

Minimising risk of damage to electrical installations in domestic premises in flood-prone areas

Having a home and its contents flood damaged is a traumatic experience. It is estimated that around 5 million¹ properties in England and Wales are at risk of flooding every year. Sadly floods seem to be becoming more common and so this figure is only likely to increase in the future.

Although certain geographical areas are prone to flooding periodically, some people will wish to continue living in their homes in such areas regardless of future flooding being inevitable.

This article provides guidance for electrical installers and consumers on practical measures that can be taken to minimise the risk of damage to the electrical installation and, where it is not possible to prevent flooding by water, measures that will minimise the time needed to return the installation to a serviceable condition and so allow the fastest possible re-occupation of the property.

It is important to note at this point that where the property in question is insured, it is essential to contact the insurers before carrying out substantial modifications to a property that are intended to minimise the effects of flooding.

Measures to prepare a property for flooding can be sub-divided into the following two categories:

- Dry flood proofing (sometimes referred to as flood resistance) – where a building is sealed, elevated or otherwise arranged so that flood water cannot enter the property.
- Wet flood proofing (or flood resilience) – where a building is modified so that damage to the building fabric and its contents is significantly minimised and, typically, clear-up times are reduced.

This article is limited to wet flood proofing measures and provides guidance on both temporary and more permanent measures that can be taken to limit or prevent damage to the fixed electrical installation and to electrical equipment and appliances connected to it. It also gives advice on ways to ensure that the electrical installation can be put back into service as quickly as possible once the flood waters have gone and the property has been dried out. It will not look at dry flood proofing which falls beyond its scope.

Flood warnings

If you believe that your property is situated in a flood prone area you should take measures to ensure you receive prior warning when flooding is forecasted. Advice on how to do this can be found on the following websites:

England

<https://www.gov.uk/prepare-for-a-flood/find-out-if-youre-at-risk>

Wales

<https://naturalresources.wales/flooding/?lang=en>

¹ Environment Agency figures. C. 2012.

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Scotland

<http://floodline.sepa.org.uk/floodupdates/>

Northern Ireland

<http://www.nidirect.gov.uk/flooding-in-your-area>

For those in England and Wales, The Environment Agency offers a free flood warning service. You can sign up for this at <https://www.gov.uk/sign-up-for-flood-warnings> or by calling **Floodline** on 0845 988 1188). This will allow you to put your prevention measures in place.

The presence of both electricity and water makes for a potentially dangerous environment

Once it seems likely that a property will be flooded, the electrical supply to the premises should be disconnected. In any case, this should be done before carrying out any work on the electrical installation. Typically, this can be achieved by operating the main-switch of the consumer unit.



Sometimes it will be necessary to operate more than one switch in order to isolate a single source of supply to all parts of the property (more than one consumer unit) or because the installation is fed from a distributed mains supply and also an alternative supply from, for example, a solar photovoltaic (PV) system.

BS 7671 *Requirements for electrical installations*, requires warning notices to be fixed in each position where there are live parts which cannot be isolated by a single device and, unless there is no possibility of confusion, the location of each isolator should be indicated (Regulation 514.11).

<p>WARNING – MULTIPLE SUPPLIES</p> <p>Isolate all electrical supplies before carrying out work.</p> <p>Isolate the mains supply at</p> <p>Isolate the alternative supplies at</p>
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In order to safeguard persons entering the property, the means of isolation should be secured in the 'OFF' position to prevent the supply being restored prematurely.

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Great care should be taken when entering standing water within premises where there is any doubt as to whether all sources of electrical supply have been isolated. Remember, even if the supply has been isolated to the property there may still be a live supply entering the premises in contact with flood water.

Temporary measures to limit damage to electrical equipment

Where a flood warning has been issued, and if you have the time to do so safely, where practicable:

1. Move any portable electrical equipment and appliances to a higher level within the property.
2. Unplug or otherwise disconnect any items that cannot be moved to a higher level.
3. Lift larger appliances such as electric cookers, fridge-freezers and home laundry equipment and place them on bricks, blocks, pallets or similar that you have stored for such an eventuality.

Permanent measures for properties in a location prone to regular flooding

Clearly, measures to ensure that the electrical installation and electrical / electronic equipment in a home are not submerged in water should be carried out wherever practical. However it will not be possible to do this in some cases and furthermore being a natural phenomenon, there may be occasions where flood water levels are significantly higher than is typical for the area.

For this reason, and because homes can also suffer water damage from, for example, burst pipes or appliance failure, Electrical Safety First commissioned the British Approvals Service for Cables (BASEC) to carry out research to investigate whether it would be feasible to re-use fixed electrical wiring post-flood after a suitable drying out period had been observed.

This research indicated that:

- Cables with low smoke halogen free (LSHF) insulation dried out quicker following immersion in water than cables having PVC insulation.
- Cables having solid rather than stranded conductors also dried more quickly.
- There was significant penetration into the sheath and around the uninsulated protective conductors therein.

The following measures will help to minimise flood damage:

1. Install central heating boilers and fixed electrical equipment and accessories such as the consumer unit, switches and socket-outlets at a height above that of any foreseeable flooding events. Advice should be sought to determine a suitable mounting height.

