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Electrical installations for open-cast mines and quarries —

Part 3: Recommendations for equipment and ancillaries

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Committees responsible for this British Standard

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Associated Offices Technical Committee
British Coal
China Clay Association
Electric Cable Makers' Confederation
Electrical Contractors' Association
Engineering Equipment and Materials Users' Association
Federation of Civil Engineering Contractors
Federation of Manufacturers of Construction Equipment and Cranes
Health and Safety Executive
Independent Engineering Insurers' Committee
Institution of Mining and Metallurgy

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Contents

Foreword

This Part of BS 6907 has been prepared under the direction of the Mining and Quarrying Requisites Standards Committee. BS 6907 is based on the International Electrotechnical Commission's publication IEC 621 "*Electrical installations for outdoor sites under heavy conditions (including open-cast mines and quarries)*" and, like that publication, is published in Parts as follows.

— *Part 1: Glossary;*

— *Part 2: General recommendations for protection against direct contact and electric shock;*

— *Part 3: Recommendations for equipment and ancillaries;*

— *Part 4: Recommendations for winning, stacking and processing machinery, pumps and low signal level and communications systems;*

— *Part 5: Recommendations for operation.*

BS 6907 sets out the guiding principles for the installation and operation of electrical equipment so as to ensure safety of persons, livestock, property and proper functioning of the plant.

It applies to the installation and operation of electrical apparatus and systems associated with outdoor sites under heavy conditions, including open-cast mines, quarries, stockpiles, etc. It applies particularly to electrical apparatus and systems used for the following:

a) winning, stacking and primary processing machinery;

b) secondary processing machinery;

c) conveyor systems;

d) pumping and water supply systems;

e) movable railway systems;

f) control, signal, supervisory and communication systems.

BS 6907 does not cover temporary and provisional places of work in the open, such as building sites and earth-moving sites, unless the equipment used is similar to that used in surface mining applications.

It takes account of British practice, electrical regulations and law and thereby differs in several respects from the IEC publication. Both cover a subject not previously the subject of an international standard or a British Standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 6907 gives recommendations for good practice for the safe and efficient installation and use of electrical equipment and ancillaries.

For winning, stacking and processing machinery, pumps and low signal level and communications systems, exemptions from these recommendations and supplementary recommendations are given in BS 6907-4, which should, therefore, be read in conjunction with this Part.

NOTE 1 A glossary of terms used in this standard is given in BS 6907-1.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 General

2.1 Design and selection

Design and selection of apparatus or equipment should be on the basis of expected loading, operating characteristics and cyclic duty taking into consideration the protection required in special and arduous environmental, operational, transportation and storage conditions including:

- high altitude;
- low and/or high ambient temperature;
- supply voltage variations;
- supply frequency variations;
- insecure power supply and transients;
- high or low humidity;
- environment (dust, wind pressure, marine atmosphere, etc.);
- flammable and/or explosive materials and/or atmosphere;
- vermin, including rodents or other small animals;
- localities prone to natural catastrophes;
- ecological impact.

In order to ensure that correct design parameters are selected, mutual agreement should be reached between the user and the supplier as to the quantitative and/or qualitative conditions.

2.2 Relevant standards

All electrical apparatus or equipment should be in accordance with the relevant British Standards.

2.3 Materials

Materials used in the construction of apparatus or equipment should be appropriate for the operational conditions, including temperature, altitude, moisture, etc.

2.4 Protection

Protection should be provided against damage, explosion, and/or over-heating during normal operation and expected fault conditions.

2.5 Operating conditions

Apparatus or equipment should be designed to meet such conditions as vibration, acceleration, deceleration, slewing and angles of inclination (tilting and mounting) which may occur under expected operational conditions.

2.6 Site conditions

Apparatus or equipment should be installed so that design features such as cooling systems are not impaired by external factors such as position, blocking of ventilation ducts, hostile environment, etc.

2.7 Earth terminal

An earth terminal should be provided on all enclosures of apparatus and equipment operating at a voltage in excess of extra low voltage.

NOTE See the IEE Regulations for the definition of extra low voltage.

