

Hæ eHa

HAE EHA
Code of Practice

Guidance on Electrical Safety Testing in the Hire Industry

This Code of Practice (CoP) recommends good working practices for the management of in-service electrical equipment for hire companies

Contents

Introduction	3
1 Scope	4
2 The Law	5
3 Electrical Equipment	9
4 Requirements for testing	12
5 In-Service inspection and testing	13
6 Procedures for in-service inspection and testing	14
7 Training	30
8 Test instruments	31
9 Definitions and explanations	33
Appendix A	36
Bibliography (by management discipline)	38
Notes	39

Introduction

This Code of Practice has been produced to assist companies that hire electrical equipment and appliances to the general public or businesses. This Code of Practice (CoP) recommends good working practices for the management of in-service electrical equipment for hire companies.

The Association would like to thank those who contributed to the content of this Code of Practice:

- HAE EHA Member Companies
- HSE
- Institute of Engineering and Technology (IET)
- Seaward



“Code of Practice (CoP) recommends good working practices for the management of in-service electrical equipment for hire companies.”

1 Scope

This Code of Practice is applicable to all electrical equipment and appliances to be hired to the general public or businesses.

This Code of Practice applies to:

- testing the electrical safety of single or multi-phase electrical equipment with rated voltage up to 1000 V a.c and 1500 V d.c for;
- hiring of equipment; and
- after repair.
- the requirements of the test procedures applied for the verification of electrical safety;
- the permissible limits for compliance; and
- mechanical parts of electrical equipment, whose proper form is a prerequisite for the electrical safety including;
- electrical parts of the equipment, which cannot explicitly be named as electrical equipment (e.g. gas fired hot water installations).

Hire equipment falling within the scope of this Code of Practice includes;

- Class I, Class II and Class III appliances and equipment;
- IT equipment supplied by plug and socket;
- Portable equipment and movable equipment e.g hand-held equipment;
- Fixed equipment e.g cookers, heaters, air conditioning equipment, luminaires, fluorescent fittings; and
- 110V equipment.

This Code of Practice does not apply

- to equipment, for which special legislation, regulations and standards should be noted for corrective maintenance, modifications and/or verifications (for example devices for EX-zones, for mining or for medical electrical devices); and
- to medical electrical equipment according to IEC 60601-1;



2 The Law

2.1 The legislation

Electrical equipment is required to be properly maintained so as to prevent danger, therefore, inspections are necessary and testing may also be required. Although reference is made to legislation, this chapter should not be considered as legal advice. In case of doubt, the specific legislation mentioned should be consulted and legal advice obtained.

The responsibilities for safety of persons at work and the maintenance of electrical equipment are detailed in legislation as follows:

- **Health and Safety at Work etc. Act 1974;**
- **Management of Health and Safety at Work Regulations 1999;**
- **Provision and Use of Work Equipment Regulations 1998;**
- **Electricity at Work Regulations 1989; and**
- **Workplace (Health, Safety and Welfare) Regulations 1992.**

2.1.1 The Health and Safety at Work. Act 1974

puts a duty of care upon both employer (sections 2, 3, 4 and 6) and employee (section 7) to ensure the safety of all persons using the work premises. This includes the self-employed.



2.1.2 The Management of Health and Safety at Work Regulations 1999

state: 'Every employer shall make a suitable and sufficient assessment of:

- (a) the risks to the health and safety of his employees to which they are exposed whilst they are at work, and**
- (b) the risks to the health and safety of persons not in his employment arising out of or in connection with the conduct by him of his undertaking'. (Regulation 3(1));**

2.1.3 The Provision and Use of Work Equipment Regulations 1998 state:

'Every employer shall ensure that work equipment is so constructed or adapted as to be suitable for the purpose for which it is used or provided'. (Regulation 4(1)).

The Provision and Use of Work Equipment Regulations 1998 (PUWER) cover most risks that can result from using work equipment. With respect to risks from electricity, compliance with the Electricity at Work Regulations 1989 is likely to achieve compliance with PUWER regulations 5 - 9, 19 and 22.

PUWER only applies to work equipment used by workers at work. This includes all work equipment (fixed, portable or transportable) connected to a source of electrical energy. PUWER does not apply to the fixed installations in a building.

The electrical safety of these installations is just one of the issues dealt with by the Electricity at Work Regulations.

2.1.4 The Electricity at Work Regulations 1989

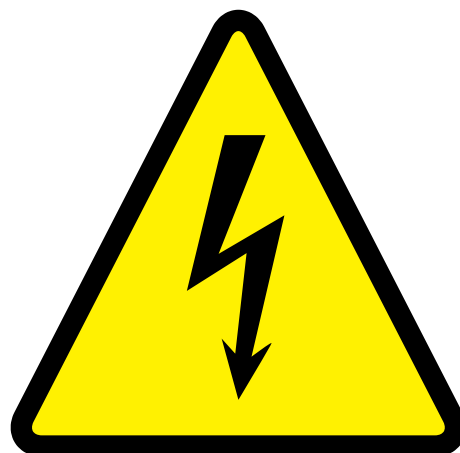
Puts a duty of care upon both employer (sections 2, 3, 4 and 6) apply to electrical equipment as defined in the Regulations which includes every type of electrical equipment from, for example, a 400 kV overhead line to a battery-powered hand lamp. It is appropriate for the Regulations to apply even at the very lowest end of the voltage or power spectrum because the Regulations are concerned with, for example, explosion risks which may be caused by very low levels of energy igniting flammable gases even though there may be no risk of electric shock or burn. Thus no voltage limits appear in the Regulations. The criteria of application is the test as to whether 'danger' (as defined) may arise.

Electrical equipment (as defined) includes conductors used to distribute electrical energy e.g cables, wires and leads and those used in the transmission at high voltage of bulk electrical energy, as in the national grid.

Table 2.1 provides a list of the Regulations in the EAWR that are particularly important to the issues surrounding in service inspection and testing of electrical equipment.

Table 2.1 Regulations in the Electricity at Work Regulations

Regulation 4	Systems, work activities and protective equipment
Regulation 6	Adverse or hazardous environments
Regulation 8	Earthing or other suitable precautions
Regulation 10	Connections
Regulation 14	Work on or near live conductors
Regulation 16	Persons to be competent to prevent danger and injury



2.1.5 Workplace (Health, Safety and Welfare) Regulations 1992

That every employer shall ensure that the workplace equipment, devices and systems are maintained. This includes keeping the equipment devices and systems in an efficient state, in efficient working order, and in good repair. Where appropriate, the equipment, devices and systems shall be subject to a suitable system of maintenance.

The scope of the Workplace (Health, Safety and Welfare) Regulations is somewhat different to the Electricity at Work Regulations. The Electricity at Work Regulations are basically concerned with ensuring an electrical installation is in a safe condition and ensuring work performed on an electrical installation is done in a safe manner. They do not deal with the consequences of maloperation of the electric system. However, the Workplace Regulations are concerned with the consequences of equipment and system failures. For example, whilst a malfunctioning emergency lighting system may not in itself be an electrical hazard, there is a potential hazard if there is no emergency lighting. These regulations impose maintenance regimes upon such systems as emergency lighting, fire alarms, powered doors, escalators and moving walkways that have electrical power supplies. The regulations are not limited to electrical systems but also include equipment e.g fencing, equipment used for window cleaning, devices to limit the opening of windows etc. The approved code of practice to the Workplace Regulations states that the maintenance of work electrical equipment and electrical systems is also addressed in other regulations. Electrical systems are clearly well addressed in the Electricity at Work Regulations and the maintenance of work equipment in the Provision and Use of Work Equipment Regulations 1992.

2.2 Who is responsible?

Everyone at work has responsibilities including, in certain circumstances, trainees. However, because of the all-embracing responsibilities of all persons this does not minimize the duties of particular persons. (Regulation 3 of the Electricity at Work Regulations)

Regulations recognize a responsibility (control) that employers and many employees have for electrical systems.

It shall be the duty of every employer and self employed person to comply with the provisions of these Regulations in so far as they relate to matters that are within his control.

It shall be the duty of every employee while at work:

- a) to co operate with his employer so far as is necessary to enable any duty placed on that employer by the provisions of these Regulations to be complied with; and**
- b) to comply with the provisions of these Regulations in so far as they relate to matters which are within his control".**

The Provision and Use of Work Equipment Regulations 1998 requires every employer to ensure that equipment is suitable for the use for which it is provided (Reg 4(1)) and only used for work for which it is suitable (Reg 4(3)). They require every employer to ensure equipment is maintained in good order (Reg 5) and inspected as necessary to ensure it is maintained in a safe condition (Reg 6).

2.3 Maintenance

Regulation 4(2) of the Electricity at Work Regulations 1989 states:

As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger.

Regulation 5 of the Provision and Use of Work Equipment Regulations 1998 states:

Every employer shall ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair.

The Approved Code of Practice and Guidance document to the Provision and Use of Work Equipment Regulations 1998 (L22) states that 'efficient' relates to how the condition of the equipment might affect health and safety; it is not concerned with productivity.

2.4 Inspection

The Provision and Use of Work Equipment Regulations 1998 include a specific requirement that where the safety of work equipment depends on installation conditions, and where conditions of work are liable to lead to deterioration, the equipment should be inspected in accordance with hirers risk assessment.



3 Electrical Equipment

3.1 Portable appliance

A portable appliance is defined as an appliance that is intended to be moved while in operation or an appliance which can easily be moved from one place to another. e.g.: Minipod Light, Extension Lead, Fan Heater, Sound & Lighting Control Desks etc. (Fig 3.1)



Fig 3.1

3.2 Moveable Equipment (sometimes called transportable)

An item of moveable equipment is equipment which is not fixed or, equipment with Wheels, Castors or other means to facilitate movement by the operator as required to perform its intended use. e.g.: Catering Oven, Evaporative Cooler, Air Compressor, Electric Plate Compactor etc. (Fig 3.2)



Fig 3.2

3.3 Hand-held appliances or equipment

A hand-held appliance or equipment is portable equipment intended to be held in the hand during normal use. Electric shock can kill or seriously injure and is one of the hazards that electrical safety legislation is intended to protect against. Many serious shocks occur when the current flow is from hand to hand as the route the current follows is through or near the heart. Hand-held appliances present a particular danger as the appliance is gripped in one hand and it is quite possible the other hand could be in contact with earthed metal. Being gripped, it becomes almost impossible to let go of the appliance under shock conditions. If the person using the appliance is sweating, e.g a construction worker using an angle grinder, then the contact resistance is significantly lowered and a larger current would flow. In addition, hand-held equipment can be the most prone to suffer misuse. Equipment used outdoors may be used under wet conditions or when the person has wet footwear thereby once again reducing contact resistance.

