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Guide to I.S. 10101: 2020 National Rules for Electrical Installations

This digital training module has been developed by the Electrical Contractors' Association, in conjunction with METAC Training and the CIF, based on the needs of electrical contractors.

The aim is to make this electronic module widely available to the full industry, to be delivered with as little disruption to working projects as possible.

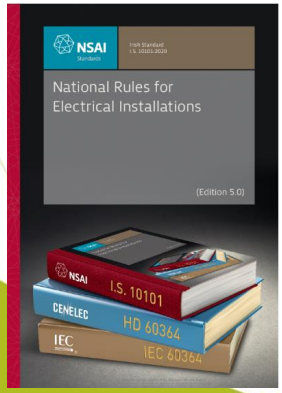
The development of this program will specifically assist electrical chargehands, foremen, supervisors and others with a responsibility for electrical installers to provide in-house training and toolbox talks that are focused on the changes a contractor needs to know about.

This programme was supported with funding from the Electrical Industries Federation of Ireland.

METAC TRAINING

skills for work, life and play

Guide to I.S. 10101:2020 National Rules for Electrical Installations



Tadhg Kirwan

CONSTRUCTION INDUSTRY FEDERATION

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I.S. 10101:2020

- I.S.10101:2020 is the first major revision to the rules in over 10 years and is based on internationally agreed standards for safety of electrical installations. I.S. 10101:2020 will replace ET 101:2008, and has been produced by industry experts who sit on the NSAI's Electro Technical Committee (ETC/TC 2)

- The National Rules for Electrical Installations are essential for electricians, electrical contractors and designers as they specify the safety requirements for electrical installations in all types of premises in Ireland.

I.S. 10101:2020

- The revision programme for I.S.10101 took two years to complete and included a three-month public consultation from December 2018 to March 2019.

- Over 600 comments were submitted, and all were considered in detail by the committee.

- The revisions bring requirements in line with recent technical developments and best practice in Europe, including new technologies such as charging of electric vehicles, solar photovoltaic systems etc. There is also a new Part 8 which gives guidance on energy efficiencies.

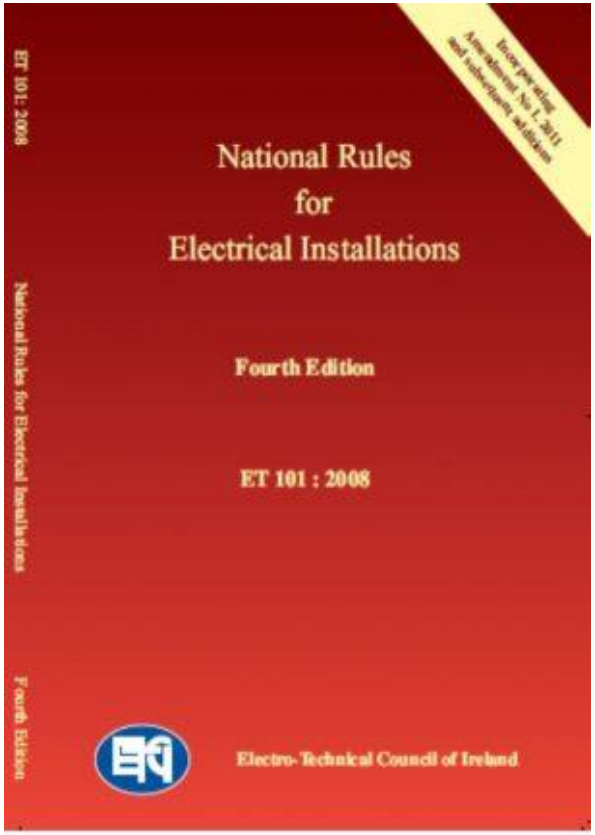
I.S. 10101:2020

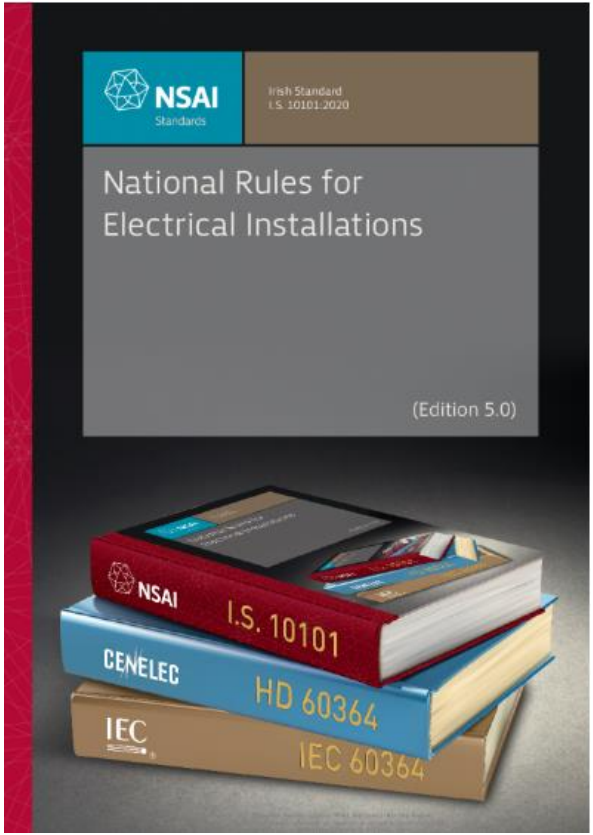
Key Dates:

- **2020**
  - 1 April 2020: New electrical installations may be designed and certified to the new standard
- **2021**
  - 31 January 2021: This is the last day new electrical installations may be designed to the old standard (*such installations **must** be certified by 31 July 2022*)
  - 1 February 2021: New electrical installations ***must*** be designed to the new standard
- **2022**
  - 31 July 2022: This is the last day an installation may be pre-connection certified to the old standard (*such installations **must** have been designed by 31 January 2020*)
  - 1 August 2022: Electrical installations ***must*** be certified to the new standard.

I.S. 10101:2020

National Rules for Electrical Installations





Electricity Regulation Act 1999

Task is to “regulate the activities of electrical contractors with respect to safety”

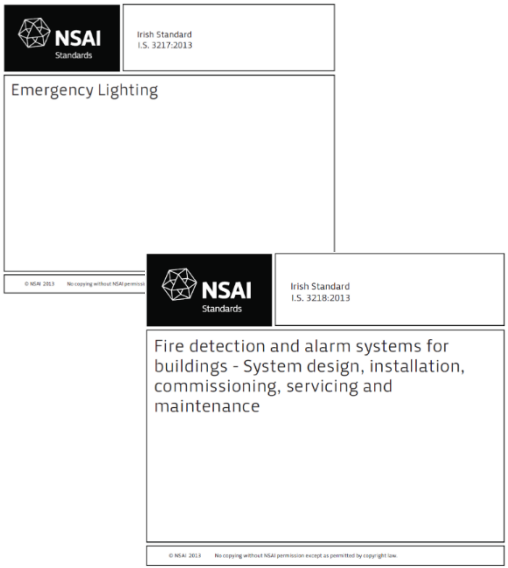
Set up a register - **RECI**
Set up a safety inspectorate - **SAFE ELECTRIC**
Have a set of rules - **ET.101**

The Electro-Technical Council of Ireland, ETCI, published the first four editions of the rules, ET101.

The fifth edition, I.S.10101, is published by the National Standards Authority of Ireland, NSAI.

I.S. 10101:2020

National Rules for Electrical Installations



NSAI have already developed standard publications in the electrical industry. These are:

IS:813 Domestic Gas Installations

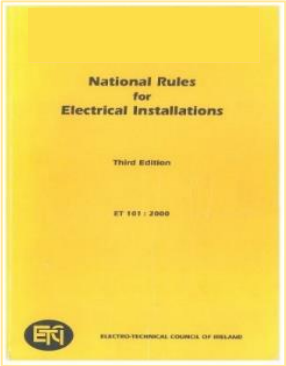
IS:820 Non Domestic Gas Installations

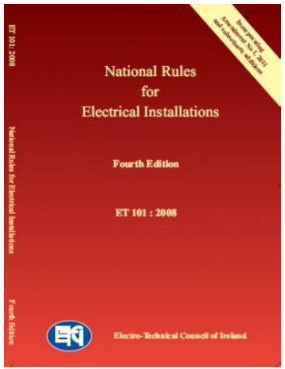
IS:3217 Emergency Lighting

IS:3218 Fire Alarm Systems

I.S. 10101:2020

National Rules for Electrical Installations





The Fourth Edition of ET 101 was released in 2008.
A lot has changed since then.
Also, the speed of change is increasing!

UK regulations are on their 18th edition
IEC and CENELEC standards have changed

NSAI is Irelands representative on-
CENELEC = European standards body
IEC = International standards body

European Harmonised Documents apply to Ireland

Primary Objective of National Rules for Electrical Installations

- **Protection against electric shock**
- **Voltage up to 1 kV a.c**
- **Safety requirements**
- **Fixed installation, not cover individual items of electrical equipment**
  - REMIT ENDS AT THE SOCKET OR ISOLATOR.

I.S. 10101:2020

Key Changes

- In ET 101 there are 7 “Parts”,
- In I.S 10101 these are now called “Chapters”
- ET 101 had all of the Annexes at the back of the book, whereas, I.S 10101 has the relevant Annex(es) for each chapter at the end of that chapter for improved readability.
  - Annexes labelled “(normative)” imply that they **must** be adhered to.
  - Annexes labelled “(informative)” imply that they are **recommended**
- Electronic access of the standard is available from SAI Global website.

I.S. 10101:2020

Key Changes

- Residual Current Devices (RCDs) on lighting circuits in domestic premises.
- Arc Fault Detection Devices (AFDDs) will now be recommended
- Electromagnetic Compatibility (EMC) Directive
- Cables to be rated Class Dca s2,d2,a2 in accordance with EN50575.
- Residual current devices (RCDs) Type AC are not recommended
- Model certificates have now been removed from Chapter 6
- Annex 8: Energy Efficiency

I.S. 10101:2020

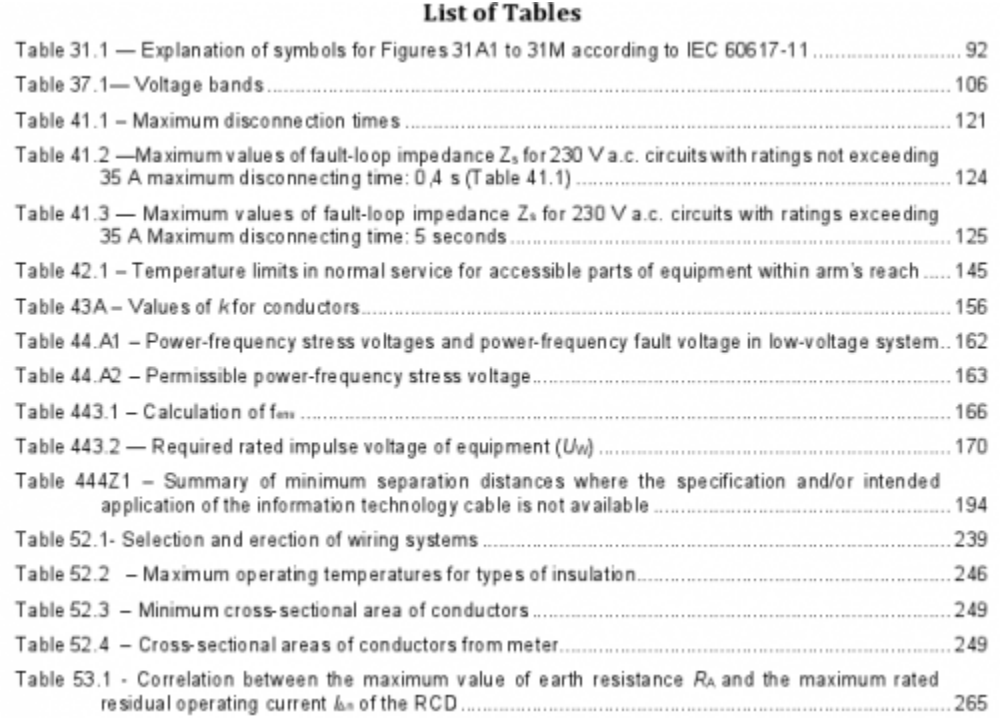
How to Navigate I.S.10101

- On pages 10-16, there is a list of contents.
- Each Chapter, and all of the chapters sections are titled and a page number provided to help the user find the required information.

I.S. 10101:2020

How to Navigate I.S.10101

- There are also extensive Lists of Tables and Figures to help navigate to the relevant section.
- These Lists are a quick and easy guide if the reader knows which Chapter the required information is in.



List of Tables

How to Navigate I.S.10101

- However, often the reader does not know which Chapter to start with. In this case the INDEX at the back of the book may be more helpful.
- The reader can search the alphabetical index for the electrical term, phrase, equipment etc. rather than reading through the list of contents aimlessly.
- E.g. if the reader needs information on “Surge Protection Devices” but does not know the chapter containing the information, simply work through the alphabetical index

I.S. 10101:2020

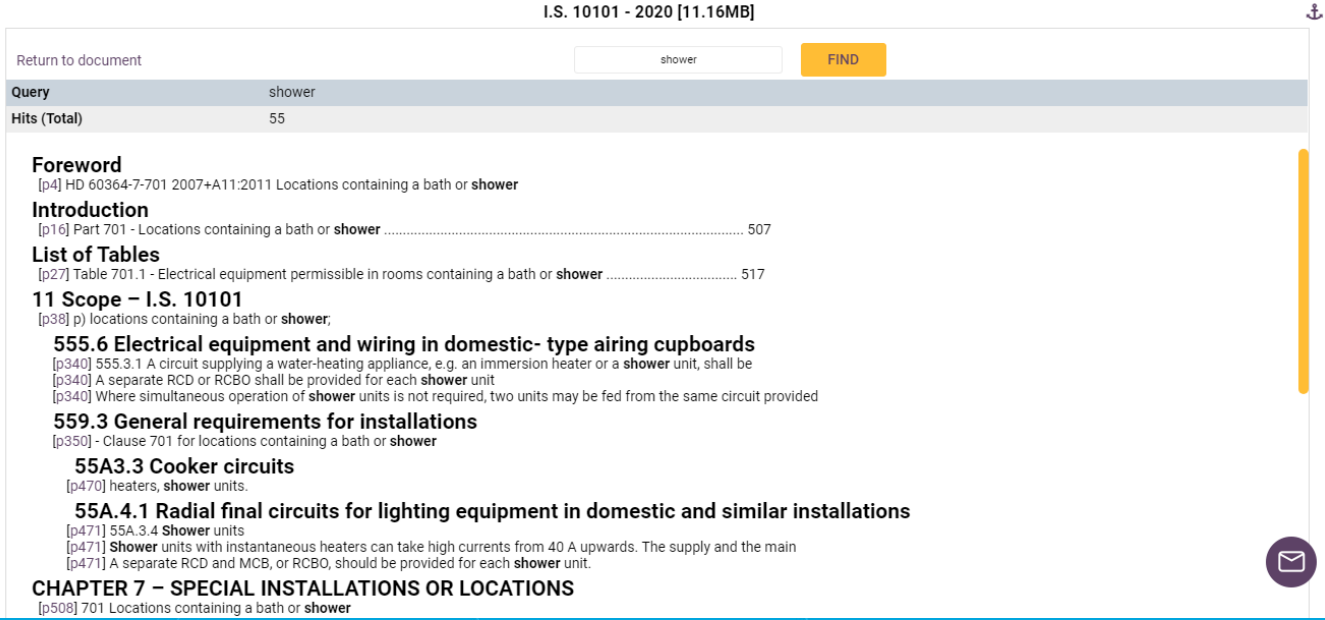
How to Navigate I.S.10101

- The index can quickly and easily navigate the reader to the required location.
- It is worth noting that the index only offers a rule number, not a page number like the list of contents

I.S. 10101:2020

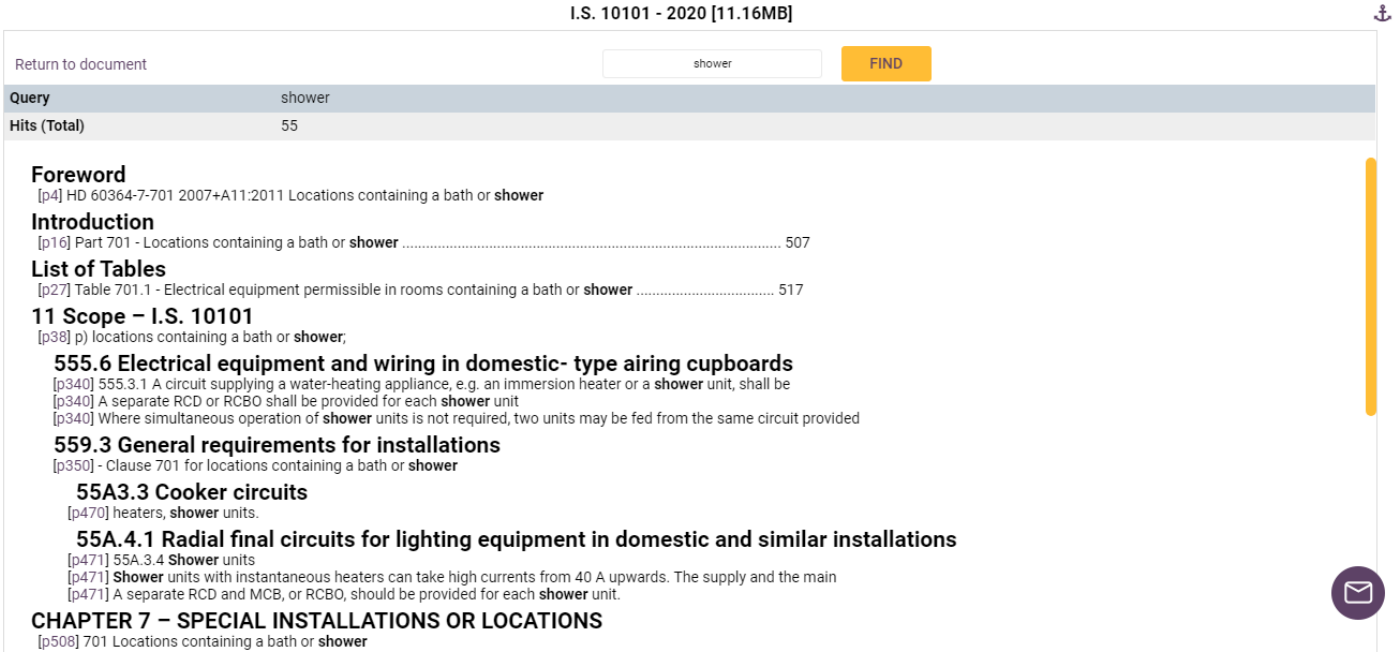
How to Navigate I.S.10101

- A new way the quickly and easily navigate the rules is the use the electronic portal via SAI Global's i2i online service.
- Here the user can type a word or rule number into the search bar, and select from the results.



