

# The Impact of Amendment Number 1 of the 17th Edition



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We look at the impact that some of the changes expected in Amendment No 1 of BS 7671:2008, the IEE Wiring Regulations (17th Edition), will have on the design, erection and verification of electrical installations.

By Geoff Cronshaw

Please note the following are draft proposals only at this stage and may or may not be included in amendment number 1 depending on the decision of the national committee, JPEL/64. Many of the proposed changes have already been mentioned in previous articles in *Wiring Matters*. As advertised in the summer edition of *Wiring Matters* and by BSI the DPC (draft for public comment) has been available for comment from 14 June this year. Many comments have already been received from the industry which will be carefully considered by the national committee at the end of the comments period.

## 1. Chapter 52 Selection and erection of wiring systems. Cables concealed in a wall or partition.

Amendment number 1 now permits an exception for minor works concerning cables concealed in a wall or partition where the designer is satisfied that there would be minimal increased risk of damage to the circuit cable due to penetration by screws, nails and the like. This is a significant change from the 17th Edition. It is important to note that the designer's decision must be recorded under part 2 of the Minor Works Certificate.

In addition Amendment number 1 also includes an exception for a cable forming part of a SELV or PELV circuit.



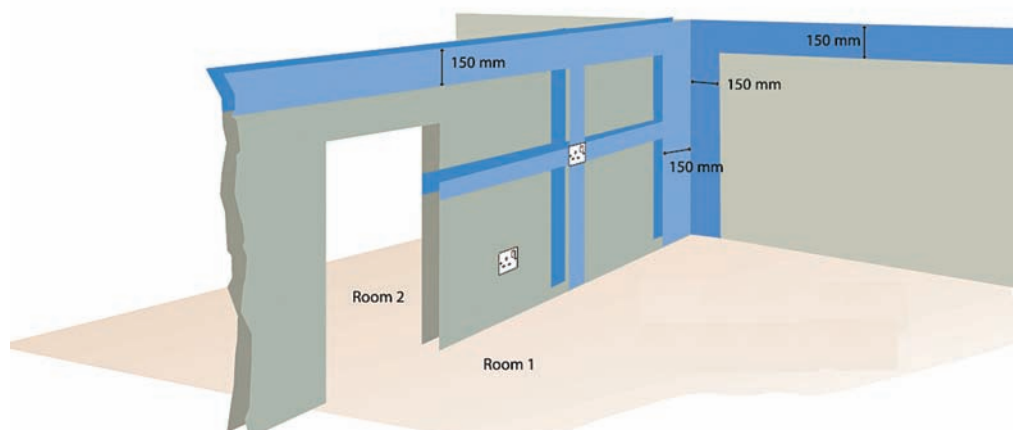
The 17th Edition introduced regulations about cables concealed in walls

## Background

The 17th Edition introduced a new series of regulations concerning cables concealed in a wall or partition (fig 1). These new Regulations introduced the concept of a skilled person and an instructed person. They also introduced the requirement for RCD protection. It is a requirement to protect cables concealed in a wall or partition (at a depth of less than 50mm) by a 30mA RCD where the installation is not intended to be under the supervision of a skilled or instructed person if the normal methods of protection including use of cables with an earthed metallic covering, earthed conduit/trunking or mechanical protection cannot be employed.

Irrespective of the depth, a cable in a partition where the construction includes metallic parts other than fixings shall be protected by a 30mA RCD.

For example, this means at present under the 17th edition (in a domestic installation) where insulated and sheathed cables are concealed in a wall at a depth of less than 50mm and have no mechanical protection, they need to be



**Fig 1: Permitted cable routes**

installed within the safe zones and need to be protected by a 30mA RCD (see fig 1).

## 2. Chapter 41 Protection against electric shock. 3.1 socket-outlets

**Amendment number 1,** Regulation 411.3.3 (c) now permits an exception for minor works associated with existing socket-outlet circuits not provided with additional protection by means of an RCD where the designer is satisfied that there would be no increased risk from the installation of the addition or alteration. This is a significant change from the 17th Edition. It is important to note that the designer's decision must be recorded under part 2 of the

Minor Works Certificate. Minor works are now defined in Part 2 of Amendment number 1 of BS 7671:2008.