2.8 Noise limitations

Consideration should be given in the design to limit the emission of noise.

2.9 Pollution by cooling medium (coolant)

Adequate precautions should be provided to prevent spillage of the cooling medium causing pollution of the environment, for example, groundwater storages, harbours, waterways, soil, etc.

Where equipment with a flame-retardant cooling medium is used, the installation should be so arranged as to inhibit the possible atmospheric contamination and noxious effects of the cooling medium.

3 Rotating machines

3.1 Mechanical construction

Rotating machines used in applications where high acceleration, overspeed, reversing or braking may be employed should be designed and constructed so as to withstand expected stresses that may occur to parts such as rotor windings or cages, stators, stator end windings, shafts and couplings.

3.2 Mechanical protection

Rotating machines should be so constructed and guarded as to prevent contact with moving parts.

4 Transformers

4.1 Transformers subject to movement or vibration

The core, coils, internal leads and enclosure should be adequately braced for arduous operating conditions (see **2.1**).

4.2 Enclosures

Transformers should preferably be totally enclosed.

All liquid-filled transformers should have a pressure relief valve. Any breather or pressure relief device should be fitted in such a way as to minimize degradation of the cooling medium (coolant) through condensation, or ingress of moisture.

4.3 Dust exclusion

Transformers of the dry type, including their cooling system, should be protected against the harmful ingress of dust.

4.4 Protection from fire

Where fire hazards to personnel or plant structure exist, the use of dry type transformers or those employing a non-toxic flame retardant cooling medium are recommended. Where a flammable cooling medium is used, adequate catchment facilities and safe means of egress should be provided.

5 Static converters

5.1 Over-voltage limitation

Where static converters are used, precautions should be taken to protect against harmful effects of over-voltage and transient over-voltage conditions.

5.2 Interference with communication and control systems

Protective or control measures should be taken to restrict the effect of electrical energy that may cause interference to communication and/or electrical control equipment.

Cognizance should be taken of standards for radio-frequency suppression and permissible harmonic currents.

5.3 Electrical coupling

The converter installation should include, where necessary, appropriate means to prevent spurious operation due to electrical coupling (e.g. resistive, inductive or capacitive) with other apparatus.

5.4 Protection against interaction between earthing systems

The converter installation should include, where necessary, appropriate means to prevent interaction between the earthing systems of the input, output and control circuits.

5.5 Limitation of harmonics

The acceptable level of harmonic generation should be arrived at in consultation with the equipment manufacturer and the supply authority.

6 Switching devices

6.1 Prevention of unintentional operation

Switching devices should be designed, constructed and installed in such a way that no unintentional switching may be caused under expected operational and risk conditions.

6.2 Isolators

Isolators should be provided with suitable means to enable them to be locked in the isolated or earthed position.

6.3 Interrupting capability

Switching devices which are not suitable for interrupting load or fault currents should be interlocked with a suitable interrupting device for that circuit and be fitted with a warning label.

6.4 Personnel protection

Switching devices should be designed, constructed and installed so as to prevent electrical and mechanical hazards to personnel.

7 Cable selection and application

7.1 Phase conductors

Selection of phase conductor size should take into consideration the expected load current, short-circuit current and duration of fault, voltage drop and the mechanical strength required for the expected method of handling. The voltage drop should be calculated for both starting and maximum load conditions. Where supplying a cyclic load, the current-carrying capacity of the phase conductors may be based on the equivalent r.m.s. value of the cyclic load, other conditions permitting.

7.2 Protective conductor

All multicore cables of the movable distribution, drum and trailing types should contain a protective conductor. In high-voltage systems, it is essential that special measures be taken to guard against deterioration of the earthing circuit. This may be achieved by either:

a) monitoring the protective conductor against increase in resistance by the use of pilot cores, high-frequency monitoring or other means; or

b) using specially designed cables in accordance with **9.3**, whether or not they are used on a drum.

The protective conductor may be in the form of core(s) and/or screen(s).

For certain classes of movable distribution cables, the armouring may, subject to **7.3**, form the protective conductor.

