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Summary Bulletin

Electrical Safety in Bathrooms

PEER REVIEWED

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Contribution of Authors

This is the second edition of the Summary Bulletin: Electrical Safety in Bathrooms, replacing the original publication of the same name, authored by Lara Oram (2005).

Joanne Quinn undertook the research for this second edition. She developed the content, and formatted and wrote the Summary Bulletin.

Catherine Bridge provided guidance for the bathroom electrical safety information contained in this document. She also reviewed the Summary Bulletin document.

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This document retains some of the general structure of the original publication by Lara Oram. The Bathroom Electrical Safety Checklist section from the original document remains substantially unchanged in this edition.

Illustrations by Andrew Fowkes and Michelle Svenger.

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Glossary

GPO	General Purpose Outlet (power point)
Hand-held shower	A shower handset connected by a flexible hose to the fixed plumbing (water) outlet.
Open-plan shower area	A shower space that is continuous with the main bathroom floor, without a hob, step, or recess.
PELV	Protected by Extra-Low Voltage
RCD	Residual Current Device (also known as ground-fault circuit-interrupter [GRCI])
Safety switch	See **RCD**
SELV	Safety Extra-Low Voltage
Wet area	The area of the bathroom intended to be used for bathing or showering, and subjected to water.
Wet room	See **Open-plan shower area**

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Background

The design of bathrooms has undergone considerable change in recent years. In particular, the size and layout of showers, combined with advances in the design of shower water controls and outlets, have been a major influence in contemporary bathroom design.

A large, open-plan shower area (also known as a 'wet room') is currently a popular inclusion in contemporary bathrooms, replacing the traditional, enclosed shower recess. Open-plan shower areas are characterised by their level entry, without a step or hob. They are larger in floor area than traditional shower areas, often 1200 x 1200mm, 900 x 1500mm, or more. Some open-plan shower areas are sufficiently large to not require a screen to contain water spray, though frameless or semi-framed glass screens are commonly used.

Adequate drainage is an important consideration for open-plan shower areas. The flow of water on the floor needs to be contained to the wet area, without the use of a step, hob or fixed screen. A trench or channel drain (Figure 1) could be more suitable than a traditional central drain. Sufficient gradient of the shower floor is also needed, to ensure water flows directly into the drain.

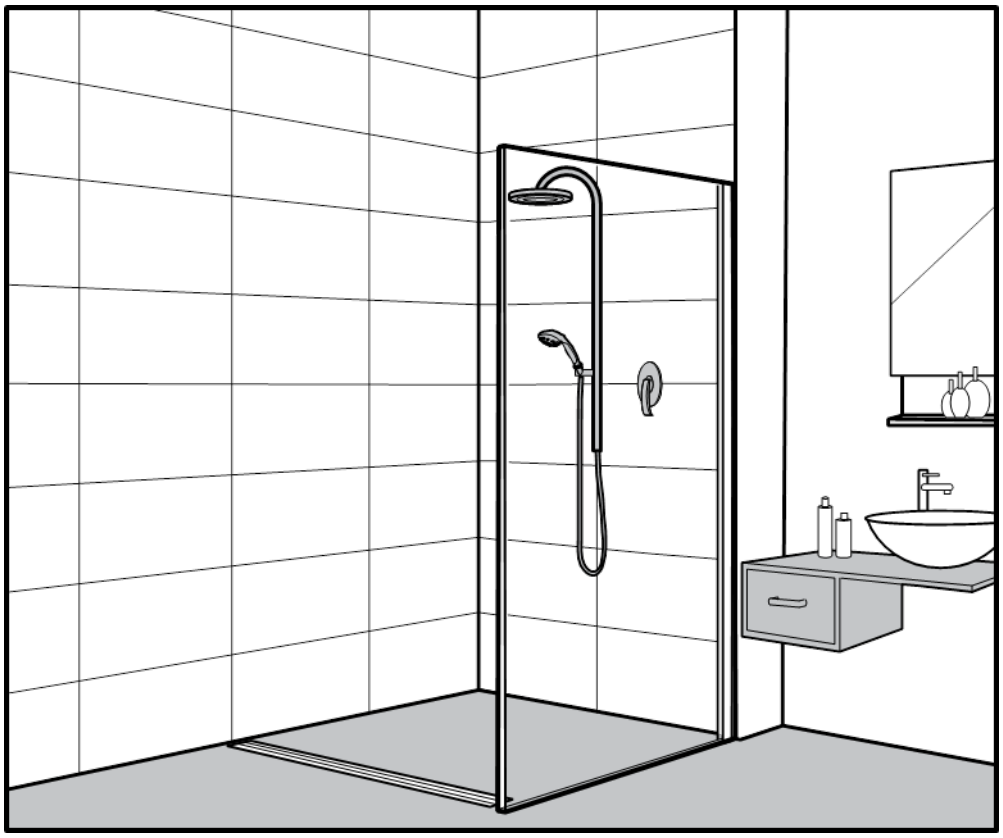

Figure 1 Open-plan Shower with Combined Overhead- and Hand-shower Outlets

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The advantages of open-plan shower areas include a visually larger bathroom and ease of cleaning, due to the continuation of the bathroom floor into the shower area. For residents with reduced mobility or requiring assistance with showering, an open-plan shower area provides the additional advantage of improved access for a carer, wheelchair, or assistive device. Open-plan shower areas are frequently prescribed in home modifications for people with disabilities.

The availability of a wide variety of shower water outlets, in addition to the traditional, wall-fixed outlet, has also had a significant effect on contemporary bathroom design. Water outlet options include ceiling-mounted and wall-mounted 'rain' showers, wall-mounted and multi-directional 'body' showers, and hand-held showers on a flexible hose. Water outlets can function on their own, or be combined in a shower system.

