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## BS 7671:2018 – A myth busting webinar: Q&A

### SPD Questions

**Q** Can SPDs be installed on load or supply side of an RCD?

**A** Regulation 534.4.7 states that an SPD installed on the load side of the RCD is required to have a surge current immunity of at least 3 kA.

RCD standards include two levels of immunity to surge currents.

1. A General type RCD with a minimum surge current immunity of 200 A with a 0.5  $\mu$ s/100 kHz waveform (Various Types)
2. A time delayed S type RCD with a minimum surge current immunity of 3000 A with an 8/20  $\mu$ s waveform

Therefore, an SPD should not be installed on the load side of a G type RCD, this is to prevent unwanted operation of the RCD due to surge current.

**Q** What is the requirement for surge protection when installing Electric Vehicle Chargers to an existing installation?

**A** The requirements for surge protection when installing electric vehicle charging equipment to an existing installation are no different to a new installation as defined in Chapter 44 of BS 7671:2018. The Client should be advised of the need for a coordinated system to be installed to effectively protect the installation.

**Q** 1. How do we know whether type 1 or type 2 is required?

**A** Manufacturers are best placed to provide guidance on correct type. To summarise, a Type 1 SPD is used at the origin of the installation, in some cases a Type 2 can be installed at the main distribution board and, in some cases, a Type 1 / 2 combined; a Type 2 SPD is used at sub-distribution boards (Exceeding 10 metres from main distribution board) and Type 3 SPDs are installed locally to sensitive electronic equipment.

Please see link below to information provided by BEAMA on SPDs.

<http://www.beama.org.uk/resourceLibrary/beama-surge-protection-guide-.html>



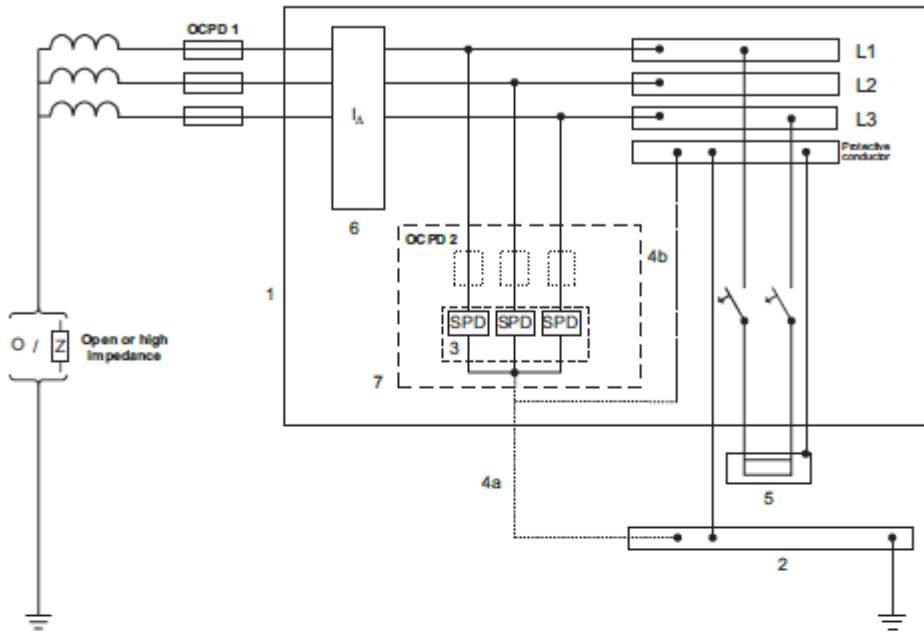
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**Q** How to install SPD on an IT system without an earth connection?

**A** See extract from BS 7671:2018 Appendix 16 below, it provides a diagram on how to connect SPDs to an IT system.

**Installation of surge protective devices in IT systems**

**Fig 16A4 – SPDs on the load side of an RCD**



**Key**

- 1 Distribution board
- 2 Main earthing terminal or bar
- 3 Surge protective devices ensuring a protection level in accordance with overvoltage Category II
- 4a, 4b Earthing connection of surge protective devices, either 4a or 4b, whichever is the shorter route
- 5 Current-using equipment
- 6 Residual current protective device (RCD) installed upstream of the surge protective devices
- 7 SPD assembly

- OCPD 1 Overcurrent protective devices at the origin of the installation
- OCPD 2 Overcurrent protective devices



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**Q** How do you provide SPD to a telephone line, does BT master socket has an SPD in already

**A** The incoming phone line and master socket outlet belongs to the telecoms equipment provider; the customer is responsible for the wiring from the secondary side of the master socket. SPDs can be installed to the secondary socket-outlets.

The older master telephone sockets used to incorporate surge protection, but they were removed in the newer models as it affected the broadband speed.

