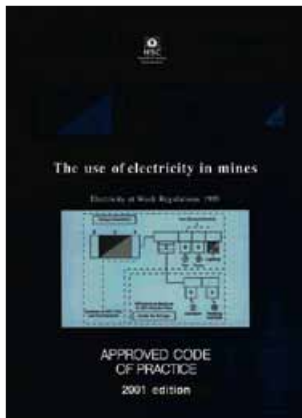


The use of electricity in mines

Electricity at Work Regulations 1989

Approved Code of Practice



This is a free-to-download, web-friendly version of L128, (First edition, published 2001). This version has been adapted for online use from HSE's current printed version.

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This Code of Practice gives practical guidance on how the Electricity at Work Regulations 1989 might be satisfied at mines and on the use of electricity in mines.

It is aimed at mine owners, mine managers, mine electrical engineers as well as both those who work in mines and employ others to do so.

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This Code has been approved by the Health and Safety Executive and gives advice on how to comply with the law. This Code has a special legal status. If you are prosecuted for breach of health and safety law, and it is proved that you have not followed the relevant provisions of the Code, a court will find you at fault, unless you can show that you have complied with the law in some other way.

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Notice of Approval

By virtue of section 16(4) of the Health and Safety at Work etc Act 1974 and with the consent of the Secretary of State for the Environment, Transport and the Regions, the Health and Safety Commission has on 18 July 2001 approved a revision to the Code of Practice entitled *The use of electricity in mines*.

The Code of Practice gives practical guidance with respect to the Electricity at Work Regulations 1989 (SI 1989 No 635), and section 2 of the Health and Safety at Work etc Act 1974 in so far as those provisions relate to the use of electricity in mines.

The revised Code of Practice comes into effect on 1 September 2001. With effect from that date, the first edition of the Code of Practice shall cease to have effect.

Signed

AVRIL ADAMS
Secretary to the Health and Safety Commission

21 July 2001

Introduction

The Regulations

1 The Electricity at Work Regulations contain a number of provisions that apply to all industries including mining, plus some additional provisions that only apply to mines. They take account of the technological advances that have been made in the use of electricity since the inception of the earlier controls and allow the routine use of a number of now well proven techniques which previously could only be introduced under exemptions from statutory controls. This Code of Practice gives practical guidance on how the Regulations might be satisfied at mines. A separate Code deals with quarries and a Memorandum of guidance has been prepared for all other industries. Among other things, the Regulations and this Code have been designed to update and replace the Coal and Other Mines (Electricity) Regulations 1956 and the Miscellaneous Mines (Electricity) Regulations 1956. Duties for compliance are placed on employers, the self-employed, mine owners, mine managers, mine electrical engineers appointed under the Coal and Other Mines (Mechanics and Electricians) Regulations 1965 and employees. The date of implementation was 1 April 1990 for all mines. The Regulations are published separately as a statutory instrument in the usual way.

The Approved Code of Practice

2 The Regulations state the objectives to be achieved. Methods of meeting these requirements are given in the Approved Code of Practice (ACOP) which has been approved by the Health and Safety Commission under section 16 of the Health and Safety at Work etc Act 1974 (HSW Act). In addition, the Code contains references to certain duties under section 2 of the HSW Act.

3 This revised edition of the Code of Practice incorporates important safety measures concerning the safe use of 3300 volt mineral-winning machinery. It also takes account of European Union requirements on the construction and placing on the market of equipment protective systems intended for use in potentially explosive atmospheres.

4 The Approved Code is intended to provide guidance on the use of electricity in mines. However, it cannot specify every possible detail or address every possible circumstance. Duty holders should remain alert to developments and hazards that may not be fully dealt with in the Code and should use their expertise to assess what further measures are desirable.

5 When proposing to depart significantly from a provision in the Code, the manager should consult the Inspector of Mines in charge of the District, inform the owner or owner's representative and keep a record to help in any future revision of the Code.

ACOP

6 Although only the Courts can give an authoritative interpretation of the law, in considering the application of these Regulations, Approved Code of Practice and guidance to persons working under your direction, you should consider the following:

If people working under control and direction of others are treated as self-employed for tax and national insurance purposes, they may nevertheless be treated as their employees for health and safety purposes. It may therefore be necessary to take appropriate action to protect them. If any doubt exists about who is responsible for the health and safety of a worker this could be clarified and included in the terms of the contract. However, remember, a legal duty under section 3 of the Health and Safety at Work Act (HSWA) cannot be passed on by means of a contract and there will still be duties towards others under section 3 of HSWA. If such workers are employed on the basis that they are responsible for their own health and safety, legal advice should be sought before doing so.

The legal framework

7 The Regulations and Code are intended to operate within the framework of duties and liabilities provided by the HSW Act. Under mining statute, persons employed at a mine are required to obey certain directions and instructions given to them, and rules issued, by those on whom duties are laid. Section 7 of the HSW Act requires employees to take reasonable care and to co-operate with those on whom duties are laid by these and other regulations. Section 2 of the HSW Act places general duties on employers for their employees, eg to provide, so far as is reasonably practicable a safe system of work and information, training and supervision necessary to safety. Sections 3 and 4 provide for the protection of non-employees from the effects of work activities, while section 6 of the HSW Act puts duties on those who design, manufacture, import or supply articles for use at work. The general duties complement the more specific duties created by these Regulations and thus must also be fulfilled.

8 The legal status of an Approved Code of Practice is set down by section 17 of the HSW Act. Reference in the Code to another document does not imply approval by the Health and Safety Commission of that document except to the extent necessary to give effect to this Code.

9 Enforcement of mining safety legislation is carried out by the Health and Safety Executive through the HSE Mines Inspectors it appoints. Sections 21 and 22 of the HSW Act give inspectors the power to issue improvement and prohibition notices which can be used to require persons to take action to improve safety standards or to prevent accidents. Such notices are backed by law and persons can be prosecuted for failure to comply.

Code availability

10 The relevant sections of this Approved Code of Practice should be drawn to the attention of those concerned at a mine. A copy of the Code should be posted in the statutory covered accommodation.

Regulation

Citation and commencement

Regulation 1

1

These Regulations may be cited as the Electricity at Work Regulations 1989 and shall come into force on 1 April 1990.

Regulation

Interpretation

Regulation 2

(1) In these Regulations, unless the context otherwise requires -

“approved” means approved in writing for the time being by the Health and Safety Executive for the purposes of these Regulations or conforming with a specification approved in writing by the Health and Safety Executive for the purposes of these Regulations;

“circuit conductor” means any conductor in a system which is intended to carry electric current in normal conditions, or to be energised in normal conditions, and includes a combined neutral and earth conductor, but does not include a conductor provided solely to perform a protective function by connection to earth or other reference point;

“conductor” means a conductor of electrical energy;

“danger” means risk of injury;

“electrical equipment” includes anything used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy;

“firedamp” means any flammable gas, or any flammable mixture of gases occurring naturally in a mine;

“injury” means death or personal injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy, where any such death or injury is associated with the generation, provision, transmission, transformation, rectification, conversion, conduction, distribution, control, storage, measurement or use of electrical energy;

“safety-lamp mine” means -

(a) any coal mine; or

(b) any other mine in which -

(i) there has occurred below ground an ignition of firedamp; or

(ii) more than 0.25% by volume of firedamp is found on any occasion at any place below ground in the mine;

“system” means an electrical system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy, and includes such source and such equipment.

2

Regulation

2

- (2) Unless the context otherwise requires, any reference in these Regulations to -
- (a) a numbered regulation or Schedule is a reference to the regulation or Schedule in these Regulations so numbered;
 - (b) a numbered paragraph is a reference to the paragraph so numbered in the regulation or Schedule in which the reference appears.

Regulation

3

Person on whom duties are imposed by these Regulations

Regulation 3

(1) Except where otherwise expressly provided in these Regulations, it shall be the duty of every -

- (a) employer and self-employed person to comply with the provisions of these Regulations in so far as they relate to matters which are within his control; and
- (b) manager of a mine or quarry (within in either case the meaning of section 180 of the Mines and Quarries Act 1954^(a)) to ensure that all requirements or prohibitions imposed by or under these Regulations are complied with in so far as they relate to the mine or quarry or part of a quarry of which he is the manager and to matters which are within his control.

(2) It shall be the duty of every employee while at work -

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

(a) 1954 c.70; section 180 was amended by SI 1974/2013.

ACOP

3

1 Responsibility for compliance with the Regulations is placed on employers, the self-employed, mine managers and employees but only to the extent of matters within their control. Additionally employees are required to co-operate with employers so far as is necessary to allow them to fulfil their legal obligations.

ACOP

2 The duties imposed by some regulations are absolute and must be met regardless of cost or any other consideration. Other regulations are qualified by considerations of reasonable practicability. In these the duty holder is allowed to assess on the one hand, the magnitude of the risks associated with a particular activity, and on the other hand, the costs in terms of physical difficulties, time, trouble and expense which would be involved in taking steps to eliminate or minimise those risks. If the risks to health and safety of a particular work process are very low and the costs or technical difficulties of taking certain steps to prevent those risks are very high, it might not be reasonably practicable to take those steps. The greater the degree of risk, the less weight that can be given to the cost of measures needed to prevent that risk. Where the risk is very severe a duty qualified by considerations of reasonable practicability approaches that of an absolute duty.

3 Employers should take steps to bring the requirements of the Electricity at Work Regulations 1989 and the contents of this Approved Code of Practice to the attention of their employees as appropriate. These duties arise under section 2 of the HSW Act. Compliance may be achieved by making copies of the Regulations and Approved Code of Practice readily available for such persons to consult.

3

Regulation

Systems, work activities and protective equipment

Regulation 4

(1) All systems shall at all times be of such construction as to prevent, so far as is reasonably practicable, danger.

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

(3) Every work activity, including operation, use and maintenance of a system and work near a system, shall be carried out in such a manner as not to give rise, so far as is reasonably practicable, to danger.

(4) Any equipment provided under these Regulations for the purpose of protecting persons at work on or near electrical equipment shall be suitable for the use for which it is provided, be maintained in a condition suitable for that use, and be properly used.

4

ACOP

Construction of systems

1 Construction should be interpreted widely. As well as covering the way individual items of equipment are assembled, it also covers the arrangement and connecting together, physically or electrically, of items to form an electrical system. In this sense the regulation embraces the planning of systems for safe operation.

4

ACOP

2 The construction of a system should be suitable with regard to:

- (a) the electrical equipment used in it;
- (b) the competence of persons likely to operate the equipment and their safety;
- (c) operational environment and conditions of use (see the ACOP to regulation 6);
- (d) maintenance, examination and testing requirements;
- (e) ability to withstand likely voltage transients, fault or overload conditions; and
- (f) the need for electrical or other forms of protection in the system.

Where available, equipment constructed to appropriate British Standards or equivalent International Specifications should be used.

3 The aim in planning and constructing a system should be to:

- (a) select suitable equipment so all new or modified systems where necessary are compatible with one another; and
- (b) ensure it is planned, installed, protected, commissioned, tested, and maintained, so as to prevent danger; and
- (c) ensure that either the supply is automatically cut off or made safe so as to minimise any danger arising.

4 Where plant essential for the safety of persons needs a secure power supply (for example, winding apparatus and ventilation fans for mines), the system should be constructed to minimise the risk of, or arising from, total power loss for any significant period of time.

5 When modifying established installations, account should be taken of any changes to the system characteristics as a whole: for example changes in fault levels, fault paths, fault clearing capabilities and switching arrangements.

6 Where the supply to the premises is provided by an Area Electricity Board or other body, it should be clearly established where the supply authority responsibilities end and those of the mine owner commence (normally the consumer terminals) in order to avoid confusion over duties for compliance with these Regulations and access to equipment, especially in an emergency.

Construction of equipment forming part of a system

7 Electrical equipment capable of producing heat, light or other radiation in potentially harmful quantities should where practicable be constructed, shielded or guarded to prevent persons being exposed to harm.

ACOP

8 Materials used in the construction of electrical equipment should be chosen to minimise danger, for example:

- (a) certain insulating materials (usually phenolic types) decompose giving off large volumes of fumes (some of them toxic or flammable) when subject to arcing. Where danger is likely to arise the use of such materials should be avoided;
- (b) equipment containing polychlorinated biphenyls (PCB) and polychlorinated terphenyls (PCT) should not be used;*
- (c) where equipment is to be used in a potentially flammable atmosphere the use of exposed light alloys containing aluminium, magnesium or titanium should be avoided since the alloy could produce incendive sparking if subject to frictional contact with rusty iron or steel; where the use of such alloys cannot be avoided they should be encased or covered with alternative material to minimise the risk.

9 Below ground in mines or in other places where there would be undue danger in the event of fire, special precautions should be taken to minimise the possibility of electrical short circuits, for example interphase barriers where appropriate.

10 Where low current auxiliary circuits are connected to high fault level bus-bars, suitable protection, such as fuses should be provided as near to the bus-bars as practicable to protect the auxiliary circuit wiring. The electrically unprotected connections between the fuses and bus-bars should be so arranged as to avoid faults: for example by keeping the leads as short as possible, by physical segregation and by use of reinforced insulation.

11 Contact makers and relays used in signalling, control and interlocking systems should be constructed and installed, so far as is reasonably practicable that any failure in their electrical operation causes the systems to fail safe.

12 Where any vehicle or locomotive with a built-in electrical power source (for example a battery, or alternator) is to be operated in a potentially flammable atmosphere then the chassis or frame should not be used as the current carrying path for any electrical circuit capable of igniting that atmosphere. This does not preclude the earthing or referencing of the chassis or frame to enable suitable electrical protective or monitoring devices to operate.

13 Where regular examinations, checks or tests have to be carried out on electrical equipment (for example, on voltage, current, or operating modes of components), facilities should be incorporated to avoid persons being exposed to danger during such work: for example by provision of permanently installed meters, indicators, extra low-voltage test points or transparent inspection covers. Where such facilities are not provided other suitable safe testing practices should be adopted.**

*The prohibitions in European Directive 76/796/EEC were implemented in the Control of Pollution (Supply and Use of Injurious Substances) Regulations 1986. SI 1986 No 902

** See Guidance Note GS38 *Electrical test equipment for use by electricians*

ACOP

Construction: operational environment and conditions of use

14 At the surface of a mine electrical equipment containing flammable liquids in such quantity as may give rise to danger in case of a fire should be so located with respect to any shaft or entrance of a mine so that persons underground will not be in any danger from the products of combustion.

15 Where necessary to avoid confusion which might lead to danger, switchgear should be clearly marked to show the circuits or other equipment it controls.

16 Where more than one plug or socket of the same type is used at the same place and danger could arise if unrelated plugs and sockets were coupled together, then precautions such as keyway coding, padlocking or marking of switchgear and plugs and sockets should be taken to avoid danger.

Protection against breakdown between high and low voltage systems

17 Where electrical energy is transformed or converted from one voltage to another, precautions should be taken to prevent danger arising from the lower voltage conductors becoming charged above their normal voltage.

Preparation for use and maintenance

18 Equipment and systems should be examined, checked and, as necessary, tested at the time of commissioning and maintained at suitable intervals thereafter to ensure that they are in safe working order. This should, where practical, include checking the effectiveness of electrical protection and any other safety features provided: for example interlocks, trip wires, and emergency stops. Where appropriate, tests for insulation resistance, earth conductivity and the resistance to earth of any earthing electrodes should be included.

19 The manager should have in force a scheme* for the systematic examination and testing of electrical equipment to prevent danger. The scheme should:

- (a) indicate when the tests and examinations should be carried out: for example, either by fixed time intervals or by routine condition monitoring;
- (b) set out the method of carrying out tests and examinations and arrangements for their prompt recording;
- (c) require copies of the scheme and records to be kept at the mine office or other suitable place and to be available for inspection;
- (d) require the results of major examinations, and tests, etc, on equipment to be kept for the life of the equipment where relevant to its continual safe operation or until it is totally reconditioned; otherwise they should be kept for *at least three years*** to provide evidence of any deterioration which might lead to danger;
- (e) require the reports of such examinations to be checked by a person competent to advise the manager in electrical engineering matters.

* The requirements on schemes of maintenance in the Management and Administration of Safety and Health at Mines Regulations 1993 apply.