## Background

Chapter 41 of the 17th Edition requires in Regulation 411.3.3 that for the protective measure of automatic disconnection of supply for an a.c. system, additional protection by means of a 30mA RCD shall be provided for socket-outlets with a rated current not exceeding 20A that are for use by ordinary persons.

The 17th Edition defines an ordinary person as "a person who is neither a skilled person nor an instructed person". An exception is permitted for socket outlets for use under

the supervision of skilled or instructed persons, The 17th Edition defines a skilled person as "a person with technical knowledge or sufficient experience to enable him/her to avoid dangers which electricity may create". An instructed person is defined as "a person adequately advised or supervised by skilled persons to enable him/her to avoid dangers which electricity may create".

Therefore this exception may apply, for example, in some commercial or industrial locations. A further exception is permitted for a specific labelled or otherwise suitably identified socket-outlet provided for connection of a particular item of equipment.



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This, for example, could be a socket outlet for a freezer in a domestic kitchen.

### 3. Changes to the periodic inspection report

Appendix 6, Model forms for certification and reporting, now includes a new electrical installation condition report that replaces the periodic inspection report (fig 4). The new condition report has a series of new inspection schedules, which include: an inspection schedule for a single distribution board installation for domestic and similar premises, a distribution board inspection schedule for multiple distribution board installations, a main intake and associated circuits inspection schedule, and a generic schedule of test results.

The periodic inspection report has been modified to form the new electrical installation condition report. For example, within the observations section the four codes: 1 (requires urgent attention), 2 (requires improvement), 3 (requires further investigation), 4 (does not comply with BS 7671:2008 amended to ...) have been replaced by three codes: code 1 Danger present, code 2 potentially dangerous, code 3 improvement recommended.



**Installation of a surge protective device**



**Stringent measures are necessary to ensure the safety of patients**

The changes to the coding system and the series of new inspection schedules represent a major change from the 17th edition of the wiring regulations. For example, under this new coding system a summary of the condition of the installation in terms of safety should be clearly indicated in Section E of the condition report. Observations, if any, should be categorised in Section M of the condition report using the coding C1 to C3 as appropriate. Any observations given a C1 or C2 classification should result in the overall condition of the installation being reported as unsatisfactory, whereas under the 17th edition only a number 1 (requires urgent attention), allocated to an observation would normally result in the overall assessment of unsatisfactory.

The new inspection schedules provide a detailed breakdown of the inspection required on each aspect of the installation to ensure that the work is carried out in an organised and efficient manner. For example, the schedule for domestic and similar premises includes over 60 check points. Each item listed on the schedule which requires

checking is accompanied with the relevant regulation number for ease of reference to the wiring regulations. In addition, the form provides a facility to indicate the outcome of the inspection of each item with either a tick (acceptable condition), a code C1 or C2 (unacceptable condition), NV (not verified), Lim (limitation), or NA (not applicable); where as under the 17th edition the inspection of a general item would normally only result in a tick in a box.

#### 4. Section 729 – Operating or maintenance gangways.

Amendment 1 now includes section 729, which applies to restricted areas. These are areas such as switchrooms with switchgear and controlgear assemblies with a need for operating or maintenance gangways for authorised persons.

This is a completely new section. The current requirements for accessibility of electrical equipment in BS 7671:2008 are contained in Fundamental Principles in Chapter 13. Regulation 132.12 states: Electrical equipment shall be arranged so as to afford as may be necessary: (i) sufficient space for the initial installation

and later replacement of individual items of electrical equipment (ii) accessibility for operation, inspection, testing, fault detection, maintenance and repair.

Regulation 15 of the Electricity at work Regulations has requirements for working space, access and lighting and requires that, for the purposes of enabling injury to be prevented, adequate working space, adequate means of access and adequate lighting shall be provided at all electrical equipment on which or near which work is being done in circumstances which may give rise to danger. Regulation 14 of the Electricity at work Regulations is concerned with work on or near any live conductors.

