 3000:2018 open it and start following the bouncing-ball * marker while referencing the articles in this issue. ■

Acknowledgment: Standards Australia, AS/NZS 3000:2018

A NOTE FROM THE COMMITTEE CHAIRMAN

Technological developments and input from stakeholders make revision of the industry bible quite a task. **Gary Busbridge** reports on the 2018 update to AS/NZS 3000.

*By now I trust that all stakeholders in the electrical industry have their own genuine copy of the **2018 Wiring Rules**.*

Unfortunately, a couple of counterfeit versions have been floating around. This is very disappointing but par for the course in these times of non-conforming products.

It has been a long ride since the 2007 edition. The revision, which started about seven years ago, has been the focus of many long debates at committee level. Our first meetings were about setting the scope of the revision, with all parties providing information and detail on changes and additions.

Technological and work practice changes were required, and there was also a call for more clarity in the Wiring Rules.

The EL-001 committee has about 35 members from all sectors of the industry. The representation includes unions, electrical contracting and engineering associations, educators, regulators, consumer advocates, manufacturers, testing and certification specialists, and network associations in Australia and New Zealand.

About 20% of the members hail from the Land of the Long White Cloud.

Thanks go to our hard-working Standards Australia project managers and to the committee for all their intense hard work to bring this publication to completion.

This was also a 'first' in that many members took the proposals for change and clarity to the electrical industry, in essence to get crucial feedback. Much information was gleaned, helping us to finesse the changes as much as possible before the public comment phase.

Ah, but the best laid plans... there was an unprecedented number of public comments to that draft, and I thank all of you in the industry for your input.

Unfortunately, the process for adding comments was a little clumsy and many comments were not registered. However, we did receive more than 2,000 comments – huge by any measure – and we tried our best to deal with them.

Implementing more RCDs in buildings is seen as the big-ticket item, but the addition of electric vehicle charging, arc fault detection and DC installations is necessary to keep abreast of emerging technologies.

The losses of power due to disaster – and potential effects on the aged, infirmed or disabled – are important matters and we have added some detail.

Further detail on discrimination and selectivity of control devices has also been provided.

There are about 200 changes or additions, many providing clarity for everyday work practices. To make things easier a red asterisk on the left side of the page indicates the changes.

Rest assured that work has started on an amendment to add many of the public comments (made as the revision was under way) and feedback from the release of the 2018 edition. Most of these comments were parked during the process, as they were seen to be out of scope and needed much research.

No rest for the wicked, they say. The EL-001 committee is facing the challenge to continue providing up-to-date and technologically advanced detail for AS/NZS 3000.

- Buzz

ALL DIAGRAMS SOURCED FROM AS/NZS 3000:2018.

THE FOUNDATION

Let's start at the very beginning, with scope, applications and fundamental principles to set the scene.

The importance of Part 1, Section 1 is expressed in the title of this article – it is the foundation for the whole document, stipulating the minimum that users must achieve in order to comply.

This section may be the least used in everyday situations, but without it the Standard could not exist.

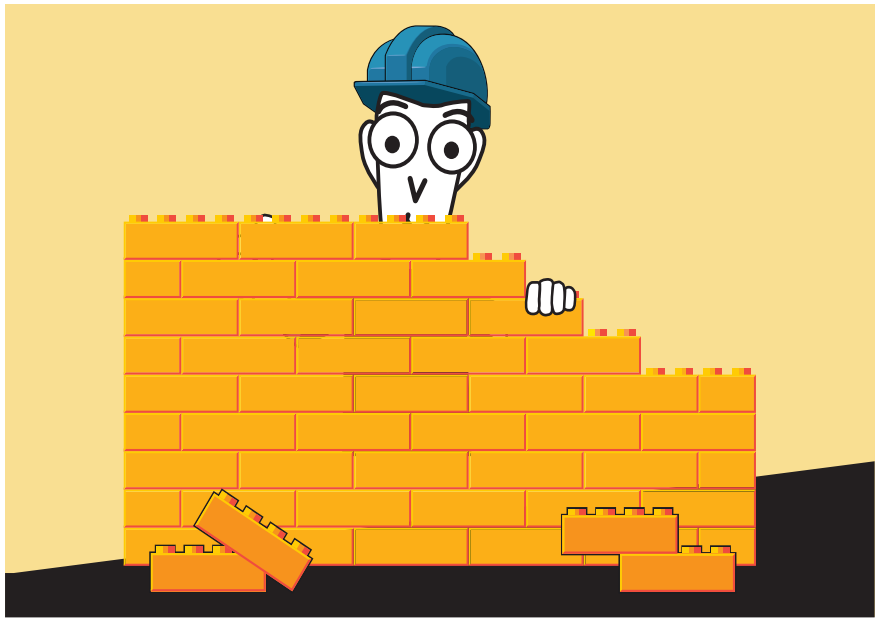
The section is crucial because:

* It sets out all underlying principles for what is required. It is what Part 2, Sections 2-8 (the detailed how-to or prescriptive 'deemed to comply' parts) are based on and underpins the 'why' for Part 2 practices to confirm compliance.
* It also provides the opportunity and mechanism for dealing with unique situations, such as the need to remedy a non-compliance that is unable to be done practically by a Part 2 solution, or the introduction and use of new or innovative technology. It provides the option to use a Part 1 solution.

However, it should be noted that the use of a Part 1 solution is (or may be) subject to the following of certain stringent processes, procedures and verification requirements in different jurisdictions.

Such solutions should never be undertaken in a cavalier manner, because they must always meet the high-level fundamental requirements.

Yet used correctly, such solutions can lead to industry and electrical installation innovation or offer the possibility for a 'get out of jail card' in situations where compliance with a Part 2 remedy may not be practical or possible.



CHANGES LISTED IN THE PREFACE INCLUDE:

* new and revised definitions;
* removal of the mains supply definition;
* renaming direct and indirect contact to basic and fault protection;
* IP ratings;
* earthing conductors to be green/yellow;
* references to AS/NZS 3018 *Electrical installations - Domestic installations* re-homed to other Standards;
* requirements for alterations and repairs clarified; and,
* guidance on Part 1 solutions.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 1, SECTION 1 IN PAGE ORDER INCLUDE:

* The Standard now also recognises mitigation of foreseeable adverse effects of disruption to supply. This led to the creation of new Appendix M *Reducing the impact of power supply outages* focused on continuity of supply for active assisted living and homecare medical situations. This is an informative appendix providing guidance to users for reference in situations where the owner or occupier has identified the possible need to mitigate such adverse effects. (p33, p559)
* Differentiation between 'accessible' (capable of being reached) and 'readily accessible' (capable of being reached quickly and unobstructed). (p34)
* Clarification that an alteration is a modification of an installation but a repair is not. (p35)
* Introduction of arc fault detection devices (AFDDs). This led to the creation of a new Appendix O *Installation of arc fault detection devices*. This is an informative appendix providing guidance to users in situations where the owner or occupier has identified the possible need to mitigate the risk of low-level arcing faults in wiring, leads and appliances (such as electric blankets) and possible resultant fires. Use of these devices is becoming more prevalent in the United States and Europe. (p35, p565)
* Definition of 'authorised person' is simplified as 'selected by the person in charge of the premises'. It now excludes the terms 'licensed electrical contractor' or 'electrician' (although these can be authorised persons, where selected). (p36)
* Definition of 'de-energised' is added as 'being separated from the source of supply but not necessarily isolated'. Two cross-references previously under *Damp situations* are moved under this new heading. (p40)
* Definition of 'electrical installation, residential' is added to define portions of an electrical installation associated with living units to differentiate it from non-residential portions of the same building or installation. Some examples are given. (p42)

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* Definition of 'electrical vehicle (EV)' is added as 'any vehicle propelled by an electric motor drawing current from rechargeable batteries' – clarified as 'on board' batteries. (p42)
* Definition of 'energised' as 'connected to a source of electrical supply' is added. (p43)
* Definition of 'fire mode' is added as 'a specific mode of operation instigated by a fire alarm being activated within the building'. (p44)
* Definition of 'functional unit' as 'part of a switchboard assembly' and clarifying that 'conductors connected but external to it' not being part of it is added. (p45)
* Definition of 'isolated' as 'separated from all sources and rendered incapable of being unintentionally energised' is added. (p46)
* Definition of 'lamp' as 'an item that emits light produced by electricity' is added. (p46)
* Definition of 'lift' as 'capable of raising or lowering persons but excluding hoists, dumb waiters, escalators or travelators' is added. (p46)
* Definition of 'live' as 'energised or subject to hazardous induced or capacitive voltages' is added. (p47)
* Definition of 'main switch' as 'a switch with the primary function of isolating a supply to an electrical installation' and (subject to labelling) possibly fulfilling regulatory requirements is added. (p47)
* Minor revision to definition of 'MEN system' to reflect not all electrical installations are MEN systems. This is also detailed in changes to other sections. (p47)
* Definition of 'neutral earthed system' as 'a system where the only connection between neutral and earth is at the generator or transformer has been added. (p48)
* Definitions 'individual' and 'combined outbuildings' are added and the differing requirements for earthing in each instance are added. (p48)
* Definition of 'protective earth neutral (PEN)' as 'both functions combined in a single conductor' is added. (p49)
* Definition of 'repair' as 'to restore the installation to safe after damage has occurred' is added. (p50)
* Definition of 'safety service' listing evacuation systems separately, also reflecting a major change in lifts identified as emergency lifts requiring different electrical installation arrangements from lifts not so identified as detailed in Sections 2-8. (p50)
* Definitions of 'socket-outlets-multiple combination' and 'socket residual current device' are added. (p51)
* Definition of 'soft wiring' as 'wiring systems using installation couplers' is added. (p51)
* Definition of 'supply, alternative' as 'to maintain the supply in case of interruption to the normal supply' is added to differentiate between alternative, normal and supplementary supplies. (p52)
* Definition of 'supply, normal' as 'the supply the installation is supplied from under normal operation' is added to differentiate between alternative, normal and supplementary supplies. (p52)
* Definition of 'supply, supplementary' as 'a supply intended to operate in conjunction with the normal supply) is added to differentiate between alternative, normal and supplementary supplies. (p52)
* Definition of 'wiring systems' as 'assemblies made up of one or more conductors, cable or busbars and parts that secure their fixings and mechanical protection', is added. (p54)
* Note is added to *Protection by barriers and enclosures* that 'IP rating shall suit the environmental conditions and the relevant mounting position specified by the manufacturer'. (p57)
* Requirement under *Design of an electrical installation* to 'reduce the inconvenience in the event of a fault' is added. See also the first item in this list and new Appendix M in those situations where the owner or occupier has identified the possible need to mitigate such adverse effects. (p66, also p33, p559)
* Requirements under *Selection and installation of electrical equipment* are changed, including subheading *Essential requirements* (renamed *General*) item (c) being modified to also require compliance with this Standard. Requirements under *Installation work practices* include additional items (f) adding further detail for wiring conductor identification, (i) dealing with breathers for condensation issues and (j) electrical equipment to be installed in a manner that maintains IP ratings. This being brought about at least in part due to manufacturer IP ratings often being compromised due to incorrect mounting and drilling for cable entry or mounting. (p68-69)
* Note 2 is added under *Verification (inspection and testing)* to draw attention to Appendix K for guidance on switchboard inspection and verification. (p70, p545)
* Text under *Compliance with the requirements of other Standards* is changed from a reference to domestic installations and AS/NZS3018 to now referring to Cl 7.8 and Appendix A for Standards applicable to specific electrical installations. (p71, p430)
* Text in *Alterations and repairs* is changed with deletion of 'alterations' from both the previous 2007 edition clause title and the text. A sub-heading *Alterations* has been added. The first two paragraphs are replaced with 'alterations to electrical installations shall comply with all relevant provisions of this Standard'. Also, the sentence dealing with repairs has been re-homed under its own sub-heading in this clause and a reference made to Appendix I for current ratings of imperial cables. (p71, p540)
* Sentence is added under *Acknowledgement by the owner or operator (of a Part 1 solution)* requiring that 'a copy of the design documentation shall be retained at site'. (p72)
* New clause is added under *Documentation (by the designer)* where a Part 1 solution has been adopted – to place a permanent warning to that effect on the main switchboard and on all of the distribution switchboards that are part of the Part 1 solution. (p73) ■

-Peter Vandenheuvel

PART 2: CURRENT CONCERNS

How to handle more volts and amps than you can poke a proverbial stick at.

Electrical contractors must deal with fault currents, arc fault currents, over currents, nominal currents, over voltage, under voltage, nominal voltage, phase voltage and more.

All are different and all (plus more not listed here) are crucial in making sure that the installations you design and complete will 'meet code', as the Americans would say.

This is the section that describes how all the key distribution elements must come together to ensure that the installation is safe and only those parts of it that are affected are turned off when an abnormal situation arises.

As noted: Part 1, Section 1 deals with all the fundamentals and their underlying principles. Part 2, Sections 2-8 contain the comprehensive how-to that turns the statements in Part 1 into detailed complying instructions.

Part 2 is the 'deemed to comply' go-to part of the Standard. Follow it to the letter and you cannot go wrong. It is a guarantee to the user that if all the relevant clauses of Sections 2-8 are followed correctly, the works will comply.

Just as users of Part 1 of this Standard can comply without reference to Part 2 (well, theoretically at least), they can also do fully complying work using only Part 2.

So, what's the major difference between using a Part 1 or Part 2 solution?

In a nutshell – the ease! Using only a Part 1 solution, users must demonstrate to the regulator or inspector, in great detail, how each and every part of the work complies, for every part of the entire installation.

On the other hand, when using only Part 2, all that is needed is to verify that it meets the Part 2 requirements already defined – then the certificate of compliance is signed.

So, do you pick the easy way or the difficult way? The choice is up to the user but there is much to be gained by using Part 2 solutions wherever possible.

So why is there no Section 1 in Part 2? Well, a decision was made when the Part 1 and Part 2 arrangement was introduced.

This allowed the layout and numbering of the preceding 2000 edition to remain. It also prevented any confusion due to having two elements named Section 1. ■

-Peter Vandenheuvel

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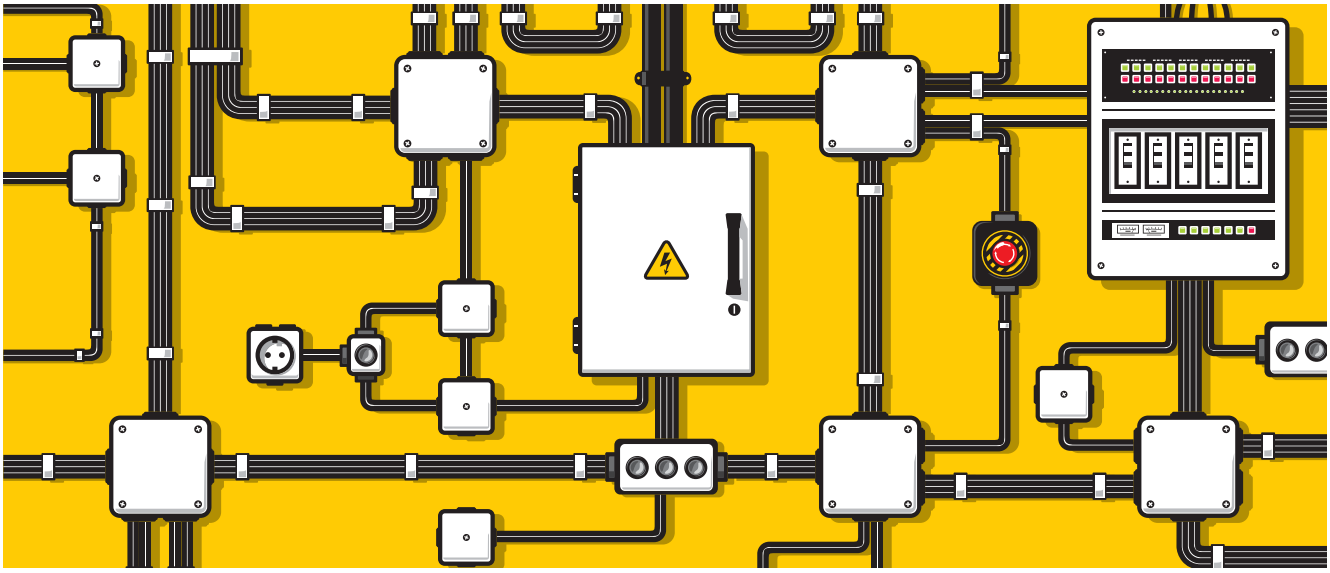
GET INTO GEAR

Here are the minimum requirements for selecting and installing switchgear and control gear.



Let's look at the overall power distribution architecture of an installation, including required functions and features, all under the Section 2 heading *General arrangement, control and protection*.

This section deals mainly with power distribution. It focuses on:

* control and isolation for maintenance, testing, fault detection and repair;
* automatic disconnection of supply for over current, fault and earth leakage currents;
* protection against over-voltage and under-voltage conditions;
* suitable arrangements for switchgear and control gear groupings, locations and access;
* controlling and protecting reliability of other parts of the installation in case of faults; and,
* verifying that switchgear and control gear installation is to manufacturer instructions.

Electricity distribution in all installations has to be arranged, installed and controlled.

It involves controlling voltages and currents that can be a shock hazard and generate considerable operating temperatures.

These hazards increase as currents and voltages get higher, especially in switchboards or environments that are already at increased temperatures. Poorly selected or installed switches, circuit breakers and other current-carrying devices can result in harmful and destructive failure, and a much-reduced service life.

This makes emphasis on careful selection and reference to manufacturers' instructions crucial to an installation's performance, as most equipment has quite different ratings in different environments. Switchgear and control gear can even be destroyed if improperly used.

For instance, the rating for a piece of equipment in 'free air' can be much higher than when it is in a small compartment – or if surrounded by items also generating heat.

This is reflected in some of the changes in this section and in the new Appendix K *Switchboard requirement summary*.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* adding switchgear operating characteristics;
* origin of sub-mains identification;
* operation of main switch details;
* position and alternative positions of overload device clarification;
* expansion of discrimination requirements;
* enhancement of switchboard arcing fault protection;
* additional and revised RCD requirements;
* clearances around switchboards clarified (and increased);
* guidance on the use of low-current arc fault detection devices;
* enhancement of requirements for 800A and over switchboards; and,
* clarification on rising mains and other tee-offs.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2 SECTION 2 INCLUDE:

* New item (f) under *Selection and installation* placing more emphasis on compliance with additional requirements in manufacturer instructions for different ratings in different installed environments. Refer also above. (p75)
* A note is added under *Arrangement of electrical installation* (d) drawing attention to the need to increase reliability of supply as further detailed in new Appendix M. (p76, p559)

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* New heading *Origin of sub-mains and final sub-circuits* requiring every sub-main and sub-circuit to commence at the main switchboard or a distribution board and for all the 'live' conductors to be connected at one switchboard' is inserted and 'common neutral' renumbered. (p76)
* New heading *Electric vehicle charging circuits* is added referencing Appendix P and special NZ requirements. (p77)
* The heading now *Common control systems* (was *Common requirements*), *General* is elevated to a sub-section heading now covering new sub-section heading *All systems*. The previous headings are renumbered to follow. A new item (d) adds that the precautions now also include short-circuiting and earthing as supplementary measures. The word 'poles' under *Direct current systems* is changed to 'conductors'. (p80-81)
* Under *Devices for isolation – general* the word 'supply' between 'active' and 'conductors' is deleted to now include all active conductors, not just the active supply conductors. Also, the word 'shall' has been moved to each of items (a) to (f) as the opening word. So, there is no material change apart from emphasising that each (a) to (f) must be complied with. (p82)
* New sub-heading *Introduction* is slotted in under 'main switches' above the otherwise unchanged wording below. The later sub-headings are renumbered to suit. Also, the 'exception' under sub-heading *General* dealing with main switches for alternative or supplementary supplies is reworded and the (a) to (g) numbering is now 1 to 7. (p83-84)
* Word 'operation' is added to 'location' for the heading to now read *Operation and location*. A new note (b) dealing with main switch operating handles and controls requiring manual operation and excluding electronic touch screens for main switch operation is included with the remaining clauses renumbered to suit. A new item (e) has been added detailing labelling requirements for any supplementary or alternative supply to identify the energy source. Under *Remote control* new item (iii) preventing overriding or bypassing by PLC or similar and new item (d) for additional requirements where touch screens or PLCs, etc, are used in conjunction with a main switch are added. (p84-86)
* Cross-reference list under *Appliances and accessories* now includes (i) 'gas appliances and accessories' and (k) 'lifts' with the remainder re-indexed to suit. (p88)
* Under *Emergency switching including emergency stopping* the paragraph mandating an isolating device where there is a risk of shock is reworded but does not appear to change the intent. (p88)
* Text under *Emergency switching devices* has slight rewording of (v) for manual reset prior to starting but no apparent change of intent. (p89)
* Text under *Fault protection* in (b) has added compliance cross-reference to cl 5.7. (p92)
* Text under *Protection against over current* has a new sub-heading *General requirements* with renumbering of the other sub-headings to suit. Also, a note at the end of that clause dealing with reduction in current-carrying capacity numbered as Note 1 and reworded, with Note 2 referencing Appendix I (ratings of imperial cables) added. (p94, p540)
* Text under *Consumer mains* (b) and (c) now does not refer to note (6) and text is added after (c) that this arrangement is regarded as unprotected consumer mains with a clarification note for unprotected consumer mains and cross-referencing added. A new Figure 2.1 follows. (p94, p95)
* Note under *Sub-mains and final sub-circuits – general arrangements* is changed to now refer to 2.2 (A) and 2.2 (B). (p96)
* The exception under *Devices for protection against both overload and short-circuit currents* is now referenced to 2.5.7.2. Note 4 regarding screw-type fuses now refers to an IEC document. (p96)
* A substantial clause *Characteristics of short-circuit protective devices* has been moved from later in this part of the Standard but not changed. The other clauses are renumbered to suit, the figures likewise. The figures are also reworked with changes. Users should acquaint themselves with any changes. (p99-100 and Figures 2.3 to 2.10)
* The first paragraph under *Protection against switchboard internal arcing fault currents – General* is reworded to include the 800A and over reference previously included in the note. There has been no change of intent. (p108)
* The first paragraph under *Reduction of the probability of the initiation of a switchboard internal arcing fault* replaces the previous term 'heavy current switchboards' with the term 'switchboards rated at 800A or greater per phase' to clarify the 2007 edition intent. (p109)
* Figure 2.11 is included, showing which are parts of a functional unit and which are not. (p110)
* Cross-reference to 2.5.4.5 (a) is added under *Protection afforded by separate devices*. (p111)
* Under *Co-ordination of protective devices*, a paragraph is added with detail on back-up (cascading) of devices with a note to use manufacturer instructions and a reference to new Figure 2.12. The references in Note 2 are re-homed, and a Note 3 added to clarify selectivity need not apply where protective devices are in series on the same circuits, such as with UPS connected supplies. (p112-113)
* Under *Safety service circuit discrimination (selectivity)*, 'selectivity' is added to the heading and the text is revised to mandate the previously more loosely worded requirements so that the original intent is reinforced. The references to figures are re-homed. (p113)
* Under *General supply circuit discrimination (selectivity)*, 'selectivity' is added to the heading and the text revised to mandate the previously more loosely worded requirements. So, the original intent has now been reinforced. The use of discrimination

studies has been included in the main text; it was previously included in the notes. The reference to figures is re-homed. (p113-115)

* Under *Types of RCD* an additional IEC Standard, IEC 62423 (*Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*), is added. Advice for users to consult the RCD manufacturer for type selection and Australia-only and New Zealand-only requirements are added. (p120-123)
* The heading *Additional protection by residual current devices* is renamed from *Where additional protection is required* and it has been changed substantially, including a virtual blanket requirement for RCDs on all final sub-circuits in domestic and residential situations. In addition, all RCDs must be installed at the switchboard. In non-residential installations RCDs must be provided on all socket-outlet circuits, lighting circuits, direct-connected hand-held electrical equipment and direct-connected equipment that represent an increased risk of electric shock. In non-domestic non-residential situations, for direct-connected type circuits up to 32A, the installing of 30mA RCDs should also be considered. There are exceptions and other changes, therefore users are advised to carefully study the new edition so that these requirements are fully understood. (p119-125)
* In *Home care installations – Australia only* RCD requirements must comply with AS/NZS 3003 and some of these may need to be Type 1 RCDs rated at 10mA. (p125-126)
* Under *Alterations to installations and replacement of switchboards – Australia only* RCDs must be installed where any sub-circuit is altered or socket-outlets are added. Also, where all the circuit protection on a switchboard is replaced, unless certain exemptions apply. For repairs, where a socket-outlet, luminaire or single item is replaced 'like with like' RCDs are not mandated. There are also some NZ-only requirements to note for NZ users. (p126-127, p130)

Advice for users to consult the RCD manufacturer for type selection and Australia-only and New Zealand-only requirements have been added.

* Heading *Protection against fire hazard due to arcing fault* is new, inserted in place of *Switchboards*, which is renumbered to suit. Low-current arcing faults, as in faulty electric blankets and other appliances, and damaged wiring and electric cords have been identified as potential sources of house and building fires. Low-current arcing fault detection devices (AFDDs) have now become available for use in situations where the owner or occupier identifies such risk. The information here and in new Appendix O is for guidance in Australia but AFDDs are required in some situations in NZ. Further details are included. (p133-134)
* The Section 2 clause *Switchboards* has been renumbered as also noted above. The previous exception is numbered '1' and a second exception added dealing with tee-offs and short branches where a smaller conductor may be used for up to 3m, or alternatively for those circuits to be otherwise protected. 'Accessibility and emergency exit facilities' (a), (b), (c) must now all be complied with and the distances/spacing around switchboards are changed as detailed in the text and the diagrams. This increases the access space to a minimum of 1m but retains access of 600mm from the open arc of switchboard doors to other open doors (i), (ii). A minimum of two emergency exits are now mandated for switchboards 800A and over or 3m long unless there is a 3m or greater clear space in front. (p134-139)
* A new header sentence is added under *Location of main switchboard* requiring (a), (b) to be complied with. All references have been re-homed to reflect the numbering change of the switchboard clause, and Note 3 under (k) has been split into two to clarify the NZ requirement. (p140-143)
* The reference under *Construction* is re-homed. A requirement is added covering the 'suitability' of the environment in which the switchboard is installed. A note (1) is added referencing Appendix K *Switchboard requirement summary* and the other notes renumbered. A new heading *Orientation and location of circuit breakers* has been inserted and the second paragraph under the moved sub-heading *Orientation of circuit breakers* has the word 'exception' removed, making this a normal requirement. A new clause *Location of fuses and circuit breakers* setting out grouping requirements and prohibited locations is added. (p143-144, p545)
* Heading *Bars or links* is reduced to *Bars* and the word 'link' removed from the entire text (and will most likely fall out of use in situations applying to connection bars). The references have been re-homed. There's a minor edit in the wording of *Exceptions* – 'is not necessary' to 'need not apply'. (p145-147) ■

-Peter Vandenheuvel

AVOIDING FUTURE SHOCK

Dennis Galvin from Legrand Australia discusses the most important changes to Section 2.

The new edition of the AS/NZS 3000 *Electrical Installations* (Wiring Rules) will come into effect in November 2018, and Part 2, Section 2 details how electrical circuits should be arranged, controlled and protected to ensure safety.

The last update to the Wiring Rules was published in 2007. The revisions for each new update not only represent a step forward in electrical safety but also allow for the requirements of emerging products and technologies.

The 2018 edition contains several important improvements, including the requirements for residual current devices (RCDs), arc fault detection devices (AFDDs), electric vehicle charging, the arrangement of neutrals for residual current circuit breakers with over-current protection (RCBOs), and switchboard access.

Undoubtedly, the most important of these improvements are the new rules for RCDs. But, to fully understand them it is necessary to examine how the rules have changed over time.

I was involved in the original introduction of RCD requirements into the 1992 edition. As background research I analysed every record of an electric shock fatality in Australia from 1945 to 1990 that I could find to determine how many could have been prevented if RCDs had been installed.

RCDs would have made no difference in only two cases. In all the other instances, RCDs would have probably prevented the fatality. This made a hugely compelling case for RCDs to be mandated in the Wiring Rules.

INCREMENTAL APPROACH

Two main problems with RCDs were identified at the time.

If an RCD trips on a lighting circuit, you lose all your lights, and for circuits feeding appliances such as refrigerators and stoves, leakage current tends to cause nuisance tripping.