Examples of Hand- Held equipment: Angle Grinder, Mains Powered Drilling Machines, Circular Saw etc (Fig 3.3)



Fig 3.3

3.4 Stationary Equipment or Appliances

An item of stationary equipment or an appliance is equipment that has a mass exceeding 18 kg and is not provided with a carrying handle, e.g Saw Benches and Air Conditioning Units etc. (Fig 3.4)



Fig 3.4

3.5 Fixed Equipment or Appliances

An item of fixed equipment or an appliance is equipment fastened to a support or otherwise secured in a specified location. E.g Personal Radio Charging Station, Hand Dryers, Portable Washrooms, Water Coolers etc. (Fig 3.5)



Fig 3.5

3.6 Information technology equipment

Information technology equipment includes electrical business equipment e.g computers and mains powered telecommunications equipment, and other equipment for general business use, e.g, printers, photo-copiers, power packs etc (Fig 3.6)

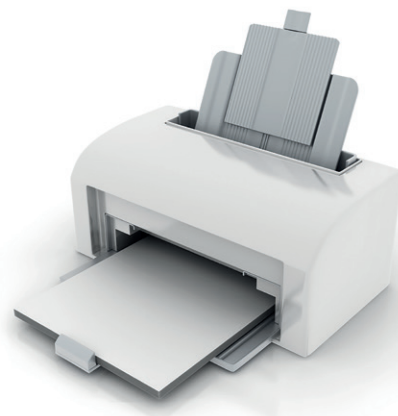


Fig 3.6

4 Requirements for testing

The requirements for inspection and testing of hired electrical equipment should be determined by performing a risk assessment. Risk assessment requires knowledge of several factors, including the user of the equipment and environment in which it is used. In many cases it may be difficult to ascertain who used the equipment or the environment in which it has been whilst on hire.

It is therefore recommended that the electrical equipment returned from hire is subjected to a combined inspection and test before it is re-hired.

Equipment may be subject to retest after prolonged storage or changing conditions.

Note should be taken of any frequently recurring damage and corrective action taken. Corrective action to be considered, such as, replacement of the equipment with a more rugged type or further investigation into the suitability of the damaged equipment.

NOTE - The requirement for subsequent testing before hire should be determined by individual company risk assessment.

These tests should only be performed by an electrically skilled or instructed person. Competency to carry out testing should include training on the subject, knowledge, experience and acquaintance with the relevant technologies, standards and local regulations. Qualifications from external or internal training providers can be included within experience gained.

The persons assessing safety should be able to recognise possible consequences and risks arising from non-conforming equipment.

Additionally requirements from the product safety standard may need to be taken into account. e.g. for the mechanical safety or for fire protection etc.

Precautions need to be taken while carrying out load tests on equipment with moving components or exposed operating surfaces e.g flanges to be removed from rotary equipment, awareness of hot surfaces, sharp blades etc.

If when testing the equipment, additional knowledge or additional test and measurement equipment is required, e.g. for microwave leakage tests, tests should be done according to the instructions of the manufacturer.

All tests should be performed in such a manner that no hazards arise for testing personnel or other individuals.

The applicable tests as listed in 6.1 of the CoP should be used to determine that

- **there are no visible faults on safety related parts, which are accessible by the user; and**
- **the intended use of the equipment, and its environment presents no hazard to the user.**

If during the in-service test it is recognized that,

- **damage, unintended use or modification leading to a reduced safety level are present; and**
- **functional hazards could occur.**

the test procedure should be interrupted and marked as failed.

5 In-Service inspection and testing

5.1 Inspection

In-service inspection and testing of equipment is essential to ensure safety. A regime of risk assessment based inspections and tests should be implemented.

A properly carried out inspection can identify many faults which will not necessarily be apparent from electrical tests, e.g a cracked case, a loose connection, a damaged flex and evidence of overheating.

5.2 Categories of inspection and testing

Two categories of in-service inspection and testing are referred to in this Code of Practice:

- (i) Formal Visual Inspection. The formal visual inspection is performed by a skilled or instructed person. Equipment failing the formal visual inspection must be removed from service, labelled and quarantined.
- (ii) Combined Inspection and Test. The combined inspection and test, which includes a Formal Visual Inspection, is performed by a skilled or instructed person and includes the tests described in 6.1 of this CoP. Equipment failing the Combined Inspection and Test must be removed from service, labelled and quarantined.



6 Procedures for in-service inspection and testing

6.1 General requirements

The sequence in which tests are performed should be as defined in this Code of Practice in order to minimise any risk to the person performing the tests. Each individual test within the sequence should be passed before proceeding to the next test in the sequence. If it is not possible to perform a specific step in the test sequence, a skilled or instructed person may decide on an alternative test procedure to assess the electrical safety of the equipment under test. The decision should be explained and should be documented. If measured values are outside the limits specified in this Code of Practice, the manufacturer of the equipment under test should be consulted for further guidance.

The combined inspection and test should always include a visual inspection in addition to some or all of the following of:

- a) Earth continuity tests (for Class I equipment only)**
- b) Insulation resistance test**
- c) Flash test (Hi-Pot test)**
- d) Protective conductor current measurement**
- e) Touch current measurement**
- f) No Load (Run) Test**
- g) Polarity check (extension leads or detachable lead sets only)**
- h) Functional checks**

The test and inspection procedure should always be based on a risk assessment, taking into account all relevant factors such as the intended use, the environment in which the equipment is used, the likelihood that user of the equipment will report any damage and the equipment manufacturers recommended test procedure.

The recommended test procedures for Class I and Class II equipment are shown in figure 6.1a and 6.1b respectively.