7.3 Armouring as protective conductor

Where the cross-sectional area of a single composite strand of the armouring is greater than 6 mm^2, the metallic armouring of a movable distribution cable may be used as a protective conductor provided that the security against breakage of the armouring (taking into account strength, elongation, lay, etc.) is at least equal to that of all the conductors; and provided that the armour conductivity is at least equal to that of a protective conductor of the required nominal cross-sectional area which would otherwise be required.

7.4 Limiting temperatures under short-circuit

Cables should be selected so as to ensure that the maximum allowable conductor temperature, considering the type of insulation, is not exceeded under expected short-circuit fault conditions (see **15.3.2** of BS 6907-2:1988).

7.5 Semiconducting layers

Where cables are fitted with substantial longitudinal semiconducting layers for the purpose of providing a current path to the protective conductor in the event of a fault, the resistance between the semiconducting element and the protective conductor should be tested to ensure that it is suitable to carry the prospective fault current.

7.6 Provision of screens and/or armouring for cables above 1 000 V

Where flexible cables are handled manually while energized, they should have metallic screens and/or armouring or should be provided with conducting elastomeric screens of substantial cross-sectional area and so placed as to limit the touch and step voltages, that may arise in the event of a cable fault.

In cases where cables are handled only by means of special insulated tools, these recommendations will apply only for voltages above 4 000 V.

7.7 Identification of protective conductor

7.7.1 For cables rated up to and including 1 000 V, in which the protective conductor is insulated, such insulation, or outer taping, should be distinctly and indelibly coloured green and yellow over its whole length so that in any 15 mm length one of these colours should cover at least 30 % and not more than 70 % of the surface, the other colour covering the remainder of the surface.

7.7.2 For cables rated at above 1 000 V, in which the protective conductor is insulated, such insulation or outer taping should at least be identified at each end by the green/yellow colour combination applied in accordance with **7.7.1**.

NOTE Suitable supplementary identification may also be used.

7.8 Terminations of flexible cables

Flexible cables should be installed in such a manner that all forms of mechanical stress are avoided at the conductor termination and gland arrangements.

7.9 Power cable twist limitation

7.9.1 Flexible cables are generally not designed to be twisted about their longitudinal axes, therefore, in installations where it is not possible to avoid such twisting, the design of the flexible cable and its installation should be discussed with the manufacturers of the cable.

7.9.2 For project design purposes the following may be adopted.

Where the normal mode of operation of the machine requires infrequent rotation through an arc of up to 360° in either direction, the distance between the clamping supports of the cable should be not less than 50 times the largest cable diameter in the cable run.

Where the normal mode of operation of the machine requires frequent rotation through an arc of up to 360° in either direction, the distance between the clamping supports of the cable should be not less than 100 times the largest cable diameter in the cable run.

NOTE Where cables designed specially for twist limitation are used, the above ratios may be reduced to 25 times and 50 times respectively.

7.10 Sheathing

Cables may be laid directly on or in the ground provided that the outer sheath is designed for the operating conditions.

Cables having extruded metallic sheaths, for example, cables with lead alloy or aluminium sheaths or mineral-insulated metal-sheathed cables, should not be used where fatigue may occur due to vibration, frequent handling or ground movement.

7.11 Segregation of power and control cores

7.11.1 *Single-core cables.* Single-core cables which are installed in a common duct, conduit or sleeving may be used for several circuits, both power and control (see also **7.12**).

All such cables (except bare earthing conductors) should be insulated for the maximum voltage applied to any cable in the duct, conduit or sleeving unless otherwise permitted by relevant standards.

When using single-core cables for alternating current circuits, all conductors of a given circuit should follow the same route and should be run touching each other wherever possible, so as to minimize inductive effects.

7.11.2 *Multicore cables*. For voltages up to and including 1 000 V, multicore cables may be used for several circuits, both power and control.

For voltages above 1 000 V, the only control core(s) which may be included in a multicore cable should be earth continuity check pilot.

