AUTUMN 11 ISSUE 40

WIRINGMATTERS

The Institution of Engineering and Technology

FIRE PROTECTION

Requirements to avoid unnecessary risk

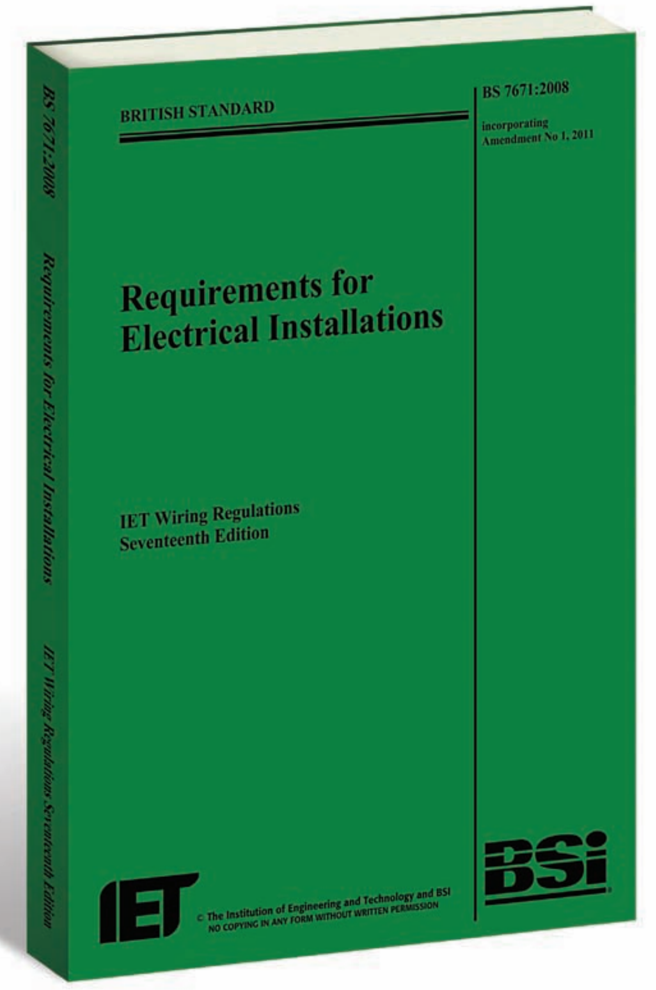
Periodic inspection
The new electrical installation condition report

Earthing
BS 7671 and the various earthing systems

Wiring Regs changes
Detailing changes to Appendix 4 by Amendment 1


ORDER BY 8 PM FOR NEXT DAY DELIVERY
MISSED LAST ORDERS?
Later than you thought?
Have your usual electrical suppliers called time?
You don't have to go without!
Register
Log in
The UK's Leading Distributor of Electrical Supplies
neweysonline
QUICK: CLICK: JOB DONE!
Search Neweys Online
Home
Products
Knowledge
My Account
PLACE YOUR ORDER ONLINE BY 8.00PM AND WE'LL DELIVER TO YOU ON-SITE, NEXT DAY
WHEN YOU NEED A LITTLE MORE TIME! - JOIN US ONLINE!
neweysonline.co.uk
QUICK: CLICK: JOB DONE!

Appendix 4 of Amendment 1 of BS 7671:2008



This article looks at some of the changes introduced into Appendix 4 (current-carrying capacity and voltage drop for cables) by Amendment 1 of the 17th edition of the Wiring Regulations.

By Geoff Cronshaw

Appendix 4 is an informative appendix within BS 7671. The appendix includes tabulated current carrying capacities for some of the most commonly used cables in the electrical installation industry.

These include single and multicore 70 degree thermoplastic and 90 degree thermosetting insulated cables with copper conductors, 70 degree thermoplastic insulated and sheathed flat cable with protective conductor (copper), a range of armoured cables, and mineral insulated cables. Also a range of cables with aluminium conductors.

Tables 4D1A to Tables 4J4A contain the current carrying capacities in amperes for the various types of cable. Each table contains reference methods.

Installation methods and reference methods

The number of installation methods described in Table 4A2 of appendix 4 has been increased to almost 80 in Amendment 1 of the 17th edition compared to just 20 in the16th edition. Although this may appear to make things more complicated, the appendix now embraces installation methods that are used but which were not previously accounted for, including installation methods in building voids, direct in ground, in ducts in the ground, and flat twin and earth cables in thermal insulation.

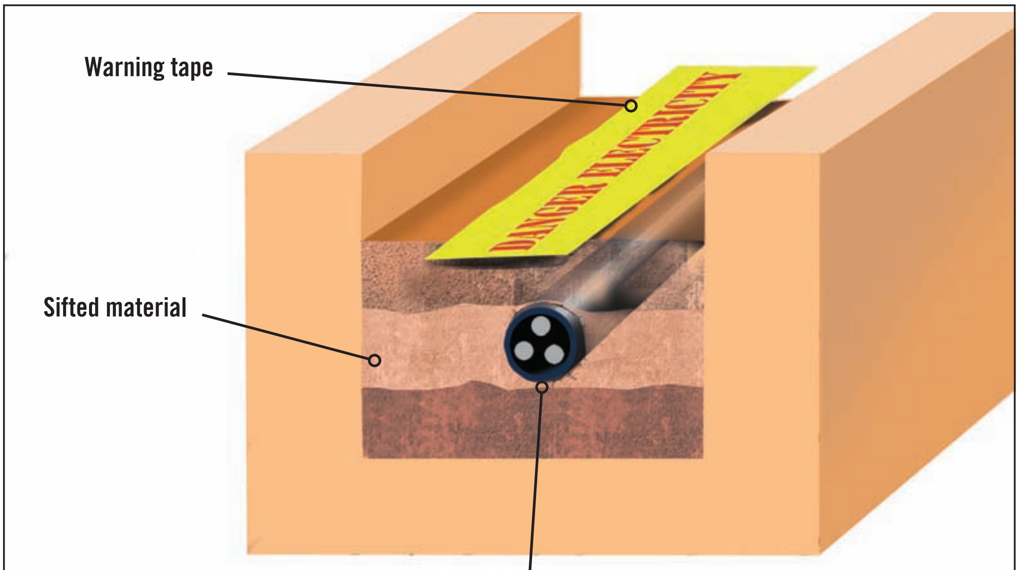
It is impractical to calculate and publish current ratings for every installation method, since many would result in the same current rating. Therefore a suitable (limited) number of current ratings have been calculated which cover all of the installations stated in the Wiring Regulations, and are called reference methods.

All the individually numbered installation methods have a lettered reference method stated against them in Table 4A2, except for flat twin and earth cables which have reference method numbers 100 to 103. There are seven alphabetically lettered reference methods, that is A to G.

The lettered reference methods broadly cover the following areas:

- Reference method A – Enclosed in conduit in thermally insulated walls etc. (Note: The wall consists of an outer weatherproof skin, thermal insulation and an inner skin of wood or wood-like material having a thermal conductance of at least 10 W/m2K. The conduit is fixed so as to be close to, but not necessarily touching, the inner skin. Heat from the cables is assumed to escape through the inner skin only. The conduit can be metal or plastic.)
- Reference method B – Enclosed in conduit on a wall or in trunking etc.
- Reference method C – Clipped direct.
- Reference method D – Direct in the ground or in ducting in the ground.
- Reference method E – Multicore cables in free air or on perforated trays etc. ▶

- Reference method F – Single-core cable touching in free air or on perforated trays etc.
- Reference method G – Single-core cable spaced in free air or on perforated trays etc.



Cable buried directly in the ground

Effective current-carrying capacity

The current-carrying capacity of a cable corresponds to the maximum current that can be carried in specified conditions without the conductors exceeding the permissible limit of steady-state temperature for the type of insulation concerned.

The values of current tabulated represent the effective current-carrying capacity only where no rating factor is applicable.

Otherwise, the current-carrying capacity corresponds to the tabulated value multiplied by the appropriate factor or factors for ambient temperature, grouping and thermal insulation as well as depth of burial and soil thermal resistivity, for buried cables, as applicable. Where harmonic currents are present further factors may need to be applied.

Important: *a rating factor has to be applied where the installation conditions differ from those for which values of current-carrying capacity are tabulated in Tables 4D1A to Tables 4J4A of appendix 4.*

The various rating factors (some of which have been modified by amendment 1) are identified below.

Ca for ambient temperature

Cc for circuits buried in the ground

Cd for depth of burial

Cf for semi-enclosed fuse to BS 3036

Cg for grouping

Ci for thermal insulation

Cs for thermal resistivity of soil.

Cables direct in ground or in ducts in the ground

It is worthwhile highlighting that the amendment 1 of BS 7671:2008 (17th edition) includes references for cables buried in the ground (installation methods 70 to 73). These were introduced in the 17th edition when it was published in 2008 but amendment 1 includes some significant changes.

The current-carrying capacities tabulated for cables in the ground are based upon a soil thermal resistivity of 2.5 K.m/W and are intended to be applied to cables laid in and around buildings, i.e. disturbed soil.

In locations where the effective soil thermal resistivity is higher than 2.5 K.m/W, an appropriate reduction in current-carrying capacity should be made. *Rating factors for soil thermal resistivities other than 2.5* ▶

Wiring Matters is a quarterly publication produced by IET Services Limited, a subsidiary of The Institution of Engineering and Technology (IET), for the IET. Michael Faraday House, Six Hills Way, Stevenage, Herts, SG1 2AY, United Kingdom Tel: +44 (0)1438 313311 Fax: +44 (0)1438 313465. The Institution of Engineering and Technology is registered as a Charity in England & Wales (no 211014) and Scotland (no SC038698). The IET is not as a body responsible for the opinions expressed.

Advertising Sales D Smith +44 (0)1438 767224 daniellesmith@theiet.org I **Editor** G D Cronshaw +44 (0)1438 767384 gcronshaw@theiet.org I **Contributing Editors** M Coles, R Townsend, P Bicheno I **Sub editors** Jim Hannah, Leanne Farnell I **Design** John Rooney, Jon Bonny, Dan Shadrake I **Production controller** Nikki McEllin

Cooperating Organisations The Institution of Engineering & Technology acknowledges the contribution made by the following organisations in the preparation of this publication: British Electrotechnical & Allied Manufacturers Association Ltd – P D Galbraith, M H Mullins I Department for Communities and Local Government – I Drummond I Electrical Contractors Association – D Locke, S Burchell I City & Guilds of London Institute – H R Lovegrove I Electrical Contractors Association of Scotland SELECT – N McGuiness I Health & Safety Executive – K Morton I Electrical Safety Council I ERA Technology Limited – M Coates, A Finney I Consultant - M. Al-Rufaie I Dept of Health - C Holme I British Cables Association – C Reed I Scottish Building Standards Agency I Department for Business, Enterprise and Regulatory Reform I GAMBICA – M Hadley, A. Sedhev I Lighting Association – L Barling
ISSN 1749-978-X

◄ *K.m/W are given in Table 4B3* (extract shown right).

It is important to note that the tabulated current-carrying capacities for cables direct in ground or in ducts in the ground, given in appendix 4, are based an ambient ground temperature of 20°C. The factor of 1.45 that is applied in Regulation 433.1.1 when considering overload protection assumes that the tabulated current-carrying capacities are based on an ambient air temperature of 30°C. To achieve the same degree of overload protection when the tabulated current-carrying capacity is based on an ambient temperature of 20°C *where a cable is "in a duct in the ground" or "buried direct" as compared with other installation methods a rating factor of 0.9 is applied as a multiplier to the tabulated current carrying capacity.*

Where cables are at depths other than 0.7 m direct buried or buried in ducts TABLE 4B4 gives rating factors (Cd) which are shown above right.

