

BS 7909:2008

Incorporating Corrigendum No. 1



BSI Standards Publication

Code of practice for temporary electrical systems for entertainment and related purposes

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 30 November 2008. It was prepared by Technical Committee CPW/4, *British standards for imaging*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other publications

This standard should be read in conjunction with BS 7671, which refers the reader to this standard for information and guidance relating to temporary electrical systems for entertainment and related industries.

This standard expects temporary electrical systems to adhere to the Fundamental Principles of BS 7671.

It is important that the requirements of legislation are followed.

Where this standard requires performance criteria to be met, the requirements in this standard take precedence over those in related standards.

Information about this document

This standard deals with the creation and operation of temporary electrical distributions and systems required for events in entertainment and other related industries. The types of electrical equipment involved is broad and is frequently supplied by a variety of specialist facilities and services providers under separate hire agreements.

The staff for such events bring a considerable range of skills; they may be employees of the facilities and services providers, or sole traders or freelance people hired under varied and separate agreements. Each event brings together different facilities and people and requires management arrangements to be in place and understood. Clause 4 of this standard outlines the management arrangements and expects the appointment of a person responsible for the temporary electrical systems to be created for the event.

The person responsible for the temporary electrical system needs to understand the equipment and procedures developed for such events as these differ considerably from those used for permanent installations. It is important to recognize these differences and the need for the safety guidance recommended. The electrical supplies required range from that available from a domestic socket-outlet, to significantly larger supplies obtained from direct connection to public or private electricity suppliers' systems or from mobile generating sets.

Considerations of portability limit the size and weight of units, and time and other constraints prevent the use of conventional fixing methods. Tight schedules, adverse weather and late changes of plan are routine problems. The reusable equipment developed for these circumstances is accepted as providing proper standards of safety if used correctly and this standard is intended to provide overall guidance for these circumstances.

There is a huge variety of events and activities in the entertainment and related industries, ranging from very simple to highly complex, that require the use of temporary electrical systems. The main body

of the standard gives recommendations for all temporary electrical systems; Clause 5 deals with the simpler temporary systems only.

Use of this document

As a code of practice, this standard takes the form of guidance and recommendations. It should not be quoted as if it is a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this standard is expected to be able to justify any course of action that deviates from its recommendations.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard gives recommendations for the management, design, setting-up and operation of temporary electrical systems using low voltage a.c. electricity, for the entertainment and similar or related industries. Mobile and transportable units with electrical systems that are used in these industries are also covered.

This standard gives guidance on matters of common interest to producers, production companies, event organizers and managers, freelance people, facilities and services hire companies, equipment hire companies, equipment manufacturers, electrical consultants, electrical installation contractors, distributors, suppliers of electricity, venues, local authorities and those responsible for safety.

The systems covered by this standard operate at low voltage as defined in BS 7671 and supply equipment normally operating at 230 V a.c. or 400 V a.c. 50 Hz. Electricity at low voltage can be taken from an existing installed electrical system, the public supply, privately owned supplies or from mobile or portable generators. Direct current supplies are outside the scope of this standard.

NOTE 1 It is expected that all electrical equipment, switchgear units, distribution units and cables used for work covered by this standard are manufactured to the appropriate product standards, and that the temporary electrical systems and their use are designed, set-up, supervised, operated and removed by suitably competent persons. It is also expected that responsibility for such temporary electrical systems is taken by a suitably competent person referred to as the person responsible.

NOTE 2 All equipment forming the temporary electrical system is expected to be delivered to site as pre-assembled units that have been tested and are known to be safe and suitable for use. This does not preclude the manufacture on site of simple units that might be necessary; though this is the exception and not the rule.

NOTE 3 Although this standard may be applied to temporary electrical distributions at exhibitions and fairgrounds, it is recommended that reference is made to BS 7671:2008, Sections 711 and 740 respectively for specific information for these activities. A more specialized document related to exhibitions is published by the Association of Event Venues.

NOTE 4 This standard does not offer guidance for hazardous locations where expert advice needs to be sought.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4533-102.9, *Luminaires – Part 102: Particular requirements – Section 102.9: Specification for photo and film luminaires (non-professional)*

BS 4533-102.17, *Luminaires – Part 102: Particular requirements – Section 102.17: Specification for luminaires for stage lighting, television, film and photographic studios (outside and indoor)*

BS 4363, *Specification for distribution assemblies for reduced low voltage electricity supplies for construction and building sites*

BS 5266-1, *Code of practice for the emergency lighting of premises*

BS 6007, *Electric cables – Single core unsheathed heat resisting cables for voltages up to and including 450/750 V, for internal wiring*

BS 6500, *Electric cables – Flexible cords rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments*

BS 7375, *Code of practice for distribution of electricity on construction and building sites*

BS 7430:1998, *Code of practice for earthing*

BS 7671, *Requirements for electrical installations*

BS EN 12193:1999, *Lighting for indoor and outdoor sports events*

BS EN 50172, *Emergency escape lighting systems*

BS EN 60439 (all parts), *Specification for low-voltage switchgear and controlgear assemblies*

BS EN 60529:1991, *Specification for degrees of protection provided by enclosures (IP code)*

BS EN 60598-1, *Luminaires – Part 1: General requirements and tests*

BS EN 60598-2 (all sections), *Luminaires – Part 2: Particular requirements*

BS EN 61558-2-6, *Safety of power transformers, power supply units and similar – Part 2.6: Particular requirements for safety isolating transformers for general use*

BS EN 61984/IEC 61984, *Connectors – Safety requirements and tests*

PAS 51, *Guide to industry best practice for organising outdoor events (available from BSI)*

[5] HEALTH AND SAFETY EXECUTIVE, *The event safety guide. A guide to health and safety and welfare at music and similar events (HSG195)* HSE Books. 1999.

[11] IEE, *Recommendations for the electrical and electronic equipment of mobile and fixed off shore installations*

[12] IEE, *Code of practice for in-service inspection and testing of electrical equipment*

[13] IEE Guidance Note 3, *Inspection and testing*

[14] HEALTH AND SAFETY EXECUTIVE, *Maintaining portable and transportable electrical equipment (HSG107)* HSE Books, 2004.

[15] HEALTH AND SAFETY EXECUTIVE, *Electrical Safety of Independent Low Voltage a.c. Portable and Mobile Generators and Connected Systems (OC482/2)* HSE Books.

3 Terms and definitions

For the purposes of this British Standard, the definitions given in BS 7671 apply, together with the following.

NOTE Some of the definitions in this British Standard are simplified to assist the general reader.