Multicore cables containing power and control cores should be in accordance with the following, as appropriate:

a) any cable containing pilot, control and supervisory cores should have such cores insulated from all other conducting elements of the cable;

b) cables operating at above 1 000 V in an unearthed system (IT system) should have either metallic screens or individual conductive rubber screens separating the power cores from the pilot core(s);

c) cables operating at above 1 000 V in an earthed system (TT or TN systems) should have metallic screens separating the power cores from the pilot core(s);

d) cables operating at up to and including 1 000 V should have pilot, control or supervisory cores separated from power cores by conductive rubber screens if on an unearthed system or metallic screens if on an earthed system. Alternatively, for either system, the pilot, control or supervisory cores should be insulated to a voltage level equal to that of the power cores.

7.11.3 *Composite multicore cables on reeling drums*. Multicore cables which contain power, pilot, control or supervisory cores may be used for reeling drum applications, subject to the voltage limitations in **7.11.2**, provided that the cable is specially designed for such reeling duty.

7.12 Separation of cables in racks

Where power and control cables, multicore and single-core are used on a common rack, tray or duct, the degree of mutual interference has to be considered.

7.13 Bending radius for flexible cables

The recommended minimum bending radius for flexible cables during installation and handling in service is as follows.

a) Unarmoured cables:

up to and including 25 mm overall diameter	6 × cable diameter
above 25 mm diameter	8 × cable diameter

b) Armoured cables:

all sizes	8 × cable diameter

Larger bending radii should be used whenever possible.

8 Cable connectors

8.1 Use of plug/socket connectors

Where plug and socket connectors are used at voltages of 380 V nominal between phases or above, the measures given in a) and/or b) should be taken to prevent the plug from being engaged with, or disengaged from, the socket while the circuit is energized.

The measures should consist of one or both of the following:

a) the provision of isolating switches which are interlocked with the plug/socket so as to prevent connection or disconnection while the circuit is energized and to prevent switching the circuit when the plug/socket connection is incomplete;

b) the provision of protective conductor monitoring by means of either a pilot core, by high-frequency monitoring, or by other means.

The measures given in item b) are intended as a safety feature and should not be used for normal isolation purposes.

8.2 Use of bolted plug/socket connectors and bolted connections

Where bolted plug/socket connectors or bolted connections are used, interlocking is not required provided that suitable and adequate operational procedures are implemented.

9 Cable drums

9.1 Drum rating factors

Drum cables should be so designed and selected that the operating temperature of the cable is not exceeded under normal operational load, with due allowance for cyclic loading and for the condition where the maximum quantity of cable is reeled on the drum.

When cables of circular cross section are installed on cable drums, the current-carrying capacity in free air should be reduced by a factor appropriate to the drum to be used. Where no precise data is available the following factors may be used.

a) Radial type drum:

	90 °C cable	75 °C cable
ventilated	0.85	0.90
non-ventilated	0.75	0.80

b) Ventilated cylindrical type drum:

	90 °C cable	75 °C cable
one layer of cable:	0.85	0.90
two layers of cable:	0.65	0.70
three layers of cable:	0.45	0.50
four layers of cable:	0.35	0.40

NOTE 1 A radial type drum is one where spiral layers of cable are accommodated between closely spaced flanges; if fitted with solid flanges, the drum is described as non-ventilated and if the flanges have suitable apertures as ventilated.

NOTE 2 A ventilated cylindrical cable drum is one where layers of cable are accommodated between widely spaced flanges and the drum and end flanges have suitable ventilating apertures.

It is recommended that provision be made in the design of ventilated cylindrical drums to space each turn apart by at least 10 % of the cable diameter.

9.2 Cable tension limits

The design of the cable drum should be such that the normal operating tensile stress in any of the cable conductors has an upper limit of 15 N/mm^2. The transient peak tensile stress of the conductors should not exceed 25 N/mm^2.

Where necessary, the cable drum should be provided with a device to protect the cable against over or under tension.

9.3 Drum diameters for flexible cables

The minimum cable drum diameters for cables in normal operating service should be in accordance with the recommendations of the cable manufacturer. As a general guide a drum diameter of 20 times the cable diameter may be used.

Where the cable may be under tension while bending, as with cable feed-on devices, the radii of such devices should be increased with respect to the drum diameter.