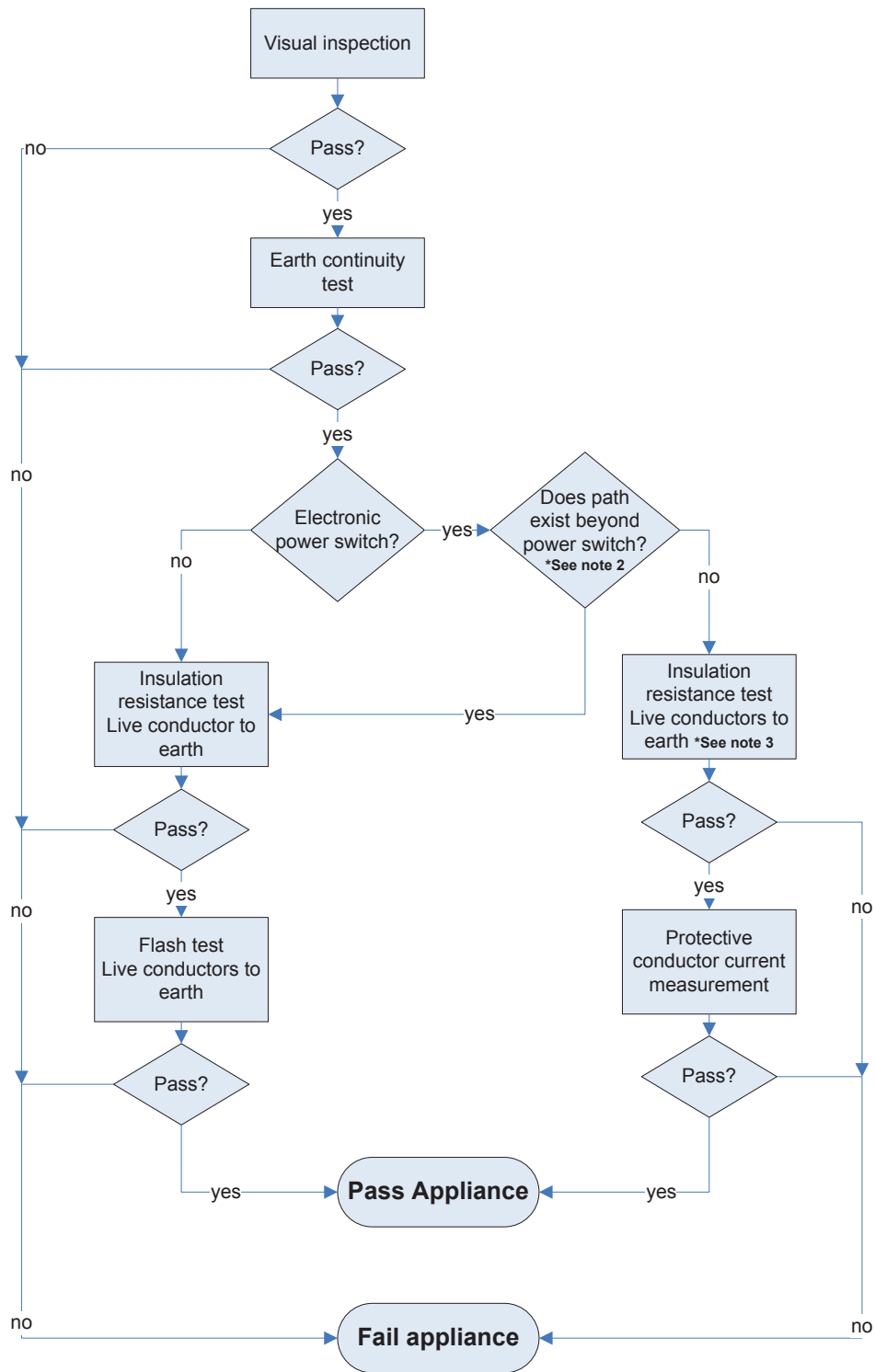


Figure 6.1a
Recommended test procedure for Class I equipment

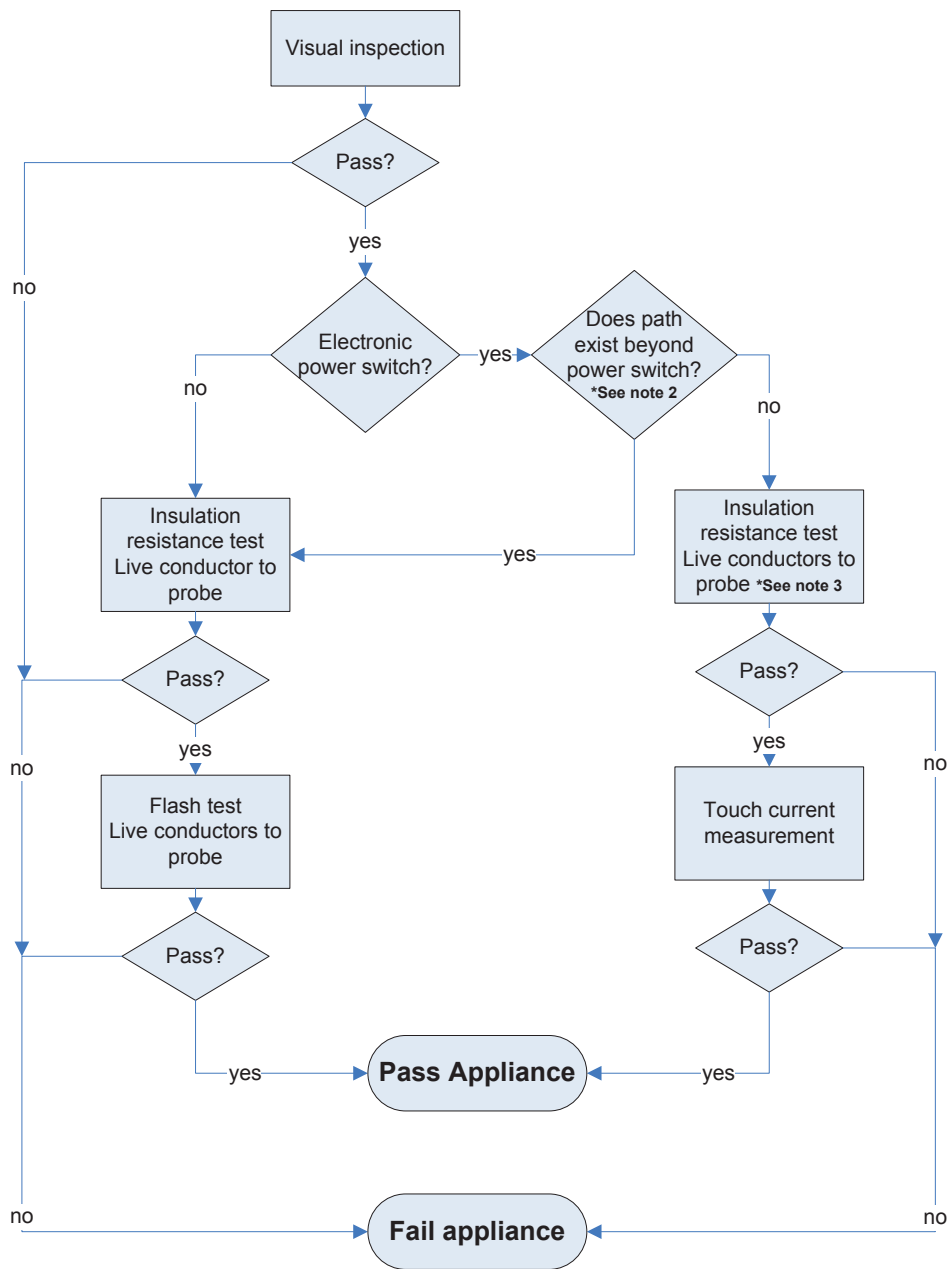


Figure 6.1b
Recommended test procedure for Class II equipment

Note

- 1 Care should be taken when applying the tests above to sensitive electronic equipment e.g. Audio Visual Equipment. Some tests, such as the insulation resistance test, may damage such equipment if they are applied incorrectly. If there is doubt the 'soft tests' described in sections 6.3 and 6.4 of this Code of Practice may be used to reduce the risk of damage.
2. When testing equipment fitted with an electronic power switch, consideration must be given as to whether the applied test voltage can pass beyond the power switch. Electronic power switches generally require mains power to function and connect the mains supply conductors to the internal live parts of the equipment. When the appliance is not energised the power switch cannot be closed and as a result, much of the insulation providing protection against electric shock may not be tested.

Some electronic power switches or electronic controls may have a path from the incoming supply conductors to internal live parts of the equipment even when the equipment is not energised. This requires a detailed knowledge of the internal architecture of the equipment and cannot be determined from a simple inspection of the equipment or associated instructions for use.

If in doubt, the equipment manufacturer should be consulted or a protective conductor/touch current measurement performed to test the insulation of the equipment under test.

3. If the electronic power switch cannot be closed the insulation test voltage may not pass beyond the switch. However, the test may identify insulation faults before the power switch, for example a mains cord punctured by an enclosure fixing screw, reducing the risk of exposure to a hazard for the person performing the tests.

6.2 Formal visual inspection

The visual inspection should take place after the item has been cleaned and dried thoroughly to detect external defects and should include the checks of the following:

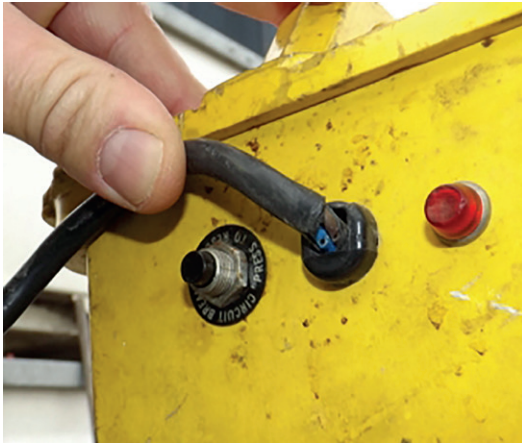
- **any signs of damage;**
- **all cables and plugs / connectors are of a suitable standard for their intended use;**
- **condition of the mains plug and the mains connectors and conductors;**
- **condition of anchorage, cable clip, accessible fuse insert;**
- **damage of the housing and protective cover;**
- **signs of overload or overheating or unintended use;**
- **signs of improper change or modification;**
- **signs of contamination, corrosion and aging;**
- **blockage of cooling inlets / vents / filters;**
- **serviceability of switches, control and setup equipment;**
- **all user accessible fuses comply the manufacturers specification and relevant safety standards (rated current, characteristics);**
- **safety related marking, labels and labelling is legible and complete;**
- **the integrity of mechanical parts i.e. guard;**
- **accessories supplied with the equipment (e.g. detachable or fixed power supply leads).**

6.2.1 Examples of visual inspection failure

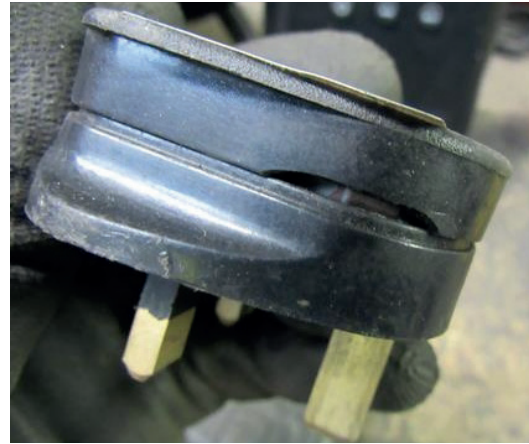
When performing a visual inspection some defects may be readily apparent but in other cases it can be difficult to differentiate between cosmetic defects and those which may compromise the electrical safety of the equipment under test. A risk based approach should always be used to assess the potential hazard posed by a visual defect.

An understanding of the typical use of the equipment, potential for misuse and common defects is invaluable. For example, extension reels are often used to power large loads without fully uncoiling the reel, resulting in localised heating within the unwound cable. Some examples of typical defects found during a visual inspection are included below as guidance.

Examples of visual inspection failures



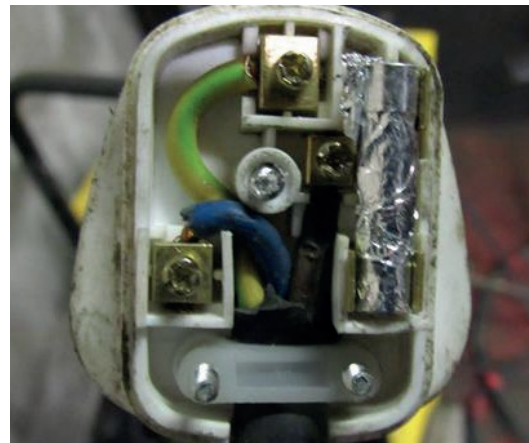
Cables should be held securely by a cable gland or cable restraint. Damaged cables should be replaced.



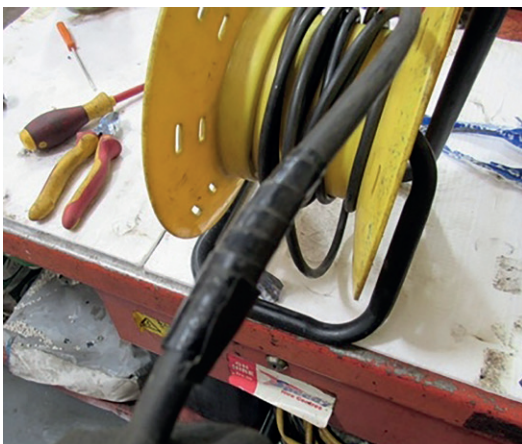
Cracked or damaged plugs should be replaced



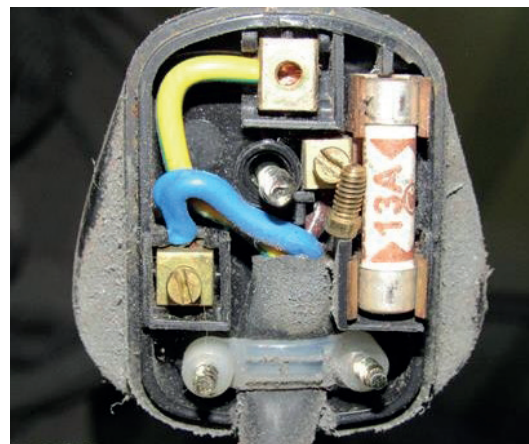
Damaged cables should be replaced



Foil provides no electrical protection and is likely to have a poor electrical connection which can result in overheating and a risk of fire. A fuse with the correct rating should always be fitted.



