

# Protective Measures & Special Installations or Locations (Part 1)

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There are a number of measures to protect against electric shock. This article, which is the first part of two, looks at summarising these protective measures applied to Special Installations or Locations as defined in Part 7 of the 17th Edition of the IEE Wiring Regulations (BS7671:2008). In particular this article looks at Sections 701 to 711.

One of the fundamental principles for electrical installations is protection for safety (Section 131) in which

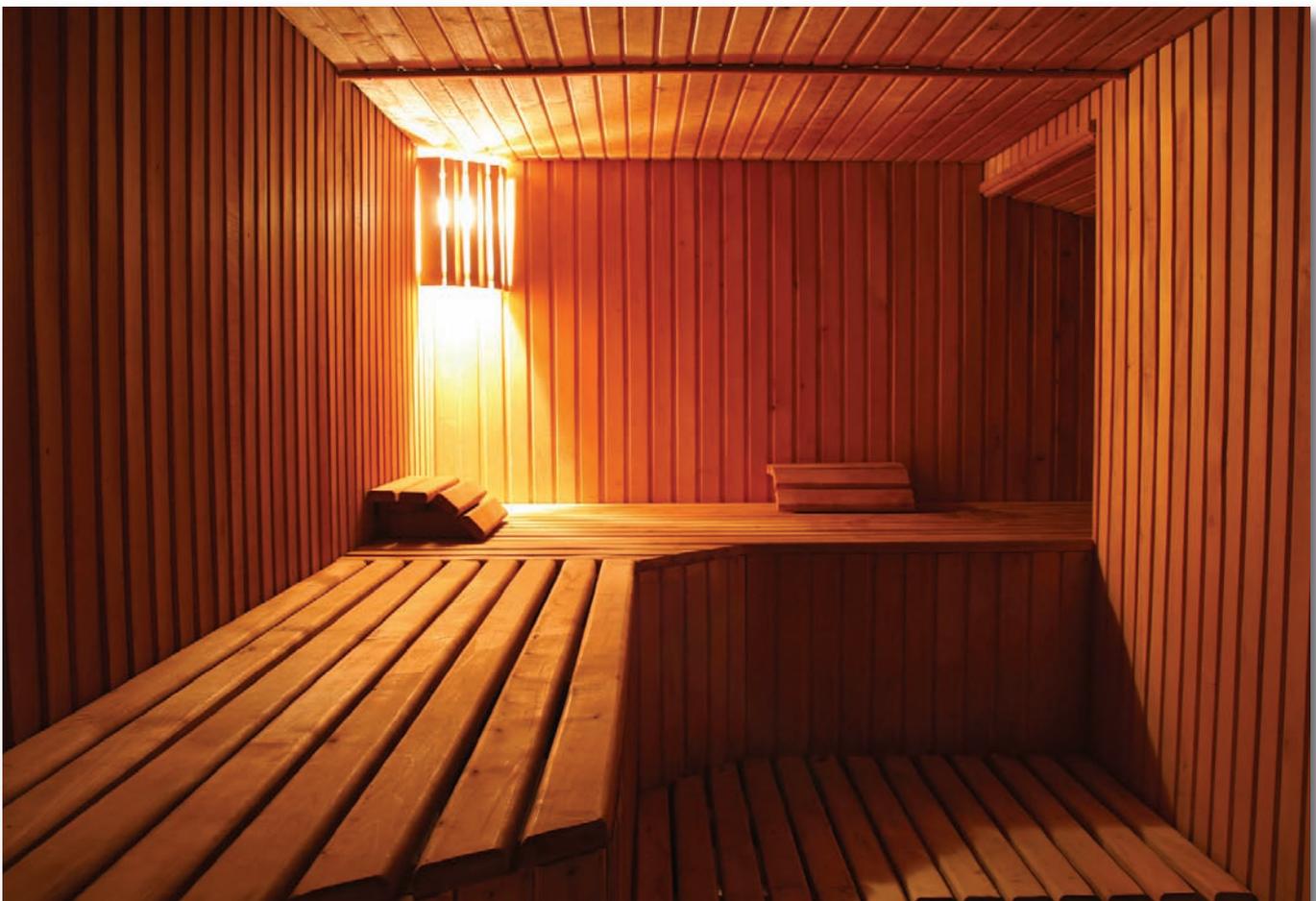
Regulation 131.2, Protection against electric shock, requires protection to prevent a person or livestock coming into contact with live parts by the provision of basic protection (direct contact) as well as fault protection (indirect contact) to prevent an electric shock when an exposed conductive part becomes live due to a fault. The technical requirements of this principle are dealt with in Part 4 of the Regulations by Chapter 41 "*Protection against electric shock*".