I.S. 10101:2020

How to Navigate I.S.10101



- More on electronic access to I.S.10101 later

Scope and Fundamental Principles

Chapter 1 - Scope

- Chapter 1 has largely remained unchanged from the previous edition, and the scope still refers to the fixed wiring installation to the socket or isolator. Equipment plugged into or wired into the isolator is handled under other standards, but not by the National Rules for Electrical Installations.
- “I.S. 10101:2020 specifies the requirements for the design, erection, and verification of low voltage electrical installations.”
- “This Standard is intended to provide for the safety of persons, livestock and property against dangers and damage which may arise in the reasonable use of electrical installations and to provide for the proper functioning of those installations.”

Chapter 1 - Scope

- I.S. 10101:2020 apply to the design, erection and verification of electrical installations including:
  - a) residential premises;
  - b) commercial premises;
  - c) public premises;
  - d) industrial premises;
  - e) agricultural and horticultural premises;
  - f) prefabricated buildings;
  - g) caravans, caravan sites and similar sites;
  - h) construction sites, exhibitions, fairs and other installations for temporary purposes;
  - i) marinas;
  - j) external lighting and similar installations
  - k) medical locations;
  - l) mobile or transportable units;
  - m) photovoltaic systems; and
  - n) low-voltage generating sets.

Chapter 1 - Scope

- Chapter 1 also lists installations to which the rules **do not** apply e.g. electrical installations in aircraft and on-board shops, electrical equipment in motor vehicles, electrical installations in mines and quarries to name a few.

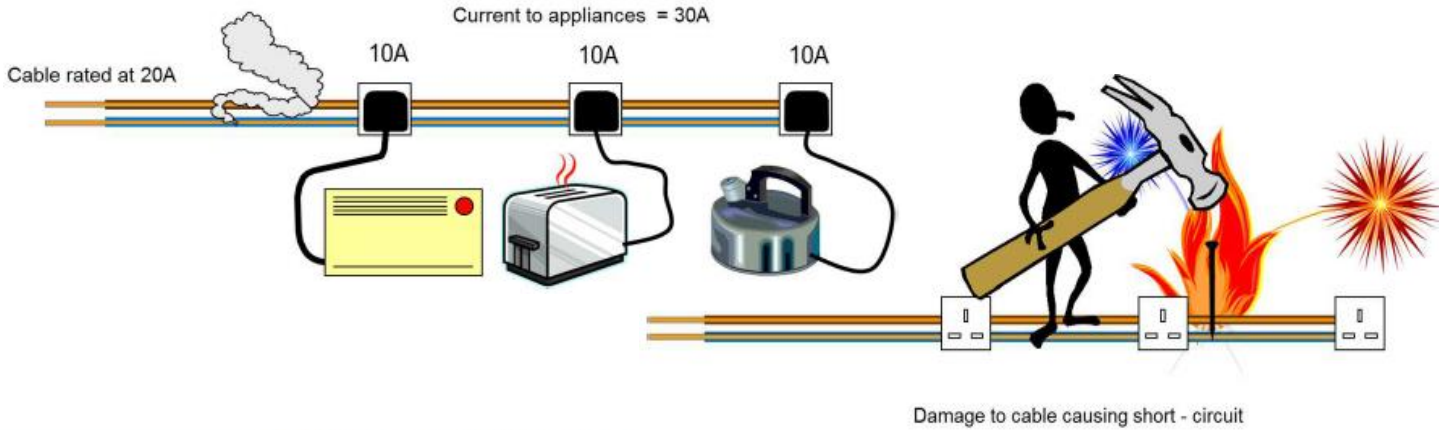
- The standard is applicable to circuits supplied at nominal voltages up to 1000V AC and 1500V DC

- Electrical equipment which takes supply from the socket or isolator is **not** covered.

- 132.1: Consideration for spare capacity:
  - “consideration should be given to the provision of cabling or ducting for new buildings, major renovations or rewiring of existing installations to support renewable energy infrastructure, for example, electric vehicles, photovoltaics, energy storage systems and other forms of microgeneration. Consideration should also be given to the additional capacity required to service this infrastructure.”

Chapter 1 - 131 - Protection for Safety

- Fundamental Principles for safety of people, livestock & property from dangers that may arise from the use of electrical installations.
  - Protection against electric shock (direct contact or indirect contact)
  - Protection against thermal effects (system designed to minimise risk of ignition of flammable material due to high temperatures or arcing)
  - Protection against overcurrent and fault currents



Definitions

Chapter 2 - Definitions

- This chapter of the standard is an alphabetical glossary of terms used throughout.
- The reader should refer to this section when looking for clarification on any unknown terminology in other chapters.
- The definitions list has been expanded and certain definitions have been modified to align with the definitions provided in the International Electrotechnical Vocabulary.
- It is important to become familiar with the new terms as they are mentioned throughout I.S.10101

New Additions:

- Bonding ring conductor:
  - An earthing bus conductor which forms a closed connecting ring.

- Bonding network:
  - Set of interconnected conductive structures that provide an “electromagnetic shield” for electronic systems and personnel at frequencies from direct current (DC) to low radio frequency (RF)

- Common bonding network:
  - Equipotential bonding system providing both protective equipotential bonding and functional equipotential bonding

Chapter 2 - Definitions

- Distribution Board:
  - Assembly containing different types of switchgear and controlgear associated with one or more outgoing electric circuits fed from one or more incoming electric circuits, together fed from one or more incoming electric circuits, together with terminals for the neutral and protective conductors

- Effiency Measures (EM):
  - Level of implementation of measures to improve energy efficiency of an electrical installation

- Electrical Installation Efficiency Class (EIEC):
  - Combination of efficiency measures (EM) and energy efficiency performance levels (EEPL).

- Instructed Person (Electrically) (BA4):
  - Person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards which electricity can create.

- Meshed Bonding Network:
  - Bonding network in which all associated equipment frames, racks, and cabinets and usually the DC power return conductor, are bonded together as well as at multiple points to the CBN (Common bonding network).

- Skilled Person (Electrically) (BA5):
  - Person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create.

General Characteristics

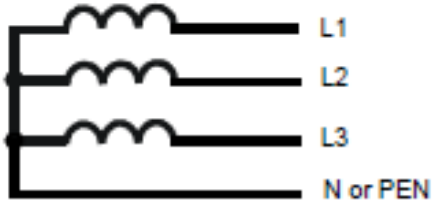
Chapter 3 - General Characteristics

- General characteristics of an installation refers mainly to the **Conductor Arrangement & System Earthing.**
- This chapter goes into more detail than Part 3 of ET 101.
- Relevant Annexes 3A & 3B are listed at the end of the chapter for improved readability.
- illustrations provided of all conductor arrangements and various earthing arrangements mentioned in the chapter

Conductor Arrangements

Figure 31.3 – Two-phase 3-wire

Figure 31.4 – Three-phase 3-wire



- **The codes used have the following meanings:**
- First letter – Relationship of the power system to earth:
  - T = direct connection of one point to earth;
  - I = all live parts isolated from earth, or one point connected to earth through a high impedance.
- Second letter – Relationship of the exposed-conductive-parts of the installation to earth:
  - T = direct electrical connection of exposed-conductive-parts to earth, independently of the earthing of any point of the power system;
  - N = direct electrical connection of the exposed-conductive-parts to the earthed point of the power system (in a.c. systems, the earthed point of the power system is normally the neutral point or, if a neutral point is not available, a line conductor).
- Subsequent letter(s) (if any) – Arrangement of neutral and protective conductors:
  - S = protective function provided by a conductor separate from the neutral conductor or from the earthed line (or, in a.c. systems, earthed phase) conductor.
  - C = neutral and protective functions combined in a single conductor (PEN conductor).

- **T** = Terra(earth): Direct connection of one point to earth

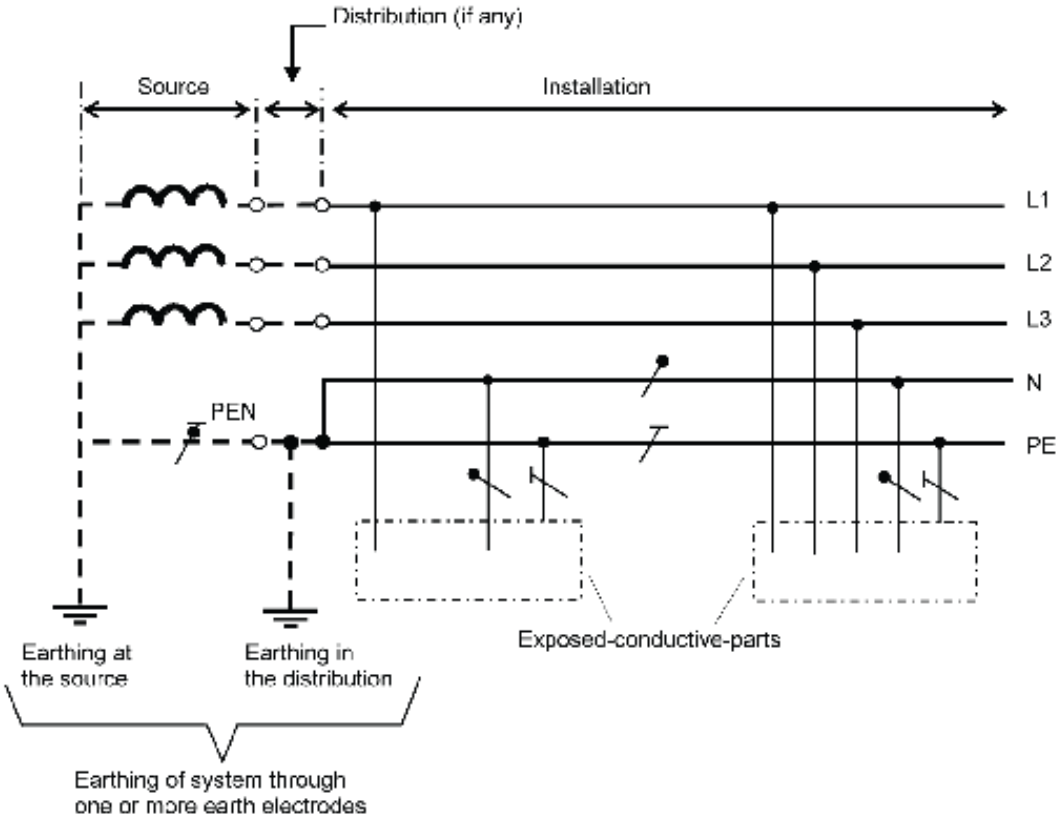
- **N** = Neutralised: Direct electrical connection of the exposed-conductive-parts to the earthed point of the power system. In A.C. systems, the earthed conductor of the power system is normally the neutral conductor.

- **C** = Combined: Neutral and protective functions combined in a single conductor (PEN conductor).

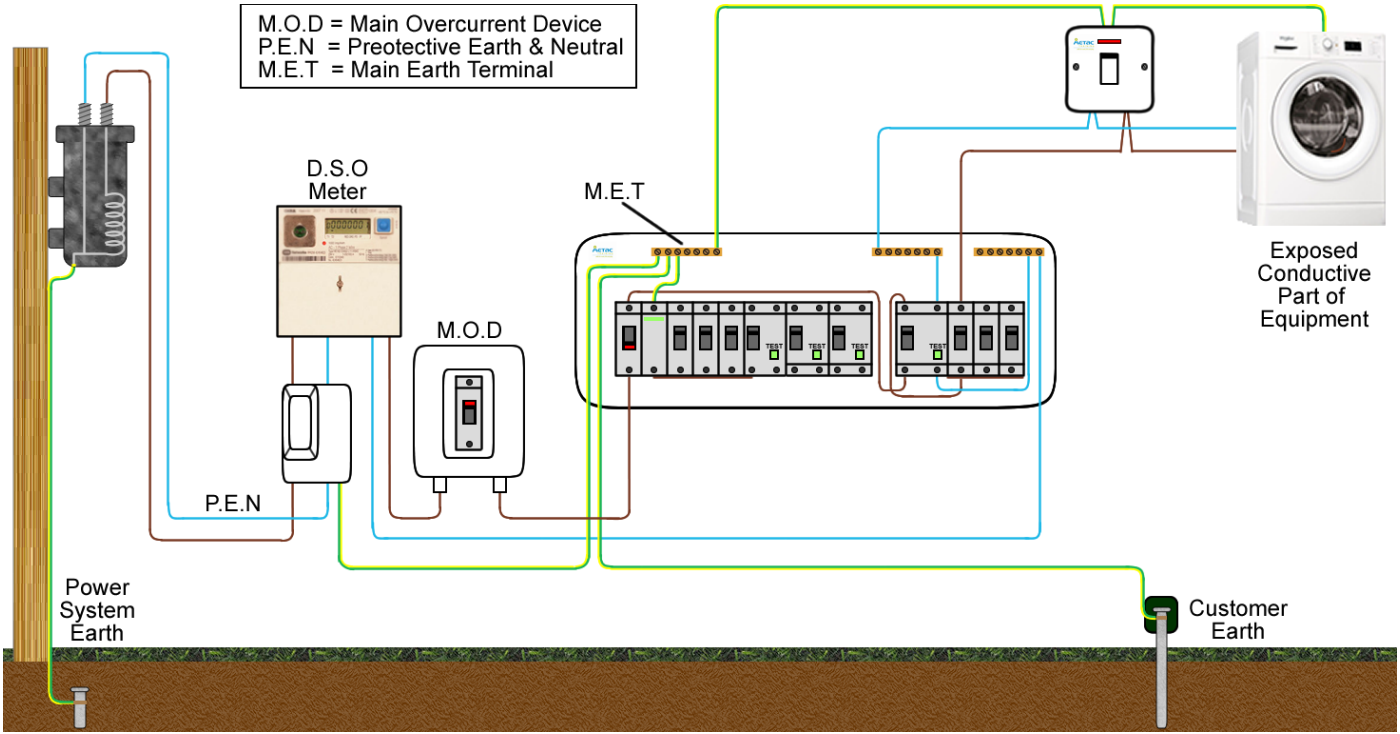
- **S** = Separate: Separate neutral and protective conductors