Extension cables should be fully unwound and checked over the entire length. Damaged cables should be replaced.



Plug should be opened and visually inspected. Terminal screws should be checked for tightness.

6.3 Earth Continuity Test (Class I equipment only)

This test is used to verify the protective earth connection by measuring the resistance of the path between the protective earth pin of the mains plug and any accessible exposed conductive parts of the equipment that could become live through a single fault condition. The test current and voltage are measured and used to calculate the resistance of the protective earth path as shown in figure 6.3.

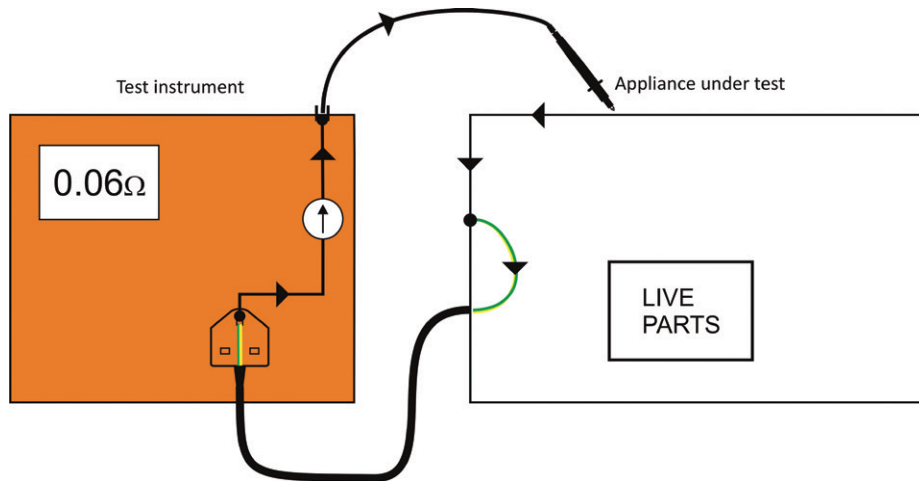


Figure 6.3
Earth continuity test

A continuity test should be made to all exposed conductive parts, which may require multiple measurements on a single item of equipment.

If the equipment is supplied without a plug the resistance will be measured from the end of the supply lead to the accessible exposed conductive parts.

If the equipment is supplied without a mains cord, the resistance shall be measured from the protective conductor terminal on the mains inlet of the equipment under test to the accessible exposed conductive parts.

One of the following two tests should be carried out:

- **A measurement made with a maximum test current of 25A for a period of 5 – 20 seconds. This is sometimes referred to as a “hard test” and is not recommended for electronically sensitive devices.**

- **A measurement made with a maximum of 200mA. This is sometimes referred to as a “soft test.” The test duration should be such that the mains cable can be flexed while the test is carried out to ensure no intermittent connections within the protective earth conductor.**

The measured resistance should not exceed the values given in table 6.1

Table 6.1 Earth continuity maximum resistance values

For appliances with a supply lead

$(0.1 + R) \Omega$ where R is the resistance of the protective conductor of the supply lead

For appliances without a supply lead

0.1 Ω

6.4 Insulation Resistance Test

The test is used to ensure that there is adequate isolation between live parts and parts which may be accessible to the equipment user or users of other electrical appliances connected to the same electrical installation. A test voltage, commonly 500V dc, is applied to the equipment under test; the return current is measured and used to calculate the resistance of the insulation.

In the case of Class I equipment, the test voltage is applied between the live conductors and the protective earth, as shown in figure 6.4a.

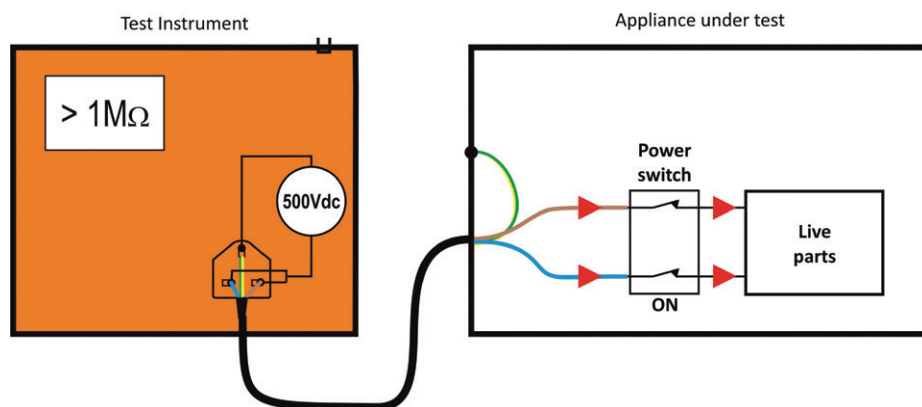


Figure 6.4a
Class I insulation test

If there is a fault in the insulation, the current returning via the protective earth conductor will result in a lower insulation resistance value, as shown in figure 6.4b.

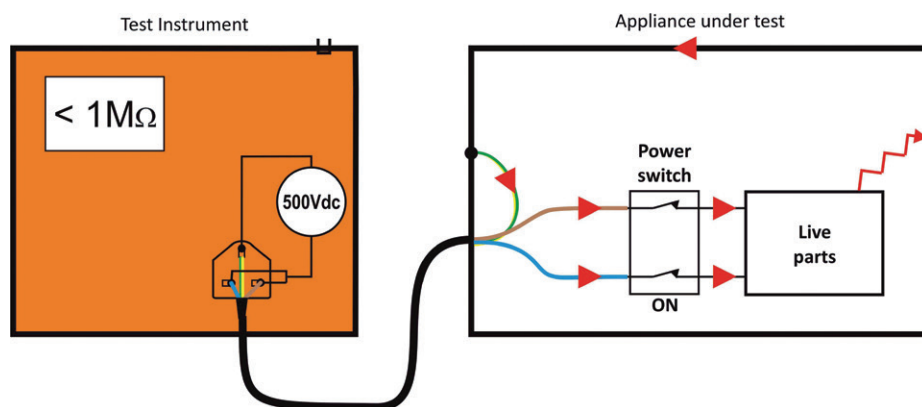


Figure 6.4b
Class I insulation test
with insulation fault

In the case of Class II equipment, the test voltage is applied between the live conductors and a test probe applied to any accessible conductive parts or suspect parts of the enclosure of the equipment under test, as shown in figure 6.4c. In the case where there are multiple discrete conductive parts, each part should be tested separately, as depicted by the dashed lines.

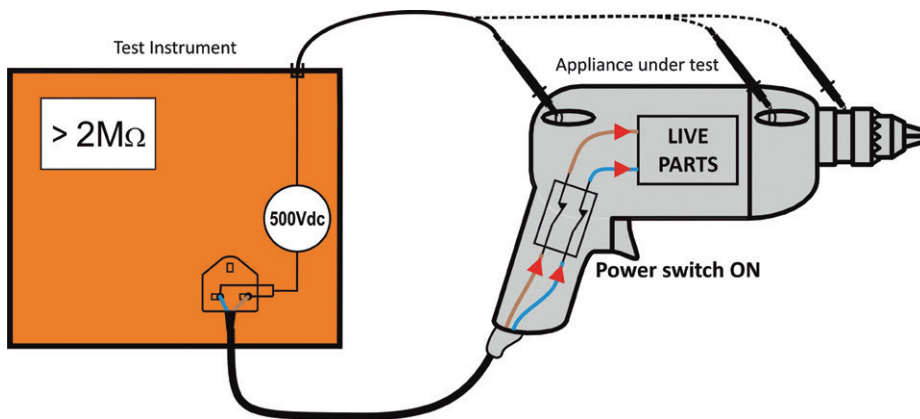


Figure 6.4c
Class II insulation test

If there is a fault in the insulation, the current returning via the test probe will result in a lower insulation resistance value, as shown in figure 6.4d.

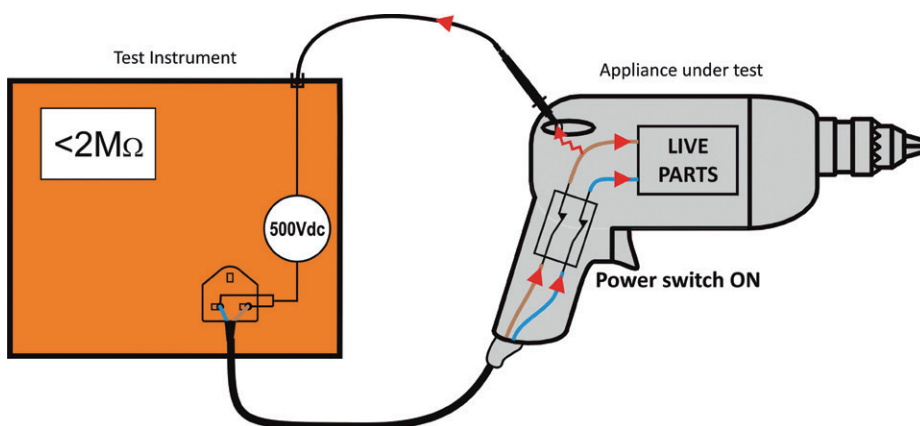


Figure 6.4d
Class II insulation test
with insulation fault

All switches, controls etc. must be in the ON position and / or at maximum setting during the measurement to ensure that the test is correctly applied to the insulation of all live parts within the equipment under test.

When testing equipment fitted with an electronic power switch, consideration must be given as to whether the applied test voltage can pass beyond the power switch. Electronic power switches generally require mains power to function and connect the mains supply conductors to the internal live parts of the equipment. When the appliance is not energised the power switch cannot be closed and as a result, much of the insulation providing protection against electric shock may not be tested.