NOTE These minimum diameters may need to be increased for certain materials under low temperature conditions.

9.4 Cable "S" bends and direction changes

The straight part between the two opposite curves of an S-shaped deflection or similar bend from one plane into another should be of a length at least equal to 20 times the diameter of the cable.

10 Control circuits and control devices

10.1 Prevention of unintentional operation

Control circuits and control devices should not automatically reset after tripping unless resetting of the control device either does not cause automatic restarting of the drive or there is no hazard to personnel created by automatic restarting of the drive.

10.2 Limitation of leakage and capacitance currents: unearthed control circuits

For unearthed control circuits, measures should be implemented which ensure (in the case of normal operating conditions with no circuit faults) that, after an operational switch-off, the total current flowing through the closing coil of a switching device is less than the current needed for holding the switched-on position of the switching device.

This total current should also be less than the drop-out current of the switching device with the smallest drop-out current.

NOTE The total current includes those currents caused by capacitance and leakage to earth and capacitance and leakage between the cores of the control circuit.

The value of the drop-out current for the switching device in use should be measured and used as a basis for determining the total permissible capacitance and leakage currents, which should not exceed 70 % of the drop-out current.

10.3 Monitoring of insulation: unearthed control circuits

For unearthed control circuits, the function of which is significant to the safety of personnel or plant, an insulation monitoring device or other means of maintaining safety should be provided.

When an insulation monitoring device is used, it should respond before the total capacitance and leakage current and the additional fault current have reached 70 % of the drop-out value as stated in **10.2**, or other effective means should be used to ensure that the 70 % drop-out value cannot be reached.

On the response of an insulation monitoring device, or other means, supply to the respective circuits should be automatically disconnected, or the affected drive should be stopped by other means or a signal should be registered for operational personnel to take appropriate action.

10.4 Limitation of leakage and capacitance currents: earthed control circuits

For earthed control circuits where a single-pole switch or switches are used for actuating the control device, the switch should be in the phase conductor to the device. The neutral conductor should be directly connected to the other terminal of the device. A double pole switch or switches may, however, be used for actuating the control device provided that they operate simultaneously in both the phase and neutral conductors.

After an operational switch-off, in the case of normal operating conditions with no circuit faults, the total current flowing through the closing coil of a device should be less than the current needed for holding the switched-on position of the device. This total current should also be less than the drop-out current of the device having the smallest drop-out current.

NOTE The total current includes those currents caused by capacitance and leakage between the cores of the control circuit.

The value of the drop-out current for the device in use should be measured and used as a basis for determining the total permissible capacitance and leakage currents which should not exceed 70 % of the drop-out current.

11 Safety circuits and safety devices

11.1 General

All safety general circuits should incorporate fail safe principles, such as those given in **11.2**, **11.3** and **11.4**.

11.2 Closed circuit

Functions should be operated by relay contacts that are closed when the relay is energized, so that failure of supply to the circuits, failure of relay contact or broken conductor will cause the drive to stop or, by its inherent characteristics, to assume automatically a safe condition.

11.3 Proving function operation

The correct operation of each function should be proved in a succeeding function to ensure that safety measures come into operation; for example, if a relay is switched to its energized or de-energized position, the succeeding function should prove the correct operation of the relay.

11.4 Fail safe principles with solid state switching devices

Where solid state switching devices are incorporated, extra precautions such as cross-monitoring techniques should be provided in addition to the recommendations given in **11.2** and **11.3**.

12 Fire detection and protection systems

12.1 General

The recommendations given in **12.2** to **12.7** are the minimum recommendations for protection of personnel and plant from the direct and indirect hazards associated with fire, either originating from an electrical source or whose combustion could be supported by materials incorporated in the electrical installation, or where fire originating from another source could cause an indirect hazard due to damage to the electrical installation.

Prevention of personal injury or loss of life by fire should be the first objective of fire protection.

Direct hazards to personnel due to fire include burns, deleterious effects of noxious fumes or vapours, asphyxiation, etc. Indirect hazards to personnel due to fire include electrocution, collapse of weakened structures, malfunction of equipment, etc.