TABLE 4B3 – Rating factors (C_s) for cables buried direct in the ground or in an underground conduit system to BS EN 50086-2-4 for soil thermal resistivities other than 2.5 K.m/W to be applied to the current-carrying capacities for Reference Method D

Thermal resistivity, K.m/W	0.5	0.8	1	1.2	1.5	2	2.5	3
Rating factor for cables in buried ducts	1.28	1.20	1.18	1.13	1.1	1.05	1	0.96
Rating factor for direct buried cables	1.88	1.62	1.5	1.40	1.28	1.12	1	0.90

NOTE 1: The rating factors given have been averaged over the range of conductor sizes and types of installation included in the relevant tables in this appendix. The overall accuracy of rating factors is within ± 5%.

NOTE 2: Where more precise values are required they may be calculated by methods given in BS 7769 (BS IEC 60287).

NOTE 3: The rating factors are applicable to ducts buried at depths of up to 0.8 m.

TABLE 4B4 – Rating factors (C_d) for depths of laying other than 0.7 m for direct buried cables and cables in buried ducts

Depth of laying, m	Buried direct	In buried ducts
0.5	1.03	1.02
0.7	1.00	1.00
1	0.97	0.98
1.25	0.95	0.96
1.5	0.94	0.95
1.75	0.93	0.94
2	0.92	0.93
2.5	0.90	0.92
3	0.89	0.91

The relevant symbols used in the Regulations are as follows:

Iz the current-carrying capacity of a cable for continuous service, under the particular installation conditions concerned.

It the value of current tabulated in this appendix for the type of cable and installation method concerned, for a single circuit in the ambient temperature stated in the current-carrying capacity tables.

Ib the design current of the circuit, i.e. the current intended to be carried by the circuit in normal service.

In the rated current or current setting of the protective device.

I2 the operating current (i.e. the fusing current or tripping current for the conventional operating time) of the device protecting the circuit against overload.

Section 5 of Appendix 4 gives information on the determination of the size of cable to be used. A part extract from Section 5, left, demonstrates how rating factors are applied. Please refer to the complete appendix for all the essential information including voltage drop. ►

5 DETERMINATION OF THE SIZE OF CABLE TO BE USED

5.1 Where overload protection is afforded by a device listed in Regulation 433.1.100 or a semi-enclosed fuse to BS 3036

5.1.1 For single circuits

(i) Divide the rated current of the protective device (I_n) by any applicable rating factors for ambient temperature (C_a) , soil thermal resistivity (C_s) and depth of burial (C_d) given in Tables 4B1 to 4B4.

For cables installed above ground C_s and C_d = 1.

(ii) Then further divide by any applicable rating factor for thermal insulation (C_i).

(iii) Then further divide by the applicable rating factor for the type of protective device or installation condition (C_f, C_c):

$$I_t \geq \frac{I_n}{C_a\, C_s\, C_d\, C_i\, C_f\, C_c}$$

a) Where the protective device is a semi-enclosed fuse to BS 3036, C_f = 0.725. Otherwise C_f = 1

b) Where the cable installation method is 'in a duct in the ground' or 'buried direct', C_c = 0.9. For cables installed above ground C_c = 1.

The size of cable to be used is to be such that its tabulated current-carrying capacity (I_t) is not less than the value of rated current of the protective device adjusted as above.

5.1.2 For groups

(i) In addition to the factors given in 5.1.1, divide the rated current of the protective device (I_n) by the applicable rating factor for grouping (C_g) given in Tables 4C1 to 4C6:

$$I_t \geq \frac{I_n}{C_g\, C_a\, C_s\, C_d\, C_i\, C_f\, C_c}$$

Additional installation methods

Amendment 1 of the 17th edition has introduced additional installation methods 117 to 120 for cables enclosed in infloor concrete troughs. An extract of the new installation methods are shown to the right.

Conclusion

Please note this article is only intended as a brief overview of some of the changes introduced into Appendix 4 by amendment 1 of the 17th edition of the wiring regulations.

Circuits must be designed that are fit for purpose and suitable for the load they are intended to supply. They should be correctly designed in accordance with BS 7671.

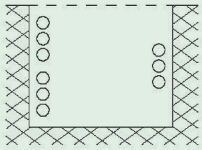
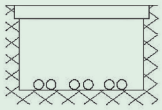
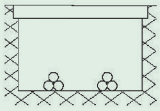
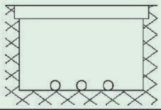
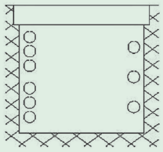
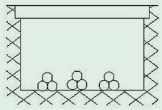
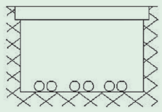
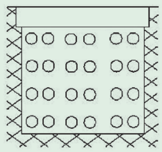
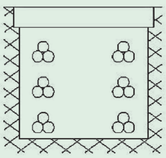
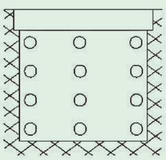
Chapter 43 deals with protection against overcurrent and also thermal constraints, Chapter 42 has requirements for protection against thermal effects, Chapter 41 deals with protection against electric shock and gives the disconnection times that must be met whilst Section 525 deals with voltage drop.

In addition Section 526 and 512.1.5 has requirements for the temperature of conductors connected to equipment terminals. Appendix 4 gives tabulated current carrying capacity and voltage drop for cables.

All these areas need to be taken into account when determining the cable size for a particular circuit. ■

For more information refer to Amendment 1 of BS 7671:2008.

TABLE 4A2 *(continued – Installation methods for cables enclosed in infloor concrete troughs)*

Installation Method			Reference Method to be used to determine current-carrying capacity
Number	Examples	Description	
117		Cables supported on the wall of an open or ventilated infloor concrete trough with spacing as follows: - Sheathed single-core cables in free air (any supporting metalwork under the cables occupying less than 10% of plan area). - Two or three cables vertically one above the other, minimum distance between cable surfaces equal to the overall cable diameters, distance from the wall not less than ½ the cable diameter. - Two or three cables horizontally with spacing as above	E or F
118		Cables in enclosed trench 450 mm wide by 300 mm deep (minimum dimensions) including 100 mm cover - Two to six single–core cables with surfaces separated by a minimum of one cable diameter	E or F using rating factors in Table 4C6
		- One or two groups of three single-core cables in trefoil formation	
		- One to four 2-core cables or one to three cables of 3 or 4 cores with all cables separated by a minimum of 50 mm	
119		Cables enclosed in an infloor concrete trough 450 mm wide by 600 mm deep (minimum dimensions) including 100 mm cover. Six to twelve single-core cables arranged in flat groups of two or three on the vertical trench wall with cables separated by one cable diameter and a minimum of 50 mm between groups	E or F using rating factors in Table 4C6
		or two to four groups of three single-core cables in trefoil formation with a minimum of 50 mm between trefoil formations	
		or four to eight 2-core cables or three to six cables of 3 or 4 cores with cables separated by a minimum of 75 mm. All cables spaced at least 25 mm from trench wall.	
120		Cables enclosed in an infloor concrete trough 600mm wide by 760 mm deep (minimum dimensions) including 100 mm cover. Twelve to twenty four single-core cables arranged in either flat formation of two or three cables in a group with cables separated by one cable diameter and each cable group separated by a minimum of 50 mm either horizontally or vertically	E or F using rating factors in Table 4C6
		or single-core cables in trefoil formation with each group or trefoil formation separated by a minimum of 50 mm either horizontally or vertically	
		or eight to sixteen 2-core cables or six to twelve cables of 3 or 4 cores with cables separated by a minimum of 75 mm either horizontally or vertically. All cables spaced at least 25 mm from trench wall.	

Protection against fire

Protection against fire resulting from the electrical installation and the use of the electrical installation has been necessary ever since electricity was introduced into buildings

By Geoff Cronshaw

It is perhaps worth noting that almost 130 years ago the first edition of the Wiring Regulations, introduced in 1882, was called the Rules and Regulations for the Prevention of Fire Risks Arising from Electric Lighting.

Amendment number 1 of the 17th edition published in July this year and coming into effect on 1 January 2012 includes requirements for protection against thermal effects. The requirements are contained in Chapter 42 for the protection of persons, livestock and property against fire caused by electrical equipment, against burns and overheating and includes precautions where particular risks of fire exist. ▶

Fig 1: Insulation support box

PROTECTION AGAINST FIRE CAUSED BY ELECTRICAL EQUIPMENT

Regulation 421 requires persons, livestock and property to be protected against damage or injury caused by heat or fire.

Regulation 421 requires measures to prevent electrical equipment from presenting a fire hazard to materials in close proximity to such equipment. The regulation gives examples of causes of damage, injury or ignition including:

- thermostats, temperature limiters, seals of cable penetrations and wiring systems
- overcurrent
- insulation faults and/or arcs causing interference
- harmonic currents
- lightning strikes, see the IEC 62305 series

Regulation 421.2 requires that the heat generated by fixed electrical equipment in normal use should not be capable of causing a fire or harmful thermal effects to adjacent fixed material. The regulation offers three installation methods for equipment which in normal operation has a surface temperature sufficient to cause a risk of fire or harmful effects to adjacent materials.

- be mounted on or within materials that will withstand such temperatures
- be screened by materials that will withstand such temperatures
- be mounted in a manner that permits safe heat dissipation and gives adequate clearance from surrounding equipment or materials. Example of an insulation support box is shown in Fig 1

Fig 2: Semi-enclosed fuses

Regulation 421.3 requires that where arcs or sparks may be emitted for example in circuit-breakers or semi enclosed fuses (Figs 2 & 3) the equipment shall either:

- be totally enclosed in arc-resistant material, or
- be screened by arc-resistant material, or
- be mounted so as to allow safe extinction of the

emissions at a sufficient distance from material upon which the emissions could have harmful effects (IEE Guidance Note 4 gives more information).

Chapter 42 also contains requirements for fixed equipment. Regulation 421.4 requires fixed equipment, for example radiant heaters and high intensity luminaries which cause a concentration of heat (Fig 4) must be at a sufficient distance from any fixed object or building element so that the object or element, in normal conditions, is not subjected to a dangerous temperature (IEE Guidance Note 4 gives more information).

Special precautions are necessary for flammable dielectric liquids. Regulation 421.5 requires that where electrical equipment in a single location contains flammable liquid in significant quantity (Fig 5), adequate precautions shall be taken to prevent the spread of liquid, flame and the products of combustion.

