

## Session 5: Wiring Rules Revision

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The Wiring Rules affect your businesses every day. Whether you are an electrical contractor or an electrical engineer, the changes to each clause in a revision of the Wiring Rules affect your compliance with State legislation.

The new and revised Wiring Rules should be ready for publishing by May/June 2018. Is your business prepared for these amendments?

This workshop is intended to provide an opportunity to work through those amendments clause-by-clause and discuss the reasoning with the Chair of the Wiring Rules committee. This will also provide a unique insight into the actual intent behind the amendments.

A finalized draft was issued for Public Comment early in 2016. This is a predetermined part of the standards development process and not surprisingly it is named the Public Comment phase. Yes, that is right each one of the electrical industry stakeholders, from the biggest businesses to the one-man show, had an opportunity to review and provide comment for the Wiring Rules committee to consider.

Over 2000 comments have been received and reviewed by the committee who have resolved these as an “agreed”, “not agreed” or “noted” comment. You may not get what you wanted but you have a right to view the resultant committee decision after this resolution process. Incidentally there have been many comments that make plenty of sense but further work is needed to refine them, so these we are consigning to Amendment 1.

The document is being readied for Committee Ballot. The committee may or may not accept the document for various reasons and any negative votes must be reconciled before it moves to a publishing phase.

There are over 200 changes that will be presented at the conference and there is a preponderance of technical updates that are essential for you to be aware. Let's get started on the major changes for each section.

### ***Part One, Section One - Scope, application and fundamental principles***

Part One of the Wiring Rules is the overriding guide for the application of the sections two to eight within Part Two but I bet that very few have been through this Part. It provides essential requirements or fundamental principles that can be used to be to depart from the “deemed to comply” requirements of Part 2. This Part can be used as a safety and performance method of achieving the requirements for any installation. Although this does require stringent documentation and negotiation with the state regulator before you could use this means of compliance. It is essentially a “design” solution!

This Part holds all the definitions for words or phrases used throughout the Wiring Rules. We have added around thirty new definitions to support the clarity required on technical issues and to provide for the new appendices that are being added, such as electric vehicle charging, arc fault detection and switchboard guidelines. The safety services section requires many definitions so that the reader can appreciate the nuances of the requirements.

An issue that has been discussed quite a lot is the disruption of supply to an installation especially where it affects the aged and infirm, so this has been added as a recommendation to consider reliability of supply in the design phase.

Alterations and repairs have always been considered under one heading but there needs to be better definition of how the two are different so there is was a bit of a change made to help clarify the situation.

To finish off, if you were to choose a Part One solution then you would need to provide a label at the switchboard alerting any persons working within that installation that all may not be what it seems from an electrical point of view.

### ***Part Two, Section Two – General Arrangement, Control and Protection***

Quite a few changes in this Section have been considered. An important consideration is that of main switches. These are invaluable in protecting the installer when working on circuits within an installation, that ability to lock off is so important. To that end a main switch must be manually operated in a single mechanical action using a knob, lever or push-button or the like. Electronic touch screens, programmable control systems or the like shall not be used as a means of operating main switches.

The main change is to the application of RCD's in domestic installations. This has been done with consideration of the impact that RCD's have had on the reduction in electrocutions within Australia. But there are still a few circuits within those installations that do not need an RCD for protection and use mechanical protection instead. Unfortunately, these circuits need to be considered as one with the protection by an RCD due to several instances of electrocution over the last few years.

All final sub-circuits in a residential installation, no matter the amperage or number of phases, are to be 30mA RCD protected. In general, the changes made now require fixed or stationary electrical equipment, such as a hot water service, cooktop, oven or range to be protected by a 30mA RCD. This is a good call and the whitegoods manufacturers support this as they now use elements that do not cause excessive earth leakage. Far better to have RCD protection than not!

In non-residential installations, all final sub-circuits, up to and including 32A, multi-phase and lighting, are to be 30mA RCD protected. There are however two scenarios to this requirement.