Direct hazards to plant due to fire include complete or partial destruction, contamination from by-products of combustion, etc. Indirect hazards to plant due to fire include weakening or damage to structures, malfunction of equipment, etc.

12.2 General protection

Appropriate measures should be taken in the installation of electrical equipment and fire protection equipment to provide for protection of personnel and, where necessary, property from hazards resulting from fire.

12.3 Analysis of need for protection

A careful analysis of the equipment and installations should be undertaken to determine the need for protection against fire and the means of providing such protection.

This analysis should evaluate fire hazards with regard to the danger of the start and spread of fire, generation of smoke, gases or poisonous fumes, or the possibility of explosion or other occurrence endangering personnel.

NOTE See BS 4547 for definitions and designations of various classes of fire.

The analysis should establish the means to be used for detecting and giving an early warning of fire, normal exits and emergency means of escape, barriers or enclosures to prevent or contain the spread of fire, availability of fire fighting personnel, access and type and quantity of fire extinguishing equipment.

A single extinguishing system may be used to protect against more than one hazard in a single area.

NOTE One method of analysis is illustrated in Appendix A.

12.4 Means of protection

12.4.1 *Escape routes*. Protection of personnel is provided by an escape route that would be followed to evacuate the workplace. Escape routes should be well defined, adequately marked and illuminated, and should always be kept free from obstructions.

NOTE A second or alternative escape route may be necessary in certain areas. Emergency lighting (fixed or portable) may be required.

12.4.2 *Portable fire appliances*. Some fires can be safely extinguished or at least contained by the use of fire hose reels, portable fire extinguishers or manually applied fire extinguishing media (such as water, sand, rock dust or extinguishing powder). Such a means is adequate where it will either prevent exposure of the workplace to fire or permit safe escape in a fire situation.

12.4.3 *Barriers and/or enclosures*. Barriers and/or enclosures constructed of materials having sufficient fire resistance to contain a fire or prevent fire penetration for an adequate period can be considered a means of protection if they are installed so as to protect the workplace from exposure to fire and/or permit safe escape for personnel.

12.4.4 *Manually activated systems*. Where personnel are normally in attendance a manually operated fixed fire extinguishing system may be installed. The manual release device or devices should be readily accessible in a fire situation and should be capable of being initiated from a safe place.

12.4.5 *Automatically activated systems*. Where personnel are not normally in attendance a fixed automatic extinguishing system may be installed. Automatically activated systems should be capable of manual activation and the manual release device or devices should be readily accessible in a fire situation and should be capable of being initiated from a safe place.

12.5 Detection, alarm and extinguishing systems and equipment

All detection, alarm and extinguishing equipment and systems should be selected and installed to suit the application, taking into account the class of fire(s) anticipated, operating conditions and area characteristics. The equipment and systems should be installed by or under the supervision of persons qualified for such installation.

All detection and extinguishing equipment and systems should be functionally tested after installation to ensure proper operation.

NOTE Testing may not require the discharge of the extinguishing medium.

A reliable source of power (e.g. battery supported system) should be provided for detection, alarm and control equipment dependent on electrical energy.

NOTE The means of fire detection may include heat detection, smoke detection, flame radiation detection, etc.

Room sizes and contours, air-flow patterns, obstructions, and other characteristics of the protected area should be taken into account when determining the location, type, sensitivity and number of detectors.

Detectors should operate even when subjected to effects of combustion that occur during a fire, such as temperature rise, smoke, water vapour, gases and radiation.

12.6 Applications

12.6.1 *General*. Portable appliances suitable for the class of fire expected should be available to all areas, easily visible, readily accessible, and so located that personnel may have the option of either using this equipment or moving to a place of safety.

Portable units should be mounted to minimize danger and sealed to discourage misuse.

Where direct fire hazards to personnel exist due to the presence of flammable liquids or vapours, a manually or automatically activated fire extinguishing system should be installed.

Where indirect hazards to personnel and plant exist an automatic alarm system with emergency manual actuation should be installed. A manually or automatically activated fire extinguishing system should also be installed.

