The University of Sydney
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The Home Modification:
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Electrical Safety in Bathrooms: Summary Bulletin

Prepared by:

The Home Modification Information Clearinghouse Project Team

Authored by
Lara Oram

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Electrical Safety In The Bathroom

There has been much confusion and discussion regarding the prescription and installation of hand held showers in bathrooms. According to the amended Australian Standard 3000:2000, Clause 7.1.2.1 (Standards Australia/Standards New Zealand, 2000, pg 172), a shower curtain is now considered a partition along with screens, doors and fixed partitions, which should "provide effective protection against spraying water." In this amendment zoning measurements are now taken from the fixed plumbing connection, not the end of the hand held shower hose. Whilst shower curtains are the preferred partition for the accessibility of showers, they are not as effective as other barriers such as fixed partitions and therefore questions have been raised. One question refers to the need to relocate all general power outlets (GPO) and light switches outside bathrooms to prevent accidental spray from hand held showers and condensation seeping into GPOs or light switches. Another issue is the safety of light fittings or luminaires, and the popular three in one heater/light and exhaust, when located in a bathroom with a hand held shower. There are no clear answers to these queries, however, safety can be maintained even with a hand held shower in place, by following the Australian Standards and ensuring installations are approved by a licensed electrician. Electricians say that a good test for electrical safety with hand held showers is to test the distance of the water spray when the barrier is in place. If the jet spray can reach a GPO or switch even with the barrier, then they should not be in the bathroom and should be relocated. Furthermore, as installing a safety switch, modifying switches or repositioning switches are considered to be the last line of defence for protection against electrocution, these, particularly safety switches, should not replace basic electrical safety principles.

When modifying bathrooms some of the relevant electrical Australian Standards to consider are as follows:

AS/NZS 3000:2000
Wiring rules
AS 60529:2004
Degrees of protection provided by enclosures (IP Code)
AS 1939 Supp 1-1990
Degrees of protection provided by enclosures for electrical equipment (IP Code) – Wallchart 1
AS 1939 Supp 2-1990
Degrees of protection provided by enclosures for electrical equipment (IP Code) – Wallchart 2
AS/NZS 3194:1993
Approval and test specification – electric shaver supply units
AS/NZS 3194:1993/Amdt 1:1995
Approval and test specification – electric shaver supply units
AS/NZS 3112:2004
Approval and test specification – Plugs and socket-outlets
AS/NZS 3100:2002
Approval and test specification – General requirements for electrical equipment

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Bathroom Zones

According to AS/NZS 3000:2000 (Standards Australia/Standards New Zealand, 2000) bathrooms are divided into four zones.

Zone 0: the interior area of the base of a bath or shower

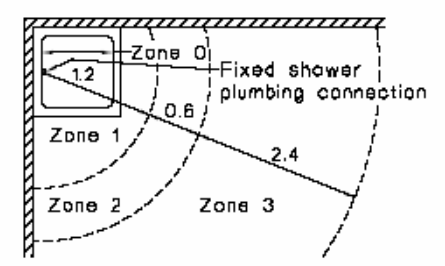
Zone 1: a). for a bath, extends from the internal rim of the bath above zone 0 to the ceiling or 2.5m above in a horizontal plane (whichever is lower).

b). for a shower over a bath, zone 1 extends to the vertical plane 1.2m radius from the shower fixed plumbing connection.

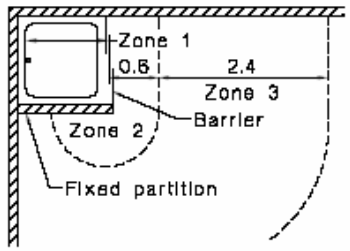
c). for a shower, includes the area from the vertical plane 1.2m radius from the shower fixed plumbing connection between floor and ceiling or to 2.5m horizontal plane above the floor (whichever is lower).

Zone 2: the area limited by the vertical plane external to zone 1 and the parallel vertical plane 0.6m external to zone 1, and between the floor and horizontal plane 2.25m above the floor.