Mindful of these concerns, the Wiring Rules initially recommended that RCDs should be fitted only on socket outlets. Interestingly, research indicated that this move alone would have prevented 87% of electric shock fatalities recorded between 1945 and 1990.

The requirement for RCDs on socket circuits was included in the 1992 edition of the Wiring Rules and implemented in Australia, although New Zealand mandated RCDs for sockets only in wet areas for fear that the costs would outweigh the benefits.

This view was subsequently revised when New Zealand introduced new insulation legislation, and five people died by inadvertently stapling through live circuits while fixing aluminium foil to the underside of floor joists. With RCDs in place, some – or perhaps all – of those deaths could have been prevented.

Over time, the requirement for RCDs has increased in Australia and New Zealand, with a consequent dramatic reduction in the number of deaths. However, although the overall number of fatalities has dropped, electricians began to make up a disproportionally high percentage of those still occurring.

Analysis indicated that most of these ongoing deaths occurred from drilling into wiring or making contact with exposed live parts where electrical insulation had broken off in roof spaces.

EXCEPTIONS ABATEMENT

Clearly, the regulations needed to tackle the changing nature of avoidable deaths.

This provided the impetus in the 2007 edition to protect all final sub-circuits in residential installations with RCDs, including lighting.

This meant that instead of locating RCDs in the socket outlet itself it was more practical to position the RCD in the switchboard, thereby protecting all downstream circuits and wiring.

To overcome the potential for losing all lighting if an RCD tripped, the Wiring Rules included a requirement for lighting to be split across at least two RCDs.

Until the latest revision, exceptions existed to prevent nuisance tripping for stationary appliances such as stoves. However, for Australia the 2018 edition stipulates that all final sub-circuits up to 32A for residential installations have to be RCD protected.

The only remaining permissible residential exceptions include relatively rare equipment – such as

home dialysis machines – where the risk of electric shock is outweighed by the risk of a nuisance trip.

Commercial exceptions include equipment with high leakage current – such as variable-speed drives or ovens – which would trip an RCD through normal operations, or those processes requiring high-reliability circuits.

Under the 2018 Wiring Rules, New Zealand still permits exceptions for RCDs for stationary appliances.

Although this update will further reduce the number of fatalities, it will be at the expense of nuisance tripping. For instance, older equipment with heating elements that have not been specifically designed to repel moisture ingress will probably experience leakage current that will cause repeated RCD trips.

A possible compromise that was discussed was for stationary appliances to be fitted with 100mA RCDs instead of 32mA, which would eliminate most of the nuisance tripping issues. The Electrical Regulators Association blocked this move.

This will mean that older stationary appliances will need to be replaced.

There is another interesting implication in the new rules. When an existing unprotected circuit is extended then an RCD needs to be installed for the new section, but the existing circuit does not need to be protected.

This will probably increase the demand for socket-outlet RCDs, which have become virtually obsolete since the Wiring Rules required RCDs to be located in switchboards.

AFDD ON THE INCREASE

Other changes to the 2018 edition include a recommendation for AFDDs to be installed in high-risk areas to prevent arcing faults and resulting fires.

AFDDs have had a chequered history, as normal current flow in some types of equipment can be interpreted by an AFDD as an arcing fault and cause nuisance tripping.

However, the greater sophistication of the latest signal processing technology allows for better protection with fewer nuisance-tripping issues.

Although Australia has elected to recommend AFDDs for 'high risk' areas, New Zealand has taken a further step to mandate their use in schools that have accommodation, and in historic buildings.

In time, we expect AFDD requirements to expand, as has been the case for RCDs. There will always be an aspect of the Wiring Rules playing 'catch up' as the nature of electrical injuries shifts with the implementation of protective measures put in place.

Yet the changes to the 2018 edition will improve safety and help the industry to take positive steps towards a point at which deaths from electric fires and shock no longer occur. ■

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A BURNING ISSUE

An innovative solution has been introduced to guard against fire due to arcing. Eaton A/NZ Power Distribution business engineering manager **Lindsay Lucas** reports.

The 2018 edition of the Wiring Rules covers a new type of circuit protection known as the arc fault detection device.

An AFDD automatically disconnects supply in the event of low-level arcing faults in final sub-circuit wiring. The intent is clear – to mitigate the risk of fires being ignited by electrical arcing.

Requirements for the use of AFDDs differ between Australia and NZ, so please refer to Clauses 2.9.6 and 2.9.7 respectively in AS/NZS 3000.

Clause 2.9 refers users to the new Appendix O for information on the installation of AFDDs.

AFDD technology has been developed over the past 20 years, first finding application in the United States, where the National Electrical Code (equivalent to AS/NZS 3000) is heavily influenced by fire protection agencies and insurers.

Eaton patented AFDDs in 1996 for the North American market and has since developed an IEC product for use elsewhere.

AFDDs have specific application in protecting final sub-circuit wiring in electrical installations. They should not be confused with arc flash detectors and similar devices used in low-voltage and high-voltage electrical switchgear for protection against fire and explosion in the event of internal arcing faults in the switchgear.

Historically, miniature over-current circuit breakers and fuses have been used for protection against fires initiated by overheating of conductors due to overloads or short-circuits.

However, the heating effect of low-level arcing faults in a conductor (series arcs) or between live conductors or live conductors and protective conductors (parallel arcs) cannot be detected by these devices because it occurs at or below their rated current.

The degradation of insulation caused by carbonisation due to these low-level arcs ultimately leads to total failure of the insulation with catastrophic results.

Similarly, residual current devices are unable to detect these faults when they do not cause an imbalance in the current-sensing device.

AFDDs employ advanced sensing techniques and algorithms to sample and analyse the waveform of the current. They discriminate between normal load current and abnormal conditions associated with arcing faults of either type.

Appendix O provides further information on the differences between series and parallel arcing faults in Figure O1.

When selecting and installing an AFDD, consideration must be given to:

* location (i.e. after the main switch – paragraph O4.1, and at the start of the final sub-circuit it protects – paragraph O4.3); and,
* ratings (paragraph O4.2), and the product standard with which it must comply (paragraph O4.2).

If the AFDD does not include integral over-current protection, it must be installed downstream of a suitably rated over-current protection device, itself selected in accordance with the relevant product standards (paragraph O4.3bi).

The short-circuit making and breaking capacity of the AFDD must be at least capable of dealing with the prospective short-circuit current at the point of installation (paragraph O4.3bii).

Protection of the sensitive electronics in an AFDD from damage due to over-voltage should also be considered as part of the installation design (paragraph O4.4).

AFDDs should be considered for areas of highest risk, for example, socket outlets (paragraph O4.3c) or other loads where there is a risk of damage to conductors leading to arcing faults.

Installations susceptible to loss from fire may benefit from AFDDs, for example, premises with sleeping accommodation; places constructed of, or for the storage of, flammable materials; and premises where valuable items are stored, such as galleries or museums.

It may also be of benefit to consider AFDDs for installations with ageing or deteriorating wiring. Circuits with deteriorating insulation passing through an area may also require consideration, in addition to those that terminate in an area. ■

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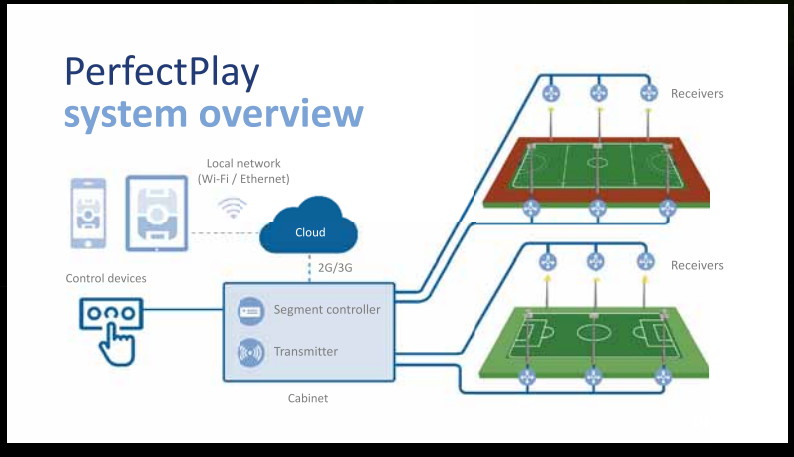

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CABLE PICKS

This section deals with wiring from the incoming supply point to the final sub-circuit extremities.

As with the selection of equipment, there are many cabling aspects to consider that may adversely affect an installation.

Section 3 *Selection and installation of wiring method* is the glue that binds the supply and distribution equipment in Section 2 to the 'consumer' devices in Section 4, so the installation architecture delivers the intended outcome.

The size of cables, where they are installed, how they are protected and how they are supported or held in place can catastrophically affect the cables themselves, the installation, the safety of people nearby and the ultimate life of the installation.

In order to deal with some of these issues, the Standard now includes additional requirements to protect cables from damage in places such as walls, where they are concealed and may be damaged during activities as innocent as the hanging of a luminaire, picture or shelf.

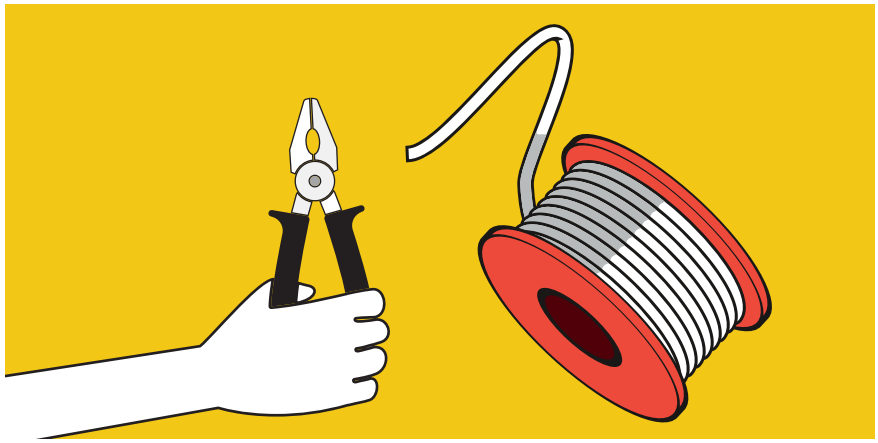
The focus on energy efficiency and the retrofitting of thermal insulation have prompted the extension to Australia of a previously NZ-only requirement. This covers wiring above ceilings, in walls and under floors to cater for – and be based on – the installation of thermal insulation.

For safety, identification of the origin of any sub-mains in an installation or to outbuildings must now be noted on the distribution switchboard supplied by the sub-main.

Now that wiring enclosures above roofs for PV installations are more prevalent, some guidance is provided on not interfering with the free flow of rain water and on the prevention of debris being trapped.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* improved safety requirements for cables passing through bulk thermal isolation;
* clarification of requirements for wiring systems likely to be disturbed;



* clarification of cable segregation from different installations in common enclosures; and,
* segregation of cables of different voltages.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2, SECTION 3 IN PAGE ORDER INCLUDE:

* Deletion of 'presence of' in sub-headings for *Humidity*, *Foreign bodies*, *Substances*; a new sub-heading *Mechanical damage* replaces *Impact*; and, further deletion of 'presence of' for 'flora', 'fauna'. There is no material change. (p153-P155)
* The new heading *Thermal insulation* clarifies which AS/NZS 3806 *Compliance programs* ratings to apply where cables pass through insulation, as these now vary depending on the length of transit through the insulation. (p155)
* The previous NZ-only requirement dealing with domestic wiring having to be based on ratings for thermal insulation in ceilings, walls and under floors is now applicable to Australia.
* The now-applicable switchboard Standard AS/NZS 61439 (*Low-voltage switchgear and controlgear assemblies - General rules*) for busbars and busways is added in Note 4. Australian users should understand this requirement, as it may affect the selection of cable size and type. (p155-156)
* Text under *Connection methods*, *Common requirements* (e) is expanded and reference made to the switchboard Standard for switchboard terminals. (p154)
* Text under *Identification* and *Exception* on there being no restriction on cable sheath colour has been moved up from the notes below, reducing the Notes to 1 and 2 but with no other change.
* Cables with yellow, green or yellow/green sheath colour are not permitted for cables with active and neutral conductors in Australia. A reference to the switchboard Standard, AS/NZS 61439, is included.
* Note 4 under Table 3.4 is added that the only permitted colour for neutral conductors in NZ domestic installations is black. (p168)
* The heading *Colour identification* is added and *Colour identification by sleeving or other means* completely redrafted, including for the prohibition on using a green, yellow or green/yellow as an active or neutral conductor.
* There are additional requirements for the sleeving of earthing and bonding and existing live conductors. The exception immediately below *Exceptions and special applications* is changed to re-home references and add the reference to Table 3.4.
* A new note (d) for a multi-core cable with a green earth is included and the note (b) further down on conductors

in flexible cords (except for yellow) has been expanded.

* See also the note immediately above for prohibited cable sheath colour for active and neutral conductors. (p168, p169-170)
* In the *Wiring systems likely to be disturbed* paragraph, 'location' is shortened and the requirement for 'support and protection' added separately as a new sub-clause. It clarifies the support requirements and contains a statement that RCDs shall not be used in lieu of mechanical protection for wiring systems likely to be disturbed.
* The first paragraph under *Wiring systems near building surfaces* has been edited but not materially changed. The new Figure 3.3, detailing treatment of such wiring (e.g. behind a recessed or wall-mounted switchboard) is also included. (p173-174)
* Additional information on the type of mechanical protection deemed to comply is included under protection methods (a) and (b), and there's a note after (c) further clarifying where earthing of the protection means need not be provided. (p177)
* The grammar of the first and second paragraphs under *Particular installation requirements* is changed but the intent remains as before. (p177-178)
* The arrangement of text under *Different electrical installations* is changed with sub-headings *Common enclosure/cable* and *Segregation* added, replacing the previous (a) and (b) and stipulating in greater detail which cables can be in a common enclosure and which must be segregated. (p181)
* The heading *Electromagnetic interference* is changed to *Minimisation of electromagnetic interference*. There has been no change to the text. (p188)
* Under *Wiring enclosures, Types* (a) wording in the first paragraph is changed to include the new Standard AS/NZS 61386. There is no other change. (p189)
* The wording under *Installation of wiring enclosures, General* is changed. The overriding paragraph remains the same but the specific requirements for enclosures installed on roofing materials are now detailed. This is at least in part due to these installations becoming more widespread, with the wiring to PV cells, etc. There is particular focus on the requirement to avoid obstructing water draining paths and promoting debris accumulation. (p190)
* A note is added under *Installation requirements, General* highlighting that there are further details and figures later in this section. It should be noted that some of these are new, e.g. for cables installed on a sloping site or near and behind a retaining wall (Figure 3.17). There is no material change. (p196-202). ■

-Peter Vandenheuvel

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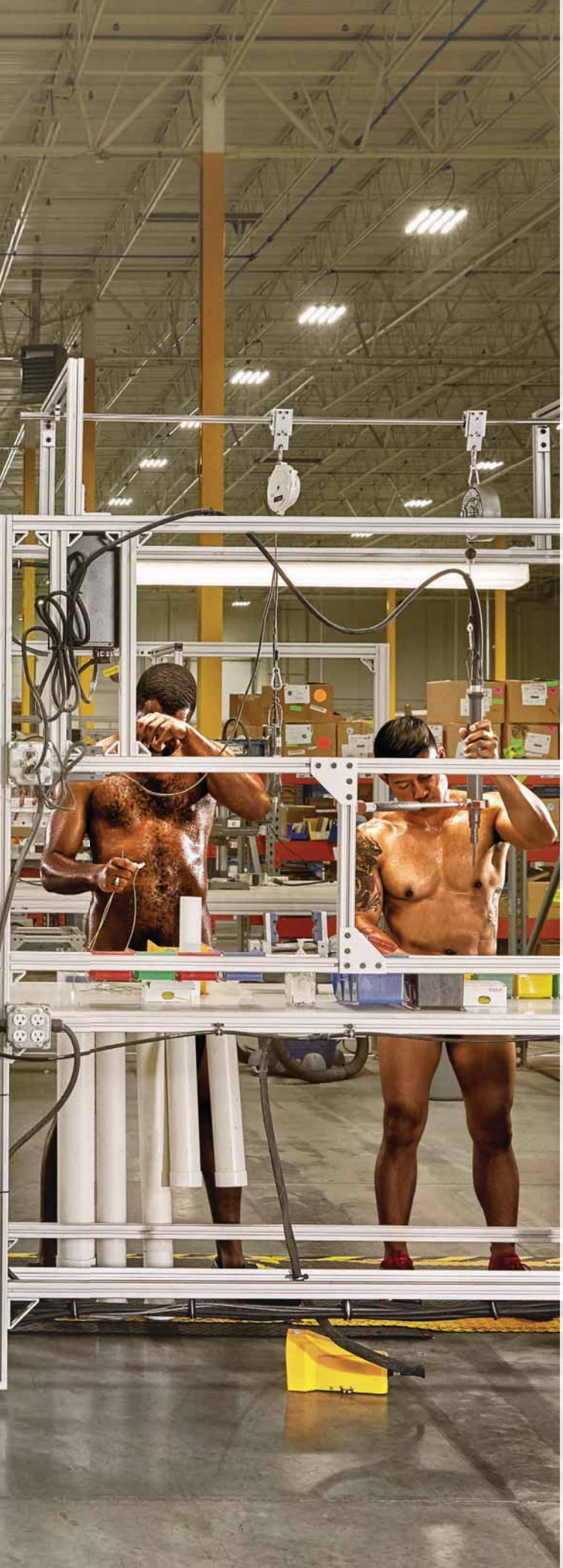

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EQUIPPED FOR POWER

Downlights are still a concern, lifts are classified in two types and general equipment requirements get an update - these are the changes from Part 2, Section 4 of the new Wiring Rules.

These are only some of the topics changed in the *Selection and installation of electrical equipment*, or Section 4. This is the important business-end of the installation, where the energy so far distributed in Sections 2 and 3 is finally put to use; the purpose for which the whole installation exists in the first place.

The selection and installation of luminaires, downlights, electric vehicle charging points and other equipment items require care and attention.

There are no less than 15 pages on luminaires, most dealing with recessed downlights which are still seen as a risk area. Considerable detail, much of it from work done in NZ, has been included as guidance for electricians.

Compliance with IP ratings is also of concern. Some electricians are unaware that untested modifications such as drilling for a mounting bolt or cable entry can affect IP integrity with serious consequences. This can create considerable problems for themselves and their customers.

Lifts are now also in the spotlight. Gone are the days of 'in case of fire do not use lift'. Many of buildings rely on lifts to get fire fighters up to the fire and get occupants down (especially those requiring assistance).

So, there are now two types: emergency lifts and (just plain) lifts.

Because not every lift in a building needs to be an emergency lift, requirements for the two types are different. Emergency lifts have to be installed in accordance with *Safety services* in Section 7 and lifts installed in accordance with this Section 4.

Requirements for the installation of electric vehicle charging outlets are now included.

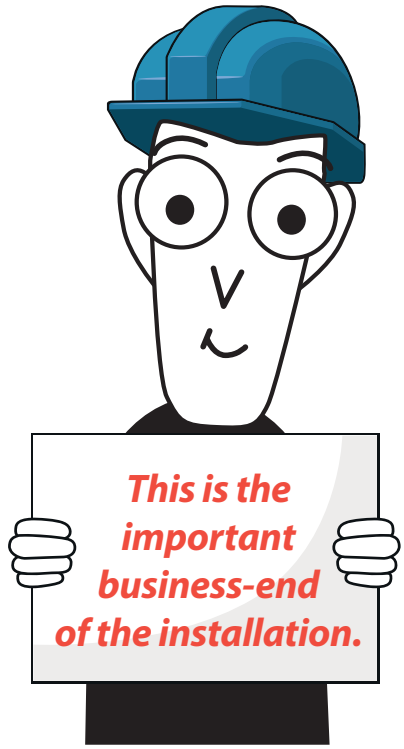
The effect of these can be considerable. The electricity needed to replace the energy from 1L of petrol would affect the maximum demand, cable size and socket-outlet size a great deal when based on a charging window (when the vehicle is at home) that may be only 12 hours a day.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* revision to figures for IP ratings;
* revision on use of installation couplers;
* inclusion of electric vehicle charging outlets;
* revision to lighting equipment and accessories;
* enhanced and updated safe installation of recessed luminaires;
* clarification of the location of accessories near cooking appliances;
* isolation requirements of gas appliances;
* clarification for air-conditioning and heat pumps;
* clarification of protection from weather locations;
* location and requirements for electric vehicle charging added;
* isolation of individual hot water systems added;
* hazardous areas at gas-relief vents; and,
* installation of non-emergency lifts.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2, SECTION 4 IN PAGE ORDER INCLUDE:

* Under *Selection and installation*, the previous note has been renumbered Note 1 with Notes 2, 3, 4 added. These reference electrical equipment installation requirements near cook tops, in damp areas and for NZ-only situations. (p213)
* Under *External influences*, the previous note is renumbered Note 1 with Notes 2 and 3 added referencing electrical installation requirements for purpose-made anti-condensation and water drains that maintain IP ratings. There is a statement that drilling a hole in the bottom will destroy the IP rating.
* Two paragraphs are added dealing with weather protection within a 30° building edge, installation requirements outside of these 'protected areas', and special requirements for metering enclosures and line-connector boxes. Figures are also included. (p214-215)
* For *Installation wiring connected by an installation coupler[s]*, the requirements *General* are slotted in before *Socket outlets*. The requirements for the couplers are set out. 'Socket-outlets' are slotted in after 'installation wiring connected by an installation coupler[s]' from after 'equipment wiring' to before it. The text of *Socket-outlets* and *Socket-outlets in installation wiring* is considerably revised. Users should make themselves aware of the new requirements. (p220-221)
* The clause *Other connection devices* in the 2007 edition (p183) is deleted.
* Under *Equipment wiring* (e) the requirement is added that installation



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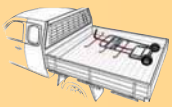

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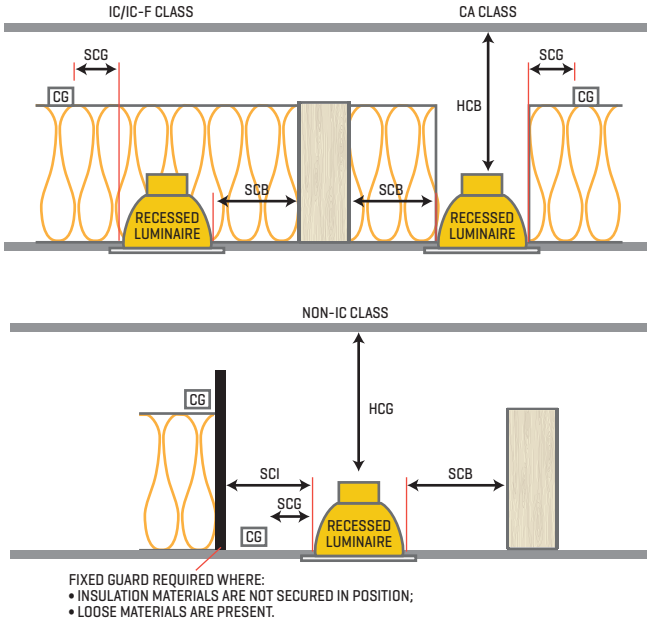
wiring passing through luminaires must not suffer damage or deterioration from luminaire UV radiation. This was at least in part brought about by use of wiring not resistant to UV through fluorescent fittings. (p222)

* Under *Socket-outlets* (a) a reference to AS/NZS 60864 is added and a new heading *Socket-outlets – alternative pin configurations* added with the requirements more clearly defined. Subject to the socket-outlets meeting all these requirements they (e.g. sockets with other-country pin configurations) can be used in any electrical installation in Australia, but not in NZ where the limitations and additional requirements set out must be complied with. (p223-224)
* A new heading *Low-voltage fixed socket outlets* has been added. This prohibits socket-outlets also having a combination telco, data, television, radio or similar wiring system socket-outlet. (p224)
* A new heading *Socket-outlets for electric vehicle charging*' is added referencing Appendix P and setting out the NZ requirement for installation of these outlets. (p224)
* Under *Location, Accessibility*, a note has been added under (a) for Standards applicable to socket-outlets mounted in a floor. (p225)
* Under *Lighting equipment and accessories* a new heading *Lamp holders, including lamp holders incorporated in a luminaire* is added. There is a change to Figure 4.9 and an exception to the requirement for the warning sign where specifically identified luminaires are exclusively installed. The previous heading *Installation precautions* has been renamed *Installation* and precautions changed to requirements. The requirements are substantially changed. (p232-243)
* The previous heading *Smoke and fire detectors* is changed to *Smoke alarms* and the term *Fire detectors* deleted from the text. (p243)
* Under *Cooking appliances, Switching devices* the text is considerably changed and Australia-only and NZ-only clauses added. A new figure is also included. (p243-245)
* Under *Water heaters* a requirement for an independent isolation switch for each heater adjacent – but not on – the heater is now included. (p246)
* Under *Electricity converters, Selection and installation* item (d) is revised to show the current Standards series that applies. (p250)
* Under *Overcurrent protection, General*, the text is changed with no real ramifications except that RCDs are now under their own heading. There is a more detailed explanation and a requirement for the correct type to suit the waveform of the converter to be selected. (p252)
* Under *Gas appliances and equipment* there are new Australia-only and NZ-only requirements for the means of isolation via a plug in a socket-outlet (with a separate switch if the socket-outlet is not accessible) or where an isolating switch is included. (p261)
* Under *Gas cylinders containing heavier than air gases, Hot particles and surfaces* requirements have been changed, Australia-only and NZ-only. Additional figures are included. (p261-264)



DIMENSION	ANY LAMP UP TO 100W
HCB- Height clearance to building element	100mm
SCB- Side clearance to building element	100mm
SCI- Side clearance to insulation	100mm
SCG- Side clearance to auxiliary equipment [control gear (CG)]	50mm

Figure 4.9: Default minimum clearances for recessed luminaires.

* A further paragraph is added under *Air-conditioning and heat pump systems* requiring a warning notice adjacent to the isolators for these systems if there are other points of isolation for ancillary associated devices. A second exception is added. (p264-265)
* A new heading *Lifts* is included. This requires lifts to comply with AS/NZS 3000. As a point of interest, users should note there are now different requirements for lifts, emergency lifts and (presumably) non-emergency or (normal) lifts. This has come about at least in part due to many buildings being too tall for evacuation without lifts. So, the old 'in case of fire do not use lifts' is no longer the case for many buildings. Imagine people needing assistance or in wheel-chairs faced with 20 or more flights of steep stairs. Consequently, when there is more than one lift, building designers, owners or occupiers must nominate the type. Both types are to be installed with the requirement of the National Construction Code (in Australia) or the New Zealand Building Code. In AS/NZS 3000 the emergency lifts are now treated as safety services, and the other lifts typically as any other part of the installation. (p265-266) ■

-Peter Vandenheuvel

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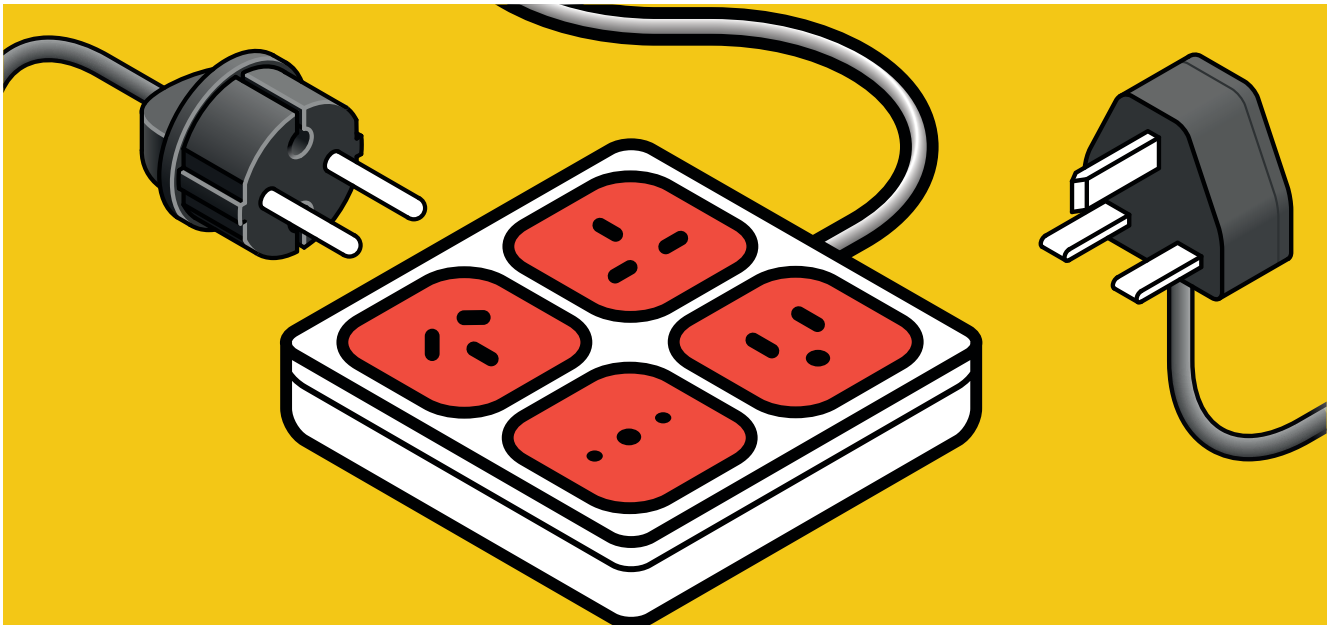
PULL THE PLUG ON RISK

Dennis Galvin from Legrand Australia reviews changes to Section 4 of AS/NZS 3000:2018 that are designed to improve safety and clarify interpretation.