Part M of Schedule 1 of the Building Regulations 2010 (England and Wales) requires, amongst other things, that reasonable provision be made to allow people to use a dwelling and its facilities. With respect to electrical equipment mounting heights, Approved Document M states that this will be achieved where:

- Switches, socket-outlets and similar wall-mounted accessories are installed such that their centre-line is between 450 and 1200 mm above floor level, and

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- (For England) consumer units are mounted so that the operating switches, (of circuit-breakers, RCDs and the like therein) are 1350 -1450 mm above floor level

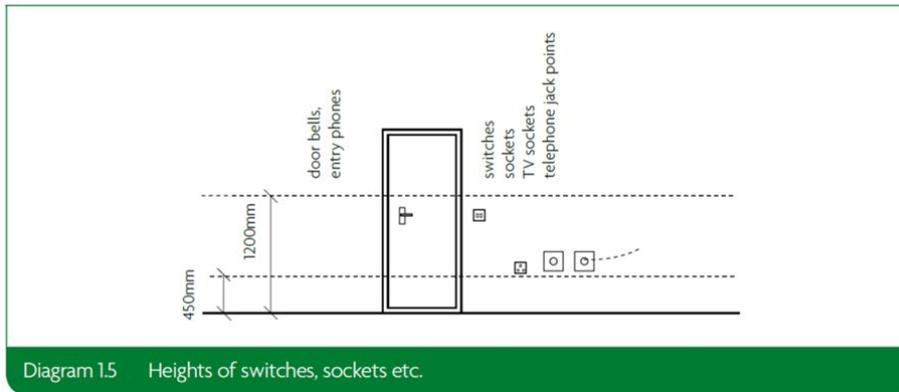


Fig 1. Extract from Approved Document M (England)

In flood-prone areas, electrical equipment should be installed at the higher limit of these tolerances.

2. Wherever possible, install cables serving floors liable to flooding from above, that is dropping down from ceiling level as opposed to coming up from under floor level.
3. With respect to the type of cable employed:
 - Consider using low smoke halogen free (LSHF) type twin and earth cables rather than PVC cables
 - Use cables having solid conductors rather than stranded conductors.
 - Consider using a cable with an insulated protective conductor (CPC). Such cable is available, but will be more expensive than conventional 'twin and earth' cable with an uninsulated cpc.
4. Instead of using twin and earth type insulated and sheathed cables embedded in the wall; install embedded conduit drops and provide access points in floor boards at strategic points to facilitate easy rewiring using single core cables with minimal disruption / damage to the building fabric. In order to avoid corrosion, conduit should be galvanised steel or PVC.
5. Place large appliances such as electric cookers, fridge-freezers and home laundry equipment on raised plinths. This may effectively preclude the use of built-in appliances. In the case of washing machines it is important that any such base is sufficiently solid and secure to ensure that the machine can operate correctly and safely.
6. Where practicable, install electric radiators / panel heaters so that they remain readily removable (mounting, for example, on 'keyhole' slots and supply them via plug and socket-outlets). This will allow them to be moved before they are immersed and damaged.
7. Install a sump pump system where the property has sub-ground floor levels

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Determining whether cables and items of electrical equipment are suitable for re-use

NOTE: *The supply to the installation or, at least to those circuits the wiring of which has been affected by flood water, must be isolated prior to an investigation into post-flood effectiveness of the conductors.*

Cables

Following a flooding incident the property in general and the wiring system therein should be allowed a reasonable time for drying-out. Removal of switches, socket-outlets and other accessories from affected circuits may aid the drying out process. One indicator, for example, of how effectively a plastered wall has dried out can be seen from an inspection of the bare plaster. A more accurate assessment can be carried out by a specialist in post-flood renovation.

When the wiring is deemed to have dried out sufficiently, an insulation resistance test should be carried out between line and neutral and between live (line and neutral conductors connected together) and the protective conductor connected to the means of earthing for the installation.

The results obtained from this testing should be compared to those recorded in the schedule of test results that accompanies the Electrical Installation Certificate or, where a periodic inspection has been carried out since the initial verification, the Electrical Installation Condition Report, where available.

The two sets of insulation resistance test results should be substantially the same.

For circuits having a nominal voltage not exceeding 500 V (as will be the case for virtually all domestic properties), the insulation resistance of all the final circuits connected to a particular consumer unit, when tested concurrently at a voltage of 500 V d.c., should be greater than 1 M Ω .

In many cases, not all circuits within a property that has been flooded will have been subjected to immersion. It is logical therefore to measure the insulation resistance of each circuit separately. As this will remove the reduction in overall resistance characterised by measurement of resistances in parallel, the resultant insulation resistance value deemed acceptable should be significantly higher.

It is recommended that a circuit is given further time to dry out if, when tested, it has insulation resistance of less than 5 M Ω .

Accessories

Accessories such as switches, socket-outlets and connection units (that do not contain electronic circuitry) may be suitable for re-use after drying out. However, any socket-outlets or connection units containing RCDs that have been submerged in the water must be replaced.

Electrical equipment and appliances

Advice should always be sought from manufacturers when considering whether an appliance or item of electrical equipment will remain serviceable after been exposed to flooding. Remember, flood waters are seldom free of particulates or contaminants.

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Before returning to use, electrical equipment and appliances should be subjected to inspection and testing as appropriate to their construction class. In the case of equipment that has been provided for the use of tenants and other cases where equipment has been so inspected and/or tested previously, the insulation resistance test results obtained from post-flood testing should be compared to the results obtained previously. The two sets of insulation resistance test results should be substantially the same.