If the electrical equipment is fixed wired direct in that installation, meaning that it cannot be moved unless by skilled persons (wiring disconnection), the requirement for an RCD is a consideration only.

If the electrical equipment is plug and socket connected in that installation, meaning that it can be unplugged and moved by unskilled persons (inadvertent damage to the equipment and insulation may occur, as well as unsafe equipment being plugged into the socket), the requirement for an RCD is a mandatory one.

There are several exceptions to the non-residential installations that exist already but a new one has been added. If the owner/operator deems that a piece of electrical equipment must not be exposed to nuisance tripping, as it may cause economic or personnel disruption for example, then the RCD can be left off the final sub-circuit. As with any of these exceptions it is required to have over-current protection at the switchboard, mechanical protection of the cable, wiring connection marked to state that RCD protection is not provided.

Where a whole switchboard is being upgraded to replace existing protection then that switchboard is to be brought up to date with RCD protection.

A repair is a like-for-like replacement and as such does not require the installation of an RCD for that final sub-circuit. This extends to a replacement of an existing socket-outlet with a multi-socket-outlet, as it is deemed to be a point for maximum demand calculations no matter the number of socket-outlets on the one fixed wired device. The replacement of halogen lights with LED lighting is also seen as a repair.

An alteration however is a change to the existing final sub-circuit and as such requires a 30mA RCD at the switchboard (or a 30mA socket-outlet RCD at the start of an extended circuit).

Home-care medical installations are now referred to AS/NZS 3003 Electrical Installations – Patient Areas rather than duplicate information between both installation standards.

It is understandable that there will be a massive restructure of the RCD Protection clause and all its parts.

Further to the above there are important changes to requirements for switchboards. Exit and egress facilities have been considered carefully by the committee, as there have been quite a few deaths and injuries of recent times due to arc flash at switchboards. The space around switchboards, including entry and exit door sizes, the distance between open doors or racked-out equipment and distances from accessible faces to walls, has now been increased to enable easier exit in case of emergency.

Technical details as to electric vehicle charging and required installation practices have been added in the appendices. Also, a new technology called arc fault detection (failure of insulation on cord extension sets and leads which could lead to arcing and subsequent fire) using an Arc Fault Detection Device

(AFDD) has been added in the appendices. Whilst both are recommendations at this stage it becomes apparent that any person looking at design and construct should consider installation of these devices where required.

### ***Part Two, Section Three – Selection and Installation of Wiring Systems***

A big one, this one, and I don't mean a huge technical change but it seems the discussion around coloured sleeving over conductors is a perennial issue and keeps raising its head. This time it was to do with white insulation on a cable becoming a "yellow" colour after a substantial period and thus causing concern that it may be inferred that the cable is an earth. Certainly, it was all sorted out but you will see some changes to help clarify the situation in this next revision.

With wiring systems, there was an allowance to have non-protected cable within 150mm of corners and this has now been removed. Having RCD protection on all circuits now makes the 50mm rule for cabling behind walls very effective.

There has been a lot of discussion centred on cabling for different electrical installations being within the same wiring enclosure, eg: cabling within conduits. This is not acceptable as the contractor may cut a conduit that he believes carries an electrical installation cabling that is not live. If there is another cable within for another electrical installation, then this leads to an unsafe situation. It is wise requirement to use different conduits or enclosures for different electrical installations.

A new standard for electrical conduits now exists, which is an adoption of an IEC standard, called AS/NZS 61386. This suite of standards is acceptable to be used in the Australian market as it is the same as the existing AS/NZS 2053 suite of standards. These will be marked with the Duty and will only differ through marking of the actual standard number.

Cable depth is always an issue and as such we have now included a diagram to show an embankment and the minimum depth from the surface of that embankment.

### ***Part Two, Section Four – Selection and Installation of Appliances and Accessories***

Appliances and accessories are a key to good installation practices and as such there are several changes made to these requirements.