The style of the latest edition harks back to the way the Wiring Rules were presented 30 years ago.

At that time, the rules were very prescriptive, clearly stating what needed to be done, and how, with little scope for misinterpretation or confusion.

However, in time the language has softened along the lines of requiring an installer to make 'a safe installation' or provide 'adequate protection' without clearly defining either. Electricians believed that their way of doing things was 'safe' and 'adequate', but in practice there was a huge range of possible interpretations based on individual experience.

The 2018 Wiring Rules have reverted to more precise instructions, leaving less potential for an incorrect interpretation and providing a more standardised approach across the industry.

Most electricians will welcome this approach, as they will have a more certain understanding of what is required for compliance with fewer grey areas to consider. It will also mean that when electricians are working on existing electrical circuitry in future they will have a great sense of surety that the original installer worked to the same understanding of the Wiring Rules.

A potential drawback of the more prescriptive approach is reduced flexibility in non-standard situations. However, the style of the new Wiring Rules strikes a good balance between the clarity of requirements for meeting the code and some 'wriggle room' where necessary.

For instance, an engineer can sign off a proposed variation as complying if this can be demonstrated to be equal in safety to the approach described by the Standard.

OVERSEAS OUTLETS

Unlike many European nations, Australia and New Zealand have been blessed with a single plug-socket system throughout the countries' histories.

Appliances are typically sold in Australia and New Zealand with factory-fitted plugs – a safer approach than in the UK, for example. The existence of legacy socket systems in older British properties meant that until quite recently appliances were often sold without plugs, and consumers fitted their own.

However, one of the downsides to the 'single socket' scenario is that the Wiring Rules have made little provision to date for meeting the plug-socket needs of international travellers.

There had been a move to install universal sockets or multi-outlet sockets with large enough apertures to accept virtually any kind of plug pins – for hotel, hospitality and travel industry applications, but such accessories were banned because they didn't conform to Wiring Rules requirements for the pin aperture.

Equally, it wasn't hitherto possible to install foreign plug sockets in an Australian or New Zealand building, as these would fail to comply with the AS/NZ 3000 Standard.

Finally, the issue is resolved in the 2018 edition of the Wiring Rules, which allows the installation of UK, US, French and German outlets, provided they conform to the International Electrotechnical Commission (IEC) Standard for apertures and can accept only one type of plug.

This move is intended to allow hotels and airports to legally install socket outlets in guest or public areas. It will

provide a safe, workable solution to a problem that has plagued the industry for many years.

The new Wiring Rules also offer much clearer guidelines for recessed luminaires.

In Australia, recessed luminaires can be installed only if they meet the minimum CA90 rating, which specifies that the casing will not exceed 90°C.

Interestingly, New Zealand permits CA135 rated luminaires, designed to not exceed 135°C. It is a somewhat counter-intuitive decision, given that many of these luminaires will be installed in wood-frame buildings and the pyrolytic ignition temperature for wood is just 105°C.

Apart from this, the Section 4 chapter on recessed luminaires is more comprehensive than before. It contains more stringent requirements and more easily understood guidelines, especially with regard to installation near insulation material. Given the number of fires caused by downlights in recent years, this guide is a timely revision.

ISOLATION ISSUES

The 2018 edition also introduces rules that require isolation switches on gas appliances – including gas heaters – stipulating that they be double-pole.

This addresses the hazard associated with single-pole connections where it is possible to generate a voltage between neutral and earth during switching, thereby creating the potential to ignite gas.

Although this inclusion makes sense from a safety standpoint, EL-001 committee members hope to amend it to avoid the necessity for large industrial-type switches in people's lounge rooms.

One option is to provide a socket for the appliance, allowing it to be unplugged to obviate the need for an unwieldy switch. This isolating switch section in Section 4 is a major amendment to the Wiring Rules, its more stringent requirements arising in direct response to numerous reported incidents, especially those involving gas fitters.

Overall, the revisions to Section 4 are well thought through and intelligently presented, providing incremental improvements to safety in several key areas, and clearer guidance.

For example, the designation of IP zones for the outside installation of electrical equipment is much clearer than before. The Wiring Rules now state that if a line is drawn down at an angle of 30° from the eaves – or any similar balcony or overhang – then above the point where the line intersects the wall, IP33 equipment can be used. Below this level IP55-rated equipment is required.

Sensible recommendations such as this will help promote best-practice installation throughout the industry and remove much of the uncertainty from safety concerns. ■

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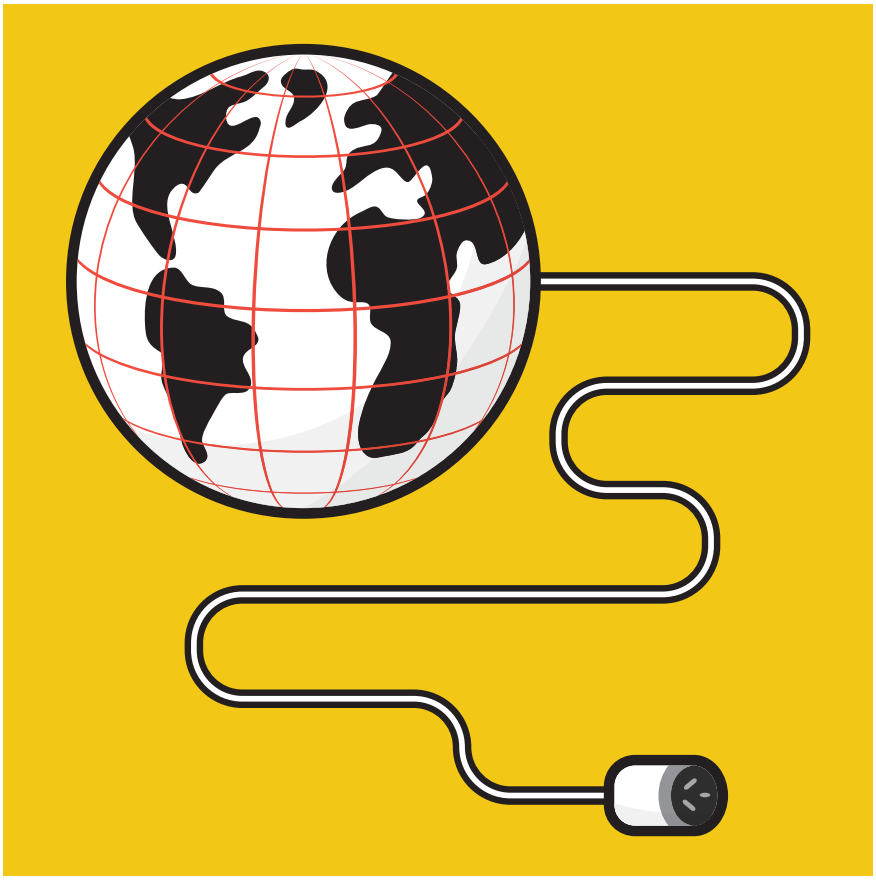
EARTH CALLING

Earthing, which is the focus of Section 5, has a crucial but often overlooked role in what makes an electrical installation very safe or extremely dangerous.



A close reading of Section 5, *Earthing arrangements and earthing conductors*, should, hopefully, dispel any misconceptions.

People see a main earth connection or an earth bonding cable connected to a pool fence or on a conductive building without any further protection and it is assumed to be somewhat benign. After all, it can (almost always) be touched without consequence.

Even in the industry some electricians don't isolate before disconnecting an earth conductor or when temporarily separating two conductors where remaking a connection. In most cases they get away with it, but that is only because everything in the installation is sound.

However, if there is an unknown fault in the installation, disconnecting an earth conductor can be just as dangerous as disconnecting a neutral when the circuit active is energised and there is a load (no matter how small) on the circuit.

Correct earthing is paramount to ensure that circuit protection operates properly and quickly. It is crucial for the safety of an installation and the people using it – and that makes this section as important as all the others.

Also, although most installations are still connected to an MEN system connected grid, there are many instances in which alternative earthing systems are required. Think of certain mine sites, remote installations, stand-alone grids, micro-grids and other settings. Hence there is more information on these alternative earthing systems.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* MEN system clarification and accessibility of connections;
* updated SELV and PELV requirements;
* expanded and clarified equipotential bonding for showers, bathrooms pools and spas;
* earthing of conductive materials in outbuildings;
* earthing for switchboard enclosures with unprotected consumer mains;
* earthing of conductive reinforcing in outbuildings with showers or baths; and,
* earthing connection point and bonding of conductive pool structures and fittings within arm's reach, with figures included.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2 SECTION 5 IN PAGE ORDER INCLUDE:

* A reworking of figures. (p269-270)
* Additional Note 5 under *Other earthing systems* to recognise additional installation systems, with other notes renumbered from (a) to (d) to 1 to 4. (p271)
* Sentence added under *MEN, General, Exceptions* after the note for the MEN or ME connection to be in an accessible position for disconnection and testing. (p281)
* Minor changes to Table 5.2 clarifying stainless and steel clad – with stainless steel being equally complying, and qualifying that the 20mm steel pipe must have a minimum 3mm wall thickness. (p283)
* Redrafted colour diagram is provided showing all the different earthing configurations that can be used. (Users should remember that earthing conductors should be installed such that the earth connection to various remaining earthing conductor connections is

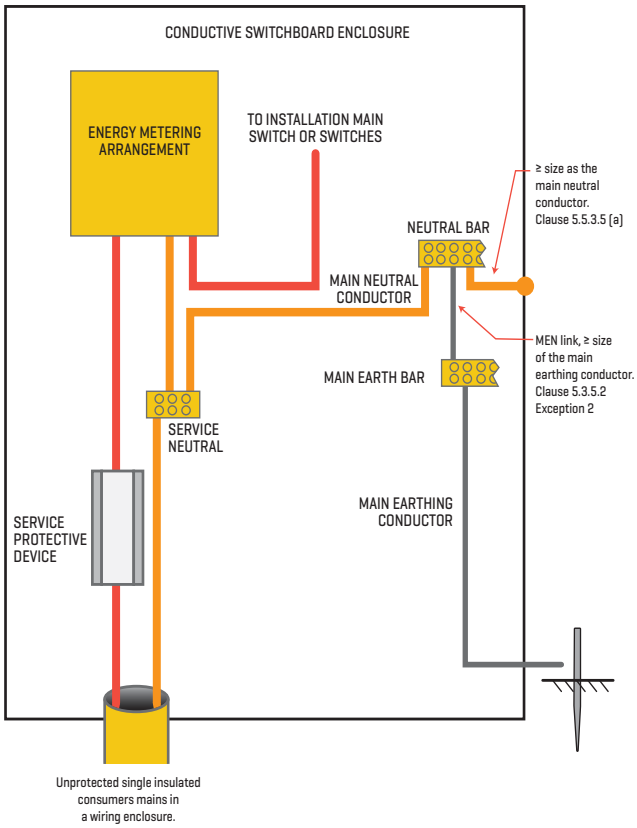


Figure 5.6(A): Earthing arrangement for conductive switchboard enclosures associated with unprotected consumer mains [clause 5.5.3.5(a)].

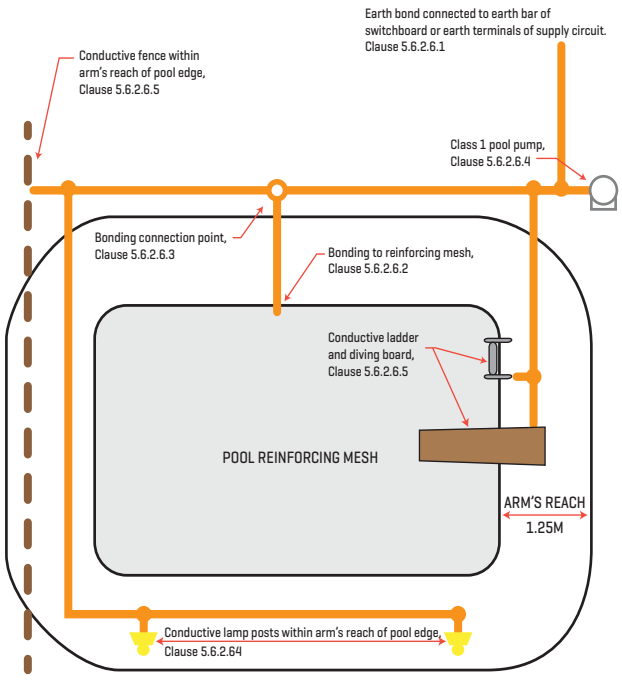


Figure 5.9: Example of bonding arrangement for pools and spas.

not accidentally disconnected if one earthing connection point is disconnected. (p292)

* New terms are introduced under *Particular methods of earthing*, *Outbuildings*, for 'individual outbuildings' and 'combined outbuildings' to clarify that individual outbuildings can have an MEN instead of an earth from the source of supply and likewise for combined outbuildings. But in the combined outbuildings only one incoming supply can have an MEN connection and all the others must have their earth conductors from that MEN connection. This has also required splitting the original (a) into (a) and (b) with considerable change in test and the original (b) becoming (c). Figures 5.4 and 5.5 have been added to explain. (p293-295)
* Under *Unprotected consumer mains* Figures 5.6 (A), (B) and (C) are added. Also, a second sentence and note are added immediately under the heading with further detail here and with references to the figures throughout. The original notes are now also headed *Exception* but the intent of these has not changed. (p296-300)
* Under *Arrangement*, *General* note (f) is changed from general access floors requiring additional bonding to grid-connected inverters now requiring bonding. There is no other change. (p304)
* Requirement for bonding under *Showers and bathrooms* for combined outbuildings is further detailed in two new paragraphs. The ending of Note 3 has is changed to 'sufficient' from the previous 'satisfactory where bonding is required at more than one location'. Note 4 is modified to clarify that this is not a requirement in existing buildings, and also with more emphasis placed on doing it wherever practicable. (p307)
* Order of headings under *Swimming pools and spas* is substantially changed and considerably modified. Due to this, all cross references have been rehomed. A new figure 5.9 *Examples of bonding arrangements* has been added. The new order of headings is:
  * *Bonding arrangement*: the wording in (a) and (c) has been changed but (a) and (d) remain as before. There are no changes in intent. The new Figure 5.9 is also referenced.
  * *Conductive pool structures*: two new paragraphs and an exception are added to further clarify the requirements and Note 2 is changed to reflect other changes.
  * *Pool equipotential conductor connection point*: is changed from 'equipotential conductor connection point' and the opening paragraph substantially reworded, with minor changes also to (a) and (c).
  * *Electrical equipment*: no change apart from an example added under (b). (p309)
  * *Conductive fixtures and fittings*: the opening paragraph is considerably expanded to reflect the changes under the *Swimming pools and spas* heading, previous (a) and (b) are deleted and or incorporated in new paragraphs 1 and 2, and new exceptions 1 and 2. (p309-310) ■

-Peter Vandenheuvel

WET AND WILD

Electricity and water make poor bedfellows, but they often have to be near each other to meet architectural and lifestyle needs. These are the changes from Section 6.

The safe bringing together of power and water continues to be a challenge but hopefully the changes to Section 6 *Damp situations* will throw more light on how best to manage this.

There are often obvious signs of something amiss, like a tingle from a tap in the shower, bath or laundry. And if there is one piece of advice worth heeding and passing on to the occupiers in such situation, it is: "Get out from wherever you are, ring the electricity distributor and do not go back until it is made safe."

Some anecdotal information suggests that up to 25% of reported shock incidents involve a problem with the neutral connection to the premises putting the person in harm's way when they become a part of the return path.

This section is very important where there is a water container, flowing water or a damp situation plus conductive parts – earthed or just connected to the mass of earth – that are both within arm's reach.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* additional content for water containers not normally entered by people;
* installation requirements for deluge showers;
* Zone 1 areas for different shower head locations;
* reduction of water containers to 40L (max);
* zoning for hinged doors on showers;
* increase of spa pools to 680L;
* prohibition of generating systems and inverters in classified zones; and,
* exclusion zones for location of pools and spas from creating a hazardous zone for electricity distributor equipment.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2, SECTION 6 IN PAGE ORDER INCLUDE:

* Under *Baths, showers and other fixed water containers*, *Scope*, the final words 'with earth potential' are changed to 'with the general mass of earth'. The sentence before 'notes' is reworded and cross-referenced but not otherwise materially changed. (p317)
* Under '(c) Zone 1' for a shower, item (ii) is clarified for a fixed wall shower to allow the 1.2 dimension to be reduced where a barrier is installed, providing this is at least 1.8m or as high as the wall connection. Item (iii) has been clarified for a fixed ceiling shower with differing arrangement as well as Australian and NZ requirements. An exception is also added. The last two previous exceptions have been changed and these now apply to Australia and NZ respectively. A further item (vi) dealing with the height of the fixed plumbing connection that was previously in the note is added, with examples of barriers detailed in the remaining note. (p318)
* Under *Other fixed water containers* (b) the maximum volume of each water container is reduced to 40L from 45L, as it is understood this volume is the most used. Likewise, for (c) the volume is also reduced to 40L. There are no other changes. (p319)
* New heading *Electrical generation systems* is added to specifically exclude installation of generators, generating systems, inverters and batteries in any classified zone. A separate line to this effect is included in Table 6.1. (p322-323)
* New figures are slotted in as Figure 6.5 and Figure 6.6 to show a shower with a fixed ceiling plumbing connection (e.g. rain shower). Likewise Figure 6.8, showing a shower with a hinged door and 6.11 for a ceiling fixed shower with a barrier. Some existing figures have also been adjusted. (p327-328, p330, p333)
* Previous figures showing water containers have been renamed and their volume reduced to 40L per container. (p335-336)
* Maximum capacity under *Spa pools or tubs*, *General*, is increased from 500L to 680L. (p337)
* First paragraph under *Luminaires, appliances and other electrical equipment* now includes the specific exclusions and cross-referencing for classified zones. (p340)
* New heading *Electricity generating systems* has been added to prohibit installation of electricity generating systems, generator sets, power systems, inverters and batteries in any classified zone. This is included in an additional line in Tables 6.2 and 6.3. (p342, p351 and p344, p352)
* A new heading *Electricity distributor's electrical equipment* prohibits pools and spas in areas where this would mean distributor electrical equipment, pits and cabinets would then end up being in a classified zone. This has been included in an additional line in Table 6.2 and 6.3. This has arisen from situations where pools and the like have been installed almost on top of pre-existing distributor equipment. (p342, p352 and p344, p352)
* A new Table 6.3 (as referenced above) for 'selection and installation of electrical equipment for fountains and water features' is included. (p352)
* Under *Saunas* the second paragraph is split and a cross-reference added, but there is no change of intent. (p354) ■

-Peter Vandenheuvel

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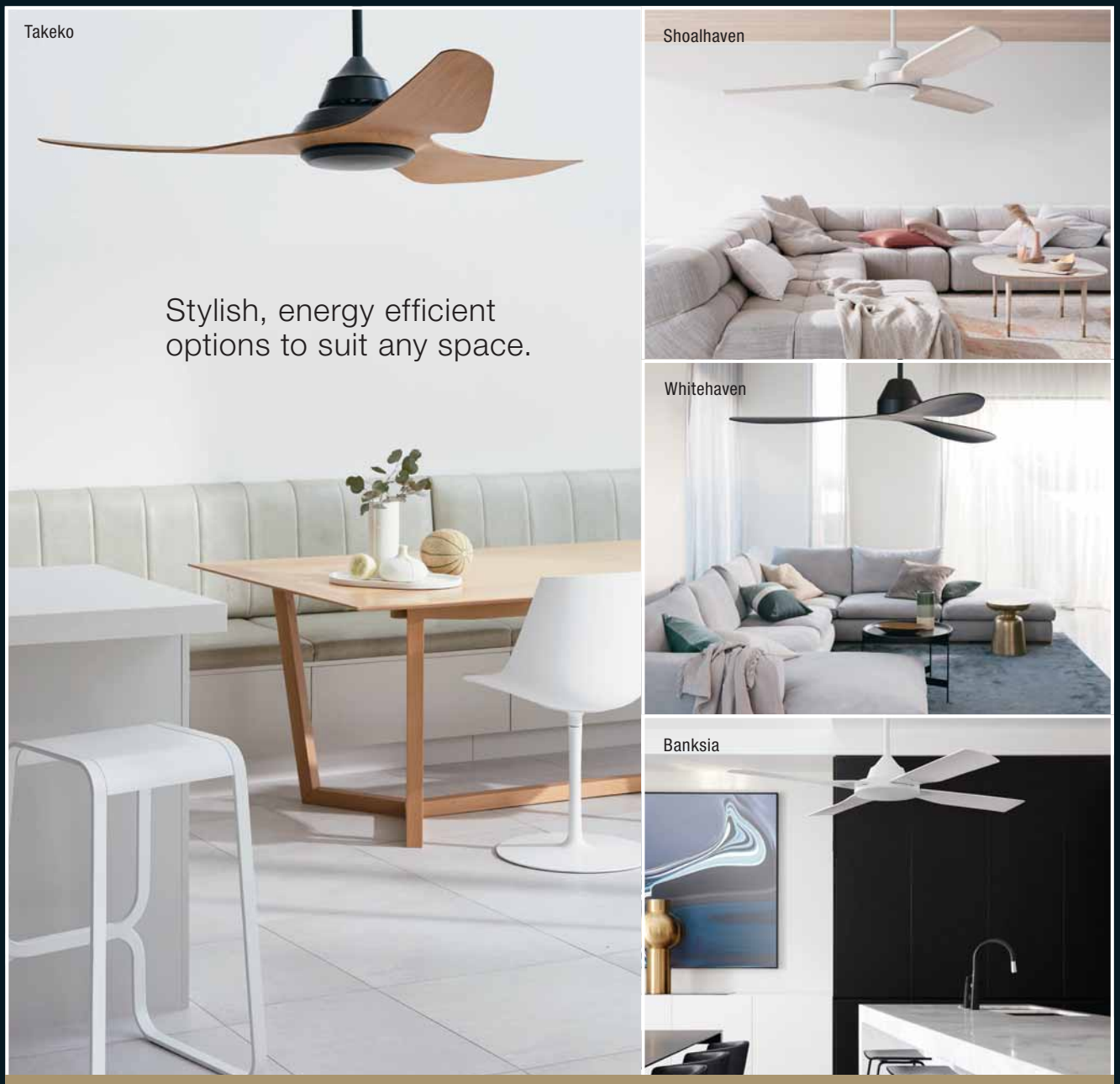

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A BIT SPECIAL

Some electrical installations have particular requirements when it comes to safety.

Electrical installations deemed *Special electrical installations* are covered in Section 7.

The categories include: safety services, generating systems, protection by electrical separation, extra-low voltage and high voltage, and explosive hazards.

It should be noted where this section does not specify a requirement, the relevant requirements of the other sections of AS/NZS 3000 apply (and these may also call for compliance with other Standards).

Emergency lifts, the only lifts now deemed as safety services, figure quite prominently in this section and in the changes.

This is one of the sections with a large number of changes, although this may not be reflected in the changes listed in the preface as summarised immediately below. For this reason, users would be well advised to come up to speed with this section.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* complete restructuring of safety services and their requirements;
* clarifications for the installation of electricity generating systems;
* addition of electric vehicle charging systems; and,
* revision of specific electrical installation requirements.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN SECTION 7, IN PAGE ORDER, INCLUDE:

* Under *Safety services* the heading *Scope* is changed to *Scope and general*, the existing heading *Scope* is included as a sub-heading and the first paragraph previously under *General* is now directly under *Scope*. (p363)
* Subheading *General* now heads up the rest of the clause. The various exceptions are listed 1 to 6 below the heading for situations that need not comply with this section. The exceptions include, but are not limited to, escalators, moving walkways, single-resident lifts, lifts not defined as emergency lifts, jacking pumps, fire alarms with battery back-up and smoke alarms in private residences. (p363)
* New notes are listed for cross-reference to AS/NZS 3009 for power supplies in hospitals. *Safety systems* in part replaces the previous edition's *Emergency systems*. This also includes *Emergency equipment* in the National Construction Code and NZ Building Code. Some information on 'fire-resistance levels' (FRL) is included. (p363-364)
* The safety services part of this section has had a complete make-over to make it more easily and logically searched, read, understood and followed. Because it has undergone such drastic change from the previous edition, users are urged to become acquainted with these requirements urgently. (p363-384)
* *Supply systems* notes the additional requirements for wiring safety services – these cannot be used for other purposes. Also, when safety services are required under emergency conditions it may be necessary to automatically disconnect (i.e. load-shed) non-essential equipment.
* New Figure 7.1 is included for wiring system classification of lift circuits (author's note: for 'emergency lifts', as these are the lifts for safety services). Details on 'wiring systems - for safety services – (mains, sub-mains, main switchboard and supplies to outbuildings)' WS classifications are detailed and required to comply with AS/NZS 3013. 'Alternative supply systems' are also included. (p364-367)
* *Main switchboard and switchgear* requires a safety service to be controlled by a main switch separate from other main switches. Safety services must be separated by metal barriers. Conductors for safety services must be separate from other safety services and from other services. Load-break switches for isolation or circuit breakers (discriminating with others in the supply circuit) must be used. Typical arrangement line diagrams have been included. (p367, p371)
* The clause *Main switches* has been redrafted. There is still no limit on the number of main switches, but each must be separate from other main switches for other parts of the installation. Each must be mechanically protected, identified as a main switch in a contrasting colour and marked 'in the event of a fire do not switch off'. (p371-373)
* *Fire pumps and fire control equipment* is substantially edited. These must also comply with AS/NZS 3013. It applies to booster pumps, automatic sprinkler system pumps, fire pump rooms, fire pump control equipment and pumps for fire hose reels. (p373-378)
* *Fire and smoke detection equipment and fire alarm systems* is substantially edited. It applies to fire and smoke detection equipment, fire

indicator panels, fire and smoke alarm systems and warning and intercom systems. (p377-378)

* *Air-handling systems* must comply with AS/NZS 3013. There is a cross-reference to Appendix H regarding the WS system. Segregation for cables is required. No switch is to be interposed between a main switch and downstream switchboard. (p378-379)
* *Evacuation equipment* must also comply with AS/NZS 3013. This must include sound systems and intercom systems to be compliant with AS 1670.4 (*Fire detection, warning, control and intercom systems - System design, installation and commissioning Emergency warning and intercom systems)*. Emergency evacuation and lighting requirements are provided for in the National Construction Code or NZ Building Code. (p379-380)
* *Emergency lifts* are safety services in Australia. Compliance with AS 1735 is not a requirement of AS/NZS 3000 but regulatory authorities may require compliance with that Standard or may have additional requirements. In NZ, lifts required for fire-fighting or other emergency purposes are safety services. Emergency lifts must also comply with AS/NZS 3013 (*Electrical installations - Classification of the fire and mechanical performance of wiring system elements*). In addition, no switch is to be interposed between a lift main switch and the downstream switchboard. (p380-382)
* *Emergency motor-room less lifts* are lifts that do not have a lift motor room. Where these are installed for evacuation, fire-brigade activities and emergency use they must comply with this requirement. (p382-384)
* Item (b) under *Electricity generation systems, General, Stand-alone system* is redrafted and now lists typical systems in (i) to (iii). Item (c) has been renamed *Inverter system*. Its intent has not changed. (p384)
* The new heading *Basic protection and fault protection* is added under *Control*, requiring provision to be made for all basic and fault protection (including MEN) connections to remain intact when supply from the output of the generator is available. (p386)
* A requirement is added directly under *Isolation, General* that an inverter or regenerative supply source shall not be connected downstream of the generating set changeover device. An exception is also included. (p385-386)
* The sentence immediately under *Over-current protection, Electricity generation system protection*, is expanded to require this to be in line with applicable Australian and NZ Standards for the particular generation system being installed and where the Standard does not specify that the further requirements detailed thereunder apply. The exception below this in the previous edition is now to apply only to a new (a), and is immediately below that item. The paragraph that was below the exception is now the new item (a). The sentence that was below the paragraph – was item (a) – is now (b) and is reworded with additional detail but its intent is not changed. (p387)
* There are changes under *Connection to electrical installation, Alternative supplies, General*. The previous (b) has now become (a) but the text is not changed. The previous (a) is now (b) and the previous text and note are now a single paragraph with no material change. The note that was under the previous (b) has been added as a further paragraph (not a note) under the new (b), so changing what it applies to. The note (c) remains. The exception is also changed to be in two parts. The first part '1' is now for Australia only, with the only change being that (i) to (iv) are now bullet points. The second part '2' is a new requirement for NZ only dealing with connections without an N-E link when the installation is operating from an alternative supply. (p389)
* There are minor changes under *Connection to electrical installation, Alternative supplies, Switching*, which is rewritten to include a previous note and the references are rehomed. There is no change of intent. (p390)
* Figures 7.3 to 7.6 have been renumbered and redrafted in colour, but no intentional change has been introduced. (p391-394)
* The previous 'notes' to (the 2007 edition) Figure 7.5 that were between *Grid-connected inverter systems* and *Stand-alone power systems* (previously p314) are not included. (p395)
* The new heading *Variable speed drive (VSD) EMI filters* requires (where these are used) that they must not reference the frame of the system, and optimally only one filter should be used on an isolated supply with multiple VSDs. It also notes that these filters when referenced to the frame may cause harmful capacitive coupled currents. (p399)
* Note 2 in Figure 7.8 dealing with separated (isolated) supplies is reworded to include that circuit breakers may operate in all live conductors or HRC fuses in all active conductors. (p401)
* Reference Standards under *Standards containing additional requirements* that are changed in this edition include those for, high-voltage installations, generating sets, inverters, low-voltage switch and control gear assemblies, stand-alone power systems, PV arrays, secondary battery systems, mobile medical facilities, floor and ceiling heating, explosive atmospheres and hazardous areas. Other text may also be changed, and users are urged to check. (p411-412)
* Reference standards under *Standards containing guidance* that are changed in this edition include those for emergency supplies in hospitals, lightning protection, UPS systems, semi-conductor power converters, rotating electrical machines, periodic verification and verification guidelines. Other text may also be changed, and users are urged to check. (p412-413)
* The new heading *Supplies for electric vehicles (NZ only)* has considerable detail and also references Appendices P and C. NZ users are urged to become familiar with these requirements. (p413-415) ■

-Peter Vandenheuvel

VERILY, IT'S CRUCIAL

Compliance must be built in from the start and monitored all the way through. Verification cannot be retrofitted. This is perhaps the single most important section of the new Standard.