3.1 activity

occasion or part of an event where a temporary electrical system is used (see 3.22)

3.2 cable splitter unit (CSU)

unit that enables a temporary distribution cable to be split into two or more outgoing circuits without further circuit protection (see B.4)

3.3 carry-in

where relatively small amounts of equipment are carried into a location and set-up for use on a temporary basis

NOTE The equipment will require less than 6kVA of power and will typically be used for recording or editing of broadcast material. The expression "radio carry-in" describes a method of working in the radio industry; the method may apply to other areas of work.

3.4 control centre (CC)

portable distribution unit providing a means of functional switching, contactor control and/or protection of a number of outgoing circuits (see B.3)

NOTE Control centres, intake switch units and final distribution units may be constructed as composite units in any combination. Control centres may include dimmers and other power-processing or controlling devices.

3.5 circuit protective conductor (CPC)

protective conductor connecting exposed-conductive-parts of equipment to the main earthing terminal

NOTE 1 A CPC is included with the line and neutral conductors to all parts of a temporary distribution.

3.6 Class I construction

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 the CPC in the temporary distribution

3.7 Class II construction

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 temporary distribution (see BS EN 61140)

NOTE Class II appliances may incorporate means for maintaining the continuity of protective circuits, provided that such means are within the appliance and are insulated from conductive accessible parts by supplementary insulation. Class II equipment will have a double square symbol, see Figure 1.

Class II equipment is identified with the Class II mark .

3.8 Class III construction

equipment in which protection against electric shock relies on a supply at Separate Extra Low Voltage (SELV) and in which voltages higher than those of SELV are not generated (see BS EN 61140)

3.9 competence (competent person)

sufficient technical knowledge, relevant skills and practical experience for the nature and complexity of the duty to be undertaken and able to prevent danger and injury to themselves and others

NOTE In the context of this standard, competence is associated with the knowledge, skill and experience to deal with the electrical and/or related managerial matters that might arise at any time during the progress of the event. The environments in which temporary distributions are used are often subject to change, therefore a competent person will be able to identify hazardous conditions and implement appropriate control measures. A competent person is aware of their limitations.

3.10 current-using equipment

equipment which converts electrical energy into another form of energy such as heat, motive power, light, or signals, etc.

3.11 dimmer

device for varying the power supplied to a luminaire, thus varying the light output

3.12 disconnecter

mechanical switching device which in the open position complies with the requirements for isolation

NOTE 1 This is the preferred term for a device that used to be referred to as an isolator.

NOTE 2 Disconnectors are not designed to make or break load current.

3.13 discrimination

design arrangements to ensure that the overcurrent protection or RCD nearest to a fault operates before any other protective device

NOTE Proper application of discrimination minimizes the inconvenience resulting from an overcurrent or earth fault.

3.14 distribution(s)

see 3.59, temporary electrical distributions

3.15 distributor/distribution network operator (DNO)

person or organization that distributes electricity to consumers using electrical lines and equipment that they own and operate

NOTE A DNO is the name given to organizations or persons distributing electricity to consumers. Such organizations are referred to as "distributors" in the Electricity Safety, Quality and Continuity Regulations (ESQCR) [4], in this standard DNO implies "distributor" as referred to in ESQCR. The exact meaning of DNO is subject to variation it may be an organization or person owning a site or premises in which they distribute electricity to separate individual entities where the electricity is consumed.

For instance, an organization or person may be a DNO where they own an industrial site on which they provide and control the means of distributing electricity to a number of separate individual units on that site, or where they own a commercial or domestic premises, such as a shopping mall, block of offices or flats, which are occupied as separate individual units and to which they provide and control the means of distributing electricity to each unit.

3.16 diversity

allowance made in calculation of system or circuit capacity that predicts that the maximum available load will not be connected simultaneously

3.17 earthing arrangements

defines the electrical system, see below

NOTE 1 Where a generator is used as the source of supply under certain circumstances it may not be necessary to connect this source to the general mass of Earth (see 7.4.2.3 and C.5.2). In this case earthing arrangement relates to the connections between the generator output, the generator's earthing terminal, the generator's chassis and the CPC of any connected distribution.

Earthing arrangements that might be encountered when considering temporary electrical systems used at events:

TN-C – system in which neutral and protective functions are combined in a single conductor throughout the system

NOTE 2 The ESQCR prohibits the use of TN-C in a consumer's installation.

TN-S – system having separate neutral and protective conductors throughout the system

TN-C-S – system in which neutral and protective functions are combined in a single conductor in the distributor's network and then separate in the consumer's part of the system

TT – system having one point of the source of supply directly earthed, the exposed-conductive-parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the source

IT – system having no direct connection between live parts and Earth, the exposed-conductive-parts of the electrical installation being earthed

3.18 electrical environment

geographical area in which an electrical system exists and its characteristics wherever measured are substantially constant

NOTE The area outside a building, a garden for example, is considered to be a different electrical environment to that within the premises. The area within touching distance around a metal columned street light would be an electrical environment. The area within a vehicle with onboard generator is an electrical environment; the area within touching distance of this same vehicle is a different electrical environment to that within the vehicle and that around the street light (See also C.2).

3.19 electromagnetic interference (EMI)

undesirable electrical and/or magnetic energy, which can be radiated, conducted or induced in a system and that causes interference with the normal operation of equipment

3.20 entertainment industry

all branches of theatre, opera, concerts, touring shows, music festivals, pop concerts, ballet, pageants, public or private spectacles or events, fashion shows, corporate and business events, sporting events, broadcast activities, news gathering, etc., staged as live performances

for an immediate audience or for the production of film, television, video or sound recorded material. Events such as county shows, jamborees and similar are also covered under this heading

NOTE Entertainment events may also be staged at fairgrounds and exhibitions and may be subject to additional specialist regulations.

3.21 equipotential bonding

electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential (see also 3.47)

3.22 event

occurrence that is an entertainment, such as a sporting, commercial or business occasion, public or private festival or pageant, where temporary electrical systems are used. This also includes any work that requires systems associated with the broadcasting or recording of the occurrence as educational, entertainment or news worthy material (see also 3.1 and 3.20)

3.23 event manager

individual who carries overall responsibility for the event, including all aspects of bringing together the staff, equipment and facilities required for the event and the safe and smooth running of the event, including its set-up, operation and removal

NOTE 1 In the context of this standard the event manager's role specifically includes the appointment of a senior person responsible to oversee any temporary electrical systems that may be required.

NOTE 2 The event manager, for example, may be a producer, promoter, event manager/organizer, news editor, project manager, production manager or other similar person.

3.24 exposed

likely to be affected by adverse environmental conditions

NOTE Environmental conditions include natural or man-made conditions, such as weather, moisture, humidity and dust.