#### Accessibility

Regulation 729.513.2 requires that the width of gangways and access areas shall be adequate for work, operational access, emergency access, emergency evacuation and for the movement of equipment.

In restricted access areas where basic protection is provided by barriers or enclosures Regulation 729.513.2.1 gives the

following minimum distances:

- i. Gangway width of 700mm between: barriers or enclosures and switch handles or circuit-breakers in the most onerous position, and barriers or enclosures or switch handles or circuit-breakers in the most onerous position and the wall
- ii. Gangway width of 700mm between barriers or enclosures or other barriers or enclosures and the wall
- iii. Height of gangway to barrier or enclosure above floor (minimum dimension 2000mm)
- iv. Live parts placed out of reach, see Regulation 417.3 (minimum dimension 2500mm)

**NOTE: Where additional workspace is needed e.g. for special switchgear and controlgear assemblies, larger dimensions may be required.**

**In restricted access areas where the protective measure of obstacles applies Regulation 729.513.2.2 gives the following minimum distances:**

- i. Gangway width of 700mm between: obstacles and switch handles or circuit-breakers in the most onerous position, and obstacles or switch handles or circuit-breakers in the most onerous position and the wall.
- ii. Gangway width of 700mm between obstacles or other obstacles and the wall
- iii. Height of gangway to

obstacles, barrier or enclosure above

- iv. Floor (minimum dimension 2000mm)
- v. Live parts placed out of reach, see Regulation 417.3 (minimum dimension 2500mm)

Regulation 729.513.3 has requirements for access of gangways. For closed restricted access areas with a length exceeding 6m, accessibility from both ends is recommended. However, gangways longer than 10m must be accessible from both ends.

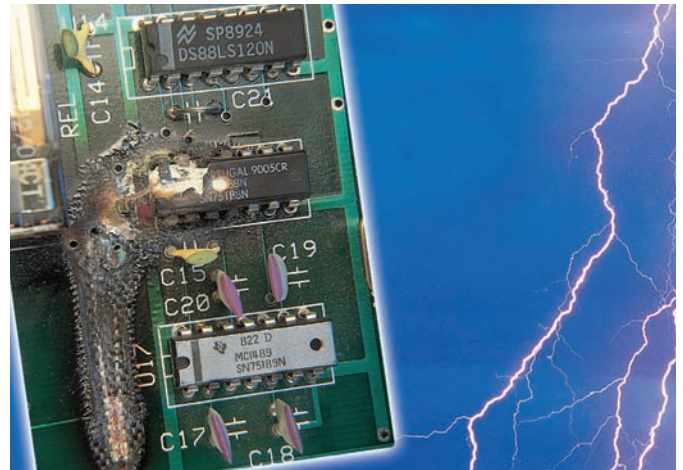
The Regulation recognises that this may be accomplished by placement of the equipment a minimum of 700mm from all walls or by providing an access door, if needed, on the wall against which the equipment is positioned. However, closed restricted access areas with a length exceeding 20m must be accessible by doors from both ends.

Finally, annex A of section 729 contains a number of additional requirements for closed restricted access areas in order to permit easy evacuation. The annex considers two cases; these include a minimum passing width of 700mm with switchgear in position and 500mm with circuit breakers completely extracted.

Persons involved in this work are advised to seek advice from the HSE.

### 5. 534 Devices for protection against overvoltage

Amendment 1 now includes section 534, which contains requirements for the installation of surge protective



**Fig 2 – Transient overvoltages can reach 6 kV**

devices (SPDs) to limit transient overvoltages where required by Section 443 of BS 7671:2008 or where otherwise specified by the designer (fig 4). A risk assessment to BS EN 62305, Protection against Lightning also determines the need for SPDs. Surge protective components incorporated into appliances are not taken into account in 534. Both lightning strikes and electrical switching can inject what are called transient overvoltages into installations. Transient overvoltages are usually only a few micro seconds in duration. However their peak value can reach 6kV (fig 2).

### Surge Protection Devices

A surge protective device (SPD) is a device that is intended to limit transient overvoltages and divert damaging surge current away from sensitive equipment. SPDs must have the necessary capability to deal with the current levels and durations involved in the surges to be expected at their point of installation. SPDs can operate in one of two ways, based on the component technologies within them. One way is as a voltage switching device where under normal conditions, the device is an open circuit.