Verification, the title of Section 8, certainly isn't a word that fits well in the "I think she'll be right" category. It is "the process of establishing the truth, accuracy or validity".

It is all about that question often posed by consultants, builders other customers and inspectors which have been known to send shivers down the spine of less-prepared or under-researched electricians and contractors when asked: "Do you comply?"

This highly important section is all about two issues:

* ensuring that installations meet the requirements set out in AS/NZS 3000 and all related Standards; and,
* confirming that all measuring, testing, inspecting and setting to work add up to the 'all clear'.

As all who are successful in the industry will attest, the process begins well before the installation is even started and doesn't finish until the last device or item of equipment is functioning successfully.

A system that prompts each activity and ensures the recording of all testing, inspections and results in real time should not be discounted. 'Start right, stay right' is the only way.

CHANGES LISTED IN THE 'PREFACE' INCLUDE:

* rearrangement of headings to differentiate between requirement types, including headings such as 'general – application – visual inspections – test requirements – accepted values';
* relocation from this section of ELV installation testing to section 7; and,
* clarification of EFLI and ELV testing and recording at the main switchboard of the date of initial energising of the installation.

SUBSTANTIAL CHANGES FROM THE 2007 EDITION IN PART 2, SECTION 8, IN PAGE ORDER INCLUDE:

* Inspection requirements under 'general requirements' (a) are now (slightly) better defined and changed from 'as far as practicable' to 'in accordance with 8.1.3 and 8.2 far as practicable'.
* Notes 1 and 2 are added to advise that additional inspection and testing may be required for specific installations and to draw attention to NZECP for wiring and fittings near conductive installations.
* The 2007 edition exception for possible later testing has not been included (but there is still an exception for RCD testing when the installation is not energised).
* The remaining previous text dealing with 'periodic inspection and testing' has been placed under its own *Periodic inspection and testing* sub-heading and the previous note under that (dealing with additional inspections for certain situations) is not included.
* These alterations have not materially changed the requirements. (Reference on the omission can be made in the 2007 edition on p330.) (p416)
* Two additional items are under *Visual inspection*: (e) 'electrical equipment' and (vii) dealing with protection against influences including moisture and (viii) suitability for intended voltage, current and frequency.
* Two notes have been added under (e): Note 1 dealing with the suitability of RCDs, residual AC current or pulsating DC current, and Note 2 referring to guidance in Appendix Q for DC circuits. (p418-419).
* Notes under *Testing*, *General*, in the 2007 edition are not included. Reference on the omission can be made in the 2007 edition on p333. (p419)
* The new sub-heading *Test methods* is created under *Testing*, *General*. It references AS/NZS 3017 *Electrical installations - Verification guidelines* as setting out common test methods and cautioning that testing must be carried out without putting at risk the operator, others in the vicinity and the test equipment. A note also advises that other test methods are not precluded. The previous reference to AS/NZS 3017 is deleted. (p419)
* The sub-heading *Low voltage* is slotted in under *Mandatory tests*, and the opening statement is reworded but not changed in intent. The note regarding repeating a failed test to confirm rectification success is placed under its own heading *Test failures* after the *Low voltage* and *Extra-low voltage* headings, so applying to both. An exception applying to (a) to (f) is added under (f) and Note 3 changed from 'HV additional testing possibly being required' to 'additional tests for isolated supplies'. (p420)
* A paragraph is added under *Continuity of the earthing system*, *General*, with a requirement for testing a PEN sub-main to confirm the correct PEN earth connection at both ends. (p421)

PRYSMIAN

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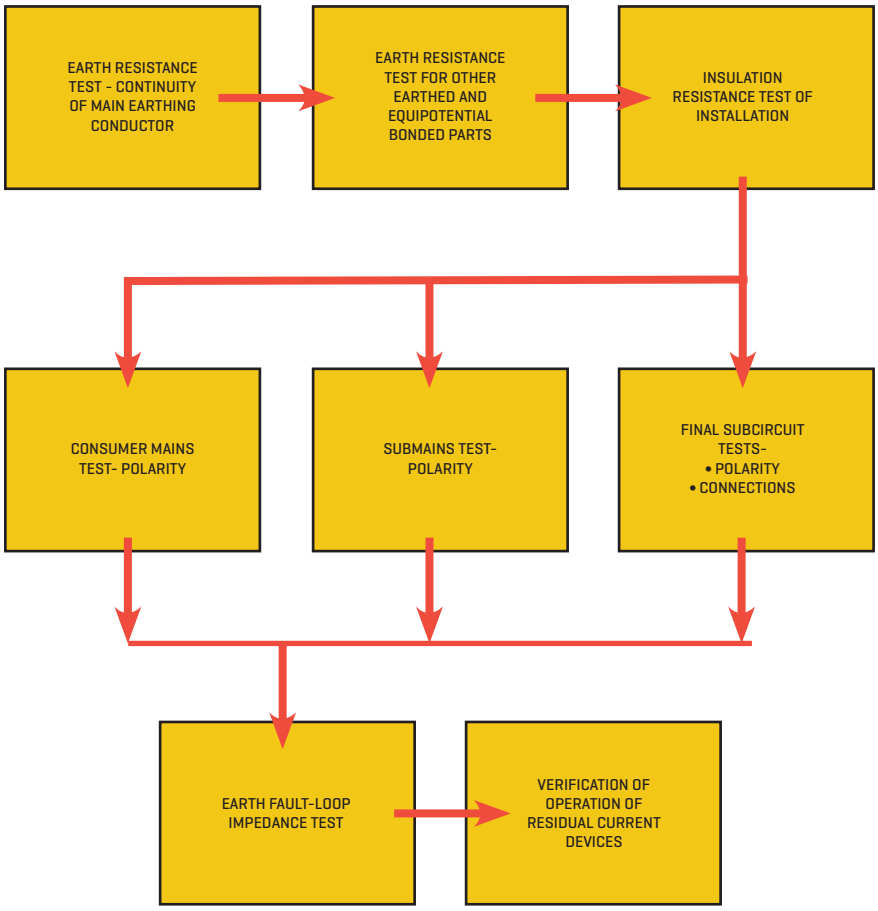

Figure 8.1: Testing sequence.

* The new sub-heading *Method* is slotted in under *Insulation resistance, General*, but the original text (now split under the two headings) is not changed. However, in Note 1 the (i) and (ii) become bullet points and in Note 2 the paragraph has been rewritten to absorb the information in (i) and (ii) into the main text. (p422)
* The arrangement and text under *Results* is substantially changed. Three exceptions and four notes are included under (a) and (b) in place of the previous text. The new exceptions and notes clarify the typical resistance values that may be obtained and may be acceptable when adverse results are found. There is now more information, but with little or no material change. (p423)
* Under the heading *Polarity, Results*, (b) is reworded to clarify that switches or protective devices must not operate in the earthing conductor or a combined PEN conductor. A new (c) is slotted in to clarify that switches or protective devices must not independently operate in the neutral conductor. There is no change to (a) – or to (d) or (e), which were previously (c) and (d). (p424)
* There are substantial changes to *Verification of earth fault-loop impedance (EFLI)*. The previous *Socket-outlet circuits not protected by an RCD* heading is changed to *Low-voltage socket-outlet circuits* so it now covers all socket-outlets rather than just the unprotected ones. All the text is changed to reflect the new wider focus.
* There are also notes. Notes 1 and 2 explain the need to test and offer additional information, Notes 3-5 advise where the EFLI tests are not (or may not be) required and Note 6 stipulating that the trip-time in circuits not usually requiring testing must still meet the maximum trip times in situations where the voltage drop may exceed requirements. (p425)
* There are further changes under *Verification of earth fault-loop impedance (EFLI)*. The sub-heading *Methods* is slotted in before *Results*, with the new sub-headings *Supply available* and *Supply not available* moved here from paragraphs previously under *Results, Methods of measurements*.
* There are also corresponding changes under *Results* to reflect the change in order of the headings. Users are again urged to become acquainted with the change in arrangement to ensure compliance. (p425-426)
* Notes 1-5 are added under table 8.1 *Maximum values of earth-fault loop impedance*. Note 3 deals with MCB selection; the others are cross-references to additional information. (p427)
* Likewise, Notes 1-5 are added to table 8.2 *Maximum values of resistance of final sub-circuits*. Some replace the previous Note 1 (a) and (b) and Note 2.
* Notes 1 and 2 explain the basis of calculation, Notes 3 and 4 reference table B.1 and Note 5 requires the shortest route length for both EFL and V Drop. (p428)
* The arrangement of text under *Operation of RCDs* is changed, with more emphasis on how testing is to be conducted and verified. The previous separate requirements for Australia and NZ are not included. The exception, for testing in Australia only not being required if no supply is available, is included now in a more direct way. Three further notes are added with guidance on suitability, test operation and a way of testing. Users (especially in NZ) are again urged to become acquainted with the change in arrangement to ensure compliance. (p428-429)
* The date of initial certification must now be available on site, as under 'verification records'. (p429) ■

-Peter Vandenheuvel

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TESTING TIMES

According to the Wiring Rules, verification is a legal requirement and should be integral to a contractor's work. **Vincent Law** from Hager Electro explains.

Verification is a term we know the meaning of but don't do enough about.

We have grown accustomed to things changing rapidly and have developed a mindset of faster, stronger and better.

The key thing we look for is 'better'. It leads us to believe that something is of higher quality or meets or exceeds our requirements and/or expectations.

This may be true on a product level but does it equate to the quality or correctness of your work?

In the world of Standards, verification is defined as: "confirmation, through the provision of objective evidence, that specified requirements have been fulfilled"; where objective evidence can be obtained by observation, measurement, test or other means.

With the recent publication of AS/NZS 3000:2018, it is a good time to remind ourselves about the objective evidence needed in relation to an electrical installation.

Clear requirements are set out in Section 8 of the Wiring Rules. In summary, the Standard provides a checklist for observations and a mandatory series of tests. To assist with this process, the regulator for each state requires contractors to complete a legal document usually in the form of a certificate of compliance.

Referring to the definition above – other than ticking a box to say something was done, what objective evidence is there to show that it actually was done? Are your readings correct? What are the implications?

In the commercial world there is a common saying: "If it wasn't written, it wasn't done." Government websites have clear guidelines and recommendations for business-related documents. Legally, records are to be kept for seven years.

Although inspectors check an installation before authorising the supply of power, is the responsibility of verification and liability on their shoulders? The answer is no.

Records in all states have shown that people have died due to installation errors – where power has been supplied – and it is always the electrician who must answer the questions.

If the relevant evidence of installation records can be provided on request, this mitigates many of the installation issues in the industry today. Section 8.4 of the Standard calls for the necessity of proper record keeping: "In order to enable re-verification of an installation, it is necessary to know the details of the original verification."

Using an exaggerated example, when you go to the doctor for a test, you trust the results and hope they give you good news. How would you feel if the doctor told you the results were good but you later found out that the readings were wrong?

In the field of measurement, your results are only as good as the accuracy of your tools and methods. Which brings a question to light: when were your tools of trade last calibrated? Although it is not stated in AS/NZS 3000, it is stipulated in AS/NZS 3017 *Electrical installations - Verification guidelines*, which the wiring rules references in the event of verification.

The unfortunate attitude of 'she'll be right' is often the main reason for neglect in this area. Contractors are generally unaware of the possible legal repercussions when something goes wrong because of an incorrect reading.

Calibration is an adjustment of a meter/device to a known reference. Checking against another meter is a good start, but how do you know which reading is correct? And both devices might have been inaccurate to start with.

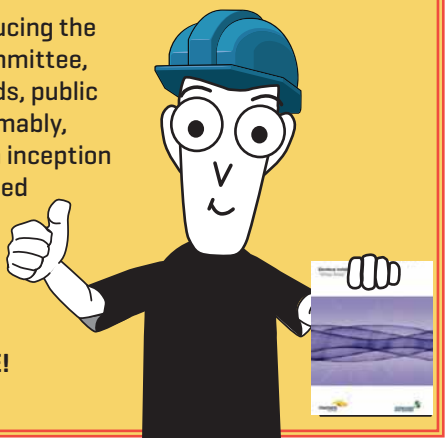
Due to the environment in which electrical contractors work, the equipment is subjected to harsher treatment than it would in a test lab.

Modern instruments are more robust, and are much more advanced and accurate than ever before, yet many things may affect measurement quality. These include exposure to magnetic fields, temperature, humidity, shock and vibration, frequency of use, etc.

Being a member of the EL-001 Committee, which is responsible for producing the Wiring Rules, is a largely-thankless task. For the 35 members of the committee, it involves painstakingly combing through associated reference standards, public comments and hours of debate and discussion (which at times, presumably, becomes quite heated). The process is lengthy, spanning many years from inception to publication, and the members of the Committee aren't often compensated for their time (in addition to their usual employment, that is).

Well, at *Electrical Connection*, we would like to thank the members of EL-001 for all of the hard work they have done to ensure the creation of a document that embraces modern technologies and best practices.

IT'S NOT AN EASY FEAT, SO CONGRATULATIONS ON A JOB WELL DONE!



If unchecked, an instrument may be 'off' without the user realising until something goes wrong.

In many fields of work, commissioning and installation verification is unfortunately often viewed and treated as a tick of the box. With the effort taken to design and install the equipment, why is installation testing seen as an inconvenience?

One of the biggest changes in the latest revision of AS/NZS 3000 is the requirement for a residual current device (RCD) on every sub-circuit.

With the extra equipment required for an installation, it is crucial to ensure that each aspect has been tested and verified. The Standard mandates that checks on RCDs be performed as part of the verification process.

Reputable product manufacturers jump through hoops and walk through fire to ensure their products are safe, and compliant to national and international Standards as well as local rules and regulations.

Quite often, the design and testing process begins years in advance so that a product is available as soon as rule changes are implemented. It is a rigorous and robust process, but at times manufacturers are let down by customers. There are contractors who fail to check their own work and misuse a product, which may lead to the unnecessary banning of perfectly functional products.

The role of the regulator in the electrical installation environment is to enforce the rules and issue penalties for non-compliances. Examples are seen in regular bulletins where offences are published with the corresponding penalty. Some lists clearly show the lack of regard for testing on the contractor side.

On a wider note, this is not just a matter of monetary penalties, it is a blatant lack of duty of care for co-workers and end users. It harms the people involved – and gives the industry a bad name.

From the issues highlighted in this article, the key point is that verification should not be treated as an afterthought. Verification is a legal requirement and it should be integral to the work you do.

Your actions (or lack of) have a greater effect than you may think. ■

***ELECTRICAL CONNECTION* WOULD LIKE TO MAKE SPECIAL MENTION OF THE FOLLOWING INDUSTRY LEADERS FOR THEIR CONTRIBUTION TO THIS WIRING RULES SUPPLEMENT. WITHOUT THEM, IT WOULDN'T EXIST.**

Principal of Vandenheuvel Consulting, Peter Vandenheuvel is the past managing director of Nilsen and former president of NECA. He is a member of EL-001.

Since 1997, Gary Busbridge has been involved with the development of various Australian Standards in the electrical sector. He is standardisation manager at Clipsal and is the chairman of EL-001.

Legrand technical director Dennis Galvin is an Australian Industries Group representative of the EL-001 committee responsible for changes to the Standards covering installation requirements.

Lindsay Lucas is engineering manager for Eaton's ANZ Power Distribution business and has a long tenure with Eaton, Cutler-Hammer and Email-Westinghouse. He is a member of Standards Australia committees EL-001 Wiring Rules, EL-004 Electrical Accessories, and EL-006 Industrial Switchgear and Controlgear.

Vincent Law is quality and compliance manager at Hager Electro. Previously, he was the verification and validation manager for a supplier in the HVAC industry. He has a Masters is Engineering Science.

ARE YOU WIRED IN PREPARATION FOR THE UPDATED STANDARDS?

With the much anticipated release of the new wiring rules AS/NZS 3000 in mid 2018, it is critical that installations are protected and comply with the updated standards.

With the much anticipated release of the new wiring rules AS/NZS 3000 in mid 2018, it is critical that installations are protected and comply with the updated standards.

In residential installations, all circuits will now be required to be protected by 30mA Residual Current Devices (RCD), this now includes hard wired devices such as hot water systems, ovens and air conditioning systems.

NHP have you covered with a complete range of Residual Current Circuit Breakers (RCBO) and RCD devices to suit these needs with the NHP MOD6 range offering:

- 6kA fault level
- 6A to 40A current ratings RCBOs
- 40A to 63A current ratings RCCBs
- 10mA & 30mA sensitives
- 1P, 2P and 3P&N
- Switched neutral and un-switched neutral options.

Not only have requirements for residential installations changed but there are also changes for non-residential installations. Formerly, socket outlets and lighting circuits up to 20A required RCD protection, however this has now increased up to and including 32A. All fixed wiring equipment up to and including 32A should now have a 30mA RCD fitted.

To ensure these requirements are met, NHP have complete range of RCBO and RCD devices with the NHP DIN-T offering:

- 6kA and 10kA fault levels
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- 40A to 125A current ratings RCCBs
- 10mA, 30mA, 100mA & 300mA sensitives
- 1P, 2P, 3P and 3P&N
- Switched neutral and un-switched neutral options.

For medical installations or medical equipment in the home, NHP have RCDs meeting the required Australian Standard AS/NZS 3003. These solutions are with 10mA devices with switched neutral in 1P width devices, saving half the space of a typical 10mA RCD.

Higher risk applications such as outdoor equipment, kindergartens, or bathrooms, NHP have a 10mA range of devices to offer that extra level of protection.

When choosing to have upstream RCD protection it is important that special selective RCDs are used. Selective RCDs prevent the upstream RCD accidentally operating which would normally cut power to many circuits instead of the intended individual circuit. NHP also offer these selective type RCDs, Type S.

These changes are improving safety at home and at work so why wait for them to be enforced and make the first step to a safer environment now with NHP.

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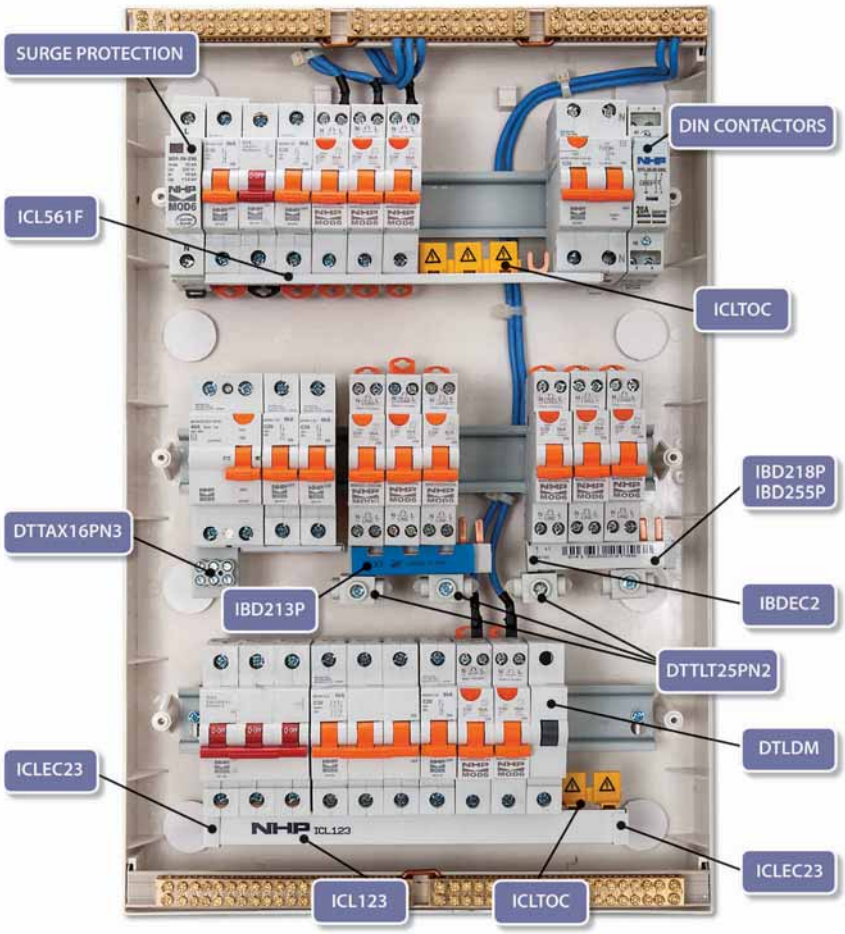
To complement this comprehensive circuit protection suite, NHP offer an extensive range of DIN wiring accessories, making installation quick and simple.



Wiring accessories range include:

- Busbar comb
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- DIN contactors
- DINT dummy MCB
- MOD6 surge protection
- Terminal pin
- Terminal way neutral link

The MOD6 range are purpose designed for domestic and commercial installations, providing the perfect complete switchboard solution.

NHP 98991_06/18

TIME FOR CHANGE IN QUEENSLAND

Amendments to Queensland electrical contractor licences mean different training requirements for QTPs and QBPs. **Simeon Barut** outlines the significance of these changes.

From 1 July 2018, new legislation came into effect for Queensland electrical contractors and their licences, including additional training requirements for qualified technical persons (QTP) and qualified business persons (QBP).

The new requirements apply to all new licence applications or when a licence holder wants to add another QTP or QBP to an existing licence.

QTPs and QBPs on existing licences will not be affected by the changes, unless there has been disciplinary action taken against them by the Electrical Licensing Committee or they want to be added to another licence.

Electrical Safety Office manager of electrical licensing Terry Moore says that the major changes that involve both QTPs and QBPs revolve around completing units of competencies within a certain time frame from the date of application.

"For both types of nominees, the major changes are additional training requirements, most of which come from the national electrotechnology qualification package UEE42111 – Certificate IV in Electrotechnology – Electrical Contracting," says Terry.

"The requirement is to complete units of competency within three years from the date of application. For QTPs, they must complete UEENEEG197A *Apply currency of safe working practices and compliance verification of electrical installation*, UEENEEG122A *Conduct compliance inspection of single phase LV electrical installations* and UEENEEG123A *Conduct compliance inspection of LV electrical installations with demand exceeding 100A per phase*.

"The changes apply to QBPs a little bit differently as they can continue to demonstrate eligibility by providing evidence of having operated a business for a period of, or periods totalling, five years. If they're not able to provide this evidence, then they need to complete UEENEEE101A *Apply Occupational Health and Safety regulations, codes and practices in the workplace*, UEENEEG175A *Develop compliance policies and plans to conduct an electrical contracting business* and one of BSBSMB401/BSBSMB401A *Establish legal and risk management requirements of small business* or hold an Australian business qualification at diploma level or higher regardless of when the qualification was obtained."

As for 'why' all these changes happened, the Office of Industrial Relations (OIR) commissioned KPMG to carry out an independent review of the then-current requirements for Queensland electrical licences following the coronial inquiry into the death of Jason Jon Garrels in Central Queensland.

Jason, who was just nine days into the job as a trade's assistant, was killed when his boss failed to turn off the power to the sub-board he was helping to install.

The review included 22 recommendations, including more thorough eligibility requirements for QTPs and QBPs on Queensland electrical contractor licences. As a result, a technical reference group made up of industry representatives, the Commissioner for Electrical Safety and members of the Electrical Licensing Committee was established to review the current requirements.

"The QTP is responsible for performance and supervision of electrical work carried out under the electrical contractor licence and the QBP is responsible for ensuring that systems of work are in place to ensure the work is carried out safely," says Terry.

"Increasing the competency and knowledge of those responsible for ensuring the performance of safe electrical installation work can only lead to better outcomes for the industry itself and the community in general, which relies on the expertise of licensed electrical workers and contractors."

The changes do not affect electrical contractors who obtained their licence before 1 July 2018 and continue to renew that licence without wanting to change their current QTP or QBP.

However, from 1 July 2018, any new electrical contractor licence applications have to meet the new eligibility requirements for QTPs and QBPs. This includes where a person looks to re-apply under a different legal structure or when a licence has expired for more than 12 months.

Interstate applicants are not affected by the changes if the interstate applicant applies under mutual recognition of an electrical contractor licence held as a sole trader.

Restricted electrical contractor licences are also not affected by the changes. ■

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CHARGING AHEAD

Australia's take-up of electric cars is slower than elsewhere, but despite a few issues this way of travel is sure to gain traction. **Phil Kreveld** reports.

Electric motor cars in their modern form have been around for more than 20 years, mainly as hybrids.

In the past five years or so, electric vehicles (EVs) have come onto the Australian market but sales are low (1,126 sold in 2017), and the total fleet is about 4,000.

Australia's take-up of EVs is up to a decade behind other advanced markets, according to Andrew Fulbrook of HIS Markit marketing consultants in the United Kingdom.

In Norway, 30% of new cars are EVs – due to government financial support and cheap electricity. About 80% of the nation's power comes from hydro schemes.

There is no government support in Australia, or cheap electricity.

Yet emissions by the Australian transport sector are projected to be a worrying 100 million tonnes of CO_2 equivalent by 2030. Replacing petrol and diesel vehicles with EVs would contribute substantially to a reduction in CO_2 emissions.

To meet our CO_2 reduction target by 2030 under the Paris agreement, a 55% reduction in transport emissions from current levels is required (if no further upward adjustments in renewable energy generation targets are made).

AS THINGS STAND

EVs and plug-in hybrids (PHEVs) are expected to constitute a growing market. Consequently, new buildings in business districts are being equipped with networks of charger stations.

The main technical issues related to such vehicles are:

- the various charger plug and charger methods; and,
- the different electrical systems employed.

Some of them use fast charging by external direct current (DC), others use alternating current (AC).