**Q** If the incoming telephone line is a fibre optic, does it still require protection from surge current?

**A** Fibre optic cables are made from glass which does not conduct electricity and is outside the Scope of BS 7671:2018. Therefore, there is no requirement to install SPDs to protect this type of cable.

**Q** When an SPD operates, does it require resetting by client or is it automatic?

**A** The SPD can operate a number of times and does not require resetting. The device will indicate when its life has expired.

**Q** How often does an SPD need replacing?

**A** SPDs are equipped with a status indicator which is green under normal operation and red when the unit requires replacement. This can be connected to a visual or audible alarm to assist the end user in identifying the device has come to its end of life.

**Q** If the SPD has no need to reset after activation and a simple red/green protection mode indication, how often does it need to be inspected by the user to check it is still functioning?

**A** The frequency of inspection of the status indicator for SPDs will depend on various factors including lightning stroke activity and will need to be assessed on an individual basis.

**Q** What about SPDs on PV systems?

**A** It may be necessary to install surge protection to adequately protect the inverter of PV systems. A risk assessment in accordance with BS 7671 Regulation 443.5 should be carried out and the manufacturers of the equipment should be consulted to determine the exact requirements.



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**Q** Are SPD's required for commercial building?

**A** The IET Wiring Regulations and, in particular, Section 443, are applicable to fixed wiring in all types of buildings, including commercial.

**Q** Prior to making a decision on SPDs based on value, is it necessary to do a risk assessment?

**A** Regulation 443.4 states that protection against transient overvoltages shall be provided where the consequence caused by overvoltage could:

- (i) result in serious injury to, or loss of, human life, or
- (ii) result in interruption of public services and/or damage to cultural heritage, or
- (iii) result in interruption of commercial or industrial activity, or
- (iv) affect a large number of co-located individuals.

It goes on to say that, in all other cases, a risk assessment according to Regulation 443.5 shall be performed to determine if SPDs are required. If the risk assessment is not performed, SPDS are required except for single dwellings where the total value of the installation and equipment therein does not justify such protection.

So, taking that into account a typical SPD costs less than a hundred pounds, the value of the complete electrical installation including, wiring consumer unit, accessories, connected equipment and not considering redecoration costs etc. Replacement costs are likely to be thousands of pounds depending on the size of installation, therefore, this would justify the installation of SPDs.

**Q** As there is discussion around the interpretation of the regulation which requires SPD's, could you clarify the IET's position on the requirement for SPD's in street lighting installations?

**A** Regulation 443.4 does not specifically mention street lighting installations, but if any of the consequences below could be caused by overvoltage, SPDS are required. Street lighting may be considered a public service.

- (i) result in serious injury to, or loss of, human life, or
- (ii) result in interruption of public services and/or damage to cultural heritage, or
- (iii) result in interruption of commercial or industrial activity, or
- (iv) affect a large number of co-located individuals.



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**Q** Do AFDDs detect open circuit arcs in the line conductor or just in the neutral?

**A** An arc occurs when there is a potential difference between conductors. An arc can occur in any live conductor of a circuit where a break or open-circuit has occurred.

**Q** Would an SPD be required in each individual apartment if there is a type 1&2 installed at the main incomer for a block of flats?

**A** The specification for surge protection will be project specific depending on several factors and manufacturers are best placed to offer guidance on this. Section 443 of BS 7671:2018 sets out the requirements for overvoltage protection. Generally speaking, a Type 1 SPD is used at the origin of the installation, in some cases a type 2 can be installed at the main distribution board and in some cases a Type 1 / 2 combined; a Type 2 SPD is used at sub-distribution boards (Exceeding 10 metres from main distribution board) and Type 3 SPDs are installed locally to sensitive electronic equipment.

**Q** is the installation of SPD a recommendation or mandatory requirement?

**A** Section 443 of BS 7671:2018 defines the requirements for surge protection.

**Q** Do we require surge protection to be installed on fire alarm installations?

**A** A fire alarm system is a good example of an installation which is required to be protected by surge protection.

**Q** Does sleeping accommodation mean domestic dwellings?

**A** BS 7671 does not define sleeping accommodation however, publication DLCP Fire Safety-risk assessment/sleeping accommodation identifies many types of sleeping accommodation. Please see link below.

<https://www.gov.uk/government/publications/fire-safety-risk-assessment-sleeping-accommodation>

This publication is not applicable to domestic premises however this does not mean that domestic sleeping accommodation is not covered by BS 7671:2018 Regulation 421.1.7

**Q** Would the protective devices already installed not protect against the arcs between line and neutral and line and earth conductors?

**A** An RCD could detect an arc between live and earth only but not all circuits require RCDs and an AFDD is intended for the purpose of detecting arcs anywhere on the circuit.