Hand-held showers have a variety of benefits due to control and localisation of water spray. They can make hair washing easier, particularly when wanting to avoid water getting into eyes or wetting the rest of the body. When hand-held showers are fastened to a slider on a vertical post, the shower outlet can be customised to suit the height of adults, children, and seated users. The inclusion of a hand-held shower is often a necessity for people with reduced mobility, particularly wheelchair users. It allows localised washing, and assists with showering by a carer.

Newer styles of shower outlets, in conjunction with an open-plan shower area, allow residents to increase their space for showering when required. However, this flexibility to increase the 'wet area' intended for showering has implications for electrical safety in the bathroom. The limited enclosure and lack of a recess or hob, in an open-plan shower area, require careful design, waterproofing, screening, and drainage, to ensure water is contained. The use of newer styles of shower outlets without an adequate shower barrier, particularly hand-held showers, can lead to water spraying beyond the designated wet area. This increases the risk of water coming into contact with electrical appliances, lights, switches, and power outlets.

When designing and constructing new bathrooms and major bathroom renovations, the designated wet area for an open-plan shower can be made sufficiently large, and electrical provisions custom-planned, to avoid the risks from water spray. However, when an open-plan shower area is being fitted as part of a home modification, the existing bathroom is generally smaller, and the location of appliances, power outlets and switches can be unsuitable. For the safety of residents and carers, measures need to be taken to ensure electrical devices will not be affected by water.

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Regulatory Requirements for Electrical Safety

There are a range of Standards relevant to electrical safety that need to be met when installing or modifying a bathroom (see Appendix 1). The primary Standard is:

AS/NZS 3000:2007 Electrical installations
(known as the Australian/New Zealand Wiring Rules)

For bathrooms, AS/NZS 3000:2007 takes a threefold approach for electrical safety: avoiding water contacting electrical devices, protecting electrical devices when water does come into contact with them, and cutting the electrical supply if devices are affected by water. The Standard separates the bathroom area into wet 'zones' based on proximity to the bath or shower water outlet. Each zone has special provisions for electrical safety. There are detailed requirements for the electrical devices allowed in each zone, and their location. The minimum resistance of those electrical devices to the penetration of water is also specified for each zone.

AS/NZS 3000:2007 requires the use of Residual Current Devices [RCDs], commonly known as 'safety switches', on new power and lighting circuits. In the bathroom, this affects all lights, power outlets [GPOs] and appliances. RCDs "are designed to provide additional protection against the effects of electric shock by automatically disconnecting (electrical) supply before serious physical injury can occur". RCDs are used "where excessive earth leakage current could present a significant risk in the event of failure of other measures of protection or carelessness by users"
(AS/NZS 3000:2007, cl 2.6.3.2.1-7).

Bathroom zones

AS/NZS 3000:2007 divides the bathroom into four zones, defined by their proximity to the water outlets for the bathtub and shower.

Zone 0	The area of the bathroom that would be submerged in water i.e. inside the bathtub or the recessed base of the shower.
Zone 1	The wet area of a bathtub or shower not submerged in water, but would be subject to water splashing or spraying during normal use. It includes the shower interior and the area directly above the bathtub.
Zone 2	Beyond the main wet area of the bathtub or shower, but would be likely to have water spray or splashing.
Zone 3	Area unlikely to be subject to water spray or splashing

The locations and dimensions of each zone for open-plan shower areas are outlined in Appendix 2.

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Required water resistance for electrical bathroom equipment

The degree of water-resistance for electrical equipment installed in the bathroom is specified with an 'ingress protection' [IP] code. The IP code for a device indicates its protection against access to hazardous parts, and its resistance to ingress of solid foreign objects and water, according to Standard AS 60529-2004.

IP codes are generally presented: **IP(first numeral)(second numeral)**
The second numeral in an IP code specifies resistance to water ingress; the higher the numeral, the greater the protection. For example, IPX4 provides protection against water splashing from all directions, and IPX7 provides protection against temporary immersion in water. Further explanation of water ingress in IP codes is provided in Appendix 3.

AS/NZS 3000:2007 sets the minimum water-resistance requirements for electrical equipment installed in each zone of domestic bathrooms. There are additional requirements for some types of electrical equipment, irrespective of their IP code. This minimum water ingress protection for each bathroom zone is outlined in Table 1.

Table 1 Minimum Water Ingress Protection in Bathroom Zones

Minimum Water Ingress Protection in Bathroom Zones		
Zone 0:	**IPX7**	**Protection against temporary immersion** - no power outlets permitted, irrespective of water-resistance - no switches permitted, irrespective of water-resistance - IPX7 lights permitted if designed and constructed for this location, at specified low voltage
Zone 1:	**IPX4**	**Protection against splashing water from all practicable directions** - no power outlets permitted, irrespective of water-resistance - IPX4 switches permitted if at least 0.3m above the floor
Zone 2:	**IPX4**	**Protection against splashing water from all practicable directions** - IPX4 power outlets permitted if at least 0.3m above the floor *and* incorporated in a shaver supply unit *or* Residual Current Detector [RCD] protected and in a cupboard - IPX4 switches permitted if at least 0.3m above the floor
Zone 3:		**No specified degree of protection** - power outlets permitted if at least 0.3m above the floor *and* protected with an RCD *or* supplied individually as a separate circuit *or* as an SELV/PELV system - switches permitted if at least 0.3m above the floor

Source: Adapted from AS/NZS 3000:2007, cl 6.2 and Table 6.1
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Special requirements apply for electrical equipment located in the ceiling or beneath the floor. Under-floor heating systems designed for bathroom use are permitted in zones 1, 2, and 3. Combination heater, light, and exhaust products recessed into the ceiling do not have a wet area zoning restriction as AS/NZS 3000:2007 specifies "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" (AS/NZS 3000:2007, cl 6.2.1).