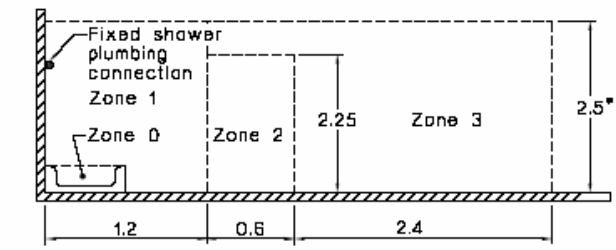
Zone 3: the area limited by the vertical plane external to zone 2 and the parallel vertical plane 2.4m external to zone 2, and between the floor and ceiling or the horizontal plane 2.5m above the floor (whichever is lower).



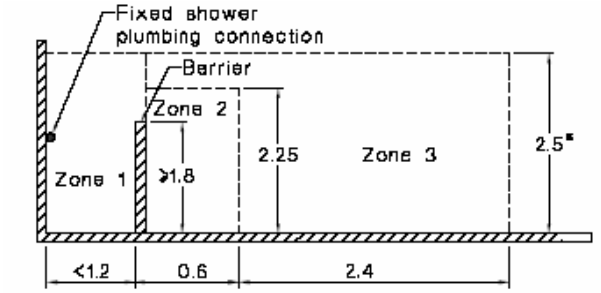
Shower without fixed partition or barrier



Shower with fixed partition and barrier



Shower without barrier



Shower with barrier

Socket outlets are not permitted in zones 0 and 1. Socket outlets are not permitted in zone 2 unless they are incorporated in a shaver supply unit or are Residual Current Detectors (RCD) protected and in a cupboard with no specific IP rating (refer to Waterproofing switches section for explanation of IP rating). For zone 3, sockets are not permitted if they are in less than 0.3m of the bathroom floor, but are permitted if they are in more than or equal to 0.3m of the bathroom floor with RCD protection.

Switches are not to be installed in zone 0. Switches are not permitted in zones 1, 2 and 3 in less than 0.3m of the bathroom floor, but are permitted in zones 1 and 2 if they are more than or equal to 0.3m above the bathroom floor with IPX4. In zone 3 however, switches in more than or equal to 0.3m of the bathroom floor do not need a specific IP rating.

Luminaires with an IPX4 are only permitted in zones 1 and 2, whereas those in zone 3 do not need a specific IP rating.

Refer to AS/NZS 3000:2000 for more detail.

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Safety Switches

Electricity will find the easiest path to the ground. In the worst case, this route could be through the water stream from a hand held shower coming into contact with a GPO. The Technical Regulator of South Australia found that the major causes of electrical shocks in the period between 2002-2003, were 41% from electrical faults, and 18% from contact with live parts (Office of the Technical Regulator, 2004). There was also a continued upward trend in electrical shocks reported in South Australia between the periods 1994-2003 which reinforces the importance of educating the public and maintaining high standards (Office of the Technical Regulator, 2004). Legislation, brought in July 1990, requires that new housing construction in NSW must be fitted with safety switches (Australian Bureau of Statistics, 1999) and "since 2000 they have also become mandatory on lighting circuits of new houses" (NSW Department of Fair Trading, 2001). The concern for older homes is that they may not have a safety switch installed and the concern for new homes is that bathrooms modified with hand held shower hoses are utilised before a safety switch is installed. According to the Consumer Products Safety Commission (Alliant Energy, 2004), deaths from electrocution in and around the home could be reduced by 50 percent if every household used Ground-Fault Circuit-Interrupters (GFCI). GFCIs or RCDs are now required in homes for bathroom applications. According to AS/NZS 3000:2000, Clause 7.1.4.2 (Standards Australia/Standards New Zealand, 2000), any socket outlets in locations where the floor is likely to become wet "must be protected by a RCD with a maximum rated residual current of 30mA." RCDs minimise the risk of electrocution and fire by detecting "current leakage to earth (residual current) through the body…and disconnecting the power within 300 milliseconds" (Government of South Australia, 2004). "An RCD does not prevent electric shock…but will respond rapidly to current through the body and will trip the supply before fibrillation has time to set in" (Maxwell Adams, 1994).

There are three types of safety switches:

1. Switchboard mounted safety switches monitor fixed wiring and electrical appliances throughout the house. These need to be installed by an electrician and are mandatory in domestic premises.
2. Safety switches that replace existing power points and protect appliances that are plugged into that socket. These also need to be installed by an electrician.
3. Portable safety switches, essential for indoor or outdoor use when working with electrical appliances that are not protected by a safety switchboard or by a safety switch power point (ActewAGL, 2002).