IEE Guidance Note 4 explains that the options available to the designer will depend on a number of considerations, for example, whether a single item of equipment is involved, or a number of items, and whether the location is indoors or outdoors. The options include:

- reducing the risk by partitioning the location with fire doors and sills
- providing bunds or kerbs around items of equipment or, for larger items of

Fig 3: Fuse wire

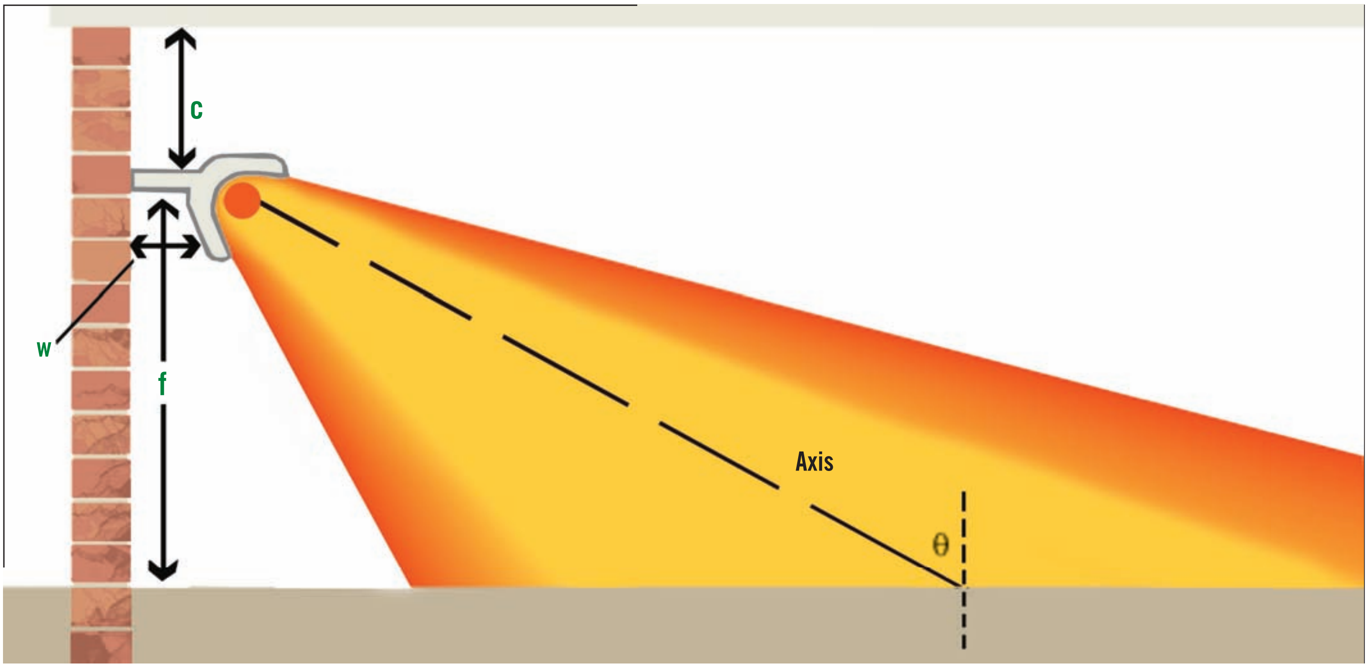


Fig 4 Focusing of heat from a heater or luminaire

equipment, a retention pit filled with pebbles or granite chips (the net capacity of the bund or retention pit when filled with pebbles or chips should exceed the oil capacity of the equipment by at least 10 per cent)

- providing a drainpit and flame arrestor
- provision of automatic fire venting and/or automatic fire suppression or foam inlets and integration with the automatic fire detection and alarm system of the building, where appropriate
- ramped floors
- use of an outdoor location
- blast walls between large items.

Fig 5 below, extracted from IEE Guidance Note 4, shows an oil-filled transformer located in a plant room, which incorporates many of the measures described above: the location is fitted with a fire door, the floor falls to a central drainage point leading to a drainpit (grille just visible to left of picture) and the walls have been constructed to contain any blast in the event of explosion.

PRECAUTIONS WHERE PARTICULAR RISKS OF FIRE EXIST

This section contains requirements for:

Fig 5 An oil-filled transformer

Emergency escape routes

In conditions BD2 (multi-storey buildings such as offices), BD3 (buildings open to the public, such as shopping centres and places of public entertainment), BD4 (high-rise buildings open to the public, such as hotels), wherever possible wiring systems should not encroach on escape routes and should in any case be as short as possible.

Locations with risks of fire due to the nature of processed or stored materials

In condition BE2 (Fire risk) Chapter 42 contains requirements for luminaires, enclosures, switchgear, cables, motors, heating appliances etc.

Requirements for locations with combustible constructional materials

Precautions should be taken so that electrical equipment does not pose an ignition hazard to walls, floors or ceilings to which it is in close proximity, by the adoption of appropriate design, installation methods and choice of electrical equipment. Distribution boards and accessory boxes for switches, socket-outlets and the like that are installed into or on the surface of a wall made from combustible materials should meet the requirements of the relevant product standard for temperature rise of such an enclosure.

Where this is not the case, the equipment or accessory should be enclosed by non-flammable material of suitable thickness, taking into account the nature of the material being employed. Refer to Regulations 422.4.1, 422.4.3, and 422.4.4 for further details.

Requirements for Fire propagating structures

Some buildings with certain shapes may facilitate the spread of fire e.g. high rise, or forced ventilation where a chimney effect may exist. Chapter 42 contains requirements to protect against these hazards.

Selection and erection of installations in locations of national, commercial, industrial, or public significance

Requirements for electrical installations in locations of national, commercial, industrial or public significance were introduced into BS 7671:2008, the 17th Edition when it was published in 2008 and this has been retained in amendment 1 of the 17th Edition.

These are areas such as museums, national monuments, airports, railway stations, laboratories, computer and data storage centres, and archiving facilities.

Regulation 422.6 requires compliance with Regulation 422.1 and consideration of a number of measures such as installation of cables with improved fire-resistance.

PROTECTION AGAINST BURNS

Regulation 423.1 requires that accessible parts of electrical equipment within arm's reach shall not attain a temperature likely to cause burns to persons, and shall comply with the appropriate limit stated in Table 42.1. The regulation contains an exception for equipment for which a harmonized standard specifies a limiting temperature.

The requirements of Regulation 423.1 of BS 7671 apply only to protection

against burns caused by contact with heated surfaces. Measures to prevent burns from heat radiation or arcing are covered by the requirements of Regulation 420.3.

Table 42.1 of BS 7671, right, gives maximum acceptable surface temperatures for accessible parts of equipment within arm's reach during normal load conditions. Factors to be taken into account when using the table are whether the part is intended to be hand-held or touched in normal use, and of what materials the equipment is manufactured.

TABLE 42.1 – Temperature limit under normal load conditions for an accessible part of equipment within arm's reach

Accessible part	Material of accessible surfaces	Maximum temperature (°C)
A hand-held part	Metallic Non-metallic	55 65
A part intended to be touched but not hand-held	Metallic Non-metallic	70 80
A part which need not be touched for normal operation	Metallic Non-metallic	80 90

Where the maximum temperatures prescribed in Table 42.1 are likely to be exceeded, albeit for a short period of time, the equipment in question should be fitted with guards or similar to prevent accidental contact.

Table 42.1 should not be applied to equipment for which a limiting temperature is specified in the relevant product standard.

It should be noted that mineral insulated cables exposed to touch are permitted to have a sheath temperature of 70°C, corresponding to a metallic part intended to be touched but not hand-held.

However, a cable having a conductor operating temperature of 90°C may achieve a surface temperature approaching 80°C in normal operation.

It must always be borne in mind that the temperatures in Table 42.1 are maximum values and that contact with any surface at or above 70°C may cause a dangerous reflex action.

BS 4086:1966 (1995) Recommendations for maximum surface temperatures of heated domestic equipment provides technical considerations and recommended maximum temperatures for controls and working surfaces of heated domestic equipment. BSI PD 6504:1983 Medical information on human reaction to skin contact with hot surfaces provides information prepared by medical experts on human reaction to contact with heated surfaces. Both provide good guidance in determining 'safe' surface temperatures.

Even if the equipment complies with its standard as to surface temperature, consideration must still be given to the risk of burns, particularly when equipment is to be installed in locations to be used by the very young or infirm where additional precautions may be necessary, such as guards over heaters.

Regulation 554.2.1 requires every heater of liquid or other substance to incorporate, or to be provided with, an automatic device to prevent a dangerous temperature rise of the substance being heated. This requirement would apply, for example, to immersion heater elements heating the water stored in cylinders for domestic premises.


Burnt out electrical distribution board

Conclusion

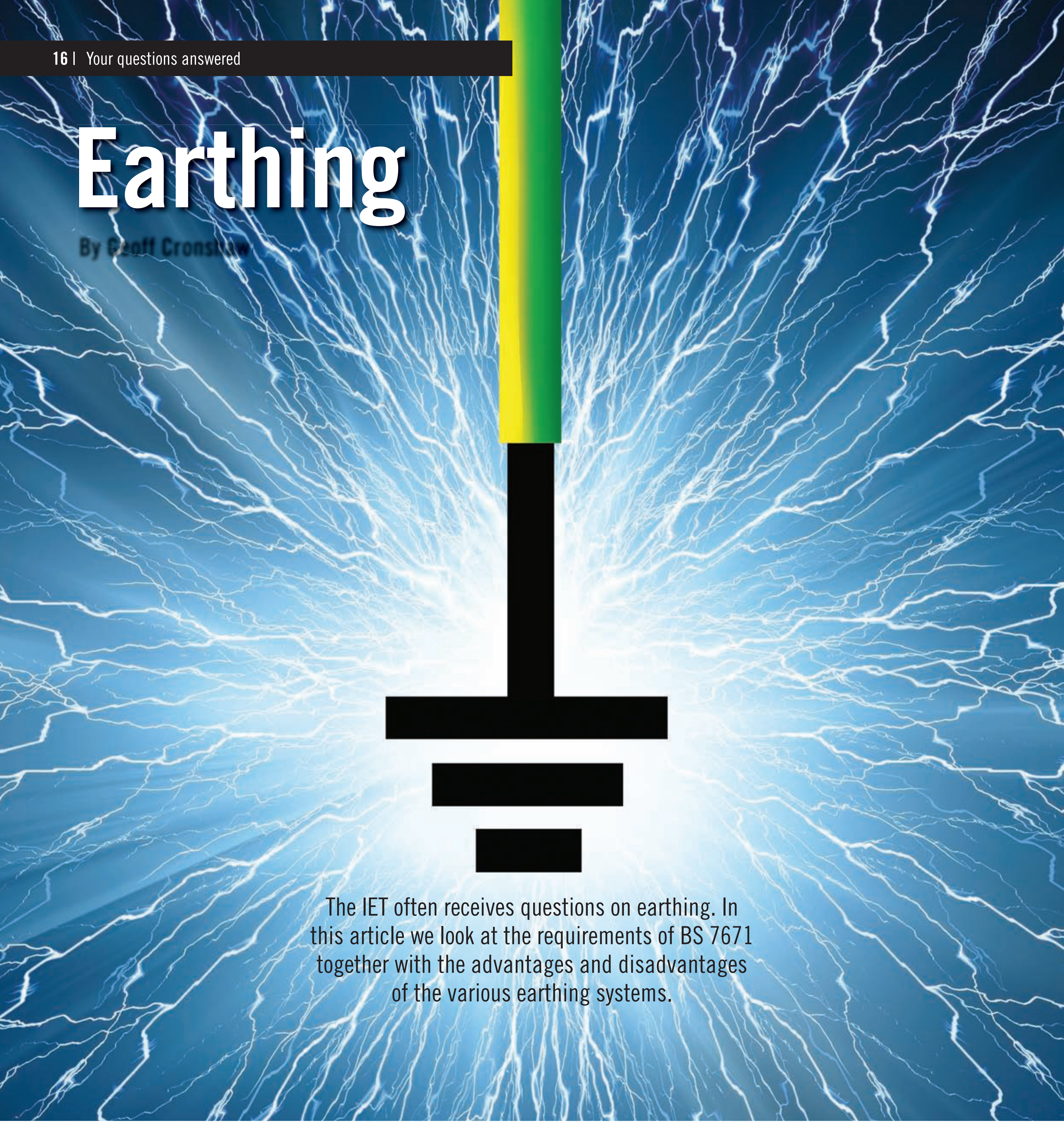
Please note this article is only intended as a brief overview of some of the requirements of Chapter 42 of amendment 1 of the 17th edition of the wiring regulations. For more information, refer to Amendment 1 of BS 7671:2008.

Thanks

Thanks to TLC-Direct for Figs 2 & 3 www.tlc-direct.co.uk

Earthing

By Geoff Cronshaw



The IET often receives questions on earthing. In this article we look at the requirements of BS 7671 together with the advantages and disadvantages of the various earthing systems.

BS 7671 lists five types of earthing system, TN-S, TN-C-S, TT, TN-C and IT. Part 2 describes the systems and Appendix 9 provides descriptions of multiple-source dc and other systems.