The Need for Increased Electrical Safety in the Bathroom

AS/NZS 3000:2007 specifies the minimum requirements for electrical safety in the bathroom. However, the extended reach of water spray resulting from having an open-plan shower area, particularly in combination with a hand-held shower attached to a flexible hose, can require additional safety measures.

The bathroom wet area zones and associated electrical safety requirements that are specified in AS/NZS 3000:2007, can be limited by barriers "that provide effective protection against spraying water" (cl 6.2.1). Barriers include screens, doors and fixed partitions, and also shower curtains. A shower curtain is the preferred partition for an accessible shower when a bathroom is modified, as they can be easily relocated or left open to increase the space for showering. However, due to this flexibility, they are not as effective or permanent as other barriers, for limiting water spray. If curtains or screens are left open during shower use, there will be no functioning barrier for the shower.

AS/NZS 3000:2007 designates wet zones based on a set distance from the "fixed shower plumbing connection" (AS/NZS 3000:2007, Figure 6.3-4, Figure 6.6-9), yet a long shower hose and an open or absent barrier could move the shower water source 2-3m beyond this location. This can make a bathroom electrical layout that was compliant with AS/NZS 3000:2007 at the time of installation, become non-compliant, and potentially unsafe, during use. It could be safer for bathroom designers and installers to apply zone 1 or 2 requirements in all areas of the bathroom that could foreseeably be splashed with water.

There are three main approaches to further increasing electrical safety in the bathroom when open shower areas and hand-held showers are used. These are:

- preventing accidental spray from hand-held showers;
- the installation of safety switches; and
- protecting electrical devices from water spray, contact with wet hands, and condensation.

A combination of these approaches would likely be required.

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Safety switches

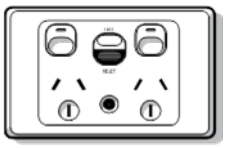
The housing requirements for safety switches, or Residual Current Devices [RCDs], are detailed in AS/NZS 3000:2007 . Since the 1990s, state legislation in Australia has required new power circuits in new and existing housing, to have RCDs on power circuits. This was followed by state legislation for RCDs on lighting circuits, between 2000 and 2008 (Master Electricians Australia, n.d., Figure 9.1).

The concern is that older homes, built prior to this legislation, may not have a safety switch installed. There is no legislative requirement to do so. However, in some states, safety switches are required for the lease or sale of a residential property. (Master Electricians Australia, n.d., Figure 9.1)

The requirements of AS/NZS 3000:2007 "are for RCDs with a maximum sensitivity of 30 mA...(which) are designed to operate before fibrillation of the heart occurs" (cl 2.6.1). However, it also advises that RCDs with a greater sensitivity "may be considered in areas of increased risk", including bathrooms. The more sensitive 10 mA RCDs "are designed to operate before muscular contraction, or inability to let go occurs" (cl 2.6.1).

There are three types of safety switches.

- **Switchboard-mounted safety switches**, fitted to power and lighting circuits in the home, are required by law in new homes. They can be installed adjacent to, or in a combined device with, circuit breakers. They must be installed by a licensed electrician.



- **Safety switches fitted to GPOs** protect appliances and extension cords that are plugged into that GPO. They will also protect the power circuit if installed on the first GPO after the switchboard. They must be installed by a licensed electrician.

- **Portable safety switches** that are part of a plug-in unit, power board or extension lead, can be used for electrical appliances when there is no protection from a safety switch in a switchboard or GPO. Portable safety switches only protect the plugged appliance. (Government of South Australia, 2011; Master Electricians Australia, n.d.)

To maximise bathroom safety, switchboard-mounted safety switches should be installed on all power and lighting circuits, whether new or retro-fitted. Traditional, larger safety switches might be easier to operate for people with reduced hand dexterity, though the newer, compact safety switches could be needed if space is limited in the switchboard. More sensitive, 10 mA safety switches integrated into GPOs

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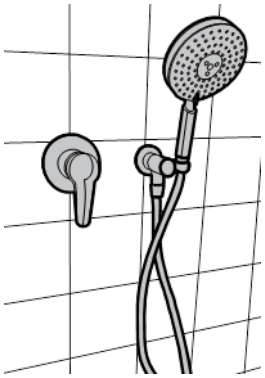
can be used as a supplementary measure in the bathroom for vulnerable residents, including children, the elderly, and people with health conditions.

Preventing accidental water spray

The extended reach of a multi-directional body shower or hand-held shower on a hose, increases the risk of water spray accidentally coming into contact with power outlets and lighting. The risk is increased when there is not a fixed shower screen, or if a shower curtain or screen is left open during use. The design of hand-held showers and the shower screening can help to reduce the risk.

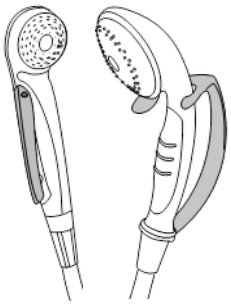
Hand-held shower hose length, grip and controls



Hand-held showers are available in a variety of **hose lengths**, from less than a metre, to two metres or more. For maximum safety, the shortest hose suitable for showering should be used, to minimise the extent of water spray. However, even if a shower hose of less than a metre is initially installed, hoses are easily changed, so a longer hose could be fitted to the shower by a resident in the future. Longer hose lengths might be used to assist showering by a carer, or to make cleaning the bathroom easier.