** See Regulation 35 - the Management and Administration of Safety and Health in Mines Regulations 1993.

ACOP

20 Where a potentially dangerous fault is found it should be recorded and action taken as swiftly as possible in order to minimise the danger. If repair is not undertaken immediately, safeguards should be implemented: for example by isolation of equipment and the application of padlocks. A system of appropriately colour coded locks should be used for defective plant.

Voltage restrictions

21 The voltage levels chosen for systems should relate to established safe practice, the circumstances of use, the type of equipment and the protection provided. The nominal line voltage levels set out below are based on established practice. The supply voltage for use underground should not exceed 11 000 volts. However in certain circumstances system voltages should be restricted to lower values which are on any:

- (a) system used below ground supplying equipment which is normally stationary but is moved at certain times with the power applied to it, for example a transformer which moves in fixed increments in relation to a working mineral face - 6600 volts;
- (b) system used below ground in a mine supplying motors or machines (excluding distribution transformers) which are designed to be moved while working and which are served by flexible (trailing) cable - the maximum voltages are:
 - (i) in any part of any mine except at a coal face of a coal mine - 3300 volts.
 - (ii) at a coalface, for which Manager's rules* have been drawn up covering pre-conditions as to use, environmental monitoring and protection and use of high voltage insulation testing - 3300 volts.
 - (iii) otherwise at a coalface - 1100 volts.
- (c) equipment carried in the hand while operating and connected by a flexible cable used -
 - (i) in parts of buildings which are clean and dry, - 250 volts have non-conducting floor coverings such as carpets or thermo-plastic tiles, non-metallic walls and where conditions approximate to those of a domestic environment
 - (ii) any other place - 125 volts with a maximum of 80 volts to earth or reference
 - (iii) on any hand-held lamp or unearthed hand-held tool, which is not double insulated - 50 volts ac or 120 volts dc
 - (iv) on any arc welding electrode holder** - 85 volts ac or 100 volts dc supplied from a welding source introduced after the commencement of the Regulations
 - (v) on any arc welding electrode holder - 100 volts ac or 125 volts dc supplied from a welding source in use before the commencement of the Regulations

* See guidance on Model Manager's Rules on Appendix 4.

** These voltages are recommended in BS 638 Part 7 1984 *Arc Welding Power Sources, Equipment and Accessories* where further guidance can be found.

ACOP

- (d) lighting system used below ground -
 - (i) at or within 10 m of a coal face - 125 volts
 - (ii) elsewhere in coal mines or in any other mine - 250 volts
- (e) system used below ground supplying electric traction equipment by means of contact lines -
 - (i) with rail returns - 650 volts
 - (ii) for other systems - 1200 volts

22 The voltage limitations referred to in paragraph 21 need not apply to systems or equipment of the following types if used so as to avoid danger:

- (a) any electrical testing equipment designed to check or test the insulation resistance of a circuit or system;
- (b) any shot firing exploder used in accordance with other Regulations, for example the Regulations on the use of explosives at mines;
- (c) any ignition circuit of a vehicle; or
- (d) equipment where a voltage is developed internally but that voltage does not appear outside and adequate safeguards have been taken to prevent danger external to the equipment, for example the high voltage required to operate a cathode ray tube.

Work near a system

23 Appropriate precautions should be taken to minimise danger from activities near electrical equipment (for example, safeguarding electrical equipment from shot firing). The precautions should ensure that:

- (a) the equipment is made safe; or
- (b) an assessment and appropriate action are carried out in accordance with the ACOP to regulation 14.

Overhead electric lines

24 Where there is a possibility of contact with live overhead conductors,* either directly by persons or indirectly by plant such as cranes, high vehicles, tipping lorries, drill rigs, or metal ladders etc, the work should be controlled to ensure that so far as is reasonably practicable, approach to or contact with these conductors is prevented. Where appropriate, effective barriers and height gauges should be used. Vehicles, trailers or loads having extending parts that can reach into the danger zone of a high voltage overhead line should not be parked under such a line.

Buried cables

25 Before any excavation work is commenced, the person in charge of the work should ascertain the location of any cables or other electrical equipment buried in the material to be excavated.** Reference should be made to plans of cable routes. The operation of schemes involving 'permit to excavate' should be adopted where it is foreseeable that equipment might be buried in the ground. Permits should usually be issued by a member of the mine electrical staff who has knowledge of the site.

* See HSE Guidance Note GS 6 *Avoidance of danger from overhead electric lines*

** See HSE Guidance Note GS 33 *Avoidance of danger from buried electric cables*

ACOP

Dismantling or removal from an electrical system

26 Appropriate safety checks and tests should be carried out before dismantling equipment or removing cables from a system to ensure that all potentially dangerous sources of electrical energy have been isolated and discharged (see also the ACOP to regulation 13) and arrangements made to ensure that, if necessary to prevent danger, they remain so during and after the work.

27 Before a person is to work on or remove a redundant cable adjacent to other cables, precautions should be taken to identify the cable so as to prevent danger: for example, by tracing and marking it along its length or by referring to plans indicating its position.

4

Regulation

Strength and capability of electrical equipment

Regulation 5

No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.

5

ACOP

1 Electrical equipment should be selected so that it is able to withstand the stresses imposed upon it by the system both in normal use and for the duration of any fault conditions. This includes the ability of the equipment to withstand the thermal, electro-magnetic and other effects of the electrical currents which are likely to exist, and for insulation to be able to withstand the applied voltage and any transient over-voltages.

2 Equipment should be selected for duties which are within the manufacturers' ratings. It should be noted that all equipment is not continuously rated.

3 Appropriate use should be made of British and International Standards in selecting electrical equipment.

5

Regulation

Adverse or hazardous environments

Regulation 6

Electrical equipment which may reasonably foreseeably be exposed to -

- (a) mechanical damage;*
- (b) the effects of the weather, natural hazards, temperature or pressure;*
- (c) the effects of wet, dirty, dusty or corrosive conditions; or*
- (d) any flammable or explosive substance, including dusts, vapours or gases,*

shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.

6

ACOP

1 The regulation requires equipment to be selected so that it is suitable for the environment in which it is to work. However, the first aim should be to site equipment so as to obviate its exposure to environments which might adversely affect safety. Where this cannot readily be achieved some of the factors to be taken into account should be:

- (a) impact, stress, strain, abrasion, vibration, crushing;**
- (b) wind, rain, snow, ice, lightning;**
- (c) solar radiation;**
- (d) vandalism or damage by animals;**
- (e) operation at other than normal temperatures and pressures;**
- (f) contact with liquids or vapour;**
- (g) contact with dirt or dust;**
- (h) auto ignition temperature of the dusts, vapour or gas;**

2 Where exposure of the equipment to combustible dust may occur, its construction should minimise the possibility of ignition of that dust.*

3 Electrical equipment used where a potentially flammable or explosive atmosphere could occur at the surface of a mine (for example, a methane drainage plant) or at places containing large quantities of explosive or flammable materials (for example, oil or petrol stores) should be so constructed, installed and maintained that it is not likely to be a source of ignition: for example, in conformity with an appropriate standard.**

* Where dust or moisture are to be guarded against, British Standard BS EN 6052: *Specification for Classification of degrees of protection provided by enclosures*, is an internationally agreed, comprehensive classification of the degrees of protection of equipment enclosures against the ingress of dust, moisture etc. It may be used as an appropriate means of specifying or selecting degrees of protection for electrical equipment enclosures by the classification of the protection according to an 'IP' number, eg IP54, IP2X, etc. See also BS 6467: Part 1: 1985 *Electrical Apparatus with protection by enclosure for use in the presence of Combustible Dusts*.

** Examples of appropriate standards are included in Guidance Note 1.

6

ACOP

4 Where necessary to avoid damage or dangerous charging of equipment* lightning protection devices and anti-static materials or devices should be used.

5 Where the conductors or insulation may be vulnerable, additional protection against physical, mechanical, chemical or other foreseeable damage should be provided by means of enclosure or armouring and sheathing.

6 Switchrooms, or substations, should not be used for the storage of flammable or explosive substances (including gases) and should be:

- (a) constructed of or treated with fire resistant materials; and
- (b) provided with suitable means to -
 - (i) control the spread of fire; and
 - (ii) extinguish fire.

7 Equipment for use below ground in mines likely to be exposed to flammable gas is dealt with in the ACOP to regulation 19.

* Guidance can be found in the following:

- (a) BS Code of Practice No 6651: 1985 *The Protection of Structures against Lightning*.
- (b) BS 2050:1978 *Electrical Resistance of Conductive and Anti-Static Products made from Flexible Polymeric Material* (Note - applies to conveyor belts etc used in mines).
- (c) BS 5958: Part 1:1980 and Part 2:1983 *Code of Practice for Control of Undesirable Static Electricity*.

7

Regulation

Insulation, protection and placing of conductors

Regulation 7

All conductors in a system which may give rise to danger shall either -

- (a) be suitably covered with insulating material and as necessary protected so as to prevent, so far as is reasonably practicable, danger; or*
- (b) have such precautions taken in respect of them (including, where appropriate, their being suitably placed) as will prevent, so far as is reasonably practicable, danger.*

7

ACOP

Protection of insulated conductors

- 1 Circuit conductors (including bus-bars and conductors in cables) which can cause danger, that are not suitably placed or otherwise safeguarded to prevent danger, should be covered with insulating material of suitable quality and thickness for the system voltage and the relevant duty. Additionally and in order to comply with regulation 6:
 - (a) such conductors used at a voltage exceeding 125 volts should be further protected by metallic screen, armour, or conduit (subject to the provisions of paragraphs 7, 9 and 10 below relating to cables) provided that non-metallic protection may be used for conductors other than those in cables if it achieves an equivalent level of safety;
 - (b) such conductors used below ground where firedamp or coal dust may be a hazard in a safety-lamp mine except those connected to circuits incapable of producing incendive sparking or arcing (intrinsically safe circuits) should be provided with a metallic covering, screens or armour so arranged to minimise the ignition of that firedamp or dust.

All cables

- 2 The outermost protective covering provided for any conductor in cables installed after the commencement date of the Regulations should not readily propagate flame.*
- 3 All terminations of cable coverings, armourings or conducting screens should where necessary be securely attached to the apparatus and adequately sealed to prevent the ingress of substances likely to be harmful to the insulation or circuit conductors.
- 4 The conducting coverings, armourings or screens provided in any cables should be connected to the frame or case of the associated equipment to ensure adequate mechanical strength for the duty and good electrical bonding. Armourings should be protected as necessary against corrosion and enclose all the conductors in the cable. (See paragraph 14 of the ACOP to regulation 8 relating to electrical conductivity of the earth or reference conductors in fixed equipment.)

Fixed cables

- 5 Paper insulated lead sheathed cables should not be used in places where they may be subject to movement or there is a significant risk of impact.
- 6 Mineral insulated cable should not be used at places subject to excessive vibration or movement.
- 7 For fixed cables operating above 650 volts, the metallic covering referred to in paragraphs 1 and 4 above should be of steel wire armour or other suitable hard metallic sheath but excluding metallic tape. Where necessary to increase conductivity, steel armourings may be supplemented by copper strands.

* Guidance can be found in BS4066: 1980 - *Tests on electric cables under fire conditions which contains an appropriate test.*

ACOP

8 Permanently or semi permanently installed cables should be positioned or properly supported at suitable intervals throughout their length, so as to minimise the risk of damage. Where the route of a cable is not obvious (for example a cable in a trench), it should be marked (for example by marker tape or 'danger' tiles buried with the cable) and its position kept on a plan at the mine office.

Flexible cables

9 For cables which are designed to move while energised, the metallic covering referred to in paragraphs 1 and 4 above may be:

- (a) steel wire armourings which are suitably flexible and enclose all of the conductors in the cable and are protected as necessary against corrosion; or
- (b) conducting screens which are suitably flexible and protect each circuit conductor individually; or
- (c) a suitable flexible conducting screen protecting the circuit conductors collectively and, notwithstanding paragraph 15 of the ACOP to regulation 8, containing an independent earth or reference conductor of at least the same cross-sectional area as the largest circuit conductor; or
- (d) a combination of (a), (b) and (c);

except that unarmoured and unscreened flexible cables may be used where they are positioned or otherwise safeguarded so that they cannot be contacted whilst energised. (See paragraphs 15 and 16 of the ACOP to regulation 8 relating to the provision of electrical earth or reference conductors and their electrical conductivity in flexible cables.)

10 Mains powered cables used on coal faces or at any other places where they are vulnerable to damage, except those forming parts of intrinsically safe circuits, should be:

- (a) operated in a system which is earthed or referenced; and
- (b) of a type in which the circuit conductors are individually enclosed by metallic or conducting elastomeric screens electrically connected to earth or the reference; and
- (c) provided with suitable leakage protection arranged to cut off the supply in the event of the screens becoming connected to a live conductor (see paragraphs 4 to 10 of the ACOP to regulation 11 relating to leakage protection).

11 Where flexible (trailing) cables do not need to be moved, they should be effectively supported and protected against physical damage. Wherever trailing cables are being utilised for the purpose of supplying 3300 volts to machinery, the moving cable should be safeguarded by a proprietary cable handling chain. Where a trailing cable supplying 3300 volts to machinery on a coal face is static, and part of an installation that is designed to move as part of its operating cycle, the cables should be enclosed all the way up to, and including, the motor terminal boxes.

12 Manual handling of flexible cables should be minimised as far as practicable, where circumstances permit, by the use of properly designed, installed, and maintained cable reeling or handling devices.

ACOP

Cables in buildings

13 Notwithstanding paragraphs 1 and 9 above, in parts of buildings which are clean and dry, have non-conducting floor coverings such as carpet or thermo-plastic tiles, non-metallic walls and where conditions approximate to those of a domestic environment, cables may be installed and used at voltages up to 250 volts without metallic coverings.

Placing and safeguarding of conductors

14 Where the option of suitably placing and safeguarding the conductors is adopted instead of insulation, or screening or armouring, the placing of the conductors should be such that they are not normally accessible to unauthorised persons (for example, uninsulated bus-bars within an enclosure or the bare conductors of an overhead power line, or trolley wires placed out of reach). Where necessary to prevent danger safeguarding should reinforce placing so that access is prevented other than by the use of keys or of proper tools by a competent person but should allow maintenance work to be carried out safely. Notices bearing instructions, such as 'Do not open when energised', should be attached to enclosure covers where appropriate to warn if dangerous bare live conductors are enclosed.

Placing of conductors so as to avoid danger from induced or leakage currents

15 Conductors in a system should be placed, arranged or otherwise protected so as to avoid induction or leakage of current into them from adjacent conductors where this might cause danger: for example, incendive sparking or shock risk from conductors which have become charged by high voltage overhead lines crossing over mine workings. Adjacent conductors which may be particularly vulnerable are those used for earthing, referencing or control, and those which form part of intrinsically safe circuits. Single core or unbalanced cables in ac power circuits, and in dc circuits in which the current varies appreciably over short periods of time should not be employed if danger could arise from leakage or induction.

16 Where the placing and safeguarding of conductors alone is insufficient to prevent danger, other precautions should be taken: for example, padlocked rooms with controlled access by a keyholder.

Regulation

Earthing or other suitable precautions

Regulation 8

Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeably become charged as a result of either the use of a system, or a fault in a system, becomes so charged; and, for the purposes of ensuring compliance with this regulation, a conductor shall be regarded as earthed when it is connected to the general mass of earth by conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth.

8

ACOP

1 This regulation applies to any exposed conductive parts which, although not normally charged, are liable to become charged either as a result of the use of the system or a fault in the system. It requires precautions to be taken to prevent danger resulting from such exposed conductive parts becoming charged.

2 The dangers to be guarded against include the risk of electric shock from exposed charged conductors and the risks of fumes, fire, arcing or explosion arising from currents in such conductors. Steps should be taken to ensure that exposed conductive parts either do not become charged or, if they do, the values of voltage and current and their duration are such that danger will not arise. The techniques available to achieve these objectives include:

- (a) double insulation;
- (b) referencing, and equipotential bonding or earthing;
- (c) use of safe voltages;
- (d) earth free non-conducting environments;
- (e) current limitation.

Double insulation

3 Double insulation to an acceptable standard prevents, as far as is reasonably practicable, exposed conductive parts from becoming inadvertently charged as a result of a fault. It is particularly suitable for certain types of portable equipment such as electrically driven hand tools. No external earthing conductor is allowed and this brings with it the important advantage that a fault in the supply cable cannot result in the exposed conductive parts becoming charged. However, the concept does rely on the insulation remaining in sound condition and this requires that the equipment be properly constructed, used and maintained.