3.25 facilities

constituent parts of an event that are needed in order that the event may be mounted and run. Such facilities involve electricity and might include staff (wet hire), or might be without staff (dry hire)

NOTE Facilities or services for instance include catering, hospitality, rest areas, welfare or first aid, toilets, wardrobe, make-up, staging, offices, workshops, trading units and similar. Facilities directly associated with the supply, distribution or use of electricity as a core part of the event are included, such as suppliers of generators, electrical distributions, television, radio, communications, public address and sound systems; lighting systems of all types and electrically operated lifting systems and stage machinery. Where appropriate these are referred to specifically.

3.26 facilities providers

individuals or organizations that provide facilities or services to events

3.27 facilities vehicles

vehicles used by facilities providers to make the facilities or service offered available to the event

NOTE Such vehicles, including transportable units used by facilities providers, often have installed electrical systems supplied from a local or onboard generator or from the temporary distribution.

3.28 final distribution unit (FDU)

portable distribution unit supplied from a control centre or intake switch unit and provides sub-circuit protection and switching for a number of outgoing circuits (see **B.5**)

3.29 freelance

person who is not permanently employed, but is engaged on a short-term or fixed-term employment to provide services in a personal capacity

3.30 indoor use

use limited to locations where protection against the effects of detrimental environmental conditions deleterious to insulation and electrical safety is ensured

3.31 ingress protection (IP) classification system

internationally agreed classification system that defines degrees of protection against solid objects, dust and liquids (see BS EN 60529:1991)

3.32 installation

items not part of a temporary electrical system and permanently fixed in a position from which they are not intended to be removed

3.33 installed electrical system (installed system)

system that is permanently fixed in position and not intended to be removed

NOTE Installed electrical systems are not covered by this standard. Such installations are part of the infrastructure of premises, buildings and mobile or transportable units, etc. covered by BS 7671.

3.34 instructed person

individual adequately advised, or supervised by skilled persons, to avoid dangers that electricity can create

3.35 intake switch unit (ISU)

switchgear designed for connection between the source of temporary supply and the remainder of the temporary electrical system providing means of isolation and switching

NOTE The ISU has one or more outgoing circuits (see note to 3.4 and B.2).

3.36 keyed single pole connector (KSPC)

single pole connectors that incorporate a key index device. There are five different key arrangements that define a connector for duty as E, N, L1, L2, or L3

NOTE The moulded shell carries an alpha numeric marking related to its circuit duty. The shells are available in colours appropriate to circuit duty, but some variation in colour related to circuit duty exist, so complete reliance on colour alone is unwise. The key indexing and alpha numeric marking is always correct to circuit duty no matter what shell colour is present. Several manufacturers produce KSPCs that follow the same logic and are interconnectable according to circuit position (see also 3.55, 7.3.4, A.4 and F.3.4.3).

3.37 kilovolt amps (kVA) and kilowatts (kW)

units that indicate the ability of a supply to provide energy, or the amount of energy consumed by current-using equipment

NOTE kVA is the product of supply voltage and current flowing. kW is the useful power delivered. This takes into account any power factor present due to the current and voltage of the circuit being out of phase.

In an a.c. electrical system the useful power delivered is typically less than the product of supply voltage and current flowing. The kVA rating is preferred as its use in calculations result in a more accurate prediction of current flow.

3.38 load-side

part of a connector or system used to distribute electricity to a load (current-using equipment)

3.39 location

site where an event takes place that requires a temporary electrical system

NOTE A location may also be referred to as a site or venue.

3.40 low voltage (a.c.)

voltage exceeding 50 V a.c. but not exceeding 1000 V a.c between conductors, or 600 V a.c. between conductors and earth

3.41 mobile and transportable units

vehicles, trailers, similar mobile units and transportable cabins and huts, etc. in which electrical distributions or systems are installed

NOTE For instance, mobile or transportable units such as broadcast technical vehicles, catering units, wardrobe or make-up units, toilets, facilities vehicles, mobile or portable site offices, workshops, trading units, and transport units with installed low voltage electrical systems. (See BS 7671, Section 717, and IEE Guidance Note 7 [1].)

3.42 open-tails

cable assembly used to connect a temporary distribution to a source of supply that is typically in the form of a switched fuse

NOTE Open-tails are short lengths of single or multi core cable that are correctly terminated usually in a single pole or multi pole connector at one end; at the other end each bare conductor has a crimped ferule or lug to suit the termination at the switched fuse. The termination of bare conductors directly onto busbars constitutes an addition to the fixed installation (see 7.3.4.4 and BS 7671, Regulation 131.8).

3.43 outdoor

unprotected environment where conditions deleterious to insulation and electrical safety are probable

3.44 performance lighting

lighting equipment for the purpose of lighting the event or activity for the required artistic effect

NOTE Performance lighting is also known as production lighting.

3.45 person responsible

person who takes responsibility for any temporary electrical system(s) used for an event or activity, reporting to the event manager

NOTE 1 The competence of a person responsible needs to be sufficient and suitable for the complexity of the temporary electrical system and event involved.

NOTE 2 Where larger more complex temporary electrical systems are involved, work may be split into manageable parts, each under the control of a person responsible. In this case the person responsible reports to a senior person responsible, who takes overall responsibility of all the temporary electrical systems involved and reports to the event manager.

3.46 power-processing

range of equipment, usually electronic, which is used to smooth, correct or manipulate electrical supplies to the equipment

NOTE This covers equipment such as uninterruptable power supplies (UPS), inverters, dimmers, variable speed motor controllers and switched mode power supplies.

3.47 protective equipotential bonding

electrical connection maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential for the purposes of safety

3.48 protective earth and neutral conductor (PEN)

conductor combining the functions of both protective conductor and neutral conductor

NOTE In the context of this standard a PEN conductor only exists as a conductor of a PME distribution that is part of a distribution network operator's (DNO's) domain. The presence and performance of a PEN conductor as part of a PME distribution can have an effect on the design and use of a temporary system.

3.49 protective multiple earthing (PME)

earthing arrangement, found in TN-C-S systems, in which the supply neutral conductor is used to connect the earthing conductor of an installation within a premises with Earth, in accordance with Electricity Safety Quality and Continuity Regulations 2002 (ESQCR) [4]

NOTE In the context of this standard a PME arrangement only exists as a distribution that is part of a distribution network operator's domain. The presence and/or use of a supply derived from a PME distribution can have a significant effect on the design and use of a temporary system.

3.50 residual current device (RCD)

mechanical 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 (see Annex E)

NOTE An RCD without integral overcurrent protection is defined as an RCCB, and an RCD with integral overcurrent protection as an RCBO.

3.51 safety lighting

lighting provided to ensure the safety of all persons on the site in the absence of adequate illumination

NOTE 1 Part of a safety lighting system classified as emergency lighting can be provided with independent power supplies and wiring to reduce the risk of danger resulting from failure of the main system.