Another important consideration for the future is the power demand on distribution networks.

Fast charging an 85kW-h battery in four hours implies an average power draw (and higher initial peak) of 21.25kW. Multiply this by the number of vehicles charging at one time and the effect on distribution systems becomes evident.

VEHICLE DRIVE-TRAINS

Hybrid drive-trains are generally more complicated than those of EVs.

Figure 1 shows the basic drive train systems schematically.

Hybrid drive-trains vary in the sharing of motive power between an internal combustion engine (ICE) and an electric motor. EVs differ in the number of motors employed.

Hybrids use the electric motor to accelerate from standstill, and the ICE charges the battery once the vehicle is under way.

MOTORS, GEARING AND TRANSMISSION

Synchronous and induction motors are used, offering a great advantage over ICEs because of high starting torque.

Synchronous motors have rotors with permanent magnet excitation (PMSM), as this is less bulky and avoids the use of slip-rings, which can cause mechanical problems.

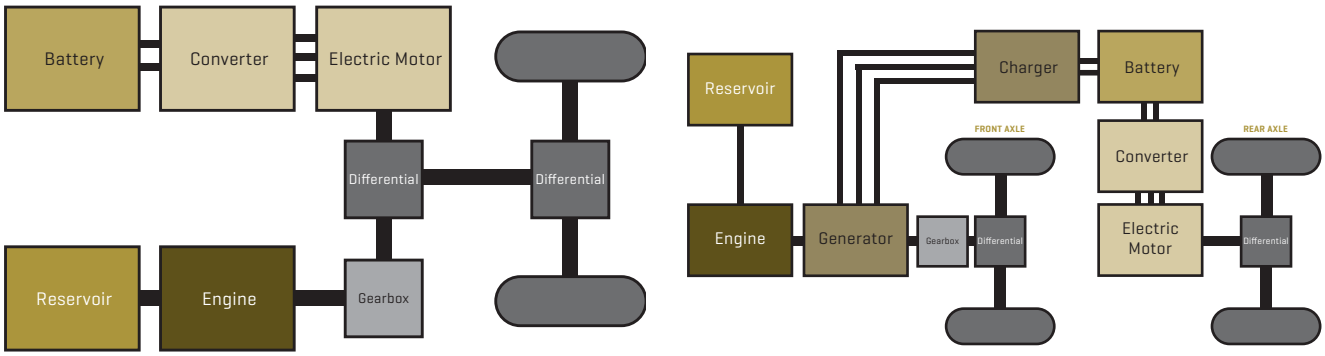

Figure 1: Parallel hybrid drivetrain (left) and parallel hybrid with all wheel drive (right).

Induction motors have squirrel cage rotors. Motors are powered by pulse width modulated (PWM) inverters thus providing speed control. Torque is controlled by inverter voltage regulation.

EVs don't have a gearbox, as they are not plagued by the torque and engine speed characteristics of an ICE.

Motors have a fixed gear ratio torque conversion stage driving a differential to provide power to the driving wheels.

Open and limited-slip differentials are used. Some vehicles, such as the Tesla S, have an open differential with an 'electronic watchdog' that detects wheelspin and compensates by braking the wheel.

EVs with individual wheel motors don't even need a differential.

DRIVES AND DYNAMIC BRAKING

Three-phase inverters drive the motors, as shown by the basic circuit in Figure 2.

The switching elements are usually insulated gate bi-polar transistors (IGBT) bypassed by freewheel diodes assisting switch-off of the IGBT.

The freewheel diodes also allow batteries to be charged via the inverter DC link when the vehicle is coasting or braking dynamically.

For dynamic braking in an induction motor the stator frequency has to be at a value less than the equivalent frequency of the rotor. This is readily achieved by the inverter.

Dynamic braking for PMSM involves field-oriented control. In outline, this requires sensing of the magnetic field vector provided by the stator with reference to the rotor.

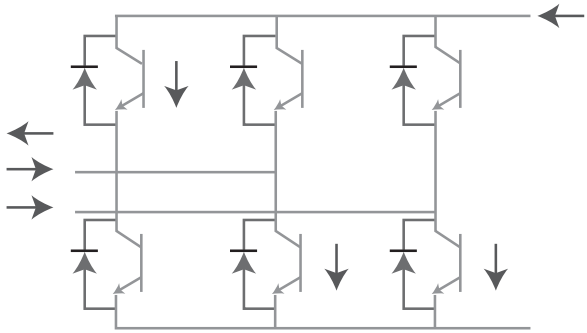

Figure 2: Bidirectional converter

The vector leads the rotor during motoring and lags behind the rotor during generation (ie: dynamic braking).

During braking, therefore, the inverter switching is adjusted to provide the lagging angle of the stator excitation with respect to the rotor.

In hybrids, dynamic breaking is crucial because of limited battery capacity – about a quarter of that in EVs.

LITHIUM BATTERIES

At the moment, lithium batteries are dominating the market.

Batteries are among the heavy components in an EV. The 85kW-h battery bank in a Tesla S weighs of 540kg.

In terms of energy density, petrol rates 45 megajoules per kilogram (MJ/kg) and the battery offers 0.567 MJ/kg (1MJ equals 0.277kW-h).

Lithium ion batteries have a very high energy density of about 200W-h per kilogram – as against lead-acid batteries at 40W-h per kilogram – and a high discharge to charge efficiency of 80-90%.

They will retain their storage capacity for 500 charge/discharge cycles based on 80% depth of discharge (DOD), although higher DODs severely limit their life.

Large-capacity batteries must have a reasonable range, as a typical EV uses 150W-h per kilometre. Rather than fully charging the batteries, some margin should be preserved for regenerative braking.

BATTERY MANAGEMENT

The main aim in charging lithium batteries is to keep the temperature under control in order to minimise lithium plating of the anode.

In this regard much depends on the design. A thin, highly porous anode works best for very fast charging, as high as replenishing the full capacity in an hour. However, such a high charge rate is not used for electric vehicles.

A new battery technology, Enevate's HD-Energy battery, is claimed to be inherently resistant to lithium plating during fast charging, and also during charging in low temperatures. It is not yet available in standard production vehicles.

High temperature increases the reaction rate with higher power output. However, it also increases heat dissipation and generates even higher temperatures.

Similarly, temperatures below 10°C impede the chemical process in cells. Unless heat is dissipated to keep the temperature below 60°C, thermal runaway can occur during charging.

There are generally two groups of liquids that transfer heat for thermal management:

- dielectric liquid, such as mineral oil, which can contact the battery cells directly; and
- conducting liquid (indirect-contact liquid), such as an ethylene glycol and water mixture, which can only contact the battery cells indirectly.

The front of a vehicle can capture air to cool the heat exchange liquid.

Cold-weather driving, as experienced in the Northern Hemisphere, is not much of a challenge in Australia.

Heat generated by the motor may be used for warming the battery. However, it might take several minutes before the battery is warm enough to provide full acceleration. Cold batteries charge more slowly, thus constraining regenerative braking.

Battery-supplied heating for passengers will limit the vehicle's range. This is not a problem for hybrids, as engine heat engine is available.

When it comes to charge management, undercharged lithium batteries lose capacity permanently, necessitating special precautions on recharge circuits.

Lithium ion batteries cannot absorb overcharge. When they are fully charged, the charge current must be cut off.

A continuous trickle charge would cause metallic lithium plating and compromise safety. Over time, the open-circuit voltage will settle to between 3.7V and 3.9V per cell.

Charge management is a complicated technology because battery voltage must be maintained within tight limits.

In the Tesla S there are about 7,000 batteries connected in paralleled strings. In order to keep cell voltages within limits, charge equalisation must take place.

There are different ways of doing this:

- resistor strings across the cells (but this wastes battery energy); and,
- capacitor and inductor charge transfer.

The switched capacitor principle is illustrated in Figure 3a. The flying capacitor, which is far more economical. is shown in Figure 3b.

The scheme in Figure 3a requires n-1 capacitors and 2n switches for a string with n batteries.

In Figure 3b only one capacitor is used, and n+5 switches (the switches are not mechanical; they are transistors).

The method of switched reactors transfers energy from the cells with higher voltage to cells with lower voltage. This method works bi-directionally, usually comparing two neighbouring cells.

Figure 3c shows one circuit of a switched reactor equalising two batteries. The transistor next to the block or cell with a higher charge is controlled with a PWM switch.

When switched on (phase 1), it draws current from this block through a reactor, which stores magnetic energy (1/2 Li2) where L is the inductance in henrys, and i the current in amps.

When switched off (phase 2), the neighbouring block is charged with this small amount of stored energy.

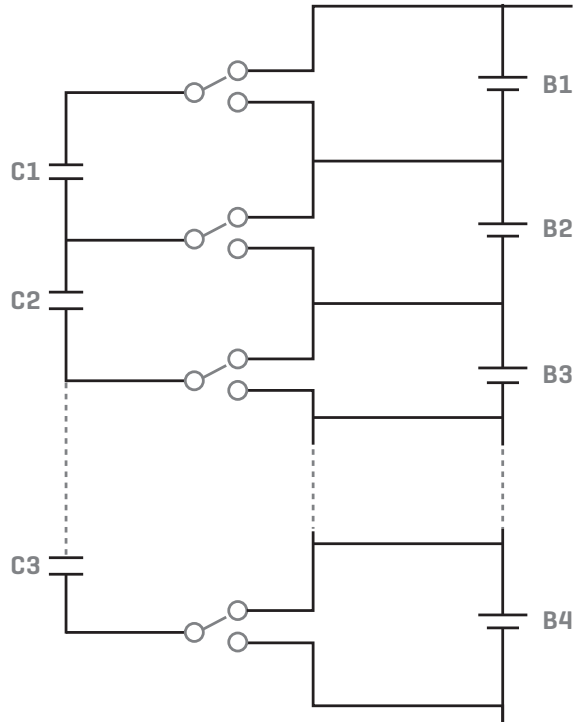

Figure 3a: Capacitive balancing

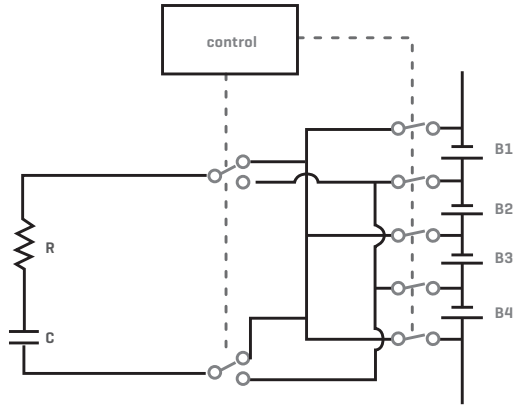

Figure 3b: Capacitive balancing

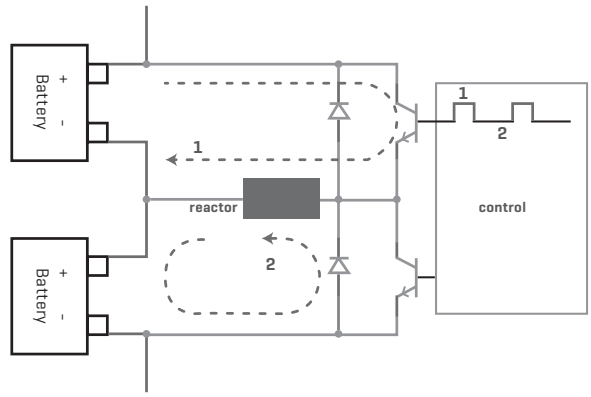

Figure 3c: Inductive balancing

Specifications for charger plugs are a source of some confusion. Fast DC charging uses a specification developed in Japan but used throughout the world (ChadeMo). The European standard, developed by the IEC is IEC6296 (J1772 is the USA equivalent), Tesla has its own fast charge specification , and then there is CCS (combined charging system).

Figure 3c shows an inductive string controller controlled by a PWM switch.

CHARGING SYSTEMS

There are two basic charging systems: AC output and DC output, the latter providing a fast charge.

EVs have their own internal charger circuit providing AC to DC conversion. The AC section for many EVs can be bypassed to allow direct DC charging.

Because of power restrictions for low AC voltage (220-240V), AC charging is slow and suited to overnight charging. DC charging requires a voltage in excess of the vehicle's battery bank, typically more than 400V. At present there is no single Standard for fast chargers, making life complicated.

There are four widely used types of EV fast charger: SAE Combo, CHAdeMO, Tesla Supercharger and China GB/T.

Generally, an EV model is designed to accept one type only. In some cases, adapters can be used to take

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advantage of another type of fast charger. However, each has its own communication protocol, in addition to the physical design of the plug.

CHAdeMO is the trade name of a Japanese initiative for a fast charging method delivering up to 70kW of high-voltage (up to 500V DC) current via a special electrical connector. It has been proposed as a global industry Standard and is specified by the Japan Electric Vehicle Standard.

The connector includes two large pins for DC power, plus other pins to carry CAN Bus (controller area network) connections between the car and charging stations.

CHAdeMO was rapidly adopted in Japan, with about 5,500 stations deployed in 2017.

The SAE Combined Charging Solution (SAE Combo, or CCS) involves a J1772 plug with two additional DC fast-charging ports. The upper part is the J1772 plug used in the United States and the lower part has two DC power pins.

CCS supports slow and fast charging with a single port and uses power line communication (PLC), which is part of the smart grid protocols supported by regulations in Europe. CCS is used by Audi, BMW, Daimler, Ford, General Motors, Porsche and Volkswagen.

The Tesla DC Supercharging network provides the fastest broadly available charging: 120kW in an hour offering a range of up to 600km.

China GB/T was developed by ABB to be compatible with a Chinese fast-charging method. It uses a connector of same physical shape as widely used in Europe, with CAN control instead of PLC.

Fast chargers are expensive and therefore not suitable for private use. There are fast AC chargers but they require three-phase power, which the typical home doesn't have.

Manufacturers of EVs generally limit the power of on-board chargers to keep the cost down. One idea is to use the vehicle's traction electronics for charging batteries.

EVS AND THE GRID

The charging current for EV battery chargers can pose harmonics problems.

A bridge rectifier without any filtering draws an extremely peaky current (Figure 4), which is usually not a problem for low-power chargers.

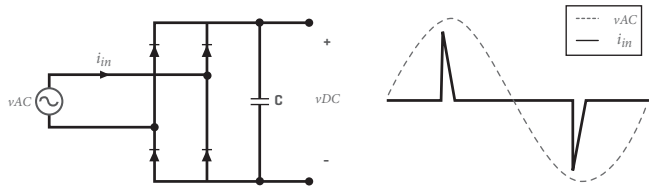

Figure 4: Harmonic distortion

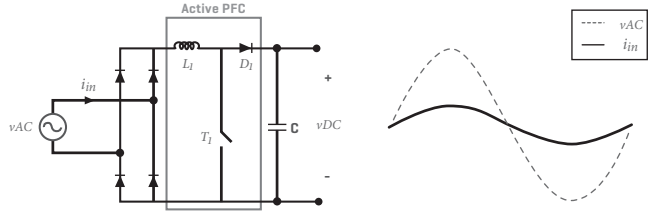

Figure 5: PFC

However, for fast chargers it is dependant on the amperage fraction of the short-circuit capacity at the point of common coupling.

The circuit in Figure 5 shows the principle of power factor correction (PFC). Note: the power factor is a combination of displacement and harmonic distortion (caused by the peaky current draw).

The switch T1 is either a metal-oxide semiconductor field-effect transistor or IGBT depending on power requirements. The active PFC circuit is basically a boost converter that is controlled to track the voltage.

This ideally results in a sinusoidal current and unity power factor. In other words, the active PFC circuit ideally makes the load look purely resistive.

The schematic representation for a typical DC charger is shown in Figure 6. Noteworthy is the galvanic isolation provided by the transformer, which also raises the voltage for the DC charging section.

The full bridge inverter on the primary provides a voltage with a frequency of 2kHz or more.

Microprocessors and a communication link with the EV are required so that the correct charging profile for the battery is observed.

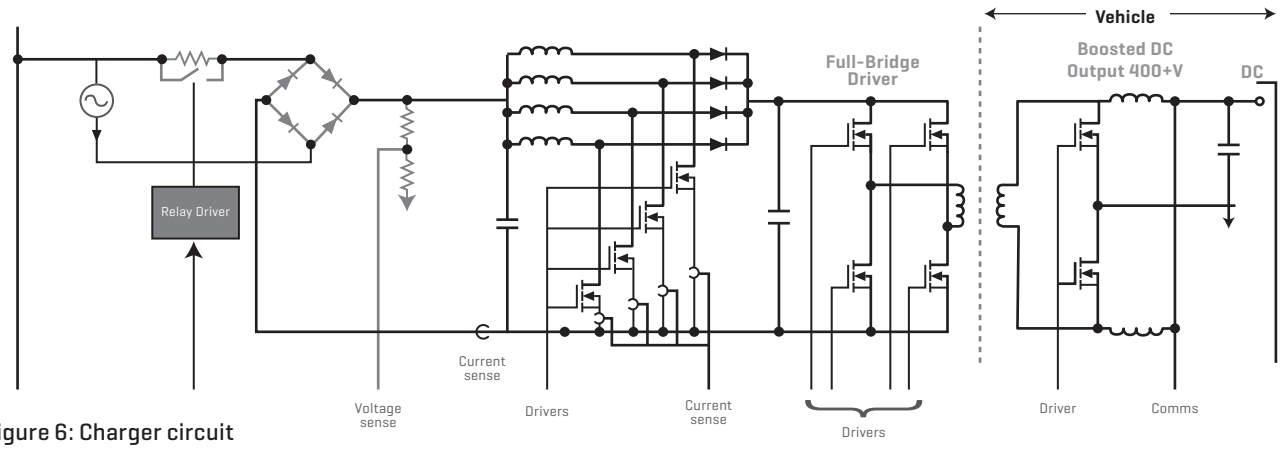

Figure 6: Charger circuit

Vehicle batteries in principle can also feed energy back to the grid, and this is similar to solar photovoltaic battery storage.

Commercial schemes have been proposed, but we are some distance off in Australia.

EVs parked at designated 'two-way energy flow' kiosks could be charged when excess renewable non-dispatchable energy is available. When required, they could provide grid support.

RECYCLING BATTERIES

Because of the relatively few EVs in use, recycling is not yet a major issue, although a market is developing if solar systems are taken onto account.

For lithium EV and PHEV batteries the focus is on collection and safe storage until enough are available to make recycling economically viable. When that point is reached, some components will be recycled locally and others will have to be sent to specialist recyclers overseas.

EVS – HERE TO STAY?

The short answer is 'yes', the world is embracing the concept.

The energy efficiency argument has two aspects: where does the energy come from and what does it cost?

An internal combustion engine typically has an efficiency of 20% (converting the fuel's calorific value to mechanical energy). For petrol it is 45MJ per kilogram or 12.5kW-h per kilogram).

An electric motor has a typical efficiency above 80% (converting kW-h to mechanical energy).

The energy multiple in manufacturing a lithium battery – against the energy that can be extracted over its life time – is 30 or more. This is of the same order as petrol.

We can assume that the energy required in building the rest of an EV is about the same as for a conventional car.

It's generally argued that transmission efficiency for an EV is better than for a vehicle with an engine because a gearbox is avoided.

So now it is a question of where the energy for battery charging comes from. If it is derived from a solar panel-inverter, the efficiency of acquiring the kW-h is about 15%. If the energy comes from a coal-fired power station, it is about 25%.

However, the marginal cost of a kW-h derived from sunshine is zero.

To wrap up: smaller batteries (lighter vehicles), more fast-charging stations, more green energy, and lower CO_2 and NOx emissions must be the conceivable future. ■

Phil Kreveld is an energy writer. He is an electrical engineer. He has worked in electrical, electronic and scientific instrumentation in Australia and the US.

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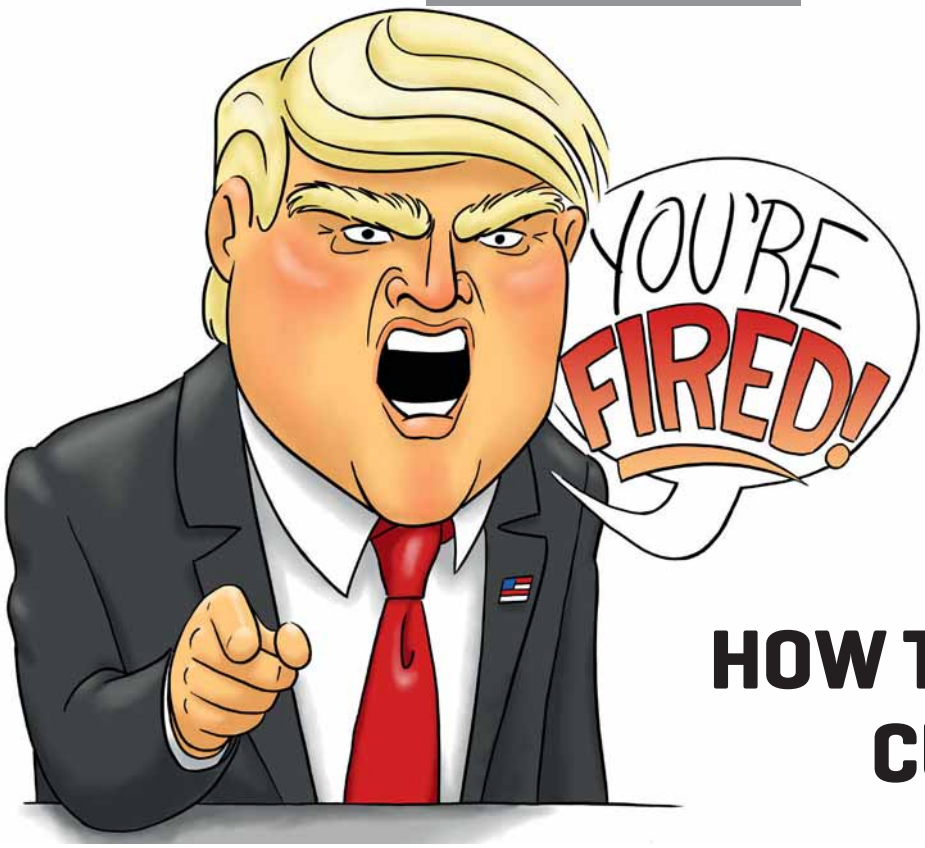

HOW TO SACK A CUSTOMER

A business relationship needs to be mutually beneficial; one that benefits the contractor as well as their customer. If it isn't, you need to know when (and how) to walk away. **Steve Keil** explains.

Conventional marketing is not quite applicable anymore. Today's modern and most advanced marketing techniques require you to not only know your customer, you should also understand their needs and behaviours. This makes it easy for you to understand exactly what a customer wants so you can market your products and services in a way that will meet their levels of expectation.

Understanding customers also makes it easy for us to continuously amend our products and services, ensuring we cater to current market needs. Clustering similar customers, or even products and services, means we are now understanding market segments, enabling us to develop standard and efficient processes to market to them in order to target them with the type of things that data suggests they desire.

This is not just true for businesses that sell tangible products, but also holds true for those in the services industry. Electrical contractors are no exception. We operate in a highly fragmented market with plenty of competition out there, and lots of opportunities. As such, you need to be able to market yourselves, keeping customers in perspective.

Sometimes a better understanding of your market and how it is segmented helps you to know your customers and type of work that you enjoy doing. You know, the stuff that keeps you jumping out of bed in the morning and getting excited about solving people's problems. The flip side is you also identify the work that saps your energy and the customers you don't want to be working for.

By applying a financial filter, you'll also understand the most (and least) profitable customer segments of your business, with the ideal delta point being the most profitable segments that energise you and that you also enjoy doing.

Not understanding your customers from a segmentation and financial bias is fraught with danger. Ignorance may well be bliss, but it can also bring pain. Let me share a real example from a few years ago.

SACKING A CUSTOMER

A friend who I'll call Jimmy (simply because I'm currently reading *Working Class Boy* by Jimmy Barnes) operates an electrical contracting business. The business has grown well over the past few years and at the time, employed 11 site workers. Yet profits were dropping to the extent that it was a major stress point for Jimmy as it was threatening the future viability of the business.

Additionally, a major customer of his, a new home builder that I'll call Builder X, was putting enormous pressure on him to reduce rates even further. The squeeze by Builder X had been going on for several years, and Jimmy had complied and reduced his rates. This put the business in a pincer of reduced rates while wages and product prices increased.

On analysis, the business had moved from a balanced portfolio of markets, being consumers, B2B service and maintenance and new residential construction, to 70% new residential construction, coming from five builders.

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Ordinarily that would be fine, particularly for a business setup for this type of work. However, a quick financial analysis found that work from four builders was profitable and with respectful relationships with those builders. However, the relationship with his largest customer, Builder X, was neither profitable nor was he treated with any respect, especially around payments.

Builder X made up over half the volume of his new home construction market segment. More importantly, Jimmy's business made a loss on every job completed for Builder X, once you factored in all his costs and overheads. Let that land for a moment.

Before you judge, it's not unusual for non-profitable customer data to be lost in a total monthly summary P&L. You have to be wired to analyse your business in this detail and if you're not, it's important that you get someone who is, whether that be a trusted accountant, bookkeeper or business coach.

On a positive note, the stress point for Jimmy also became the easiest way to fix the profitability of his business. That is, get the customer profitable or sack them. Additionally, invest time and effort to attract more business from the profitable segments that you most enjoy doing the work for.

My conversation with Jimmy went something like this.

Me: *"You need to put your rates up to Builder X."*

Jimmy: *"I can't; he won't accept them."*

Me: *"Then stop working for him, he'll send you bankrupt - sack this customer."*

Jimmy: *"I can't, I need the volume."*

Me: *"You don't need the volume, mate; you're paying him to wire his houses! You'd be better off standing on the corner of Collins St, handing out $100 notes to everyone who passes by. At least they'd be nice to you and like you. This guy treats you like crap."*

Jimmy: *"Ok... ok, so how do I sack him?"*

It is a constant point of frustration for me that our highly skilled industry undervalues the services we bring to the community. As electrical contractors, we tame a life threatening element that we're all reliant on for the day-to-day comforts of the 21st century. We spend several years training to do so skilfully. Those with an entrepreneurial spirit take even higher risks by starting their own businesses, ultimately providing jobs and taking responsibility for the safekeeping and economical security of those employees and their customers. Rant over.

There are some customers, though, that believe in a win/lose relationship.

Part of the discussion with Jimmy prior to suggesting he sack Builder X was highlighting that his consumer work was highly profitable, as was his B2B service and maintenance segment. Jimmy shared with me that he loved doing that part of his business, as did his team, due to the diversity of work that came through these segments.

He enjoyed the new home market, too, as it did provide a solid foundation of core ongoing work, albeit at lower margins.

The strategy was set that working with builders had to be on agreed terms, not on those set by Builder X. Jimmy set up a checklist for what a business relationship with a builder should look like. It was a partnering and co-dependent one, where each party respected the other's expertise and services. It included agreeing on rate schedules that valued the skills and high level of services Jimmy's team provided.

CUSTOMERS AREN'T ALWAYS EQUAL

I'm an advocate for the contractor/customer relationship being a partnering one, built on trust and mutual respect. There are some customers, though, that believe in a win/lose relationship. When confronted with such customers, the best way to manage them is by controlling the relationship tightly and ensuring such customers understand strict expectations, including payment terms.

CONCLUSION

And that's how Jimmy sacked Builder X. He met with him and highlighted his new rates, payment terms, the way he expected work to be distributed and other factors needed for the business relationship to work successfully.

Jimmy confirmed that he'd be more than happy to work for Builder X, but it would have to meet his business' criteria.

Not surprisingly, Builder X didn't agree to these terms, effectively stopping Jimmy from doing his work.

Lines were drawn. Jimmy moved on and successfully rebuilt a balanced portfolio of profitable work, while retaining a selection of boutique home builders that valued his services.

I received a call from Jimmy about 18 months later. He highlighted that Builder X had called him and asked whether Jimmy would honour the rate schedule provided 18 months earlier. Jimmy politely declined but highlighted that he'd be happy to work with Builder X on his new rate schedule and payments terms, which were now 14 days from invoice.

Builder X accepted the terms. Apparently, he struggled to find a contractor in the area who could provide the quality of service that Jimmy's business did. ■

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Steve Keil has spent his career in trade-related businesses, first as a contractor then with an electrical wholesaler. In 2004, he founded Laser Plumbing & Electrical.

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SHOW ME THE MONEY

For a contractor, it's essential to be paid on time and in full for work completed. In this article, resident estimating expert **Brian Seymour** explains how to go about it.