Some electronic power switches or electronic controls may have a path from the incoming supply conductors to internal live parts of the equipment even when the equipment is not energised. This requires a detailed knowledge of the internal architecture of the equipment and cannot be determined from a simple inspection of the equipment or associated instructions for use.

If in doubt, the equipment manufacturer should be consulted or a protective conductor/touch current measurement performed to test the insulation of the equipment under test, as described in see section 6.5 or 6.6.

Equipment fitted with surge protection devices or filter components in the mains circuitry may give a low insulation resistance reading and in some cases an apparent test failure. In such cases the test voltage may be reduced to 250 Vdc or the insulation resistance test can be replaced by a protective conductor current and/or touch current measurement.

It should not be assumed that the equipment under test is free from insulation faults and any exposed conductive parts of the equipment under test should not be touched during the insulation resistance test.

It should be confirmed that the insulation resistance is not below the limits of Table 6.2.

Table 6.2 Minimum insulation resistance values

Appliance Class	Minimum Insulation Resistance
Class I heating and cooking equipment with a rating to 3 kW	0.3 MΩ
All other Class I equipment	1.0 MΩ
Class II equipment	2.0 MΩ

6.5 Protective Conductor Current Measurement (Class I equipment only)

The protective conductor current measurement provides an alternative means of testing the insulation where an insulation resistance test or flash test cannot be used, for example when the equipment under test is fitted with an electronic or “no volt” mains switch. This test, sometimes referred to as an earth leakage test, measures the current in the protective earth conductor while the equipment under test is operating at the rated supply voltage, as shown in figure 6.5a.

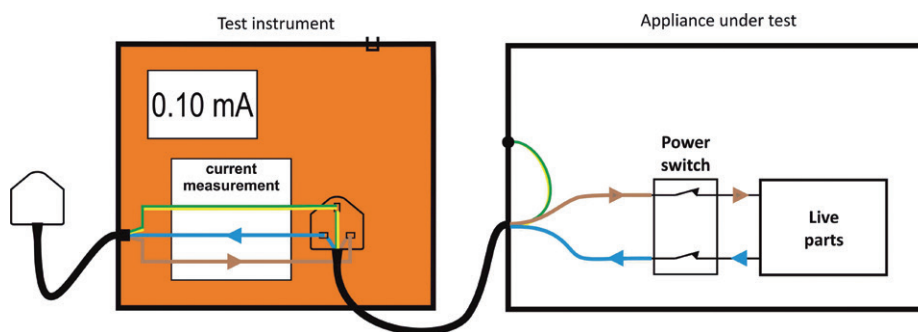


Figure 6.5a
Protective conductor current measurement

All switches, controls etc. must be in the ON position and / or at maximum setting during the measurement to ensure that the test is correctly applied to the insulation of all live parts within the equipment under test.

Components such as EMC filtering connected between live parts and protective earth may result in a protective conductor current under normal condition. A fault in the insulation will result in a larger current in the protective conductor, as shown in figure 6.5b.

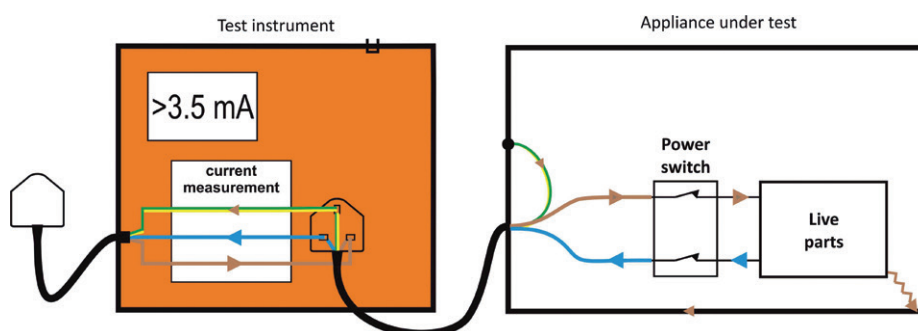


Figure 6.5b
Protective conductor current measurement in equipment with an insulation fault.

It should not be assumed that the equipment under test is free from insulation faults and any exposed conductive parts of the equipment under test should not be touched during the protective conductor current test.

Note: The equipment under test will be energised and any risk associated with the operation of the equipment, for example rotating parts, must be assessed and controlled.

Measured values shall not exceed those in table 6.3.

Note: Equipment with a protective conductor current designed to be above 3.5mA should be installed in accordance with the particular requirements in the current edition of BS 7671.

Table 6.3 Maximum protective conductor current values

Type of equipment	Maximum protective conductor current
Portable or Hand-Held Class I equipment	0.75 mA
Class I heating appliances	0.75 mA or 0.75 mA per kW, whichever is the greater, with a maximum of 5 mA
Other Class I equipment	3.5 mA

6.6 Touch Current Measurement

A touch current measurement can be used to assess the insulation between live conductors and any accessible conductive parts of the enclosure of the equipment under test when an insulation resistance test or flash test cannot be performed, for example when the equipment under test is fitted with an electronic or “no volt” mains switch. This test, sometimes referred to as a touch leakage test, measures any current flowing via a test probe from accessible conductive parts of the enclosure of the equipment under test to earth while the unit is operating at the rated supply voltage, as shown in figure 6.6a.

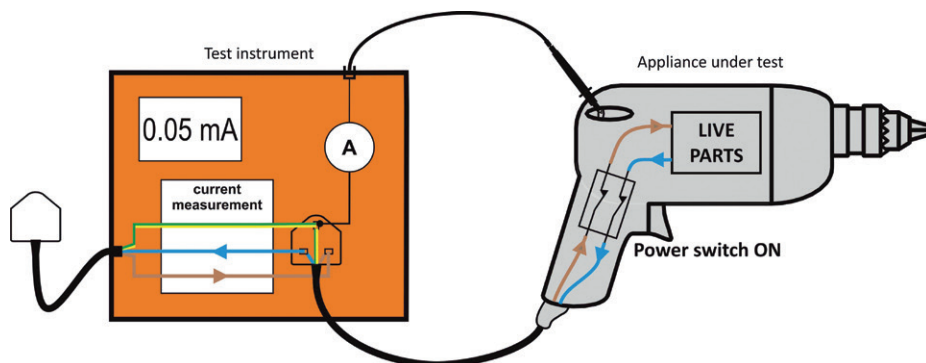


Figure 6.6a
Touch current measurement

All switches, controls etc. must be in the ON position and / or at maximum setting during the measurement to ensure that the test is correctly applied to the insulation of all live parts within the equipment under test.

A fault in the insulation between live parts and the location where the test probe is applied will result in an increase in the current returning via the test probe, as shown in figure 6.6b.

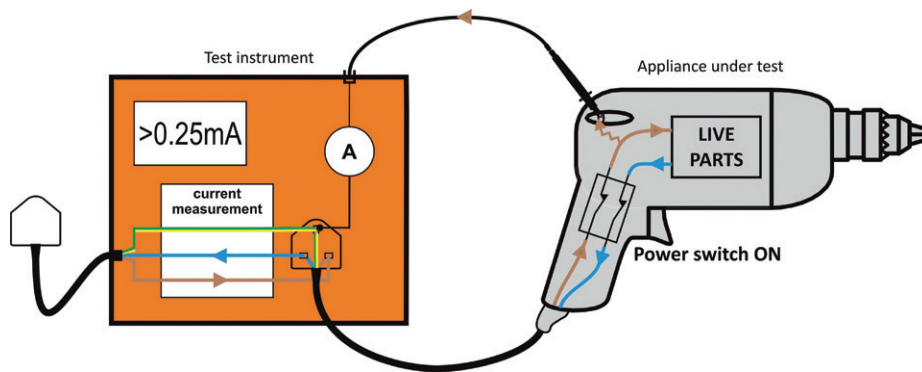


Figure 6.6b
Touch current measurement in equipment with an insulation fault.

It should not be assumed that the equipment under test is free from insulation faults and any exposed conductive parts of the equipment under test should not be touched during the touch current test.

Note: The equipment under test will be energised and any risk associated with the operation of the equipment, for example rotating parts, must be assessed and controlled.

Confirm that the TOUCH CURRENT does not exceed 0.25mA for all Class II types of equipment.

6.7 Flash Test (Withstand voltage test)

The flash test is used to check the integrity of the insulation when exposed to voltages much greater than the nominal mains voltage and ensure there is adequate protection against transient over-voltages that may occur on the mains supply.

In the case of Class I equipment, the test voltage is applied between the live conductors and the protective earth conductor, as shown in figure 6.7a.

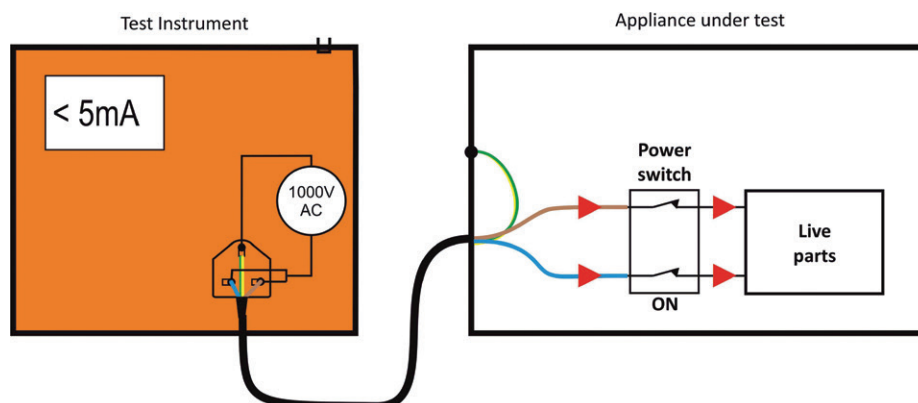


Figure 6.7a
Flash test on a Class I appliance

If there is a fault in the insulation, the current returning via the protective earth conductor is measured, as shown in figure 6.7b.