NOTE 2 Provision of sufficient working, safety and emergency lighting is a legal requirement.

3.52 seamless back-up generation

use of two or more compatible generators synchronized together and supplying a load so that the supply to the load is maintained if one of the generators should fail

3.53 services

input to an event provided by hired personnel (see also facilities)

3.54 set-up, setting-up

the process of creating a temporary electrical distribution or system

NOTE Within the industry this may also be referred to as "rigging", "installing", "fit-up", "get-in" or similar expressions.

3.55 single pole connectors

high current connectors where each individual connector carries only one conductor of the circuit

NOTE 1 These are used as connectors for circuit conductors where the current exceeds 125 A. The preferred type is the KSPC, although there are other types known as BAC and CamLok, which are not keyed. These different types of connector are not inter-connectable across types (see also 3.36).

NOTE 2 BAC single pole connectors exist in 150 A and 400 A types. In use BAC connectors are arranged so that the supply-side connector has the appearance of a male contact with an insulating tip that will conform to IPXXB the British Standard finger test. The load-side connector has the appearance of a female contact, which is open and does not conform to IPXXB. BAC connectors have rubber based black outer shells. They may be used in any conductor of a circuit; they need to be marked for circuit duty when incorporated into a temporary distribution. BAC connectors are manufactured to an obsolete standard BS 5550-7.5.4 (see also 7.3.4).

NOTE 3 CamLok single pole connectors are used up to 400A. In use CamLok connectors are arranged so that the supply-side connector has the appearance of a female contact which is open and does not conform to IPXXB the British Standard finger test. The load-side connector has the appearance of a male contact and does not have an insulating tip and does not conform to IPXXB. CamLok connectors have rubber based outer shells that exist in a variety of colours, it cannot be guaranteed that the correct colour for circuit duty will be available; therefore care is needed when using CamLok connectors in a temporary distribution. Some CamLok connectors are used in the UK. Equipment brought into the UK by foreign touring shows often use CamLok single pole connectors, (see also 7.3.4).

3.56 skilled person

individual with relevant training and experience to identify, assess and avoid dangers that electricity can create

- 3.57 supplementary equipotential bonding conductor**
conductor maintaining various exposed-conductive-parts and extraneous-conductive-parts at substantially the same potential.
NOTE In certain situations or places of increased shock risk, supplementary equipotential bonding is required.
- 3.58 supply-side**
part of a connector or system used as a source of electricity
- 3.59 temporary electrical distribution (temporary distribution)**
all switchgear, distribution units, protective devices, cables, connectors and metering equipment, etc. that forms the means of supplying electricity to all parts of an event
NOTE There can be a main distribution and several sub distributions, or several independent distributions provided by separate facilities providers.
- 3.60 temporary electrical system (temporary system)**
all switchgear, generators, distributions units, cabling, connectors, protection, and measuring devices and current-using equipment including mobile and transportable units that are required for an event
NOTE 1 There can be a main system and several subsystems connected, or several independent systems provided by one or more facilities provider.
NOTE 2 Some examples of temporary systems are given in Annex D Figures D.1, D.2 and D.3.
- 3.61 venue**
premises specifically adapted for the hosting of events of all sizes, such as theatres, concert halls, sports stadia, show grounds, exhibition halls, arenas and similar
NOTE May sometimes be referred to as a location or site.

4 Management of an event and supply of equipment for temporary electrical systems

4.1 Management of the event

Every event or activity should have someone with overall responsibility for the management and safe execution of the work necessary to create and run that event or activity.

NOTE 1 Depending upon the nature of the event or activity this person may be a producer, news editor, event manager/organizer, promoter, project manager, production manager or other similar person. This person will be referred to as an event manager for the purposes of this standard.

The event manager should ensure that a person is appointed to accept the overall responsibility for all temporary electrical systems required. This senior person responsible should have sufficient and suitable competence to deal with the size and complexity of the work involved, which can vary considerably.

NOTE 2 No matter what the size or complexity of the work, health and safety legislation applies, particularly the Management of Health and Safety at Work Regulations [2], the Provision and Use of Work Equipment Regulations [3] and the Electricity at Work Regulations [7]. Events bring together many different facilities, services and people to safely function together in an environment that is often owned or occupied by others who may not be directly associated with the event. It is of fundamental importance that the event manager and all persons responsible understand the need for co-operation and co-ordination between all parties associated with the event at the premises involved, in accordance with regulations 11 and 12 of the Management of Health and Safety at Work Regulations [2].

4.2 Outlining the parameters of the event

The event manager should provide an outline of the type, size and aims of the event, where and when it will be held and how it will be managed.

An event might require one or multiple separate temporary electrical systems of varying complexity with more than one electrical environment. The outline should provide this information and also the responsibilities of others working directly with the design, provision, setting-up, or use of distribution or current-using equipment.

The anticipated number of supplies and how they are to be provided, used and managed should be discussed at an early stage with the senior person responsible.

NOTE The complexity increases with the number of electrical environments, each with its electrical supply and associated temporary system supplying the units and facilities related to that sector of the event. In reality the environments will probably overlap each other, the different temporary systems will come close together and earth referenced signal cables may be connected between electrical equipment from different electrical environments. These situations mean that protective bonding between temporary systems and electrical environments will be required. The person responsible for the electrical system should be sufficiently competent to understand and manage its use.

Examples can be found in Annex D, Figure D.1, Figure D.2 and Figure D.3 with the related commentary.

4.3 Responsibility for the temporary electrical system(s)

The senior person responsible should have sufficient and suitable competence to enable them to ensure the safety in all respects of any temporary electrical system in all conditions that can reasonably be predicted to occur.

Where large or multiple temporary electrical systems are involved consideration should be given to splitting the work into manageable units, with each unit having a separate person responsible for the temporary electrical system involved, reporting to the senior person responsible (see 5.1, 5.2, 6.1, 8.1 and 9.2). Each separate person responsible should have sufficient and suitable competence to enable them to ensure the safe use of the temporary system(s) they are responsible for.

Every person responsible should know and understand the requirements of the event or activity and the extent of their own responsibility. (See also Clause 5 and 6.1.)

NOTE 1 The small/simple form of temporary electrical system typically is supplied from a single installed electrical system using 13, 15 or 16A connectors where the total power used does not exceed 6 kVA.