This chapter highlights four general protective measures that are generally permitted (Regulation 410.3.3):

- Automatic disconnection of supply (Section 411)
- Double or reinforced insulation (Section 412)
- Electrical separation for the supply to one item of current using equipment (Section 413)
- Extra –low voltage SELV and PELV (Section 414)

The application of one or

more of these protective measures in an installation needs to take into account the external influence. Section 415 also gives requirements to provide additional protection by the provision of a residual current device (RCD) and supplementary equipotential bonding for certain conditions, including Special Installations or Locations. For Special Installations or Locations (Part 7) there are particular requirements for each Section that either supplement or modify the requirements of



	<b>Automatic Disconnection of Supply (411)</b>	<b>Double or Reinforced Insulation (412)</b>	<b>Electrical Separation –supplying single item of equipment (413)</b>	<b>Extra Low Voltage (414)</b>	<b>General Requirements and Additional Protection (415)</b>
<b>Locations containing a bath or shower (701)</b>	All circuits of the location require additional protection by provision of one or more 30 mA RCDs with the characteristics specified in Regulation 415.1.1.	General Regulations of this Section apply	Circuits can only supply one item of current using equipment or there can only be one single socket outlet allowed.  Not permitted for electric floor heating systems.	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts in zones 0, 1 and 2 by either; (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures affording a degree of protection at least IPXXB or IP2X in accordance with Regulation 416.2. If SELV is used to supply an electric floor heating system then connection of the metallic grid to the supply circuit is not required.	Local supplementary bonding is required connecting protective conductor of each circuit supplying class I or II equipment to accessible extraneous conductive parts in the location.  Note: This can be omitted under certain conditions (See Regulation 701.415.2)
<b>Swimming pools and other basins (702)</b>	All extraneous conductive parts in zones 0, 1 and 2 are to be connected by supplementary bonding conductors to the protective conductors of exposed conductive parts of the equipment situated in the zones.  If using this measure for equipment for use in the interior of a basin when not occupied the circuit is to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1  If using this measure for zones 0 and 1 of a fountain then the circuit is to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1  If using this measure for zone 2 then the circuit is to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.	General requirements of this Section apply except where specific zone requirements determine the protective measure	If using this measure for equipment for use in the interior of a basin when not occupied it shall only supply one item of equipment with the source being installed outside zones 0, 1 and 2. (The source can be installed in zone 2 if the supply circuit is protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1)  If using this measure for zones 0 and 1 of a fountain then only one item of equipment can be supplied with the source being installed outside zones 0 and 1.  If using this measure for zone 2 then only one item of equipment can be supplied with the source being installed outside zone 2. (The source can be installed in zone 2 if the supply circuit is protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1)	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts in zones 0, 1 and 2 by either; (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures affording a degree of protection at least IPXXB or IP2X in accordance with Regulation 416.2.  If using this measure for equipment for use in the interior of a basin when not occupied the SELV source is to be installed outside zones 0, 1 and 2. (The source can be installed in zone 2 if the supply circuit is protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1)  If using this measure for zones 0 and 1 of a fountain then the SELV source is to be installed outside zones 0 and 1.  If using this measure for zone 2 then the SELV source is to be installed outside zones 0, 1 and 2. (The source can be installed in zone 2 if the supply circuit is protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1)	Zones 0 and 1 Except for fountains, in zone 0 only protection by SELV not exceeding a nominal 12 V ac (30 V dc) and in zone 1 not exceeding 25 V ac (60 V dc) is allowed. In either case the source is to be installed outside zones 0, 1 and 2.  Equipment for use in the interior of basins that is intended to be used when people are not inside the zone 0 are to be supplied by either SELV, automatic disconnection of supply or electrical separation (refer to each measure for the requirements). If a socket outlet is used to supply this equipment then a notice is to be provided to warn the user that is shall be used only when the basin is not occupied by persons.  Zones 0 and 1 specific to fountains These zones shall use one or more of SELV, automatic disconnection of supply and electrical separation (refer to each measure for the requirements)  Zone 2 This zones shall use one or more of SELV, automatic disconnection of supply and electrical separation (refer to each measure for the requirements)
<b>Rooms and cabins containing sauna heaters (703)</b>	All circuits for the location require additional protection by providing one or more 30 mA RCDs with the characteristics specified in Regulation 415.1.1. An exception is the sauna heater unless recommended by the manufacturer.	General Regulations of this Section apply	General Regulations of this Section apply	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts in zones 0, 1 and 2 by either; (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures affording a degree of protection at least IPXXB or IP2X in accordance with Regulation 416.2.	Circuits require additional protection by RCDs (refer to automatic disconnection of supply)
<b>Construction and demolition site installations (704)</b>	If using this measure for supplying a socket outlet or hand held piece of electrical equipment not exceeding 32 A then additional protection is required by a 30 mA RCD with the characteristics specified in Regulation 415.1.1  A circuit supplying one or more sockets outlets with a rating exceeding 32 A shall have an RCD not exceeding 500 mA interrupting the supply to the line conductors. Also Regulations 411.3.2.5 and 411.3.2.6 are not applicable  A TN-C-S supply shall not be used to supply the site, except for the supply to fixed building(s).	General Regulations of this Section apply except where specific measures are required	If using this measure for supplying a socket outlet or hand held piece of electrical equipment not exceeding 32 A then each socket outlet and hand held piece of electrical equipment is to be supplied by an individual transformer or by a separate winding of a transformer.  Special attention to be paid to Regulation 413.3.4 which requires flexible cables and cords to be visible throughout their length if liable to mechanical damage	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts by either;  (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures in accordance with Regulation 416.2.  SELV is preferred for portable hand lamps in damp or confined spaces	Circuits supplying a socket outlet or hand held electrical equipment not exceeding 32 A is to be protected by either;  (i) reduced low voltage (see Section 411.8 of BS7671) (ii) automatic disconnection of supply (refer to protective measure) (iii) Electrical separation (refer to protective measure) (iv) SELV or PELV (general requirements apply)  Reduced low voltage is preferred for supply to general portable hand lamps, portable hand tools and local lighting up to 2 kW.