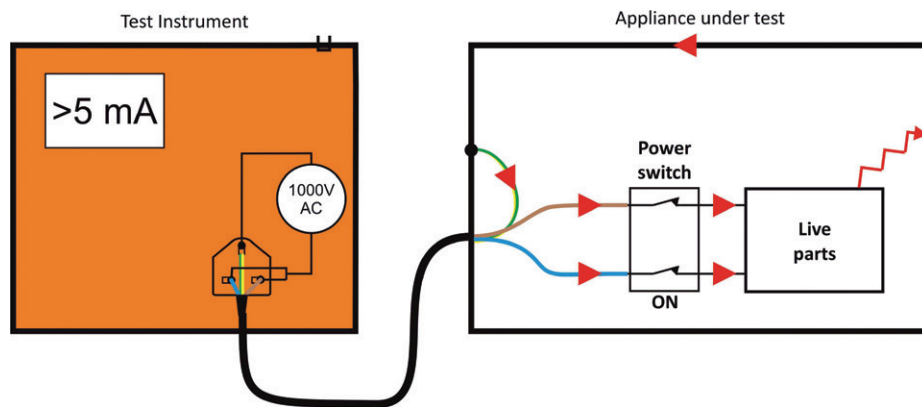


Figure 6.7b
Flash test on a Class I appliance with an insulation fault

In the case of Class II equipment, the test voltage is applied between the live conductors and a test probe applied to any accessible conductive parts or suspect parts of the enclosure of the equipment under test, as shown in figure 6.7c. In the case where there are multiple discrete conductive parts, each part should be tested separately, as depicted by the dashed lines.

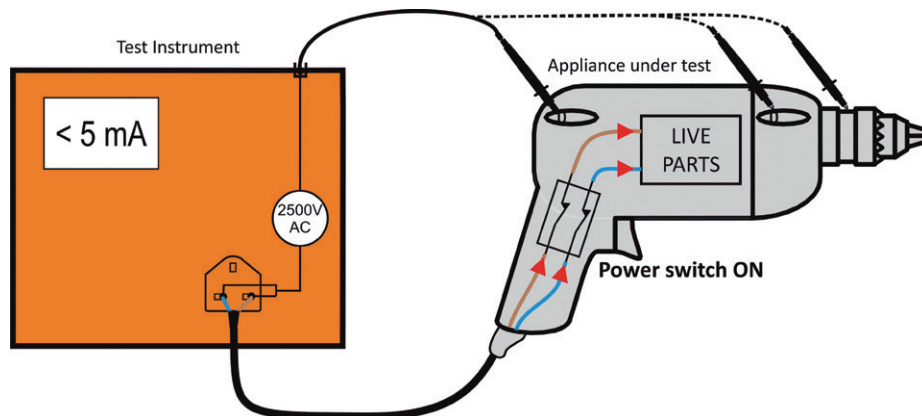


Figure 6.7c
Flash test on a Class II appliance

If there is a fault in the insulation, the current returning via the test probe is measured, as shown in figure 6.7d.

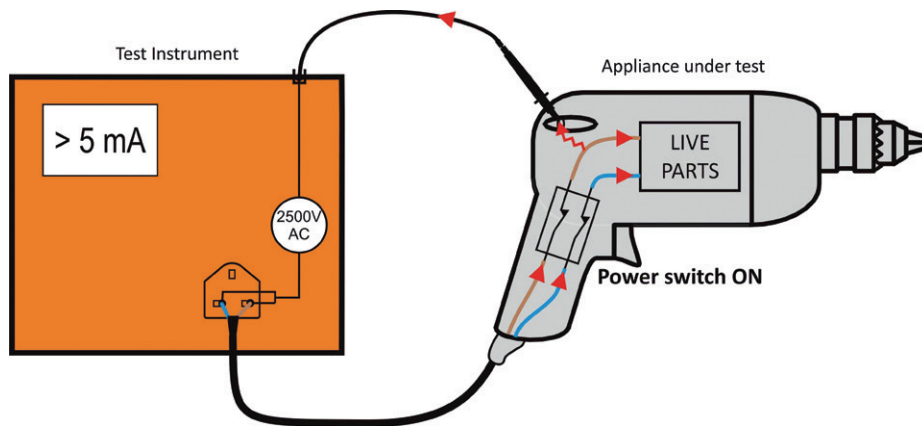


Figure 6.7d
Flash test on a Class II
appliance with an
insulation fault

The test method is similar to that used when performing an insulation resistance test however the use of a higher test voltage increases the probability of detection of potential insulation defects. A thorough visual inspection supplemented by a flash test can provide a robust method for detection of damage to the insulation. Care must be taken when performing the flash test, particularly when testing equipment with sensitive electronic components, as inappropriate use or excessive test voltage may result in damage to the equipment under test.

All switches, controls etc. must be in the ON position to ensure that the test is correctly applied to the insulation of all live parts within the equipment under test.

When testing equipment fitted with an electronic power switch, consideration must be given as to whether the applied test voltage can pass beyond the power switch. Electronic power switches generally require mains power to function and connect the mains supply conductors to the internal live parts of the equipment. When the appliance is not energised the power switch cannot be closed and as a result, much of the insulation providing protection against electric shock may not be tested.

Some electronic power switches or electronic controls may have a path from the incoming supply conductors to internal live parts of the equipment

even when the equipment is not energised. This requires a detailed knowledge of the internal architecture of the equipment and cannot be determined from a simple inspection of the equipment or associated instructions for use. If in doubt, the equipment manufacturer should be consulted or a protective conductor/touch current measurement performed to test the insulation of the equipment under test, as described in see section 6.5 or 6.6.

The values for minimum recommended test voltage are shown in table 6.4.

In order to minimise risk for the test operator and other staff in the immediate vicinity, the area where flash testing is carried out should comply with BS EN 50191.

No flashover or breakdown should occur during the test. Breakdown is assumed to occur when the measured current exceeds 5mA. In some cases the current measured at the test voltages shown in table 6.4 may exceed the limit values shown in table 6.4 due to filter components in the mains circuit of the equipment under test rather than a breakdown of the insulation. If in doubt, consult the manufacturer of the equipment under test for guidance or compare historical results for the equipment under test.

Table 6.4 Withstand voltage leakage current limits

Construction	Minimum Test Voltage(see note 1)	Limit
Class I	1000V	<5mA
Class II	2500V	<5mA

Note 1: Commercially available test equipment may have nominal voltages that differ from those shown in table 6.4. Nominal test voltages of 1250V (Class I) or 3750V (Class II) are commonly used. The values shown in Table 6.4 are taken from BS EN 62841-1 Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety Part 1: General requirements, Annex D Electric strength.

6.8 Testing portable RCDs

When the equipment under test includes a residual current device (RCD), an (electrically) skilled person should decide on the appropriate additional tests. Instructions from the manufacturer should be taken into account.

A formal visual inspection, as described in 6.2, and the electrical tests for equipment fitted with an electronic mains switch should be performed.

Note:

1. An earth continuity test should be performed to confirm the protective earth terminal on the mains output socket is connected to the protective conductor in the supply, regardless of the class of construction.
2. An RCD requires mains power to operate and make the connection from the incoming mains conductors to the mains output socket. A flash test cannot test beyond the RCD, however, a flash test does provide a useful means for verifying the integrity of insulation of the mains cable and other parts connected to the supply side of the equipment.

In addition to the appropriate electrical tests from those listed in 6.1, the operation of the RCD should be tested as follows:

- **Connecting the RCD to a mains supply and then pushing the test button. The RCD should operate and disconnect the supply;**

and

- **Measuring the trip time using an RCD test instrument according IEC 61557-6**

The test current and maximum allowable trip times according to BS EN 61008 are shown in table 6.8 for an RCD with a rated residual operating current $I_{\Delta n}$.

Table 6.8
Maximum RCD trip times

Test current	$\frac{1}{2} I_{\Delta n}$	$I_{\Delta n}$	$5 \times I_{\Delta n}$
Maximum trip time	RCD should not trip	300ms	40ms

Note:

The RCD should not trip at half the rated residual operating current. This test is used to check for nuisance tripping.

The test at 30mA trip time test should be performed as a minimum. Trip time tests should be performed using test currents starting on a positive (0°) and negative (180°) half cycle. The measured trip time shall not exceed the values should in table 6.8.

When performing RCD trip time measurements, the RCD under test must be powered from an electrical outlet that is not protected by an RCD otherwise the supply RCD may operate, giving misleading test results. If a non-protected outlet is not available, a suitable isolating transformer should be used to prevent the test current from tripping the supply RCD.

The most common failure mode for an RCD is a jamming or sticking mechanism which is often rectified simply by performing a trip time test. If an RCD fails to trip within the required time period the test should be repeated.

6.9 Appliance Lead Tests

An appliance with a detachable power supply flex should be tested in conjunction with the lead set.

If there is a possibility that a lead set could be used to power a different piece of equipment it should be labelled and tested separately from the appliance as follows:

3-core lead sets:

- **Visual inspection;**
- **Earth Continuity, Polarity and Insulation Resistance tests;**

2-core lead sets

- **Visual inspection;**
- **Class II - Polarity and Insulation Resistance tests.**

2 core leads sets must not be used to supply an earthed socket outlet or Class I appliances.

6.10 Extension leads including 110V junction boxes

Where extension leads are fitted with a 3-pin mains plug and socket(s) these should be tested as Class I appliances with the addition of a polarity check. Any such extension leads that are found to be without a protective earth conductor should be removed from service and marked as defective.

Extension leads fitted with 3-pin mains plug and socket(s) must never be fitted with two-core mains cable as there is the possibility that the extension lead could be inadvertently used to supply a Class I appliance which, as a consequence, would not be earthed.

The polarity throughout should be verified.

Coiled extension leads should always be fully uncoiled before use and during inspection and testing.

In the case of multi-way extension leads, the earth continuity and polarity of each individual socket outlet should be tested.



6.11 Functional test

A functional test of the equipment should be carried out to ensure that it operates as intended. A function test must only be performed after the equipment has successfully passed a combined inspection and test.

Note: The equipment under test will be energised and any risk associated with the operation of the equipment, for example rotating parts, must be assessed and controlled.