However at a certain threshold voltage the SPD conducts and diverts the current through it. It has two states, ON and OFF, hence the name of voltage switching. Air-gap technology is an example of a voltage switching device.

Another way is as a voltage limiting device. Voltage limiting type SPDs again present an open circuit under normal circuit conditions. When an overvoltage is detected the device begins to conduct, dropping its resistance dramatically such that the overvoltage is limited and the surge current is diverted away from the protected equipment (fig 3). Metal Oxide Varistors (MOVs) are a common example of voltage limiting devices. Advanced SPDs often utilise hybrid technologies combining voltage switching with voltage limiting components.

### Selection of SPDs

Section 534 contains requirements for the selection of SPDs in order to ensure that the correct type of SPD is installed at the correct position within an installation. Typically, Type 1 SPDs are used at the origin of the installation, Type 2 SPDs are used at distribution

boards and Type 3 SPDs are used near terminal equipment. Combined Type SPDs are classified with more than one Type, e.g. Type 1+2, Type 2+3. Type 1 SPDs are only used where there is a risk of direct lightning current.

Section 534 advises that in selecting an SPD, the key parameter is its limiting voltage performance (protection level Up) during the expected surge event. The SPD energy withstand (e.g. Iimp) also needs to be sufficient for its location within the installation. An SPD with a low protection level will ensure adequate protection of the equipment, while an SPD with a high energy withstand may only result in a longer operating life. All SPDs are to comply with BS EN 61643.

#### Connection of SPDs

Section 534 contains a number of requirements for the Connection of SPDs depending on the type of supply and system earthing. Therefore, for example, Section 534 requires that SPDs at or near the origin of the installation (if there is a direct connection between the neutral conductor and the protective conductor at or near the origin) shall be connected between each line conductor and the protective conductor/main earthing terminal which ever is the shorter distance.

#### SPD installation in conjunction with RCDs

Clause 534.2.6 of Section 534 is concerned with ensuring that the correct type of RCD is selected in conjunction with the correct type of SPD. Where SPDs are installed on the load side of an RCD, the operation of the SPD could potentially cause the RCD to operate unless it is of the S type.

Where SPDs are installed on the supply side of an RCD the operation of the SPD will not affect the RCD. Manufacturers should be able to provide advice on selection of devices.

#### SPD status indication

Section 534 requires indication to be provided by a status indicator local to the SPD itself and/or remote, that the SPD no longer provides (or provides limited) overvoltage protection.

#### Critical length of connecting conductors

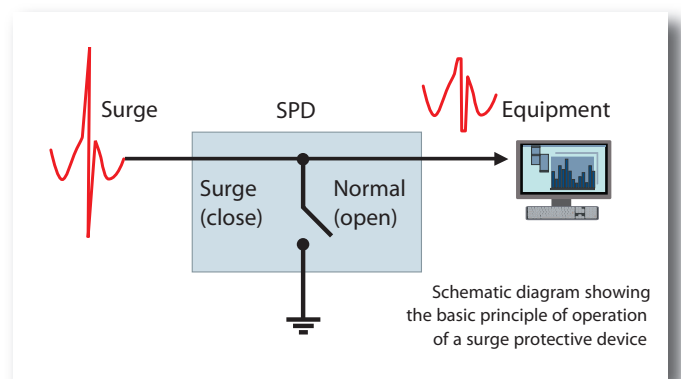
To gain maximum protection the supply connecting conductors to the SPD shall be kept as short as possible, to minimise additive inductive voltage drops across the conductors. Current loops shall be avoided. Regulation 534.2.9 has specific requirements on conductor lengths.

#### Cross-section of connecting conductors

Regulation 534.2.10 states: The connecting conductors of SPDs shall either: i) have a cross-sectional area of not less than 4mm<sup>2</sup> copper (or equivalent) if the cross-sectional area of the line conductors is greater than or equal to 4mm<sup>2</sup>, or ii) have a cross-sectional area not less than that of the line conductors, where the line conductors have a cross-sectional area less than 4mm<sup>2</sup>. Where there is a structural lightning protection system, the minimum cross-sectional area for Type 1 SPDs shall be 16mm<sup>2</sup> copper, or equivalent.