I.S. 10101:2020

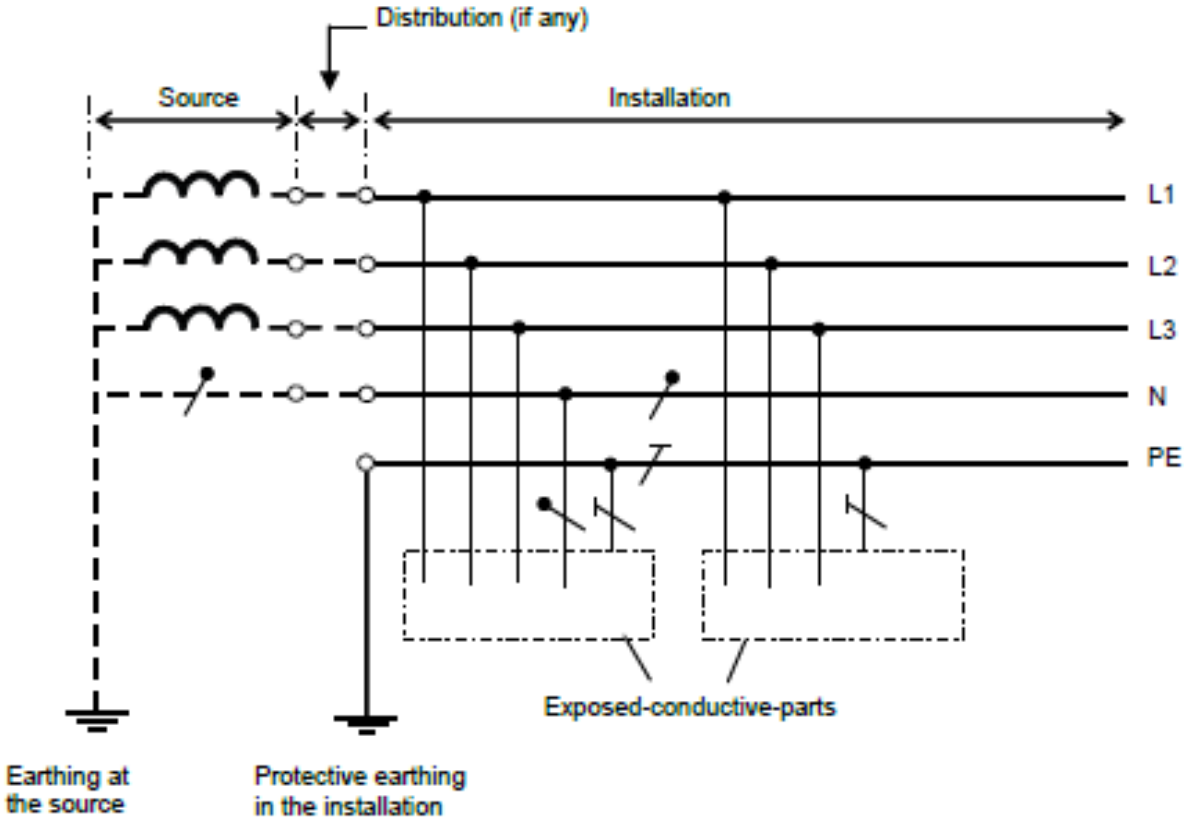
Chapter 3 - TN-C-S Earthing System



Chapter 3 - TN-C-S Earthing System



Chapter 3 - TT Earthing System



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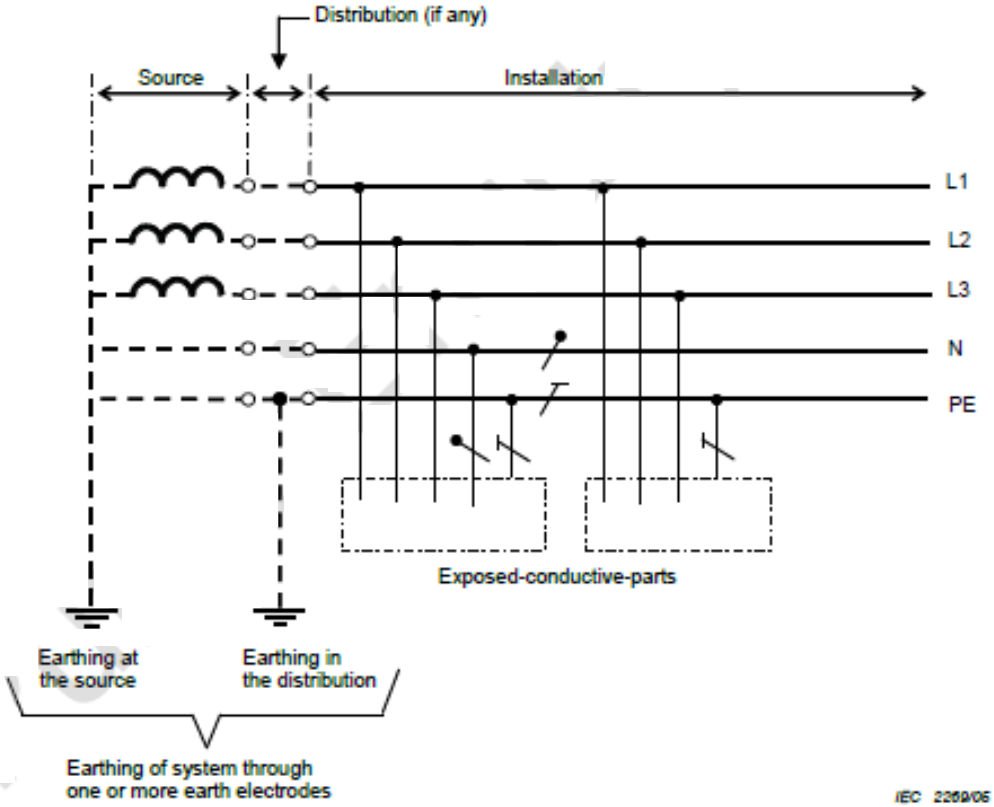
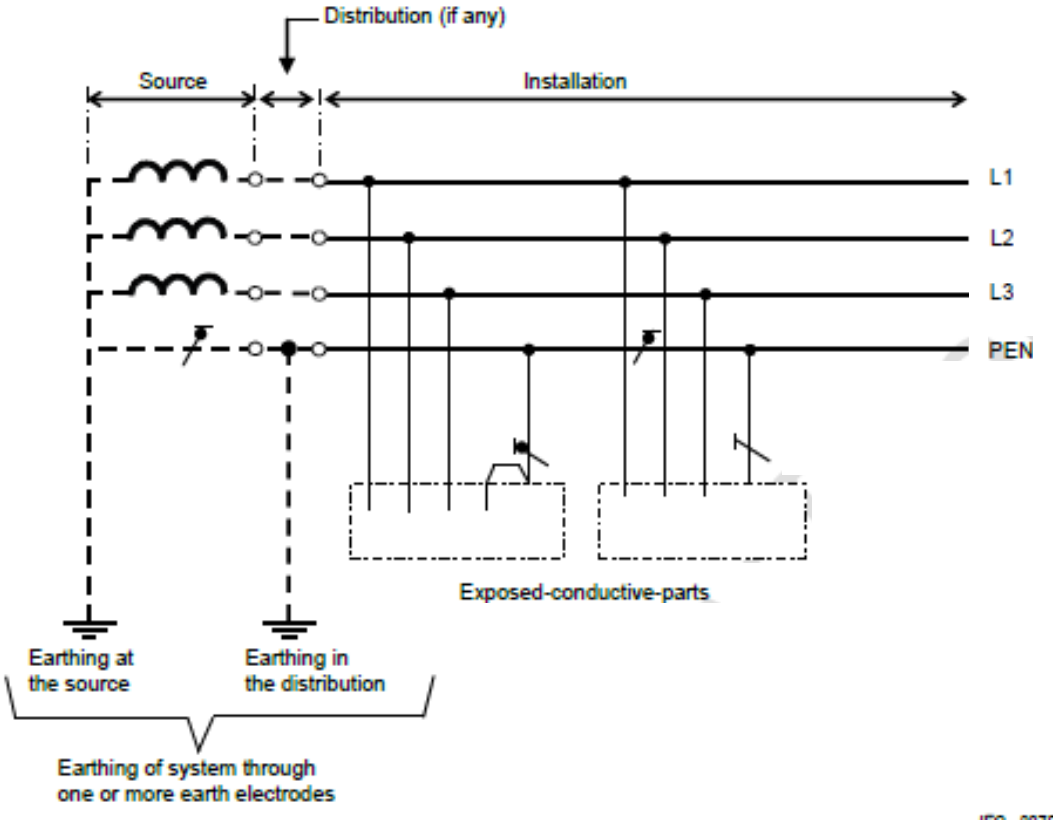
Chapter 3 - TN-S Earthing System



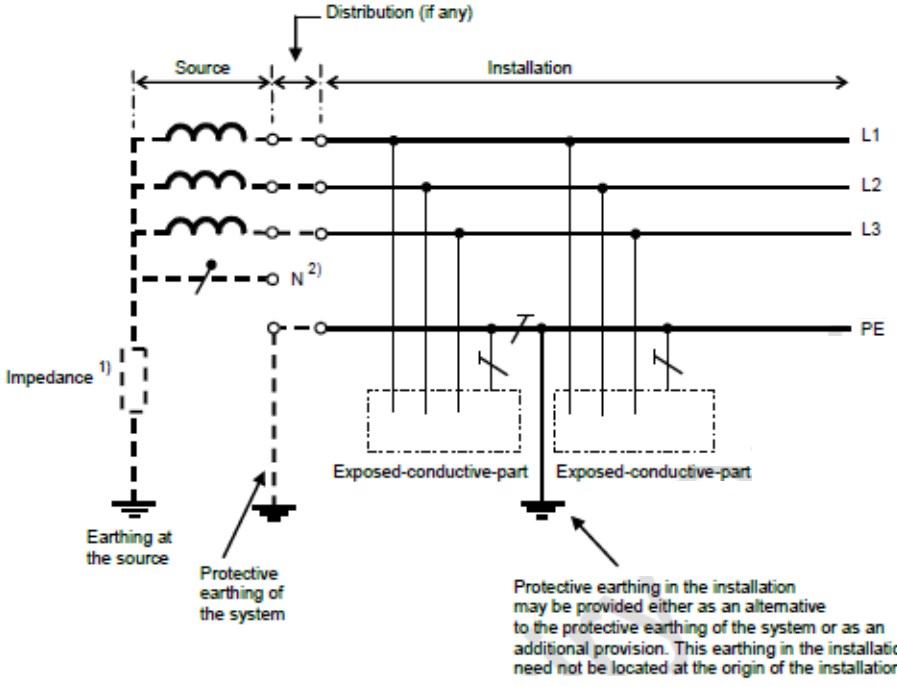
I.S. 10101:2020

Chapter 3 - TN-C Earthing System



I.S. 10101:2020

Chapter 3 - IT Earthing System



NOTE Additional earthing of the PE in the installation may be provided.

1) The system may be connected to earth via a sufficiently high impedance. This connection may be made, for example, at the neutral point, artificial neutral point, or a line conductor.

2) The neutral conductor may or may not be distributed.

Protection for Safety

Chapter 4 - Protection for Safety

- Chapter 4 deals with protection against electric shock as applied to electrical installations.

- It is based on I.S. EN 61140 which is a basic safety standard that applies to the protection of persons and livestock. I.S. EN 61140 is intended to give fundamental principles and requirements that are common to electrical installations and equipment or are necessary for their co-ordination.

- The fundamental rule of protection against electric shock, according to I.S. EN 61140, is that hazardous-live-parts must not be accessible and accessible conductive parts must not be hazardous live, neither under normal conditions nor under single fault conditions.

In the previous edition:

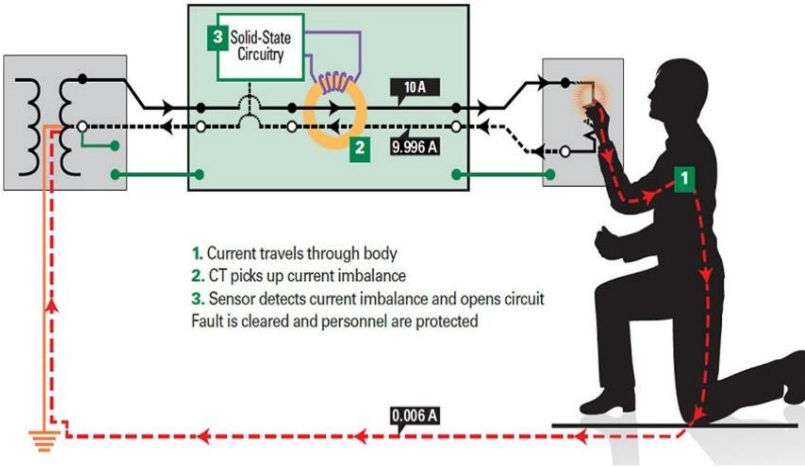
- Protection under **normal conditions** (now designated **basic protection**) was referred to as protection against **direct contact.**
  - Persons and livestock/animals are protected from coming into contact with live parts by basic protection e.g. cable insulation, containment, enclosures, barriers etc.

- Protection under **fault conditions** (now designated **fault protection**) was referred to as protection against **indirect contact**.
  - Persons and livestock/animals are protected from dangerous voltages that may appear in an installation due to fault conditions. This is achieved by earthing and bonding, and automatic disconnection through protective devices e.g. MCB's, RCD's etc.

Chapter 4 - Protection for Safety

Chapter 4 details safety and protection, including:

- Automatic disconnection of the supply in the event of a fault,
- Protective earthing & equipotential bonding,
- Protection by double of reinforced insulation



Chapter 4 - 411.3.2 - Automatic Disconnection

- The maximum disconnection time stated in Table 41.1 shall be applied to final circuits not exceeding 32A.

Table 41.1 – Maximum disconnection times

System	$50\ V < U_o \leq 120\ V$ s		$120\ V < U_o \leq 230\ V$ s		$230\ V < U_o \leq 400\ V$ s		$U_o > 400\ V$ s	
	a.c.	d.c.	a.c.	d.c.	a.c.	d.c.	a.c.	d.c.
TN	0,8	Note 1	0,4	5	0,2	0,4	0,1	0,1
TT	0,3	Note 1	0,2	0,4	0,07	0,2	0,04	0,1

Where in TT systems the disconnection is achieved by an overcurrent protective device and the protective equipotential bonding is connected with all extraneous-conductive-parts within the installation, the maximum disconnection times applicable to TN systems may be used.

U_o is the nominal a.c. or d.c. line to earth voltage.

Chapter 4 - 411.3.3 - Additional Protection

- **411.3.4 Additional requirements for circuits with luminaires.**

- Additional protection by an RCD with a rated residual operation current not exceeding 30 mA shall be provided for all lighting circuits in domestic premises.

Chapter 4 - 411.3.3 - Additional Protection

- The ideal solution to this requirement is a separate RCBO on each lighting circuit.

- This may also be adhered to with the less expensive option of using (a minimum of) two RCD’s and splitting lighting (and socket) circuits across them. This way, in the event of an RCD trip not all lights are lost.

Chapter 4 - 411.3.3 - Additional Protection

- 30mA RCD protection may be omitted pending a risk assessment for:

  - A) socket outlets for use under the supervision of skilled or instructed persons, e.g. in some commercial or industrial locations or

  - B) a specific socket outlet provided for connection of a particular item of equipment.

    -mobile equipment with a current rating not exceeding 32A for outdoor use.

- Tables 41.2 & 41.3 provide Maximum values of fault-loop impedance, Z_S
  - "Z_L" ET 101 has been changed to "Z_S" to harmonise with other European standards.

Max Loop Impedance For MCBs & RCBOs												
Type	6A	10A	16A	20A	25A	32A	40A	50A	63A	80A	100A	125A
B	7.67Ω	4.6 Ω	2.87Ω	2.3Ω	1.84Ω	1.44Ω	1.15Ω	0.92Ω	0.73Ω	0.57Ω	0.46Ω	0.37Ω
C	3.83Ω	2.3Ω	1.44Ω	1.15Ω	0.92Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω
D	1.92Ω	1.15Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω	0.14Ω	0.11Ω	0.09Ω

- Note: for MCB's & RCBO's:

- Type B – General purpose, instantaneous tripping current 3 - 5 x I_n
  - E.g. B Type 10A MCB (3-5 times its rated current):
  - 5 x 10A = 50A.
  - 230V / 50A = 4.6Ω Maximum Loop Impedance, Z_s
- Type C – Motors, inductive lighting, etc. instantaneous tripping current 5 - 10 x I_n
- Type D – Transformers, instantaneous tripping current 10 - 20 x I_n

6D.6.4.3.7.2 Measurement of the earth fault loop impedance: Consideration of the increase of the resistance of the conductors with the increase of temperature.

- Loop impedance measurements are made at room temperature, with low currents.
- In reality the resistance of the conductors may increase with an increase in temperature due to faults. Therefore, it is now recommended that loop impedance results comply with the following calculation:

$$Zs(m) \leq \frac{2}{3} \; x \; \frac{Uo}{Ia}$$

6D.6.4.3.7.2 Measurement of the earth fault loop impedance: Consideration of the increase of the resistance of the conductors with the increase of temperature.

$$Zs(m) \leq \frac{2}{3} \; x \; \frac{Uo}{Ia}$$

- This means that recommended Zs values should be less than 2/3 the values in tables 41.2 & 41.3
  - E.g. Type B 10A MCB Max Zs from Table 41.2 = 4.6Ω
  - New recommended Max Zs: 4.6Ω x 0.666 = 3.06Ω

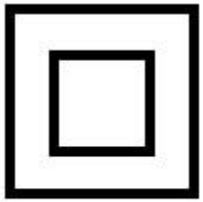
Recommended Zs values to comply with:

$$Zs(m) \leq \frac{2}{3} \; x \; \frac{Uo}{Ia}$$

Max Loop Impedance For MCBs & RCBOs												
Type	6A	10A	16A	20A	25A	32A	40A	50A	63A	80A	100A	125A
B	7.67Ω	4.6 Ω	2.87Ω	2.3Ω	1.84Ω	1.44Ω	1.15Ω	0.92Ω	0.73Ω	0.57Ω	0.46Ω	0.37Ω
Recommended Max	5.11Ω	3.06Ω	1.91Ω	1.53Ω	1.22Ω	0.96Ω	0.76Ω	0.61Ω	0.48Ω	0.38Ω	0.30Ω	0.24Ω
C	3.83Ω	2.3Ω	1.44Ω	1.15Ω	0.92Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω
Recommended Max	2.55Ω	1.53Ω	0.96Ω	0.76Ω	0.61Ω	0.48Ω	0.38Ω	0.30Ω	0.24Ω	0.19Ω	0.15Ω	0.12Ω
D	1.92Ω	1.15Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω	0.14Ω	0.11Ω	0.09Ω
Recommended Max	1.28Ω	0.76Ω	0.48Ω	0.38Ω	0.30Ω	0.24Ω	0.19Ω	0.15Ω	0.12Ω	0.09Ω	0.07Ω	0.06Ω

- 412 Protective measure: double or reinforced insulation

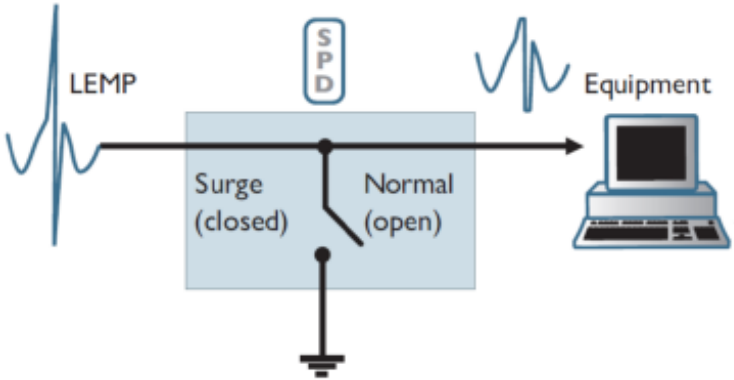
- Double insulation, aka Class II, is a type of protection commonly used in appliances and power tools.
- The use use of the symbol, below, on appliance data badge may mean there are two layers of insulation, or one reinforced layer of insulation to prevent against electric shock, even in a fault condition.



Double insulated symbol

I.S. 10101:2020
Chapter 4 – 443 - Protection Against Transient Overvoltage's of Atmospheric Origin

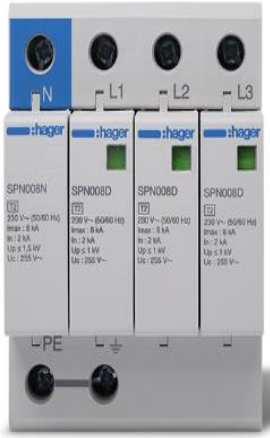
- Lightning events near power lines, and switching operations in an installation, can cause ‘spikes’ on voltage supplies.
- This ‘Spike’ called a ‘Transient Overvoltage’ can harm electronic equipment.
- Surge protection devices block and divert this overvoltage and restrict it to a safe level.



The function of an SPD is to divert the surge current to earth and limit the overvoltage to a safe level. In doing so, SPDs prevent dangerous sparking through flashover, and also protect equipment.

Chapter 4 - 443.4 - Overvoltage control

- Protection against transient overvoltage, **Surge Protection Device**, **shall** be provided where the consequence caused by overvoltage affects:
  - 1. human life, e.g. safety services, medical care facilities;
  - 2. public services and cultural heritage, e.g. loss of public services, IT centres, museums; commercial or industrial activity, e.g. hotels, banks, industries, commercial markets, farms. a large number of individuals, e.g. large buildings, offices, schools.