Referencing and equipotential bonding or earthing

4 System referencing is closely related to equipment earthing or equipotential bonding and, although the two are often used in combination their respective objectives should not be confused.

8

ACOP

- 5 An electrical system may be connected to a reference point such as the general mass of earth or the metallic framework of an installation so as to:
- (a) permit the system to function;
 - (b) enable fault protection or insulation monitoring systems to function, for example earth fault protection;
 - (c) stabilise the potential between circuit conductors and the reference point; and
 - (d) reduce the prospective shock voltage between circuit conductors and the reference point.
- 6 Equipotential bonding or earthing serves to reduce danger arising from:
- (a) potential differences between exposed conductive parts, and
 - (b) the passage of fault current through fortuitous paths.
- 7 In general where single phase systems are earthed or connected to a reference point then the connection should be at the mid voltage point, however, for earthing practices for electric arc welding reference should be made to the relevant guidance material.* In control and interlock circuits however, the phase or pole which is connected directly to the control relay coil may be referenced where this is necessary to prevent mal-operation of the relay by earth or reference faults on the control circuit.
- 8 In the case of polyphase systems, in general the neutral point should be earthed or referenced at the source of supply.
- 9 Where the mid-point or neutral point is artificially created by the use of balanced impedances or resistances, the arrangements should be no less effective for protective purposes than earthing or referencing at the source.
- 10 A conductor used to connect a system to earth or a reference point should not incorporate any switch, fuse or other device that results in loss of reference. This does not preclude the use of current limiting devices or suitable arrangements to transfer the reference from one point to another, nor the use of switches designed to open all the circuit conductors (including the neutral) simultaneously to prevent danger. Where the continuity of earth or reference conductors is interrupted by disconnection of restrained plugs and sockets, the earth or reference circuit should be the first to make on connection and the last to break on disconnection.
- 11 Where referencing and equipotential bonding or earthing is adopted, any exposed conductive parts should be efficiently connected together and to the reference point. Except that if the reference point is remote and inaccessible but is connected to the general mass of earth by means of suitable earth electrodes, the equipotential bonding or earthing should be similarly connected to the general mass of earth. In these circumstances the resistance between the earth electrodes and the general mass of earth should be low enough to allow the electrical protection equipment to operate in the event of a fault occurring. Generally this resistance should not exceed 2 ohms.
- 12 Where 'earth free' referencing is used a specific reference point should be created (for example the metal framework of a vehicle) and all exposed conductive parts of equipment bonded to this part by suitable conductors.

* See HSE Guidance HSG118 *Electrical safety in arc welding*

ACOP

13 The design and construction of an earthing or referencing conductor should be suitable for the maximum current it may carry under fault conditions and should be adequate to withstand foreseeable wear and tear. In some circumstances (for example, where the earth conductor is a screen enclosing a circuit conductor) the earth conductor may carry short circuit current for a brief period if faults occur on more than one circuit conductor simultaneously and this should be taken into consideration.

14 In fixed equipment or cables, earthing or referencing conductors including joints and connections should have a combined conductivity of not less than 50% of the largest circuit conductor in relation to which they are provided. In the case of cables having metallic coverings, not less than half of the minimum 50% conductivity should be provided by the metallic covering. But at the surface of mines, a lower level of conductivity may be used for fixed cables operating on power systems in which the maximum earth fault current is restricted and which are protected by automatic leakage fault trip devices. However, the level of safety should be no less than that which would be achieved on an equivalent unrestricted system.

15 In flexible cables, earthing or referencing conductors should have a combined conductivity, including any joints or connections, of not less than that of the largest conductor in the cable. Except that for flexible cables operating on power systems in which the maximum earth fault current is restricted, a lower level of conductivity may be used but the level of safety should be no less than that which would be achieved on an equivalent unrestricted system. In no circumstances should the combined conductivity of the earthing or referencing conductors be less than half of that of the largest conductor in the cable.

16 Unscreened flexible (including pliable wire armoured) cables should incorporate a separate earth conductor or conductors in addition to any armouring provided for mechanical protection.

Use of safe voltages

17 Low voltages should only be considered as a substitute for earthing or other precautions against exposed conductive parts becoming charged when the voltages being used are at or below 50 volts ac or 120 volts dc; for example, those derived from an isolation transformer. Above these levels a combination of reduced voltage and other techniques should be used for equipment carried in the hand while alive. This is reflected in the restrictions of paragraph 21 of the ACOP to regulation 4.

18 In highly conducting locations or where the body may be damp and have a large area of contact with earthed or referenced conductors, consideration should be given to using dc hand-held equipment including dc welding equipment.

ACOP

Earth-free non-conducting environments

19 This specialised technique is based on the principle of eliminating possible dangerous differences in potential between live conductors and earth by ensuring the absence of earthed conducting parts. In the context of mines it is only suitable as an alternative to earthing in connection with work on live equipment in purpose designed electrical test workshops. In addition to the precautions for live working set out in the ACOP to regulation 14, when this alternative to earthing is used the voltage between any two accessible parts should not exceed 250 volts. The associated power supply should be designed to prevent the leakage current to earth exceeding 100 milliamperes and should be provided with effective means for cutting off the supply automatically should the leakage current exceed one third of its prospective maximum.

Current limitation

20 If the leakage fault currents which could cause electric shock are severely limited by high integrity passive devices, such as high integrity-resistors, the risk of electric shock from exposed conductive parts, for example the framework of machines, is correspondingly reduced. This technique is particularly useful for equipment that is moved while energised and is reflected in the guidance on earthing for flexible cables in paragraphs 15 and 16, and in conjunction with the earth-free non conducting environments referred to in paragraph 19 above.

8

Regulation

Integrity of referenced conductors

Regulation 9

If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.

9

ACOP

1 This regulation aims to prevent referenced conductors that carry electric current in normal conditions from reaching significant potentials above reference thereby giving rise to possible danger. It is particularly relevant to phase and neutral systems independent of whether the neutral and protective conductors are combined or separated.

2 The regulation does not prohibit all electrical devices from being placed in referenced conductors. Proper joints or bolted links or bar primaries of current transformers may be inserted provided the integrity of the conductor is maintained.

9

ACOP

3 The regulation would also permit the inclusion of other devices such as removable links or manually operated knife switches but suitable precautions should be taken to ensure that these devices are not removed or operated in a way as to give rise to danger. Devices such as fuses, thyristors and transistors should not be inserted into reference conductors except that double pole fuses may be acceptable if these are fitted within self-contained electrical equipment which itself is not part of the fixed installation and is connected to the fixed equipment by means of a plug and socket.

Combined neutral and protective conductors

4 Because of other constraints imposed by these Regulations, the use of combined neutral and protective conductors is only likely for supplies to mine offices, canteens, amenity blocks etc. An open circuit or high impedance in a combined neutral and protective conductor would almost certainly result in the exposed and extraneous conductors connected to the protective conductor becoming charged at a significant potential. Since this would lead to a risk of electric shock or burn, the integrity of the combined neutral and protective conductor should be treated with great importance. Where a protective conductor is combined with a neutral conductor, precautions should be taken to prevent persons from simultaneously contacting the protective conductor and earth. All metalwork which may reasonably become charged within a building should be bonded together and connected to the protective conductor.

Separate neutral and protective conductors

5 Although an open circuit or high impedance in a neutral is less likely to give rise to danger with this system than with the combined neutral and protective conductor, nevertheless, danger could arise and appropriate precautions should be taken.

9

Regulation

10

Connections

Regulation 10

Where necessary to prevent danger, every joint and connection in a system shall be mechanically and electrically suitable for use.

1 In making connections, so as to prevent danger, account should be taken of the following need to:

- (a) provide adequate insulation to prevent electric shock;
- (b) avoid high resistances which can lead to overheating, arcing, fire; and
- (c) prevent incendive sparking where a flammable atmosphere may be present.

2 Circuit conductors with differing current carrying capacities should not be connected together, unless the circuit electrical protection is arranged so as to protect the circuit conductor having the least current carrying capacity.

10

ACOP

Joints, plugs and sockets

3 Cable glands, couplers, plugs and sockets, and cable entries of junction and sealing boxes should be constructed to prevent danger under foreseeable conditions of use (for example they should secure the cable terminations and coverings), maintain effective electrical continuity of bonding and circuit conductors, and if necessary be sealed to prevent ingress of moisture or other contaminant.

4 Where an interlock circuit and power conductors are taken through a plug and socket, the plug and socket should be constructed to ensure that any potentially dangerous supply is not connected while the plug is being inserted or removed. For example, the interlock circuit pins should be shorter than the power circuit pins, to ensure that the plug is properly engaged in the socket before the control circuit is completed.

5 Where plugs and sockets are used below ground, they should be of the restrained or bolted type.* If they are used on equipment operating at above 1100 volts, and served by flexible cable, they should be of a bolted type, to protect such equipment from interference by unauthorised personnel.

* For example BS 5125: 1974 *Specification for 50A flameproof restrained and bolted plugs and sockets for voltages not exceeding 650V primarily for use in mining* and BS 5620: 1979 *Specification for 200A flameproof restrained and bolted plugs and sockets for voltages not exceeding 1100V primarily for use in mining*.

10

Regulation

Means for protecting from excess of current

Regulation 11

Efficient means, suitably located, shall be provided for protecting from excess of current every part of a system as may be necessary to prevent danger.

11

ACOP

1 Excess current might result from overload, short circuit or leakage on the system. Generally electrical equipment is designed for use in systems which incorporate some form of excess current protection. Where excess current protection is not provided the size, strength and capability of the equipment in the system should be adequate for the most onerous thermal, magnetic, electrical and mechanical stresses to which it may be subjected.

Overcurrent and short circuit protection

2 Excess current protection should operate at as low a value of time and current as possible allowing for any necessary discrimination to permit the effective operation of equipment. The overcurrent protection devices used should match the characteristics of the system and be supplemented if necessary by other devices; for example, where a motor, which is only protected by an overcurrent device in the control gear, is required to start and stop frequently there may be need to supplement the overcurrent device by a thermal device to prevent it overheating.

11

ACOP

3 Circuit breakers should be capable of making and breaking the system short circuit current without danger. Equipment not required to make or break a system short circuit should be capable of carrying such a short circuit current without danger either indefinitely or until such time (normally less than 5 seconds) as the system fault can be cleared.

Leakage protection

4 In assessing the potential danger from a leakage of electrical energy consideration should be given to the characteristics of the system and the maximum energy available. The danger from leakage can be minimised by limiting the prospective leakage fault current in the system provided there is a proper relationship between that current and the leakage protection device.

5 Power systems which are referenced to earth (excluding those using an earth return), should have leakage protection provided to cut off the supply of electricity automatically in the event of excess leakage to earth or reference as follows:

- (a) systems comprising equipment designed not to move while energised - those in which the voltage exceeds 650 volts
- (b) systems comprising equipment that is intended to move while working except that this does not apply to equipment used inside buildings as described in paragraph 21(c)(i) of the ACOP to regulation 4 and to systems covered by paragraph 22 of the ACOP to regulation 4 - those in which the voltage exceeds 125 volts

6 For power systems with their reference connected solidly to earth, the maximum value of trip settings should not exceed 5 amperes, or 15% of the rated load current, whichever is the greater. Where cables containing conducting elastomeric screens are used, the trip setting should take account of the low screen conductivity and should be less than 1 ampere.

7 For power systems where there is a high risk of fire, shock or ignition of flammable gas, limitation of the maximum prospective leakage fault current should be practised. The fault current and its duration should be limited to as low a value as reasonably practicable to minimise the risk of shock or damage leading to incendive sparking or arcing.

8 In power systems in coal mines the following values of earth fault current limitation should be adopted:

- (a) for mains lighting at or within 10 m of a coalface - 1 ampere maximum
- (b) where more than one neutral point is connected to earth - 2 amperes maximum
- (c) on every system below ground operating at voltages between 650 and 1200 volts - 2 amperes maximum
- (d) on every system supplying equipment designed to be moved while working and which is served by flexible (trailing) cable, up to 3300 volts - 2 amperes maximum
- (e) on every other system below ground to which the above does not apply operating at voltages between 250 and 650 volts, and supplying electrical equipment installed in zones which the manager has specified under regulation 19(1) - 16 amperes maximum

ACOP

11

9 No system that operates above 1200 volts and has a maximum prospective earth fault current exceeding 150 amperes should be installed below ground in a coal mine.

10 The settings of leakage fault protective devices in the switchgear controlling the circuit should be selected to ensure effective operation. Leakage fault protection may not be effective if the ratio between the maximum prospective earth fault current and that required to operate the tripping mechanism is less than 3:1 and a value of at least 5:1 is preferable.

Regulation

12

Means for cutting off the supply and for isolation

Regulation 12

(1) Subject to paragraph (3), where necessary to prevent danger, suitable means (including, where appropriate, methods of identifying circuits) shall be available for -

- (a) cutting off the supply of electrical energy to any electrical equipment; and
- (b) the isolation of any electrical equipment.

(2) In paragraph (1), "isolation" means the disconnection and separation of the electrical equipment from every source of electrical energy in such a way that this disconnection and separation is secure.

(3) Paragraph (1) shall not apply to electrical equipment which is itself a source of electrical energy but, in such a case as is necessary, precautions shall be taken to prevent, so far as is reasonably practicable, danger.

ACOP

12

Cutting off the supply

1 Suitable means for cutting off the supply may be initiated automatically or manually and should be:

- (a) capable of cutting off the supply under all foreseeable normal and abnormal conditions;
- (b) in a suitable location having regard to the risks, for example fire or flooding, the availability of persons to operate switchgear, accessibility and ease of use;
- (c) arranged so as to minimise the possibility of the loss of electrical power to equipment essential for the safety of persons such as ventilating fans, winding apparatus and water pumps;
- (d) clearly marked so as to show its relationship to the equipment which it controls, unless this is self evident.

ACOP

2 Switchgear should be provided as necessary and in particular in the following circumstances:

- (a) for the protection of flexible cables or equipment mounted on a movable structure, for example a pantehnicon. In general this should be done at its junction with fixed equipment (including any fixed cable). In a coal mine, where the switchgear intended to protect a flexible cable serving a pantehnicon that is moved while energised, is not positioned at its junction with a fixed cable/equipment, then a means to trip the switch should be provided at the pantehnicon;
- (b) on or near mobile machines to cut off the power in an emergency;
- (c) in the case of electrically driven cutting machines, such as shearers and roadheaders, the switch should be suitable for immobilisation purposes and form part of the machine itself.

3 Remote tripping devices should be used where a means of cutting off the power supply is needed if switchgear cannot be sited near the operator. The remote tripping circuitry should, so far as is reasonably practicable, fail to safety.

Isolation of equipment from the supply

4 In providing means of isolation account should be taken of the accessibility and ease with which the procedure can be carried out, the circumstances under which it may be required and the need to prevent mistaken operation and to avoid restoration of power while work is being carried out: for example, by the provision of facilities for padlocking, removable isolator handles and posting of notices.

Equipment which is itself a source of energy

5 Where equipment, other than batteries, may store energy (for example, capacitors) provision should be made for such energy to be discharged as part of the isolation procedure. However, in the case of some equipment, such as battery terminals, it is not practical to provide means of isolation and discharge. In such cases other precautions should be taken to prevent danger.

Precautions for work on equipment made dead

Regulation 13

Adequate precautions shall be taken to prevent electrical equipment, which has been made dead in order to prevent danger while work is carried out on or near that equipment, from becoming electrically charged during that work if danger may thereby arise.

1 Isolation should be carried out by a person competent to ascertain that no danger will arise during the work or when the electricity supply is restored. At coal mines the competent person should be a member of the electrical engineering staff appointed under regulation 11(3) of MASHAM. Where it is necessary for one member of staff to isolate for another, the member responsible for the isolation should be:

- (i) fully trained in isolation procedures and conversant with any 'permits to work' scheme that may be in operation at the mine; and
- (ii) be authorised in writing by the mine manager to perform such isolation, taking account of any restrictions, for example on the maximum voltage or type of system.