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Weatherproofing Switches and Power Outlets

In addition to safety switches, weatherproof switches (refer to Table 1) can provide a higher level of safety, particularly when utilizing a hand held shower hose, with the risk of direct spray onto a light switch or GPO, and seem to be a cheaper alternative to relocating switches. Weatherproof, however, does not mean waterproof and they do not eliminate the need for having a safety switch or RCD in place, and following basic electrical safety principles. When considering weatherproof switches and GPOs, refer to the supplier and AS 1939 Supp 1-1990 for Ingress Protection (IP) ratings. Ingress Protection rating refers to the degree of resistance a fitting has to foreign solid objects and water. The first digit in the IP rating refers to foreign solid objects such as dust and the second digit refers to water protection. For example, IP65 would have complete protection against entry of dust and protection from a low pressure jet of water from all practicable directions.

Ingress of Solid Foreign Objects		Ingress of Water	
X	Protection unspecified (untested)	X	Protection unspecified (untested)
0	Non-protected	0	Non-protected
1	Protection of the back of the hand against accidental access to hazardous parts, and protection of equipment against objects larger than 50 mm	1	Protection against drops of water falling vertically
2	Protection of fingers against access to hazardous parts, and protection of equipment against objects larger than 12.5 mm	2	Protection against drops of water falling vertically when the object is tilted by up to 15° from its normal position in any direction
3	Protection of persons holding tools or wires (larger than 2.5 mm diameter), and protection of equipment against objects larger than 2.5 mm (e.g. ball bearings)	3	Protection against spraying water at up to 60° from the vertical
4	Protection of persons holding small tools or wires (larger than 1 mm diameter), and protection of equipment against objects larger than 1 mm (e.g. ball bearings)	4	Protection against splashing and spraying water from all practicable directions
5	Protection against entry of dust in sufficient quantity to interfere with satisfactory operation of equipment	5	Protection against a low pressure jet of water from all practicable directions
6	Complete protection against entry of dust	6	Protection against heavy seas or a strong jet of water from all practicable directions
		7	Protection against temporary immersion
		8	Protection against continuous submersion (tests subject to agreement, but no less severe than second numeral 7)

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There are a number of products that could be used for weatherproofing switches and power outlets in conjunction with a safety switch or RCD in place. Note: this is not an exhaustive list.

Table 1: Comparison of weatherproof switches and sockets

Product	Image	IP Rating	Comments	Advantages	Disadvantages
Clipsal 2000 series and C2000 Classic series (2031V66)		IP66	they consist of a waterproof membrane, which is a rubber seal between the switch dolly and the mechanism.	- designed for wet areas - completely protected against dust and protected against jets of water of similar force to heavy seas - prevent the need for relocating light switches - similar to a standard switch -wet fingers are not a risk	may be more difficult for someone with limited finger dexterity to function with the rubber seal

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Product	Image	IP Rating	Comments	Advantages	Disadvantages
HPM standard size weatherproof switch		IP56	they consist of a waterproof membrane between the switch dolly and the mechanism.	-protected against quantities of dust that could interfere with satisfactory operation and protected against jets of similar force to heavy seas - prevent the need for relocating light switches - similar to a standard switch	may be more difficult for someone with limited finger dexterity to function with the rubber seal
Clipsal 31VHWP Weatherproof Flush Switch		IP54	the switch plate is a translucent rubber membrane.	protected against quantities of dust that could interfere with satisfactory operation and protected against splashing water from all directions.	- the press-button switch may be more difficult for someone with limited finger dexterity to function - designed for outdoors - aesthetics

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Product	Image	IP Rating	Comments	Advantages	Disadvantages
Clipsal 223H weather protected enclosure		IP23	translucent cover	protected against solid objects larger than 12mm and protected against spraying water at up to 60° from the vertical when not in use	not sealed at joint
HPM WS44 series Aqua Weatherproof Utility Boxes and Enclosures		IP23	can be surface or flush mounted	protected against solid objects larger than 12mm and protected against spraying water at up to 60° from the vertical when not in use	not sealed at joint
Clipsal 25EL30 Bodyguard Safety Power Point				- useful for appliances in wet areas - monitors balance of current flow and cuts off when irregular	not a weatherproof socket