7 Training

Personnel should be trained and / or have relevant experience to be competent to inspect and test a specific piece of equipment.



8 Test instruments

8.1 Safety of test equipment

Suitable test equipment complete with test probes and leads must be used to perform the tests described in this Code of Practice. Dedicated appliance test instruments provide a convenient means of performing the recommended tests for all the types of electrical equipment likely to be encountered, however this does not preclude the use of a range of suitable single function test devices.

All test instruments should comply with BS EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use. Test leads and probes should comply with BS EN 61010-031 Safety requirements for electrical equipment for measurement, control and laboratory use: Safety requirements for hand-held probe assemblies for electrical measurement and test.

Users must always read and understand the operating instructions and follow the advice given before using test instruments.

Generally, specific electrical safety testers offer the most convenient means of providing the required test facilities but this does not preclude the use of suitable individual general test instruments.

Test probes and leads, in particular those used to apply or measure voltage over 50 V a.c. and 100 V d.c. should comply with the recommendations given in HSE Guidance Note GS 38.

Test probes should:

- **Have finger barriers or, alternatively, be shaped to guard against inadvertent hand contact with the live parts;**

and

- **Be insulated to leave an exposed metal tip not exceeding 4 mm measured across any surface of the tip. Where practicable it is strongly recommended that this is reduced to 2 mm or less, or that spring loaded retractable screened probes are used.**

Leads should:

- **Be adequately insulated and the choice of insulating material may be influenced by the environment in which the leads are to be used;**
- **Be coloured so that one lead can be easily distinguished from the other;**
- **Be flexible and of sufficient capacity for the duty expected of them;**
- **Be sheathed to protect against mechanical damage;**
- **Be long enough for the purpose; and**
- **Not have accessible exposed conductors other than the probe tips or have live conductors accessible to be touched if a lead becomes detached from a probe, indicator or instrument when in use.**

8.2 Dedicated electrical safety test instruments

Dedicated electrical safety test instruments commonly provide a number of the following test functions:

- i. Measurement of earth continuity with one or more pre-set test currents up to a maximum of 25A, sometimes referred to as a 'hard test';
- ii. Measurement of earth continuity using a low value of current, typically 200 mA, sometimes referred to as a 'soft test';
- iii. Measurement of insulation resistance using a test voltage of 500 V d.c. Some test instruments may provide an additional test voltage of 250 V d.c.
- iv. Insulation test by means of a protective conductor/touch current measurement;
- v. Flash test;
- vi. Load measurement or operation test.

8.3 Withstand voltage test (also known as Flash test)

The withstand voltage test is commonly confused with a dielectric strength test. A dielectric strength test is used to determine the maximum electric field that an insulating material can withstand before breaking down i.e. the insulating material is stressed to the point of failure. The withstand voltage test is used to confirm the ability of insulating materials to withstand voltages expected during normal use, including any transient over-voltages that may be present on the mains distribution system. The chosen test voltage takes into account the magnitude of likely transient over-voltages but is lower than the intrinsic breakdown voltage of the insulating material. Unlike a dielectric strength test, a withstand voltage test is a non-destructive test.

The withstand voltage test is commonly performed as a routine test at the end of the production process to confirm that the product has been correctly assembled. It can also be applied after an appliance has been repaired to confirm correct reassembly of all components which provide insulation. During the life of a product it is a useful alternative to an insulation resistance measurement, particularly in cases where there is a greater risk of failure in the insulation, for example, due to inappropriate use, physical damage or exposure to moisture or other contaminants that may affect the insulating properties.

A withstand voltage test is performed by applying a test voltage and confirming that no breakdown or flashover occurs, hence the name flash test. Monitoring the leakage current through the insulation when the test voltage is applied provides a convenient means of detecting any breakdown. Common practise is to assign a limit value for the leakage current, where a leakage current which exceeds the limit value is indicative of a breakdown in the insulation.

Withstand voltage testing should only be performed in a safe environment where no hazard can arise for the person performing test or others in the immediate vicinity.

8.4 Instrument accuracy

The accuracy of a test instrument should be verified and recorded annually or in accordance with the manufacturer's instructions. Many test instruments are calibrated on an annual basis, and issued with a certificate stating the level of accuracy at that time. Further adjustment may be required.

8.5 Ongoing accuracy and maintaining records

In addition to calibration, it is good practice to verify the performance of test equipment at regular intervals between calibration dates. One method of assessing the on-going accuracy of test instruments is to maintain records, over time, of measurements taken from designated reference device e.g. a resistance box.

In each instance, the designated reference device must be used for every subsequent assessment. Before such a system is implemented, the accuracy of each test instrument must be confirmed and this could only be carried out by a recognised calibration facility. Test leads should be assessed at the time of calibration.

To avoid ambiguity, the relevant testing points on the reference device should be labelled allowing other operatives, who may not usually be charged with the task of test instrument assessment, to follow the system. Should the results be inconsistent the instrument may need to be recalibrated.

Many test instrument manufacturers produce proprietary "checkboxes", that incorporate multiple reference values or functions, e.g. high and low resistance, earth fault loop impedance and RCD simulation.

Equipment used for this purpose should itself be calibrated periodically.

9 Definitions and explanations

Appliance.

An item of current-using equipment.

Basic insulation.

Insulation applied to live parts to provide basic protection against electric shock and which does not necessarily include insulation used exclusively for functional purposes.

Bonding conductor.

A protective conductor providing equipotential bonding.

Circuit.

An assembly of electrical equipment supplied from the same origin and protected against overcurrent by the same protective device(s).

Class I equipment.

Equipment in which protection against electric shock does not rely on basic insulation only, but which includes means for the connection of exposed conductive parts to a protective conductor in the fixed wiring of the installation. Refer also to BS 2754 and BS EN 61140.

Class II equipment.

Equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as supplementary insulation are provided, there being no provision for the connection of exposed metalwork of the equipment to a protective conductor and no reliance upon precautions to be taken in the fixed wiring of the installation. Refer also to BS 2754 and BS EN 61140.

Class III equipment.

Equipment in which protection against electric shock relies on supply at SELV and in which voltages higher than those of SELV are not generated. See definition of SELV. Refer also to BS 2754 and BS EN 61140.

Current-using equipment.

Equipment which converts electrical energy into another form of energy, e.g light, heat or motive power.

Danger.

Risk of injury to person.

Double insulation.

Insulation comprising both basic insulation and supplementary insulation.

Earth.

The conductive mass of the Earth, whose electric potential at any point is conventionally taken as zero.

Earthing.

Connection of the exposed-conductive-parts of electrical equipment to the main earthing terminal of an electrical installation. Metal parts of an electrical installation or appliance may become electrically charged if there is a fault. The purpose of earthing is to minimise the risk of electric shock should anyone touch those metal parts when a fault is present. This is achieved by providing a path for fault current to flow safely to earth which also causes the protective device to disconnect thereby removing the danger.

Earthing conductor.

A protective conductor connecting the main earthing terminal of an installation to an earth electrode or to other means of earthing.

Electric shock.

A dangerous physiological effect resulting from the passing of an electric current through a human body or livestock.

Electrical equipment.

(abbr: Equipment). Any item for such purposes as generation, conversion, transmission, distribution or utilisation of electrical energy, e.g machines, transformers, apparatus, measuring instruments, protective devices, wiring systems, accessories, appliances and luminaires, connected by plug or permanently connected to a final circuit of the distribution system.

Electrical installation.

(abbr: Installation). An assembly of associated electrical equipment supplied from a common origin to fulfil a specific purpose and having certain co-ordinated characteristics.

(Electrically) Skilled Person – (referred to as skilled person in this CoP)

person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create

[IEV 195-04-01]

(Electrically) Instructed Person – (referred to as Instructed person in this CoP)

person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards which electricity can create.

[IEV 195-04-02]

Electronic Switch.

See *No Volt Switch*.

Emergency switching.

An operation intended to remove, as quickly as possible, danger, which may have occurred unexpectedly.

Equipotential bonding.

Electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential.

Exposed conductive-part.

A conductive part of equipment which can be touched and which is not a live part but which may become live under fault conditions.

Fault.

A circuit condition in which current flows through an abnormal or unintended path. This may result from an insulation failure or a bridging of insulation. Conventionally the impedance between live conductors or between live conductors and exposed- or extraneous-conductive-parts at the fault position is considered negligible.

Final circuit.

Electric circuit intended to supply directly electric current to current using equipment or socket outlets.

IEV 812-14-03]

Fixed equipment.

Equipment designed to be fastened to a support or otherwise secured in a specific location e.g. bathroom heater or towel rail.

Flexible cable.

Cable whose structure and materials make it suitable to be flexed while in service.

Fuse.

A device which by the melting of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device.

Hand-held appliance or equipment.

This is portable equipment intended to be held in the hand during normal use, e.g. hair dryer, drill, soldering iron.

Hired.

To engage the temporary use at a price (In this case, *Electrical Equipment*)

Information technology equipment.

Information technology (IT) equipment includes electrical business equipment e.g. computers and mains powered telecommunications equipment, and other equipment for general business use, e.g. PC's, laptops, printers, sensitive electronic devices.

In-service test.

A test performed at a defined time interval for the assessment of safety.

Insulation.

Suitable non conductive material enclosing, surrounding or supporting a conductor.

Isolation.

An assembly consisting of a detachable flexible cable or lead fitted with a plug and a connector intended for the connection of electrical equipment to the electrical supply.

Lead set.

(abbr: Installation). An assembly of associated electrical equipment supplied from a common origin to fulfil a specific purpose and having certain co-ordinated characteristics.

Leakage current.

Electric current in an unwanted conductive path under normal operating conditions.

Live part.

A conductor or conductive part intended to be energised in normal use, including a neutral conductor.

Luminaire.

Equipment which distributes, filters or transforms the light from one or more lamps, and which includes any parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and, where necessary, circuit auxiliaries together with the means for connecting them to the supply. For the purposes of the EAW Regulations a lampholder, however supported, is deemed to be a luminaire.

Main earthing terminal.

The terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors, and conductors for functional earthing, if any, to the means of earthing.