An area that causes concern is zoning for the use of IP rated switches and socket-outlets in external applications. This has brought about a zone of 30 degrees from the horizontal from the edge of a verandah (facia or soffit) to the exterior wall where an accessory with no IP marking can be mounted within that triangular zone. The exterior wall below that triangular zone requires an accessory with a minimum IP23 to be mounted. There is an exception to this that meter boxes have always been IP23 minimum and over the years have proven to be weather-resistant so they may be installed on the wall outside of that triangular zone.

As we all are aware there have been many failures of d.c. isolating switches on solar systems over the last year or so and many were attributed to poor installation of switch enclosures and subsequent water entry and damage.

Drain plugs have been used in the normal electrical industry for many, many years to allow condensation to drain from inside without affecting the IP rating of the enclosure. So, we have added a clause explaining their use.

Soft wiring systems, as used in office partitions and the like, have always been a part of the industry but the rules have effectively been quiet on the topic. Now there will be specific requirements added for the installation of the soft-wiring systems (installation wiring connected by installation couplers) and their components.

For years there has been a push in the hotel market to provide different country configurations of socket-outlets in hotel rooms. This has become a point of contention as some would argue that these do not conform to Australian socket-outlet standards. That could not be further from the truth as other country configurations only need to comply with their national standards and the safety and performance requirements of our Australian standard. This has been clarified within the text.

The Australian standard for socket-outlets has never allowed data or TV sockets to be on the same plate as the socket-outlet. So, this has been included in the revision. Be aware that this doesn't preclude the USB charging sockets to be on a socket-outlet, as these only provide power, albeit extra-low voltage, to charge those smart devices, not to transmit data or TV signals.

With stoves and cooktops, it has been found that there is much confusion as to where the cooker switch and various socket-outlets and switches can be mounted. To this end, we have created a prohibited zone around and upwards of 150mm from each side of the cooktop to the ceiling or range-hood, whichever comes first or if there is nothing above, to a height of 2.5 metres. A new figure has been added to explain this in more detail.

I am sure you are all aware of the changes to recessed luminaires or downlights that have occurred over the last year or so. These details from the recessed luminaire standard have been added into the Wiring Rules so that all facets of the industry have the same detail. Now all downlights have a classification which can be easily understood by the wholesaler, the contractor, the specifier and the end-user and is marked on the product and on the packaging. The classifications range from the lowest rating of "Do not Cover" (no insulation around or above, not suitable for residential installation) to the highest rating of "IC-4" (insulation and combustible materials can abut and cover and does not allow air transfer from room to ceiling space or vice-versa).

Mounting of isolating switches adjacent to split-system air-conditioners has been part of the standard for quite a while and now we are including water heaters, and heat pumps in that. Remember that the isolating switch should be mounted adjacent to and not on the unit to be isolated.

Of recent times the AS/NZS 5601 gas Installation standard has been fully revised, so we have had to add to and expand some clauses to provide that update. Some notable changes are sources of ignition (switches and socket-outlets) are not to be mounted in prohibited zones, and the position of gas relief and vent terminals regarding accessory mounting.

### **Part Two, Section 5 – Earthing Arrangements and Earthing Conductors**

Whilst there are only a few major changes within this section it is all too important to stress the need for good electrical and mechanical earth bonding with metallic structures.

The requirements for MEN have been updated and provided with further detail to provide clarification and understanding to the reader.

There is one issue regarding outbuildings that has been confounding the committee and ultimately the contractor for too many years. To understand and clarify it has been necessary to provide detail as to an Individual and Combined outbuildings. If I can use the definitions to explain:

**Individual outbuilding:** A single structure containing a switchboard that is separated by an area of land from the structure containing the switchboard that supplies it. (was what we all knew as an Outbuilding)

**Combined outbuilding:** Two or more structures, sharing conductive reinforced foundations, conductive building frames or conductive roofing etc. and each containing a switchboard that is separated by an area of land from the structure containing the switchboard that supplies them.