To restrict the usable length of the hose, clamp devices are available, which fasten the hose to a sliding post or a wall bracket. They can also be used to lock the direction of water spray. These are an option for residents with reduced physical or cognitive ability, including children, who could be at risk of over-spraying water.

Adequate grip and controls on the shower handset can aid the user to control the direction of the water spray and avoid water being sprayed beyond the shower wet area. There are a variety of features in the design of shower handsets that can assist with control of water spray, including:



- **a handset that is lightweight and comfortable to hold**, so it is easy to manoeuvre;
- **a handle that is shaped or textured** to reduce accidental rotation and slipping of the handset in wet hands;
- **controls on the handset** designed for ease of switching between water-spray patterns, such as rain, jet, pulse, etc. while showering;
- **a control on the handset** that adjusts or turns off the flow of water; and
- **compatibility with wall-bracket or holder on a sliding rail**, for ease of attachment and detachment during showering.

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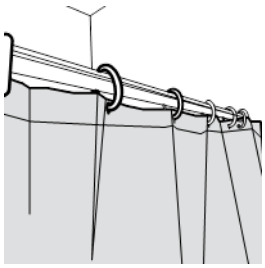
Shower curtains



Shower curtains can be used for temporary screening in the absence of a fixed screen. Shower curtains need to be of sufficient length and width to prevent water overspray from the shower. Multiple curtains, or custom-sized curtains, could be required for larger showers.

Shower curtains with weights incorporated into the curtain hem, provide a more effective barrier to water spray than ordinary curtains. The weights help the curtain to stay in place, to reduce the amount of water escaping the shower area, and 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 to hold the curtain taut at the wall. When suitable shower curtains are unavailable, some residents make their own shower curtain modifications, sewing weights into the hem, attaching table cloth weights, or fastening the curtain to the shower grate.

Protection from water spray, wet hands, and condensation

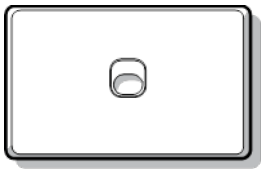
Power outlets, appliances, and switches in the bathroom environment, require their own additional protection from moisture. This could involve their relocation, or the inclusion of features to protect against accidental water spray, direct contact from wet hands, and condensation.

Relocating power outlets and light switches

A GPO is usually installed in the bathroom, for personal-care activities such as hair drying and shaving. However, relocating GPOs and light switches, to either another location in the bathroom, or outside the bathroom, could be the safest option for avoiding water contact.

The cost to relocate GPOs and light switches is dependent upon their location and the wall material. Relocation in a plasterboard cavity wall can be an inexpensive process, just the cost of labour for an electrician, and simple plaster and paint repair. In contrast, when tiled surfaces, waterproofing, and solid masonry walls are involved, the process can be both complex and expensive, involving multiple tradespeople.

Water-resistant switches and power outlets



Water-resistant switches and GPOs can provide a higher level of safety, particularly with the risk of direct spray from a hand held shower hose. Changing standard switches and GPOs to water-resistant devices is relatively straightforward for an electrician, when modifying a bathroom. It could be a less complex and expensive alternative to relocation, as rewiring through bathroom walls can be avoided.

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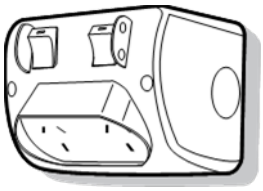
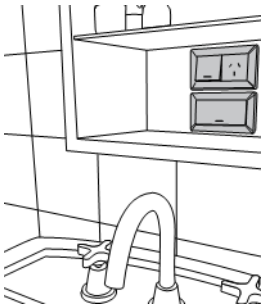


Water-resistant switches and **GPOs** are often marketed as 'weatherproof' units, for outdoor use. Switches and GPOs would require an IP code of at least IPX4, with the 4 indicating "protection against splashing and spraying water from all practicable directions" (AS 1939 Supp 1-1990) to withstand accidental spray from a hand-held shower.

Enclosing switches and power outlets in a cabinet

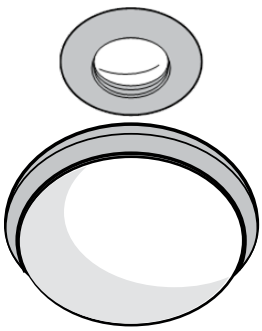


Enclosing switches and GPOs inside a bathroom cabinet can be a better alternative to relocating them further away from the shower, on the wall. AS/NZS 3000:2007 allows GPOs to be located in zone 2 when they are enclosed in a cabinet, provided they are RCD protected. Similarly, switches can be located in zone 1 and 2, provided they are enclosed in a cabinet that has at least IPX4 protection. As an additional precaution, switches that would be likely to be operated when hands are wet (such as a switch for an extractor fan) should be located so that moisture from hands does not run onto other switches or devices.

Space can be provided inside cabinets for covered storage of electric personal care devices commonly used and stored in the bathroom, such as hairdryers, electric toothbrushes, and shavers. The design of the cabinet should consider protection of contained GPOs, switches, and appliances when the door is closed or left open.

Water-resistant and covered light fittings

There are specific water-resistance requirements for luminaires [light fittings] in wet zones 0, 1, and 2 of the bathroom in AS/NZS 3000:2007 (Table 6.1). However, there is no IP rating for light fittings in zone 3, or for light fittings recessed into the ceiling. IPX4 protection is required for zone 1 and 2. Due to the risk of water splashing from a hand-held shower, it is safer for IPX4 light fittings to be extended to zone 3 and beyond, if they could be subject to water contact.