### 6. Section 444 – measures against electromagnetic disturbances

**Amendment 1 now includes requirements for the avoidance and reduction of electromagnetic disturbances.**



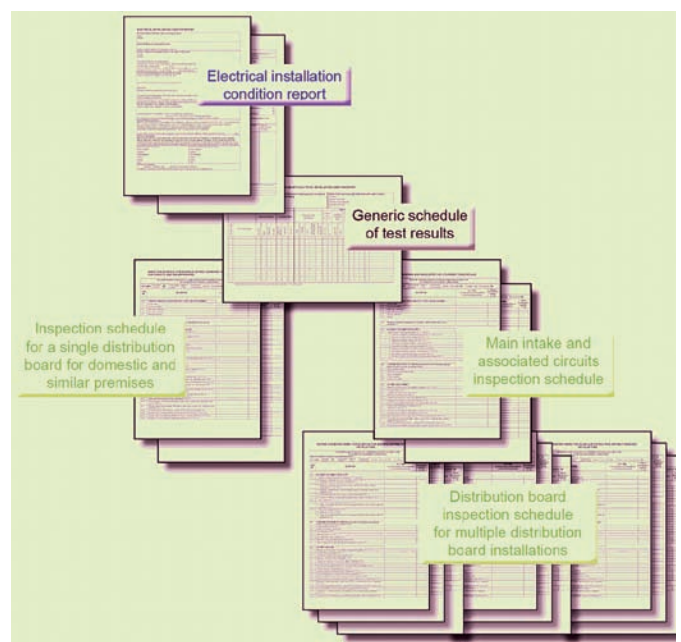
**Fig 3 – When an overvoltage is detected the device begins to conduct**

Section 444 requires that consideration must be given to the location of the sources of electromagnetic disturbances relative to the positioning of other equipment. Potential sources of electromagnetic disturbances within an installation typically include:

- i. Switching devices for inductive loads
- ii. Electric motors
- iii. Fluorescent lighting
- iv. Welding machines
- v. Rectifiers
- vi. Choppers
- vii. Frequency converters/regulators including Variable Speed Drives (VSD)
- viii. Lifts
- ix. Transformers
- x. Switchgear
- xi. Power distribution busbars

#### Regulation group 444.4.2 contains measures to reduce EMI.

Regulation 444.4.2.1 includes the following requirements to reduce the effects of



**Fig 4 – the new electrical installation condition report**



**Amendment 1 now includes section 710. Please note, this article is repeated from a previous edition of Wiring Matters for completeness.**

### The risks

There are particular risks associated with medical locations. Therefore stringent measures are necessary to ensure the safety of patients likely to be subjected to the application of medical electrical equipment.

Shock hazards, due to bodily contact with the 50Hz mains supply, are well known and documented. Currents of the order of 10mA passing through the human body can result in muscular paralysis followed by respiratory paralysis depending on skin resistances, type of contact, environmental conditions and duration. Eventual ventricular fibrillation can occur at currents just exceeding 20mA. These findings are listed in IEC/TR2 60479-1 'Effects of current on human beings and livestock – general aspects'.

The natural protection of the human body is considerably reduced when certain clinical procedures are being performed on it. Patients under treatment may have their skin resistance broken or their defensive capacity either reduced by medication or nullified while anaesthetised. These conditions increase the possible consequences of a shock under fault conditions.

In patient environments where intracardiac procedures (see note 1, below) are undertaken, the electrical safety requirements are even stricter, in order to protect the patient against 'microshock'. Patient leakage

### There are particular risks associated with medical locations

electromagnetic interference:

- i. The use of additional conductors e.g. a bypass equipotential bonding conductor for screen reinforcement,
- ii. The use of surge protective devices and/or filters to improve electromagnetic compatibility with regard to conducted electromagnetic phenomena for electrical equipment sensitive to electromagnetic disturbances.
- iii. The selection of a common route for all the conductors (live and protective conductors) of a power circuit, to avoid inductive loops.
- iv. The separation of power and signal cables.