- For all other cases, a risk assessment according to 443.5 shall be performed in order to determine if protection against transient overvoltage is required. If the risk assessment is not performed, the electrical installation shall be provided with protection against transient overvoltage, a **Surge Protection Device**
  - More on SPD's in Chapter 5

Chapter 4 - Annex 42B - Arc Fault Detection Devices (AFDD)

- Fires by electrical installations are often initiated by arc faults that result from parallel arcs, or series arcs caused by **insulation defects between active conductors or loose terminal connections**.
- During a series arc fault, there is no leakage current to earth therefore RCDs cannot detect such a fault. Moreover, the impedance of the series arc fault reduces the load current, in such case, and the current remains below the tripping threshold of a circuit-breaker or a fuse.
- In the case of a parallel arc between line and neutral conductor, the current is limited by the impedance of the installation and the arc itself, therefore, the resulting fault current could be lower than the operating current of the overcurrent protective device.

Damaged conductor

Arcing leads to flame

Unpredictable
Fire consequences

Parallel Arc Fault

Series Arc Fault

Causes of Arc Faults

Kink/break in the cable

Cable wear due to frequent use

Line damage resulting from drilling or construction work

Incorrect wire stripping

Incorrect bending radii

Loose screwed connections

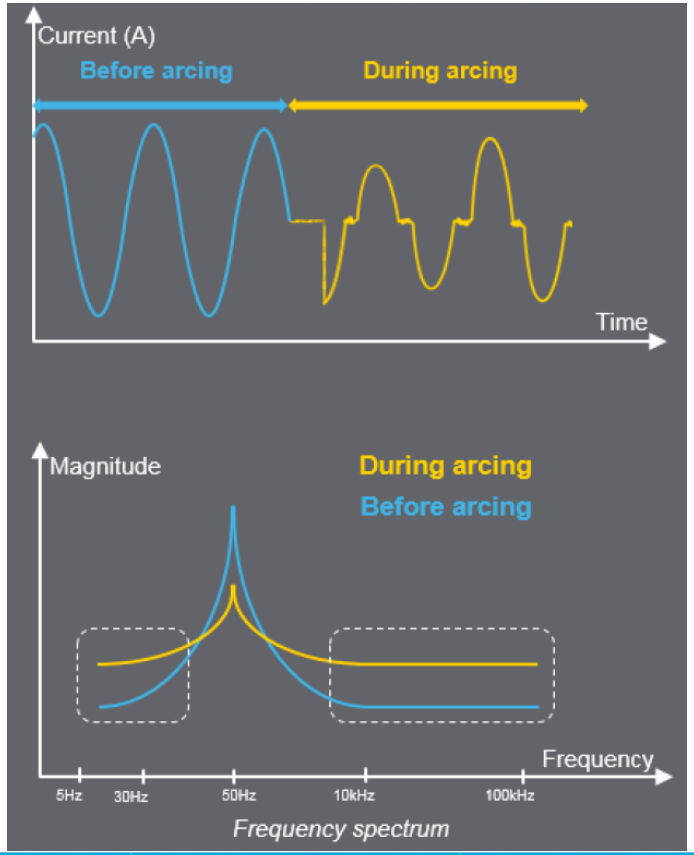
Defective wall plugs

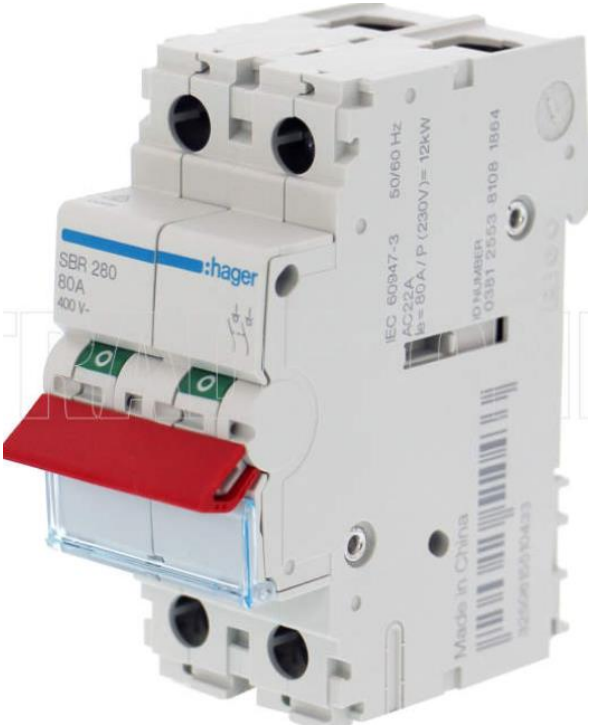
Rodent bites

Chapter 4 - Annex 42B - Arc Fault Detection Devices (AFDD)

- It is expected that AFDD's become a regulation in certain areas in the coming years.
- AFDDs are recommended if there is an increased risk of fire, such as:
  - Premises with sleeping accommodation, for example, houses, hotels, and hostels.
  - Locations with a risk of fire due to the nature of processed or stored materials, for example, stores of combustible materials.
  - Locations with combustible constructional materials, for example, wooden buildings.
  - Fire propagating structures, for example, thatched buildings and timber-framed buildings.
  - Locations with endangering of irreplaceable goods, for example, museums, listed buildings and items with sentimental value.

AFDD


Current (A)
Before arcing
During arcing
Time
Magnitude
During arcing
Before arcing
Frequency
5Hz
30Hz
50Hz
10kHz
100kHz
Frequency spectrum



- In single phase installations, every distribution board shall be provided with an isolation switch for the purpose of disconnecting the supply to equipment.
- In a household, or similar installation, the isolation switch shall interrupt **both Live and Neutral** conductors.
  - **These are not overcurrent protection devices**

Selection & Erection of Equipment

Chapter 5 - 512.1.5 - Compatibility

- Unless other suitable precautions are taken during erection, all equipment shall be selected so that it will not cause harmful effects on other equipment nor impair the supply during normal service, including switching operations.

- The above Clause will require sign off by the appropriate person that the installation complies with the **Electromagnetic Compatibility** (EMC) Directive 2014/30/EU**.**

- The installation will of course apply only to the fixed wiring and switchgear, and not to any appliance connected after the isolator of socket.

- Conductor identification:
- **Phase 1 – BROWN**
- **Phase 2 – BLACK**
- **Phase 3 – GREY**
- **Neutral – BLUE**
- **Earthing, Bonding– GREEN/YELLOW**

Chapter 5 – 516 – Measures related to protective conductor currents

- It is common for appliances and electrical equipment to discharge small amounts of leakage current to the protective conductor under normal operation.
- In the case of an RCD supplying a number of circuits, each feeding various appliances, the combined leakage of the appliances could amount to the rated tripping current of the RCD, 30mA, causing a nuisance trip when there is no fault present.
- Consideration should be given to dividing the equipment over a number of RCD's / RCBO's to avoid nuisance tripping.

- Cross sectional areas of conductors from meter

Table 52.4 – Cross-sectional areas of conductors from meter

Rating of main overcurrent protective device A	Cross sectional area of conductor mm^2
63	16
80	25
100	35
125	35

- A single phase installation can now have a Main Overcurrent Device (MOD) of 125A if required.

I.S. 10101:2020
Chapter 5 - 527 - Selection & Erection of Wiring Systems to Minimise the Spread of Fire

- “For all buildings, cables shall as a minimum meet the requirements of Class Dcd S2,d2,a2 or higher in accordance with I.S. EN 50575. In addition, cables shall be tested in accordance with I.S. EN 61034-2 and the smoke generated shall result in transmittance values of not less than 60%.”

- All cables installed in every installation which will be certified to I.S.10101 must as a minimum comply with the Class Dca S2,d2,a2 standard. The standard should be clearly identified on the cable reel or drum. It will not necessarily be identified directly on the cable.

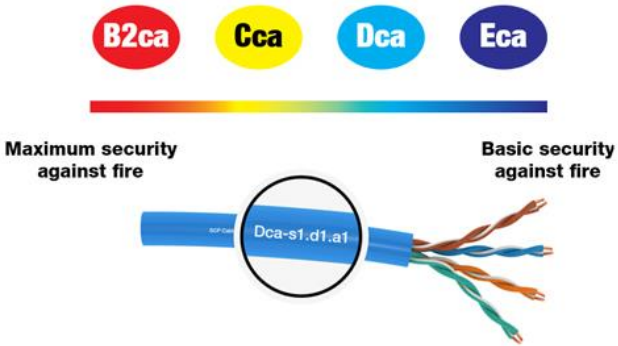
I.S. 10101:2020
Chapter 5 - 527 - Selection & Erection of Wiring Systems to Minimise the Spread of Fire

Euroclass	Test Method	Classification Criteria	Additional Criteria
A_{ca}	PCS ≤ 2.0 MJ/KG		
$B1_{ca}$	EN 50399 30 KW Burner	FS ≤ 1.75 m THR $_{1200s}$ ≤ 10 MJ HRR ≤ 20 kW FIGRA ≤ 120 W/s	Smoke production (s) Flaming droplets (d) Acidity (a)
	EN 60332-1-2	H ≤ 425 mm	
$B2_{ca}$	EN 50399 20.5 kW Burner	FS ≤ 2.0 m THR $_{1200s}$ ≤ 30 MJ HRR ≤ 60 kW FIGRA ≤ 3000 W/s	Smoke production (s) Flaming droplets (d) Acidity (a)
	EN 60332-1-2	H ≤ 425 mm	
C_{ca}	EN 50399 20.5 kW Burner	FS ≤ 2.0 m THR $_{1200S}$ ≤ 30 MJ HRR ≤ 60 kW FIGRA ≤ 3000 W/s	Smoke production (s) Flaming droplets (d) Acidity (a)
	EN 60332-1-2	H < 425 mm	
D_{ca}	EN 50399 20.5 kW Burner	THR $_{1200s}$ ≤ 70 MJ HRR ≤ 400 kW FIGRA ≤ 13000 W/s	Smoke production (s) Flaming droplets (d) Acidity (a)
	EN 60332-1-2	H ≤ 425 mm	
E_{ca}	EN 60332-1-2	H ≤ 425 mm	
F_{ca}	EN 60332-1-2	H ≤ 425 mm	

Clause 527 requires all cables to be rated

Class Dca s2, d2, a2

in accordance with EN50575.



Dca = flame propagation and heat emission test

s2 = emission of **S**moke and transmittance

d2 = burning **D**roplets or particles

a2 = **A**cidity and corrosiveness of emitted gas

I.S. 10101:2020

Chapter 5 - 530.6 - Distribution Boards

The first draft of IS 10101 stated that distribution boards in domestic installations will need to be manufactured from **“non-combustible material”.** This is now replaced with **“metallic or non-metallic materials complying EN 61439”**

--Type tested assembly
--Already has fire test incorporated
--Includes component electrical and physical sizing
--Includes busbars and connections
--Already Established standard

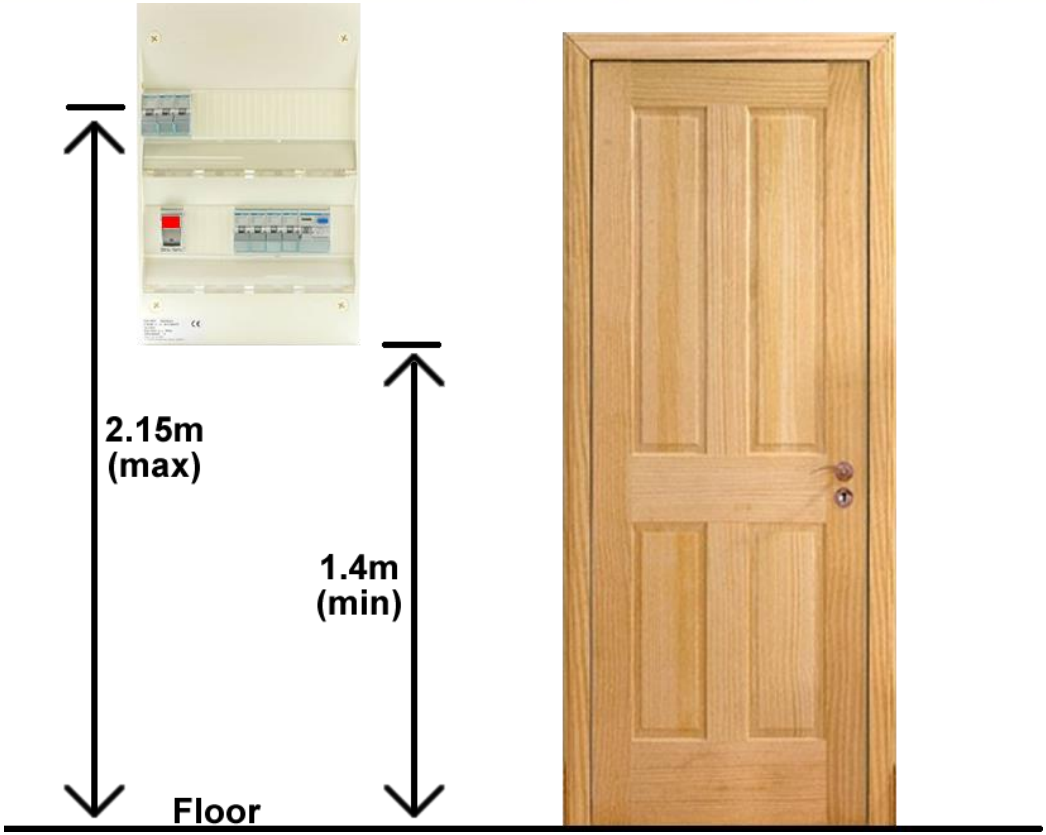
Many domestic premises have distribution boards installed in the main entrance hallway, which is the escape route, and therefore the Clause 530.6.1 provides protection for the escape route.

Non-combustible material may include steel or metal boards.

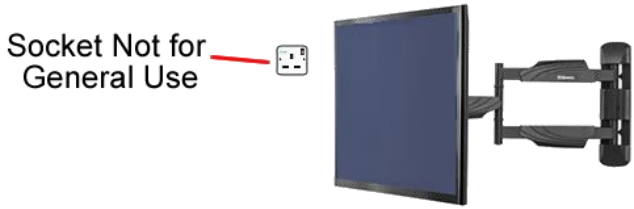
Chapter 5 - 530.6.2 - Erection of Distribution Boards

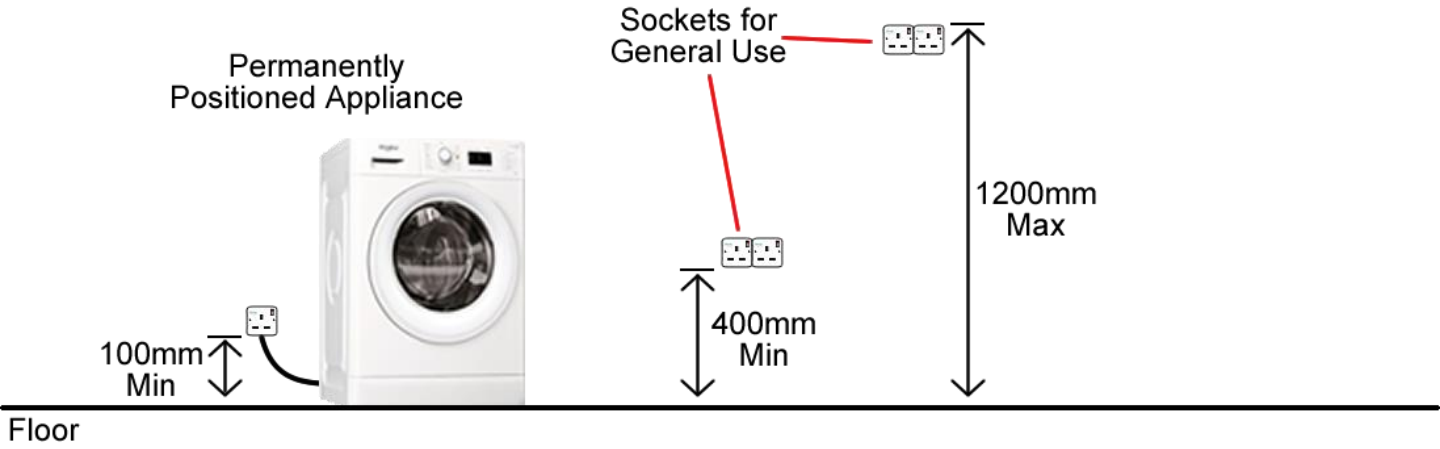
- 530.6.2.3 A wall-mounted distribution board shall be mounted at a height not greater than **2,15m to the top of the highest protective device.**
  - This is a change from ET 101 in that the height restriction 2.15m is lower but the measuring point is not the top of the board, but the highest MCB, RCBO, FUSE or RCD.
- Where a wall-mounted distribution board is mounted at a height less than 1,4 m measured from the floor to the bottom surface of the distribution board, it shall be accessible only by authorised persons.
- Distribution board shall **NOT** be mounted:
  - - under timber staircases
  - - where it may be covered by garments or similar articles
  - - in a bathroom.
    - ET:101 did not allow a Distribution Board in Storage or Airing cupboards or in a washroom or WC. These locations are allowed under I.S. 10101:2020

Chapter 5 - 530.6.2 - Erection of Distribution Boards



- General purpose socket & switch height must be mounted between 400mm and 1200mm.





Chapter 5 - 531.3.3 - Types of RCDs

Clause 531.3.3

Residual current devices (RCDs) Type AC are not recommended in new installations.

RCD technology has improved greatly, and alternative devices now provide better protection.

Devices can now combine RCD and AFDD.

This table summarises the various types of RCD referred to in the 18th Edition

RCCB Type	Residual / Leakage current components				Transient Resistant
	AC 50Hz	AC 50Hz Pulse	Smooth DC	AC>50HZ<kHz	3kA/20µS Current Wave
AC	✓	X	X	X	X
A	✓	✓	< 6mA (1)	X	X
AKV	✓	✓	< 6mA (1)	X	✓
F	✓	✓	< 10mA (1)	✓	✓
B	✓	✓	✓ (1)	✓	✓
EV	✓	✓	< 6mA (2)	✓	✓

1. **Type B** RCCBs detect DC residual currents and trip if the smooth DC current exceeds the trip threshold.
   Note: Type A, AKV and **F** will function safely with smooth DC residual currents present up to the levels indicated but they do not detect smooth DC. Therefore they must not be installed upstream of Type B RCCBs.
2. **Type EV RCCBs trip if the smooth DC current > 6mA** i.e. They must only be used for protecting a single ECVP.