IPX4 downlights and other styles of weatherproof light fittings are readily available.

Bathroom light fittings with a covered light globe are safer, when a hand-held shower is installed, as water coming into direct contact with heated lamps [light globes] can cause the glass to shatter (Lara Oram, 2006). As a further safety precaution, a plastic diffuser will eliminate the risk of glass breakage.

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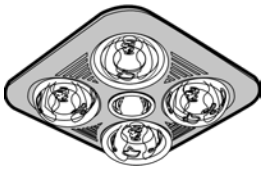
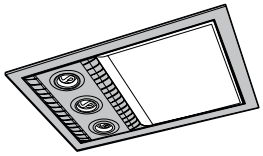
Location and protection of combination heater, light, and exhaust

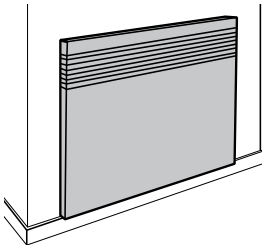


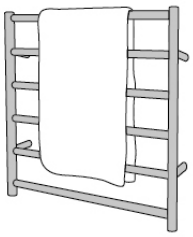


Combination heater, light, and exhaust products recessed into the ceiling do not have a wet area zoning restriction (AS/NZS 3000:2007, cl 6.2.1). Nevertheless, direct water spray from a hand-held shower on a hot glass cover, exposed light globe, or heat lamp, could cause the glass to shatter. When hand-held showers are in use, the risk of water contact needs to be minimised through the location of the combination heater, light, and exhaust fitting. If the location of this type of unit could leave it susceptible to water spray, irrespective of the zone, alternative forms of lighting, heating, and exhaust, should be considered.

Water-resistant fixed heaters, towel warmers, and under-floor heating

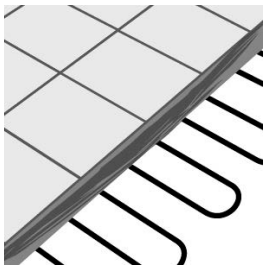
A fixed heater in the bathroom avoids the need for a portable heater. Portable heaters can be particularly dangerous, as they can be positioned too close to water; have electrical cables that are a trip hazard; and can burn people or material if they are inappropriately located.





Fixed heaters need to be installed to comply with AS/NZS 3000:2007 and additional precautions taken, if they could still come into contact with water spray. According to AS/NZS 3000:2007, wall-mounted heaters can only be installed in zone 3 of the bathroom . However, even in zone 3, heaters could be subject to water spray from hand-held showers. Heaters with at least IPX4 resistance against water spray are available, and are a safer option.

Towel warmers with IPX4 protection are readily available, and can be used for supplementary heating. Towel warmers with an integrated heater are also available.



Protected under-floor cable heating systems are an alternative form of heating that could be considered when major bathroom works are being undertaken. They are permitted in zones 1, 2, and 3 (AS/NZS 3000:2007, cl 6.2.4.5).

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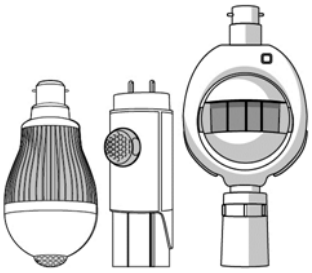
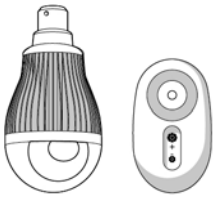
Sensor and remote control switches

Many devices with sensor and remote control switches can be easily installed without changes to wiring. Sensor switches enable hands-free operation of lights, exhaust fans, and heaters, eliminating the risk from wet hands contacting the switch. Sensors are available with activation by infrared motion detectors, sound detection, and humidity detection for exhaust fans.



L.E.D light globes and tubes, **light-globe converter units** installed between the bayonet fitting and standard light globe, light fittings, exhaust fans, and heaters, are some of the bathroom electrical devices available with built-in sensor switches. Stand-alone sensor devices are also available.

Remote control switches also permit safe use of bathroom switches. Remotely controlled devices for the bathroom include lights, heaters, exhaust fans, combination heater, light, and exhaust units, and L.E.D. light globes and tubes.



L.E.D. light globes are available with in-built remote switching, to provide on-off, colour change, and dimmable light, for standard screw or bayonet light fittings. Some light globes can be controlled with smart-phone devices.

Approaches for Bathroom Electrical Safety – Comparison

The most suitable methods for increasing electrical safety are dependent on a number of factors, including:

- the scope of works to be undertaken e.g. a new bathroom with new plumbing, or minimal changes to fixtures and fittings in an existing bathroom;
- the available funds for the new bathroom or bathroom changes;
- the type of construction of the bathroom e.g. framed cavity walls or solid masonry;
- the housing type e.g. separate house with full access under the floor and within the ceiling, or an apartment; and
- the current and future needs of all residents and users of the bathroom.

The appropriate methods for increasing electrical safety will vary in each bathroom situation, and the advantages and disadvantages of each method would need to be determined for each individual case. A comparative summary of methods for bathroom electrical safety is contained in Table 2.