There will be new figures added to provide detailed information on earthing and MEN requirements that should help even more.

Earth bonding of unprotected consumer mains also requires a further clarification and there are more details added to the clause with diagrams to explain the requirements.

Bonding of showers and bathrooms has been updated to include the different types of outbuildings and has had further figures added to explain. So too has there been a total restructure of the clause for bonding requirements for pools and spas. There is not too much added to the technical requirements but the clause now follows the installation process. A new figure is provided to help clarify the various installation requirements.

### **Part Two, Section Six – Damp Situations**

An area that was not previously covered was fish farms, believe it or not! The scope is altered to provide a bit of clarity as to the types of water-holding containers and the zones that the rules are concerned with.

It seems that there are numerous state-of-the-art plumbing accessories out on the market now and one that needed to be included was the flush

ceiling-mounted shower head. These fittings look great and tumble water directly down as if rain from heaven, so a new clause and diagram were added.

How the market changes? To that end we had to change the minimum storage capacity of laundry troughs to 40 litres from 45 litres, and spa pools to 680 litres from 500 litres. Pools are getting bigger so there is less space inside the home for troughs and laundry I guess!

Now this one will make you laugh but we had to put something into the exclusion zones for pools and water features about electricity distribution equipment and electricity generation systems because of some issues in Western Australia and Queensland.

Unfortunately, pools are put in to the home as the kids grow older which means that there can be distribution equipment, consumer mains, pits and domes, near the added pool. In Western Australia, kids were using one such dome as a diving platform, which is great except for the fact that if anything goes wrong then massive problems...water and electricity don't mix! In Queensland, it is quite common that an overhead consumer main runs across the pool area, luckily high enough that kids don't Tarzan off it, but nonetheless still very dangerous.

The changes affect the swimming pool industry as now it is a requirement that the pool installer must check location of such and if the pool can't be moved or redesigned, then the distribution equipment must be moved from the exclusion zone before installing the pool. Similarly, and this affects the electrical contractor, any electricity generation equipment must be located away from the pool exclusion zones.

### ***Part Two, Section Seven – Special Electrical Installations***

Grid-connected inverter systems and alternative supplies have been considered due to the influx of these systems within the market. Wind and solar generation of electricity must be governed by the voltage that it may impose on the network and kept within constraints to ensure that power quality on the grid is not affected.

There has been a total restructure of Clause 7.2 Safety Services to help the reader in understanding the requirements of the section. For too long there has just been further detail added to the section in various clauses and it is up to the reader to find the necessary requirements of various types of installations.

To this end the restructure has separated each of the relevant types of installations with its own requirements without having to refer to other clauses within the section. Therefore, if you want to find out the requirements for "air-handling systems" or "main switches", just head to the relevant clause and all of them are there. This will be a great change and help the installer no end.

## ***Part Two, Section Eight – Verification***

Whilst the changes to this section are minor to some extent and do not change the requirements dramatically there has been a need to stress that verification process is not to place the operator, people in the vicinity and the test equipment at risk.

There has been a restructure and addition of relevant technical detail to the clauses on insulation resistance and testing of low voltage. This will help to clarify the requirements with a new clause added for testing of extra-low voltage.

Two areas that have had a major overhaul are Earth Fault Loop Impedance (EFLI) testing and operation of RCD's. These changes will provide clarity on test procedures and requirements.

## ***Appendix A – Referenced Documents***

This appendix is Informative and lists all the referenced standards within the Wiring Rules.

## ***Appendix B – Circuit Protection Guide***

This appendix is Informative and is a guide only. There has been a change to Table B1 "Circuit Route Lengths based on Earth Fault Loop Impedance" to add more information as to voltage drop values.

## ***Appendix C – Circuit Arrangements***

This appendix is Informative and is a guide only. Table C1 has been updated to add Electric Vehicle Charging Stations and Table C2 has clarified the requirements for Thermal Heating Elements in equipment.