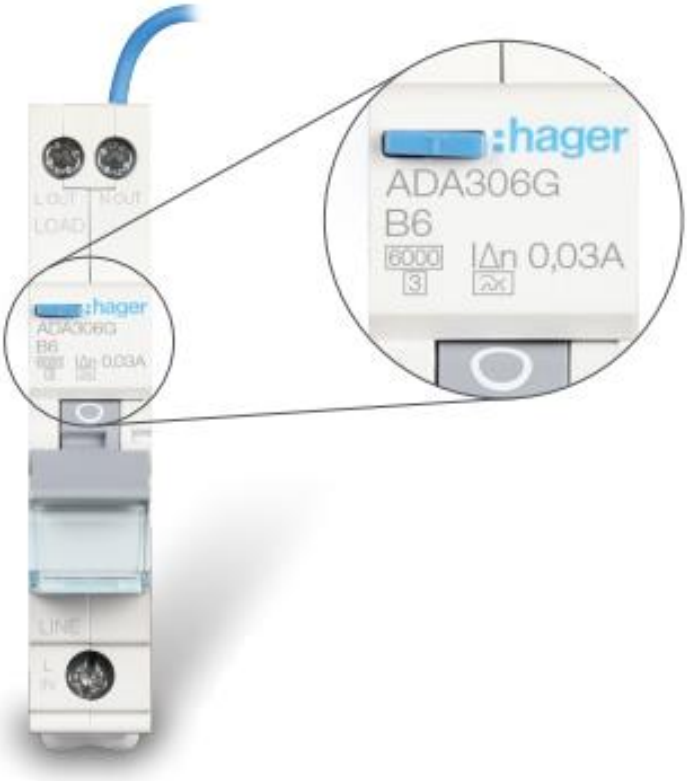
Doughie CLA 7/16

Type AC

Type A

Type B

Chapter 5 - 531.3.3 - Types of RCDs

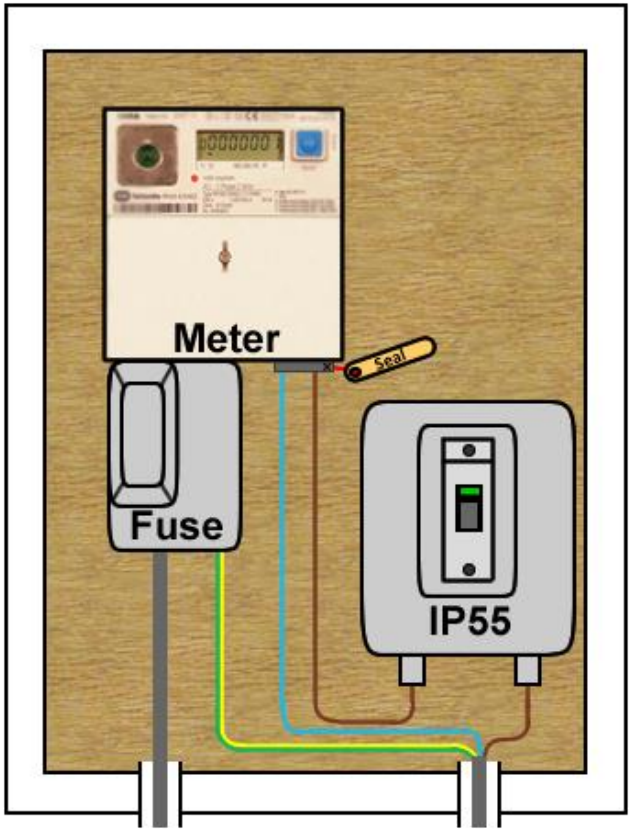


I.S. 10101:2020
Chapter 5 - 53.3.3.2.3 - Main overcurrent device for domestic and similar installations

- " - f) A Type C MCB may be used as the main overcurrent protective device, providing it complies with the maximum fault-loop impedance value Zs in Table 41.3"

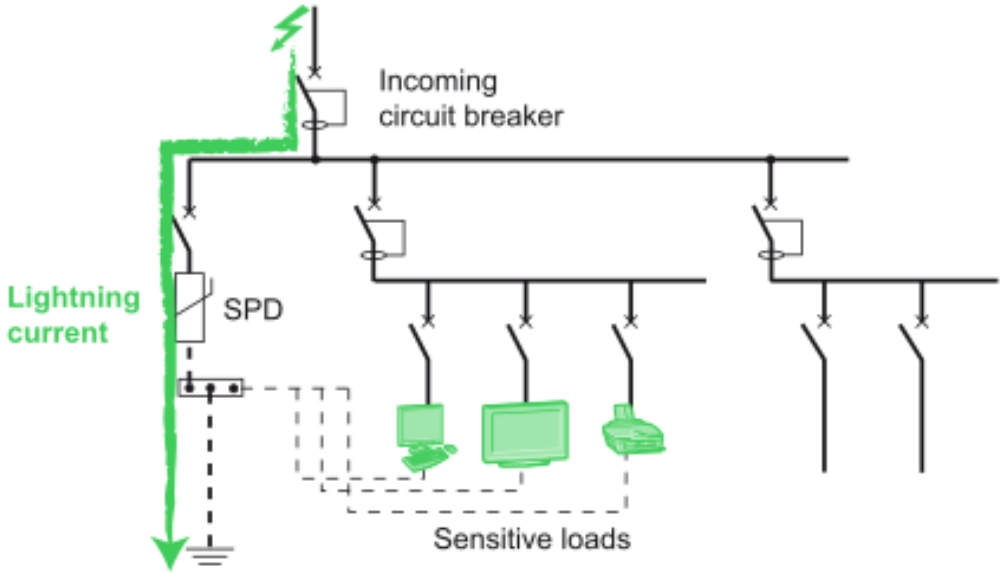
- If a Type C MCB is used as the main overcurrent device, MOD, the fault loop impedance must be measured at the device to confirm it complies with Table 41.3.
  - For a C63 MCB the maximum loop impedance value allowed is 0.36Ω

Chapter 5 - 533.3.5 - Main Overcurrent Device



- A main overcurrent protective device may be located within a standard meter cabinet
- This breaker must have a breaking capacity of at least 9kA (if the MIC is <50kA),
- Be housed in an IP55 enclosure with a transparent hinged cover fitted at the bottom right of the cabinet.

This is a complete new section. It provides details on selection of Surge Protection Devices (SPDs) including wiring diagrams, especially where lightning protection will be installed in a building



Type 1 SPD:

- A type 1 SPD can discharge partial lightning current with a typical waveform 10/350µs. These usually employ spark gap technology.

Type 2 SPD:

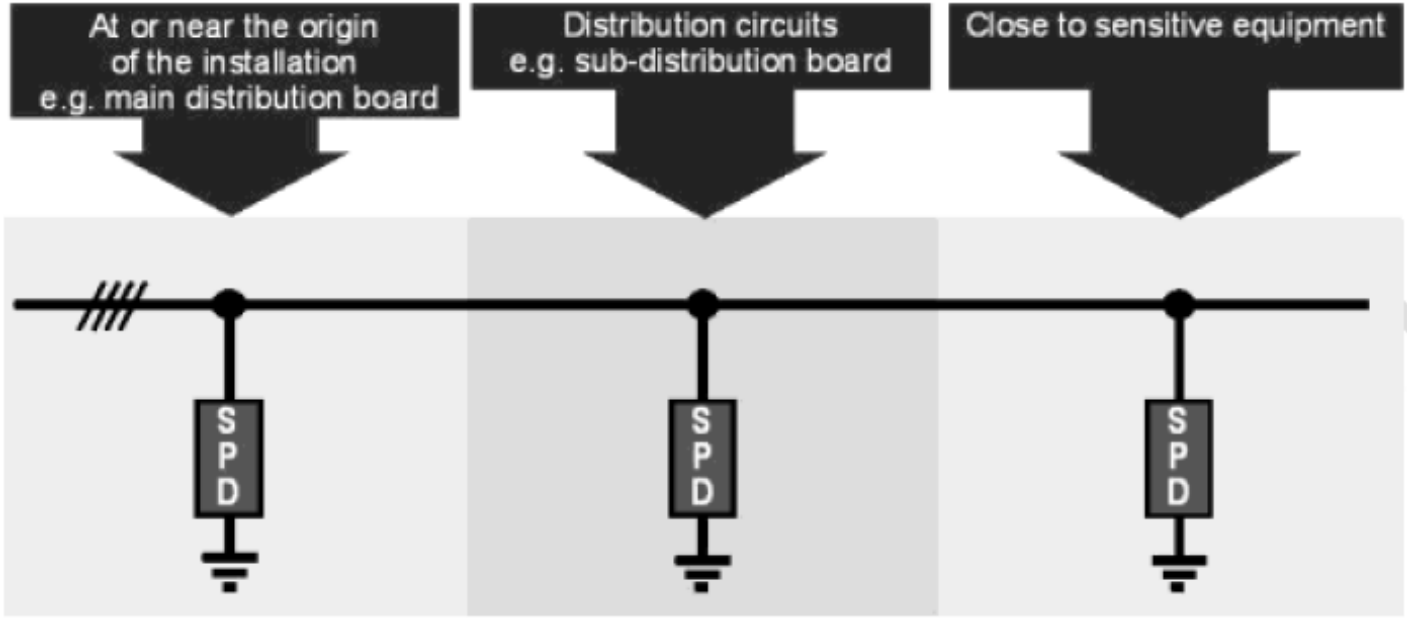
- Type 2 SPD's can prevent the spread of overvoltages in the electrical installations and protect equipment connected to it. It usually employs metal oxide varistor (MOV) technology and is characterised by an 8/20µs current wave.

Type 3 SPD:

- Type 3 SPD have a low discharge capacity. They must therefore only be installed as a supplement to Type 2 SPD and in the vicinity of sensitive loads.
  Type 3 SPD's are characterised by a combination of voltage waves (1.2/50 µs) and current waves (8/20 µs).

I.S. 10101:2020

Chapter 5 - 534.4.1 - SPD Location & Type of SPD

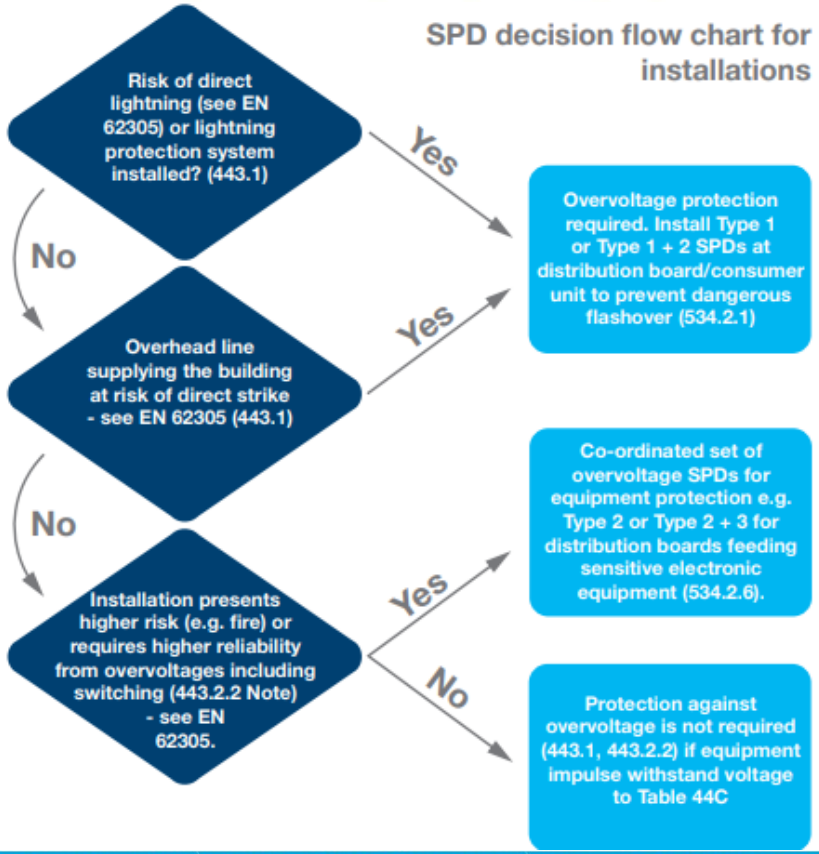


Type 1 SPD and/or Type 2 SPD	Type 2 SPD or Type 3 SPD	Type 2 SPD or Type 3 SPD

Selection of SPD:

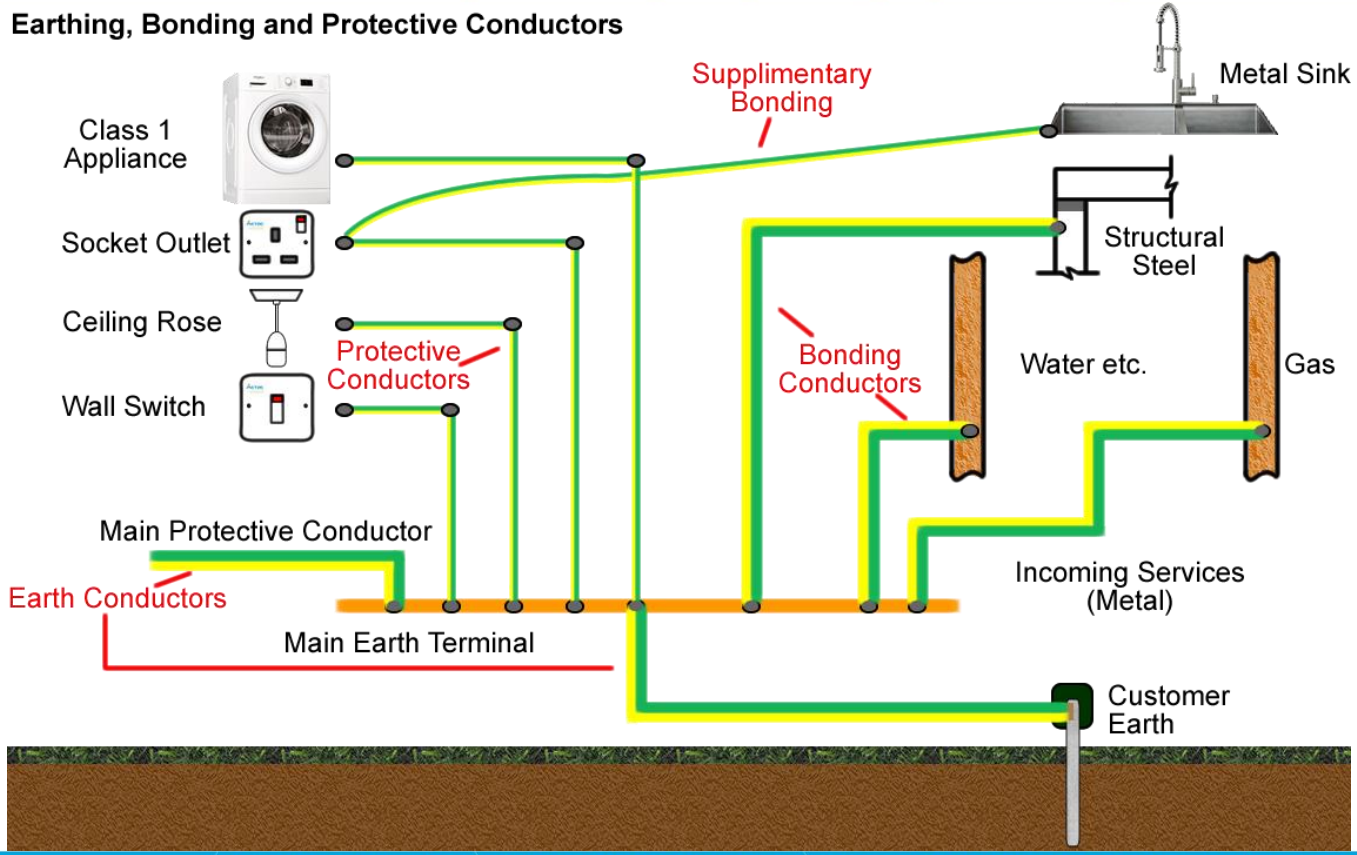
- The choice of SPD depends on a number of criteria:
  - The risk of lightning strikes
  - The exposure of the building to transients
  - The sensitivity & value of the electrical equipment that requires protection
  - Earthing system
  - Level of protection
- Surge protection devices are classified according to their functions:

Chapter 5 - Selection & Erection of Equipment



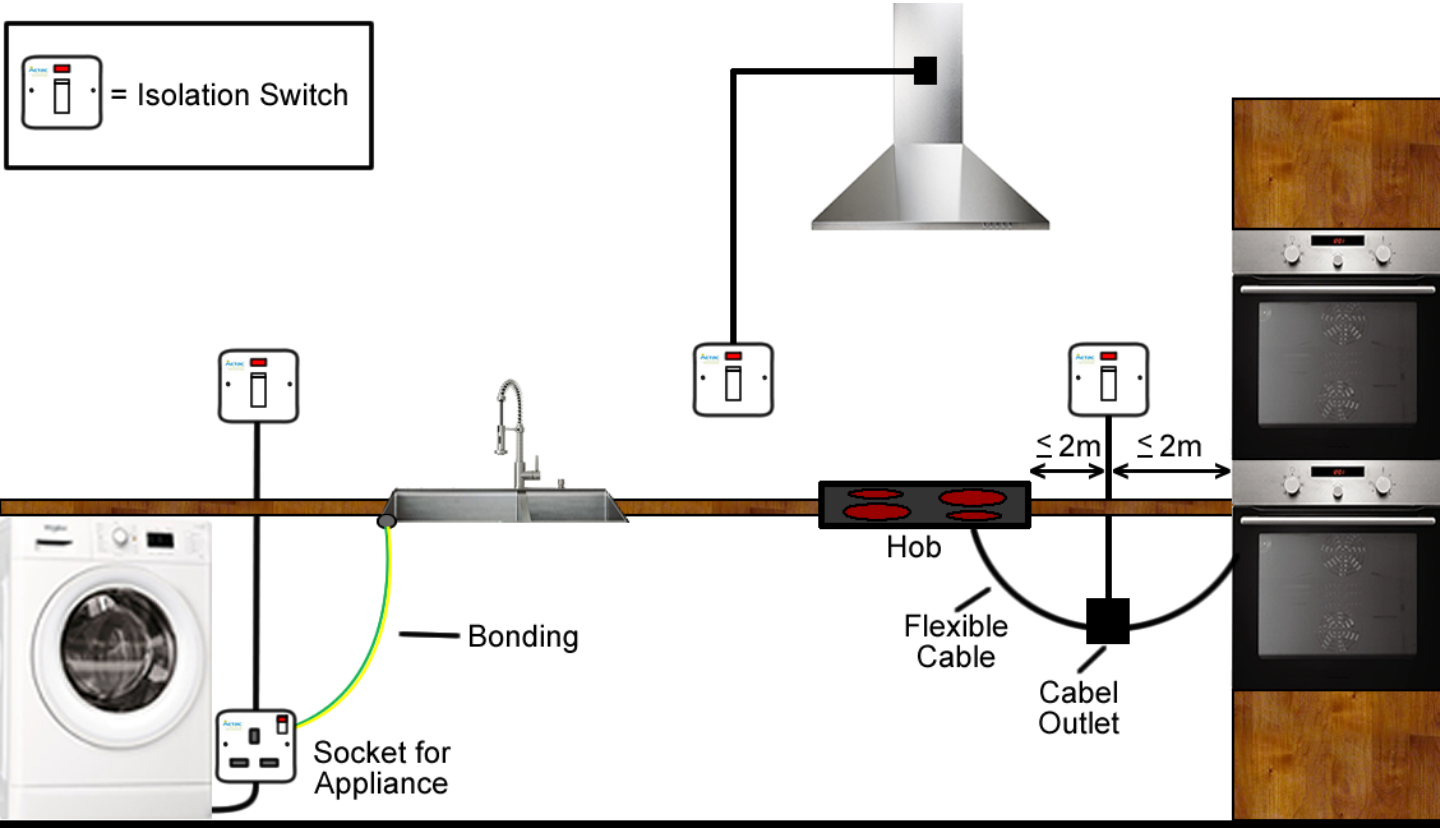
Supplementary Bonding:

- Clause 544.2.8 has been Removed from ET101.
- In I.S.10101:2020 The rule requiring kitchen sinks to be bonded has been removed.