2 During the time persons are working on equipment, precautions should be taken to ensure that the equipment remains isolated for as long as is necessary to prevent danger. In general additional precautions such as earthing should be taken, particularly if the continued control of isolation of equipment cannot be guaranteed. Furthermore there may be danger that equipment will become live as a result of induction, backfeeds or leakage: for example, low voltages from other circuits inadvertently impressed on the secondary side of the transformer may cause a hazard when transformed up and this should be borne in mind when working on the primary side. Safe methods should be used for earthing circuit conductors: for example it may be necessary to apply the earth to the circuit through a circuit breaker capable of making and breaking fault current safely.

3 A safe method of working is essential to ensure the continued effectiveness of the measures taken. This should include, as appropriate, locks, control of keys and control of withdrawn fuses or links. There should be a formal system for the control and issue to nominated persons of padlocks and keys used for this purpose and each of the padlocks should be clearly marked so as to identify the person to whom it was issued.

4 Permit-to-work systems should form part of the isolation and check procedures for circuits above 250 volts but may not be necessary where isolation can be assured in an alternative way such as for work inside isolator interlocked compartments or compartments supplied by flexible cables using restrained plugs and sockets. If the person planning the work and carrying it out and the person isolating the equipment are not one and the same, the person in charge should issue clear instructions detailing the work to be done and the methods and places of isolation and subsequent restoration of the supply.

ACOP

5 Where appropriate an instrument such as a 'dead line checker' should be used as an additional check that a circuit conductor is not charged before a person touches that conductor.

6 When light bulbs are to be changed in lighting circuits the precautions taken do not necessarily need to include isolation and padlocking of the circuit provided that the lighting circuit is switched off either by a member of the electrical engineering staff or a person appointed by the manager to do so. Within 275 metres of a coal face light bulbs should be changed only by a member of the electrical engineering staff.

13

Regulation

Work on or near live conductors

Regulation 14

No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless -

- (a) it is unreasonable in all of the circumstances for it to be dead; and*
- (b) it is reasonable in all circumstances for him to be at work on or near it while it is live; and*
- (c) suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.*

14

ACOP

1 In general, work on live conductors should only be considered on those systems which it is impracticable to make dead before the work is carried out (for example, work on storage battery terminals) or the carrying out of certain electrical tests by trained persons. Persons at work are permitted to be near live conductors only if this is reasonable in all the circumstances. If it would be reasonable for the work to be carried out at a safe distance then work near the conductors would be prohibited by the regulation.

2 Equipment users should bear in mind at the time of ordering, purchase and installation of plant, the manner of operation, maintenance and repair of the electrical equipment which will be necessary during the life of the plant. Where possible the design of electrical equipment and of the installation should eliminate the need for live work which puts persons at risk of injury. This can be done by careful thought at the design stage of an installation, by the provision of alternative power supplies, properly laid out distribution systems, and well-designed equipment housings and inbuilt test facilities. Persons should not be permitted to work near uninsulated conductors if this work can be carried out at a safe distance from them.

14

ACOP

Assessment of risks before live working

3 No persons should attempt to work on or near any live conductor capable of causing danger unless all the associated risks have been competently assessed and it has been concluded that it is necessary for the work to be performed live and that it is not practicable to make the conductors dead. This assessment should take into account the danger of:

- (a) Electric shock - where the danger to be avoided from the live conductors is that of electric shock alone, then all conductors operating at a voltage in excess of 50 volts ac or 120 volts ripple free dc should be treated as dangerous and in need of assessment. In wet situations for conductive locations even these voltages may be dangerous and live work should not take place at voltages above 25 volts ac or 60 volts dc.
- (b) Arc burn and fire - where the danger to be avoided from the live conductors includes the risk of arc burn and fire then all such conductors should be treated as dangerous and in need of assessment. Any authorisation should take into account the results of this assessment.
- (c) Ignition of flammable gases - at any place where flammable gas is likely to occur in a quantity sufficient to indicate danger, work should not be carried out on or in proximity to any exposed live conductor other than one in an intrinsically safe circuit which it is not practicable to make dead. Effective precautions should be taken to ensure that incendive sparking will not occur as a result of interconnecting different intrinsically safe sources or circuits* including testing instruments.**

Procedures following assessment

4 The procedures adopted following assessment should where relevant include:

- (a) the provision of adequate information to the person carrying out the work about the live conductors involved, the associated electrical system and the foreseeable risks;
- (b) the use of suitable equipment and protective clothing, for example insulating helmets, goggles and gloves, insulating mats and stands (to prevent electric shock current via the feet), and insulated tools and insulated test probes. There should be procedures for periodically examining this protective equipment and replacement of it when necessary;
- (c) the use of suitable insulated barriers or screens;
- (d) the use of suitable instruments and test probes. Testing to establish whether electrical conductors are live or dead should always be done on the assumption they may be live;
- (e) effective control of the area where there is danger from live conductors. This means ensuring that those who are not competent and those whose presence is unnecessary are prohibited from entering the area by the provision of barriers or lockable enclosures and warning notices;
- (f) consideration of whether the presence of an additional person, suitably trained to recognise danger, render first aid and call for assistance in an emergency, would substantially contribute towards safe working practices. This would normally be the case, and where this is so, such a person should be present.

* Further guidance can be found in BS 6704: 1996 *Code of Practice for Selection, Installation and Maintenance of Intrinsically Safe Electrical Equipment in Coal Mines*.

** Further guidance can be found in BS 6705: 1987 *Specification for Electrical Measuring Instruments for use on Intrinsically Safe Circuits in Coal Mines*.

ACOP

5 Although general guidance on the application of the Regulations is given above there are known specific circumstances in which work on or near live conductors is necessary. These are:

- (a) the cleaning of commutators or slip rings provided that the voltage between any two brushes does not exceed 650 volts whilst work is in progress;
- (b) work on, or in proximity to telephone and signalling apparatus or intrinsically safe equipment in accordance with any conditions of certification;
- (c) the use of any electrical test instrument (excluding test lamps) for testing a circuit at the surface of the mine;
- (d) the use of any instrument for testing insulation resistance or conductance;
- (e) work on or near battery terminals.

Arc welding

6 Electric arc welding is a special case of work near live conductors. The precautions* should include provision of suitable protective clothing and insulated electrode holders. In addition, the article being welded and any associated metalwork should be bonded to any surrounding metalwork or framework on which the operator is standing.

* See HSE Guidance HSG118, *Electrical safety in arc welding*.

14

Regulation

Working space, access and lighting

Regulation 15

For the purposes of enabling injury to be prevented, adequate working space, adequate means of access, and adequate lighting shall be provided at all electrical equipment on which or near which work is being done in circumstances which may give rise to danger.

15

ACOP

1 In assessing the adequacy of the working space, account should be taken of the nature of the risk. An adequate working space will have sufficient headroom and sufficient space in the vicinity of live conductors to prevent inadvertent contact with the conductors or, danger from induction, leakage or flash-over between conductors. There should be a firm and even floor and no obstructions to free movement; also good housekeeping should be practised in the area.

2 Where natural lighting is inadequate, a sufficient level of artificial lighting should be provided to minimise the risk of error by persons maintaining or operating electrical equipment. Below ground the lamp carried by a person may provide a sufficient level of illumination.

15

Regulation

Persons to be competent to prevent danger and injury

16

Regulation 16

No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent danger or, where appropriate, injury, unless he possesses such knowledge or experience, or is under such degree of supervision as may be appropriate having regard to the nature of the work.

ACOP

1 No person should interfere with electrical apparatus at a mine and no person should operate any such apparatus except:

- (a) a member of the electrical engineering staff;**
- (b) a person carrying out duties in pursuance of an authorisation by the manager;**
- (c) in an emergency or for the purpose of cutting off the electricity.**

2 Any competent person authorised by the manager to install, examine, test, maintain, use or operate electrical equipment should have appropriate skill and technical knowledge to avoid danger to himself and others. In assessing a person's competence to avoid danger, account should be taken of:

- (a) experience, technical knowledge and ability to understand the system and electrical equipment on which work is being carried out; and**
- (b) the level and degree of supervision under which the person is to work.**

3 Persons not competent to work on their own, for example trainees, should be adequately supervised. Consideration should be given to the qualities and experience of persons selected to fulfil supervisory duties.

16

Regulation

Provisions applying to mines only

17

Regulation 17

(1) The provisions of regulations 18 to 28 and Schedule 1 shall apply to mines only; and the provisions of that Schedule shall have effect in particular in relation to the use below ground in a coal mine of any film lighting circuit (as defined by paragraph 1 of that Schedule) at or in close proximity to a coal face.

(2) Expressions to which meanings are assigned by the Mines and Quarries Act 1954 shall, unless the contrary intention appears, have the same meanings in regulations 18 to 27 and Schedule 1.

ACOP
17

1 The manager's rules mentioned in paragraph 4 of Schedule 1 should follow the principles set out in paragraph 13 of the ACOP to regulation 19.

Regulation

Introduction of electrical equipment

Regulation 18

Before electrical equipment (other than equipment approved for the purposes of regulation 20(1) is first introduced into any underground part of a safety-lamp mine to which the Coal and Other Mines (Surveyors and Plans) Regulations 1956^(a) apply, the manager shall submit to an inspector a copy of the ventilation plan required to be kept for that part by regulation 9 of those Regulations, on which the intended locations of that equipment shall be shown, together with a copy of any schematic diagram relating to that part prepared for the purposes of regulation 24(1).

18

(a) SI 1956/1760, to which there are amendments not relevant to these Regulations.

ACOP

1 The manager should send the relevant information and plan to the inspector not less than one month before the introduction of electricity into the part of the mine to allow sufficient time for an inspector to respond. The part of the mine may be a simple development or an extensive development which might include several longwall faces for the extraction of an area of coal. It is not necessary for a manager to notify separately on each occasion when equipment is about to be installed if the information has already been provided on a development plan previously submitted and agreed with the inspector. In any case the plans submitted should contain sufficient information to support the extent of the submission. If the submission involves 3300 volts coalface equipment, sufficient details will need to be included to demonstrate that full and proper consideration has been given to safe use.

2 The plan and schematic diagram should show each planned stage of development or sequence of working of that part of the mine as significant changes are made in the ventilation or electrical arrangements. The ventilation arrangements for each stage and sufficient details of the electrical equipment to be installed at each stage should be shown on the plan. Consultation and exchange of information between electrical engineering staff and those persons responsible for ventilation are necessary to ensure safety in these matters and should be formally established by such procedures as a requirement for both parties to sign the plans.

3 The manager should provide such information for a mine or part of a mine in which electrical equipment has not previously been installed.

18

Regulation

Restriction of equipment in certain zones below ground

Regulation 19

(1) *At every safety-lamp mine containing any zones below ground in which firedamp whether or not normally present is likely to occur in a quantity sufficient to indicate danger, there shall be prepared a suitable plan identifying such zones.*

(2) *Electrical equipment shall not be energised in such zones unless it is -*

- (a) *equipment of a kind approved for that purpose;*
- (b) *equipment approved pursuant to regulation 20(1);*
- (c) *equipment the use of which was lawful in such zones immediately before the coming into force of these Regulations;*
- (d) *equipment which has received a certificate of conformity or a certificate of inspection in accordance with Council Directive 82/130/EEC^(a) on the approximation of the laws of the Member States concerning electrical equipment for use in potentially explosive atmospheres in mines susceptible to firedamp, as adapted to technical progress by Commission Directives 88/35/EEC^(b), 91/269/EEC^(c) and 94/44/EC^(d).*
- (e) *equipment such as is specified in regulation 21(2);*
- (f) *equipment which is not capable of producing incendive electrical sparks in normal use; or*
- (g) *electrically-powered equipment not permanently installed in the mine but required occasionally for monitoring, testing, recording and measurement, and used where the concentration of firedamp is 0.8% by volume or less in accordance with suitable rules drawn up by the manager to ensure that danger will not thereby arise, which rules shall in particular include provision for personal supervision of that equipment by a competent person and testing for firedamp when it is in use;*

and any lights which conform with this paragraph shall be permitted lights in any mine such as is specified in paragraph (1).

19

ACOP

Zones where flammable gas is likely to occur

1 Although the use of non-certified electrical equipment in certain areas is not new, the concept of zoning in a formal manner is new. Managers should continue to exercise prudent judgement in introducing equipment not included in regulation 19(2)(a) to 19(2)(e). In determining zones the manager should take account of the normal and foreseeable concentration of firedamp in normal and abnormal circumstances such as occur during ventilation breakdowns or unusual emissions. Parts of the mine outside the zone should be restricted to areas where adequate standards of ventilation can be assured at all times when the equipment may be required. The assessment should consider whether the equipment would need to be used in the event of a breakdown of a main fan or for underground degassing operations. Any equipment installed in a zone should be of a type required by regulation 19(2).

^(a) OJ No L59, 2.3.82, p10.

^(b) OJ No L20, 26.1.88, p28.

^(c) OJ No L134, 29.5.91, p51.

^(d) OJ No L248, 23.9.94, p82.

19

ACOP

2 Plans of the underground workings should be to a suitable scale and the zones to be identified should be depicted by any convenient means. It may be more convenient in some cases to depict the parts of the mine lying outside the zones where firedamp is likely to occur, providing this is clear and can be readily understood. The zones to be identified should be marked on the electrical plan required for compliance with regulation 24.

3 In order to comply with section 2(2)(c) of the Health and Safety at Work etc Act 1974, all persons employed below ground should be made aware of the zones where flammable gas is likely to occur. Notices should be posted at the entrances to the zones to warn persons that only suitable types of electrical equipment are to be used beyond that point.

Approved equipment and equipment certified to European Harmonised Standards

4 Information relating to the kinds of certified and approved equipment which are suitable for use in zones specified by the manager is given in Guidance Note 1 and its appendices, at the end of this Code of Practice.

5 Equipment which is not installed, commissioned, tested, maintained, repaired* and operated in accordance with the conditions of certification, or approval, ceases to be suitable equipment. Consequently any work on such equipment should be carried out only by suitably competent persons. Before equipment is commissioned after installation or repair, appropriate checks should be made as necessary to ensure that it complies with any certification or approval conditions that are applicable to an end user.**

6 Safety-lamp bulbs (light-sources) which, prior to the commencement of these Electricity Regulations, were approved for the purpose of regulation 4 of the Coal and Other Mines (Safety Lamps and Lighting) Regulations 1956 (regulation 4 now revoked) may continue in use in accordance with the terms of their approval and are covered by Guidance Note 1, Appendix 1 (item 6).

7 Electric safety lamps containing a generator driven by compressed air were, prior to commencement of these Electricity Regulations approved under regulation 19 of the Coal and Other Mines (Safety Lamps and Lighting) Regulations 1956 (regulation 19, now revoked), and are covered by Guidance Note 1, Appendix 1 (item 6). Any new type of lamp not covered by such approval will now have to be of a certified type (for example, to the type of protection 'p' - pressurised as defined in EN 50016).

* As outlined in Deep Mined Coal Industry Advisory Committee Guidance *The repair and overhaul of apparatus intended for use in coal mines susceptible to firedamp*. Reference ISBN 0 7176 1249 X

** BS 7924: 1999 *The repair and overhaul of certified electrical apparatus intended for use in mines susceptible to firedamp*

ACOP

8 Additionally the following provisions apply to the safety of the operation and maintenance of electric safety lamps containing a generator driven by compressed air where firedamp may be present:

- (a) the air pressure in such a unit should not be turned on unless the unit is assembled and closed;
- (b) any unit which is suspected to be defective should not be used;
- (c) the units should be dismantled, repaired, altered or adjusted by competent persons appointed in writing by the manager; and
- (d) the units should be cleaned, overhauled and tested by competent persons at the intervals dictated by the manager's scheme (see ACOP 4, paragraph 19).

9 Personal electrical equipment, including watches and calculators, may not be energised in a regulation 19 zone unless it is of an approved type. Details of personal medical equipment which is approved can be obtained from the Department of Health or from the Mines and Quarries Inspectorate. Non-essential personal electrical equipment should not be taken below ground in a mine in which there are zones where firedamp is likely to occur or in a safety-lamp mine.

10 Certificates issued by a recognised certifying authority testify only that the equipment has been found to comply with the definition of the type of protection in the relevant standards. Certification normally relates only to safety in respect of ignition of flammable gas. Such certificates do not vouch for the quality of the equipment in any other respect. Thus incorrectly installed and used equipment, that which is not maintained correctly, that which is subject to an electrical fault (as opposed to normal working), that which may not be suitable for the intended duty, etc, is generally not covered by the certificate and may be in breach of these Electricity Regulations or other statute.