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RCDs can detect leakage current to earth, AFDDs are more sensitive. Similar to the difference between sensitivity of RCDs and circuit breakers.

**Q** You mention doing a risk assessment to justify not fitting SPD or AFDDs. Is there a recommended format/template to follow?

**A** There are not any model forms for documenting evidence but there is nothing to stop you making your own.

**Q** Given use of the risk assessment route, if e.g. in an existing dwelling has not had any previous issues with lightning stroke (i.e. over many years of its existence) is it reasonable that this could be used as justification for including within the risk assessment (BS EN 62305 takes into account risk including geographical location, absence of overhead line in proximity to dwelling)

**A** There is a simplified risk assessment in BS7671:2018 Regulation 443.5. But as you correctly state, a more detailed version of the risk assessment is in BS EN 62305-2 protection against lightning, risk management.

The risk assessment does not take into account any previous issues with lightning strokes.

**Q** Surge Protected Extension Leads are widely available. Are these recommended for localized equipment (TV's HiFis etc.), rather than a fixed installation?

**A** An SPD would need to be installed at the source to protect the installation and conform to BS 7671. This would reduce the overvoltage which would be seen by the lower rated device in the extension lead.

**Q** Why isn't the SPD at the utilities distribution, isn't there a level of expectation that the supply authority control the supply within certain tolerance.

**A** The DNO cannot control lightning on adjacent lines from entering the property unless they installed an SPD at the origin of every installation.

**Q** 18TH Edition Compliant Consumer Units are being to be sold by wholesalers and retailers, many with MCBs already installed. Are these deemed to still be compliant with the 18th Edition?

**A** Regardless of the name it is being sold by the wholesaler. Whether if it conforms to BS 7671:2018 or not will depend on the installation requirements and the decisions taken by the designer.



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**Q** If I am adding new circuits to an existing distribution board within an installation, do I need to consider installing an SPD to protect that distribution board? In particular, if one or more of the circuits have cabling extending outside for instance for outside lighting.

**A** The whole installation needs to be protected in order to be effective. The specification for surge protection will be project specific depending on several factors and manufacturers are best placed to offer guidance on this.

You should inform the customer of the requirement to install surge protection to comply with the IET Wiring Regulations and provide them with sufficient information for them to make an informed decision. If the client refuses to have SPDs installed, this could be recorded on the electrical installation certificate to provide evidence that best efforts were made.

**Q** Is there any guidance on selecting the rating of the protective device for SPDs?

**A** Manufacturers of the equipment should be consulted to provide the correct rating of protective devices for SPDs.

**Q** What is the maximum distance of cable can be used to connect an SPD in a circuit?

**A** Regulation 534.4.8 of BS 7671:2018 has requirements for the maximum length of connecting conductors “Consideration shall be given to limit the total wiring length of conductors between connection points of the SPD assembly, which should preferably not exceed 0.5 m and in no case exceed 1.0 m.”



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## **AFDD questions**

**Q** As 421.1.7 is currently recommended as "additional fire protection", how would you advise designers to protect themselves in a court of law, if the worst case scenario was to occur and somebody died as a result of these devices not being used?

**A** It is the designer's duty to make the Client aware of the benefits of installing AFDDs, they should provide adequate information to allow the Client to make an informed decision. The installer could provide the information in writing and request that the client responds indicating whether to include the devices within the installation. This communication could be appended to the electrical installation certificate and a copy retained by the installer.

This would demonstrate that the installer had made best efforts to advise the customer. It is also recommended to advise the Client to speak with their insurance company to see if they would pay-out in the event of not installing AFDD, despite recommendation in BS 7671:2018.

**Q** Are applications of AFDDs generally associated with the type of system configuration e.g. TN, TT and IT. Can they be installed on all these three systems?

**A** AFDDs are suitable for installation on TN, TT and IT earthing systems.

**Q** How do I know when to specify AFDD?

**A** Regulation 421.7 of BS 7671:2018 provides information and examples of where AFDDs can be installed. Please see extract below.

NOTE: Examples of where such devices can be used include:

- premises with sleeping accommodation
- locations with a risk of fire due to the nature of processed or stored materials, i.e. BE2 locations (e.g. barns, woodworking shops, stores of combustible materials)
- locations with combustible constructional materials, i.e. CA2 locations (e.g. wooden buildings)
- fire propagating structures, i.e. CB2 locations
- locations with endangering of irreplaceable goods.

**Q** Can you confirm AFDD's are recommendations and not mandatory?

**A** AFDDs are a recommendation in Regulation 421.1.7 of BS 7671:2018 and not a requirement.





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**Q** If carrying out an electrical installation condition report and the building contains items from the criteria check, e.g. sleeping accommodation, and AFDD's are not fitted would this be recorded as a non-compliance/deviation?"