NOTE 2 The large/complex forms of temporary electrical systems include all those that do not clearly fall within that described in 4.3, Note 1. More than 6 kVA of power can be:

- *obtained from one or more installed sources and/or generators,*
- *used in complex ways, including supplying mobile or transportable units,*
- *used at locations that involve other electrical environments,*
- *used in association with various permanent or temporary structures,*
- *used by or in the presence of artists, crew members, audience, guests or the public in varying numbers.*

The range of large/complex work is considerable and might involve one or more interrelated electrical systems and multiple separate temporary systems. The work can involve a significant number of electrical crews and crew members. There can also be issues related to the location, environment, weather, or other people who might be affected by the use of electricity (see Clause 6).

4.4 Early planning

Early in the planning of the event the following should be discussed and agreed between the event manager and the senior person responsible (see 5.2, 5.3, 6.1, 6.2, 6.4 and 6.5).

- a) The arrangements for procuring equipment.
- b) The arrangements for providing any crew required.
- c) The amount of power required and how it will be obtained.

4.5 Provision of equipment

Equipment provided should be in the form of tested complete stock items that can be plugged together at the location to form the temporary electrical system required.

NOTE 1 The equipment provided can be owned by a person or organization employed on the event or by one or more others who will supply the equipment under a hire agreement or contract for use at the event. The supplier of the equipment might also provide specialist labour to set-up and operate the equipment. Such labour needs to be suitably competent for the work involved, whether they are permanently employed or freelance.

Equipment should be provided in a safe and serviceable condition and within a valid period having passed a formal inspection and test. Evidence of this should be provided by a suitable "tested" label applied to the equipment or by printed or electronic certificate clearly referring to the equipment concerned. These methods should include relevant dates that show the period of validity. Equipment should be provided suitable for use in the manner for which it was designed.

Mobile and transportable units with low voltage electrical systems should be supplied with appropriate certificates of inspection and test of their installed systems.

The name of the owner or supplier should be shown on the equipment.

NOTE 2 The supplier of equipment needs to understand the importance of ensuring the equipment they supply is in a safe and serviceable condition and that evidence of this is provided. It is important for the supplier to recognize the implications on all temporary systems that are set-up and used if this duty is not met.

5 Small/simple events and activities requiring up to 6 kVA

5.1 General

NOTE 1 The following processes are applicable to small/simple events and activities that have temporary electrical systems using a maximum of 6 kVA from single phase supplies. The supply will typically be obtained from an installed source using 13 A, 15 A or 16 A connectors.

Events and activities requiring small/simple temporary electrical systems involve a small number of people and the conditions in the vicinity of the location should not impose complications on the management of the temporary electrical system.

Where practicable, Class II insulated equipment should be used to reduce the risk of electrical shock.

NOTE 2 Examples of simple activities include: small photographic shoots, small TV interviews and documentary work, radio carry-ins, temporary locally set-up editing facilities, small conferences, small theatrical performances and similar.

NOTE 3 It is possible that certain separate parts of a larger event might fall within the scope of a simple activity covered by Clause 5, in which case the person responsible would be directed by the senior person responsible for all the temporary electrical systems of the larger event.

5.2 Person responsible

The person responsible for the small/simple temporary electrical system should have sufficient and suitable competence to manage the system involved. If the work is outside their known competence they should state this and not accept the work.

The person responsible should understand their responsibilities and have the following information.

- a) The date, time and location of the event.
- b) Details of local and environmental conditions that might be encountered.
- c) The number of people involved or affected by the electrical system, including artistes, crew, public, etc.
- d) Where electrical supplies are to be obtained from.
- e) How much equipment is needed and how it will be procured.

The person responsible should understand that a site survey might be necessary and that a risk assessment is required.

In the event of a problem arising with the temporary electrical system or the installed electrical system at a location, the person responsible should have quick and effective access to assistance from an electrically skilled person who has sufficient and suitable competence to deal with the problem (see Clause 4 and 5.1, Note 3).

5.3 Planning the small/simple temporary electrical system

While planning the system, a diagram to show how it is set-up should be prepared and the equipment required should be listed, which will help in determining exactly what is needed, the power required and the ease with which the system can be looked after or changed.

With a clear idea of what is required the following should be carried out.

- a) Prior agreement should be sought on whether the owners or occupiers of the location are prepared to supply the power required. In the cases where the owners or occupier supply electricity, agreements should be reached to determine which of their sockets and other electrical equipment will be used. Owners or occupiers can insist that evidence is provided that the temporary electrical system being set-up is safe and suitable. All relevant test information along with a diagram of the temporary system should be made available at all times.

NOTE It is advisable to agree with the location owner or occupier the state in which the installed electrical system is to be left upon completion of the event.

- b) Ascertain what electrical equipment is currently in use at the location. Ensure there is not any unwanted interaction between the temporary system and the permanently installed equipment and that one will not compromise the operation of the other in any way.
- c) Check that the source of supply is safe and suitable to use; this should include as a minimum a visual inspection of the socket outlets to be used, a polarity check and an assessment of earth fault loop impedance. If the source fails the visual inspection, polarity or earth loop impedance checks, it should not be used.

NOTE There are plug-in devices commercially available that check polarity and earth fault loop impedance (see G.1 and G.2).

5.4 Risk assessments

Risk assessments relating to the particular use of electricity for the event should be undertaken by the person responsible for the temporary electrical system. These should then be given to the event manager at a sufficiently early time to allow any risks that have been identified to be resolved, either by removing the risk or ensuring that it is minimized and controlled.

Risks should be constantly monitored, re-assessed and acted upon as the event or activity develops.

5.5 Supplying and checking equipment

The suppliers of equipment should ensure it is supplied in a safe and serviceable condition (see 4.5).

The person responsible for the temporary electrical system should ensure that the equipment selected for use:

- a) has evidence of being within a valid period after passing a formal inspection and test;
- b) is safe, serviceable and suitable for the purpose and conditions that exist;
- c) is visually inspected for damage before use.

Equipment failing any of these checks should not be used.

5.6 Setting-up a small/simple temporary electrical system

Every temporary distribution should be protected by an RCD with a rated residual operating current ($I_{\Delta n}$) not exceeding 30 mA and an operating time not exceeding 40 ms at a residual current of $5I_{\Delta n}$, which should be placed at the socket providing the supply so that all circuits supplied from this source are protected.

The test or "T" button on the RCD should be pressed with the electricity supply switched on. The RCD should operate and switch off the supply. If the RCD does not operate it should be removed and replaced with a correctly functioning device.

When the temporary distribution has been set-up, the following checks should be carried out (see G.1 and G.2).

- a) Each circuit has been set-up as planned.
- b) Each socket outlet of the temporary distribution has correct polarity and acceptable earth fault loop impedance.
- c) The equipment that requires a supply has been connected and switched on one at a time.
- d) The connected equipment is functioning correctly.
- e) Any instructions have been given to those who will be using the temporary electrical system or are affected by its use.