When designing an electrical installation, one of the first things to determine is the type of earthing system. For an LV supply the distributor will be able to provide this information.

The system will either be TN-S, TN-C-S (PME) or TT for a low-voltage supply given in accordance with the Electricity Safety, Quality and Continuity Regulations 2002 as amended.

This is because TN-C requires an exemption from the Electricity Safety, Quality and Continuity Regulations, and an IT system is not permitted for a low voltage public supply in the UK because the source is not directly earthed. Therefore TN-C and IT systems are both very uncommon in the UK.

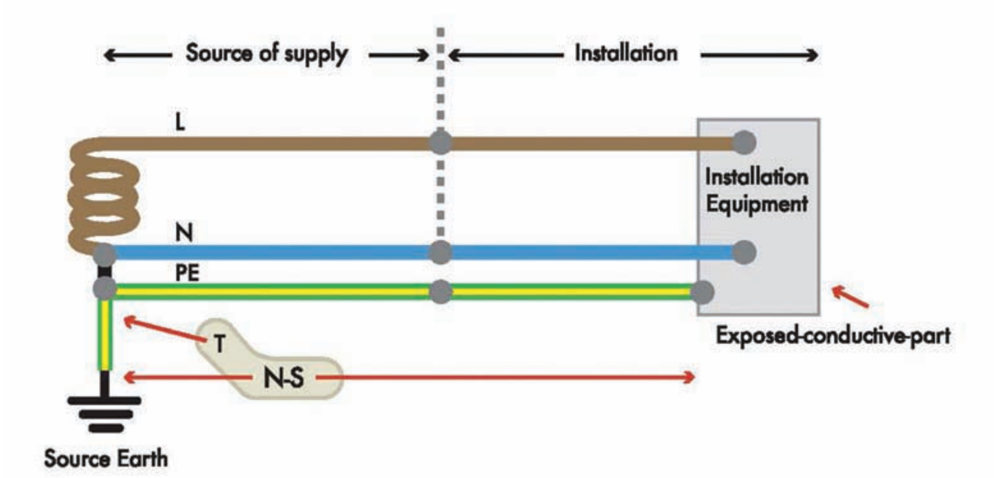


Fig 1 TN-S system

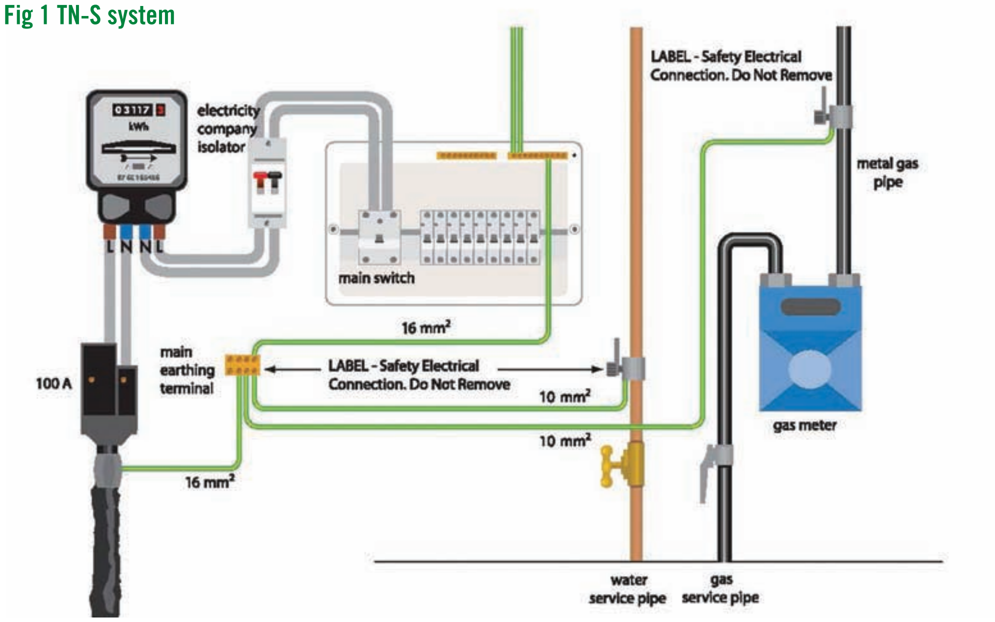


Fig 2 Cable sheath earth (TN-S system). Schematic of earthing and main equipotential bonding arrangements. Based on 25mm² tails and selection from Table 54.7. Note: An isolator is not always installed by the electricity distributor

OVERVIEW OF EARTHING SYSTEMS

TN-S system earthing

A TN-S system, shown in Fig 1, has the neutral of the source of energy connected with earth at one point only, at – or as near as is reasonably practicable to – the source, and the consumer's earthing terminal is typically connected to the metallic sheath or armour of the distributor's service cable into the premises.

TN-C-S system earthing

A TN-C-S system, shown in Fig 3, has the supply neutral conductor of a distribution main connected with earth at source and at intervals along its run. This is usually referred to as protective multiple earthing (PME). With this arrangement the distributor's

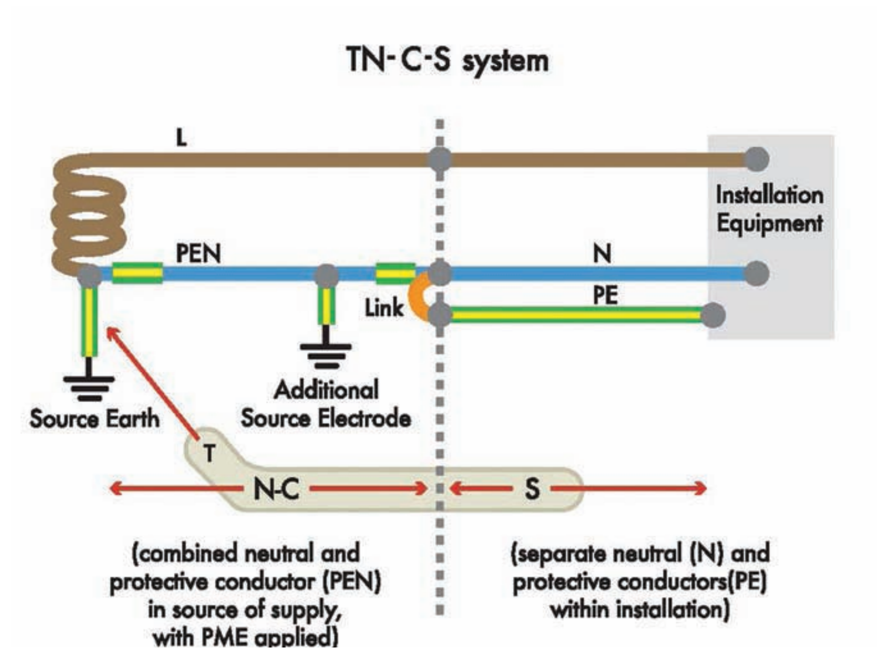


Fig 3 TN-C-S system

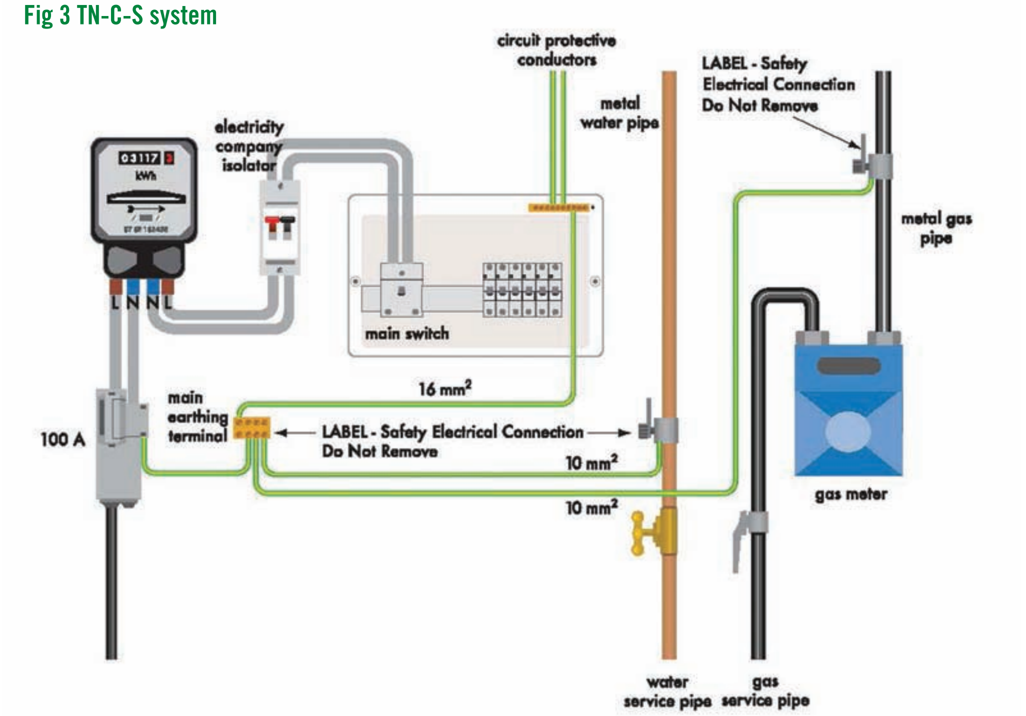


Fig 4 PME supply (TN-C-S system). Schematic of earthing and main equipotential bonding arrangements. Based on 25mm^2 tails and selection from Table 54.7. Note: An isolator is not always installed by the electricity distributor

neutral conductor is also used to return earth fault currents ▶ arising in the consumer's installation safely to the source. To achieve this, the distributor will provide a consumer's earthing terminal which is linked to the incoming neutral conductor.

TT system earthing

A TT system, shown overleaf, has the neutral of the source of energy connected as for TN-S, but no facility is provided by the distributor for the consumer's earthing. With TT, the consumer must provide his or her own connection to earth, i.e. by installing a suitable earth electrode local to the installation.

REQUIREMENTS OF BS 7671

Earth electrodes

BS 7671 recognises a wide variety of types of earth electrode. Regulation 542.2.3 lists the types recognised which include earth rods, earth plates and underground structural metal work.

The soil resistivity of the ground is probably the single most important factor in the determination of the type of earth electrode. Rods can only be as effective as the contact they make with the surrounding material. Thus, they should be driven into virgin ground, not disturbed (backfilled) ground.

Where it is necessary to drive two or more rods and connect them together to achieve a satisfactory result, the separation between rods should be at least equal to their combined driven depth to obtain maximum advantage from each rod.

In some locations low soil-resistivity is found to be concentrated in the topsoil layer, beneath which there may be rock or other impervious strata which prevents the deep driving of rods, or a deep layer of high resistivity. Only a test or known information about the ground can reveal this kind of information. In such circumstances, the installation of copper earth tapes, or pipes or plates, would be most likely to provide a satisfactory earth electrode resistance value.

Whatever form an earth electrode takes, the possibility of soil drying and freezing, and of corrosion, must be taken into account. Preferably, testing of an earth electrode should be carried out under the least favorable conditions, i.e. after prolonged dry weather. Further information on earthing principles and practice can be found in BS 7430:1998 'Code of Practice for Earthing' (which is current but is being updated).

Earthing conductors

Earthing conductors which are defined in BS 7671 as a protective conductor connecting the main earthing terminal of an installation to an earth electrode or other means of earthing must be adequately

sized particularly where buried partly in the ground, and be of suitable material and adequately protected against corrosion and mechanical damage.

The size of an earthing conductor is arrived at in basically the same way as for a circuit protective conductor, except that Table 54.1 of BS 7671 must be applied to any buried earthing conductor. For a TN-C-S (PME) supply, it should be no smaller than the main bonding conductors.