	<b>Automatic Disconnection of Supply (411)</b>	<b>Double or Reinforced Insulation (412)</b>	<b>Electrical Separation –supplying single item of equipment (413)</b>	<b>Extra Low Voltage (414)</b>	<b>General Requirements and Additional Protection (415)</b>
<b>Agricultural and horticultural premises (705)</b>	Circuits supplying socket-outlets not exceeding 32 A are to be protected by 30 mA RCDs, exceeding 32 A by 100 mA RCDs and all other circuits 300 mA RCDs.  A TN-C system shall not be used in the installation (including residences and other premises).	General Regulations of this Section apply	General Regulations of this Section apply	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts by either; (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures affording a degree of protection at least IPXXB or IP2X in accordance with Regulation 416.2.	Supplementary bonding is required in locations where livestock can touch exposed conductive parts and extraneous conductive parts. This includes a metal grid in the floor if installed and extraneous conductive parts in, or on a floor e.g. reinforced concrete. Spaced floor arrangements should also be included. (Where no metal grid is installed in the floor a TN-C-S supply is not recommended).
<b>Conducting locations with restricted movement (706)</b>	This measure can only be used for supplying fixed equipment. Also requires supplementary equipotential bonding of all exposed conductive parts of fixed equipment and conductive parts of the location  If a functional earth is required then equipotential bonding is required between all exposed conductive parts and extraneous conductive parts inside the location and the functional earth	This measure can only be used for supplying fixed class II equipment or equipment with equivalent insulation. The supply circuit is to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1	This measure can only be used for supplying a hand held tool or an item of mobile equipment and fixed equipment as long as only one item is connected to a secondary winding of a transformer. The transformer can have more than one winding.  The unearthed source is to have simple separation and is to be located outside the location, unless it is part of the fixed installation within the location.	SELV can be used for supplying a hand held tool or an item of mobile equipment, hand lamps and fixed equipment.  PELV can be used for supplying fixed equipment provided there is equipotential bonding of exposed conductive parts, extraneous conductive parts inside the location and the connection of the PELV system to earth.  Basic protection is to be provided by basic insulation complying with Regulation 416.1 or barriers or enclosures complying with Regulation 416.2	For this type of location the protective measures applicable for the supply to various types of equipment are limited (refer to each measure)
<b>Electrical installations in caravan / camping parks (708)</b>	For a TN system only a TN-S installation can be used, however a TN-C-S system can be used to supply permanent buildings on the site.	General Regulations of this Section apply	General Regulations of this Section apply	General Regulations of this Section apply	Each socket outlet is to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1
<b>Marinas and similar locations (709)</b>	For a TN system the final circuits to pleasure craft and houseboats are not to include a PEN conductor.  Socket outlets and final circuits intended for fixed connections to supply houseboats are to be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1	General Regulations of this Section apply	General Regulations of this Section apply	General Regulations of this Section apply	General Regulations of this Section apply
<b>Exhibitions, shows and stands (711)</b>	Structural metallic parts which are accessible from within the stand, vehicle, wagon, caravan or container shall be connected via main protective bonding conductors to the main Earthing terminal within the unit.  A system of type TN shall be TN-S (TN-C-S is prohibited for supply to a caravan or similar construction).	General Regulations of this Section apply	General Regulations of this Section apply	Irrespective of the nominal voltage used there shall be provision of basic protection of live parts by either; (i) Basic insulation complying with Regulation 416.1. (ii) Barriers or enclosures affording a degree of protection at least IPXXD or IP4X in accordance with Regulation 416.2	A cable supplying a temporary structure is to be protected at its origin by an RCD not exceeding 300 mA. It is to incorporate a time delay or be of the S-type to provide discrimination where final circuit RCDs are used.  Each socket outlet not exceeding 32 A and all final circuits other than for emergency lighting shall be protected by a 30 mA RCD with the characteristics specified in Regulation 415.1.1.