**A** AFDDs are a recommendation in Regulation 421.1.7 of BS 7671:2018 and not a requirement. It would not be deemed necessary to include as a departure from the Regulations on the certificate but may be prudent to add as a note and provide information to advise the customer of the benefit of AFDDs.

**Q** Where is the documented statistics that the IET have used to introduce the SPD's and the AFDD's into the regs?

**A** The requirements have been agreed at international level and adopted into BS 7671:2018. The IET Wiring Regulations takes account of the technical intent of agreements reached at international (IEC) and European (CENELEC) level in the form of harmonised documents.

**Q** There have been several social media demonstrations of AFDD's not working when subjected to manually created arcing. If I'm unable to test and confirm it will work how can I verify and then recommend them?

**A** The trip time of an AFDD is dependent on the current and time length of an arc, it is difficult to manually create an arc of sufficient magnitude and duration to trip an AFDD. The equipment is subjected to type testing during manufacturing, similar to circuit-breakers.

**Q** Is it the client or designer's obligation to assess the need for AFDD's?

**A** It is the designer's duty to make the Client aware that BS 7671:2018 recommends the installation of AFDDs, they should provide adequate information to allow the Client to make an informed decision.

The designer could provide the information in writing and request that the client responds, indicating whether to include the devices within the installation. This communication could be appended to the Electrical Installation Certificate and a copy retained by the installer.

This would demonstrate that the installer had made their best efforts to advise the customer. It is also recommended to advise the Client to speak with their insurance company to see if they would honour a claim should a loss be incurred which could have been avoided if an AFDD had been installed.

**Q** Does the recommendation for AFFDs apply to commercial or just domestic installations?

**A** The IET Wiring Regulations are applicable to fixed wiring in all types of buildings including commercial.



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**Q** If an AFDD which is installed for a ring final circuit, would it still protect the appliance plugged into the socket?

**A** Arc Fault Detection Devices will protect the circuit and all equipment connected downstream of the protective device which would include the appliance.

**Q** Can you use an arc welder with an AFDD?

**A** Welding machines should not affect AFDDs. AFDDs are programmed to ignore specific types of arcs as they look for particular signatures in the sinewave; other examples are arcs caused by motors in domestic appliances and breaking the circuit of fluorescent luminaires.

**Q** Can you define 'recommendation' with respect to AFDDs?

**A** The recommendation for AFDD is as opposed to a requirement of BS 7671:2018. If AFDDs are not installed it would not be considered a departure from BS 7671:2018

**Q** Can you advise which circuits should be protected by AFDDs in the areas suggested in BS 7671:2018. Should all circuits be protected?

**A** The decision to protect circuits with AFDDs will differ per installation depending on the risk. Whilst it may be appropriate to protect individual final circuits on some installations, if the risk is due to a fire propagating structure such as a timber framed building, then all circuits must be protected.

**Q** Could you use one AFDD to protect the whole consumer unit?

**A** AFDDs are required to be installed on each of the final circuits to be protected.

**Q** When will test devices for AFDDs be released?

**A** AFDDs are not required to be tested. The equipment is subjected to type testing during manufacturing, similar to circuit breakers. There is a manual test button to test mechanical operation.

**Q** Are AFDDs required for the DC side of solar PV installations?

**A** Regulation 421.1.7 recommends AFDD for AC final circuits only.



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**Q** In the regulations, it states AFDD for premises with sleeping accommodation, in the past this was hospitals, old people's homes, it does not specifically mention domestic premises, but most manufacturers have taken this as required, what is the IET's position?

**A** BS 7671 does not define sleeping accommodation however, publication DLCG Fire Safety-risk assessment/sleeping accommodation identifies many types of sleeping accommodation. Please see link below.

<https://www.gov.uk/government/publications/fire-safety-risk-assessment-sleeping-accommodation>

This publication is not applicable to domestic premises however this does not mean that domestic sleeping accommodation is not covered by BS 7671 Regulation 421.1.7.

**Q** Are AFDDs available combined with MCBs or only with RCBOs?

**A** AFDDs are available with both circuit-breaker and RCBO protection.

**Q** Are AFDD devices affected by DC leakage like some RCD types?

**A** AFDDs are not affected by DC leakage current due to the nature of operation. Unlike RCDs, they do not operate by magnetic field. AFDDs use microprocessor technology to analyse the AC waveform to monitor for particular signatures in the sinewave.

Please see links below for further information on SPDs and AFDDs.

<https://electrical.theiet.org/resources/articles/arc-fault-detection-devices-afdd/>

<https://electrical.theiet.org/resources/articles/surge-protective-devices-spd/>

<http://www.beama.org.uk/resourceLibrary/beama-guide-to-arc-fault-detection-devices--afdds-.html>

<http://www.beama.org.uk/resourceLibrary/beama-surge-protection-guide-.html>