Sizing of circuit protective conductors

There are several factors which may influence or determine the size required for a circuit protective conductor. A minimum cross-sectional area of 2.5mm^2 copper is required for any separate circuit protective conductor, i.e. one which is not part of a cable or formed by a wiring enclosure or contained in such an enclosure.

An example would be a bare (where permitted) or insulated copper conductor clipped to a surface, run on a cable tray or fixed to the outside of a wiring enclosure. Such a circuit protective conductor must also be suitably protected if it is liable to suffer mechanical damage or chemical deterioration or be damaged by electro- dynamic effects produced by passing earth fault current through it. If mechanical protection is not provided the minimum size is 4mm^2 copper or equivalent.

BS 7671 provides two methods for sizing protective conductors including earthing conductors (see also Table 54.1). The easier method is to determine the protective conductor size from Table 54.7 but this may produce a larger size than is strictly necessary, since it employs a simple relationship to the cross-sectional area of the phase conductor(s).

You need to PROVE it's safe!

VI-PD KIT

VI-PD Voltage Tester & Proving Unit

Before doing any electrical work, it is essential to be sure the circuit is safe. Remember, nothing is more dangerous than trusting a defective voltage indicator to test for a dead circuit.

Safe electrical work requires the use of a voltage indicator that has been proved with a proving unit. Voltage indicators should always be tested with a proving unit or known live source before and after use.

- VI-13700 voltage indicator is GS38 compliant
- Clear indication of a live circuit, whether AC or DC
- Tough moulded ABS construction with bright LED indication & double insulated cable
- Constructed with large finger guard & retractable, lockable prod sheath for safe operation
- PD440 proving unit tests voltage indicators up to 440V

MARTINDALE ELECTRIC

Call us on 01923 441717
for your nearest stockist

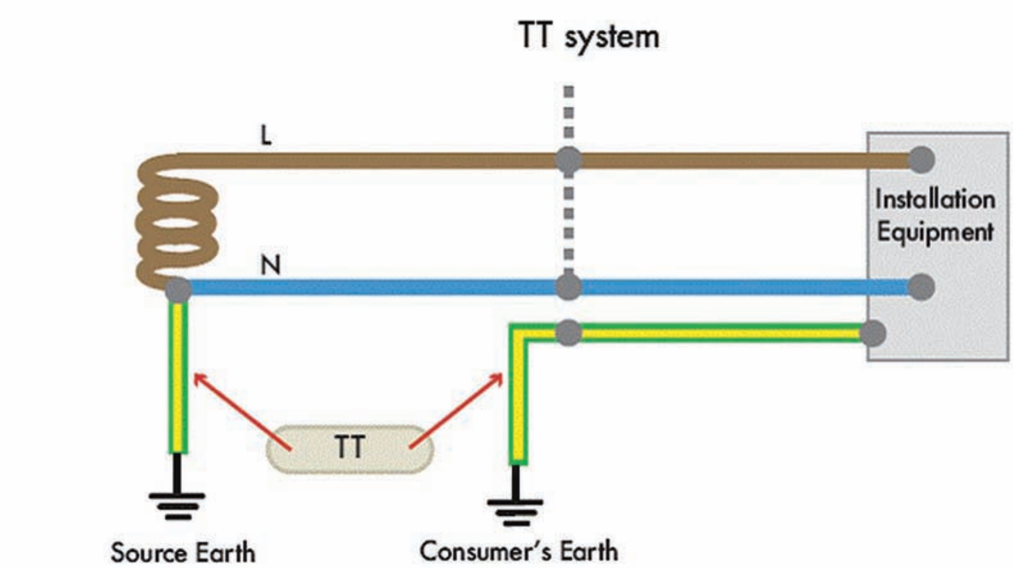


Fig 5 TT system

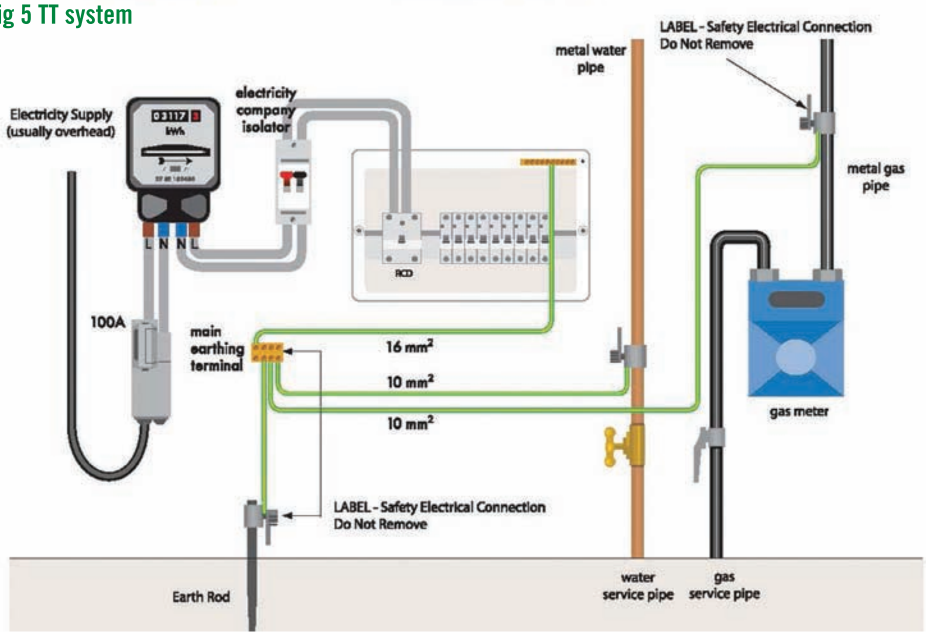


Fig 6 No earth provided (TT system). Based on 25 mm² tails and selection from Table 54.7. Note: An isolator is not always installed by the electricity distributor. Manufacturers recommendations should be sought with regards to connections to earth electrodes.

The second method involves a formula calculation. The formula is commonly referred to as the 'adiabatic equation' and is the same as that used for short-circuit current calculations (see Regulation 434.5.2). It assumes that no heat is dissipated from the protective conductor during an earth fault and therefore errs on the safe side. Even so, application of the formula will in many instances result in a protective conductor having a smaller csa than that of the live conductors of the associated circuit. This is quite acceptable.

Regulation 543.1.3 states: The cross-sectional area, where calculated, shall be not less than the value determined by the following formula or shall be obtained by reference to BS 7454.

$$S = \frac{\sqrt{I^2 t}}{k}$$

where:

S is the nominal cross-sectional area of the conductor in mm².

I is the value in amperes (rms. for a.c.) of fault current for a fault of negligible impedance, which can flow through the associated protective device, due account being taken of the current limiting effect of the circuit impedances and the limiting capability (I^2t) of that protective device.

Account shall be taken of the effect, on the resistance of circuit conductors, of their temperature rise as a result of overcurrent - see Regulation 413-02-05.

t is the operating time of the disconnecting device in seconds corresponding to the fault current I amperes.

k is a factor taking account of the resistivity, temperature coefficient and heat capacity of the conductor material, and the appropriate initial and final temperatures.

TYPE OF EARTHING SYSTEMS, ADVANTAGES AND DISADVANTAGES

Protective multiple earthing (PME).

Such a supply system is described in BS 7671 as TN-C-S. The advantage of this system is that it provides an effective and reliable method of providing customers with an earth connection. For example the maximum Ze specified by a distributor is 0.35 Ω for TN-C-S supplies compared to 0.8 Ω for TN-S supplies.

However, under certain supply

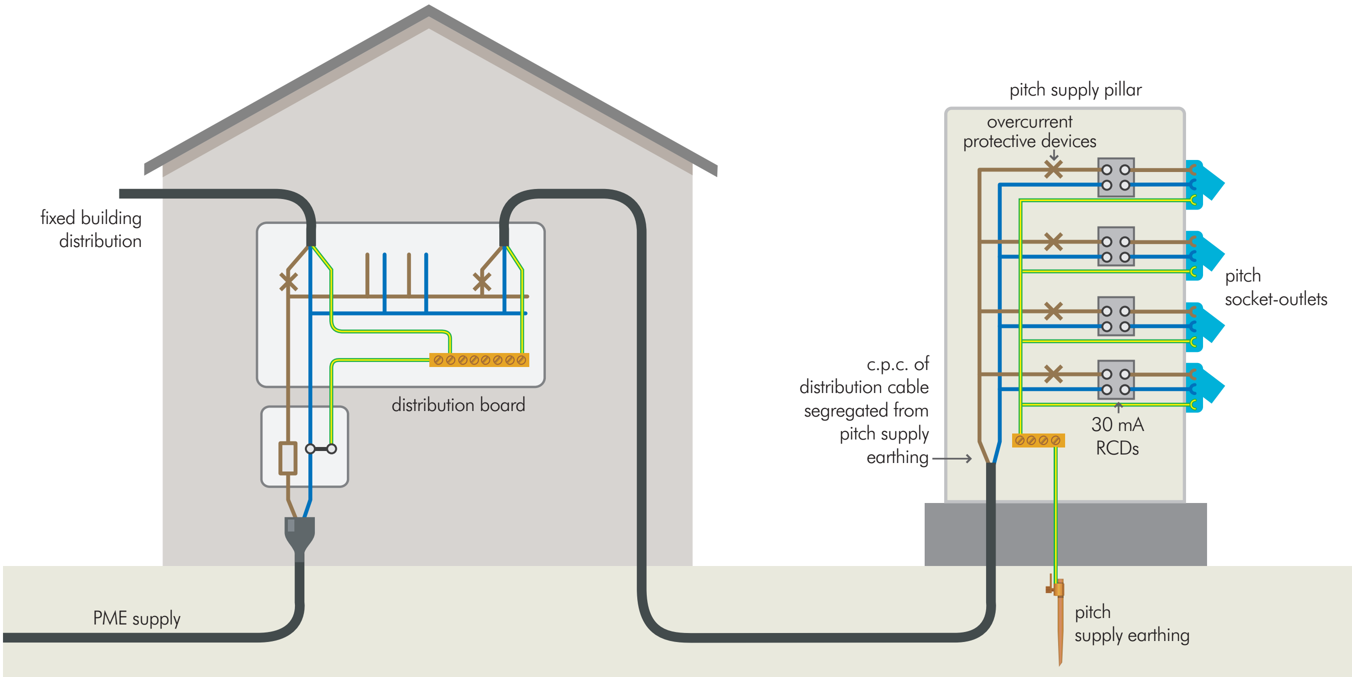


Fig 7 Typical site distribution for a PME supply, separation from PME earth at pitch supply point