Equipment which is incapable of producing 'incendive sparks'

11 Information relating to the kinds of equipment which are suitable for use under regulation 19(2)(f) are given in paragraph 17 of Guidance Note 1.

Equipment allowed by virtue of manager's rules

12 Regulation 19(2)(g) allows certain non-certified, non-approved equipment such as surveyor's theodolites or electrician's test instruments to be used in a zone specified by the manager. Providing the manager makes rules and the equipment is under the control of a competent person, such equipment can contribute to the safe working of a mine. In addition to the precautions for ensuring a safe atmosphere, every effort should be made to make sure that the safest possible equipment is used and in this connection the advice of a senior electrical engineer should be sought.

ACOP

13 The manager's rules should make provision for:

- (a) the appointment of a competent person to be in general charge of the equipment at all times while it is below ground. However, this should not preclude the keeping below ground of non-certified insulation testers in suitable locked containers provided the access to the instruments is under the control of the electrical engineering staff;
- (b) the observance of all instructions and warnings on the equipment and in any applicable written instructions;
- (c) the examination of the equipment by a competent person before it is taken below ground to ensure it is in safe working order, and the recording of the results in a book provided for the purpose;
- (d) the avoidance of the removal of covers except by a competent person;
- (e) the secure connection of all cables before the equipment is switched on, and for the equipment to be switched off before cables are disconnected;
- (f) the equipment only to be energised at places where the concentration of firedamp is 0.8% by volume or less;
- (g) when the equipment is in use, the supervision at all times by a competent person who should make tests for firedamp in the general body of the air, and in areas which are adjacent to the place where the equipment or associated electrical circuits are being used and which may contain more firedamp than the general body (for example, waste edges, roof levels of roadways and rippings). The tests should be made continuously by means of an automatic firedamp detector (AFD) or similar portable constant reading instrument which should be checked for accuracy immediately before being taken into the mine and set to alarm at 0.8% by volume of firedamp;
- (h) the action to be taken in the event of:
 - firedamp occurring in excess of that stipulated in the rules,
 - equipment being left unattended;
- (i) the removal of items of equipment containing batteries to a safe place (which in the special case of non-certified insulation testers could be a locked container at its intended place of usage).

General requirements

14 Where electrical equipment is not of a type covered by regulation 19(2) and is taken through a zone in which firedamp is likely to occur, adequate precautions should be taken to ensure that it is not energised while within the zone.

Regulation

Cutting off electricity or making safe where firedamp is found either below ground or at the surface

Regulation 20

(1) Where any person at a mine detects firedamp in a concentration exceeding 1.25% by volume in the general body of the air either below ground at that mine or at any place on the surface thereof where any exhauster in a firedamp drainage system is installed, firedamp is monitored or its heat content measured, he shall forthwith -

- (a) cut off the supply of electricity to any electrical equipment situated at the place where the said concentration was detected; or
- (b) (where this is not possible) take all reasonably practicable steps to make such equipment safe; or
- (c) (if the taking of the measures specified in sub-paragraphs (a) and (b) above does not fall within the scope of his normal duties) report the matter to an official of the mine who shall ensure that those measures are taken;

except that the provisions of sub-paragraphs (a) to (c) above shall not apply if the electrical equipment is approved for the purpose of remaining energised in such circumstances or (in the case of a safety-lamp mine) is electrical equipment such as is specified in regulation 21(2).

(2) If the supply of electricity to electrical equipment is cut off or the equipment made safe in accordance with paragraph (1), it shall remain in that condition until the senior official on duty at the mine having determined that it is safe to do so, directs that such precautions are no longer necessary.

(3) If the supply of electricity to electrical equipment is cut off or the equipment made safe in accordance with paragraph (1), details of the time, duration and location shall be recorded.

20

ACOP

1 Initial siting of equipment and arrangement of systems should take account of the possible need for isolation or making safe when flammable gas occurs and subsequent restoration to normal conditions.

2 Where equipment derives power from an internal source (eg a battery, generator, or alternator) precautions may be needed in addition to cutting off the supply to make that equipment safe. Such precautions may include: removal to a non-hazardous area, disconnecting the mechanical drive to a generator, isolation of circuits fed from batteries as near to the battery terminals as possible so as to reduce to a minimum the conductors or components remaining energised. The introduction, location and use of equipment at places where flammable gas is likely to exceed the statutory limit should be carefully planned and controlled, especially if batteries are used as these cannot be made completely dead and their rapid removal may not be reasonably practicable. Where necessary, instructions should be issued for making the equipment safe in these circumstances.

20

ACOP

3 Following the dispersal of concentrations of firedamp exceeding 2% by volume from the general body of air some gas may remain within equipment. Enclosures which include normally arcing or sparking devices should be purged of flammable gas before operations resume.

Equipment approved to remain energised

4 Details of the types of electrical equipment which are approved by the Health and Safety Executive for the purpose of regulation 21(1) are provided in Appendix 2 to Guidance Note 1 at the end of this Code of Practice.

5 If an approved source of supply has an electrical input which is not an approved source, such as a signalling transformer supplied from the mains then the unapproved source of supply must be cut off if flammable gas occurs in excess of the statutory limit at the place where the transformer is sited.

6 Approved protective devices (barriers) which limit the energy that can be transferred from a source outside the specified zone to a circuit in the zone may be used subject to the conditions imposed by the approval: for example devices used to separate approved telephones below ground from those at the surface which may not be approved. Such devices should be located in places where flammable gas is not likely to occur: for example at the surface of the mine.

7 Equipment approved by HSE and its predecessors for the purpose of other regulations, eg locomotives, should not be confused with equipment approved for the purpose of regulation 20(1) and must either be switched off or made safe if firedamp occurs in a quantity exceeding the stipulated limit.

20

Regulation

Approval of certain equipment for use in safety-lamp mines

Regulation 21

(1) Subject to paragraph (2), no electric safety-lamp, gas detector, telephone or signalling equipment, or other equipment associated therewith or required for the safety of persons shall be taken or used below ground at any safety-lamp mine unless it is equipment which has been approved pursuant to regulation 20(1) or (in the case of electric safety-lamps) is of a type for the time being approved pursuant to section 64(2) of the Mines and Quarries Act 1954.

(2) Nothing in paragraph (1) shall prevent the taking or use below ground at any safety-lamp mine of any electrical equipment which was, before the coming into force of these Regulations, approved pursuant to regulations 20 and 21A of the Coal and Other Mines (Electricity) Regulations 1956.^(a)

(a) SI 1956/1766; the relevant amending instruments are SI 1974/1853 and SI 1977/1205.

21

ACOP

21

- 1 In order to minimise the risk of ignition only apparatus required for the safety of persons underground together with its source of supply, will be so approved, for example:
- (a) telephones, communications and signalling equipment (including shaft signalling equipment, as appropriate) which is necessary in emergency for escape or rescue;
 - (b) monitoring instruments and associated equipment including data highways, eg methanometers and fire detectors, data from which is necessary for the effective control of the mine environment and which warn of potentially dangerous conditions;
 - (c) electric safety lamps which are essential to persons in an emergency, eg personal cap lamps or hand lamps;
 - (d) rescue equipment, eg breathing apparatus, or equipment provided to take defensive action in emergency, eg an electrically initiated triggered barrier.

Regulation

22

Means of cutting off electricity to circuits below ground

Regulation 22

At every mine at which electrical equipment which may give rise to danger is installed below ground and is supplied from a power source at the surface of the mine, switchgear shall be provided at the surface for cutting off the supply of current to that equipment, and adequate provision shall be made for the operation of that switchgear, including such means of communication as will, so far as is reasonably practicable, enable the switchgear to be operated in case of danger.

ACOP

22

- 1 All electrical systems supplied from the surface of the mine and used underground, except telephone signalling systems and data highways for monitoring, should be provided with switchgear at the surface to cut off the power underground.
- 2 Persons appointed by the manager should be available at the surface to operate the switchgear whenever persons are below ground. Operation may be manual or be initiated by remote tripping. Any remote tripping circuit should be monitored and incorporate good standards of reliability. Where the power supply to underground equipment at one mine is taken from a neighbouring mine the same principles for cutting off the power supply are applicable.
- 3 Adequate provision for communication should enable the appointed person to be contacted from the surface and underground entrances to the mine (ie shaft or drift top and bottom) and also from the main electricity distribution centre or centres underground.
- 4 In the case of combined mines or mine complexes, the component mines may be treated separately for the purposes of this regulation. If however there is an electrical interconnection below ground, other than circuits approved for the purposes of regulation 20(1), then arrangements in accordance with paragraph 2 above should be made to ensure that all power can be cut off at the surface.

Regulation

23

Oil-filled equipment

Regulation 23

Electrical equipment using oil as a means of cooling, insulation or arc suppression shall not be introduced below ground at a mine.

ACOP

23

1 Oil-filled equipment which was below ground in the mine at the commencement date may continue in operation and, indeed, be redeployed below ground at that same mine, or be brought to the surface for maintenance and then returned below ground at that mine. Until it can be replaced by equipment which is not a fire hazard such equipment should be located and arranged so as to minimise the risk to persons should the oil be ignited, eg installed with drainage pits and sited near an upcast shaft so that the products of any combustion are swiftly removed without affecting persons underground and in any case such equipment should not be located at or near a working face.*

* The place where electrical apparatus is used in miscellaneous mines must also comply with the requirements of regulation 33 of the Miscellaneous Mines (General) Regulations 1956.

Regulation

24

Records and information

Regulation 24

(1) Suitable schematic diagrams of all electrical distribution systems intended to be operated at the mine (other than those operating at a voltage not exceeding 250 volts) shall, so far as is reasonably practicable -

- (a) be prepared and kept in the office at the mine; and*
- (b) show the planned settings of any circuit electrical protective devices.*

(2) Copies of such portions of the schematic diagrams prepared pursuant to paragraph (1) as are necessary to prevent danger and which show at least those parts of the electrical system which are served by switchgear operating at a voltage in excess of 250 volts shall be displayed at each place where such switchgear is installed.

(3) Plans on a suitable scale shall be kept in the office at the mine showing, so far as is reasonably practicable, the position of all permanently installed electrical equipment at the mine supplied at a voltage in excess of 250 volts.

ACOP

24

1 Schematic diagrams of the distribution system covering both surface installations and those below ground, should be as clear as possible using simple line techniques and easily understood symbols. They should show all electrical equipment including cables operating at a voltage exceeding 250 volts. Additionally, the drawing should show the planned settings of any electrical circuit protection devices which are designed to be adjustable.

ACOP

2 Relevant portions of the schematic diagrams should be available at sub-stations for reference purposes. It may be convenient to produce several separate schematic diagrams each relating to a section of the mine electrical systems according to location. Copies of these separate diagrams could then satisfy regulation 24(2), and when collected together form a composite diagram, to satisfy regulation 24(1).

3 The scale plans should show the location of relevant equipment including cables installed above and below ground. Equipment subject to frequent changes of location should be shown if the constraints within which the equipment moves can be readily depicted, eg cutting and loading equipment used at the coal face.

4 The plans required by regulation 24(3) and diagrams required by regulation 24(1) may be combined on one plan provided this does not lead to confusion.

5 Updating of plans and diagrams should be carried out such that no plan or diagram is so out of date as to lead to danger. Review of plans every three months would normally be appropriate but if there are substantial changes the plan should be updated forthwith.

24

Regulation

Electric shock notices

Regulation 25

Where, at any place at a mine, electric arc welding is taking place or electrical energy is being generated, transformed or used at a nominal voltage in excess of 125 volts a.c. or 250 volts d.c., a notice shall be displayed in a form which can be easily read and understood and containing information on the appropriate first-aid treatment for electric shock and details of the emergency action to be taken in the event of electric shock.

25

ACOP

1 Notices* should be posted in sub-stations, control and switch rooms, engine houses and in reasonable proximity to other places where switchgear and motors are installed.

2 In order to comply with section 2(2)(c) of the Health and Safety at Work etc Act 1974, the notice used should also include a prohibition on unauthorised persons tampering with electrical equipment and directions on action to be taken in the event of fire or explosion.

25

* For example, the HSE poster *Electric shock: first aid procedures*.

Regulation

Introduction of battery-powered locomotives and vehicles into safety-lamp mines

26

Regulation 26

No locomotive or vehicle which uses an electrical storage battery, either partly or wholly, as a power source for traction purposes shall be introduced below ground at a safety-lamp mine unless it is an approved locomotive or vehicle.

ACOP

26

1 Any locomotive approved for the purposes of regulation 3(3) of the Coal and Other Mines (Locomotives) Regulations 1956 is considered to be approved for the purposes of this regulation.

2 Any locomotive or vehicle constructed in accordance with the consolidated European Machinery Directive 98/37/EEC, does not require approval because the Supply of Machinery (Safety) Regulations 1992 disapplies this regulation to such vehicles.

Regulation

Storage, charging and transfer of electrical storage batteries

27

Regulation 27

At any mine in which electrical storage batteries are used below ground, those batteries shall, so far as is reasonably practicable, be used, stored, charged and transferred in a safe manner.

ACOP

27

1 Where a vehicle has a mains power supply, for example a trolley locomotive that has a traction battery for operating beyond the limits of the trolley wires, or where regenerative braking is practised, the battery and vehicle design may allow the charging of the battery on the vehicle provided the manager is satisfied that the ventilation is not adversely affected and any flammable gas is safely dispersed at all times.

2 Charging apparatus for traction type batteries should incorporate means of automatically cutting off the charging current if excessive leakage current between the battery under charge and its container are detected.

3 During the topping up of batteries care should be taken to minimise spillage.

ACOP

4 It is traditional to change traction type batteries only at charging stations* designated by the mine manager and generally this should be the preferred practice. Improved vehicle design may allow batteries to be safely changed at designated transfer stations. Such transfer stations should be of adequate size and suitably equipped for the purpose: for example provided with suitable arrangements for lifting or handling traction batteries and adequate means of combating fire. Where the transfer of traction type batteries requires the use of trailing cables, arrangements should be made to protect the cable from damage due to overtension and particular care should be taken to maintain plugs and sockets in a clean and dry condition. Only traction type batteries having a mid-point isolator should be stored below ground at places other than the designated charging stations.

5 During the transportation or storage of a traction type battery all isolators provided on the battery container should be switched off. Batteries should be transported in a suitable purpose designed carrying case or vehicle.

6 Charging stations for traction type batteries should be established in settled ground and not sited in proximity to methane drainage extractors or discharge points. The charging apparatus should be arranged so that it is on the intake side of the battery racks and the air passes from the battery racks directly into an airway and does not subsequently ventilate the working place or heading.

7 The permanent lighting provided in underground charging stations in safety-lamp mines must be permitted lights as specified by regulation 19(2).

* Regulation 32 of the Coal and Other Mines (Locomotives) Regulations 1956 applies only to the charging of battery-powered locomotives and should be treated as guidance for other battery-powered traction vehicles.

27

Regulation

Disapplication of section 157 of the Mines and Quarries Act 1954

Regulation 28

Section 157 of the Mines and Quarries Act 1954^(a) (which provides a defence in legal proceedings and prosecutions in certain circumstances) shall not apply in relation to any legal proceedings or prosecutions based on an allegation of a contravention of a requirement or prohibition imposed by regulations 18 to 27 or by or under Schedule 1.

(a) 1954 c.70; section 157 was amended by SI 1974/2013.

28

Regulation

Defence

Regulation 29

In any proceedings for an offence consisting of a contravention of regulations 4(4), 5, 8, 9, 10, 11, 12, 13, 14, 15, 16 or 25, it shall be a defence for any person to prove that he took all reasonable steps and exercised all due diligence to avoid the commission of that offence.

29

Regulation

Exemptions certificates

Regulation 30

(1) Subject to paragraph (2) the Health and Safety Executive may, by a certificate in writing exempt -

- (a) any person;*
- (b) any premises;*
- (c) any electrical equipment;*
- (d) any electrical system;*
- (e) any electrical process;*
- (f) any activity,*

or any class of the above, from any requirement or prohibition imposed by these Regulations and any such exemption may be granted subject to conditions and to a limit of time and may be revoked by a certificate in writing at any time.