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Table 2 Methods for Increasing Electrical Safety in Bathrooms Modified for Accessibility

Installation of safety switches		
METHOD	ADVANTAGES AND DISADVANTAGES	EXAMPLES*
Switchboard-mounted safety switches	- regulated for new power and light circuits in new housing and renovations. - must be installed by licensed electrician ✓ protects all GPOs and switches on connected circuits	 
Safety switches that replace existing GPOs	- protects electrical appliances and devices plugged into the GPO - can extend the same RCD protection to other devices on the circuit if installed on the first GPO after the switchboard - must be installed by licensed electrician ✓ limited re-wiring required ✓ visually similar to standard GPOs ✓ can supplement the 30mA switchboard circuit with a more sensitive 10 mA power cut out for critical areas such as bathrooms × only protects the applicable GPO or circuit × limited styles of GPO with RCD protection, so available GPO switches might not be suitable for people with reduced hand dexterity	
Portable safety switches	- available as plug-in unit, power board or extension lead ✓ can be used for electrical appliances when there is no protection from a safety switch in a switchboard or GPO × only protects appliances and devices plugged into the unit × not recommended for use in wet areas.	

✓ Advantage × Disadvantage

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Preventing accidental water spray from hand held shower

METHOD	ADVANTAGES & DISADVANTAGES	EXAMPLES
Minimising shower hose length	- shower hose < 1m available ✓ reduces risk of water overspray beyond shower wet area compared to longer hose × a longer hose is easily installed by the resident at a later time	
Grip and handset of hand-held shower	- handset with non-circular cross section and textured grip ✓ avoids handset rotating or slipping in wet hands, causing water overspray	
Controls on handset of hand held shower	- on-off control and/or water flow-spray control ✓ water flow can be easily reduced or turned off if the water spray is difficult to control × very few products available on the market with on/off control on handset	
Wall Holder or rail bracket for handset	- restricts usable length of the shower hose and/or movement of handset ✓ can temporarily restrict the length of shower hose or movement of handset for use by people with reduced cognitive ability or hand dexterity	
Weighted shower curtain	- weights sewn into hem - shower base needs to be graded to a drain, channel drain could be needed ✓ reduces water escaping from under or around the curtain ✓ curtain can be relocated to provide larger wet area for showering ✓ curtain can be opened to provide access to the full length of the shower area for ease of access × curtain is not a permanent barrier and is easily left open or relocated	

✓ Advantage × Disadvantage

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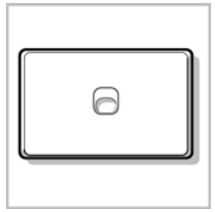
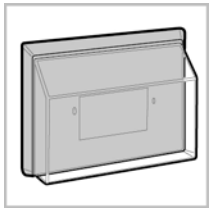
Protection from hand-held shower spray, wet hands, and condensation

METHOD	ADVANTAGES & DISADVANTAGES	EXAMPLES
Relocate all GPOs and light switches outside bathrooms	✓ removes GPOs and switches from wet environment × can be complex and costly in masonry, waterproofed, and tiled walls × inconvenient for using appliances in the bathroom × prevents control of lighting and appliances from within the bathroom × residents could use unsafe extension cords for appliance use in bathroom	
Installation of water-resistant (IPX6) switches	- protection against strong jets of water from any direction ✓ can prevent the need for relocating light switches ✓ similar in appearance to a standard switch ✓ wet fingers are not a risk × could be more difficult for someone with limited finger dexterity to function with the rubber seal × few styles of IPX6 switch are available	
Installation of water-resistant GPOs	- protection provided by cover or shroud ✓ can prevent the need for relocating GPOs, depending on proximity to the plumbing outlet × no protection for wet hands plugging appliances into the GPO, or for appliances that are not suitably rated for use in wet areas of the bathroom × can be bulky	 

✓ Advantage × Disadvantage

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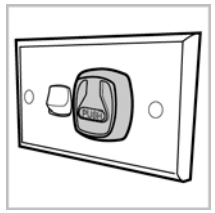
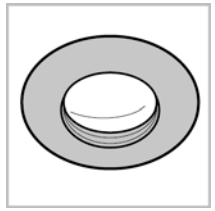
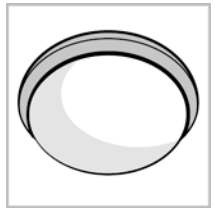
Containing all GPOs and light switches inside a bathroom cabinet	✓ GPOs and switches can be retained in bathroom for convenient access ✓ Can eliminate need for complicated rewiring required by relocation of switches and GPOs ✓ Can provide covered storage of appliances: hairdryer, shaver, electric toothbrushes etc.	
Covering GPOs with receptacle caps	× not weatherproof or resistant to water spray **should not** be used in the bathroom as a device to prevent water seepage into sockets	
Water-resistant (IPX4) light fittings	- IPX4 required in bathroom zones 1 & 2 ✓ extended to other areas of bathroom provides added safety from water spray ✓ a variety of downlights and other light fittings available × only fixed downlights currently available in IPX4, not gimbal	
Covered light fittings	- provide cover over lamp (light globe) ✓ covering light globes avoids risk of them exploding when contacted by water ✓ plastic diffusers eliminate risk of glass breakage	

✓ Advantage × Disadvantage

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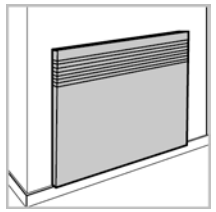
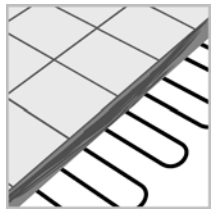
High wall-mounted heaters	- only permitted in zone 3 ✓ avoids resident using dangerous portable heaters in wet area ✓ low cost × not resistant to water spray	
Water-resistant wall-mounted heaters	- water resistant to IPX4 permitted in zones 1 & 2 - can incorporate a towel warmer ✓ avoids resident using dangerous portable heaters in wet area	
Water-resistant towel warmers	- water resistant to IPX4 permitted in zones 1 & 2 ✓ provides supplementary heating	
Under-floor heating	- can be installed in zones 1,2 & 3 ✓ heating concealed in floor, cannot come into contact with water × can only be installed as part of major renovation	