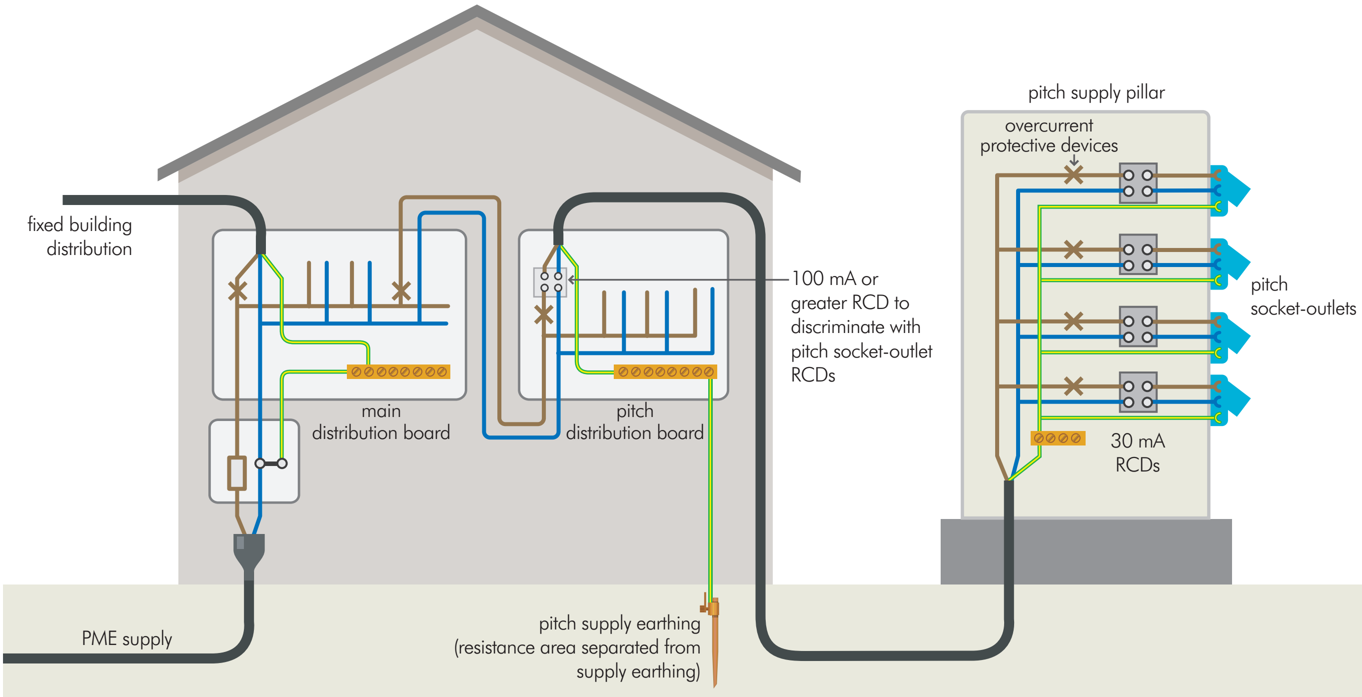


Fig 8 Typical site distribution for a PME supply, separation from PME earth at main distribution board

DON'T MISS

Professional Electrician

ELEX 2011

The Electricians' Exhibition

Sponsored by IET Electrical excellence

Ricoh Arena, Coventry

Thursday 15th & Friday 16th September 2011

10.00am - 4.00pm






- SEE AND TRY OUT ALL THE LATEST ELECTRICAL PRODUCTS FROM LEADING MANUFACTURERS AND SUPPLIERS
- HUNDREDS OF SHOW DISCOUNTS
- **FREE** INDUSTRY SEMINARS FROM THE ELECTRICAL SAFETY COUNCIL, NICEIC AND IET.
- **FREE** *PROFESSIONAL ELECTRICIAN* T-SHIRT
- **FREE** BACON ROLL

To register for FREE entry, visit **www.elexshow.info**

☎ or call **01923 237799**

system fault conditions (PEN conductor of the supply becoming open circuit external to the installation) a potential can develop between the conductive parts connected to the PME earth terminal and the general mass of earth. However, since there are multiple earthing points on the supply network and bonding is provided within the building complying with BS 7671, the risk is considered to be small.

Special Locations

The Energy Networks Association publications provides guidance on PME systems. Whilst PME systems provide an effective and reliable earth connection precautions need to be taken when dealing with special locations.

For example Regulation 9(4) of the Electricity Safety, Quality and Continuity Regulations does not allow the combined neutral and protective conductor to be connected electrically to any metalwork in a caravan or boat. This prevents PME terminals being used for caravans or boat mooring supplies, although they may be used for fixed premises on the sites, such as the site owner's living premises and any bars or shops, etc.

Filling stations are another area where precautions need to be taken. The reference publication is the 3rd edition "Design, construction, modification, maintenance and de-commissioning of filling stations" published by the Association for Petroleum and Explosive Administration (APEA) and the Energy Institute (EI) which for new sites and sites undergoing refurbishment then a TT or a TN-S system are used where the TN-S is exclusive to the filling station and not shared with any other electricity consumers. APEA and the Energy Institute (EI) advise that for existing sites where TN-C-S or a TN-S supply shared with consumers is utilised these must be risk assessed with regards the value of the Diverted

PV SYSTEM TEST REPORTS MADE SIMPLE

New PV Solar software helps installers produce all electrical test documentation for client handover packs quickly and easily.

Seaward SolarCert Elements helps solar installers create comprehensive system information in line with IEC 62446 including customised inspection reports, installation layout diagrams, photographs and all information for PV installation such as datasheets.

Seaward Electronic Ltd. is based at Bracken Hill, South West Industrial Estate, Peterlee, County Durham, SR8 2SW
Tel. + 44 (0) 191 586 3511
E mail: sales@seaward.co.uk

www.seawardsolar.com

Electrical Training

SCOTTISHPOWER

- 17th Edition Wiring Regulations includes the First Amendment
- Inspection & Testing of Electrical Installations
- Broaden your skills - become HV Operational with C&G accreditation
- SMART Metering - the big roll out has started
- EU Skills Safety Passport - essential for electrical staff on construction sites

For more information, please go to www.spenergynetworks.com/spcoursebookings
Centres in Liverpool and Glasgow

Contact no: 0141 614 2143

Wiha TorqueVario VDE

17th Edition Wiring Regulation 134.1.1 requires that manufacturer's instructions, including the proper torqueing of terminal screws, should always be followed. Germany's Wiha Tools now offer a 1000V insulated torque-setting screwdriver for absolute assurance. The Wiha TorqueVario VDE offers safety to both the client and fitter for around £119 ex VAT.

Call Wiha Tools now on 01527 910986 or email info.uk@wiha.com
Wiha Tools, Avon House, Buntsford Drive, Bromsgrove, B60 4JE

www.wiha.com/england

Megger raises the bar for multifunction testers

New from Megger, the MFT1700 series brings the convenience of 2-wire non-trip loop testing to multifunction installation testers. Safety rated at Category IV, the top of the range MFT1730 includes 3-pole earth electrode testing, phase rotation indication and is rechargeable.

For more information call Megger on 01304 502 101 or e-mail uksales@megger.com

www.megger.com

Wiring Regulations Digital – Domestic Package for £99!

The IET are offering Wiring Matters readers the opportunity to purchase the Domestic Package of Wiring Regulations Digital for just £99 (inc VAT). The package contains e-book versions of BS 7671, the On-Site Guide, Guidance Notes 1 & 3 and the Electrician's Guide to the Building Regulations. The price includes all 17th Edition versions and Amendment No 1 versions of each book as they become available.

Visit www.theiet.org/digital-regs and enter the code WRDDP1 at checkout.

www.theiet.org/digital-regs

Handheld Electronic Label Printer

Brother's P-touch range of durable handheld electronic label printers are perfect for electrical installers who need to mark wiring and tools clearly and effectively. Brother's patented TZ tapes create durable labels that are scuff, fade, water, temperature and chemical resistant. The label printers are designed to withstand tough on-site conditions and their compact design make them easy to store and transport.

Brother T: 0844 499 9444

brother
at your side

www.brother.co.uk/electrician

IET
Electrical **excellence**

BTEC

Electrical Installation Design 3 day course + project work

London 13-15 Sep
Birmingham 12-14 Oct
London 15-17 Nov
(+ 6 weeks learner support)

From £600 + VAT

For further information contact us: T: 01438 767289
E: coursesreg@theiet.org www.theiet.org/elec-design-course

www.theiet.org/elec-design-course

NON-CONTACT VOLTAGE AND MAGNETIC DETECTION

Martindale Electric's latest VT2 and VT3 non-contact voltage detectors safely and quickly verify the presence of AC voltages. Additionally the VT3 also detects magnetic fields, using a separate green indicator.

These new products allow rapid and safe detection of mains electricity, without the need to make physical contact with a conductor.

Martindale Electric 01923 441717

www.martindale-electric.co.uk

For details on how to feature your product contact **Danielle Smith** on **01438 767224**

Neutral Current (DNC). Values in excess of 100 mA to be subject to greater investigation with possible recommendation for removal and replacement with a TT or isolated TN-S system.

Also, mines and quarries are another area. A supply taken to an underground shaft, or for use in the production side of a quarry, must have an earthing system which is segregated from any system bonded to the PME terminal.

Finally, because of the practical difficulties in bonding all accessible extraneous-conductive-parts electricity distribution companies might not provide a PME earth to construction sites and agricultural and horticultural installations.

In addition, Regulation 704.411.3.1 does not allow a PME earthing facility to be used as a means of earthing unless all extraneous-conductive-parts are reliably connected to the main earthing terminal in accordance with Regulation 411.3.1.2.

Furthermore, Regulation 705.415.2.1 includes a note which states: Unless a metal grid is laid in the floor, the use of a PME earthing facility as a means of earthing for the electrical installation is not recommended.

TT system

With TT, the consumer must provide his or her own connection to earth, i.e. by installing a suitable earth electrode local to the installation.

The circumstances in which a distributor will not provide a means of earthing for the consumer are usually where the distributor cannot guarantee the earth connection back to the source, e.g. a low voltage overhead supply, where there is the likelihood of the earth wire either becoming somehow disconnected or even stolen.

A distributor also might not provide means of earthing for certain outdoor installations, e.g. a construction site temporary installation, leaving it to the consumer to make suitable and safe arrangements for which they are fully responsible.

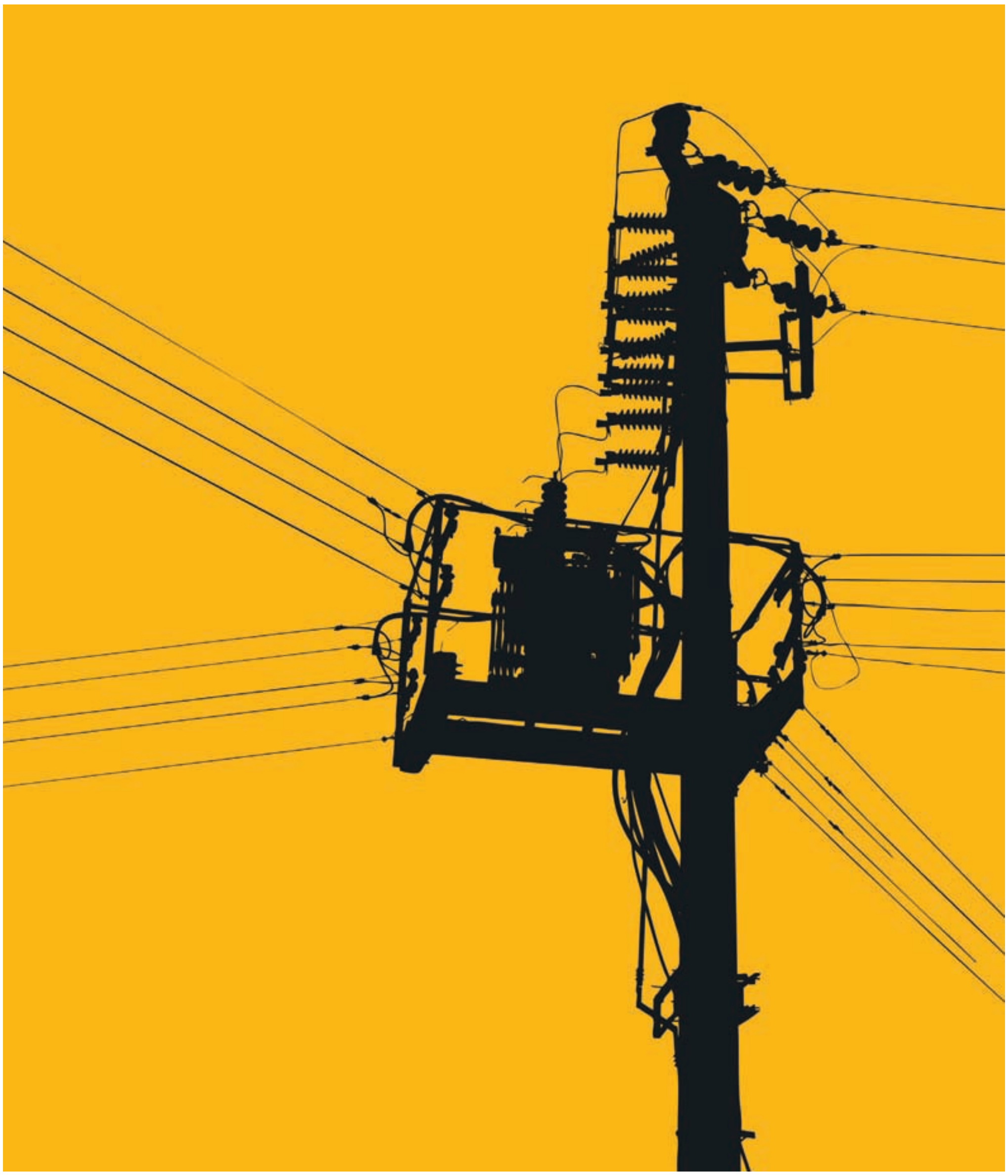
The electricity distributor is required to make available his supply neutral or protective conductor for connection to the consumer's earth terminal, unless inappropriate for reasons of safety (Reg 24 of ESQCR). Construction site, farm or swimming pool installations might be inappropriate unless additional precautions are taken, such as an additional earth electrode.