(2) The Executive shall not grant any such exemption unless, having regard to the circumstances of the case, and in particular to -

- (a) the conditions, if any, which it proposes to attach to the exemption; and*
- (b) any other requirements imposed by or under any enactment which apply to the case,*

it is satisfied that the health and safety of persons who are likely to be affected by the exemption will not be prejudiced in consequence of it.

30

Regulation

Extension outside Great Britain

Regulation 31

These Regulations shall apply to and in relation to premises and activities outside Great Britain to which sections 1 to 59 and 80 to 82 of the Health and Safety at Work etc. Act 1974 apply by virtue of Articles 6 and 7 of the Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 1977^(a) as they apply within Great Britain.

(a) SI 1977/1232.

31

Regulation

Disapplication of duties

Regulation 32

The duties imposed by these Regulations shall not extend to -

- (a) the master or crew of a sea-going ship or to the employer of such persons, in relation to the normal ship-board activities of a ship's crew under the direction of the master; or*
- (b) any person, in relation to any aircraft or hovercraft which is moving under its own power.*

32

Regulation

Revocations and modifications

Regulation 33

(1) The instruments specified in column 1 of Part 1 of Schedule 2 are revoked to the extent specified in the corresponding entry in column 3 of that Part.

(2) The enactments and instruments specified in Part II of Schedule 2 shall be modified to the extent specified in that Part.

(3) In the Mines and Quarries Act 1954, the Mines and Quarries (Tips) Act 1969^(a) and the Mines Management Act 1971,^(b) and in regulations made under any of those Acts, or in health and safety regulations, any reference to any of those Acts shall be treated as including a reference to these Regulations.

33

(a) 1969 c.10.

(b) 1971 c.20.

Schedule 1

Provisions applying to mines only and having effect in particular in relation to the use below ground in coal mines of film lighting circuits

Schedule 1

Regulation 17

1 In this Schedule, “film lighting circuit” means any electric circuit at a coal mine, not being permanently installed thereat, and required occasionally to supply mains electricity to electric lights for the purpose of providing illumination for photography or video-recording, and includes the said lights and any other electrical apparatus in that circuit.

2 A film lighting circuit shall not be used unless -

- (a) not less than 7 days prior to such use, details of when and where it is to be used have been notified to the Health and Safety Executive; and
- (b) within the 24 hours immediately preceding such use -
 - (i) it has been externally examined; and
 - (ii) the insulation thereof and the conductance of every conductor of every flexible cable forming part of it have been tested.

3 The manager shall make, and ensure the carrying out of, arrangements to prevent the accumulation of dust on any surface of any luminaire or apparatus in sufficient quantities to give rise to spontaneous ignition.

4 The manager shall make suitable rules with respect to the use of film lighting circuits, for the purpose of ensuring, so far as is reasonably practicable, that such use will not give rise to danger; and those rules shall in particular require -

- (a) continuous testing for firedamp when a film lighting circuit is in use; and
- (b) the operation of any such circuit to be personally supervised by a competent person.

5 No person shall fire any shot or round of shots in a place in which, or in the vicinity of which, any part of a film lighting circuit is installed.

Schedule 2

Revocations and modifications

Schedule 2

Regulation 33

Part I Revocations

<i>Column 1</i> <i>Regulations and orders revoked</i>	<i>Column 2</i> <i>Reference</i>	<i>Column 3</i> <i>Extent of revocation</i>
The Electricity Regulations 1908	SR & O 1908/1312	The whole Regulations
The Manufacture of Cinematograph Film Regulations 1928	SR & O 1928/82	Regulation 12
The Cinematograph Film Stripping Regulations 1939	SR & O 1939/571	Regulation 14
The Electricity (Factories Act) Special Regulations 1944	SR & O 1944/739	The whole Regulations
The Factories (Testing of Aircraft Engines and Accessories) Special Regulations 1952	SI 1952/1689	In regulation 2(2), the definitions of "Earthed", "Flameproof" and "Intrinsically safe"; regulations 14, 15, 16, 17 and 18
The Coal and Other Mines (General Duties and Conduct) Regulations 1956	SI 1956/1761	Regulation 6(2)
The Coal and Other Mines (Safety-Lamps and Lighting) Regulations 1956	SI 1956/1765	Regulations 4, 18, 18A and 19
The Coal and Other Mines (Electricity) Order 1956	SI 1956/1766	The whole Order
The Miscellaneous Mines (Electricity) Order 1956	SI 1956/1779	The whole Order
The Quarries (Electricity) Order 1956	SI 1956/1781	The whole Order
The Dragonby Ironstone Mine (Diesel, Diesel-Electric and Storage Battery Vehicles) Special Regulations 1958	SI 1958/320	The whole Regulations
The Winn's Ironstone Mine (Diesel, Diesel-Electric and Storage Battery Vehicles) Special Regulations 1958	SI 1958/321	The whole Regulations

Schedule 2

<i>Column 1 Regulations and orders revoked</i>	<i>Column 2 Reference</i>	<i>Column 3 Extent of revocation</i>
The Silverwood Mine (Electric Trolley Locomotives) Special Regulations 1958	SI 1958/1276	The whole Regulations
The Gasswater A Mine (Storage Battery Locomotives) Special Regulations 1959	SI 1959/37	The whole Regulations
The Gasswater B Mine (Storage Battery Locomotives) Special Regulations 1959	SI 1959/38	The whole Regulations
The Glass Houghton Mine (Shuttle Cars) Special Regulations 1959	SI 1959/663	The whole Regulations
The Heights Mine (Storage Battery Locomotives) Special Regulations 1960	SI 1960/223	The whole Regulations
The Coal Mines (Firedamp Drainage) Regulations 1960	SI 1960/1015	Regulation 12(1)(b)
The Construction (General Provisions) Regulations 1961	SI 1961/1580	Regulation 44
The Hopton Mine (Locomotives and Diesel Vehicles) Special	SI 1961/1583	The whole Regulations
The Cocklakes Mine (Locomotive and Diesel Vehicles) Special Regulations 1961	SI 1961/1796	The whole Regulations
The Long Meg Mine (Locomotive and Diesel Vehicles) Special Regulations 1961	SI 1961/1774	The whole Regulations
The Sandwich Anhydrite Mine (Lighting) Special Regulations 1962	SI 1962/192	The whole Regulations
The Thistleton Mine Special Regulations 1962	SI 1962/364	Regulations 4, 22 to 42, and 53 to 80
The Force Crag Mine (Storage Battery Locomotives) Special Regulations 1962	SI 1962/1501	The whole Regulations
The Potts Ghyll Mine (Storage Battery Locomotives) Special Regulations 1963	SI 1963/270	The whole Regulations
The Chislet Mine (Electric Trolley Locomotives) Special Regulations 1963	SI 1963/896	The whole Regulations
The Lnharry Mine (Storage Battery Locomotives) Special Regulations 1963	SI 1963/906	The whole Regulations
The Easton Mine (Diesel, Diesel - Electric and Storage Battery Vehicles) Special Regulations 1963	SI 1963/1074	The whole Regulations

Schedule 2

<i>Column 1 Regulations and orders revoked</i>	<i>Column 2 Reference</i>	<i>Column 3 Extent of revocation</i>
The Guildie Howes Mine (Locomotives and Diesel Vehicles) Special Regulations 1965	SI 1965/33	The whole Regulations
The Muirshiel Barytes Mine (Storage Battery Locomotives) Special Regulations 1965	SI 1965/120	The whole Regulations
The Dragonby Ironstone Mine (Diesel, Diesel-Electric and Storage Battery Vehicles) (Amendment) Special Regulations 1965	SI 1965/1299	The whole Regulations
The Coal and Other Mines (Mechanics and Electricians) Regulations 1965	SI 1965/1559	Regulation 11(3)
The Redburn Mine (Storage Battery Locomotives) Special Regulations 1965	SI 1965/1698	The whole Regulations
The Settingstones Mine (Storage Battery Locomotives) Special Regulations 1966	SI 1966/351	The whole Regulations
The Coal and Other Mines (Electricity) (Amendment) Regulations 1967	SI 1967/1083	The whole Regulations
The Aberllefeni Mine (Storage Battery Locomotives) Special Regulations 1967	SI 1967/1395	The whole Regulations
The Briach Goch Mine (Storage Battery Locomotives) Special Regulations 1967	SI 1967/1396	The whole Regulations
The Preston Manor Mine (Lighting) Special Regulations 1968	SI 1968/38	The whole Regulations
The Chudleigh Knighton Tunnel Mine (Lighting) Special Regulations 1968	SI 1968/39	The whole Regulations
The West Golds Mine (Lighting) Special Regulations 1968	SI 1968/40	The whole Regulations
The Broadway New Pit Tunnel Mine (Lighting) Special Regulations 1968	SI 1968/103	The whole Regulations
The Mainbow Mine (Lighting) Special Regulations 1968	SI 1968/104	The whole Regulations
The Nangiles and the Janes Mine (Storage Battery Locomotives) Special Regulations 1968	SI 1968/868	The whole Regulations
The Camborne Mine (Storage Battery Locomotives) Special Regulations 1969	SI 1969/570	The whole Regulations
The Cotgrave Mine (Suspended Monorail Diesel Locomotives) Special Regulations 1969	SI 1969/744	The whole Regulations

Schedule 2

<i>Column 1 Regulations and orders revoked</i>	<i>Column 2 Reference</i>	<i>Column 3 Extent of revocation</i>
The Levant Mine (Storage Battery Locomotives) Special Regulations 1969	SI 1969/1236	The whole Regulations
The No 4 Adit Mine (Lighting) Special Regulations 1970	SI 1970/1103	The whole Regulations
The Rixey Park Mine (Lighting) Special Regulations 1970	SI 1970/1547	The whole Regulations
The Horden Mine (Cable Reel Shuttle Cars) Special Regulations 1971	SI 1971/18	The whole Regulations
The Mount Wellington Mine (Storage Battery Locomotives) Special Regulations 1971	SI 1972/1270	The whole Regulations
The Cornish Hush Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/348	The whole Regulations
The Beckermat Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/396	The whole Regulations
The Burtree Pasture Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/483	The whole Regulations
The Haile Moor Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/1235	The whole Regulations
The Carrock Fell Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/1236	The whole Regulations
The Prince of Wales Mine (Storage Battery Locomotives) Special Regulations 1972	SI 1972/1393	The whole Regulations
The Rixey Park Mine (Storage Battery Locomotives) Special Regulations 1973	SI 1973/1208	The whole Regulations
The Beaumont Mine (Storage Battery Locomotives) Special Regulations 1974	SI 1974/1654	The whole Regulations
The Coal and Other Mines (Electricity) (Second Amendment) Regulations 1974	SI 1974/1853	The whole Regulations
The Ledston Luck Mine (Cable Reel Shuttle Cars) Special Regulations 1974	SI 1974/1929	The whole Regulations
The Factories Act 1961 etc. (Repeals and Modifications) Regulations 1974	SI 1974/1941	Regulation 3(2)(a)
The Hendre Mine (Storage Battery Locomotives) Special Regulations 1974	SI 1974/1985	The whole Regulations

Schedule 2

<i>Column 1 Regulations and orders revoked</i>	<i>Column 2 Reference</i>	<i>Column 3 Extent of revocation</i>
The Mines and Quarries Acts 1954 to 1971 (Repeals and Modifications) Regulations 1975	SI 1975/1102	The entry in Schedule 2 relating to the Coal and Other Mines (Electricity) Regulations 1956
The South Leicester Mine (Electric Lighting) Regulations 1976	SI 1976/696	The whole Regulations
The Coal and Other Mines (Electricity) (Third Amendment) Regulations 1977	SI 1977/1205	The whole Regulations
The Bolsover Mine (Cable Reel Shuttle Cars) Regulations 1977	SI 1977/2035	The whole Regulations
The Ackton Hall Mine (Cable Reel Load-Haul-Dump Vehicles) Regulations 1978	SI 1978/1539	The whole Regulations
The Coal and Other Mines (Metrication) Regulations 1978	SI 1978/1648	The entries in the Schedule relating to - (a) regulation 18 of the Coal and Other Mines) Safety-Lamps and Lighting) Regulations 1956; and (b) the Coal and Other Mines (Electricity) Regulations 1956
The Coal and Other Mines (Electric Lighting for Filming) Regulations 1979	SI 1979/1203	The whole Regulations
The Scraithole Mine (Storage Battery Locomotives) Regulations 1979	SI 1979/1658	The whole Regulations
The Lynemouth Mine (Electric Lighting) Regulations 1980	SI 1980/1395	The whole Regulations
The Manton Mine (Electric Lighting) Regulations 1980	SI 1980/1396	The whole Regulations
The Vane Tempest Mine (Electric Lighting) Regulations 1980	SI 1980/1397	The whole Regulations
The Yew Tree Mine (Storage Battery Locomotives) Regulations 1980	SI 1980/1405	The whole Regulations
The Coal and Other Mines (Safety-Lamps and Lighting) (Amendment) Regulations 1983	SI 1983/710	The whole Regulations

Schedule 2

<i>Column 1</i> <i>Regulations and orders revoked</i>	<i>Column 2</i> <i>Reference</i>	<i>Column 3</i> <i>Extent of revocation</i>
The Miscellaneous Mines (Metrification) Regulations 1983	SI 1983/994	In regulation 1(2), the reference to the Miscellaneous Mines (Electricity) Regulations 1956; and in the Schedule the entries relating to those 1956 Regulations
The Quarries (Metrification) Regulations 1983	SI 1983/1026	in regulation 1(2), the reference to the Quarries (Electricity) Regulations 1956; and in the Schedule the entries relating to those 1956 Regulations
The Mines (Miscellaneous Amendments) Regulations 1983	SI 1983/1130	The whole Regulations

Guidance

Part II Modifications

- 1 The Mines and Quarries Act 1954 shall be modified as follows:
 - (a) in section 64(2) (which relates to safety-lamps) after the word “one” insert “conforming with the provisions of regulation 19(2)(a) to (d) of the Electricity at Work Regulations 1989 or”;
 - (b) in section 182(1) (which defines “permitted lights”) the words “or health and safety regulations” shall be substituted for the words “or Regulations 18 and 18A of the Coal and Other Mines (Safety-Lamps and Lighting) Regulations 1956 as substituted and inserted respectively by the Coal and Other Mines (Safety-Lamps and Lighting) (Amendment) Regulations 1983”.
- 2 Regulation 4 of the Coal and Other Mines (Fire and Rescue) Regulations 1956^(a) (which relates to the provision of dust or sand in relation to electric motors) shall be modified by substituting the words “which is not electrical apparatus that is designed to be moved while working” for the words “which is not portable apparatus for the purposes of the Coal and Other Mines (Electricity) Regulations 1956”.
- 3 The Shipbuilding and Ship-repairing Regulations 1960^(b) shall be modified as follows:
 - (a) in regulation 51(3)(c) (which requires the provision of lamps and torches in confined spaces in vessels) the words “of an appropriate type” shall be substituted for the words “of a safety type approved for the purpose of this Regulation”;
 - (b) in paragraphs (1) and (3) of regulation 59 (which impose restrictions with respect to the application etc of naked lights, fires, lamps and heated rivets in oil-carrying vessels), the words “a lamp of an appropriate type” shall be substituted for the words “a safety lamp of a type approved for the purpose of this Regulation” where they respectively appear.

(a) SI 1956/1768; to which there are amendments not relevant to these Regulations.

(b) SI 1960/1932; the relevant amending instrument is SI 1983/644.

Guidance

4 Section 1(4) of the Mines Management Act 1971 (which relates to exceptions from statutory responsibilities that may be placed on managers' assistants) shall be modified by the substitution of the following paragraphs for paragraph (d) -

- “(d) responsibility for making rules under regulation 19(2)(g) of the Electricity at Work Regulations 1989; and
- (e) such other responsibilities as may be prescribed.”.

Electrical equipment which may be energised below ground in mines where firedamp may be a hazard

Guidance Note 1

Introduction

1 Where firedamp may occur in mines, precautions are necessary to minimise the risk of explosion from electrical causes. The main safeguard is the provision of adequate ventilation to dilute firedamp to safe concentrations. However various well-established methods for protecting electrical equipment (explosion protection) have been evolved as a further safeguard in the event that it becomes engulfed in an explosive atmosphere.