Regulation 444.4.2.2 requires the following parts to be

connected to the equipotential bonding network:

- i. Metallic containment, conductive screens, conductive sheaths or armouring of data transmission cables or of information technology equipment
- ii. Earthing conductors of antenna systems
- iii. Earthing conductors of the earthed pole of a d.c. supply for information technology equipment
- iv. Functional earthing conductors
- v. Protective conductors.

Requirements for earthing and equipotential bonding are contained in Regulation group 444.5 and requirements

for segregation of circuits are contained in Regulation group 444.6. Section 444 has an informative annex which gives information on:

- Structures for the network of equipotential conductors and earthing conductors
- Equipotential bonding networks in buildings with several floors
- Installations containing a high density of interconnected equipment
- Design guidelines for segregation of circuits
- Conditions for zero segregation

7. Section 710 – medical locations

currents from applied parts introduced directly to the heart can interfere with cardiac function at current levels which would be considered safe under other circumstances.

Patient leakage current which can flow into an earthed patient is normally greatest when the equipment earth is disconnected. A limit is set to the amount of leakage current which can flow in the patient circuit when the protective earth conductor is disconnected.

Patient leakage currents (see note 2) of the order of  $10\mu\text{A}$  have a probability of 0.2 per cent for causing ventricular fibrillation or pump failure when applied through a small area of the heart. At  $50\mu\text{A}$  (microshock), the probability of ventricular fibrillation increases to the order of 1 per cent (refer to BS EN 60601-1).

#### Note 1

“Intracardiac procedure”: This is a procedure whereby an electrical conductor is placed within the heart of a patient or is likely to come into contact with the heart, such conductor being accessible outside the patient’s body. In this context, an electrical conductor includes insulated wires, such as cardiac pacing electrodes or intracardiac ECG electrodes, or insulated tubes filled with conducting fluids (catheter).

#### Note 2

“Patient’s leakage current”: Current flowing from a medical electrical equipment applied part via the patient to earth.

Additional to the consideration of risk from electric shock, some electromedical equipment (life-support

equipment, surgical equipment) perform such vital functions that loss of supply would pose an unacceptable risk to patients. Medical locations where such equipment is used require secure supplies. This has implications not only for the provision of safety (emergency) power supplies but also render some conventional protection measures unsuitable. Hence, for example, when protecting circuits supplying critical medical equipment, restrictions are stipulated on the use of RCDs.

#### Additional measures

Since the type and description of these hazards can vary according to the treatment being administered, the manner in which a medical room is used necessitates some division into different areas for differing medical procedures. Section 710 segregates medical locations into different “Groups”. These are:

##### Group 0

medical location where no applied parts are intended to be used and where discontinuity (failure) of the supply cannot cause danger to life.

##### Group 1

medical location where discontinuity of the electrical supply does not represent a threat to the safety of the patient and applied parts are intended to be used as follows: – externally – invasively to any part of the body, except where 710.3.7 applies

##### Group 2

Medical location where applied parts are intended to be used in applications such as intracardiac procedures, vital treatments and surgical

operations where discontinuity (failure) of the supply can cause danger to life.

To protect patients from possible electrical hazards, Section 710 requires additional protective measures to be applied in medical locations.

These include: particular requirements for protection against electric shock; medical IT systems – requirements concerning supplementary equipotential bonding; additional requirements for the selection and erection of electrical equipment including switchgear and controlgear; safety services including the sources and detailed requirements for safety lighting.

#### Further information

**Important: this article is only intended as a brief summary**

**of possible forthcoming requirements in BS 7671. Persons involved in these areas should seek specialist advice.**

Information on the installation of surge protective devices – HD 60364-5-534.

Information on medical locations – UK Health Departments.

Information on operating or maintenance gangways – HSE.

#### Conclusion

It is important to point out that this article is based on draft proposals only at this stage which may or may not be included in amendment number 1 depending on the decision of the national committee, JPEL/64. Amendment number 1 to the 17th edition of the IEE Wiring Regulation (BS 7671:2008) has an expected publication date of July 2011.