A poor payment schedule causes severe cashflow problems and introduces a domino effect into paying wages, suppliers and sub-contractors.

Under the contract, a contractor or sub-contractor overdue for a progress payment is able to suspend work until the money is paid in full. This can jeopardise the entire project and threaten the liquidity of all involved.

There have been many studies into the causes of unrealistic payment arrangements. The main findings have been:

- disagreement on the valuation of work;
- errors in claims; and,
- unrealistic cashflow.

Any withheld payments will delay the project, in turn affecting the work schedule and leading to cost overruns and extensions of time.

PAY ATTENTION

It starts at the time of enquiry when you first discuss a project with the client or pick up the tendering documents.

Many contractors are too keen to get their teeth into a substantial project. They read the scope and details of the work but don't pay enough attention to other clauses that will affect the financial outcome.

A SIGNED CONTRACT

Don't even attempt to start the job until you have a signed written contract.

If your client is unwilling to sign the contract, this should ring warning bells.

Even if you are a small contractor specialising in residential work, you need a contract. There are lots of templates on websites.

Your project may be a small refurbishment job for Mrs Jones, but the absence of a signed contract setting out the scope of work could easily lead to disputes at the time of payment.

Contractors carrying out small residential works, in which they have to complete the rough-in before the sheeting and finishing trades, often find that the client's perception of the scope has altered.

It is usually the contractor who is short changed.

READ THE CONTRACT

Who is the client and who is responsible for paying you?

Take note of financial obligations, such as the schedule of payments and the targets that initiate the progress payments.

Make clear provision for variations – who can authorise them and approve them for payment.

Also, spell out penalties for late payments, finance charges and the right to suspend work until payment is made.

Study the scope of work – the agreement that describes the work to be performed and contains any milestones, reports, deliverables, and end products that are to be provided by the performing party.

The scope should also contain the timeline, usually in the form of a builder's schedule or Gantt chart.

Understand the critical dates set out in the contract – they can be devastating if you miss them.

RESOURCES

Having read the contract and scope of work, do you have the resources to complete the job?

If this project requires a high level of sub-contractor expertise, or the hiring of specialised equipment that your opposition already has, are you wasting your time submitting a tender?

If your motive for attempting the project is to break into this type of work, then you will need to assess the overall cost to determine whether it is viable.

PAYMENT

Ensure your invoices are clear, complete and correct.

Many claims are reduced or knocked back due to poor or vague details – inaccuracies in paperwork, incorrect terminology, incomplete dates and unclear payment methods.

Your invoices for claims should:

- identify the service;
- state the project and any identifying numbers or codes;
- state the dates applicable;
- state the details of the claim including any fees, duty and GST;
- state the monetary value;
- state payment terms; and,
- confirm the date of retention release.

CHECK ON THE CLIENT

It's essential to know who you are dealing with.

This industry has a history of projects that have ended in financial disaster.

Many disastrous projects have been conducted by developers that were less than authentic. They are known in the industry as the 'Lazarus Disciples' (arisen from previous failed projects).

You need to be aware of the potential risk associated with such companies.

If you have never worked for the potential client before, you must carry out a company search and check the credentials through your own industry. On a large project, it is wise to establish whether the client is capable of completing all aspects within the timeframe.

LEGISLATION

The aim of the Building and Construction Industry Security of Payment Act is to ensure that anyone who undertakes construction work (or the supply of related goods and services) under a contract is entitled to receive, and is able to recover, specified progress payments.

It is in your interests to download a copy of the act from the web. ■

DISCLAIMER: This article is based on the author's decades of electrical contracting experience and is not a substitute for legal or accounting advice. Should you need help in collecting debts then discuss the issue with your legal representative or engage a debt-recovery lawyer.

Brian Seymour, MBE, is the author of Electrical Estimator's Labour Unit Manual, Starting Out, Electrical Contracting in Australia and 100 Years – Electrical Contracting in Australia.

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CAP IT OFF

There is concern in the market about underprepared apprenticeship graduates, but the issue may not be what you think it is. **James Tinslay** explains.

To the rest of the world, the term 'capstone' means the stone on the top of a structure or wall, or the crowning achievement.

In the electrical industry the meaning is not that much different, except it is meant to be the final step that apprentices must go through to be eligible for an electrician's licence.

It sounds fair and reasonable that apprentices must have a thorough assessment of all the training on and off the job that has been undertaken over four years. After all, the licence will allow employment and promote safe practices throughout their career.

However, there are substantial issues with the capstone assessment, despite its pivotal role in Standards and employer confidence in quality outcomes.

Although the capstone assessment is relatively consistent across states and territories, the delivery models differ markedly. They include a fully government-regulated test, a prescribed government option and a reliance on registered training organisations (RTOs) solely using what is in the training package.

Compounded with this is the high failure rate across these models when apprentices sit the tests. Despite this, there is little appetite among regulators to adopt a unified delivery approach for the capstone assessment.

The issue apprentices and employers face is not so much the capstone but the disconnect between the completion of a Certificate III qualification and the awarding of an electrician's licence.

All jurisdictions require the completion of the qualification. Most require additional information such as further assessment, the provision of a trade certificate or the like, a statement confirming that the apprentices have at least 12 months' relevant wiring experience, etc.

There was hope at one stage with the Commonwealth and states and territories working on a national licensing system, but that has been abandoned and there is little support to participate in a further attempt.

The subsequent introduction of a mutual recognition arrangement works reasonably well, but it does not deal with jurisdictional variations in the issuing of a licence.

It is well understood that most apprentices at the end of the notional four-year term do not have the breadth of experience across the whole industry. In four years they cannot gain the knowledge and experience of domestic, commercial and industrial work – not to mention specialist work such as solar, emergency power, etc.

Apprentices in group training schemes sometimes have an advantage when they have worked with employers in different sectors, but that is still no guarantee.

Industry involvement in the capstone assessment is relatively minor, so this is an opportunity for the electrical contracting sector. With its vast experience of training apprentices through group training arrangements and RTOs it can help regulators to work towards a national and standardised approach.

This approach, working hand-in-hand with an independent validation of the capstone assessment, would be an opportunity to bring independence to the process and build closer links between industry and regulators.

At the core of this would be the aim to substantially increase the success rate of the assessment, which is now so poor that it calls into question the validity of the process – but not necessarily the capstone assessment.

Employers and apprentices deserve a nationally consistent arrangement to ensure timely, dependable and reproducible outcomes. ■

James Tinslay is a consultant and engineer with some 40 years of industry experience. He is an ex-CEO of NECA and a director of NECA Electrical Apprenticeships.

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A word from the CEO

As I'm writing this Australia has just seen its sixth prime minister in 11 years. These changes are having an obvious effect on policy certainty, consistency and the ability for industry to invest. To make sure that issues we've been advocating for on behalf of NECA members aren't overlooked, I met with members of the new cabinet in October. Some of the areas NECA has urged the Government to take action on are:

- Tax – implementing the tax cuts for small, medium and family businesses which have already been passed by Parliament.
- Workplace relations – delivering a framework that is fair to both the employee and employer delivering greater flexibility and efficiency.
- Skills and education – improving the quality of vocational education, actively promoting the benefits of a trade career path and uniformly adopting the Skilling Australia Fund.
- Infrastructure – continuing the investment, creating jobs and boosting the economic growth.

Awards season

What do Taronga Zoo, the d'Arenberg Cube restaurant, a RAAF Pilot Training School, the Pharos wing at MONA, Parklea Correctional Centre and the first community-funded floating solar system all have in common? Easy – they're all projects that won NECA members a state Excellence Award.

I was lucky enough to attend the Award presentations around the country and it was really inspiring to see the contribution NECA members are making to so many important projects right across Australia.

All our state winners are automatically entered into the 2018 NECA National Excellence Awards, the most prestigious award for our industry.

I'm not on the judging panel, but I can tell you that it's not going to be an easy task picking winners this year.

The Awards will be presented at a gala dinner on 22 November at the Grand Hyatt in Melbourne. It's always a fantastic event and there's still time to book tickets – visit the Awards section of www.neca.asn.au to book.

Suresh Manickam
CEO, National Electrical and Communications Association

New Wiring Rules

After months of waiting, the 2018 Wiring Rules were finally released in June this year. If you haven't got your hands on a copy yet and you're a NECA member, we're making it easy for you. If you're after a hard copy, pick one up at a discounted price from your local Chapter. You can also access the new Standard for free on NECA's Technical Knowledge Database 24/7 – just one of the benefits of being a NECA member.

ISMAA Update

Early this year, NECA was appointed by the Federal Government to deliver their Industry Specialist Mentoring for Australian Apprentices (ISMAA) program to electrotechnology apprentices Australia-wide. The program has been running for some time now and one of NECA's mentors, Adam Waterhouse, has given us an insight into the most frequent areas the mentors are called on to provide advice.

- **Profiling:** Every task has a profile that the apprentices must work through in progression. There have been significant improvements in progress in this area with the mentors available to deal with questions via a quick phone call.
- **Confidence:** Mentors have helped apprentices to find ways to talk to their employers about work or personal issues that the employer and apprentice can then work through and deal with before they develop further.
- **Maths skills:** A lot of the mentors relate to the struggles that apprentices have when the maths component of their apprenticeship ramps up. They share tricks and resources and training resources with their mentees to help them master their maths skills.
- **Finances:** Managing budgets can be tricky when you first start earning. Again, this is an area experienced by many mentors who can give advice on how they overcame the challenges for example getting a concession card for cheaper bills.
- **Downtime:** Keeping motivated during the downtime between jobs can be tricky for some. The mentors are able to explain to the apprentices how the contracting sector works, reassuring them and keeping them focused.

"An apprenticeship can be a rollercoaster; one day you're up, the next you're down. The mentors help smooth out the ride and support the apprentices with advice and tools to help them complete their training," Adam says.

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SAFETY FRONT OF MIND FOR STANDARDS AUSTRALIA

With the publication of the Wiring Rules as well as a number of other standards in the electrical sector, safety remains the highest priority as more and more guidance is provided to the professionals across the industry, writes Standards Australia stakeholder engagement manager for energy and electrotechnology **Simona Tomevska.**

The highly anticipated update to the Wiring Rules was released in June 2018. This latest revision is an update to the 2007 version, and given the rapid advancement of technology and the improvement in terms of safe practices of the industry in this period, there are some significant changes.

Changes include a review of provisions for mains switches, RCDs, arc fault, switchboards, kitchens, DC power, showers and earthing requirements. Additional material has been included for areas such as types and variations of conduit for electrical installations, a checklist of switch board equipment, and guidance around the construction of private aerial lines.

Safety that has been front and centre in this revision with stakeholders across Australia and New Zealand taking into account new installation methods in developing the Standard. This is a major focus point for the Standard given so many of the everyday aspects of Australian life are impacted by the Wiring Rules. Charging your phone, flicking a light-switch, and even taking a shower are all directly impacted by this Standard.

Prior to the publication of AS/NZS 3000:2018 *Electrical installations* there was a pirated version that was released into the community through social media. The first objective of the Wiring Rules is the impact it has on safety of the Australian public, and Standards Australia takes this very seriously.

Use of the pre-publication copy (distinguished by its green cover, as opposed to the official purple cover) is strongly discouraged. The unauthorised version has been altered to an extent where Standards Australia has no way of confirming its accuracy. As a result, electrical professionals are reminded to adhere to the correct copy of the Wiring Rules to avoid any risk associated with use of an illegal copy, and to best achieve compliance with building codes, and state and territory regulations.

SAFETY ON CONSTRUCTION AND DEMOLITION SITES

A large section of the standards published for the energy sector are aimed at improving safety. This includes the safety of the professionals in the industry, as well as the consumers that interact with electrical installations on a daily basis. DR AS/NZS 3012 *Electrical installations – construction and demolition sites* has been drafted by the relevant Standards Australia technical committee as an example of this commitment to safety.

The draft Standard outlines requirements for the design, construction and testing of electrical installations that supply electricity to appliances and equipment on construction and demolition sites. Requirements are also set out for the in-service testing of portable, transportable and fixed electrical equipment used on construction and demolition sites.

Ultimately, the Standard focuses on electrical installations that power the tools and site requirements on construction and demolition sites, arguably some of the most dangerous work environments, even on the best of days. The requirements outlined in this Standard are designed to protect people and property from electric shock, fire and physical injury hazards that can come from electrical installations such as these.

This Standard applies to electrical installations associated with construction and demolition sites which include, but is not limited to:

- Building and excavation work.
- Parts of buildings that undergo structural changes requiring temporary electrical installations.
- Civil engineering works including construction or maintenance of roads, airfields or airstrips, bridges, railways, etc.
- Laying, lining or maintenance of pipes and cables.
- Work in which explosives are used.

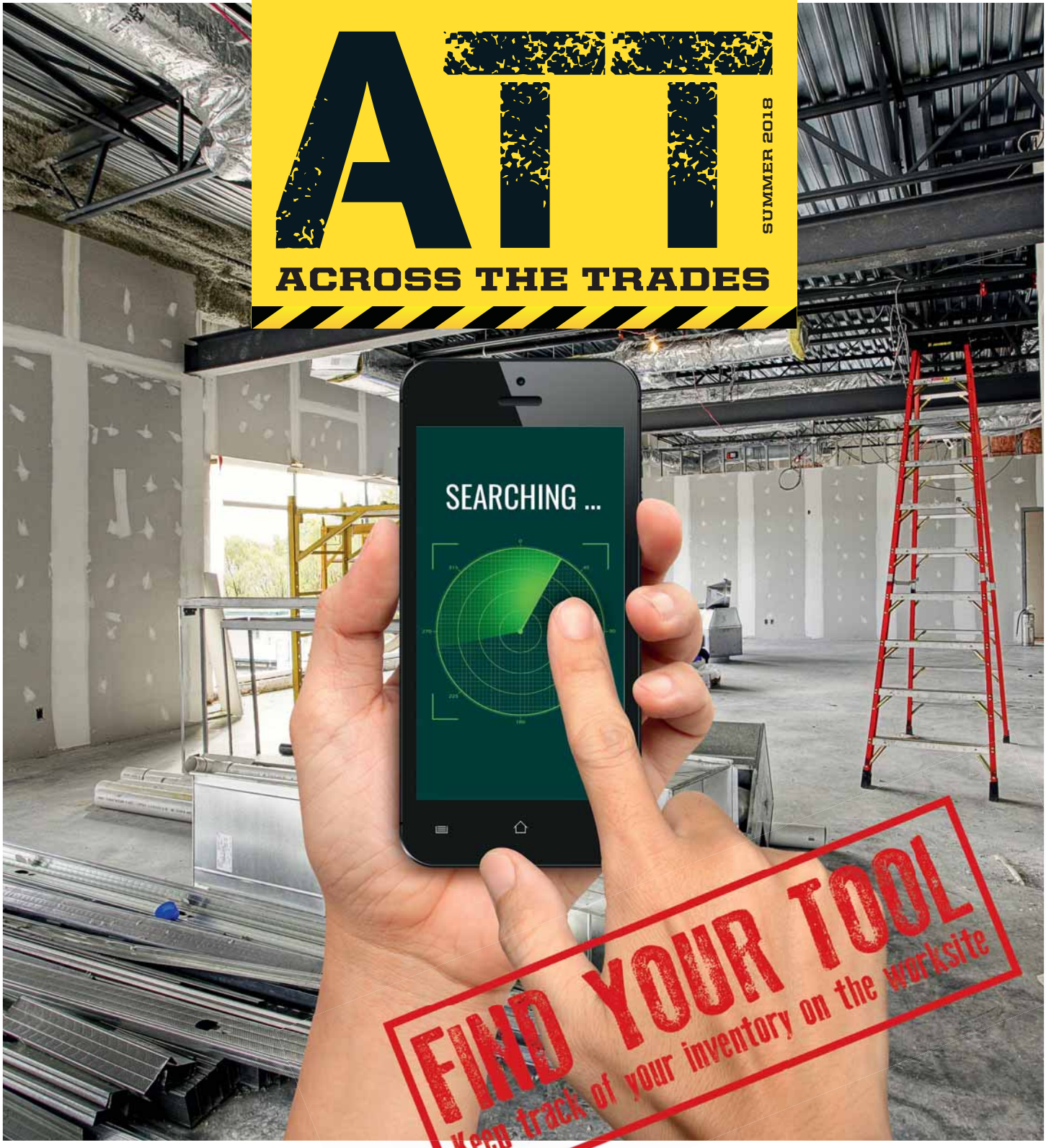
This draft Standard was recently out for public comment, allowing the Australian public, especially including the electrical industry to be given the opportunity to shape its final form. Following these comments being considered by the committee, the Standard will be published in due course.

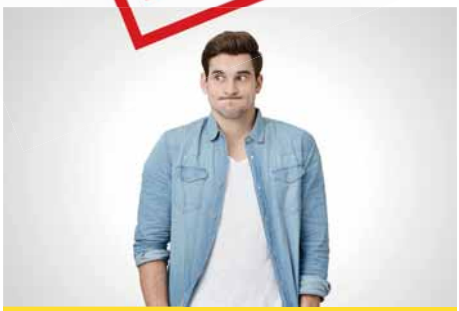
The electrical sector continues to be a key industry for Standards Australia, and each standard published prioritises safety to ensure the industry is well-guided as technology and installation methods further develop. ■

ATT

ACROSS THE TRADES

SUMMER 2018





KEEPING TRACK

INVENTORY MANAGEMENT SOLUTIONS FOR BUSINESSES HAVE OFTEN BEEN ARCHAIC; HOWEVER, WITH TECHNOLOGY EVOLVING, SOME COMPANIES HAVE DEVELOPED WAYS TO MAKE TOOL TRACKING EASY AND ACCESSIBLE. **SIMEON BARUT** EXPLAINS.

Gone are the days of inventory management being done with pen and paper. Today, technology is taking over and playing an integral role in the way businesses monitor their inventory, with multiple solutions available to business owners.

Understanding what you have and where it is can often lower costs and speed up fulfillment. It also helps with organisation because without any sort of system in place, it's hard to know what tools are needed, when they're needed and where they're needed.

Further, theft on building sites is a serious issue too. In December 2017, $400,000 in equipment was stolen from a locked trailer at a worksite in Melbourne. In the year prior, hundreds of tools were stolen from various worksites across the country.

Whether thefts occur during work hours or after, understanding where and when employees are using specific tools is vital to ensuring the security of your items. With dozens of workers on site at any one time, employees entering areas and using tools they don't have the skills or need to use can cause headaches with time management.

This especially goes for those on-site as tracking the tools you have and need can be incredibly important to getting a job done. But, in a larger business, what would normally work with eight employees won't work when you have 80 employees so using effective tool management software can make a huge difference.

Milwaukee digital marketing manager Ayman Harrak says his company has embraced the importance of tool management with the introduction of its One Key app.

"With One Key, we provide our customers an inventory management platform that a business owner can easily manage," says Ayman.

"It also allows any business owner – or whoever's in charge of the company's inventory management – to track tools both via a web and mobile solution that also allows tool customisation, tracking and security, all in the one solution."

One Key aims to eliminate the need for spreadsheets or other means of manual tracking when it comes to tool management.

"Traditionally, a large organisation would have one person in charge of managing inventory and it would generally be a primitive process with only that person having access. With our platform, it allows users to create an account and add any tools they want, whether it's Milwaukee or a different brand," Ayman says.

"These tools can vary from a scissor lift to a cement mixer and they can all be managed from one central system so it offers peace of mind to company owners as they know where each tool is and who's actually using it."

While One Key aims to make inventory management accessible on a digital platform, its main goal is to make the information available to everyone in an organisation. One Key is a cloud-based solution. This means it's accessible to anyone that has a smart device whether you're on the tools driving around to different jobs, or on the maintenance side of things when it comes to repairs, warranties and general records of tools.

"There are situations where customers who aren't traditional tradies are using the software, showing that it is truly scalable. This technology offers users so many opportunities because it branches out to such a wide variety of business owners."

Where One Key shines, though, is when it is paired with Milwaukee One Key-enabled tools, Ayman explains.

When combined, the One Key portal offers a fast and easy platform to access just about anything you need to know about a specific tool, including purchase information, tool

status and performance reports, and maintenance scheduling.

Then, if a One Key-enabled tool is stolen or misplaced, the user can flag the tool as 'missing' through the One Key app and immediately send a notification to a smart phone or device that is in range of that tracked tool.

Of course, if you don't want to rely on smart phones to keep track of your tools, there are options available too. Take Melbourne-based Leash It's Tradie Leash system as an example.

Tradie Leash updates the location of connected tools every 10 seconds and can be programmed to abide by specific rules for specific products. For example, if a tool hasn't been used or moved for an hour, the system can notify those on site, who can then return or move the tool to a more appropriate (or secure) location.

While Tradie Leash can be used as a simple tool tracking device, the gateway can also track workers. If a worker enters an area they are not permitted, Tradie Leash can alert a foreman via a message, allowing them to follow up quickly.

All of Leash It's solutions, including Tradie Leash, operate on an Internet of Things (IoT) platform called LeashView, which allows all of a company's products to operate on the same system, if required.

"It doesn't matter if you're using the Tradie Leash or another one of our products, all the gateways between the different devices will all work together," Leash It founder and chief executive Tony Lotzof says.

Ultimately, all inventory management systems aim to deliver a greater level of efficiency and optimise the use of a business' assets.

For now, the days of tracking everything through a spreadsheet are slowly dying out and the use of technology is continuously proving to be a much more effective way of implementing tool and inventory management processes.

"Inventory management has been around for a long time and there have been specific ways to do it, albeit inefficient. We're basically creating a platform that is easy to use, easily accessible and suitable for whatever role the user holds in a company," says Ayman.

"Everyone having access to information that shows where tools are and what projects they're on is a lot more efficient than one person having access to an Excel spreadsheet."

Additional reporting by Cameron Grimes.

Milwaukee
www.milwaukeetool.com
Leash It
www.ileashit.com

THE 'O' WORD

WE MAY LIVE IN AN AGE WHERE SAFETY REIGNS SUPREME, BUT CAN YOU BE TOO SAFE? ACCORDING TO ONE AUDIOLOGIST, YOU CAN BE OVERPROTECTED AND IT'S POTENTIALLY AS DANGEROUS AS UNDER-PROTECTION.

Overprotection isn't a term you often hear in the same breath as building sites or manufacturing plants. In fact, you wouldn't be alone in believing overprotection is near impossible where hazardous environments are concerned, but that is simply not the case.

As under-protection tends to be the well-documented phenomenon, it can be hard to fathom the flipside, let alone determine what it looks like.

Take, for instance, the dangerous compromise of using hearing protection that essentially makes us partially deaf to protect our hearing, but could, in turn, inadvertently prevent a worker from hearing an important signal with disastrous results. It's an uncomfortable conversation that's been swept under the rug, but the industry must start asking the hard questions. Starting with, if more well-intentioned PPE for workers is redundant, how can employers judge what the appropriate level of noise protection is?

Considering there are no hard and fast rules, audiologist Theresa Schulz from Honeywell Industrial Safety says it's good practice to become familiar with the "risk of overprotection" at certain noise levels when managing hearing equipment.

"If a worker is in a safe environment and there is no risk that they won't hear an important communication signal then there likely is no risk, even if the noise is attenuated to 50dB or so. However, the risk of overprotection should be considered if the noise is attenuated below about 70dB," she says.

According to Safe Work Australia, 70dB is roughly the level of loud conversation.

Employers can begin to mitigate risk by preventing overexposure to hazardous noise by accurately monitoring each individual's daily protected exposure level, something that hasn't been possible until recently.

"The next best solution is to measure the effectiveness of the hearing protection and subtract that from the exposure level to estimate the protected exposure level. And the third best solution is what most employers do, which is to use the labelled attenuation (often with some derating paradigm) to estimate how much protection workers should be getting from the hearing protector," Theresa says.

Once efforts have been made to mitigate noise hazards with engineering controls, employers need to revisit how they choose hearing PPE. The prevailing challenge of overprotection has been cause for custom innovation, like individual earplug fit-testing because there is no universal fit.

Theresa advises that at this stage, it's necessary to consider all tempering factors such as communication, comfort, size, shape and ease of insertion. It's also worth reviewing which models are apt for the individual and task at hand.

In the case of earplugs, there are many options available that might be appropriate, including corded and uncorded or single-use and reusable. The right fit can provide level hearing attenuation by naturally blocking more high frequencies than low, allowing some high frequencies to still pass through, but as Theresa explains, "The sound that gets through is perceived as more natural".

Looking forward, using new technologies that allow collection of personal noise dose inside the hearing protection itself throughout the work shift is highly beneficial. Personal sound exposure monitoring (PSEM) accurately measures what the true risk level is, allowing employers to truly cater their level of hearing protection case-by-case, eliminating the need for potentially harmful exposure estimates.

This is especially helpful for employees who already have some degree of hearing loss and may not know it, making them more susceptible to overprotection. The best preventative measure for this predicament is to discern existing damage with an audiogram, Theresa says. And it's another reason why individual fitting is especially imperative as it could be the difference between keeping our workers safe and them coming to devastating harm.

Honeywell Industrial Safety
www.honeywellsafety.com

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RIDGID KJ-5000 water jetter

The RIDGID model KJ-5000 portable water jetter gives you 5,075psi actual working pressure to handle commercial and industrial pipe clearing applications. This jetter propels a highly flexible and lightweight hose through 50mm to 250mm lines. As you pull the hose back, it power scrubs the line flushing debris away and restoring drain lines to their full, free-flowing capacity - all without the use of harmful chemicals.

The KJ-5000 offers a water flow rate of 23L/min and features a 20L fuel tank with built-in fuel level gauge, 60m of lightweight 3/8" hose, 60m remote reel with 1/4" hose and four nozzles in a convenient carry box.

RIDGID Tools
www.ridgid.com.au

Fiorentini range

Forklift market leader Toyota Material Handling Australia (TMHA) has secured the national distribution rights for the Fiorentini range of floor sweepers, scrubbers and dryers.

Fiorentini Sweeper Company manufactures a large range of highly manoeuvrable battery electric and internal combustion floor sweepers – ideal for use in warehouses, logistics and distribution centres and most industrial applications where a dust-free environment is essential.

The new Australian distribution agreement, signed between TMHA and Fiorentini gives the sweeper range the product-support back-up of TMHA's 17-branch national network and huge mobile service fleet.

Toyota Material Handling
www.toyotamaterialhandling.com.au

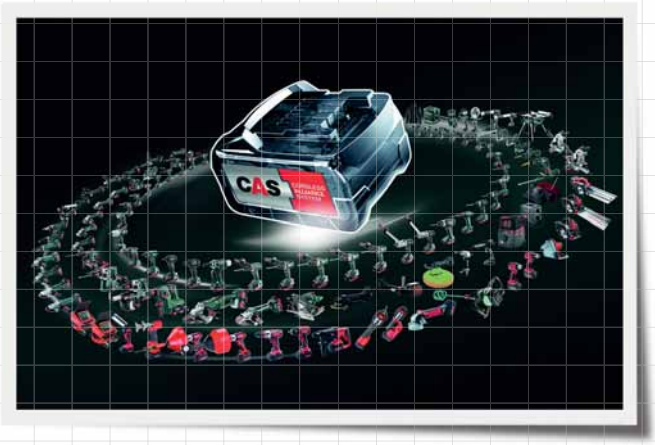
Mid-steel toe work boot

Boasting an oil- and slip-resistant non-marking rubber outsole, the Detroit mid-steel toe work boot from Keen is geared to ensure safety on site in the event of spillage or when faced with wet working conditions.

For further resistance against the elements, both natural and work-related, the Detroit Boot features a waterproof NUBUCK leather upper for total comfort and dryness. Coupled with the Keen.Dry waterproof breathable membrane, this boot ensures a dry foot and prevents undue sweating.

This is capped off by a dual density compression moulded EVA midsole for better support of the arch and torsional stability ESS shank for further reduced fatigue in your calf and foot.

Keen
www.escape2.com.au



Cordless Alliance System

Nine power tool manufacturers have launched the Cordless Alliance System (CAS), which will see tools from Metabo, Mafell, Rothenberger, Eibenstock, Starmix, Haaga, Steinel, Collomix and Eisenblatter able to be operated with a single manufacturer-independent battery pack.

The basis of the CAS is Metabo's battery pack technology. In the past few years, the German manufacturer has delivered a series of innovations in this area of technology. This notably includes the second generation of Metabo 18V LiHD battery packs, the 8.0 ampere hours (Ah) capacity battery pack with only 10 cells that delivers 1,600W of power.