2 This guidance note describes the types of explosion protected electrical equipment which meet the requirements of regulations 19 (Restriction of electrical equipment in certain zones below ground) and 21 (Approval of certain equipment for use in safety-lamp mines) as appropriate.

3 Firedamp is a mixture of naturally occurring flammable gases and is usually comprised predominantly of methane.

4 The likelihood of gas being present differs from mine to mine and from one part of a mine to another. Moreover if dangerous concentrations of flammable gas occur in workings certain electrical equipment may need to remain energised to allow men to withdraw safely or to facilitate rescue. Provision is made in the Regulations for these contingencies and guidance is given on electrical equipment considered suitable for use in such circumstances in paragraph 20 of this guidance note.

Guidance

Restriction of electrical equipment in certain zones below ground (Regulation 19)

5 The regulation requires mine managers to identify zones below ground where firedamp is likely to occur in a quantity sufficient to indicate danger. Outside such zones dangerous concentrations are unlikely to exist, and therefore the electrical equipment need not be of an explosion protected type. Electrical equipment used within zones identified by the manager should be designed and constructed to prevent ignition of a flammable atmosphere.

6 Explosion protection concepts for electrical equipment are described and specified in various national (eg British Standards) and international standards (eg European Harmonised Standards) which are recognised in most countries.

7 Moreover most countries only accept such electrical equipment if it is of a type which has been certified by a national authority. For the purposes of the Gassy Mines Directive (82/130/EEC) and the European Potentially Explosives Atmospheres (ATEX) Directive (94/9/EEC), EECS and SIRA Certification Service are the recognised national certification authorities. Intertec Testing Service is also recognised for the purposes of ATEX.

8 Whether or not electrical equipment is protected, and wherever it is situated below ground, it must be cut off from its supply of electricity should flammable gas be detected in the vicinity in a concentration sufficient to indicate danger. This does not apply to equipment which is essential for safety and is approved by HSE to remain energised when the concentration of flammable gas exceeds the statutory limit for the use of electricity (regulation 20 - Cutting off electricity or making safe where firedamp is found either below ground or at the surface).

9 Regulation 19(2)(a) - EECS and SIRA, the national certifying authorities, certify mining electrical equipment if it conforms to published concept standards. The most common standards are those relating to Flameproof (FLP or type 'd'), Intrinsically Safe (IS or type 'i') and Increased Safety (type 'e') equipment but there are other standards. Equipment so certified is deemed to be approved by HSE for the purposes of the regulation.

10 ATEX came into force in Great Britain on 1 March 1996. All equipment manufactured on or after 1 July 2003 must comply. Manufacturers may in the meantime market equipment complying with ATEX. To enable such equipment to be introduced into mines, HSE has issued an approval under Regulation 19(2)(a) allowing all ATEX category M1 and M2 equipment to be taken into a zone and be energised (see Appendix 3). HSE may also approve equipment as being explosion protected even if it does not conform to published concept standards. Such approvals will usually include special conditions of use and might be time limited. Requirements for particular types of approved apparatus are contained in Testing Memoranda published by HSE from time to time.

11 Regulation 19(2)(b) permits the use of electrical equipment in the zones identified by the manager if the equipment is approved for the purpose of regulation 20 (Cutting off electricity or making safe where firedamp is found either below ground or at the surface). This type of equipment can be left energised with firedamp present in excess of the statutory limit and is that described in Appendix 2 of this guidance.

Guidance

12 Regulation 19(2)(c) permits the use of electrical equipment in zones where firedamp may occur if the use of that equipment was lawful before the commencement date of the Electricity at Work Regulations. Thus electrical equipment certified by HSE or its predecessors may be used in a zone identified by the manager.

13 Regulation 19(2)(d) permits electrical equipment to be used in zones identified by the manager if it is of a type constructed to Harmonised CENELEC (European Committee for Electro-Technical Standardisation) Standards and is certified by one of the national certification authorities of the European Economic Community (EEC).

14 Each EEC Government must notify its certifying authority to the European Commission and electrical equipment certified by that body as conforming to the Harmonised Standard will be marked with the distinctive community mark 'Ex' in accordance with Council Directives 82/130/EEC and 88/35/EEC.

15 Appendices 1 and 2 of this guidance note list the categories of electrical equipment described in paragraphs 9 to 13 and identify typical markings used on the equipment.

16 Regulation 19(2)(e) permits the use of certain electrical equipment in zones where firedamp may occur if the use of that equipment was lawful immediately before the commencement date of the Electricity at Work Regulations and approved under regulations 20 and 21A of the Coal and Other Mines (Electricity) Regulations 1956.

17 Regulation 19(2)(f) permits the use of electrical equipment which is neither certified nor approved by HSE if it can be positively established that it is not capable of producing incendive sparks in normal use. Examples of such equipment are resin-filled cable joints and power cables having a suitable covering in accordance with paragraph 1(b) of the ACOP to regulation 7.

18 Regulation 19(2)(g) is intended to permit the use below ground under controlled circumstances of electrical equipment which may not be specifically protected to prevent incendive electric sparking. The regulation specifies alternative safety precautions.

Approval of certain equipment for use in safety-lamp mines (Regulations 20 and 21)

19 Regulation 20 requires equipment to be isolated or made safe when dangerous concentrations of firedamp occurs unless it is of a type approved by HSE for the purpose of remaining functional. Regulation 21 ensures that certain equipment, needed for the safety of persons, is always of a type that can remain functional in dangerous concentrations of firedamp, by only allowing approved types to be taken underground. Safety equipment so approved comprises signalling and communications systems, environmental monitoring systems, gas detectors and electric safety lamps. Additionally, HSE has issued an approval to allow all equipment certified in accordance with 'Category M1', as defined in the ATEX Directive 94/9/EC, to remain functional in dangerous concentrations of firedamp (see Appendix 3 to this guidance note).

Guidance

20 The regulation requires certain kinds of electrical equipment essential for safety to be of a type approved for the purposes of regulation 20(1) by HSE, for example signalling equipment, communications equipment, electric safety lamps and gas detectors used for statutory purposes. Such equipment may be needed to allow men to withdraw from the mine workings in an emergency, or to facilitate rescue or other safety operations and can remain energised by virtue of regulation 20 (Cutting off electricity or making safe where firedamp is found either below ground or at the surface).





21 This equipment, because of its special nature, must not only be safe in an explosive atmosphere, but may also incorporate particular operational features which are important for general safety and which the approval will take into account where appropriate.

Electrical equipment for use in mines in which firedamp may occur and which meets the requirements of regulation 19(2)

Appendix 1

1 **Flameproof enclosures** (as defined in the relevant standards quoted, eg type of protection 'd' as defined in clause 2.1 of BS 5501: Part 5: 1977)

(a) Equipment certified by HSE and predecessors:


<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
From 1929 to 1972	Equipment carried the marking - FLP No 0001 to 6152  GROUP I
BS 229:1929 BS 229:1940 BS 229:1946 BS 229:1957	<i>Note:</i> Certification to BS 229 was discontinued in 1972 but supplementary certificates may still be issued dependent upon safety considerations.
From 1972	With the introduction of BS 4683 the year of issue preceded the certificate number -
BS 4683: Parts 1 and 2 1971	FLP 720001  GROUP I In 1981 the mining certification service became 'HSE(M)' and the marking was preceded by these letters -
	HSE(M) FLP 810001 GROUP I 
From 1981	Certification to BS 5501 was introduced as an alternative to BS 4683. The marking includes the year of issue, the relevant part number of BS 5501 (ie Part 5) and the letters EEx d -
BS 5501: Part 5: 1977	EEx d I HSE(M) 81.5.0001  <i>Note:</i> If the certificate and marking includes suffix 'X' special conditions of use apply.

Guidance

Note: Use of letters 'FLP' within a crown symbol are optional.

(b) Equipment certified by a European Notified Body or other approved body in accordance with the European Directive 82/130/EEC or 94/9/EC, as adapted to technical progress by Commission Directive 88/35/EEC:



EEC Directives:

EEx d I HSE(M) 83.5.0001  ①

82/130/EEC
88/35/EEC
EN 50.014
EN 50.018

Notes: (i) HSE(M) or identity of other approved body.
(ii) If the certificate and marking includes suffix 'X' special conditions of use apply.

94/9/EC

 9999  I M2 EEx d

Notes: (i) '9999' or other number identifying the EU Notified Body that performed the quality management module assessment described in the 94/9/EC. This body may be different from the Notified Body issuing the certificate attesting conformity with the ESHRs of the Directive.
(ii) If the certificate and markings includes suffix 'X' special conditions of use apply.

2 Intrinsically safe apparatus and systems (as defined in the relevant standards quoted, eg type of protection 'i' as defined in clause 2.1 of BS 5501: Part 7: 1977)





(a) Equipment certified by HSE and predecessors:

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
BS 1259: 1945	From 1954 the prefix 'IS' was used - Ministry of Fuel and Power IS 1001 (Methane)
	In 1959 the marketing was extended to include reference to the standard and class. Numbers continued in ascending order -
BS 1259: 1958	BS 1259: 1958 IS 1150 to 1990 CLASS 1
	In 1979 five-figure numbers were introduced to avoid conflict with Group II numbering -
	BS 1259: 1958 IS 11001 CLASS 1
BS 1259: 1958	In 1981 the mining certification service became 'HSE(M)' and marking was preceded by these letters -
	HSE(M) IS 11057 CLASS 1

Guidance

Relevant standards	Comments and examples of marking used
From 1981	Certification to BS 5501 was introduced as an alternative to BS 1259. The marking included the year of issue, the relevant part number of BS 5501 (eg part 7) and the letters EEx i -
BS 5501: Part 7: 1977 (EN 50.020)	
From 1983	
BS 5501: Part 9: 1981 (EN 50.039)	EEx i I HSE(M) 81.7.0001
	<i>Note:</i> If the certificate and marking includes suffix 'X' special conditions of use apply.

(b) Equipment certified by a European Notified Body or other approved body in accordance with European Directive 82/130/EEC or 94/9/EC, as adapted to technical progress by Commission directive 88/35/EEC:

EEC Directives: 82/130/EEC 88/35/EEC EN 50.014 EN 50.020 (for apparatus) EN 50.039 (for systems)	EEx i I HSE(M) 83.7.0001  
	<i>Notes:</i> (i) HSE(M) or identity of other EEC approved body. (ii) If the certificate and marking includes suffix 'X' special conditions of use apply.
94/9/EC	 9999  I M1 EEx ia (or M2 if EEx ib)
	<i>Notes:</i> (i) '9999' or other number identifying the EU Notified Body that performed the quality management module assessment described in the 94/9/EC. This body may be different from the Notified Body issuing the certificate attesting conformity with the ESHRs of the Directive. (ii) If the certificate and marking includes suffix 'X' special conditions of use apply.

General notes

- (i) Bells and relays carrying the marking 'T/BR/No 001 to T/BR/No 181'; telephones carrying the marking 'T/TEL/No 001 to No 107'; and remote control circuits carrying the marking 'T/RC/No 001 to No 079' being equipment certified before 1954 by the Mines Department Testing Station as conforming to Testing Memorandum No 10, do not meet the requirements of this regulation. Certificate holders or users of such equipment are advised to contact HSE regarding any proposals for continued use of such equipment in zones below ground in mines after the date of commencement of the Electricity at Work Regulations 1989.
- (ii) Any hearing aid certified as intrinsically safe by a national authority and carrying the marking 'M & Q' may be used at a place where flammable gas may occur.




Guidance

3 **Increased safety apparatus** (as defined in the relevant standards quoted, eg type of protection 'e' as defined in clause 2.1 of BS 5501: Part 6: 1977)

(a) Equipment by HSE and predecessors:

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
BS 4683: Part 4: 1973	No certificates were issued to this standard prior to 1983. Marking requirements are - HSE(M) 'e' 830001 GROUP 1
From 1981 BS 5501: Part 6: 1977	Certification to BS 5501 was introduced as an alternative to BS 4683. The marking includes the year of issue, the relevant part number of BS 5501 (ie Part 6) and the letters EEx e - EEx e HSE(M) 85.6.0001 <i>Note:</i> If the certificate and marking includes suffix 'X' special conditions of use apply.

(b) Equipment certified by a European Notified Body or other approved body in accordance with the European Directive 82/130/EEC or 94/9/EC, as adapted to technical progress by Commission Directive 88/35/EEC:

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
EEC Directives: 82/130/EEC 88/35/EEC EN 50.014 EN 50.019	EEx e I HSE(M) 82.6.0001  ① <i>Notes:</i> (i) HSE(M) or identity of other EEC approved body. (ii) If the certificate and marking includes suffix 'X' special conditions of use apply.
94/9/EC	 9999  I M2 EEx e <i>Notes:</i> (i) '9999' or other number identifying the EU Notified Body that performed the quality management module assessment described in the 94/9/EC. This body may be different from the Notified Body issuing the certificate attesting conformity with the ESHRs of the Directive. (ii) If the certificate and marking includes suffix 'X' special conditions of use apply.

4 **Pressurised apparatus** (as defined in the relevant standard quoted, eg type of protection 'p' as defined in clause 2.1 of BS 5501: Part 3: 1977 - EN 50.016)


Equipment certified by HSE or other approved body in accordance with the European Directive 82/130/EEC, as adapted to technical progress by Commission Directive 88/35/EEC:

Guidance



<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
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EEC Directives:

82/130/EEC
88/35/EEC
EN 50.014
EN 50.016

EEx p I HSE(M) 83.3.0001  ①

Notes: (i) HSE(M) or identity of other EEC approved body.
(ii) If the certificate and marking includes suffix 'X' special conditions of use apply.

 9999  I M2 EEx p

Notes: (i) '9999' or other number identifying the EU Notified Body that performed the quality management module assessment described in the 94/9/EC. This body may be different from the Notified Body issuing the certificate attesting conformity with the ESHRs of the Directive.
(ii) If the certificate and marking includes suffix 'X' special conditions of use apply.

5 Lamps and lights approved for the purposes of section 64 of the Mines and Quarries Act 1954, and previously for the Coal and Other Mines (Safety Lamps and Lighting) Regulations 1956*

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
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For mains lighting

BS 229, BS 4683
BS 5501, BS 889

Mains lighting - see the marking of flameproof and intrinsically safe equipment, in items 1 and 2 of this appendix.

For safety lamps

Markings - HSE(M) (or M&Q) App No SL/A 001
HSE(M) (or M&Q) App No SL/B 001
HSE(M) (or M&Q) App No SL/C 001

HSE Testing
Memorandum No 1
additionally for cap lamps
BS 4945: 1973

For other lights accessories to equipment
M&Q Approval No LR20/001, or HSE(M) Approval No L 001.

For lights containing a generator driven by compressed air: M&Q Approval No LR19/1.001, or HSE(M) App No L 001.

* Regulations 4 and 19 of the Coal and Other Mines (Safety Lamps and Lighting) Regulations 1956 are revoked and replaced by the requirements under these Regulations. Safety-lamp bulbs will continue to be assessed in accordance with HSE Testing Memorandum TM1 to meet the requirements of regulation 21 (Approval of certain equipment for use in safety-lamp mines), lights containing a generator driven by compressed air will from the commencement of the Regulations be certified by HSE to the type of protection 'p' as defined in BS 5501: Part 3: 1977 (EN 50016).

Guidance

6 Shotfiring equipment approved by HSE and predecessors

Equipment approved for the purpose of the Coal and Other Safety-Lamp Mines (Explosives) Regulations 1993, regulation 5, or the Stratified Ironstone, Shale and Fireclay Mines (Explosives) Regulations 1956, regulations 12, 14, 28(6) and 47, or the Coal Mines (Cardox and Hydrox) Regulations 1956, regulations 5, 12 and 21(5).

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
HSE Testing Memoranda No 5 (Exploders and Related Apparatus) No 13 (Detonators) Circuit testers must conform to intrinsic safety standards (see item 2). Cardox shells and initiators have to be constructed to HSE approved specifications	Exploders and circuit testers are marked - M&Q Approval No P (or L) 001 <i>or</i> HSE(M) App No ESF L (or P) 001 (for exploders) <i>or</i> HSE(M) App No CTD 001 (for circuit testers)

7 Locomotive equipment approved for the purposes of the Coal and Other Mines (Locomotive) Regulations 1956, regulation 3(3) by HSE and predecessors

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
HSE Testing Memorandum No 12	Marking - Locomotive type - M&Q Approval No 001 <i>or</i> Locomotive type - HSE(M) App No BLO 001 <i>Note:</i> Various abbreviations designate the type of locomotive in the second example, eg BLO for battery locomotive.