TN-S system

A TN-S system has the neutral of the source of energy connected with earth at one point only, at or as near as is reasonably practicable to the source and the consumer's earthing terminal is typically connected to the metallic sheath or armour of the distributor's service cable into the premises or to a separate protective conductor of, for instance, an overhead supply.

Large consumers may have one or more HV/LV transformers dedicated to their installation and installed adjacent to or within their premises. In such situations the usual form of system earthing is TN-S. ■

More information on earthing and bonding is available in IEE Guidance Note 5 and 8. Also more information on special locations is available in IEE Guidance Note 7.



Electrical **excellence**

Order Form

How to order

BY PHONE
+44 (0)1438 767328
BY FAX
+44 (0)1438 767375

BY POST
The Institution of Engineering and Technology
PO Box 96
Stevenage
SG1 2SD, UK
Over the Web

ONLINE
www.theiet.org/books

Details

Name:

Job Title:

Company/Institution:

Address:

Postcode: Country:

Tel: Fax:

Email:

Membership No (if Institution member):

Ordering information

Quantity	Book No.	Title/Author	Price (£)
		Subtotal	
		- Member discount **	
		+ Postage/Handling*	
		Total	

Payment methods

☐ by **cheque** made payable to the Institution of Engineering and Technology

☐ by **credit/debit card**

☐ Visa ☐ Mastercard ☐ American Express ☐ Maestro Issue No:______________

Valid from: ☐☐ ☐☐ Expiry date: ☐☐ ☐☐ Card security code: ☐☐☐☐

Card No: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐☐☐☐ (3 or 4 digits on reverse of card)

Signature____Date______________________
(Orders not valid unless signed)

Cardholder Name:

Cardholder Address:

Town: Postcode:

Country:

Phone: Email:

By official **company purchase order** (please attach copy)
EU VAT number:_________________________________

INFORMATION SECURITY:
Please do not submit your form by email. The IET takes the security of your personal details and credit/debit card information very seriously and will not process email transactions.

* Postage/Handling: postage within the UK is £3.50 for any number of titles. Outside UK (Europe) add £5.00 for first title and £2.00 for each additional book. Rest of World add £7.50 for the first book and £2.00 for each additional book. Books will be sent via airmail. Courier rates are available on request, please call +44 (0)1438 767328 or email sales@theiet.org for rates

** To qualify for discounts, member orders must be placed directly with the IET.

GUARANTEED RIGHT OF RETURN:
If at all unsatisfied, you may return book(s) in new condition within 30 days for a full refund. Please include a copy of the invoice.

DATA PROTECTION
The information that you provide to the IET will be used to ensure we provide you with products and services that best meet your needs. This may include the promotion of specific IET products and services by post and/or electronic means. By providing us with your email address and/or mobile telephone number you agree that we may contact you by electronic means. You can change this preference at any time by visiting www.theiet.org/my

IET Electrical excellence

Order for **£20.40***

Your essential guide for quick reference of information on the IET Wiring Regulations has been updated to reflect the changes in BS 7671:2008(2011).

Pre-order the On-Site Guide now for just £20.40 (RRP: £24).

IET Members pay just £15.60 for this title.

Order now at **www.theiet.org/onsite-wm**

* Offer available for the 1st copy only pre-ordered directly from the IET before 18th September 2011. Not to be used in conjunction with any other offers or discounts.

IET The Institution of Engineering and Technology

MF/1 Revision 5 – updated version available from the IET!

MF/1 is a key industry Standard Model Form of General Conditions of Contract for the supply of electrical, electronic or mechanical plant with erection. Revision 5 has been updated to include a number of key changes.

Ensure you have the latest version.

IET Members receive a 35% discount on this title.

Buy now at **www.theiet.org/model-forms**

MEMBER PRICE: £39.00
RETAIL PRICE: £60.00

Published: 2010
Paperback: 92pp
ISBN: 978-1-84919-245-3
Product code: PMPA1060

Periodic Inspection and the Electrical Installation Condition Report

BS 7671:2008 Amendment 1 was published on 1 July. One of the amendments is to the reporting of a periodic inspection for an electrical installation where the previous 'Periodic Inspection Report' has been changed to 'Electrical Installation Condition Report'. This article will answer some typical questions and describe some of the key aspects of what has been amended.

By Paul Bicheno

Why change the 'Periodic Inspection Report'?

It is worth stating that an electrical installation should still be subjected to periodic inspection and testing as recommended in Regulation 135.1. This states that every electrical installation is subjected to periodic inspection and testing in accordance with Chapter 62. The reporting of the inspection and testing is the key change. As part of the Amendment 1 development programme the technical committee responsible for BS 7671 JPEL/64 decided that periodic inspection and testing was not being carried out and reported in a clear and consistent manner. A project team was set-up to propose developments to the existing periodic inspection report. The result of the project team was issued as part of the Amendment 1 draft for public comment (DPC) stage. Over 500 comments were received on this topic alone from a number of areas of the industry. After reviewing these comments the Committee eventually decided on the solution now published as part of Amendment 1.

When should the new condition report be used?

Although Amendment 1 was published on 1 July this does not mean that engineers who provide reports associated with periodic inspection and testing need to start using the new electrical installation condition report straight away. The introduction to Amendment 1 states that it comes into effect on 1 January 2012 so this is when the new report will be need to be used. Until that time the existing periodic inspection report can be used.

What are the main changes?

The first point to mention is the change of name to 'Electrical Installation Condition Report'. It was agreed that this name is more meaningful to a client as it clearly states that it is a report relating to the condition of the electrical installation. The structure of the report remains the same – it has the report pages and associated schedule of inspections and schedule of test results. All of these are included as model forms in Appendix 6 of BS 7671:2008(2011). However, a key change is to the schedule of inspections that is to be used when carrying out a periodic inspection. Previously the schedule of inspections was generic and used for both the periodic inspection report and electrical installation certificate. Now a condition report will need to have a schedule of inspections relevant to the periodic inspection work carried out. Included in Appendix 6 is an inspection schedule for domestic and similar premises with a supply rated up to 100 A. This particular schedule is aimed at smaller electrical installations such as domestic and small commercial type premises where the supply is rated no more than 100 A single-phase or three-phase. Originally the intention was to have a series of schedules aimed at larger installations to complement this schedule; however, the comments from industry during the DPC period voiced concerns over the amount of paperwork that could be generated if this approach was adopted. Therefore, the decision was taken to only have the domestic and similar schedule. For larger installation arrangements a list of example items requiring inspection has been included in Appendix 6. The intention is for this list to be used as the basis of the inspection for a larger installation arrangement. The key difference being no dedicated schedule is provided. This will need to be agreed between the client and person doing the work as to how the inspection aspect is documented. The previous ‘Schedule of Inspections’ model form remains but is to be used only when new installation work is being certified and not as part of a periodic inspection. Finally, the schedule of test results remains applicable to both installation work and periodic inspection and testing and thus would be included as part of the report. The structure of an electrical installation condition report applicable to domestic or similar premises is shown in Fig 1.

What is the intention of the condition report?

It is worth clarifying that the report is intended to report on the condition of an existing installation and not to certify an installation. The person carrying out the inspection and testing is looking to determine if there is any damage, deterioration, defects, dangerous conditions and any non-compliance with the requirements of the Regulations which may give rise to danger. Only these aspects should be recorded on the report and not a full list of non-compliance with the Regulations. Installations built to an earlier edition are not likely to fully comply with the current edition. However, this does not mean that the installation is unsafe for continued use. Also the report should not state how any

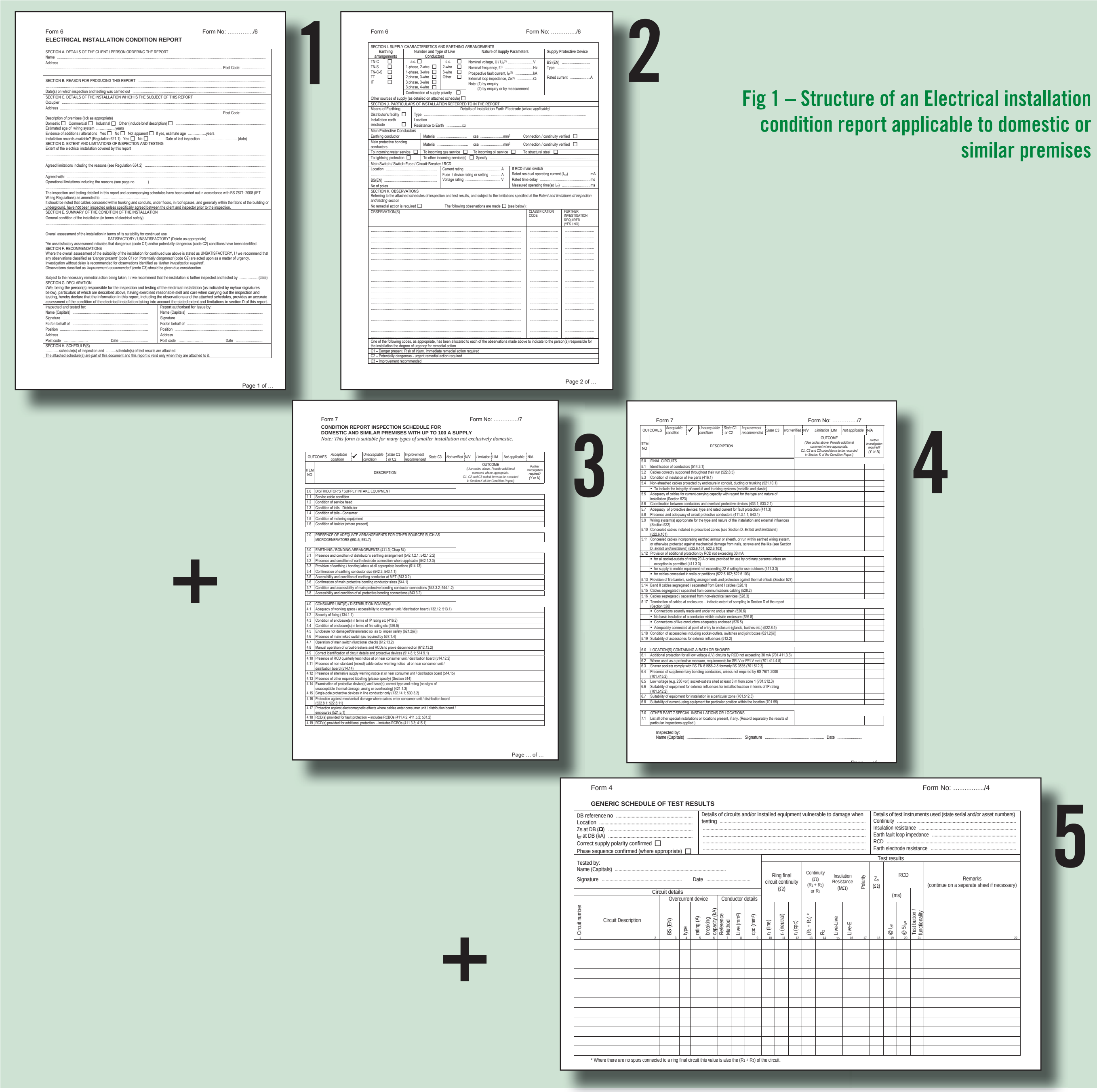


Fig 1 – Structure of an Electrical installation condition report applicable to domestic or similar premises