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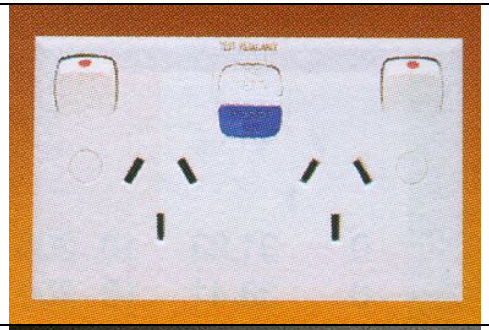
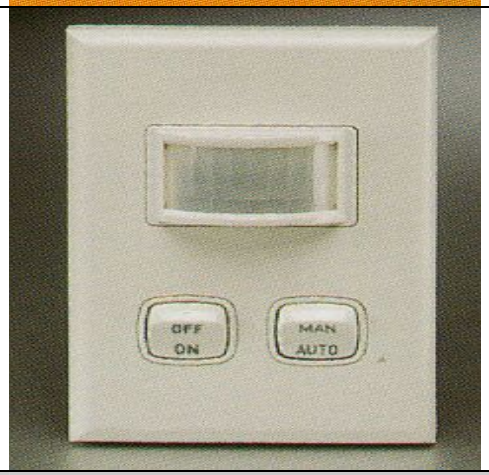
Product	Image	IP Rating	Comments	Advantages	Disadvantages
HPM Electresafe Safety Power Point				- useful for appliances in wet areas - monitors balance of current flow and cuts off when imbalances occur	not a weatherproof socket
HPM XL632 Automatic Light Switch			operated by an infrared motion detector	provides hands free light switching and therefore, no risks of water contact from wet hands	not weatherproof
Ceiling Mounted Pull-down Mechanisms			cord-like mechanism to control lights and heaters	can function with wet hands without the risk of electrical shock	- the terminal is still exposed to moisture - possible cord contamination after exposure to moisture

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Product	Image	IP Rating	Comments	Advantages	Disadvantages
Receptacle Caps			Suppliers state that outlet caps are designed as a deterrent for children attempting to insert objects into a GPO, not as a means of waterproofing the GPO. "The devices are designed to protect individuals from accidental shock resulting from the insertion of foreign objects" (Currall, 1995)	tamperproof	- not weatherproof or resistant to water spray - **should not** be used in the bathroom as a device to prevent water seepage into sockets

Table 1: Comparison of weatherproof switches and sockets

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Light Fittings

Ceiling lights in bathrooms usually require a covering or light fitting as a general rule of thumb, as water coming in direct contact with the light globe can cause the globe to explode. The Electrical Safety Office in Queensland suggests that a light globe located in zone 3 of a bathroom with a hand held shower in place (Note: according to AS/NZS 3000:2000, luminaires in zone 3 do not require an IP rating), needs a covering but does not necessarily require a waterproof enclosure as in outdoor lighting.. Therefore, a light fitting with a complete enclosure surrounding the light globe may be the safest option for a bathroom. Nevertheless, some waterproof outdoor lights look less industrial and may be an option for bathroom application.

Wall Mounted Heaters & Heaters/Lights & Exhaust

Wall mounted heaters face the same safety issues as light globes. They are not waterproof and cannot be waterproofed and hence, can only be safely applied in zone 3 of the bathroom. The three-in-one heater/light and exhaust, on the other hand, do not have a zoning restriction as the wiring is above the ceiling and therefore, out of the wet area zone. Australian Standards (2000) confirms this in Clause 7.1.4 of the Wiring Rules: “electrical equipment recessed into a ceiling such that all live parts are above the lower surface of the ceiling is considered to be outside any zone immediately below the ceiling.” Nevertheless, direct spray on any open light globe such as that from a hand-held shower could cause the glass to ‘explode.’ In the presence of a three-in-one heater/light and exhaust or a wall mounted heater, therefore,
a safety switch needs to be in place and general electrical safety precautions need to be adhered to.

Home Automation/ Sensor Switches

Motion sensor switches enable hands free operation of lights and are activated by infrared motion detectors. They, along with sound activated switches, eliminate the risk of water coming into contact with the light switch via wet hands. The sensor detects motion or sound, switches the light on and will usually remain on for a pre-programmed length of time. Remote controlled switches also permit safe use of bathroom switches. Sound and movement activated switches or remote controlled switches also eliminate switch deterioration from continual contact and are an alternative for individuals with reduced mobility and limited finger dexterity.