**Table 1 – Summary of the general protective measure requirements for Special Installations or Locations (701 to 711)**

the protective measures defined in Chapter 41. Table 1 summarises the application of the protective measures for the defined Special Installations or Locations, highlighting the specific supplementary or modified requirements for a protective measure. In certain

instances there are additional general requirements as well as additional protection (Section 415) requirements which enhance the protective measures. As well as the general protective measures already described there is the

protective measure of obstacles and placing out of reach (Section 417). It is worth highlighting that this is a protective measure that only provides basic protection and would only be applicable in installations that are restricted to skilled or instructed persons under the supervision

of skilled persons. There are also other protective measures that are applicable in an installation that is controlled or under the supervision of skilled or instructed persons (Section 418) to avoid unauthorized changes, these are:

	<b>Obstacles and placing out of reach (417)</b>	<b>Non-conducting Location (418.1)</b>	<b>Earth free local equipotential bonding (418.2)</b>	<b>Electrical separation – supplying more than one item of equipment (418.3)</b>
<b>Locations containing a bath or shower (701)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Swimming pools and other basins (702)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Rooms and cabins containing sauna heaters (703)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Construction and demolition site installations (704)</b>	Not permitted	See Note 1	See Note 1	See Note 2
<b>Agricultural and horticultural premises (705)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Conducting locations with restricted movement (706)</b>	Not permitted	Not applicable as it is a conducting location	See Note 3	See Note 2
<b>Electrical installations in Caravan / camping parks (708)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Marinas and similar locations (709)</b>	Not permitted	Not permitted	Not permitted	See Note 2
<b>Exhibitions, shows and stands (711)</b>	Not permitted	Not permitted	Not permitted	See Note 2

**Note 1:**

Although the use of this measure is not specifically restricted by a Regulation in Part 7 for this location this method of protection is not recognised for general application and is only to be applied where the installation is under the supervision of skilled or instructed persons so that unauthorized changes cannot be made. There are specific requirements for some locations that effectively restrict the use of this measure (refer to Table 1).

**Note 2:**

Although the use of this measure is not specifically restricted by a Regulation in Part 7 for this location this method of protection is only to be applied where the installation is under the supervision of skilled or instructed persons so that unauthorized changes cannot be made. There are specific restrictions in the use of electrical separation supplying only a single piece of equipment for some locations that effectively restricts the use of this measure (refer to Table 1).

**Note 3:**

Although the use of this measure is not specifically restricted in Part 7 by a Regulation for this location this measure would not be permitted due to the requirements for specific equipment types and allowable protective measures (refer to Table 1).

**Table 2 – Specific protective measures applied to Special Installations or Locations (701 to 711)**

- Non-conducting location (Section 418.1) (Sections 701 to 711).
- Earth-free equipotential bonding (Section 418.2) The IET Guidance Note 7 – Special Locations deals with Special Installations or Locations. This is being aligned and updated to the 17th Edition and will provide additional guidance to the information provided here. ■
- Electrical separation for the supply to more than one item of current using equipment (Section 418.3)

Due the nature of these types of protective measures there are a number of restrictions in relation to Special Installations or Locations. Table 2 summarises the application of the above protective measures for the defined Special Installations or Locations