Earthing, Bonding and Protective Conductors
Supplimentary Bonding
Metal Sink
Class 1 Appliance
Socket Outlet
Ceiling Rose
Wall Switch
Protective Conductors
Bonding Conductors
Structural Steel
Water etc.
Gas
Main Protective Conductor
Earth Conductors
Main Earth Terminal
Incoming Services (Metal)
Customer Earth

I.S. 10101:2020

Chapter 5 - 555.1.2 Isolation of Appliances



Verification & Certification

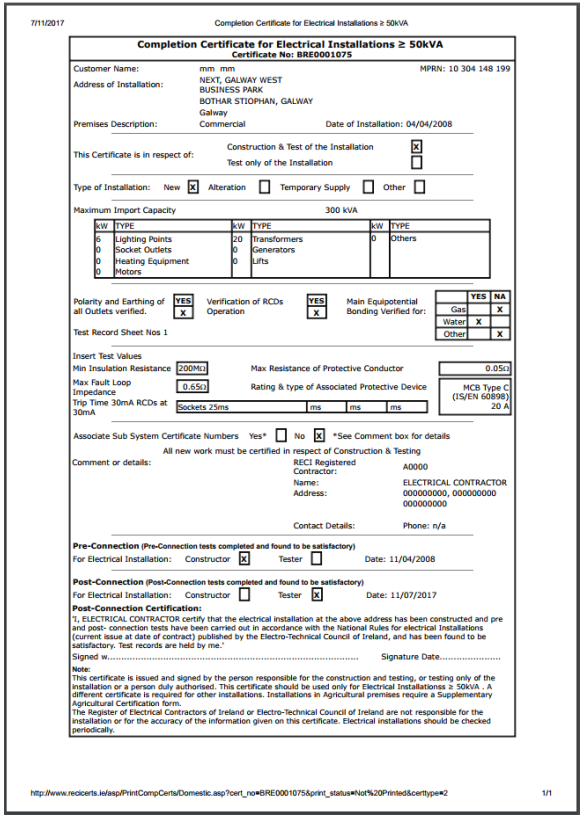
I.S. 10101:2020

Chapter 6 - Inspection & Testing

Chapter 6 has been completely revised to align with the CENELEC Standard. Sample certificates were provided in ET101, they have now been removed.

Certification will soon transition to an **online format** and therefore model certificates are no longer included in the National Rules for Electrical Installations.

CRU now oversee the inspection and verification process, and certificates are issued by Safe Electric.



7/11/2017 Completion Certificate for Electrical Installations ≥ 50kVA

Completion Certificate for Electrical Installations ≥ 50kVA
Certificate No: BRE0001075

Customer Name: mm mm MPRN: 10 304 148 199

Address of Installation: NEXT, GALWAY WEST BUSINESS PARK, BOTHAR STIOPHAN, GALWAY, Galway

Premises Description: Commercial Date of Installation: 04/04/2008

This Certificate is in respect of: Construction & Test of the Installation [X] Test only of the Installation [ ]

Type of Installation: New [X] Alteration [ ] Temporary Supply [ ] Other [ ]

Maximum Import Capacity 300 kVA

kW	TYPE	kW	TYPE	kW	TYPE
6	Lighting Points	20	Transformers	0	Others
0	Socket Outlets	0	Generators		
0	Heating Equipment	0	Lifts		
0	Motors				

Polarity and Earthing of all Outlets verified. YES [X]

Verification of RCDs Operation YES [X]

Main Equipotential Bonding Verified for:

	YES	NA
Gas		X
Water	X	
Other		X

Test Record Sheet Nos 1

Insert Test Values

Min Insulation Resistance 200MΩ

Max Resistance of Protective Conductor 0.05Ω

Max Fault Loop Impedance 0.65Ω

Rating & type of Associated Protective Device MCB Type C (IS/EN 60898) 20 A

Trip Time 30mA RCDs at 30mA: Sockets 25ms | ms | ms | ms

Associate Sub System Certificate Numbers Yes* [ ] No [X] *See Comment box for details

Comment or details: All new work must be certified in respect of Construction & Testing

RECI Registered Contractor: A0000

Name: ELECTRICAL CONTRACTOR

Address: 000000000, 000000000 000000000

Contact Details: Phone: n/a

Pre-Connection (Pre-Connection tests completed and found to be satisfactory)

For Electrical Installation: Constructor [X] Tester [ ] Date: 11/04/2008

Post-Connection (Post-Connection tests completed and found to be satisfactory)

For Electrical Installation: Constructor [ ] Tester [X] Date: 11/07/2017

Post-Connection Certification:

'I, ELECTRICAL CONTRACTOR certify that the electrical installation at the above address has been constructed and pre and post- connection tests have been carried out in accordance with the National Rules for electrical Installations (current issue at date of contract) published by the Electro-Technical Council of Ireland, and has been found to be satisfactory. Test records are held by me.'

Signed w..... Signature Date.....

Note:

This certificate is issued and signed by the person responsible for the construction and testing, or testing only of the installation or a person duly authorised. This certificate should be used only for Electrical Installations ≥ 50kVA . A different certificate is required for other installations. Installations in Agricultural premises require a Supplementary Agricultural Certification form.

The Register of Electrical Contractors of Ireland or Electro-Technical Council of Ireland are not responsible for the installation or for the accuracy of the information given on this certificate. Electrical installations should be checked periodically.

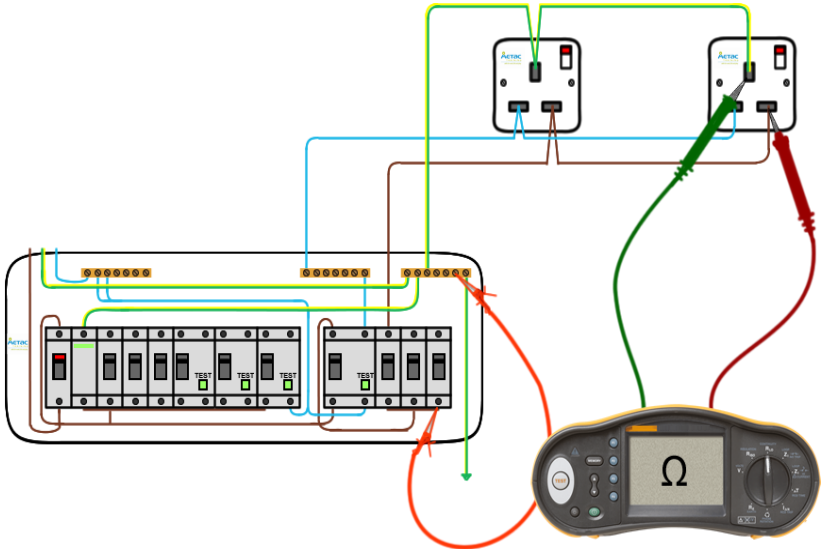
http://www.reicerts.ie/asp/PrintCompCerts/Domestic.asp?cert_no=BRE0001075&print_status=Not%20Printed&certtype=2 1/1

- Continuity of conductors 6.4.3.2
- Insulation resistance of the electrical installation 6.4.3.3
  - New: “Where the circuit includes equipment that is likely to influence the results or be damaged, only a measurement between the live conductors connected together and earth shall be made.”
- Detection of erroneous connections between circuits 6.4.3.3.1
  - New: “This test may now also be made using a voltage tester following energisation of the installation.”
    - The erroneous test can now be carried out at post connection stage with a voltage tester. This eliminates the possibility of incorrect readings through the neutrals of loads which are switched in during the pre connection method.
- Polarity 6.4.3.6
- And in some cases, Measurement of the earth electrode 6.4.3.7.2

I.S. 10101:2020

Continuity of Conductors 6.4.3.2 Rp+Re Method

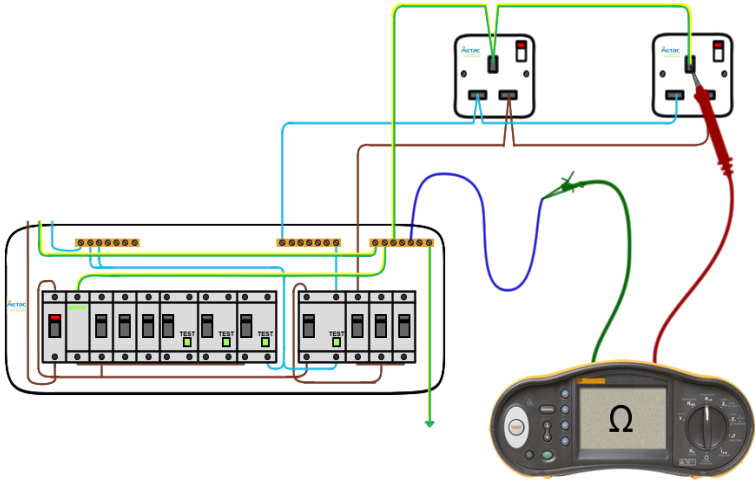
1. Connect phase to earth at distribution board.
2. Null/zero the resistance of the test leads with the test instrument.
3. Take a resistance reading between phase and earth at each outlet
4. Record the highest reading for each circuit.



I.S. 10101:2020

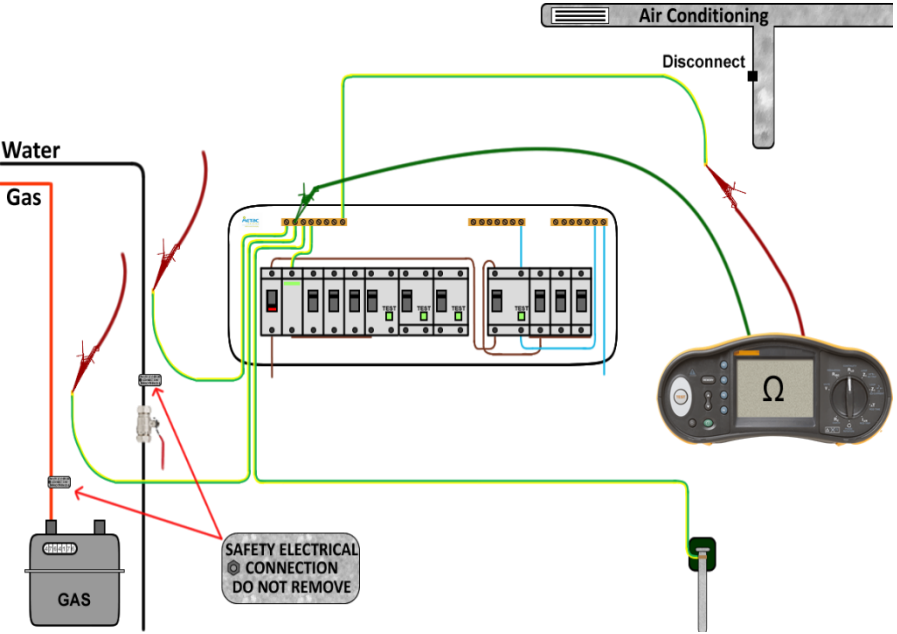
Continuity of Conductors 6.4.3.2 Re Method

1. You must have a wander lead which will reach the furthest outlet of each circuit.
2. Null/zero the resistance of the wander lead and the test leads with the test instrument.
3. Connect one end of the wander lead to main earth terminal at the distribution board and connect the other end to one of your test leads.
4. Take a reading at the earth of each outlet.
5. Record the highest value and note its position.



I.S. 10101:2020

Continuity of Bonding Conductors

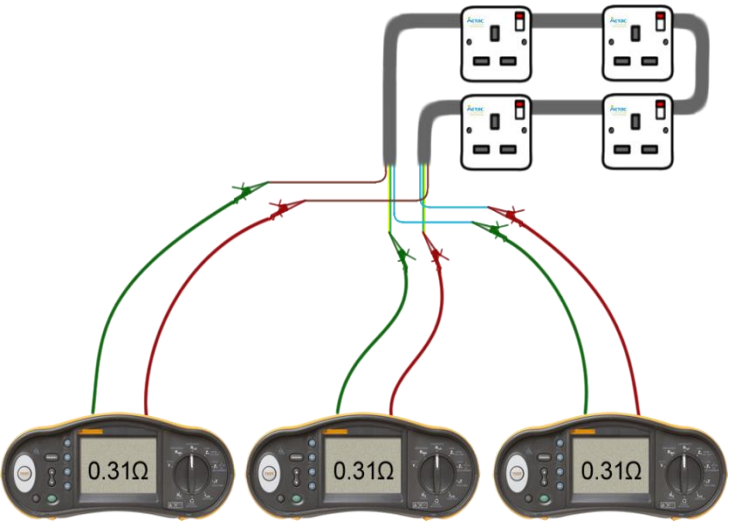


Bonding conductors shall be verified via the Re method and the bonding section at the top left of the test record sheet completed accordingly.

1. Main equipotential bonding - Disconnect one end first.
2. Bathroom bonding
3. Kitchen equipment (sinks, food preparation areas etc.)

I.S. 10101:2020

Continuity of Ring Circuit Conductors 6.4.3.2



1. Separate all conductors in the ring circuit at the distribution board or a socket.
2. Null/zero the resistance of the test leads with the test instrument.
3. With crocodile clips, measure the resistance from both ends of the Brown conductors, and then both ends of the blue conductors - **the difference should be no more than 0.01Ω.**

I.S. 10101:2020

Insulation Resistance 6.4.3.3

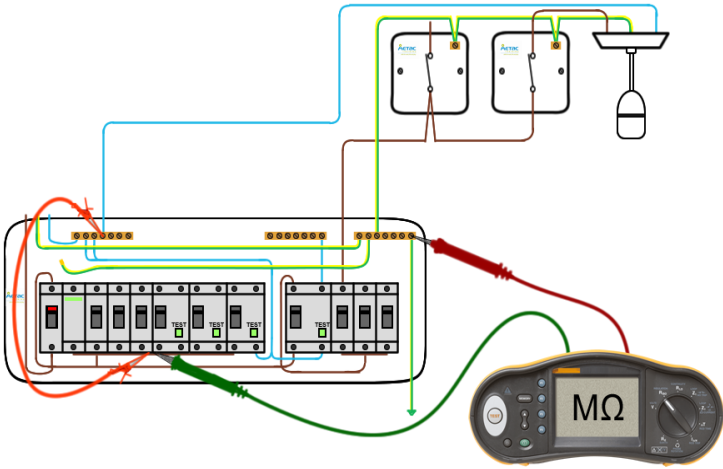
The purpose of this test is to ensure that there are **no short circuits.**

- In practice, it may be necessary to carry out this measurement during erection of the installation before the connection of the equipment.
- When testing insulation resistance between current carrying conductors, some electronic appliances and devices such as smoke alarms, computers, discharge lighting etc. should be disconnected for this test as they may be damaged by the high test voltage.
- “Where the circuit includes equipment that is likely to influence the results or be damaged, only a measurement between the live conductors connected together and earth shall be made.”

I.S. 10101:2020

Insulation Resistance Phase & Neutral to Earth

1. Link between Phase and Neutral at the distribution board.
2. Disconnect any Surge Protection Devices.
3. Switch on all MCBs to get insulation reading for the complete installation.
4. Test between the earth terminal and either end of the link at 500V (250V pre-test is good practice)
5. If the result is sufficiently high copy the figure for all circuits on the test record sheet. If the result is not acceptable, work through circuits individually. Turn on one circuit at a time to isolate the problematic circuit.