The event or activity should only proceed when the temporary electrical system has passed all the required checks and is confirmed as safe for use. Any equipment found to be faulty at inspection or during use should be removed from service and labelled as faulty with an indication of the problem.

If at any time the installed electrical supply fails or in some way shows that it is unsafe or not suitable for use, work should be stopped and the conditions re-assessed. If there are indications that the system is unsafe for use, the advice of a suitably skilled person should be sought (see 5.10).

5.7 Changes to the system

If changes to the temporary electrical system are required, the relevant circuits should be isolated and the following actions should be carried out.

- a) Disconnect the parts of the distribution where changes are to be made.
- b) Visually inspect any new equipment needed prior to connection.
- c) Re-assess the risks and apply corrective actions, if required.
- d) Set-up in the new arrangement.
- e) Check it is safe to reconnect the temporary electrical system to the supply.
- f) Power should be restored and the system confirmed as functioning correctly before work is resumed.

5.8 Leaving the system unattended

5.8.1 General

If at any time the temporary electrical system is to be left unattended, the supply should be switched off and the system secured against use by unauthorized persons. The system should be re-checked to ensure that it is safe before re-energizing.

5.8.2 Person responsible leaving the system

If the person responsible for the temporary electrical system leaves the location whilst the system is still in use or energized then a suitable deputy should be appointed. The deputy should have sufficient and suitable competence to control the use of the system in the form that it is in. It is advisable that the appointed deputy is able to contact the person responsible in case of need.

5.9 Removing the system

When the event or activity has been completed, the temporary electrical system should be dismantled in a safe manner. Equipment should be packed for return to the supplier and any faulty equipment should be labelled and notified to the supplier.

5.10 Problems with the installed electrical system

If the installed electrical system at a location has been found to be unsafe, the owners or occupiers should be made aware of the problem and a recommendation made that their electrical system be inspected by a suitably competent person.

If there are electrical problems with the installed system at the location caused by the people and work associated with the event, then appropriate correction of these should be agreed. The person responsible for the temporary electrical system should arrange for the problems to be investigated by a suitably competent person and an agreed arrangement for correction of the problems put into action [see 5.3a)].

6 Large/complex events and activities requiring in excess of 6 kVA

6.1 Responsibility

6.1.1 Person responsible

NOTE 1 A senior person responsible might take responsibility for all the temporary electrical systems, or the size and complexity of the event might require the work to be split into smaller units, with a separate person taking responsibility for each unit and answering to the senior person responsible (see 4.3).

Any person taking responsibility for large/complex temporary electrical systems should be trained and experienced in all aspects of the control and use of temporary electrical systems and competent to perform the work required (see Clause 4 and 9.2).

NOTE 2 People responsible for temporary electrical systems might be Crew Chiefs, Chief Electricians, Gaffers, Best Boys, Production Electricians, Engineering Managers, Sound Supervisors, Unit Managers, Communications Engineers, Project Managers, Site Managers, Technical Managers, Lighting Directors, Lighting Designers or Directors of Photography.

If the size and complexity of an event requires the work to be split into smaller units, a senior person responsible should be appointed.

The senior person responsible should have the skills to manage and control the crew and all aspects of the work they undertake. The role should include responsibility for all people and equipment involved and any affect that the temporary electrical system(s) might have on others. Any person taking responsibility for large/complex temporary electrical systems should know and understand the following.

- a) The extent of the work under their control and its requirements, including a site survey where necessary.
- b) The responsibilities that the particular role carries.
- c) The number of people involved with or affected by the temporary electrical system, including artistes, crew or public.
- d) The competence of those under their control.
- e) The amount of power required and how the supply is to be obtained.
- f) The electrical issues that might affect any mobile or transportable units with installed electrical systems.
- g) The equipment needed and how it will be provided.

6.1.2 Allocation of responsibility

Where a temporary electrical system(s) is split into smaller parts, the senior person responsible should ensure that the design, provision, distribution, co-ordination and control of the system at the location are assigned to suitably competent people.

All parties should agree on the allocation of responsibilities.

A person should not accept any duty they know to be outside of their competence.

The senior person responsible, any separate person responsible and the event manager should agree which of the following are included as part of their duties.

- a) Retaining any records, drawings, agreements, etc. that might be needed for the temporary electrical system.
- b) Arranging for the electrical supplies required.
- c) Checking the safety and suitability of the electrical supplies.
- d) Designing the temporary electrical system(s) involved.
- e) Selecting and obtaining the equipment required.
- f) Ensuring the equipment required is safe and fit for purpose.
- g) Assessing and controlling the risks throughout the event and providing risk assessments as required.
- h) Setting-up and testing the temporary electrical systems.
- i) Controlling the operation of the system and any changes that might be needed.
- j) Removing the temporary electrical system(s) and restoring the location to a condition that was agreed with the owners or occupiers before the event or activity.

6.1.3 Principle responsibilities

6.1.3.1 General

The following principle responsibilities should be undertaken either separately or in combination.

6.1.3.2 System design

Designing large/complex temporary electrical systems should include:

- a) analysis of the production requirements;
- b) investigation and assessment of expected site conditions;
- c) consideration of the electrical characteristics of the supply;
- d) consultation with relevant authorities and experts;
- e) calculation of electrical details to ensure safety and suitability;
- f) calculation of weight and loading details for structural design and erection purposes;
- g) provision of lists of equipment required;
- h) specification of non-standard set-up procedures;
- i) specification of system tests, test methods and limiting parameters;
- j) guidance on foreseeable emergency procedures.

6.1.3.3 Site work

Site work should include:

- a) assessment of actual site conditions;
- b) understanding the design specifications and special requirements;
- c) liaison with other parties on site;

- d) provision of supplies for the set-up process [see also 6.1.3.6b) Note];
- e) proper application of standard erection procedures;
- f) provision of satisfactory workmanship;
- g) co-operation with persons responsible for testing and operating the temporary electrical system.

6.1.3.4 Testing and certification

The testing procedure for large/complex temporary electrical systems should include:

- a) standard electrical safety checks;
- b) special safety checks required by the design specification;
- c) recording of test results and evaluation of safety implications;
- d) initiating any remedial action required;
- e) provision of appropriate written certification that the system is safe for use.

6.1.3.5 Operation

The operation of a large/complex temporary electrical system should include:

- a) energizing and controlling the system to the event requirements within the design limitations;
- b) provision of competent staff to keep the temporary system in good condition;
- c) prevention of tampering and damage to the temporary system, by performers, other technical and non-technical personnel, and members of the public;
- d) dealing with unforeseen production requirements safely;
- e) dealing with emergencies;
- f) ensuring that temporary electrical systems remain safe when not in active use, whether energized or not.