## ***Appendix D – Minimum Sizes of Posts, Poles and Struts for Aerial Line Conductors***

This appendix is Informative and is a guide only. There are minor changes.

## ***Appendix E – Electrical Installation Requirements in National Building Codes***

This appendix is Informative and is a guide only. There have been updates incorporated and the Classifications of buildings, Class 1 to Class 10, have been added.

## ***Appendix F – Installation of Surge Protective Devices***

This appendix is Informative and is a guide only. A recent update was undertaken by the standards committee that handles the development of Protection against Lightning standards.



### ***Appendix G – Degrees of Protection of Enclosed Equipment***

This appendix is Informative and is a guide only. There is no change.

### ***Appendix H – WS Classification of Wiring Systems***

This appendix is Informative and is a guide only. There is no change.

### ***Appendix I – Protective Device Ratings and Metric Equivalent Sizes for Imperial Cables Used in Alterations, Additions and Repairs***

This appendix is Informative and is a guide only. There is no change.

### ***Appendix J – Symbols Used in this Standard***

This appendix is Informative and is a guide only. There are minor changes.

### ***Appendix K – Switchboard Guidelines***

This is a new appendix and is Informative and provides the requirements for building and verifying a switchboard. There is a need for contractors to understand the specific requirements for switchboards. This appendix has been reinstated from a previous edition of the Wiring Rules but has been updated to reflect latest practices and the recently published AS/NZS 61439 series of Switchboard Assembly standards. If you are involved with switchboard or panel board design, manufacture or installation this is a must use appendix.

### ***Appendix L & M – Electric Shock Survival***

These appendices were for Australian and New Zealand resuscitation techniques and were found to be outdated to some degree. It was agreed to delete both appendices as there are now Occupational Health and Safety requirements for recurring resuscitation training.

### ***Appendix M – Reliability of Supply***

This is a new appendix and is Informative and is a guide only. It provides recommendations for continuity of supply after natural and man-made disasters, especially for the vulnerable persons. This appendix provides something to consider in the design of installations and the reliability of the supply to that installation in the event of disaster.

### ***Appendix N – Electrical Conduits AS/NZS 2053 Series and AS/NZS 61386 Series***

This is a new appendix and is Informative and is a guide only. It provides details as to these standards that will run in parallel for electrical conduit. The latter standard AS/NZS 61386 is an adopted standard from Europe but has the same testing requirements and will be marked with the same duty ratings as the AS/NZS 2053 electrical conduits.

### ***Appendix O – Arc Fault Detection Devices (AFDD)***

This is a new appendix and is Informative and is a guide only. It provides details on the Arc Fault Detection Device and its installation. Effectively the AFDD senses any arc fault in cables, whether a series or parallel arc. Flexible cords are especially prone to being squashed in door jambs and behind beds and this can cause the copper conductors to fracture either in the active or neutral core or across the active and neutral core.

As you can imagine this is a very small arc that is created but the ramifications are that it can lead to fire and serious losses. The AFDD will disconnect the offending circuit when it senses the arc. These devices are especially good for protection of bedroom areas, timber framed homes and places of storage.

### ***Appendix P – Electric Vehicle (EV) Charging***

This is a new appendix and is Informative and is a guide only. It provides details on the electric vehicle charging socket-outlets and their installation. The different modes of charging from the wall mounted socket-outlet to the high-current direct d.c. charging stations are explained fully.

### ***Appendix Q – D.C Power Installation Guidelines***

This is a new appendix and is Informative and is a guide only. It provides details on the installation of d.c. power applications. Although some d.c. power requirements are detailed within the Wiring Rules, it was seen that there should be more specific guidelines added for the installer due to the trend that we have seen overseas for some installations to be run directly from d.c. supplies, e.g.: data centres run direct from PV systems.

Well, there you go a bit of an overview of the changes that have been agreed for the AS/NZS 3000 Wiring Rules revision. May/June 2018 seems far off still, but we are now closer than ever!