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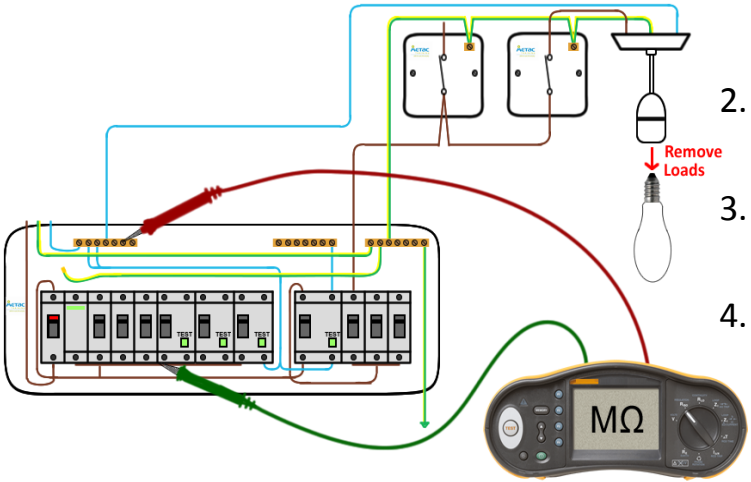
Insulation Resistance Phase to Neutral



1. Ensure all appliances, lamps, LED's, sensitive equipment & SPD's are removed before test as they may be damaged by the high test voltage.
2. Set insulation tester on 500V range when testing. (250V pre-test is good practice)
3. Switch on all MCBs and test between the Phase busbar and the Neutral terminal.
4. If the result is sufficiently high copy the figure for all circuits on the test record sheet. If the result is not acceptable, work through circuits individually. Turn on one circuit at a time to isolate the problematic circuit.

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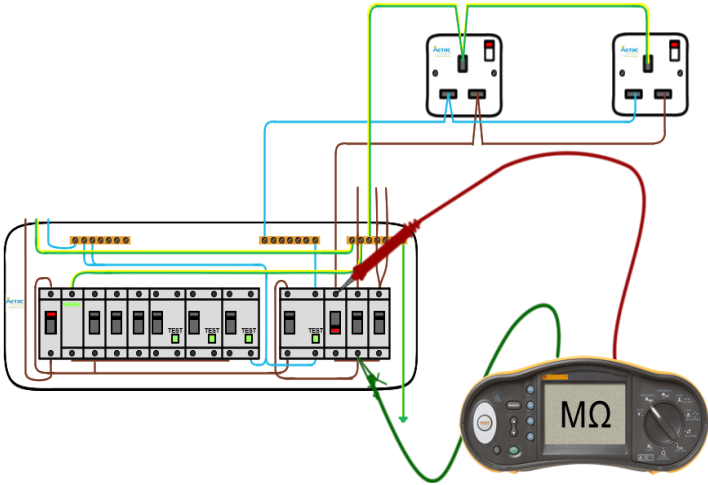
Erroneous Connections Between Circuits 6.4.3.3.1

1. All loads in the circuit should be disconnected e.g. appliances switched off; lamps removed etc.
2. Switch off MCB of circuit that you are testing, all other MCB's switched on.
3. Using an Insulation Tester at 500V measure between the phase conductor of the disconnected circuit and all other phases i.e. the busbar.

- A low reading will indicate there is an erroneous connection between circuits.



Note:
"Where it is not practicable to disconnect all loads, the erroneous test may also be made using a voltage tester following energisation of the installation" I.S.10101: 6.4.3.3.1

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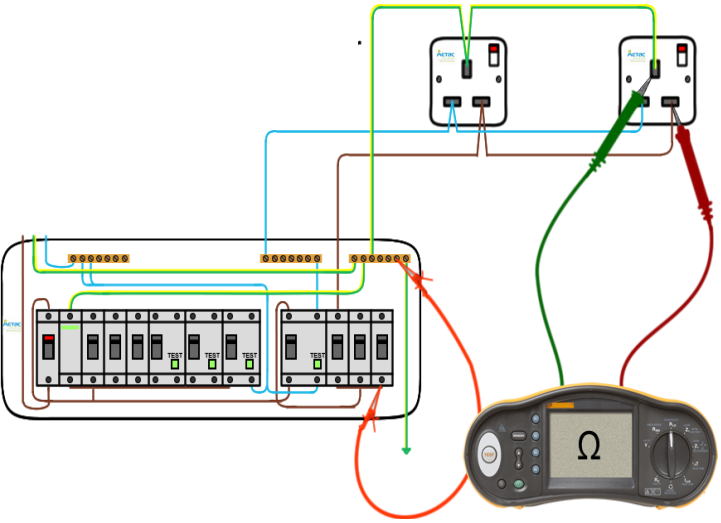
Polarity Test 6.4.3.6



1. Link between Phase and Earth at the distribution board
2. Using a continuity tester check each outlet.
   - between Phase and Earth should give a low resistance reading
   - between Neutral and Earth there should be an infinity reading
3. The procedure should be repeated with a link between neutral and Earth to verify the neutral is connected and that phase and earth are not reversed.

- **Note:** The methodology above is similar to that of the Rp+Re test. Therefore, it is possible to perform the polarity test **while** performing the Rp+Re test.

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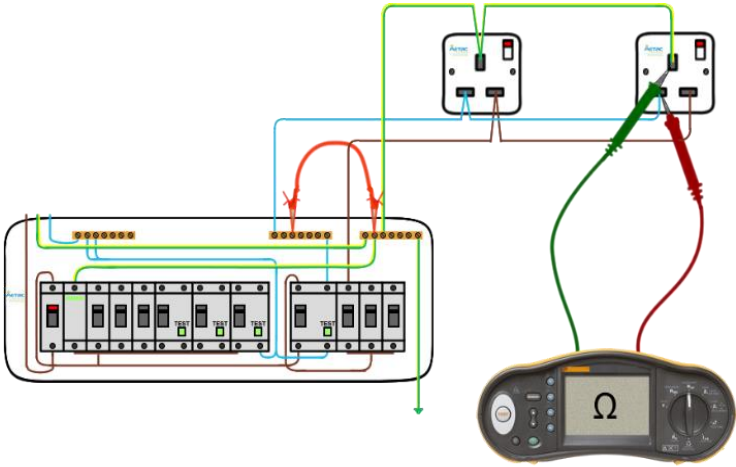
Polarity Test 6.4.3.6

The procedure should be repeated with a link between neutral and Earth to verify the neutral is connected and that phase and earth are not reversed.



Chapter 6 - Post Connection Tests

- Protection by automatic disconnection of the supply 6.4.3.7
  - This clause covers both:

- Earth fault loop impedance 6.4.3.7.3
- Verification of operation of RCD's

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Earth Fault Loop Impedance 6.4.3.7.3

- The purpose of the test is to mimic an earth fault current to determine what current would flow in the protective conductor in a fault condition. The value of loop impedance for a circuit must be low enough so that sufficient fault current can flow in order to trip the MCB/RCBO.

- This test is carried out for the supply cable(Ze) and at the furthest outlet of each circuit(Zs) and must be recorded in the test record sheet.

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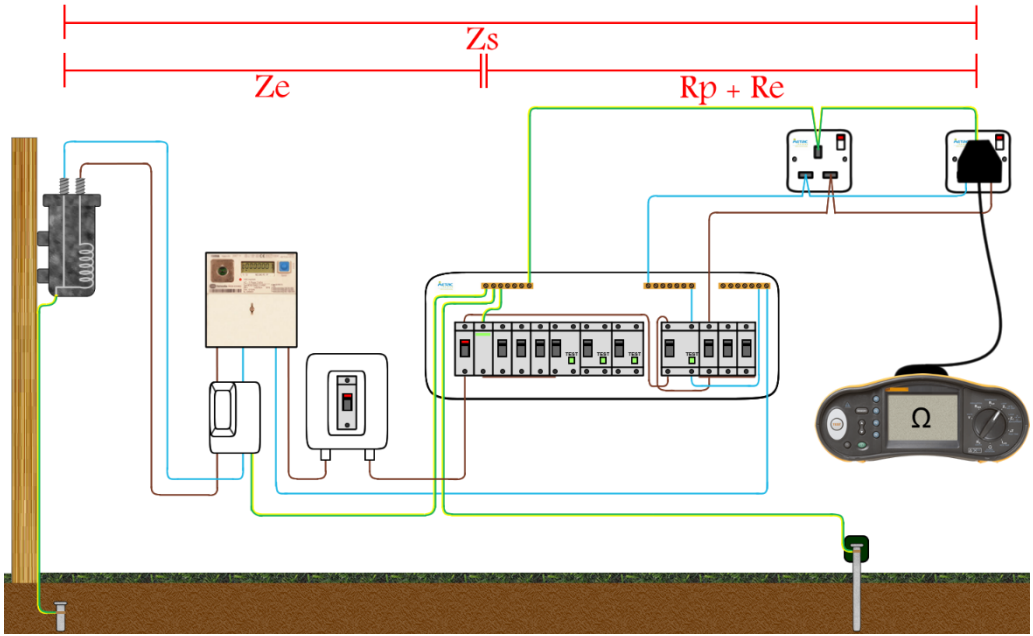
Earth Fault Loop Impedance 6.4.3.7.3



(Rp + Re) + Ze = Zs

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Earth Fault Loop Impedance 6.4.3.7.3

Max Loop Impedance for MCBs & RCBOs												
Type	6A	10A	16A	20A	25A	32A	40A	50A	63A	80A	100A	125A
B	7.67Ω	4.6 Ω	2.87Ω	2.3Ω	1.84Ω	1.44Ω	1.15Ω	0.92Ω	0.73Ω	0.57Ω	0.46Ω	0.37Ω
C	3.83Ω	2.3Ω	1.44Ω	1.15Ω	0.92Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω
D	1.92Ω	1.15Ω	0.72Ω	0.57Ω	0.46Ω	0.36Ω	0.29Ω	0.23Ω	0.18Ω	0.14Ω	0.11Ω	0.09Ω

Note:

“Consideration of the increase of the resistance of the conductors with the increase of temperature due to faults” I.S.10101: 6D.6.4.3.7.2

$$\mathrm{Zs\ (m)} \leq \frac{2}{3} \times \frac{Uo}{Ia}$$

It is now recommended to keep less than ⅔ the values in the table above.

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Verification of Operation of RCD's 6.4.3.6

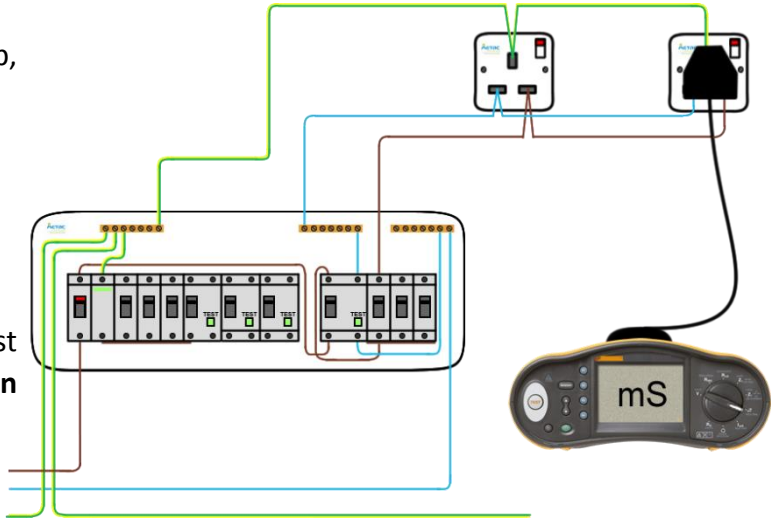
a) **½ X** current at 0° degrees, result is no trip

b) **½ X** current at 180° degrees, result is no trip, tick **½ x IΔn** box on test record sheet

a) **1 X** current at 0° degrees, note the result,

b) **1 X** current at 180° degrees,

- Record the higher trip value on the test record sheet in the box marked **1 x IΔn** ***1 x IΔn Must be less than 300mS**



a) **5 X** current at 0° degrees, note the result,

b) **5 X** current at 180° degrees,

- Record the higher trip value on the test record sheet in the box marked **5 x IΔn** ***5 x IΔn Must be less than 40mS**

- Upon completion of the verification of a new installation or additions / alterations to an existing installation, an electrical installation verification report shall be provided.

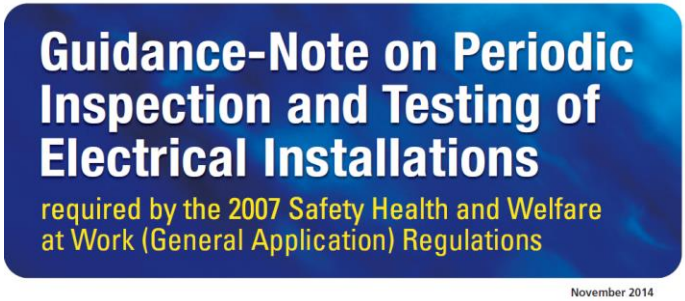
- Such documentation shall include details of the extent of the installation covered by the report, together with a record of the inspection and the results of testing
  - Completion certificate & test record sheets

- The initial report of the electrical installation should make a recommendation for a period between initial verification and the first periodic verification.

Chapter 6 - 6.5 - Periodic Inspection and Testing

- HSA Guidance Note for Periodic Inspection and Test give suggested time intervals for periodic inspections in various electrical installations.

- This is noted in 6.5.2: Frequency of periodic verification.



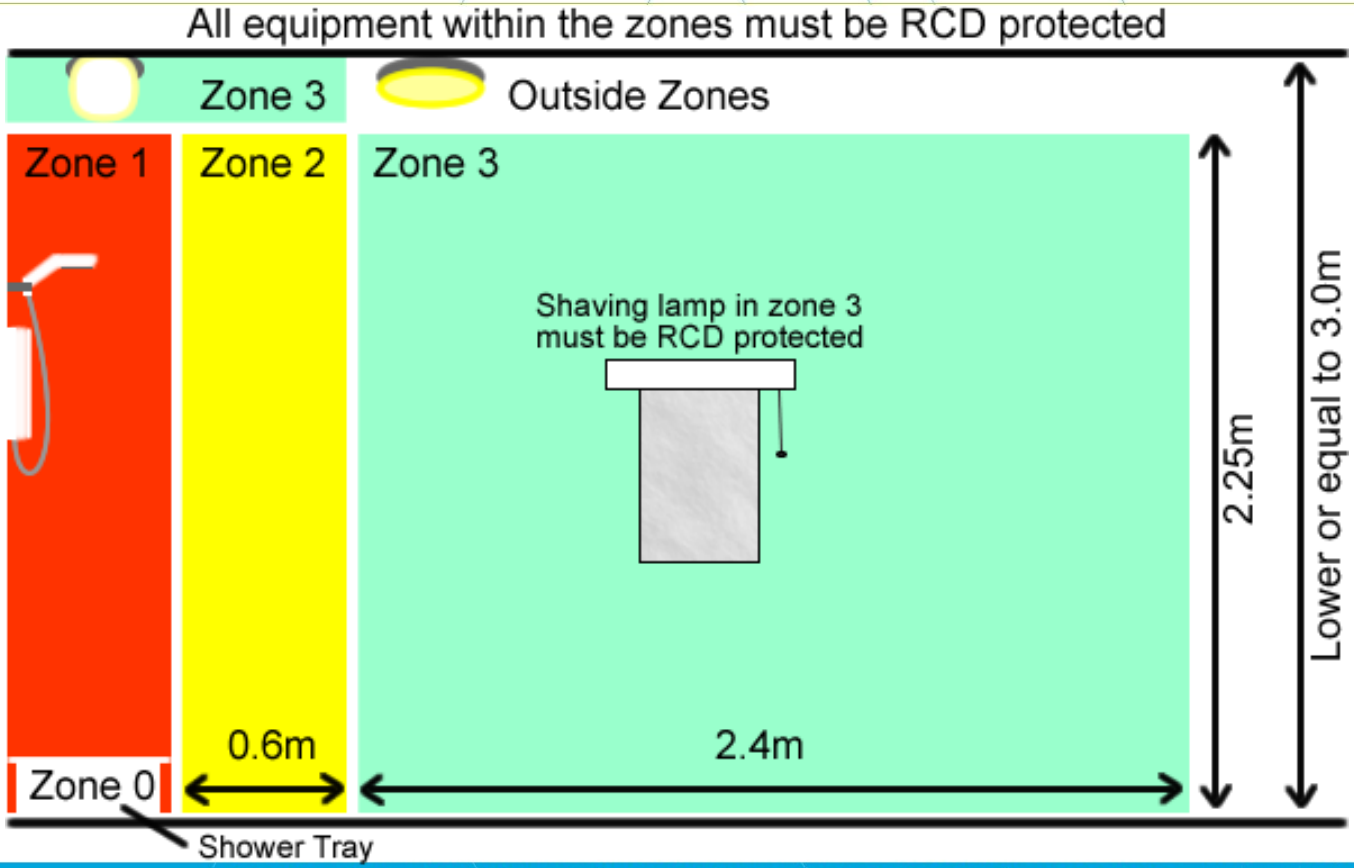
Type of Workplace	Suggested Period between Visual Check	Suggested Period between Inspection & Testing
Commercial	1 year	5 years
Educational establishments	1 year	5 years
Hospitals	1 year	5 years
Industrial	1 year	3 years
Residential accommodation	1 year	5 years
Offices	1 year	5 years
Shops	1 year	5 years
Laboratories	1 year	5 years
Agricultural / Horticultural	1 year	3 years
Cinemas	1 year	3 year
Leisure complexes(excluding swimming pools)	1 year	3 years
Restaurants / Hotels	1 year	5 years
Theatres	1 year	3 years
Public houses / Bars	1 year	5 years
Marinas	4 months	1 year
Laundrettes	1 year	1 year
Petrol stations	1 year	3 years
Construction sites	3 Months	6 Months