6.1.3.6 Removal of equipment

The safe removal of equipment should include:

- a) co-operation with others to produce a work plan;
- b) provision of supplies required for the removal processes;

NOTE It is recommended that a separate temporary distribution is planned in advance for facilities that need to be energized during the set-up and removal.

- c) de-energizing and isolating the temporary system, or parts of the system, as close as possible to the origin of the supply, when no longer required and with reference to the pre-arranged work plan, taking precautions to ensure that isolated sections are not subsequently reconnected;
- d) notifying when subcircuits are isolated so that disconnection and removal can proceed;

- e) safe disconnection and removal of all temporary cables and switchgear, etc., from the site;
- f) inspection of equipment that is to be re-used, under the same agreement, at another site without return to the supplier;
- g) setting aside and marking suspect or faulty equipment for repair and retesting;
- h) restoration of all alterations and modifications to the location to an agreed standard;
- i) notifying the location owner or occupier that the site and all permanent installations have been left safe.

6.2 Electrical supply

6.2.1 Supplies required

NOTE Supply can be obtained by connection to an installed supply at a location, from a generator or from a Distribution Network Operator (DNO).

Electrical requirements as outlined in BS 7671, Regulations **132.2** and **313.1** should be discussed and agreed between the senior person responsible, the event manager and the supply providers early in the planning.

The supply requirements should include the following details.

- a) Maximum demand in kVA.
- b) Number of phases, current per phase, power factor and harmonic content.
- c) Earthing arrangements of all supplies that might be used for the event, or be involved with the event via earth referenced signal cables, or the planned or casual interconnection of protective conductors.

NOTE It is important to know whether the supplies to be used are TN-S, TN-C-S, or TT and whether the main earthing terminal at a location is connected to earth rods, tapes, mats or conductive structural reinforcement forming the foundations. This information might affect the design and operation of the temporary system (see Annex C).

- d) Seamless back-up requirements where generators are used.
- e) Earthing arrangements for generators (see Annex C).
- f) Overload and residual current protection at the supply.
- g) Prospective short circuit current rating.
- h) Earth fault loop impedance at the supply terminals.
- i) Connection and disconnection dates.
- j) Metering, tariff or charges.
- k) Most suitable positions for connection to the supply.
- l) Method of connecting the temporary electrical system to the supply.
- m) Responsibility and procedure for safe connection; operation and disconnection.

- n) Precautions to be taken by the users and/or the suppliers.
- o) Maintenance and standby arrangements.
- p) The possibility of the temporary electrical system extending into other electrical environments.
- q) Mechanical protection of temporary connections.
- r) The existence of any hazardous environments.

The results of these agreements should be recorded and provided for those designing, setting-up, testing and operating the temporary electrical system.

6.2.2 Electrical supplies from installed sources

NOTE Many venues such as exhibition halls, sports stadia, theatres, and similar premises have permanent connection points to supply electricity for temporary systems as part of the offered facilities.

If a venue plans to provide permanent connection points to electrical supplies for a temporary electrical system(s) the supply should be arranged in a convenient manner to enable the connection of temporary distributions (see Annex F for details).

6.3 Risk assessments

The person responsible for the temporary electrical system should prepare a risk assessment, to be given to the event manager, which covers the provision, setting-up, operation and removal of the system. The results of the risk assessment should be communicated to all relevant people and incorporated into the planning and design of the temporary electrical system.

All significant hazards related to the temporary electrical system and its use should be considered, including the following.

- a) Weather conditions, including the possibility of lightning.
- b) The effects that lighting might have on nearby transport routes.
- c) Time of day.
- d) The presence of the general public, including children, people with special needs, or animals.
- e) Hazardous environments, such as mines, petroleum installations, processes producing flammable dust or explosive materials (see 8.12).
- f) The presence of overhead or underground power cables or other utilities.
- g) The presence of water.
- h) The length of time the temporary electrical system is needed.
- i) Possible mutual EMI effects between the temporary electrical system and any permanent electrical installations.

There should be a continuous assessment of risks that may occur or change as the event develops. Any hazards should be removed or minimized and controlled and the event manager kept informed.

6.4 Equipment

6.4.1 General

Equipment should be delivered to the location in a safe and serviceable condition with evidence of valid formal inspection and test. The person responsible should ensure this evidence is checked before the equipment is used (see 4.5, 8.4 and 9.4).

6.4.2 Specialist equipment

Where specialist equipment is accompanied by a technician, operator or crew, they should be fully advised of their responsibilities in relation to the temporary electrical system and their duties within the event as a whole.

6.4.3 Specific electrical requirements

Where equipment with unusual or specific electrical characteristics is used, the requirements of the equipment and its supplies should be discussed with the equipment providers prior to the design of any temporary system.

NOTE Such equipment can include variable speed lifting equipment, high power discharge lighting, mobile or transportable units and broadcast technical vehicles. BS 7671, Section 717 deals with aspects of mobile and transportable units.

6.5 Crew

Regardless of the process used for selecting crew to staff the temporary electrical system, details of the work involved should be discussed and agreed between the event manager, senior person responsible and person(s) responsible where applicable.

Crew members might have varying skills and experience, so the person responsible should fully consider the competence and suitability of potential crew members before accepting them.

7 Design and instructions for setting-up temporary electrical systems

7.1 Design

7.1.1 General

The design of each temporary electrical system should meet the requirements of the event and take account of the supplies to be used and the conditions present at the location, including physical and environmental conditions and potentially hazardous sites. Account should be taken of the guidance given in other parts of this standard.

The person designing the temporary electrical system should ensure all requirements are properly met and recorded. The design details and any special requirements including tests should be provided to the person responsible for the temporary electrical system.

The temporary electrical distribution should conform to the relevant requirements of BS 7671. The equipment forming the temporary distribution should conform to Annex A and be selected, taking account of the features given in Annex B.

Effective site communications should be considered as a part of the planning and design process.

7.1.2 Principles of the temporary distribution

The conductors used in all parts of the temporary distribution including those within ISUs, CC, FDUs, and similar distribution or control units should be arranged so that the conductors forming Line, Neutral and CPC at any particular circuit position all have the same cross-sectional area.

NOTE 1 This allows standard flexible cables and connectors to be used and the various distribution units that might be designed and built for use in temporary distributions to have a consistent and predictable current rating. The use of undersized or oversized conductors at any particular circuit position removes this consistency and understanding.

Wherever three-phase and neutral overcurrent protective devices are used they should be four-pole devices interlocked so that all poles open together. There should be overcurrent sensing on all four conductors.

NOTE 2 This is to take account of the probability that there will be a neutral current that is greater than any phase current due to harmonics and lack of phase balance in temporary distributions covered in this standard.