Feasibility of Relocating Light Switches and Socket Outlets

Most people prefer to have a GPO in the bathroom to carry out self-care activities such as hair drying and shaving, however, relocating GPOs and light switches may ultimately be the safest option. Electricians comment that relocation is a simple process

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depending on where the switch is to be repositioned. The main cost involved in relocating a switch is the labour cost charged by the Electrician.

Shower Curtains

Weighted shower curtains, with weights sewn into the hem of the curtain, provide a more effective barrier to water spray, than ordinary curtains. The weights help the curtain to stay in place, thus reducing the amount of water escaping the recess and also prevent the curtain from swaying into the shower recess and 'sticking' to the body. There are also shower curtain systems that have a magnetic catch for holding the curtain taut at the wall.

Suppliers, Contractors & Information Sources

Note: This is not an exhaustive list.

Clipsal Australia Pty Ltd	Weatherproof switches & heater/exhaust/light combinations. **Phone:** (02) 9794 9200 **Fax:** (02) 9790 7660 **Email:** plugin@clipsal.com.au **Website:** www.clipsal.com.au
Come Inside Homeware	Weighted shower curtains **Phone:** (03) 9369 9441 **Fax:** (03) 9369 9442 **Email:** service@comeinside.com.au **Website:** www.comeinside.com.au
HPM Industries Pty Ltd	Weatherproof switches, safety switches **Phone:** 1300 369 777 **Fax:** 1300 369 780 **Email:** sales@hpm.com.au **Website:** www.hpm.com.au
Independent Living Centre NSW	Product information, supplier details and advice **Phone:** 1300 885 886 **Fax:** (02) 9890 0966 **Email:** help@ilcnsw.asn.au **Website:** www.ilcnsw.asn.au
IXL Appliances	Heaters, heater/exhaust/light combinations **Phone:** (03) 5222 2922 **Fax:** (03) 5221 8219 **Email:** service@ixl.com.au **Website:** www.ixl.com.au
Jaeco International	Weighted shower curtains **Phone:** (02) 9526 1604 **Fax:** (02) 9525 1274 **Email:** josi-ane@jaeco.com.au **Website:** www.jaeco.com.au
National Electrical Contractors Association	Information on and details for licensed electrical contractors **Phone:** (08) 8272 2996

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Office of the Chief Electrical Inspector	Technical regulator responsible for electrical safety in Victoria **Phone:** (03) 9203 9700 **Fax:** (03) 9686 2197 **Email:** info@ocei.vic.gov.au **Website:** www.ocei.vic.gov.au
Office of the Technical Regulator	Electrical enquiries for South Australia **Phone:** (08) 8226 5500 **Fax:** (08) 8226 5529 **Website:** www.technicalregulator.sa.gov.au
Pajaka Design & Technology	Shower curtains with magnetic catch **Phone:** (02) 9816 2103 **Fax:** (02) 9816 2103
PDL Electrical Products	Weatherproof switches, safety switches **Phone:** 1300 735 266 **Fax:** 1300 735 329 **Email:** help@pdl.com.au **Website:** www.pdl.com.au
Powerpac Products Pty Ltd	Weatherproof switches, safety switches **Phone:** (03) 9882 6499 **Fax:** (03) 9804 0978 **Email:** sales@powerpac.com.au **Website:** www.powerpac.com.au
Queensland Electrical Safety Office	**Phone:** 1300 650 662 **Fax:** (07) 3237 0229 **Website:** www.eso.qld.gov.au
Tee Zed Products	Receptacle caps **Phone:** 9386 4000 **Fax:** 9386 4999 **Email:** info@tee-zed.com.au **Website:** www.tee-zed.com.au

Bathroom Electrical Safety Checklist

When modifying a bathroom and deciding upon the safest option for the client, consider the following:

- has the home been installed with a safety switch?
- is the client aware of the general electrical safety principles and the dangers associated with using hand held shower hoses around electrical fittings?
- is the client likely to accidentally spray the switches or light fittings?
- is the client showering with the partition in place?
- can the client use a waterproof switch with a rubber seal?
- what are the costs of modified or weatherproof switches?
- is the client likely to be non-compliant with general electrical safety precautions, eg. would the client flick a switch with wet fingers?
- are there risks of falls and confusion if switches were relocated, eg. entering the bathroom whilst forgetting to switch on the external light switch?
- what are the costs of relocating switches?
- will the client be able to utilise a home automation system?
- what will be the changing needs or future needs of the client?

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