Special Installations or Locations

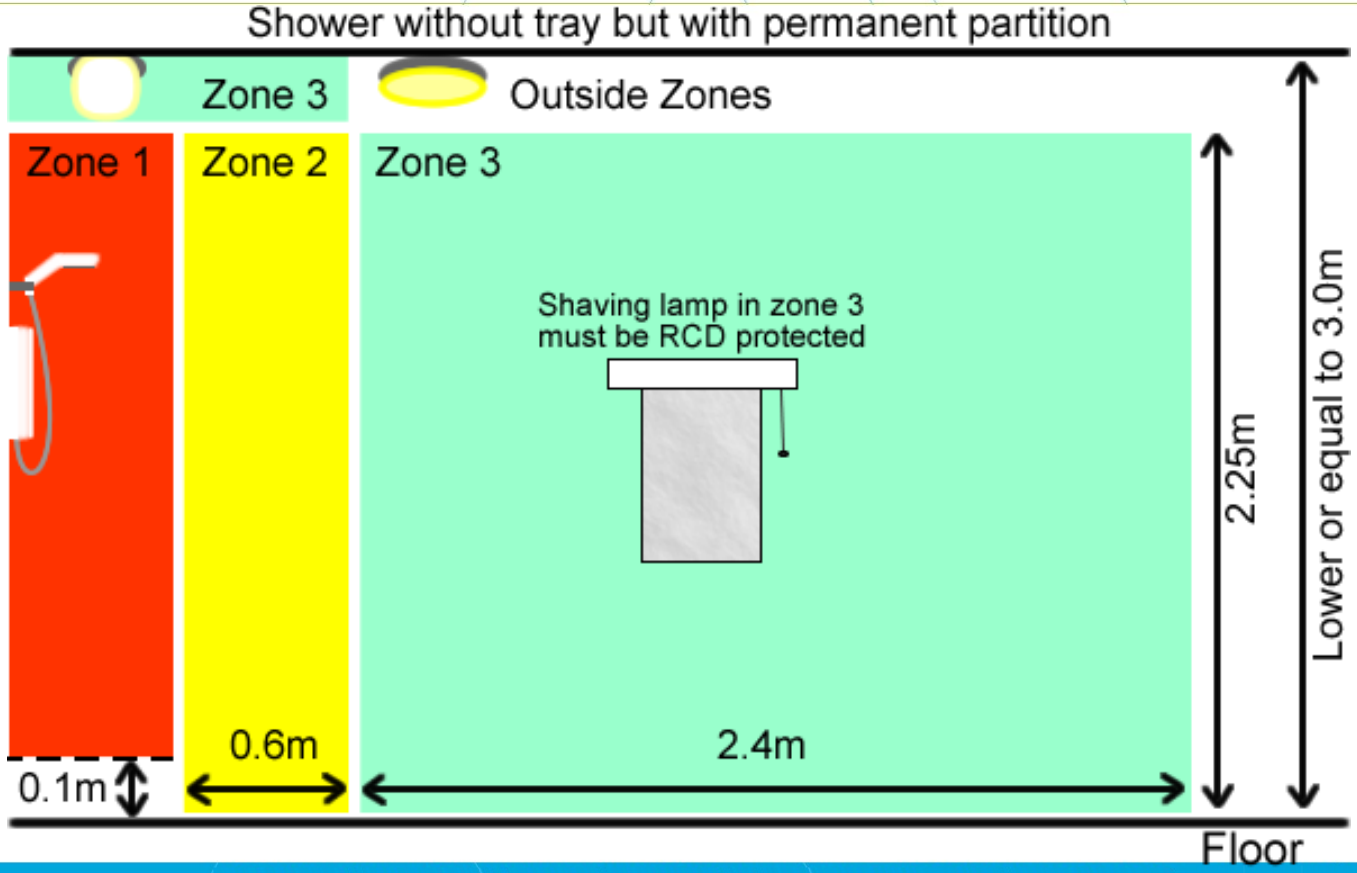
Chapter 7 - 701 - Locations Containing a Bath or Shower

- Bathroom Zones:
- Zone 0:
  - The interior of a bath tub or shower basin
- Zone 1:
  - The area above the bath or sower to a height of 2.25m from the floor.
  - Where there is no shower basin, 1.2m from the fixed water outlet.
- Zone 2:
  - Distance of 60cm from the border of Zone 1 (edge of bath/shower basin)
  - To a height of 2.25m from the floor.
- Zone 3:
  - The area above zones 1 & 2, higher than 2.25m to a height of 3m.
  - 2.4m horizontally from the border of zone 2.

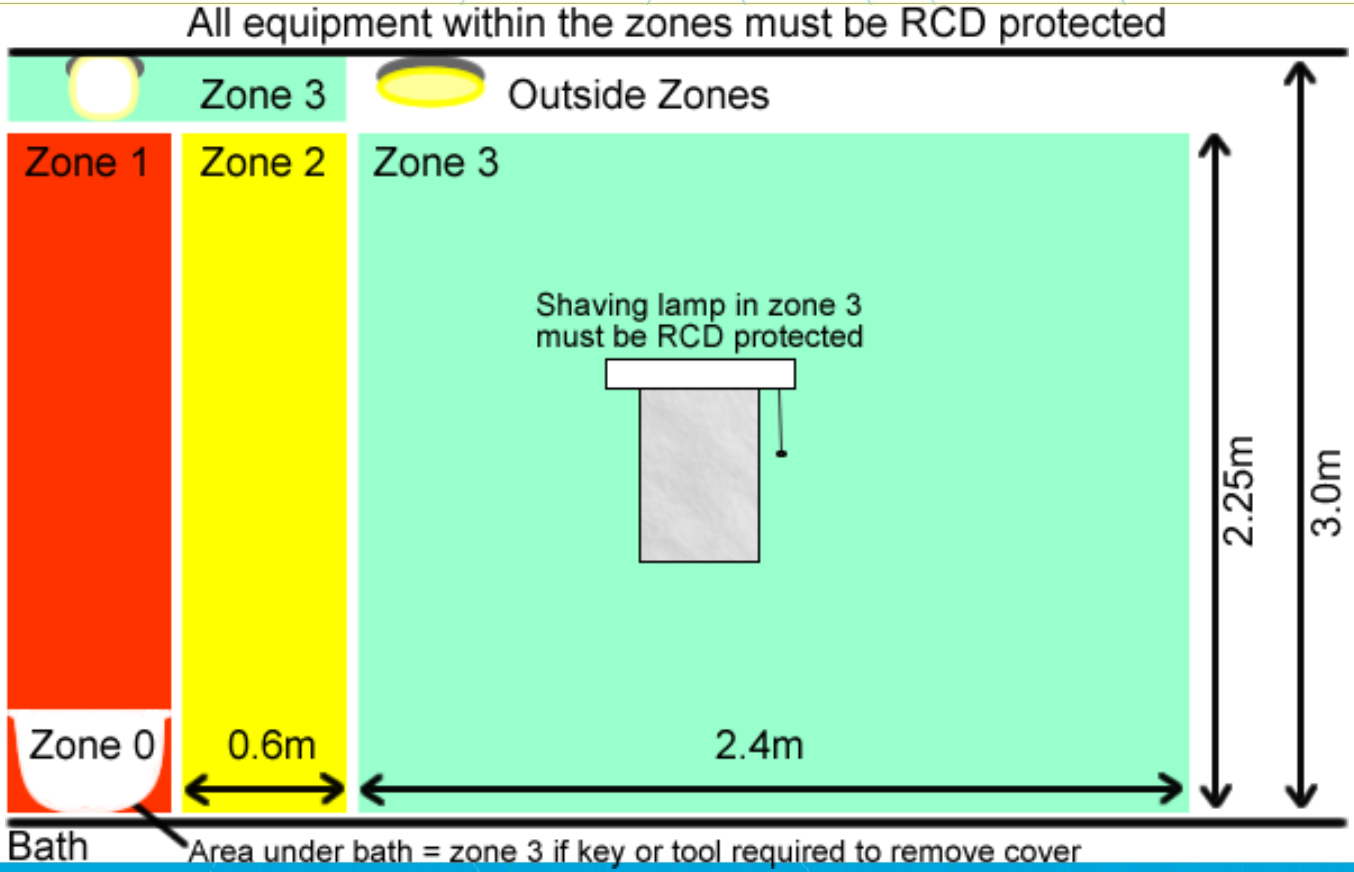
Chapter 7 - 701 - Locations Containing a Bath or Shower



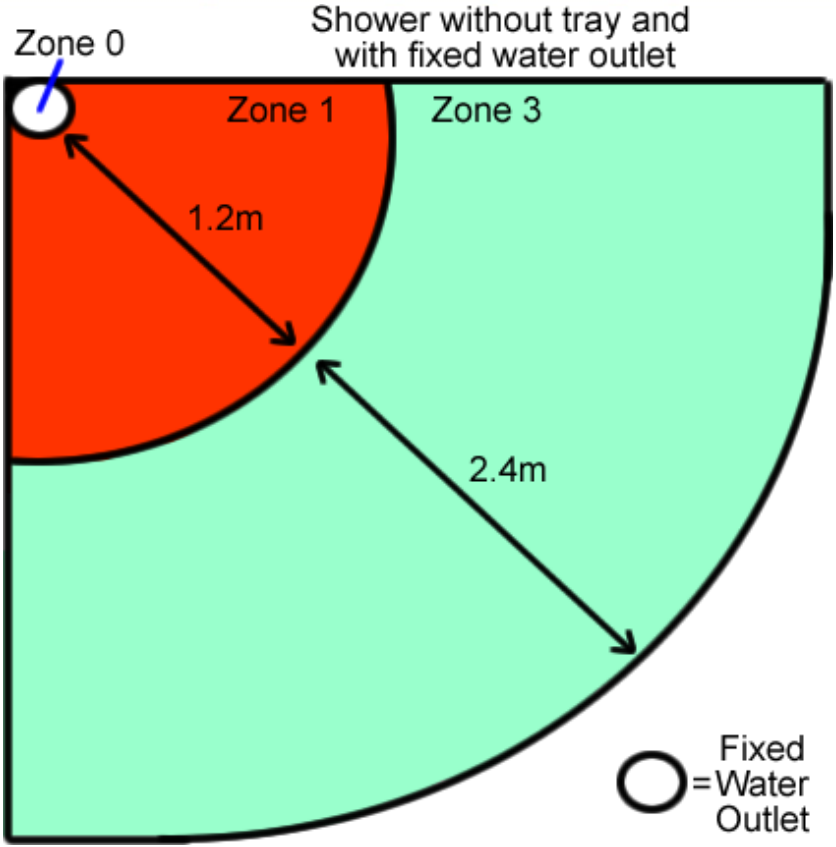
Chapter 7 - 701 - Locations Containing a Bath or Shower



Chapter 7 - 701 - Locations Containing a Bath or Shower



Chapter 7 - 701 - Locations Containing a Bath or Shower



Chapter 7 - 705.55.1 - Socket-outlets

- “Socket-outlets of agricultural and horticultural premises shall comply with: - I.S. 411 or BS 1363-2 as appropriate provided the rated current does not exceed 20 A and installed in a location to suit the environment”.

- Standard 13-amp socket outlets may now be installed in an Agricultural Installations. We would expect that this would normally require the installation of a suitable I.P rated outlet.

Chapter 7 - Special Installations or Locations

The associated CENELEC 60364 series of HDs have been updated which is now reflected in I.S.10101

Part 710 Installations in Medical Locations

Part 710 has been revised in accordance with HD 60364-7-710:2012 and contains several changes including;

Clause 710.411.6.3.101

Now requires risk assessment of "other electrical equipment" before being used in the patient environment.

Clause 710.415.2.2

Now requires the resistance of supplementary protective bonding conductors in group 1 as well as group 2 medical locations, to not exceed 0.2 Ohms.

Clause 710.55.101

Now requires the intended use of a medical location to be considered with regard to the decision on the number of socket outlets to be protected by a single RCD.

Clause 710.55.102

Now requires that socket outlets of medical IT systems in group 2 locations be un-switched, coloured blue, and clearly and permanently marked "Medical Equipment Only".

Chapter 7 - 712 - Solar Photovoltaic Systems (PV)

- The requirements for solar photovoltaic systems have expanded significantly in I.S.10101:2020

- Solar PV is in greater demand than ever before, therefore more detail is provided regarding safety and installation methods.

- 712.537.4.2: Emergency Isolation
  - Automatic isolation of DC into the building when mains AC supply is disconnected, provided by a “shunt switch”
  - Located as close to the solar PV modules as possible.

Chapter 7 - 722 - Charging for Electric Vehicles

- Charging for Electric Vehicles was published as an amendment to ET.101:2008 in 2017.

- This section is now consolidated as Part 722 in Chapter 7 and has unchanged from the version released previously.

- 730: Onshore Units of Electrical Connections for Inland Navigation Vessels:
  - This section is entirely new.

Energy Efficiency

Annex 8 - Energy Efficiency

- This section is entirely new and very informative. It provides recommendations and guidelines on design and erection of electrical installations to optimise energy efficiency,
  - including metering, load control and minimisation of losses in conductors.
- It introduces recommendations for the design of an electrical installation
- Part 4:
  - “The requirements and recommendations of this part shall not impair the requirements included in other parts of IS:10101”

Annex 8 - 8.3.2.2 - Load Shedding & Device Choice

- “For example, incandescent lamps have been widely used with timers or presence detectors for corridors, stairs, etc. to improve the energy efficiency of the installation as the lamps are switched on only when people are present.

- Their replacement with lamps using another technology, which are far more sensitive to the number of switching operations, can dramatically reduce the life-time of these lamps, in some cases leading to a rejection of the timers which were used previously.

- The consequence is that lamps may now remain switched on day and night to avoid having to change them too often and by so doing, reduces the energy efficiency of the installation.

Annex 8 - 8.3.2.2 - Load Shedding & Device Choice

- This example illustrates how important it is to take into consideration the comprehensive cost sensitivity of the user:
  - The cost of replacement of the lamps exceeds the savings on energy cost.
  - The right choice regarding energy efficiency may be to use lamps with the right technology regarding the switching issue in order to offer a lower energy consumption of the installation and a normal expected lifetime of the lamps.”

Annex 8 - Energy Efficiency

- Know the key electrical loads
- Calculate copper losses
- Size cables suitably – or – move the load centre
- Prosumer Produces and Consumes electricity
- Time of day is relevant to electrical load profile
- Consider load dropping and control
- Monitoring and metering
- Time of day tariff
- Several alternative supplies

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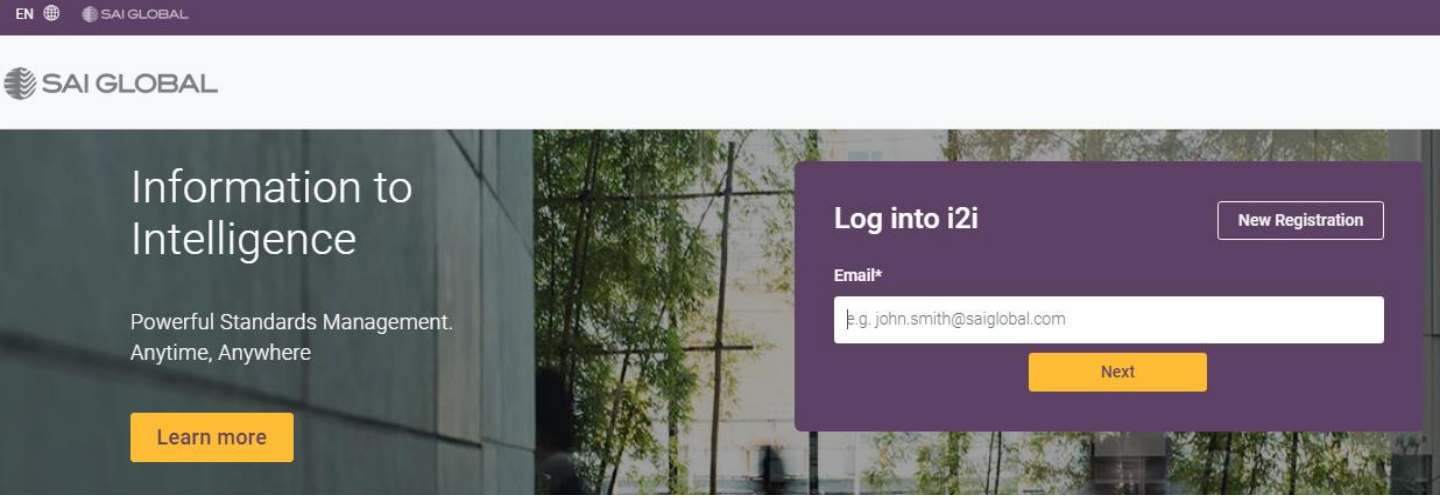

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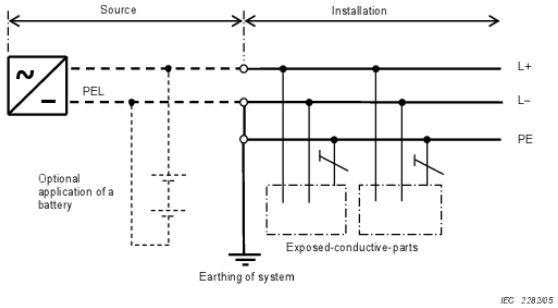

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Foreword
[p4] HD 60364-7-701 2007+A11:2011 Locations containing a bath or **shower**

Introduction
[p16] Part 701 - Locations containing a bath or **shower** 507

List of Tables
[p27] Table 701.1 - Electrical equipment permissible in rooms containing a bath or **shower** 517

11 Scope – I.S. 10101
[p38] p) locations containing a bath or **shower**;

555.6 Electrical equipment and wiring in domestic- type airing cupboards
[p340] 555.3.1 A circuit supplying a water-heating appliance, e.g. an immersion heater or a **shower** unit, shall be
[p340] A separate RCD or RCBO shall be provided for each **shower** unit
[p340] Where simultaneous operation of **shower** units is not required, two units may be fed from the same circuit provided

559.3 General requirements for installations
[p350] - Clause 701 for locations containing a bath or **shower**

55A3.3 Cooker circuits
[p470] heaters, **shower** units.

55A.4.1 Radial final circuits for lighting equipment in domestic and similar installations
[p471] 55A.3.4 **Shower** units
[p471] **Shower** units with instantaneous heaters can take high currents from 40 A upwards. The supply and the main
[p471] A separate RCD and MCB, or RCBO, should be provided for each **shower** unit.

CHAPTER 7 – SPECIAL INSTALLATIONS OR LOCATIONS
[p508] 701 Locations containing a bath or **shower**

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555.3 Water-heating equipment

555.3.1 A circuit supplying a water-heating appliance, e.g. an immersion heater or a shower unit, shall be protected by an RCD having a rated residual operating- current not exceeding 30 mA.

This requirement does not apply to immersion-heaters used for industrial or similar purposes.

A separate RCD or RCBO shall be provided for each shower unit

Where simultaneous operation of shower units is not required, two units may be fed from the same circuit provided only one unit is supplied at a time. This may be achieved by an arrangement of interlocked contactors

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