7.2 Electrical supplies

7.2.1 Source of supply

Any permanently installed system used as a source of supply should conform to BS 7671. The earthing arrangements of the supply should be identified so that the design can take account of any particular requirements that might be necessary (see Annex C). Evidence of the most recent formal inspection and test of the permanently installed system should be made available and checked by the person responsible.

A means of isolation controlled by the person responsible should be provided as close to the point of supply as practicable. For most temporary distributions the first isolation unit will be an intake switch unit (ISU). The protective measures at the source of supply and the rating of the cabling to the ISU should be compatible and conform to BS 7671.

NOTE For further information on RCDs at the source of supply see 7.6 and Annex E.

If the source of supply does not have suitable overcurrent protection for the cable feeding the first ISU then the ISU should be positioned so that the length of this cable does not exceed 3 m. Where suitable protection is provided, longer runs of cable may be used. The design should take these factors into account (see 8.8.2).

If low voltage supplies other than 230/400 V or 50 Hz are required they should be supplied by a transformer or separate generator. Any intended departure from this standard requires special consideration by the designer and should be noted in the completion certificates. The resulting degree of safety of the temporary system should not be less than that obtained by compliance with this standard (see Annex G).

7.2.2 Generators as a source of supply

NOTE 1 Mobile or static generators can be used if a permanent electrical installation is inadequate or unavailable, or if there are operational advantages to run from an independent electrical supply.

Generators can be used to supply all or part of the power required and are available at 230 V single-phase or 400 V three-phase and neutral operating at 50 Hz. If operation outside these parameters is required, this should be discussed with the generator supplier.

NOTE 2 For a large/complex temporary electrical system, or where a seamless back-up is required, two or more generators can be paralleled through suitable synchronizing and protective switchgear. In special circumstances, interconnection with the public or a private network can be arranged. This requires specific discussion and agreement with the DNO about the requirements of ESQCR [4].

Where a generator is used, careful consideration should be given to the way the supply is earthed (see 7.4.2 and Annex C).

7.2.3 Responsibility for connection to a supply

NOTE 1 Connection to the source of supply can be via suitable connectors of the appropriate rating, cables terminated at a switched fuse, or directly to busbars (see also 7.3.4.2, 7.3.4.3 and 7.3.4.4).

Agreement should be reached between the owner of the source of supply and the person responsible for the temporary electrical system as to who will make the connection and any tests that are required for the temporary system before connection.

NOTE 2 The event as a whole can have more than one connection to a permanently installed source or connections to two or more different installed sources or generators or any combination of these.

Line or neutral conductors from different supplies should not be interconnected. Specific care should be taken when considering interconnection between CPCs from different supplies or earth referenced signal cables between equipment fed from different supplies (see 7.4, Annex C and Annex D).

Connection to exposed conductors should only be carried out with the circuit disconnected from the source of supply and secured so that it cannot be accidentally re-energized.

7.3 Cables and connectors

7.3.1 General

All cables for temporary distributions should be terminated with connectors of rating equivalent to that of the cable (see 7.3.4.2, Note 2). At no point should it be possible for a circuit protective device to be of

a higher rating than the cable, connectors or equipment it is intended to protect.

Where connections to a switched fuse are required, open-tails can be used if correctly terminated in an appropriate connector to supply the distribution that will follow. In this case the open-tails should be correctly coloured and bear correct alpha numeric markings to reduce the chance of misconnection to the source of supply.

The cables used for temporary distributions should always have the neutral and protective conductors of the same cross-sectional area as each of the line conductors. The rating of conductors and all controlling devices should take account of the imposed loads and the high possibility of 100% out of balance in multi-phase distributions. Current-using equipment can produce harmonics that cause the neutral current in three phase distributions to exceed the line current.

The design of the temporary distribution and selection of cable ratings should take account of environmental conditions and any grouping or routing of cables that can give rise to an excessive increase in temperature of the conductors. Where single pole connectors and cables are used, the running of such cables should ensure that they are kept close together to minimize EMI effects (see 8.8.1).

7.3.2 Identification of conductors and single pole connectors

Conductors and single pole connectors should be clearly marked and coloured according to Table 1 as appropriate.

Single pole connectors should be keyed according to purpose so the chance of misconnection is removed. If the single pole connectors do not have a keyed index they should be clearly marked and coloured (see 7.3.4).

Care should be taken to ensure the correct connection of open-tails to terminals at a switched fuse or busbars as these could show outdated colours. The comparison of old colours to new colours is shown in Table 1.

The coding or colouring for the temporary distributions should be in accordance with BS 7671, Table 51.

Table 1 Marking of conductors and single pole connectors

	Earth	Neutral	Line 1	Line 2	Line 3
Alpha-numeric mark	E	N	L1	L2	L3
Before March 31st 2006	Green/Yellow	Black	Red	Yellow	Blue
After March 31st 2006	Green/Yellow	Blue	Brown	Black	Grey

Colours alone should not be used on cables to denote ownership, as they are easily confused with circuit function. Ownership should be shown using text or symbols.

7.3.3 Cables

All cables for the temporary distribution should be multicore except for circuits above 125 A where single core cables are usually provided for portability.

Cables should be flexible and of suitable conductor size and mechanical strength for their intended duty. Cables for indoor use should be PVC or rubber sheathed as specified in BS 6500 or equivalent, with a minimum voltage designation of 300/500 V (ordinary duty flexible as a minimum, as defined in BS 7540-1). Cables for outdoor use should be rubber insulated and sheathed as specified in BS 7919 (H07RN-F or equivalent), with a minimum voltage designation of 450/750 V (heavy duty flexible as a minimum, as defined in BS 7540-1) and resistant to abrasion and water.

All multi-core cables used for temporary distribution should have line, neutral and CPC conductors present and correctly terminated throughout the entire distribution.

Cables of different ratings should only be connected through a distribution unit providing suitable overcurrent protection for all cables.

NOTE Cables with armour protection are not usually necessary.

Identification of conductors should comply with BS 7671, Table 51.

Any cables liable to come into contact with high temperature luminaires should conform to BS 4533-102.17.

7.3.4 Connectors

7.3.4.1 General

With the exception of connecting open-tails to a source of supply, all temporary electrical connections on site should be made using plugs, sockets and cable couplers that conform to British or international standards appropriate for the current and voltage and actual site conditions. Preferred standards are listed in Table 2.

Pin connections should conform to international, national or industry standards.

Connectors not approved to another specific type standard should conform to BS EN 61984.

Plugs, sockets and connectors conforming to BS EN 60309-2 should be used in accordance with the recognized voltage colour code and mandatory keyway positions.

The choice of connectors for any use should not permit the interconnection of circuits that are not compatible. Care should be exercised with connectors brought into the UK by touring shows and productions from other countries, as the detail circuit functions of these can be different to those used in the UK.