✓ Advantage × Disadvantage

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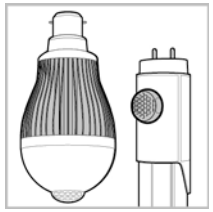
Combination heater, light, and exhaust unit in ceiling	- all live parts in ceiling, so can be installed in zones 1,2 & 3 × direct spray on units with hot glass covers, uncovered heat lamps and light globes, can cause glass to shatter	 
Remote control switches	- available for lights, L.E.D. light globes, heaters, exhaust fans, and combination heater, light, and exhaust units - available with proprietary remote controls and control by smart phone - L.E.D. light globes and tubes with remote control include dimming, on-off, and colour functions ✓ eliminates touching of 'live' switches with wet hands ✓ devices with remote control can usually be easily interchanged with standard devices, without wiring changes × remote controllers can be misplaced	 
Sensor switches	- available built in to lights, L.E.D. light globes and tubes, light globe converter units, heaters, and exhaust fans, as well as separate sensor devices - sensors available with activation by infra-red motion detection, sound detection, and humidity detection for extractor fans ✓ eliminates touching of 'live' switches with wet hands ✓ devices with built-in sensors, and light globe conversion units, can usually be easily interchanged with standard devices without wiring changes × bathroom users might want to override the sensor operation of a light, fan or heater × movement sensors could cause lights to unexpectedly turn off if resident is too still	

✓ Advantage × Disadvantage

* These examples are just a small selection of currently available equipment and devices on the market, provided for illustrative purposes only

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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, e.g. would the client flick a switch with wet fingers?
- ☐ Are there risks of falls and confusion if switches were relocated, e.g. 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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Appendix 1: Standards Relevant to Electrical Safety in the Bathroom

AS/NZS 3000:2007 (Incorporating Amendment Nos 1 and 2)
Electrical installations (known as the Australian/New Zealand 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) Wall chart 1 (Supplement 1 to AS 1939-1990)

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 3112:2011 (Incorporating Amendment Nos 1 and 2)
Approval and test specification – Plugs and socket-outlets

AS/NZS 3100:2009 (Incorporating Amendment Nos 1 and 2)
Approval and test specification – General requirements for electrical equipment

AS/NZS 60335.2.105:2006 (Incorporating Amendment No. 1)
Household and similar electrical appliances—Safety
Part 2.105: Particular requirements for multifunctional shower cabinets

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Appendix 2: Bathroom Zones

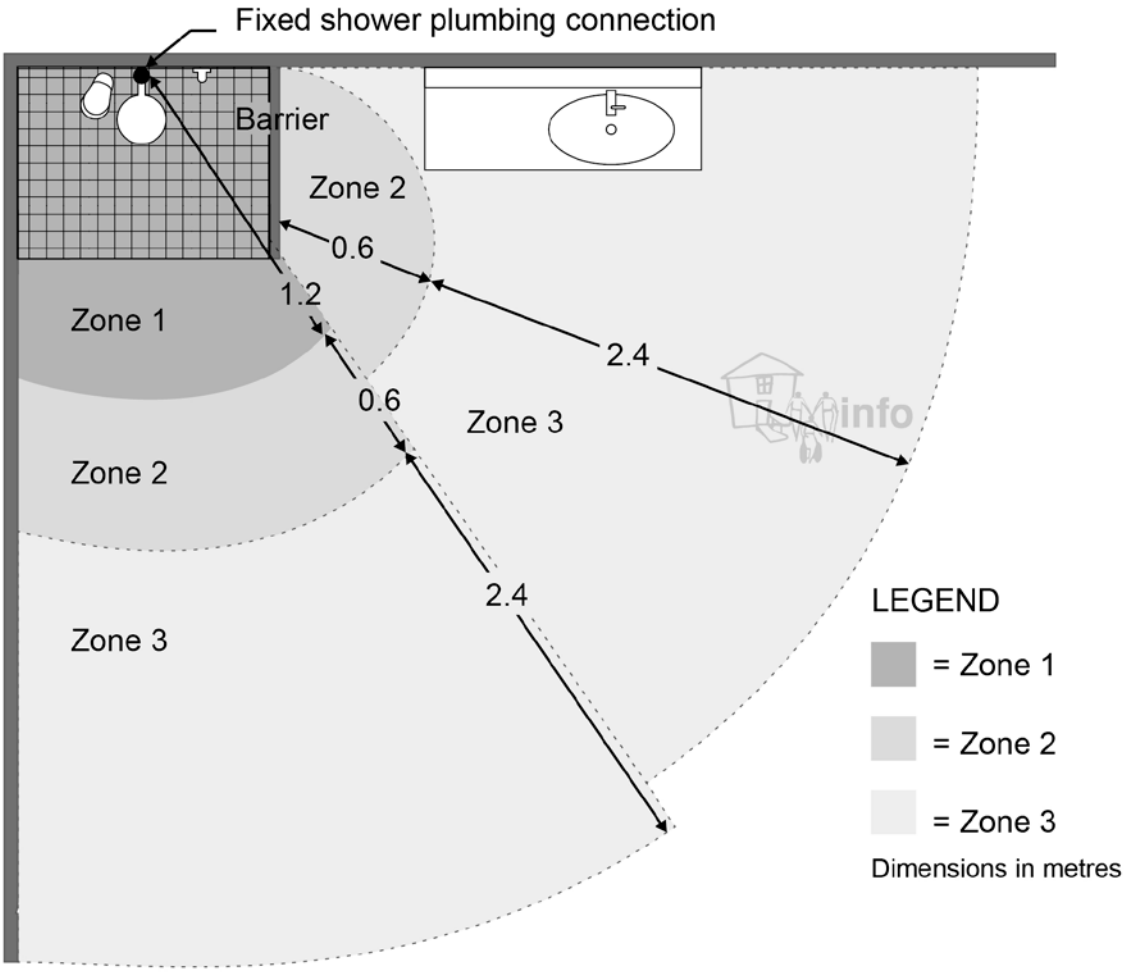

Figure 2 Bathroom Zones – Open Plan Shower: Effect of shower barrier on bathroom zones, plan view