Cordless Alliance System
www.cordless-alliance-system.com

Honeywell Miller tool lanyards

Statistics from SafeWork Australia confirm that falling objects in the workplace are a significant cause of injury and death. Although it's mandatory to use fall protection when working at height, anchoring tools is often overlooked.

Fortunately, Miller lanyards provide a quick and simple solution to tether your tools, keeping tools right where you need them while also preventing injury.

The Swivel Tether attachment point easily attaches to tool hang holes or slots. The Double D-ring tool shackle features an anti-vibration eye pin. Finally, the Karabiner tool lanyards are constructed from high-strength elastic bungee cord and carries up to 6.8kg.

Honeywell Safety Products
www.honeywellsafety.com

Fyrepex

With PEX pipes and derivatives of PEX pipes growing in popularity across the plumbing industry, Trafalgar has launched FYREPEX, an intumescent sealant that expands with the heat of a fire, which enables it to be used with PEX water or gas pipes, as well as air-conditioning services.

As the sealant expands, it actively crushes the pipe to block off the penetration for up two hours during a fire. Tested to AS1530.4 and AS4072.1 in accordance with the National Construction Code (NCC), FYREPEX is non-toxic and is approved for both walls and floors, and is available in a 310ml cartridge and a 600ml sausage.

Trafalgar
www.tfire.com.au

LEGAL

A FAIR SHAKE...

THE VAST MAJORITY OF TRADIES WILL FALL UNDER THE THRESHOLD WHERE UNFAIR DISMISSAL LAWS ARE APPLICABLE. EMPLOYMENT LAW EXPERT **LISA ANAF** OUTLINES YOUR RIGHTS AND OBLIGATIONS.

Did you hear the story about the tradie who got fired for being too attractive? It all started one afternoon when a Kiwi roofing technician was working outside in the hot sun, shirt off, at a suburban property in Auckland. According to him, he was invited to come inside for a drink by the client's wife, who allegedly told him he was "the best looking tradie she'd ever seen".

Apparently the client didn't agree. The following day, the tradie was pulled aside by the boss and told that a complaint had been received about "unprofessional behaviour" and also the poor standard of work on the job. The tradie was subsequently stood down until further notice.

Was this a fair decision? Well, according to the tradie himself, there was more to the story. He claims his boss invented the complaint about unprofessional behaviour as a cover for other problems with the job caused by the boss himself. He decided to sue for unfair dismissal. New Zealand's Employment Relations Authority (ERA) concluded that the accusation of 'unprofessional behaviour' was unfounded and the tradie was unfairly dismissed. The ERA awarded the tradie $22,875 for unfair dismissal, "loss of dignity, humiliation and lost wages". As a result of the experience the tradie now has a new job, 15 minutes of fame and a loyal social media following.

Needless to say, unfair dismissal laws also apply in Australia and tradies need to take care to ensure their business does not become subject to a claim.

So who can bring a claim? Award-covered or enterprise-agreement covered employees can bring a claim. Also, any of your employees can bring an unfair dismissal claim if their annual rate of earnings is below what is known as the 'high income threshold'.

If there is no agreed amount for non-monetary items then the Fair Work Commission can estimate a real or notional value.

At the time of writing, the high income threshold in Australia is $145,400 per annum. In other words, any employee who is earning less than this amount can bring a claim against your business.

So what counts towards an employee's 'earnings'?

An employee's 'earnings' include:

- wages;
- amounts dealt with on the employee's behalf or as the employee directs; and,
- the agreed monetary value of non-monetary benefits.

'Earnings' do not include amounts that cannot be determined in advance. This means that incentive-based bonuses and non-guaranteed overtime rates cannot be taken into account.

If there is no 'agreed' amount for non-monetary items then the Fair Work Commission can estimate a real or notional value.

Table 1 sets out some examples of benefits that have and have not been accepted as contributing to an employee's 'earnings'.

If the employee is earning above the threshold, this does not mean employers have free reign to terminate as they wish. If an employee is award- or agreement-free and earns over the high income threshold, employers will still need to make sure that a termination is not for an unlawful or discriminatory reason, and that the termination complies with the terms of the employment contract and any applicable HR policies.

Unfair dismissal laws apply to all businesses. Unless your employees are earning above the threshold, you need to take these laws into account before terminating anyone.

Table 1: Examples of non-monetary benefits

Earnings:	Not earnings:
Base salary	Discretionary or incentive-based bonuses
Superannuation contributions over and above the minimum required by law	Minimum superannuation contributions (currently 9.5%)
Guaranteed overtime	Non-guaranteed overtime
The private use of a fully maintained company car	Annual travel allowance for the use of a private car for work purposes
Fringe benefit tax paid by an employer in a genuine salary sacrifice situation when an employee has forgone wages in return for a benefit	Fringe benefits tax paid by the employer where the employer is free to choose whether to provide a particular benefit to an employee
The private use of a work phone or tablet/ laptop	
Tax-deductible work-related expenses	

Lisa Anaf is an employment law expert at national law firm Mills Oakley. She can be contacted at lanaf@millsoakley.com.au.

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THE POWER OF THE APOLOGY

ELTON JOHN SAYS THAT SORRY SEEMS TO BE THE HARDEST WORD; HOWEVER, IT COULD BE THE MOST IMPORTANT WORD IN YOUR BUSINESS' VOCABULARY. **CECELIA HADDAD** EXPLAINS.

It is human nature to make mistakes, in fact it is possibly one of the biggest causes of business failure today. While a mistake can cause damage to your reputation, how you respond to that error can be the difference between disruptive and disastrous.

A well-constructed and genuine apology may not only minimise reputational damage but could repair your reputation taking it to an even greater level. On the flip side, a poorly delivered apology or no apology at all can cause irreparable harm to your reputation.

How can an apology be so powerful? Well mostly, it tips the scales (or balances them again depending on the situation) and this can mean a lot in business. It can turn a customer's anger into a positive emotion and it can shine a favourable light on an individual or company.

There are myriad situations where an apology may be required and too many to mention – a job schedule running behind time, the wrong building product installed in a home, one of your employees was rude to a customer – the list goes on.

Regardless, there are some guidelines you can follow to make a good apology, great.

Public or private

Determine if the situation requires a private or public apology. This of course depends on a number of factors. Were you aware of the situation already or did it take a customer complaint for you to find out? Did the customer complain in person or on social media?

If you are already aware of an error but the customer has not complained, you should promptly come clean, taking the high ground and explaining to your customer what went wrong, say sorry and tell them how you will fix it.

Use the right channels

If the issue broke on social media, you have two audiences to talk to – the customer and their followers and friends. You would still follow the same procedure adding that you will be in touch directly with the customer so in this case the apology needs to be handled both online and in person.

By far, a private complaint and apology will be far less detrimental to your business providing you manage

the process correctly. However, if handled correctly, an apology played out on social media can also hold you in a favourable light.

Action immediately

If you are certain you or your company is at fault, apologise immediately. This has the potential to diffuse the situation before anger is heightened and may also help contain the situation if the customer thinks they are being heard.

Don't sit on an issue hoping it will blow over. There is so much wrong with that approach. Respond as soon as possible, preferably within the first hour but only if you have all the facts. A prompt response is recommended before speculation and rumour take over.

Own it

Whether it was your fault personally or that of an employee, as the business owner you need to take responsibility. If the incident was caused by an employee and it's a sackable offence, you should let the customer know that but still take full responsibility. Don't ever say "It was out of my control" or "I didn't know this was going on". It won't help your reputation at all.

Whether it was your fault personally or that of an employee, as the business owner you need to take responsibility.

Always use a double apology

Apologise for what you did, not just the effect it had. For example, don't say "we are sorry if we offended anyone" – it implies you may not have offended anyone. Apologise for the mistake and any grief/inconvenience it has caused.

Actions speak louder

The apology shouldn't stop at 'sorry'. You need to commit to taking action to minimise the risk of the same thing happening again or at all. This could mean further investigation, more resources or training, stricter standards – whatever it takes to fix the problem, reduce the risk or prevent the situation from ever occurring again.

Credibility

Even the most well-constructed apology won't guarantee you will be forgiven if it isn't genuine. In fact, if the apology is not believable it could backfire causing more harm than the mistake itself. Footballer Neymar has been slammed after it emerged he earned over £200,000 for a 90-second video in which he apologises to the Brazilian people for appearing like a 'spoilt kid' on the football pitch. The video apology backfired after it was discovered that Neymar had been paid to read the text, which was contrived by an ad agency. Instead of improving his popularity, the apology only made it worse.

Even the most well-constructed apology won't guarantee you will be forgiven if it isn't genuine.

Seek legal advice

If the error could result in legal action then seek the advice of a professional. I would recommend running any statements by a lawyer as a precaution.

Its always a good idea to use a sounding board and run your apology by someone else, if possible, someone who is objective and outside your business.

If you do it right, not only will a good apology set you on the right course again but can potentially see you in a better position than when you started. You may retain and even gain new customer loyalty in the process.

Cecelia Haddad
Cecelia Haddad is the director of Marketing Elements, a PR company that specialises in the building and environmental sectors.

CASH FLOW

PLAN TODAY TO GET PAID TOMORROW

IF YOU SET UP NEW CUSTOMERS PROPERLY IN THE BEGINNING, YOU WILL AVOID SO MANY PROBLEMS LATER, WRITES PRUSHKA FAST DEBT RECOVERY CHIEF EXECUTIVE AND MENDELSONS NATIONAL DEBT COLLECTION LAWYERS DIRECTOR **ROGER MENDELSON.**

Many of the problems experienced by tradespeople when it comes to collecting their debts could be avoided.

This article contains very simple tips that are so easy to implement. If you follow them, you will have fewer disputes, better cash flow and fewer bad debts.

THE INITIAL CALL

Most tradespeople will receive their initial contact by telephone or, increasingly, by SMS.

Even if you operate a small business and handle all incoming enquiries yourself, often when you are out on the job, this is the critical time where mistakes get made.

No matter where the enquiry came from and regardless of whether it is by phone, SMS or email, it is always important to talk with the new customer.

Asking the right questions will enable you to not only determine more fully exactly what the job will involve and whether it would commercially viable for you to do it, but to also ascertain if the customer is one you actually want to have.

If the customer is evasive on the phone, then be very wary.

There are certain fundamental questions which you need answered:

- Full name, address and contact details of the customer.
- Does the customer own the property where the works are to be carried out?
- If the customer is not the owner, in what capacity is he requesting the works? It may be that it is for an elderly mother or the customer is a tenant or an agent for the owner.
- If the customer is not the property owner, ask for the full name and address of the owner and ask if he is authorised to place the order on behalf of the owner.

- Advise the caller that you will email your estimate of costs or basis for charging costs and also include your business trading terms and that for you to proceed, he/she must acknowledge by email that he agrees to the terms.

The above simple steps will allow you to ensure that you will be invoicing the property owner or if not the owner, someone who has agreed to be responsible for the account.

The preferred position should always be that you want authority from the property owner. The reason is that this will reduce later disputes about the nature of the work and, additionally, the owner has equity in real estate (being the property where the work is to be carried out), so will be a person or company that is worth suing should things go pear-shaped.

The terms that you email the new customer will be your standard business trading terms. If you haven't had a set prepared, then I recommend that you do so. The terms will incorporate all the provisions that you would need so that if you do have to sue, you will have the best possible chance of success.

In addition, you will want clauses that work to your benefit. A major one is a default clause, which will provide that if the customer defaults, you will have the right to charge interest and all subsequent debt collection and legal costs onto the defaulting customer.

Just following these simple procedures will ensure that you are well positioned to sue for the full amount owing, including all debt collection costs. And, if the customer is the property owner, you can feel comfortable that he or it has the financial means to pay the judgment.

Just being in the position where you have detailed business terms in place and dealing with a property owner means that it is highly likely that the customer will ultimately pay the account and you won't have to sue. The reason is that if the customer refuses to pay, he/she will be faced with a court order for not just the amount of the job but also considerable debt collection and legal costs. If the customer is the property owner, then there are several powerful legal enforcement processes available to you to enforce the judgment.

Get paid... Following a few simple steps will ensure you get paid on time.

The risky customers are those who order a job but are not the owner of the property.

The consequence of this is that your risk of that debt becoming a bad debt is low and the chances of it being paid promptly, without the need to even go to a debt collection agency or lawyer are high.

The risky customers are those who order a job but are not the owner of the property. If you are in the situation where you cannot get the owner to acknowledge liability for the job and to authorise you to proceed, then take great care in advancing credit, insist on a significant deposit and on regular progress payments.

Plumbers are in the enviable situation where, by the nature of the work they are carrying out there is always a property and every property has to have an owner. Accordingly, by following the simple processes outlined above, you should have very few bad debts. Those which you do have should be close to 100% recoverable by the debt collection agency you use.

Roger Mendelson
Roger Mendelson is CEO of Prushka Fast Debt Recovery and principal of Mendelsons National Debt Collection Lawyers, which provides customised business trading terms for plumbers, prepared by their specialist debt collection lawyers for $1,320. Call 1800 641 617.

VOLKSWAGEN CRAFTER

Volkswagen has launched its second-generation Crafter in Australia with a host of mechanical highlights and new advanced safety technology available across the large van and cab chassis range.

Whereas the first model was based on the Mercedes-Benz Sprinter and, at the end of its lifecycle, was offered with just a single transmission (six-speed manual) driving the rear wheels only, the fully redesigned in-house-developed new Crafter has emerged with a broader range that includes an eight-speed automatic transmission option and front- and all-wheel drive variants.

As before, Crafter vans come with three lengths (medium wheelbase/5,986mm, long wheelbase/6,836mm and LWB with overhang/7,391mm) and three roof heights (standard, high and super-high). Cab chassis models are available in three-seater single and seven-seater dual cab body styles with either a medium (6,204mm) or long wheelbase (7,004mm). There are 59 variants in total!

A more powerful and efficient version of VW's 'EA288 Commercial' 2.0L four-cylinder common-rail turbo-diesel engine is now in service, offering features such as fuel-saving automatic engine idle-stop and brake energy regeneration, and available in single or twin turbo guise.

The single TDI340 produces 103kW of power and, as the model name indicates, 340Nm of torque, while the bi-turbo TDI410 has a more muscular 130kW and 410Nm. Both engine variants produce maximum pulling power at 2,000rpm.

The TDI340 single turbo is paired with either the six-speed manual or an eight-speed automatic with the front-wheel drivetrain – note that the manual is restricted to tradie-targeted 'Runner' vans – while the higher-output TDI410 is used across a broad spread of manual/auto FWD, AWD and RWD variants, the latter split between single and twin rear tyre format.

At launch, only the TDI340 'Runner' variants and TDI410 front-drivers had come onstream, with a progressive rollout occurring for other configurations across AWD, TDI340 autos and RWD. The entire range should be available by early 2019.

VW says the new generation brings with it a wide variety of benefits, from improved payload and cargo capacity to the latest in driver assistance technology.

Gross vehicle mass (GVM) ranges from 2,550kg to 4,490kg, while payload starts at 1,115kg and, depending to the variant, climbs as high as 2,392kg. Maximum braked towing capacity is 2,500kg, although some variants were still to be rated at the time of writing.

The cavernous front-drive vans offer a cargo capacity of up to 18.4m^3 and a load compartment height of up to 1,961mm, while load length runs as long as 4,855mm and width between the wheel arches spans 1,380mm on most variants. Dual-tyre models are slightly narrower.

With the optional alloy tray fitted, the cab chassis load area ranges from 5.5m² to 8.8m², with 2,700-4,300mm in load length, 2,040mm width at the arches and tray height of 400mm.

VW claims the new Crafter sets new standards for driver assistance and comfort systems in the large van segment, pointing to the introduction of an electromechanical steering system that, in replacing the previous hydraulic power steering set-up, not only helps with manoeuvrability and fuel economy but also enables a new suite of active safety features to be offered.

These include active lane keep assist, park assist and rear traffic alert systems, on top of other driver-assist tech such as adaptive cruise control, driver fatigue detection, front assist with city emergency braking, a multi-collision brake system, crosswind assist system, blind-spot monitoring, and more. Not all of these are fitted standard.

Front, side and curtain airbags are fitted to most variants (super-high roof vans are the exception to the rule on side/curtain protection), while other notable safety features include a reversing camera on all closed-bodied models, front and rear parking distance monitor, and a side protection sensor-based system.

The new generation also brings LED headlights and cornering fog lights, while vehicles with tow hooks include an electronic trailer stabilisation function, which works in conjunction with the electronic traction and stability control systems. Four-wheel ventilated disc brakes with ABS, EBD and brake assist are also on-board.

Infotainment-wise, VW has 'crafted' a couple of different configurations for radio/navigation and other media, all with an 8.0" colour touch screen, Bluetooth hands-free mobile phone functionality, VW's App-Connect system (integrating Mirror Link, Android Auto and Apple CarPlay), USB connections, SD card slot and more. Digital radio is optional, while a higher-grade package includes satellite navigation and more sophisticated media control.

The cabin also features a vast array of storage compartments, power sockets and, right from the base level, the driver's seat has a broad range of adjustment including height and electric four-way adjustable lumbar support. Front 'ErgoActive' suspension seats with electric massaging function are also available as an option.

Even with the switch to an all-new platform, VW says the Crafter remains compatible with existing cabinet systems from leased vehicles or previous models. The company has also developed a wide range of fit-out and body conversion options catering for the various trades.

Pricing starts from $48,290 plus on-road costs for the Crafter 35 TDI340 LWB front-drive single cab chassis with an eight-speed auto, while the vans kick off with the Crafter 35 TDI340 MWB front-drive Runner manual from $48,490.

The cab chassis line-up tops out at $64,790 for the Crafter 50 TDI410 LWB 5.5t rear-drive dual-tyre double cab chassis auto, while the vans peak at $71,490 for the Crafter 50 TDI410 LWB (with overhang) 5.5t rear-drive dual-tyre auto.

CITROEN BERLINGO

Citroen has unveiled its third-generation Berlingo compact van that is under study for Australia by its local importer Inchcape Australasia – and is expected to be given the green light for release here in 2019.

Shared with other PSA Group brands including Peugeot (Partner) and Opel/Vauxhall (Combo), neither of which are expected to be sold Down Under, the redesigned Berlingo is based on the French manufacturer's modular EMP2 platform and will be produced in two sizes – M and XL – in similar fashion to the current L1 short body and L2 long body variants.

The M version measures 4,400mm long with a 2,780mm wheelbase, while the XL version stretches 4,750mm while resting on a 2,970mm wheelbase. Width is 2,100mm (including mirrors) and height 1,800/1,850mm on M/ML respectively.

Three-seat 'Extenso' and five-seat crew cab versions will also be available, and in overall terms the new Berlingo is slightly bigger than the current generation. This translates to improved load capacity, especially in the XL where up to 4.4m^3 of volume is available, plus a higher payload range of up to 950kg.

Minimum load volume on the M is 3.3m^3, while payload goes up to 1t. The load width between the wheel arches remains at 1,230mm. Maximum towing capacity is listed at 1,500kg across the range.

Citroen says the new platform provides the basis for improved dynamic performance and extra comfort and security, pointing to the inclusion of some 20 driver-assist safety systems and four connectivity technologies on its latest van.

The driver assistance features include an 'overload' indicator (monitoring payload) and surround rear vision system (covering the passenger side of the vehicle and rear end) – both claimed to be firsts in this segment – as well as a colour head-up display, automatic electronic park brake, adaptive cruise control (with stop function), active lane departure warning, driver attention alert, traffic sign recognition, blind-spot monitoring, auto-dipping headlights, cornering lights and an 'active safety brake' device.

Count on keyless entry/start, hill start assist, side park assist, trailer stability control, grip control with hill descent assist also being part of the package.

The new connectivity highlights include wireless smartphone charging and Citroen's latest 3D connected navigation and telematics unit, which might be restricted to the European market. The infotainment system seen at the international launch combines an 8.0" touchscreen with voice recognition and smartphone mirroring (Android Auto, Apple CarPlay and MirrorLink).

The cabin has come in for a full-scale workover, with Citroen pointing to the modern design, more upmarket (and hardwearing) materials, improved ergonomics and clever new storage solutions. A variety of sliding doors and rear panel, tailgate or glazed swing door options are available, the latter including a hinged rear roof flap that is designed to assist electricians and other tradespeople when carrying long objects such as ladders.

The powertrains available in Europe are a 1.2L PureTech petrol – producing 82kW when combined with a six-speed manual, or 97kW with an Aisin-sourced eight-speed automatic – and two BlueHDi diesels: a 97kW 1.5L offered in manual and automatic guise; and a 1.6L unit in 56kW and 75kW tune, both restricted to a five-speed manual only. ▲

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MERCEDES-BENZ V6 X-CLASS X350D

THE flagship V6 diesel-powered version of Mercedes-Benz's X-Class dual cab ute has begun arriving in Australian showrooms, launching in two model variants – Progressive and Power.

Whereas the four-cylinder versions rely on Nissan-sourced turbo-diesel powerplants, the X350d, as the luxury brand's V6 ute is known, uses Mercedes' own 3L single-turbo oil-burner that develops 190kW of power at 3,400rpm and 550Nm of torque from 1,400rpm through to 3,200rpm.

It is paired exclusively with Benz's 7G-Tronic Plus seven-speed automatic transmission (with steering wheel shift paddles and a fuel-saving automatic engine idle-stop feature) and drives all four wheels on a full-time basis via the German manufacturer's 4Matic permanent 4WD system with low-range reduction gear and a rear differential lock.

These are all important additions as they help further differentiate the X-Class from its donor vehicle, the Nissan Navara, which uses the same four-cylinder engines and other powertrain and driveline components – but has no access to Mercedes' V6.

Provisional figures based on European spec indicate that the X350d will have a 2,285kg kerb weight and 965kg payload, based on its 3,250kg gross vehicle weight (GVW). It can accelerate from 0-100km/h in a claimed 7.5 seconds, and return combined-cycle fuel economy of 9L per 100km.

As well as the rear diff lock, the 4Matic system includes a centre differential that distributes torque between the front and rear axle on a 40:60 per cent ratio during normal driving conditions. There are three drive modes: the road-oriented 4MAT, which continuously varies torque distribution; 4H, which locks in a 30:70 front/rear split and is better suited to low-traction off-road surfaces; and 4L, which holds firm at 50:50 for use in tougher crawling-speed conditions.

Off-road stats point to 222mm of ground clearance, a fording depth of up to 600mm, approach/departure angles of 30°/25° respectively, ramp breakover angle of up to 22° and a maximum tilt angle of up to 49°.

Mercedes' Dynamic Select system also offers selectable driving modes that modify engine response and transmission shift points (not suspension settings). These include comfort, eco, sport, manual and off-road modes.

While generally mimicking the high level of specification with the equivalent four-cylinder variants, the X350d has arrived with a more sophisticated 'active' lane keep assist system, meaning it will apply the brakes automatically and manoeuvre the vehicle back into position if the driver unintentionally veers out of a lane. This is a step up from the current system which uses only pulsed vibrations through the steering wheel to warn the driver.

Fuel consumption comes in at 7.9L/100km. (They also have a six-speed manual option and, on Progressive, a cab chassis rear end.)

As per Navara, the X-Class has a ladder-frame chassis with independent double-wishbone front suspension and multi-link solid axle at the rear – coil springs are used at both ends – along with ventilated disc brakes at the front and vented discs at the rear, too, where the Nissan uses drums. ▲

TOYOTA HILUX

Toyota Australia has introduced an upgrade for its top-selling HiLux, headlined by a diesel particulate filter (DPF) switch for all diesel-powered models.

This is an important mechanical tweak that allows the driver to initiate a manual 'burn off', which unclogs the DPF, addressing concerns raised by tradies and other owners typically based in city areas who have faced unexpected repair bills stemming from a system failure.

The DPF works by capturing fine particles before they are emitted through the exhaust and regularly burning them off at extremely high temperatures.

This occurs automatically in normal operating conditions via the engine's electronic control unit, or ECU, but if the vehicle spends most of its time doing short trips at low speeds, the system might rarely get to a high enough temperature for automatic filter regeneration (burn-off). As a result, the DPF can become overloaded and lead to failure.

A warning is now given to the driver, who can use the manual DPF switch to initiate a burn-off.

The switch is now a feature on all diesel-powered HiLux variants, including both the 2.8L and 2.4L engines.

Toyota has also introduced revised front end styling for its HiLux SR and SR5 extra cab and dual cab models, grafting the premium bumper and grille from the upmarket Rogue variant launched earlier this year.

The redesigned front end has a large trapezoidal grille with honeycomb insert and outboard fog lamps.

The latest update to HiLux also brings with it some slight improvements to fuel economy of select SR and SR5 variants with a six-speed automatic transmission. On 4x2 RS and SR5 automatic models, the official combined-cycle consumption drops 0.2L per 100km to 7.9L/100km, while equivalent 4x4 variants come in at 8.4L/100km (down 0.1L). ▲

NEW MAHINDRA PIK-UP VARIANTS

Niche Indian brand Mahindra is pitching its broader range of Pik-Up utes right at the trades, with a 'Tradie Pack' headlining on a new S6 4x2 single cab chassis variant priced from $23,990 drive-away.

Mahindra Automotive Australia says the pack was developed in direct response to trade customers, adding a general purpose aluminium tray, Bluetooth phone connectivity and cruise control for an extra $2,000 over the entry level S6, which continues from $21,990.

Bluetooth and cruise was previously only available on the top-spec S10, while the factory approved aluminium tray was included among the various fit-out options developed for the vehicle.

Three other new variants have also arrived to bolster the budget ute line-up. This brings the entire range to nine variants, topping out at the S10 4x4 dual cab with tub.

As with the remainder of the Pik-Up range, the new variants use the latest version of Mahindra's 2.2L four-cylinder 'mHawk CRDe' turbo-diesel engine that delivers 103kW of power and 330Nm of torque (available from 1,600-2,800rpm).

There is still no automatic transmission available, meaning all variants rely on a six-speed manual gearbox. An Eaton rear differential lock is fitted across the range, while 4x4 versions use a BorgWarner-sourced part-time four-wheel drive system.

All Pik-Ups are fitted with dual front airbags, hill descent control, electronic stability control, rollover mitigation and ABS brakes with electronic brake-force distribution.

Standard equipment on S6 runs to projector headlights, fabric seats with vinyl inserts, air-conditioning, tubular side steps and 16-inch steel wheels with 245/75 R16 tyres.

Maximum braked towing capacity is 2.5t, while payload ranges from 1,470kg to 1,070kg. ▲

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Cutter blade shears the metal between the anvils




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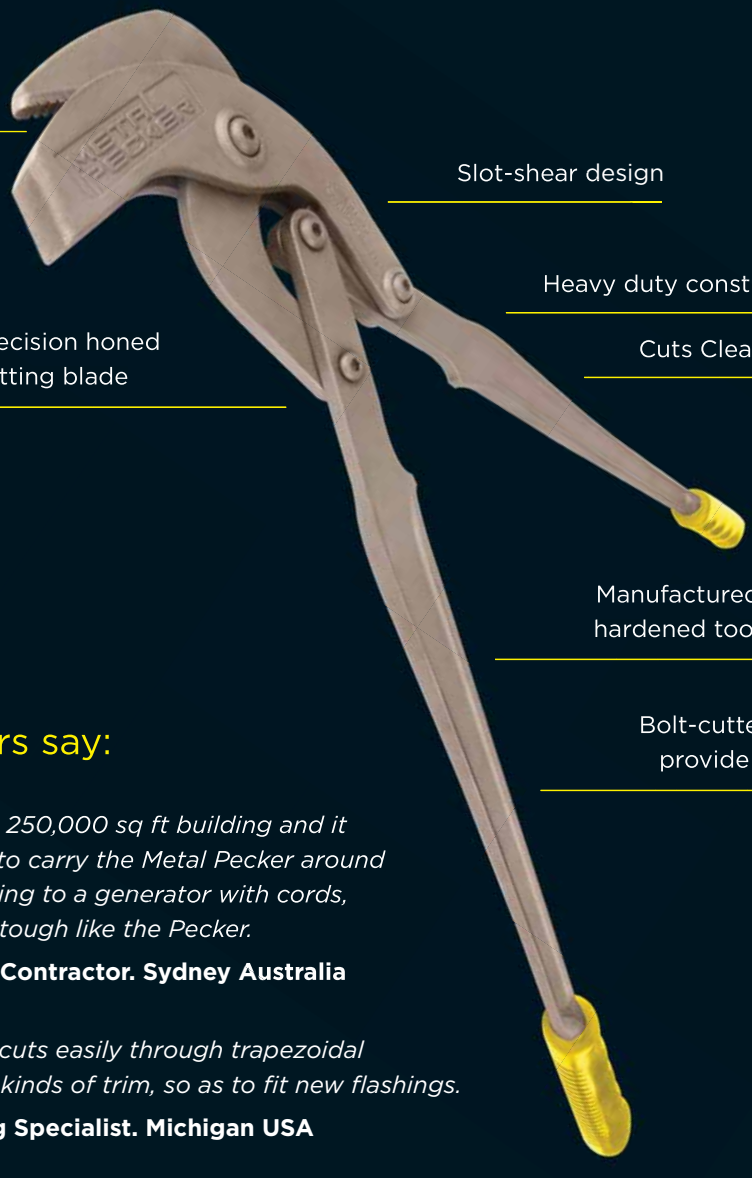

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HOLDEN COLORADO Z71 XTREME

Holden has released a new limited-edition flagship version of its Thai-built Colorado one-tonne ute, dubbed the Z71 Xtreme and equipped with a host of additional equipment to boost its off-road credentials.