Movable equipment

Equipment which is either:

- 18 kg or less in mass and not fixed, e.g. small welding set, transformer or
- equipment with wheels, castors or other means to facilitate movement by the operator as required to perform its intended use, e.g. air conditioning unit.

Neutral conductor.

A conductor connected to the neutral point of a system and contributing to the transmission of electrical energy.

No Volt (Zero volt or Electronic) switch.

A switch that requires mains power in order to energise. Without voltage applied the switch will fail to remain closed.

Phase conductor.

A conductor of an a.c. system for the transmission of electrical energy other than a neutral conductor.

Portable appliance.

An appliance of less than 18 kg in mass that is intended to be moved while in operation or an appliance which can easily be moved from one place to another. i.e extension lead, food mixer.

Portable equipment.

Electrical equipment which is moved while in operation or which can easily be moved from one place to another while connected to the supply. i.e Vacuum cleaner, lawn mower.

PPE.

Personal Protective Equipment relevant to individual equipment and job type, e.g. Eye protection, gloves, ear defenders etc

Protective conductor.

A conductor used for some measures of protection against electric shock and intended for connecting together any of the following parts:

- Exposed Conductive Parts
- The Main Earth Terminal
- Earth Electrodes

Protective conductor current.

Electric current (leakage) which flows in a protective conductor.

Reinforced insulation.

Single insulation applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in the relevant standard. The term 'single insulation' does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

Residual current device (RCD).

A switching device or association of devices intended to cause the opening of the contacts when the residual current attains a given value under specified conditions.

SELV (Separated Extra-Low Voltage).

An extra-low voltage system which is electrically separated from Earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.

Socket-outlet.

A device, provided with female contacts, which is intended to receive a plug. A luminaire track system is not regarded as a socket-outlet system.

Stationary equipment or appliance.

Electrical equipment which is either fixed, or equipment having a mass exceeding 18 kg and not provided with a carrying handle e.g. refrigerator, vending machine.

Supplementary insulation.

Independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation.

Touch current.

Electric current through a human body when it touches one or more accessible parts of equipment.

Zero Volt switch

See *No Volt Switch*

Appendix A.

Nominal resistance of appliance supply cable protective conductors.

Nominal conductor csa	Nominal conductor resistance at 20 °C Length	Length	Resistance at 20 °C	Maximum current-carrying capacity
(mm ²)	(Ω/m)	(m)	(Ω)	(A)
0.5	0.039	1	0.039	3
		1.5	0.0585	
		2	0.078	
		3	0.117	
		4	0.156	
0.75	0.026	5	0.195	6
		1	0.026	
		1.5	0.039	
		2	0.052	
		3	0.078	
1.0(0.75) (See Note)	0.019	4	0.104	10
		5	0.130	
		1	0.0195	
		1.5	0.0293	
		2	0.039	
1.25	0.015	3	0.0585	13
		4	0.078	
		5	0.0975	
		1	0.0156	
		1.5	0.0234	
1.5	0.013	2	0.0312	15
		3	0.0468	
		4	0.0624	
		5	0.078	
		1	0.0133	
2.5	0.008	1.5	0.020	20
		2	0.0266	
		3	0.0399	
		4	0.0532	
		5	0.0665	
4	0.005	1	0.008	20
		1.5	0.012	
		2	0.016	
		3	0.024	
		4	0.032	
		5	0.040	
		1	0.005	
		1.5	0.0075	
		2	0.010	
		3	0.015	
		4	0.020	
		5	0.025	

NOTE – Where manufacturers' flex is less than 2 metres in length and has a csa of 0.75mm² and is fitted with a non rewirable plug, it may be rated at 10A and be fused to 13A in accordance with BS 1363 Table 2 Note C

Worked example of maximum resistance measurement calculation (R):

25M cable with Cross-Sectional Area (CSA) of 1.5mm²
Resistance per Metre – 0.0133Ω

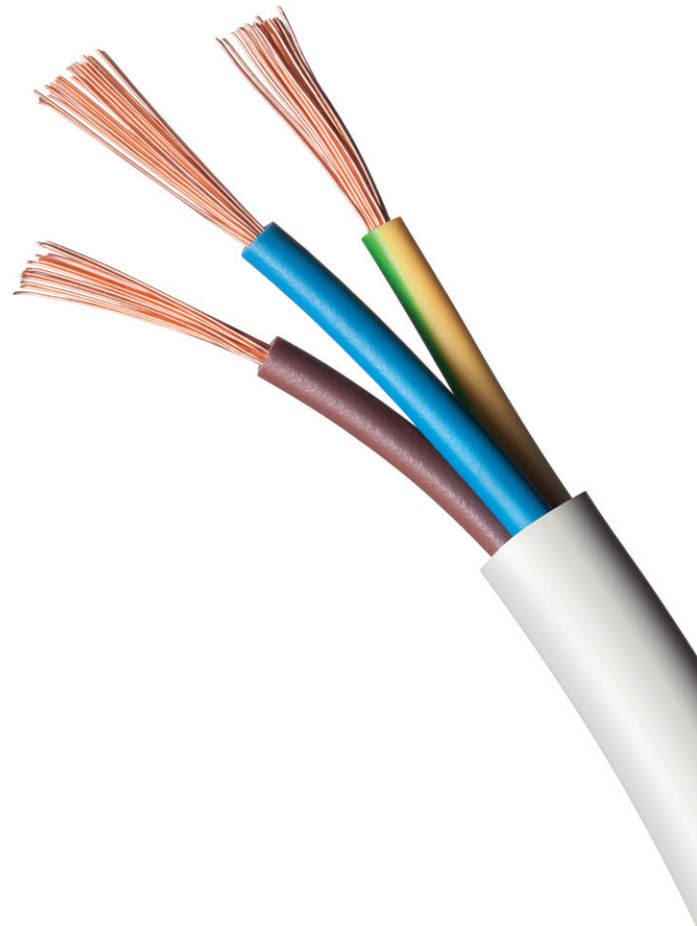
So,

$$25\text{M} \times 0.0133\Omega = 0.3325\Omega$$

Don't forget to add the appliance resistance of 0.1Ω.

$$0.3325\Omega + 0.1\Omega = 0.4325\Omega$$

This can rounded to two figures so the maximum resistance of the cable in this example is 0.43Ω



Bibliography (by management discipline)

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Corporate governance

FINANCIAL REPORTING COUNCIL. *Internal control. Revised guidance for directors on the combined code*. London: Institute of Chartered Accountants, 2005.

GREAT BRITAIN. Companies Act 2006. London: The Stationery Office.

GREAT BRITAIN. The Employer's Liability (Compulsory Insurance) Act 1969. London: The Stationery Office.

GREAT BRITAIN. The Employer's Liability (Compulsory Insurance) General Regulations 1972. London: The Stationery Office.

Business risk management

BS 31100:2008, *Risk management – Code of practice*

BS 25999, *Business continuity management*

HSE. Principles of sensible risk management: <http://www.hse.gov.uk/risk/riskmanage.pdf>

INSTITUTE OF DIRECTORS. *Investors in People: its impact on business performance*. London: IoD, 2001.

Investors in People: www.investorsinpeople.co.uk

PAS 99, *Specification of common management system requirements as a framework for integration*

Health, safety and welfare

Priced publications, also available for free download at: <http://www.hse.gov.uk/pubns/books/index.htm>

GREAT BRITAIN. The Health and Safety at Work etc Act 1974. London: The Stationery Office.

GREAT BRITAIN. The Management of Health and Safety at Work Regulations 1999. London: The Stationery Office.

GREAT BRITAIN. The Construction (Design and Management) Regulations 2007. London: The Stationery Office.

GREAT BRITAIN. The Control of Asbestos at Work Regulations 2002. London: The Stationery Office.

GREAT BRITAIN. The Control of Substances Hazardous to Health Regulations 2002. London: The Stationery Office.

GREAT BRITAIN. The Control of Vibration at Work Regulations 2005. London: The Stationery Office.

GREAT BRITAIN. The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002. London: The Stationery Office.

GREAT BRITAIN. The Electricity at Work Regulations 1989. London: The Stationery Office.

GREAT BRITAIN. The Fire Precautions (Workplace) Regulations 1997 as amended 1999. London: The Stationery Office.

GREAT BRITAIN. The Health and Safety (Consultation with Employees) Regulations 1996. London: The Stationery Office.

GREAT BRITAIN. The Health and Safety (Display Screen) Equipment Regulations 1992. London: The Stationery Office.

GREAT BRITAIN. The Health and Safety (First Aid) Regulations 1981. London: The Stationery Office.

GREAT BRITAIN. The Health and Safety (Safety Signs and Signals) Regulations 1996. London: The Stationery Office.

GREAT BRITAIN. The Health and Safety (Young Persons) Regulations 1997. London: The Stationery Office.

GREAT BRITAIN. The Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972. London: The Stationery Office.

GREAT BRITAIN. The Lifting Operations and Lifting Equipment Regulations 1998. London: The Stationery Office.

GREAT BRITAIN. The Management of Health and Safety at Work Regulations 1999. London: The Stationery Office.

GREAT BRITAIN. The Management of Health and Safety at Work and Fire Precautions (Workplace) (Amendment) Regulations 2003 and the Regulatory Reform (Fire Safety) Order 2005. London: The Stationery Office.

GREAT BRITAIN. The Manual Handling Operations Regulations 1992. London: The Stationery Office.

GREAT BRITAIN. The Noise at Work Regulations 2005. London: The Stationery Office.

GREAT BRITAIN. The Provision and Use of Work Equipment Regulations (PUWER) 1998. London: The Stationery Office.

GREAT BRITAIN. The Personal Protective Equipment Regulations 1992. London: The Stationery Office.

GREAT BRITAIN. The Reporting of Injuries Diseases and Dangerous Occurrence Regulations 1995. London: The Stationery Office.

GREAT BRITAIN. The Work at Height Regulations 2005. London: The Stationery Office.

GREAT BRITAIN. The Workplace (Health Safety and Welfare) Regulations 1992. London: The Stationery Office.

Notes

Hæ eHa

www.hae.org.uk
www.eha.org.uk

Version V82021