



भारतीय मानक ब्यूरो

(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)

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WIDE CIRCULATION DRAFT

Our Reference: ETD 22/T-1

04 July 2023

TECHNICAL COMMITTEE: ELECTRICAL APPARATUS FOR EXPLOSIVE ATMOSPHERES SECTIONAL COMMITTEE, ETD 22

ADDRESSED TO:

1. All Members of Electrotechnical Division Council, ETDC
2. All Members of Electrical Apparatus for Explosive Atmospheres Sectional Committee, ETD 22
3. All others interested.

Dear Sir/ Madam,

Please find enclosed the following draft:

| Doc No. | Title |
|-------------------|---|
| ETD 22 (22810) WC | Code of Practice for Installation and Maintenance of Electrical Equipment in Mines (<i>First Revision of IS 4051</i>) |

Kindly examine the attached draft and forward your views stating any difficulties which you are likely to experience in your business or profession if this is finally adopted as National Standard.

Last Date for Comments: 02 September 2023

Comments if any, may please be made in the enclosed format and emailed at eedt@bis.gov.in or sent at the above address. Additionally, comments may be sent online through the BIS e-governance portal, www.manakonline.in.

In case no comments are received or comments received are of editorial nature, kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in.

Thanking you,

Yours faithfully,

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FORMAT FOR SENDING COMMENTS ON THE DOCUMENT

[Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/ table/figure, etc, be stated on a fresh row. Information/comments should include reasons for comments, technical references and suggestions for modified wordings of the clause. **Comments through e-mail to eetd@bis.gov.in shall be appreciated.**]

Doc. No.: ETD 22(22810)WC

BIS Letter Ref: ETD 22/T-1

Title: Code of Practice for Installation and Maintenance of Electrical Equipment in Mines (*First Revision* of IS 4051)

Last Date for Comments: 02 September 2023

Name of the Commentator/ Organization:

| Clause/ Para/ Table/ Figure No. commented | Type of Comment (Technical/ Editorial/ General) | Comments/Modified Wordings | Justification of Proposed Change |
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NOTE- Kindly insert more rows as necessary for each clause/table, etc.

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DRAFT FOR COMMENTS ONLY

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Draft Indian Standard

**CODE OF PRACTICE FOR
INSTALLATION AND MAINTENANCE OF
ELECTRICAL EQUIPMENT IN MINES**

*(First Revision of IS 4051)
ICS 29.260.20*

**Electrical Apparatus for Explosive Atmospheres
Sectional Committee, ETD 22**

**Last Date of Comments:
02 September 2023**

FOREWORD

This Indian Standard will be adopted by the Bureau of Indian Standards on the recommendation of the Electrical Apparatus for Explosive Atmospheres Sectional Committee.

This standard was first published in 1967 to guide and govern the general aspects of installation and maintenance of electrical equipment in mines. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards.

The environment and conditions in mines, in general, demand special attention and care during the installation and maintenance of electrical equipment. Lack of proper working space, poor lighting conditions and the frequent shifting of equipment are some of the factors which have to be taken into consideration while planning an installation and maintaining it inside a mine. This code details the general rules to be adopted in all mines in addition to precautions to be exercised specially in gassy coal mines.

The various Indian Standards listed in Clause 2, provide in a convenient form a record of those matters which experience has shown to be of importance in keeping electrical equipment, in general, in good working condition. The relevant Indian Standards should be consulted for general guidance in regard to particular electrical equipment. This code details the additional precautions to be exercised in the maintenance of electrical equipment installed in mines.

The essential principle of flameproof enclosure (as defined in IS/IEC 60079-0 and IS/IEC 60079-1) is that the hazardous atmosphere is not excluded from the electrical apparatus, and it is recognized that an explosion may occur inside the enclosure, but the enclosure is sufficiently strong to withstand an internal explosion and is so constructed that flame passing from inside to the outside is cooled to such an extent that it is incapable of igniting the surrounding hazardous atmosphere. This is achieved by controlling the lengths of the possible flame paths and the clearance in them.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2:2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

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Draft Indian Standard

CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT IN MINES

(First Revision)

1 SCOPE

This standard covers minimum requirements for all electrical work and electrical equipment operating or intended to operate at all voltages in electrical installations in coal mines.

The requirements of this standard apply to all types of mines unless otherwise specified.

2 REFERENCES

2.1 Statutory Requirements

- a) *Electricity Act, 2003*
- b) *Mines Act, 1952*
- c) *Mines Rules, 1955*
- d) *Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010*

2.2 References

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Electrical Equipment — Any accessories, appliance or fitting, cables, etc., used or intended for use as a part of or in conjunction with an electrical installation.