Following in the muddy footsteps of Toyota's HiLux Rugged X and now able to access the most difficult of job sites, the Z71 Xtreme is based on an Australian-designed concept of the same name shown at the Bangkok motor show a couple of years ago, and carries into production many of the accessories used on the show special.

Priced at $69,990 driveaway, the Xtreme doesn't come cheap, but Holden claims it has more than $19,000 worth of extra equipment and genuine accessories that justify the increase in price over the donor Colorado Z71 dual cab, which tops out at $57,190 plus on-road costs.

These include what Holden is claiming is a best-in-class winch – fully integrated with winch bar and heavy-duty bash plate, and offering a 10,000lb load capacity and 30m synthetic line – along with upgraded front suspension, high-performance LED front light bar, vehicle recovery kit and 18" (265/60 R18) Goodyear Wrangler all-terrain tyres.

There is a roof tray kit, rear steel step built into the bumper, full towing package (offering up to 3.5t braked capacity), soft tonneau cover and, of a more cosmetic nature, black grille, bonnet bulge, fender flares, black tubular side steps, black extended sports bar, Colorado branding on the tailgate and Xtreme decals on the rear flanks.

The powertrain remains unchanged, with the 2.8L 'Duramax' four-cylinder common-rail turbo-diesel remaining in service with 147kW of power on offer (from 3,600rpm) and, given this is only available with an automatic gearbox, 500Nm of torque (from 2,000-2,200rpm).

The transmission in question is the familiar six-speed auto with 'Active Select' sequential manual gear selection, driving through a part-time four-wheel-drive system.

Holden has advised that the extra components add about 150kg to the vehicle, giving a useable payload of around 850kg. The Xtreme's GVM (3,150kg) and maximum front (1,450kg) and rear axle mass (1,850kg) remain the same as a Z71.

Other headline features common to high-series (LTZ/Z71) Colorado variants include a MyLink infotainment system with 8.0" colour touch screen, satellite navigation and premium audio, remote vehicle start, climate-control air-conditioning, leather upholstery and electric/heated front seats.

All Colorados come with seven airbags as standard, and as a crew cab the Xtreme includes rear park assist and a reversing camera.

Other safety features include automatic headlights, an electronic stability control system that incorporates various other headline items (ABS brakes, electronic brake-force distribution, rollover mitigation, traction control, hill start assist, hill descent control and trailer sway control), while top-end variants such as this one add more technology such as front park assist, forward collision alert, lane departure warning, tyre pressure monitoring and rain-sensing windscreen wipers. ▲

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SSANGYONG MUSSO

South Korean brand SsangYong is making a comeback to Australia after switching from its previous independent distributor to its own factory operation – and the new-generation Musso ute is leading the charge.

Full local specifications were still to be confirmed at the time of writing, but SsangYong senior management in both Korea and Australia were promising to bring a highly competitive model range to market, pitched at the lower end of the high-volume 4x4 pick-up segment.

Pricing will start from $30,3490 for the EX with a manual transmission, with auto adding $2,000. Two higher-series auto-only grades will also be offered in ELX and Ultimate guise.

All models will be covered by a seven-year/unlimited-kilometre warranty (including seven years' roadside assistance) and, right from the get-go, high-level safety technology such as autonomous emergency braking and forward collision warning.

The Musso nameplate – which is Korean for 'rhino' – is familiar in Australia, harking back to the mid-size SUV sold under both the SsangYong and Daewoo brands in the 1990s using technology sourced from Mercedes-Benz. The ute version was dubbed the 'Musso Sports' before being renamed 'Actyon Sports' in 2007. It was never a big player but soldiered on for several years before finally disappearing from the market in 2016.

The new-generation Musso is based on SsangYong's Rexton body-on-frame large SUV and, as with its predecessor, will only be available as a five-seat dual cab that offers plenty of interior space and a decent tray size, which on the standard version measures 1,300mm long, 1,570mm wide and 570mm high. A long-wheelbase version is also expected to be available early next year, adding 400mm in load bed length.

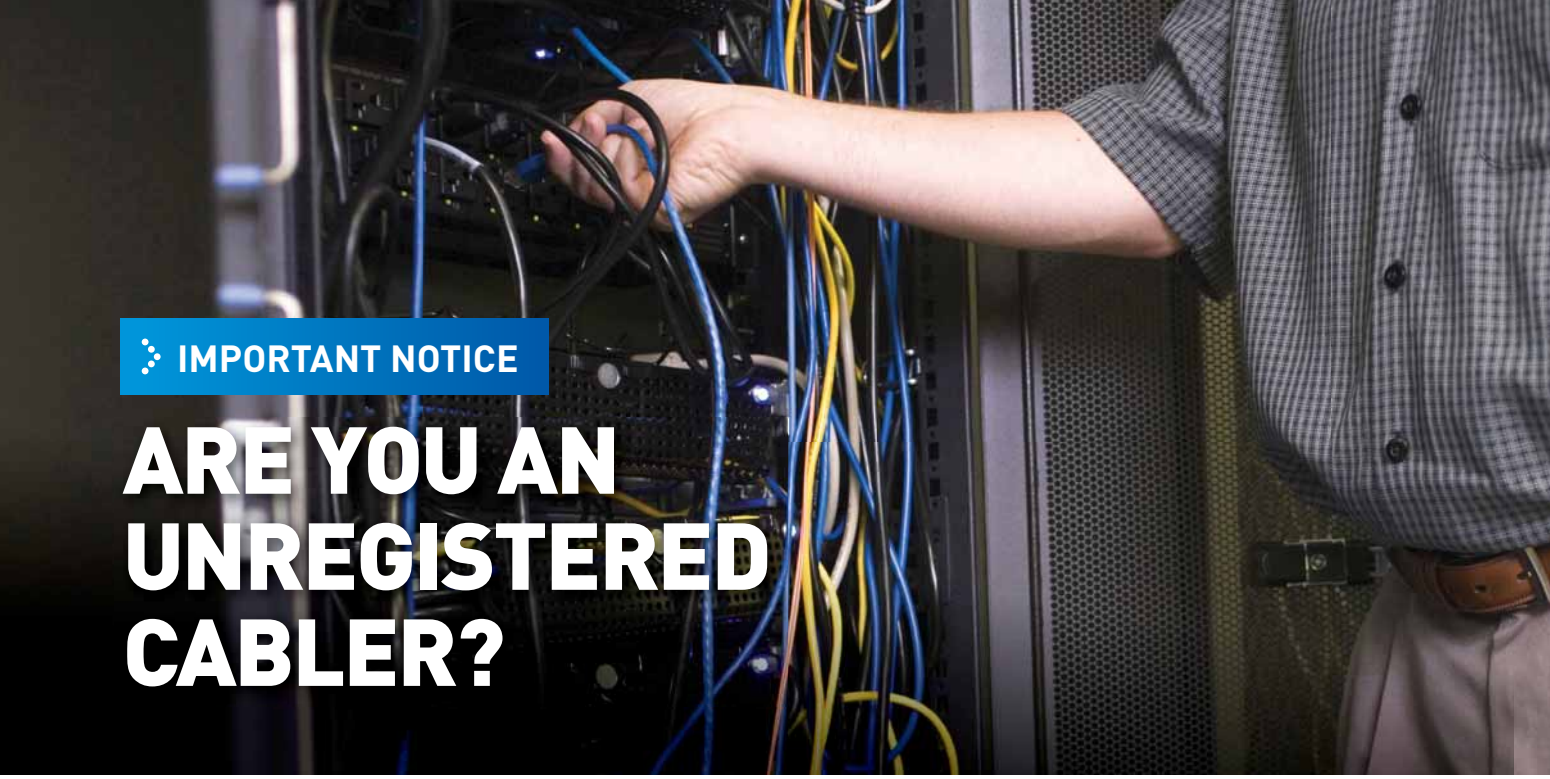
Musso will launch in Australia with a 2.2L 'e-XDi220' four-cylinder turbo-diesel engine developing 133kW of power at 4,000rpm and 400Nm of torque from 1,400-2,800rpm, driving through a six-speed manual or Aisin-sourced six-speed automatic transmission and a part-time 4x4 system.

Preliminary figures point to fuel economy of 7.9L/100km on the combined cycle for the manual, or 8.6L/100km with the auto, which looks about right considering the kerb weight ranges from 2,080kg to 2,192kg, depending on the model grade.

Payload is listed at 688-800kg, which is less than the full one tonne, but this could change with the availability of a leaf spring rear suspension compared to the standard coil spring set-up. Australian-specific suspension tuning is also anticipated.

Braked towing capacity will be 3,000kg, although SsangYong Australia says it is working with suppliers to homologate for a 3.5t rating.

The Musso measures 5,095mm long, 2,175mm wide, 1,840mm high, and rests on a 3,100mm wheelbase. Ground clearance is 215mm, while the maximum braked towing capacity is 2,800kg for the manual and 3,000kg for the auto. As well as the extra traction afforded by the 4x4 system's high and low range, electric hill descent control and hill start assist will be fitted. ▲



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BOSCH G SERIES INTEGRATED ACCESS PANEL

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START DATE	LOCATION
22/11/2018	Welshpool

BOSCH SOLUTION 6000 INTRUSION ALARM PANEL

This course covers the features, functionality and programming of the Bosch Solution 6000 alarm panels. This course DOES NOT cover basic intruder detection installation and participants must possess a knowledge of security system installations before they attend.

START DATE	LOCATION
21/11/2018	Welshpool

BOSCH SOLUTION 2000/3000 INTRUSION ALARM PANEL

This course covers the features, functionality, and programming of the Bosch Solution 2000 & 3000 intrusion panels. At the conclusion of this course, participants will be able to install and program the Solution 2000 & 3000 panels along with their most common accessories.

START DATE	LOCATION
20/11/2018	Welshpool

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ELECTRICAL CONTRACTOR TRAINING PROGRAM (ECTP) - ELECTRICAL CONTRACTORS NOMINEES/IN-HOUSE LICENCE, ELECTRICAL CONTRACTORS BUSINESS LICENCE

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START DATE	LOCATION
26/11/2018	Jandakot
3/12/2018	Jandakot
10/12/2018	Joondalup

DESIGN AND INSTALL GRID CONNECTED PHOTOVOLTAIC SYSTEMS

This course delivers the requisite training to licensed electricians for the design and installation of grid-connected photovoltaic systems and associated equipment required for Clean Energy Council Accreditation. It provides detailed knowledge and practical skills in the design and installation, set-up, test, fault find, repair and maintenance of grid-connected photovoltaic systems. The Units of Competency can contribute to the completion of relevant Certificate III, Certificate IV, Diploma and Advanced Diploma qualifications from the UEE30811 Electrotechnology Training Package.

START DATE	LOCATION
26/11/2018	Jandakot
10/12/2018	Jandakot

UEENEEF102A INSTALL AND MAINTAIN CABLING FOR MULTIPLE ACCESS TO TELECOMMUNICATION SERVICES (OPEN CABLER REGISTRATION)

This nationally-endorsed course provides applicants with the training, skills and knowledge required to meet the Australian Communications Media Authority (ACMA) Open Cabler Registration.

START DATE	LOCATION
1/12/2018	Joondalup

BATTERY STORAGE FOR GRID-CONNECTED PV SYSTEMS

This course delivers the requisite training in the design and installation of battery storage for grid-connected PV systems. It provides detailed knowledge and practical skills for the design, installation, fault-finding and repair of battery storage systems for grid-connected photovoltaic systems. Completion of this course meets the requirements for Clean Energy Council Battery Storage endorsement that will be applied to existing CEC Design and Installation of Grid-Connected PV Systems Accreditation.

START DATE	LOCATION
19/11/2018	Jandakot

UEE20111 CERTIFICATE II IN SPLIT AIR-CONDITIONING AND HEAT PUMP SYSTEMS

This nationally endorsed qualification provides participants with the training and knowledge to install, commission and de-commission single head split air conditioning and heat pump systems to a prescribed routine, where the maximum plant capacity for each system does not exceed 18kWr. It includes wall hung, floor, and ceiling suspended, cassette and ducted fan coil split and water heating heat pump systems.

START DATE	LOCATION
3/12/2018	Jandakot

10145NAT COURSE IN ELECTRICIAN - MINIMUM AUSTRALIAN CONTEXT GAP TRAINING

This course provides the Minimum Australian Context Gap training to holders of an Offshore Technical Skills Record (OTSR) for the UEE30811 Certificate III in Electrotechnology Electrician qualification.

START DATE	LOCATION
10/12/2018	Joondalup

www.training-diary.com.au

Be included in the *Electrical Connection* Training Diary for **FREE**

Email paulskelton@build.com.au

GSES
www.gses.com.au

INSTALL ONLY GRID CONNECT PV SYSTEMS WITH BATTERIES

This course comprises online material including theory, quizzes, and written answers; and a three-day practical component including theory revision and the hands-on installation of a battery system, testing, commissioning and programming selected multi-mode inverters.

START DATE	LOCATION
14/11/2018	Sydney
27/11/2018	Brisbane

DESIGN AND INSTALL GRID CONNECT PV SYSTEMS

This course consists of two main components: online theory completed at students' own pace and the face-to-face (3 days) component held at the GSES Training Facility in Botany, Sydney. Electricians must complete both the online and practical components to be eligible for CEC Provisional Design & Install Grid-Connected PV Systems Accreditation.

START DATE	LOCATION
20/11/2018	Brisbane

DESIGN AND INSTALL GRID CONNECT PV SYSTEMS WITH BATTERIES

This course comprises online material and a system design task; and a three-day practical component including theory revision and the hands-on installation of a battery system, testing, commissioning and programming selected multi-mode inverters.

START DATE	LOCATION
14/11/2018	Sydney
27/11/2018	Brisbane

INSTALL ONLY GRID CONNECT PV SYSTEMS

This course has been designed to address the PV grid-connect market in Australia and is ideal for electricians who wish to expand their knowledge and skills. The delivery mode of this course is designed for busy tradespeople who do not have the time to attend face-to-face courses to gain relevant qualifications. With a fully flexible web-based format, the online course allows students to complete the theory in their own time.

START DATE	LOCATION
20/11/2018	Brisbane

CLIPSAL
www.clipsal.com/training

C-BUS BASIC

This course is an entry level training course designed for consultants, electrical contractors, system integrators and partners who wish to learn how to install and program C-Bus. The course will equip trainees with the skills to work with C-Bus products and become involved with the concept of commercial and residential automation.

START DATE	LOCATION
27/11/2018	Eagle Farm
27/11/2018	Malaga
3/12/2018	Sydney Olympic Park
4/12/2018	Notting Hill

C-BUS AUTOMATION CONTROLLER

This course is designed for electrical contractors, consultants and apprentices who wish to learn how to do basic programming of the C-Bus network automation controller.

START DATE	LOCATION
21/11/2018	Gepps Cross
6/12/2018	Macquarie Park
11/12/2018	Notting Hill

CCTV Security Systems

Matchmaster security systems are suitable for home, offices including small business applications. These systems use the latest technology in IP and network video recording offering full HD 1080P all the way to 4K high resolution. These systems come in wired and wireless configurations with high grade video processing and recording capacity up to 24TB (6TB x 4HDD)

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www.matchmaster.com.au

NECA EDUCATION & CAREERS
www.necaeducation.com.au

CONSTRUCTION WIRING

Construction wiring is a specialised area providing regulatory, industrial relations and cost challenges for contractors. Successfully managing these challenges requires comprehensive skills and knowledge of the relevant Australian and industry standards to ensure compliance and eliminate risks.

START DATE	LOCATION
3/12/2018	Carlton North

CPR+LVR

This course allows you to gain the skills and knowledge that will keep you safe, should you need to perform a low voltage rescue and CPR on a mate or colleague until the professionals arrive.

START DATE	LOCATION
21/11/2018	Carlton North

ELECTRICAL INSTALLATION TESTING

Electricians and RECs have a legal obligation to test and certify that their electrical work complies with relevant standards. It is essential that you or your employees have the essential testing skills so that you can test and sign off on COES with confidence.

START DATE	LOCATION
14/11/2018	Carlton North
5/12/2018	Carlton North

FIRST AID

This course provides the skills and knowledge required to provide first aid response, life support, management of casualty(s), the incident and other first aiders, until the arrival of medical or other assistance. The course includes performing CPR and providing basic emergency life support.

START DATE	LOCATION
26/11/2018	Laverton North

STRUCTURED AND COAXIAL CABLING

Do you need more knowledge on how to structure telecommunications infrastructure? Or want to expand your skills to include Cat5/6/7 and service pay TV/smart TVs? This course builds on the knowledge gained during your Open Registration course to give you greater insight and detail in structuring telecommunication infrastructure and installing, terminating and testing coaxial cabling.

START DATE	LOCATION
24/11/2018	Carlton North

REGISTERED ELECTRICAL CONTRACTOR (BUSINESS)

If you want to start your own electrical contractor business then this course is for you. The course sets out the knowledge and skills required to ensure regulatory, technical, occupational and workplace relation requirements are met in conducting a contracting business.

START DATE	LOCATION
24/11/2018	Carlton North

SAFE WORK PRACTICE (SWP)

Brush up on your knowledge before you go for your electrical licence. This component prepares you for the SWP component, plus you can book your assessment at the same time.

START DATE	LOCATION
15/11/2018	Carlton North
14/12/2018	Carlton North

A GRADE REFRESHER

This refresher covers all your main obligations and highlights the changes to current laws to make sure you are up-to-date and current

START DATE	LOCATION
20/11/2018	Carlton North

ESTIMATING ELECTROTECHNOLOGY PROJECTS - FUNDAMENTALS STAGE 1

Estimating is a key component in establishing a successful contracting business. Knowing what to charge is only part of the equation. Knowing how long a job will take and what is involved in developing a quotation for a job is critical. This course reviews the methods and procedures commonly used in estimating plus more.

START DATE	LOCATION
14/11/2018	Carlton North

STRATEGIC LEADERSHIP

This course will help you to develop practical tools and techniques you need to plan for the future of your team or contribute to the organisation's future plans. You will understand the power of a good vision and how to turn the vision into reality through well-crafted strategies and plans that are measurable and achievable.

START DATE	LOCATION
21/11/2018	Carlton North

GRID CONNECT

This course provides licensed electricans with the skills to design, install, set-up, test, fault find, repair and maintain grid conencted photovoltaic systems and the associated equipment

START DATE	LOCATION
30/11/2018	Carlton North

EFFECTIVE COMMUNICATION SKILLS

Effective communication is a fundamental skill for most roles in an organisation. This course will help you to understand the key elements of communication and how to improve your own communication style.

START DATE	LOCATION
28/11/2018	Carlton North

LICENSED ELECTRICAN THEORY (LET)

Brush up on your knowledge before you go for your electrical licence. This component prepares you for the LET component PLUS you can book your assessment at the same time.

START DATE	LOCATION
27/11/2018	Carlton North
10/12/2018	Carlton North

LICENSED ELECTRICIAN PRACTICE (LEP)

Brush up on your knowledge before you go for your electrical licence. This component prepares you for the LEP component PLUS you can book your assessment at the same time

START DATE	LOCATION
22/11/2018	Carlton North
3/12/2018	Carlton North

For more training dates visit

www.trainingdiary.com.au

Brush up on your knowledge & sit your LEA's before the new wiring rules come in!

NECA Education & Careers run LEA tutorials so you can brush up on what you need to know to sit the LEA exams. Plus you can book your assessment at the same time! Visit out website for dates and cost.

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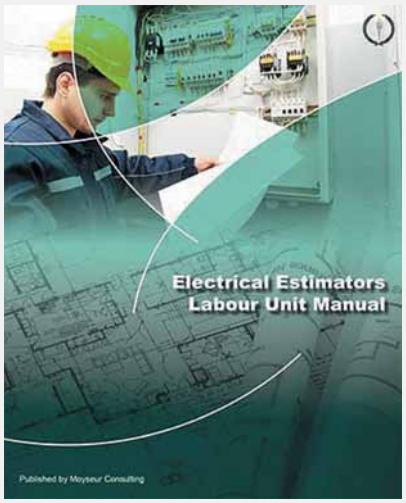


ELECTRICAL ESTIMATOR'S LABOUR UNIT MANUAL 14TH EDITION

This labour unit manual has been produced to assist contractors to allow a realistic labour allocation to their jobs. These units have been developed over a number of years using actual time studies. This publication also includes a CD estimating spreadsheet and templates for calculating hourly charge out rates and minor installation quotations.

Written by Brian Seymour,
Electrical Connection contributor.

$120.00 .....CODE 583

ELECTRICAL WIRING PRACTICE VOLUME 1 & 2

Volume 1 and 2 of Electrical Wiring Practice has beenupdated to provide guidance in the use of the Australianand New Zealand Wiring Rules, AS/NZS 3000:2007, including the 2009 Amendments. Taking a practical approach,this book employs clear visual tools to illustrate the knowledge and practices required by specified products and the Standards.

$186.95 .....CODE 086

POCKET SPAN TABLE BOOK

Updated and expanded, the 2007 edition of this popular publication is a must-have for students. The 330-page Pocket Span Table Book continues to be presented in an easy to carry pocket sized durable and spiral bound format. Included are new span tables for MGP10 and Treated F7 seasoned softwood, and LVL and I-beam floor joists, as well as new bracing installation details and nominal fixing requirements.

$35.95 .....CODE 635

SOLAR HOT WATER

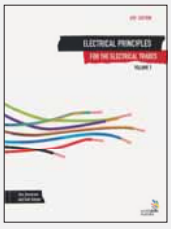
This booklet gives you an understanding of solar hot water heaters and the most common models and their features. It also covers retrofits, size and site locations, including mains pressure versus low pressure, collectors, tanks, boosting and freeze protection, warranties, rebates and Standards.

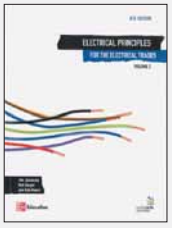
$16.95 .....CODE 589

ELECTRICAL PRINCIPLES FOR THE ELECTRICAL TRADES: VOLUME 1 & 2

VOLUME 1: Ideal for electrical apprentices, the 6th edition of Electrical Principles for the Electrical Trades is the first volume of a two-volume set. Written by two TAFE/VET teachers, the book looks at the fundamental knowledge required to become a successful electrician. A portion of the proceeds from this book will go to WorldSkills Australia.

VOLUME 2: Volume 2 of Electrical Principles for the Electrical Trades explores the electrical applications of the principles learned in Volume 1. This is an excellent learning resource for electrical apprentices and teachers, as well as being a suitable long-term reference for tradespeople. A portion of the proceeds from this book will go to WorldSkills Australia.





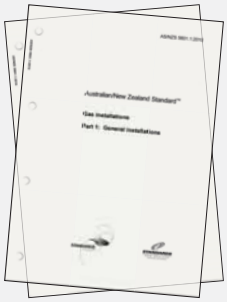
$136.00 .....CODE 085

ELECTRICAL INSTALLATION STANDARDS

NEW GAS INSTALLATION STANDARD PLUS AMDTS

PART 1: GENERAL INSTALLATIONS (A)
PART 2: LP GAS INSTALLATIONS (B)

After six years, the building industry can breathe a little easier with the release of the updated AS/NZS 5601. It highlights minimum requirements for the design, installation and commissioning of gas installations and provides 'deemed to comply' solutions to promote uniform Standards. If you work with gas, this revised Standard is vital.



$305.00 UNTIL SOLD OUT .....CODE 489A
$205.00 UNTIL SOLD OUT .....CODE 489B

AS/NZS 3017:2007

VERIFICATION GUIDELINES

This Standard provides testing procedures and inspection guidelines to ensure that an electrical installation complies with the requirements of AS/NZS 3000 with regard to the prevention of a fire or preventing a person from receiving an electric shock. It includes tests for earth continuity, insulation resistance, polarity and incorrect circuit connections, fault-loop impedance and operation of residual current devices.

$155.95 UNTIL SOLD OUT .....CODE 127

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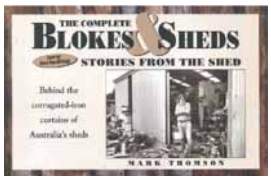
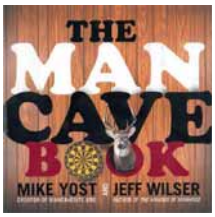
THE COMPLETE BLOKES AND SHEDS



The Complete Blokes and Sheds "goes to the heart of what's sacred to many Australian men. Like the dunny (outside toilet), the footy game (football), and the meat pie with sauce, the shed has acquired an important place in Australian culture and mythology. It stands as a symbol of the Aussie male's integrity and a testimony to his ability to fix anything with a length of fencing wire, a hammer and a piece of 2 x 4.

$45.00 .....CODE 534

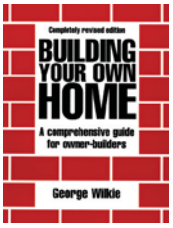
THE MAN CAVE BOOK



The Man Cave Book is a tribute to great and glorious man spaces and the craftsmen behind them. Complete with instructions and insights into creating your own unique refuge and shrine to beer, sports, and everything else that's right with the world, this is an essential manual for any man cave enthusiast.

$39.95 .....CODE 550

BUILDING YOUR OWN HOME

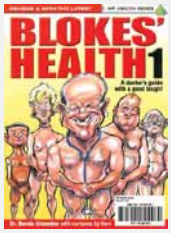


This complete guide to building your own home covers every step of the process. It explains how to select land and gives design guidelines, outlines the roles of professional consultants and the workings of control authorities, offers advice on preparing working drawings, details a who's who of subcontracting and the supply industry and includes detailed drawings showing how all the components are assembled to achieve the desired result. An indispensable guide to building your own home.

$45.95 .....CODE 760

THE ONLINE STORE FOR TRADIES

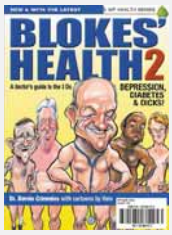
BLOKES HEALTH



This is an absolute gem of a publication and a valuable resource for men of all ages. Written by Dr Bernie Crimmins, Blokes Health provides extremely useful health advice in a simple manner. There aren't many books you can buy that could actually SAVE YOUR LIFE!

$19.95 .....CODE 394

BLOKES' HEALTH 2



Following in the footsteps of Dr Bernie Crimmins original best-seller, Blokes' Health: comes Blokes Health 2. We all want to live as long as and as healthy as we can, with good quality of life. In this book Dr Bernie Crimmins outlines the main health problems that affect males and gives some simple advice on how to prevent, or detect early, those particular diseases which may lead to an early demise.

$19.95 .....CODE 671

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WIRELESS LIGHTING CONTROL: FIT FOR A CONTENDER

When the Chicago Cubs embarked on the $500 million restoration and expansion of historic Wrigley Field, they looked to Audacy to help bring the iconic venue into the modern age.

Starting with the Clubhouse, Audacy developed a customised, app-driven wireless lighting control system that allows the Cubs to create custom lightscapes which can easily shift between day, night and celebration settings.

"The Clubhouse itself had some very unique features that we wanted to make sure lighting control could handle," says Carl Rice, VP of Wrigley Field Restoration and Expansion, "and we found that the Audacy product was a perfect match".

While superior player comfort and performance was the organisation's goal, an intuitive system that was easy to install, configure and maintain was the engineers' goal. Thanks to Audacy, both have been achieved.

"The Audacy system has given us flexibility even beyond the original scope of the project," says Carl Rice. As well as significant cost and energy savings well into the future.

"The system has been terrific," said Crane Kenney, President, Chicago Cubs Business Operations.

Having chosen a 100+ year-old company to take their 100+ year-old ballpark into the future, the Cubs now trust Audacy to light their new office building and guest suites.

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