8 Vehicles and locomotives using storage traction batteries and approved by HSE for the purposes of regulation 26 of these Regulations

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
HSE Testing Memorandum No 12	Marking - Locomotives - as in item 8 above.
Traction batteries may need to satisfy the requirements of the type 'e' increased safety standard BS 5501: Part 6 (EN 50 019)	Free steered vehicle type - HSE(M) App No BV 001 Battery tugger type - HSE(M) App No BV 001

Guidance

9 Electrical equipment approved for the purposes of the Miscellaneous Mines (Electricity) Regulations 1956 by HSE and predecessors

Electrical equipment approved for the purposes of regulation 5 of the Miscellaneous Mines (Electricity) Regulations 1956 (now revoked) can continue in use by virtue of regulation 19(1)(c). Such equipment however should not be used in any mine of coal, stratified ironstone, shale and fireclay unless it also complies with one of the other items listed in this appendix.

Equipment approved by HSE and predecessors, to remain energised in flammable gas for the purposes of regulation 20(1)

Appendix 2

1 Equipment previously approved by HSE and predecessors for the purposes of one or more of the following:

- (a) The Coal and Other Mines (Electricity) Regulations 1956, regulations 20 and 21A (now revoked and replaced by (2) below under these Electricity Regulations).
- (b) The Coal and Other Mines (Ventilation) Regulations 1956, regulation 4(1)(a).
- (c) The Coal and Other Mines (Explosives) Regulations 1961, regulations 50(2) and 76(2).
- (d) The Coal and Other Mines (Locomotives) Regulations 1956, regulation 12(a).

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
Those for intrinsically safe apparatus	Typical marking would include 'Mines Department (or M&Q) Approval', and more recently M&Q Approval No ER 20.001 or HSE(M) App No SIG 001
	} For signalling or equipment telephones
Testing Memorandum No 7 (Methanometers)	M&Q Approval No ER 21A 001 or HSE(M) App No M (or FD) 001
	} For methanometers or firedamp detectors

Guidance

2 Equipment approved for the purposes of these Electricity Regulations, regulation 20(1) to remain energised in flammable gas

<i>Relevant standards</i>	<i>Comments and examples of marking used</i>
Those for intrinsically safe apparatus	<p>Equipment will be marked - HSE(M) EAWR 20 (Equipment designation) 001</p> <p><i>Note:</i> Various abbreviations are used to designate the equipment, eg SIG for signals, M for methanometers, etc. The list of abbreviations is available from HSE.</p>

HSE(M) FILE REF: L4.3/3/96

HSE(M) Approval No EAWR 19 & 20 (ATEX) 1

Health and Safety at Work etc Act 1974 (a)

Electricity at Work Regulations 1989 (b)

Appendix 3

Approval of electrical equipment for the purposes of Regulations 19 and 20 of the Electricity at Work Regulations 1989

1 I approve, pursuant to regulation 19(2)(a) of the 1989 Regulations Category M 1 and Category M 2 equipment, in relation to which the requirements of regulation 6(2) of the 1996 Regulations have been complied with, for the purpose of being energised in certain zones below ground specified in regulation 19(1) of the 1989 Regulations;

2 I approve, pursuant to regulation 20(1) of the 1989 Regulations Category M1 equipment, in relation to which the requirements of regulation 6(2) of the 1996 Regulations have been complied with, for the purposes of remaining energised in the circumstances described in regulation 20(1) aforesaid.

In this certificate -

- (i) "The 1989 Regulations" means the Electricity at Work Regulations 1989/635;
- (ii) "The 1996 Regulations" means the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996/192;
- (iii) "Category M 1 equipment" and "Category M 2 equipment" mean equipment within those descriptions specified in paragraph 1 of Schedule 4 to the 1996 Regulations.

Dated 27 October 1999

D.Mitchell

The holder of a post designated HM Chief Inspector of Mines, a person duly authorised by the Health and Safety Executive to act in that behalf

Additional provisions for the operation of trolley locomotives

Guidance Note 2

Construction of electric trolley locomotive track

1 Where trolley locomotives are supplied by a single overhead conductor with track return, the track should be electrically continuous and have a conductance such that the maximum voltage drop along its length does not exceed 7 volts per 1000 metres run under any operating condition. Rail joints should either be welded or effectively secured by mechanical means and bonded across by copper conductors. The resistance of any rail joint should not be greater than the resistance of 10 metres of rail. The two rails making a track should be connected to one another at intervals of not more than 100 metres by means of copper conductors having a combined cross section not less than the associated overhead conductor. Where there are two or more rail tracks in a road, each rail track should be connected to a common earthing point at the surface of the mine.

2 Only the negative pole of a direct current supply should be connected to the rails and no switch or fuse should be connected in the negative pole. Precautions should be taken to prevent electric currents in trolley locomotive rail tracks leaking to any other rail track or other extraneous metal work.

Overhead conductors

3 The voltage applied to any overhead conductor should not exceed that specified in paragraph 21(e) of The ACOP to regulation 3. Overhead conductors should only be used to supply electricity to trolley locomotives and to ancillary equipment directly associated with their operation. They should be suitably insulated from any metal which is not part of the system of electrical conductors and supported so that the following clearances are maintained:

- (a) a vertical clearance between the overhead conductors and the top of the rail of at least 2.2 metres; and
- (b) a clearance of at least 110 millimetres from overhead conductors, uninsulated connectors and current collectors to the roof or sides of the road.

4 Switchgear for cutting off the electricity supply to the overhead conductor(s) should be provided at every point at which a cable supplies electricity to the overhead conductor. For a single overhead conductor system with track return, switchgear should incorporate protective devices arranged to cut off the supply of electricity to the overhead conductor automatically in the event of:

- (a) a short circuit between an overhead conductor and track;
- (b) a leakage of current which results in a potential difference between any suspension wire for that conductor and track exceeding 20 volts; and
- (c) so far as is reasonably practicable, breakage of an overhead conductor.

Guidance

For a twin overhead conductor system the support of electricity should be cut off automatically in the event of:

- (a) a short circuit between conductors; and
- (b) leakage fault current to earth exceeding 2A.

In addition means for cutting off the supply of electricity from the overhead conductor in an emergency should be provided along its entire length. Such means should be designed to fail to safety as far as is reasonably practicable.

5 Where overhead conductors are sectionalised, any gap between each section of a conductor should be sufficiently large to prevent its being bridged by current collectors.

6 Overhead conductors should be shielded by a suitable insulated cover to prevent inadvertent contact, at every place in a road where:

- (a) persons regularly pass; or
- (b) persons normally enter or leave man-riding vehicles; or
- (c) persons work under or close to the conductor.

7 An illuminated indicator, clearly visible to the driver of any approaching locomotive, should be sited at a distance from the end of every overhead conductor which is compatible with the braking distance of a locomotive. For locomotives which cannot operate beyond the limits of the overhead conductor, track device(s) should be provided and arranged so that in the event of any locomotive passing this indicator, the locomotive is automatically braked safely to rest.

8 In addition to any notices required by the Electricity at Work Regulations 1989, clear signs giving warning of the presence of any overhead conductor should be displayed in a prominent position at every access point into the length of road in which a conductor is installed and at every location at which persons normally work under or close to the conductor.

Vehicles hauled by trolley locomotives

9 There should be effective conducting paths between any metallic part of the vehicles used on electric trolley locomotive systems and the track. Every man-riding vehicle should have a steel roof.

Model Manager's Rules for the use of 3300 volts apparatus at a coalface

Appendix 4

Voltage restriction

1 Portable apparatus (listed in the schedule to these Rules) must not be operated by electricity exceeding a nominal voltage of 3300 volts.

Cables

2 The cables must:

- i) as far as possible, be routed and protected in such a way as to avoid their being trapped or crushed;
- ii) have each power core enclosed and protected by a screen of wires. The wires must be earthed to the metallic covering at each end of the cable; and
- iii) include an earth conductor(s) with a cross-sectional area, and conductance not less than half that of the power conductor with the greatest current capacity.

3 The moving cable attached to the power loader must:

- i) be protected by a cable handling system. The system must be in use at all times during normal operations; [NB - any abnormal situations should be specified and controlled under additional manager's rules]
- ii) be inspected at least once during each working day by an electrical engineer or electrician, appointed under regulation 11(3) of MASHAM, to ensure that the cable is in a satisfactory condition for use.

4 The power loader cable must not protrude beyond the width of the cable handling protection system at any point along its length.

5 As far as possible cable troughs must be kept clear of debris.

6 Supervision of the operations at the end of the face, in the vicinity of the power loader, must include particular attention to the trailing cable.

System protection

7 Effective means must be in place to cut off the electricity supply to the portable apparatus if the leakage current to earth exceeds 0.4 amperes.

8 A phase sensitive short circuit protection device, set at the minimum level commensurate with practical operating conditions, must be provided to cut off the electricity supply to the portable apparatus automatically, in the event of a short circuit fault.

Guidance

Action in the event of a fault

9 Before restoring an electricity supply that has been cut off automatically, a member of the electrical engineering staff, appointed under regulation 11(3) of MASHAM, and authorised for the purpose, must test the insulation of the apparatus with an insulation testing instrument operating in excess of 2400 volts, to determine whether it is safe to restore the supply.

10 If a trapped or crushed trailing cable causes operation of the earth leakage protection or a short circuit protection, the cable should normally be replaced; or if the damage is localised and the affected section can be removed, the electrical engineer may authorise shortening of the cable, and the fitting of a new plug underground. [NB - the fitting of a new plug underground must be in accordance with additional manager's rules.]

Movement of energised equipment

11 The portable apparatus, except for the cables, must be secured to a movable base, or other device that will enable it to be readily moved without danger.

Examination and records

12 All accessible parts of the portable apparatus, and the cable protection and handling systems must be examined at least once every working day by a member of the electrical engineering staff appointed under regulation 11(3) of MASHAM, and authorised for the purpose.

13 A record must be kept of these daily examinations. In particular, the record should indicate:

- any trip caused by excessive leakage to earth;
- any short circuit fault causing the supply of electricity to be cut off automatically; or
- any open sparking at the face.

Schedule

The schedule should list:

- portable prime movers used, including their duty and rating;
- portable switchgear controlling the portable prime movers;
- the flexible cables connected to, and supplying, the prime movers;
- the flexible cables connected to, and supplying, the portable switchgear.

Model Manager's Rules for the use of 3300 volts apparatus at a coalface

Environmental monitoring and protection

Types of continuous monitoring and location of transducers

1 Continuous monitoring must be provided, and transducers located, as follows:

a) firedamp monitoring at:

- i) the outbye end of the intake gate;
- ii) the return end of the face conveyor;
- iii) the outbye end of the return gate;

b) airflow monitoring at the outbye end of the return gate.

Warning, alarm and trip levels

2 All the alarms must be audible and/or visual. They must also be activated simultaneously at the face, and in the colliery control room.

3 Firedamp monitor (a)(i) must be set to activate the alarm if the concentration of firedamp [in the general body of air] reaches [0.6%]*; and to trip the 3300 volts portable apparatus automatically if it reaches 1.25%.

4 Firedamp monitor (a)(ii) must be set to activate the alarm if the concentration of firedamp [in the general body of air] reaches [1.0%]*; and to trip both the shearer and the conveyor automatically if it reaches 1.25%.

5 Firedamp monitor (a)(iii) must be set to activate the alarm if the concentration of firedamp [in the general body of air] reaches [1.0%]*. If electric power is used in the return gate, the monitor must be set to trip the power supply automatically if the concentration of firedamp reaches 1.25%.

6 Airflow monitor (b) must be [set to activate/give] a warning if the air quantity on the district falls to [22m³/s]*, and an alarm if it falls to [20m³/s]*.

Action in the event of alarms or trips

7 In the event of any alarm, the control room operator must immediately contact the command supervisor for the district. The command supervisor must then investigate the cause and take the necessary remedial action.

Guidance

8 In the event of the tripping of apparatus, the control room operator must immediately contact the command supervisor for the district, and notify the manager, or in his absence, the substitute for the manager. The command supervisor must investigate the cause of the trip, and ensure that power is not restored until it is safe to do so.

9 When taking action in accordance with paragraphs 7 and 8, the control room operator must record the timing of the events, and the name of the person contacted. The record must be countersigned by the manager, or by a person authorised to sign on his behalf.

10 Any abnormal occurrence must be reported to the manager. The command supervisor's daily report must include a full report of any warning, alarm or trip.

Monitoring provisions for testing 3300 volts equipment

11 Before any high voltage testing takes place, a member of the electrical engineering staff appointed under regulation 11(3) of MASHAM, and authorised for the purpose, must ensure that it is safe to carry out the tests, and confirm that no alarm or trip has been activated. He must inform the control room operator when the tests are about to begin.

12 If, during the tests, an alarm is activated, either at the face or in the control room, the testing must be stopped until the command supervisor for the district is satisfied that it can be restarted safely.

Planned maintenance of environmental monitoring systems

13 Before undertaking planned maintenance on the environmental monitoring and protection system described in these rules, the person appointed under regulation 11(3) of MASHAM to undertake such work must contact the command supervisor for the district. The command supervisor must notify the control room operator before maintenance begins, and when it has been completed.

* The figures in brackets are typical values only. The actual values should be decided by the manager.

Model Manager's Rules for the use of 3300 volts apparatus at a coalface

Use of inbuilt high voltage (HV) insulation tester

General

- 1 The user must observe all instructions and warnings on the use of the inbuilt HV insulation tester, and must comply with the manufacturer's operating instructions.
- 2 The test 'instrument' must be operated only by a member of the electrical engineering staff, appointed under regulation 11(3) of MASHAM, and authorised for the purpose.
- 3 A permit to use the tester must be completed before any test is carried out. For normal, or routine testing, the permit must be completed by an electrician appointed under regulation 11(3). For testing following a system fault, the permit must also be signed by a person authorised to make determinations for the presence of firedamp. Normally, this will be the command supervisor for the district.

Normal and routine testing

- 4 The inbuilt HV insulation tester must only be used:
 - a) to carry out a routine, or random test; or
 - b) in accordance with the manager's maintenance scheme.

Use following a system fault

- 5 Following a system fault trip, fault indication, or where a system fault is suspected, the HV insulation tester must only be used under the supervision of a person authorised to make determinations for firedamp.

Guidance

6 Before any testing takes place:

- a) the person referred to in paragraph 5 must ensure that it is safe to undertake the test; and
- b) where practicable, all equipment to be tested must be externally examined for signs of physical damage; and
- c) any flameproof enclosure which is:
 - i) connected to the circuit being tested; and
 - ii) in areas where firedamp is not normally present, but is likely to occur in quantities which indicate danger;

must be in a condition which satisfies the requirements of its flameproofing certificate during the HV insulation test.

7 The person referred to in paragraph 5 must inform the control room [operator] when the tests are about to start. If the concentration of firedamp [in the general body of air] exceeds 1%, or any monitoring alarm is activated, either at the face or in the control room, the test must not be carried out. If, during the test, the concentration of firedamp exceeds 1%, or any monitoring alarm is activated, the testing must stop until the command supervisor for the district is satisfied that it is safe to restart testing.

MODEL PERMIT TO USE INBUILT HV INSULATION TESTER

To be completed before any test is carried out and to be attached to the electrician's shift report.

DAY DATE SHIFT

1. REASON FOR TEST

ROUTINE/RANDOM If system fault; state failure:-
MANAGER'S SCHEME
SYSTEM FAULT

2. EQUIPMENT TO BE TESTED

GEB CABLE(S) MOTOR

3. EXAMINATION

External examinations of equipment under test
(System fault only)

SIGNED.....

4. FIREDAMP

The general body of the area in which tests are to be carried out has been tested for firedamp content.
(System fault only)

Max firedamp %
found

Person authorised by manager to carry out test

SIGNED.....

5. INSULATION TEST

Test Result Megohms

Person authorised by manager to carry out test

SIGNED.....

6. ENTRY INTO LOGS

Entries of above information in the maintenance/operational log.

SIGNED.....

Further information

HSE priced and free publications can be viewed online or ordered from www.hse.gov.uk or contact HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995. HSE priced publications are also available from bookshops.

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