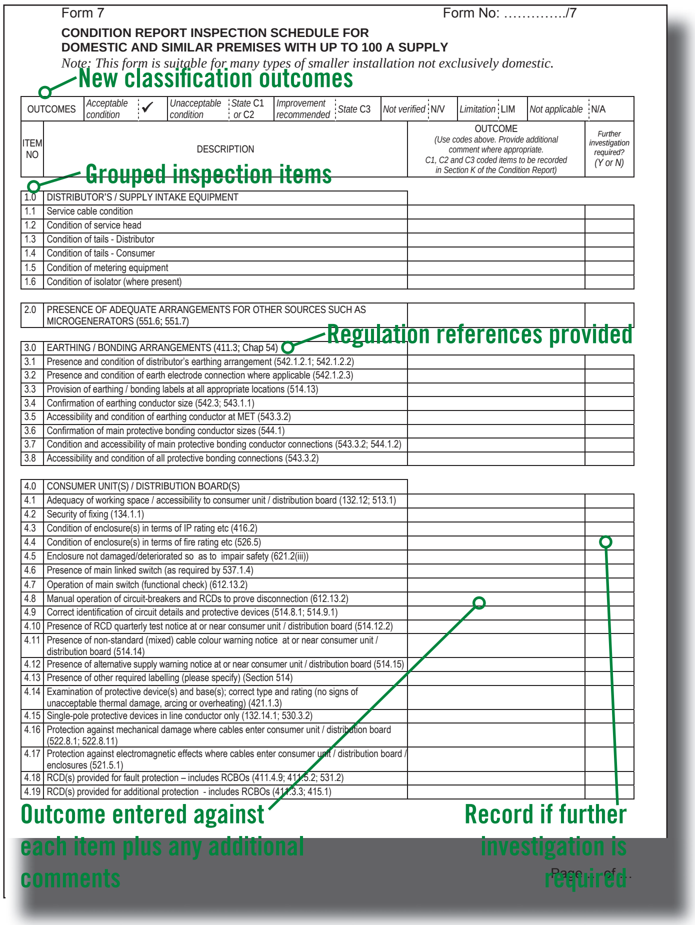
defects should be rectified e.g. consumer unit should be replaced. This information should be provided separately if requested by the client.

Domestic and similar condition report inspection schedule

A main part of the work was to produce an inspection schedule that would be a benefit to the person carrying out the inspection to enable them to inspect an installation in a structured and consistent way and for the client to better understand the result of the inspection. The format of the published domestic and similar condition report inspection schedule (see Fig 2) has been designed so that a number of specific items requiring inspection are listed that are likely to be relevant to an installation of this type and size. Any relevant regulation references are provided for an item to assist the inspector. The requirement is for an outcome based on the inspector's assessment to be recorded against each item. These are listed in Table 1 along with a description of their meaning but are also included as part of the schedule for easy reference. The person carrying out the work should also record an associated comment to reinforce the reason for a particular outcome. This approach is intended to provide more detail on the condition of a number of aspects of an installation and is one of the key differences compared to the previous report where only a summary list of observations and recommendations were recorded. This has the benefit of providing a detailed assessment to the client to clarify any dangers, improvements or limitations and will aid any future inspection of the installation. For each item there will also be a requirement to record if any further investigation is recommended as it is recognised that various factors could inhibit a complete inspection at the time it is carried out or the inspector has not verified an item but feels that further assessment is needed to confirm the safety aspect. The second key difference is to do with the classification codes to highlight an unacceptable condition or improvement. This is now limited to C1 (danger present – immediate remedial action required), C2 (potentially dangerous – urgent remedial action required) and C3 (improvement recommended). The previous C3 code (further investigation) is now covered by an individual entry for each item and summarized on the observations section K on the report. The previous C4 code (does not comply with BS 7671:2008 amended to..) has been removed from the reporting process as this was an area causing confusion. The intention is not to list why an installation does not comply with the current requirements just the condition with regards to safety. Any C1, C2 or C3 classification code should be recorded in the summary of observations section K on the report. Any C1 or C2 classification code will now mean that the condition of the installation would be classed as unsatisfactory in the summary section E on the report and will need to be conveyed to the client. The client should be notified of any C1 classifications straight away so that immediate remedial action can be taken such as repair, replacement or isolation. If remedial work is not part of the periodic inspection contract then it is recommended that a dangerous condition notification is issued to the client highlighting their responsibility. A final point to highlight with regards to the schedule is the Committee agreed that the guidance notes for the inspector included in Appendix 6 should have a statement highlighting that any older installations designed prior to BS 7671:2008 may not have been provided with RCDs for additional protection. If this is the case then the inspector should record a C3 classification code as a minimum in relation to item 5.12 of the schedule. This is to highlight that the installation could be improved in this respect.

How will the condition report models forms be made available?

The model forms as published in Amendment 1 will be made available as a downloadable via the IET's electrical website http://electrical.theiet.org/wiring-regulations/forms/index.cfm. They are also provided by other organisations. However they are model forms and may well be tailored in some way to suit their preferred method of publication. ■


Form 7 Form No: ..../7

CONDITION REPORT INSPECTION SCHEDULE FOR
DOMESTIC AND SIMILAR PREMISES WITH UP TO 100 A SUPPLY

Note: This form is suitable for many types of smaller installation not exclusively domestic.

OUTCOMES	Acceptable condition	✓	Unacceptable condition	State C1 or C2	Improvement recommended	State C3	Not verified	N/V	Limitation	LIM	Not applicable	N/A

ITEM NO	DESCRIPTION	OUTCOME (Use codes above. Provide additional comment where appropriate. C1, C2 and C3 coded items to be recorded in Section K of the Condition Report)	Further investigation required? (Y or N)
1.0	DISTRIBUTOR'S / SUPPLY INTAKE EQUIPMENT		
1.1	Service cable condition		
1.2	Condition of service head		
1.3	Condition of tails - Distributor		
1.4	Condition of tails - Consumer		
1.5	Condition of metering equipment		
1.6	Condition of isolator (where present)		
2.0	PRESENCE OF ADEQUATE ARRANGEMENTS FOR OTHER SOURCES SUCH AS MICROGENERATORS (551.6; 551.7)		
3.0	EARTHING / BONDING ARRANGEMENTS (411.3; Chap 54)		
3.1	Presence and condition of distributor's earthing arrangement (542.1.2.1; 542.1.2.2)		
3.2	Presence and condition of earth electrode connection where applicable (542.1.2.3)		
3.3	Provision of earthing / bonding labels at all appropriate locations (514.13)		
3.4	Confirmation of earthing conductor size (542.3; 543.1.1)		
3.5	Accessibility and condition of earthing conductor at MET (543.3.2)		
3.6	Confirmation of main protective bonding conductor sizes (544.1)		
3.7	Condition and accessibility of main protective bonding conductor connections (543.3.2; 544.1.2)		
3.8	Accessibility and condition of all protective bonding connections (543.3.2)		
4.0	CONSUMER UNIT(S) / DISTRIBUTION BOARD(S)		
4.1	Adequacy of working space / accessibility to consumer unit / distribution board (132.12; 513.1)		
4.2	Security of fixing (134.1.1)		
4.3	Condition of enclosure(s) in terms of IP rating etc (416.2)		
4.4	Condition of enclosure(s) in terms of fire rating etc (526.5)		
4.5	Enclosure not damaged/deteriorated so as to impair safety (621.2(iii))		
4.6	Presence of main linked switch (as required by 537.1.4)		
4.7	Operation of main switch (functional check) (612.13.2)		
4.8	Manual operation of circuit-breakers and RCDs to prove disconnection (612.13.2)		
4.9	Correct identification of circuit details and protective devices (514.8.1; 514.9.1)		
4.10	Presence of RCD quarterly test notice at or near consumer unit / distribution board (514.12.2)		
4.11	Presence of non-standard (mixed) cable colour warning notice at or near consumer unit / distribution board (514.14)		
4.12	Presence of alternative supply warning notice at or near consumer unit / distribution board (514.15)		
4.13	Presence of other required labelling (please specify) (Section 514)		
4.14	Examination of protective device(s) and base(s); correct type and rating (no signs of unacceptable thermal damage, arcing or overheating) (421.1.3)		
4.15	Single-pole protective devices in line conductor only (132.14.1; 530.3.2)		
4.16	Protection against mechanical damage where cables enter consumer unit / distribution board (522.8.1; 522.8.11)		
4.17	Protection against electromagnetic effects where cables enter consumer unit / distribution board / enclosures (521.5.1)		
4.18	RCD(s) provided for fault protection – includes RCBOs (411.4.9; 411.5.2; 531.2)		
4.19	RCD(s) provided for additional protection - includes RCBOs (411.3.3; 415.1)		

Page ... of ...

Fig 2 – Domestic and similar installations condition report inspection schedule

Table 1 – Classification code outcomes used for the inspection schedule for domestic and similar premises with up to 100 A supply

Classification code outcomes	Description
Acceptable condition (✓)	The condition of the particular item inspected has been classed as acceptable
Unacceptable condition (C1)	The condition of the particular item inspected has been classed as unacceptable. Immediate danger is present and the safety to those using the installation is at risk (e.g. a live part is directly accessible)
Unacceptable condition (C2)	The condition of the particular item inspected has been classed as unacceptable. There is potential danger and the safety to those using the installation may be at risk (e.g. absence of main protective bonding)
Improvement recommended (C3)	The installation is not dangerous for continued use but the inspector recommends that an improvement could be made in relation to the item inspected (e.g. no RCDs for additional protection are installed)
Not Verified (N/V)	A particular item on the schedule is relevant to the installation but has not been verified as to its condition
Limitation (LIM)	A particular item on the schedule is relevant to the installation but there were certain limitations in being able to check the condition
Not Applicable (N/A)	The particular item on the inspection schedule is not relevant to the installation being inspected

Electrical **excellence**

Wiring Matters

Re-Subscribe Today

Re-subscribe to keep receiving free copies of *Wiring Matters Magazine* and stay ahead of developments in BS 7671.

Re-subscribing is easy and there are two ways to do it:

1. **Go online at www.subscription.co.uk/cc/wm/I311and follow the "subscribe" link to fill in the electronic form** (please note that for this you will need your unique reference number printed next to your address on the wrapper of this magazine)*.

2. **Complete the enclosed re-subscription application card** and fax or post it back to the details provided at the bottom of the form.

Why should I re-subscribe?
There are plenty of reasons to read Wiring Matters, including:

- articles are written by industry experts at the IET involved with the development of BS 7671, the IET Wiring Regulations
- articles are based on current issues and the questions you ask
- updates to the Wiring Regulations are covered well in advance
- it is free to receive!

Re-subscribe now:

www.**subscription**.co.uk/cc/wm/I311

*If you have destroyed the magazine wrapper and need a copy of your unique reference number, please send an email to controlled1@subscription.co.uk with your full name and address details.