Source: Adapted from AS/NZS 3000:2007, Figure 6.9
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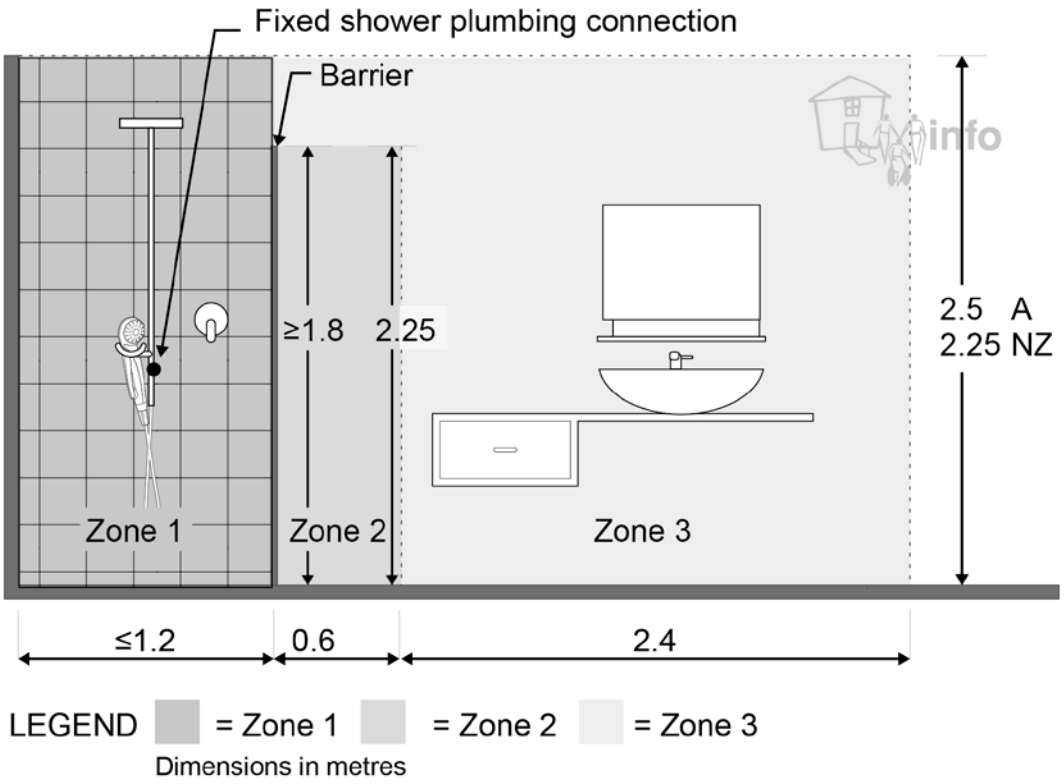

Figure 3 Bathroom Zones – Open Plan Shower: Effect of shower barrier on bathroom zones, elevation view

Source: Adapted from AS/NZS 3000:2007, Figure 6.8
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An open plan shower does not have a raised hob or a depression in floor, so zone 1 is applicable to the entire open plan shower area. Zone 0 does not apply (see zone descriptions in Table 3).

Without a shower barrier, zone 1 extends 1.2m from the fixed plumbing connection. A shower barrier allows zone 1 to be reduced to the area enclosed by the shower barrier (Figures 2, 3).

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Table 3 Bathroom Zone Specification

Bathroom Zones	
Zone 0:	the interior area of the base of a bath or shower, with the shower base "defined by either a raised hob or a depression in the floor".
Zone 1:	a) for a bath, extends from the internal rim of the bath above zone 0 to the horizontal plane 2.5m (Aus) or 2.25m (NZ) above the floor. 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 a horizontal plane, 2.5m (Aus) or 2.25m (NZ) 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 (Aus) or 2.25m (NZ) above the floor (whichever is lower).

Source: Adapted from AS/NZS 3000:2007, cl 6.2.2.1
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Appendix 3: IP Code – water ingress

Ingress Protection [IP] codes are indicated with:

IP(first numeral)(second numeral)

The first numeral indicates the degree of protection from access to hazardous parts and resistance to ingress of solid foreign objects. The second numeral indicates the degree of resistance to water. There may also be an optional suffix of up to two letters in the code, indicating the degree of protection against access to hazardous parts, and supplementary testing information. (AS 60529-2004)

The IP codes concerning resistance to ingress of water are indicated IPX_, with the second numeral selected from the codes in Table 2.

Table 4 Water Ingress Protection Codes

Ingress of Water	
X	Protection unspecified (untested)
0	Non-protected
1	Protection against drops of water falling vertically
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 against spraying water at up to 60° from the vertical
4	Protection against splashing and spraying water from all practicable directions
5	Protection against a low pressure jet of water from all practicable directions
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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