12.6.2 *Quantity of extinguishing medium available*. The quantity of medium to be kept available at the particular area of fire hazard should be commensurate with the quantity of flammable material present, the type of extinguishing system, the magnitude of personnel hazard and the method of delivery of the medium.

Portable appliances are naturally limited in the quantity of medium contained. Where necessary, multiple units may be installed.

Where manually actuated or automatically actuated systems are installed to accomplish total flooding of an enclosed volume, sufficient supply of extinguishing medium should be available to flood at least 50 % more than the enclosed volume.

12.6.3 *Precautions*. Fire extinguishing media applied to locations involving energized electrical equipment should be safe in use. Unless appropriate precautions are taken to permit the use of conductive extinguishing media, a non-conductive medium should be used.

The use of certain foam, powder or gaseous extinguishing media may cause harm to personnel due to suffocation, toxicity or limited visibility. Where such media are used in manually or automatically actuated systems for total flooding of an enclosed volume, an alarm system should be provided and release of the media should be delayed for sufficient time to permit personnel to escape. Means should be provided for deactivating and locking out the extinguishing system in areas where escape cannot readily be achieved.

When installing systems using carbon dioxide as the fire extinguishing medium it should be borne in mind that carbon dioxide is heavier than air and can produce unconsciousness and death when present in a confined area in fire extinguishing concentrations. Where personnel are present other media should be used or adequate warning given for evacuation before the medium is released.

Ambient temperatures should be considered when selecting an appropriate fire extinguishing medium.

Fire blankets should be supplied for smothering clothing fires in areas of high fire risk.

Consideration should be given to the need for shutting down, or redirecting ventilation systems in the event of a fire.

12.7 Additional recommendations

12.7.1 *Fire protection notices.* Notices indicating the location of fire protection equipment and any other information relevant to its safe usage should be prominently displayed.

12.7.2 *Equipment or plant in remote locations.* The following measures are recommended in order to minimize fire hazards for equipment or plant in remote locations:

a) use of gravel-filled containment areas surrounding transformers and outdoor switchgear to absorb the insulating oil completely in case of tank rupture;

b) use of flame retardant cables or, alternatively, coating of cables after installation with flame retardant paint;

c) use of non-combustible materials for wall panels, ceilings and false floors of control rooms and switch rooms.

12.7.3 *De-energization of electrical equipment.* Provision should be made for prompt de-energizing of electrical circuits and equipment involved in a fire.

12.7.4 *Flammable gases or liquids.* Where flammable gases or liquids are used, provision should be made to cut off supply in the event of a fire so as to prevent subsequent re-ignition or explosion.

12.7.5 *Supplementary fire extinguishing equipment.* When fixed fire extinguishing equipment is temporarily de-activated or otherwise rendered inoperative, alternative fire extinguishing equipment should be made available. This may include portable equipment, gravity-feed water storage systems or self-contained fire water pumps. Portable fire extinguishing equipment may supplement fixed (manual or automatic) fire extinguishing equipment for early control of small fires.

Appendix A Typical analysis sheet for fire protection systems

Equipment or area	Personnel protection	Property protection	Systems		Portable	Type of detection	Extinguishing media	Remarks
			Automatic	Manual				

Detection system:

1. Heat
2. Products of combustion or smoke
3. Flame radiation
4. Other

Extinguishing media:

1. BC powder
2. ABC powder
3. Water
4. Halon 1211
5. Halon 1301
6. Carbon dioxide
7. Foam
8. Other

blank

Publications referred to

BS 4547, *Classification of fires*.

BS 6907, *Electrical installations for open-cast mines and quarries*.

BS 6907-1, *Glossary*.

BS 6907-2, *General recommendations for protection against direct contact and electric shock*.

BS 6907-4, *Recommendations for winning, stacking and processing machinery, pumps and low signal level and communications systems*.

BS 6907-5, *Recommendations for operation*[1].

IEC 621, *Electrical installations for outdoor sites under heavy conditions (including open-cast mines and quarries) IEE Regulations for electrical installations (the Wiring Regulations)*[1].

[1] Referred to in the foreword only.

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