3.2 Flameproof Enclosure — An enclosure (as defined in IS/IEC 60079-1) for electrical machinery or apparatus that shall with stand, when the covers or other access doors are properly secured, an internal explosion of the flammable gas or vapour which may enter or which may originate inside the enclosure, without suffering damage and without communicating the internal flammation (or explosion) to the external flammable gas or vapour for use in which it is designed, through any joints or other structural openings in the enclosure (*see also* Para 5, Foreword).

3.3 Intrinsically Safe Circuit — denotes that any sparking that may occur therein in normal working is incapable of causing an explosion of the prescribed flammable gas or vapour (as defined in IS/IEC 60079-11).

3.4 Intrinsically Safe Equipment — denotes that it is so constructed that when connected and used under prescribed conditions any sparking that may occur therein is incapable of causing an explosion of the prescribed flammable gas or vapour.

4 EXCHANGE OF INFORMATION

4.1 Before ordering the electrical equipment, information regarding the duties, location and installation conditions under which they would operate, should be gathered by the engineers responsible for their procurement, installation and maintenance so that the electrical equipment or apparatus is procured to suit these conditions.

4.2 Further, before any electrical equipment is introduced into an area likely to be dangerous, full consultation should take place between those persons familiar with the nature and extent of the anticipated risk, and the electrical engineer responsible for the proposed installation, so that the necessity for special measures may be decided.

5. GENERAL REQUIREMENTS

5.1 All electrical equipment should be installed and maintained as to prevent, as far as possible, electric shock and occurrence of fire and explosion.

5.2 All materials, appliances and components used in the installation should conform to the appropriate Indian Standards. Where there are no appropriate standards, the material shall be of such quality and type as not to impair the safety of the installation.

5.3 All electrical installations shall comply with the requirements of the Electricity Act, 2003 and the amendments made from time to time, Mines Act, 1952 and Mines Rules, 1955 in general, DGMS Circulars issued from time to time and Chapter-IX of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 and the amendments made from time to time, in particular and regulations made there under, that may be applicable.

5.4 It is recommended that the authorities concerned with the administration of the rules and regulations in the matter of the layout of the installation of electrical equipment in mines, should be consulted in regard to the rules and regulations that may be applicable. Attention is invited to the provision of Regulation 95 of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 wherein it has been made obligatory on the part of the owner of a mine or his agent to give written notice of the installation of any mining electrical equipment to the authority having jurisdiction.

5.5 Electrical installation and maintenance shall be carried out only by authorized persons competent to undertake such work under the rules and regulations that may be in force.

6. DESIGN

6.1 General

6.1.1 Only electrical equipment and instruments suitable for mine service should be used in mines. In locations in gassy mines where use of such equipment is mandatory, only flameproof and intrinsically safe equipment designed and approved for mine service shall be used.

6.1.2 In this standard, the governing assumption is that it is the responsibility of the user to assess the risk in any specific condition and to take the necessary precautions.

6.1.3 Where a choice lies between electrical equipment containing flammable insulating oil and equipment of the oil-free type or of a type containing non-flammable cooling fluid, it is preferable to adopt one of the latter types.

6.1.4 Since flameproof equipment is normally designed for use in reasonably dry atmospheric conditions, special precautions should be taken to prevent any deleterious effects of moisture and coal dust on the equipment where extremely damp and humid conditions prevail.

6.2 Layout

6.2.1 Due to the conditions of operation of electrical equipment inside mines, special care has to be taken to ensure that they are placed well clear of roadway traffic, protected from dripping water and collapsing roof and sides.

6.2.2 Adequate space in accordance with Regulation 37 of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 should be provided around apparatus to allow proper facilities for maintenance purposes.

6.2.3 All rooms designed to accommodate electrical equipment, for example, sub-stations, haulage rooms, should be lined with fireproof material.

6.2.4 Meticulous care is required in the design of such housings in regard to freedom from dampness and water penetration, proper ventilation and illumination, exits and passageways to suit the equipment position.

6.2.5 No flammable or explosive material shall be stored in any room, compartment or box containing any electrical apparatus in a mine or below ground in the vicinity of any electrical apparatus.

6.3 Electrical Protection of Circuits and Apparatus

6.3.1 General

6.3.1.1 All circuits and equipment should be suitably protected against the effects of over current, negative sequence/unbalance, under voltage, short-circuit and Earth-leakage protection should be provided, wherever necessary.

6.3.1.2 It is recommended that the installation should be sectionalized to the utmost practicable extent to ensure selective clearance faults.

6.3.1.3 Where necessary electrical equipment shall be provided with devices which will cause the electrical circuit thereto to be disconnected in the event of failure of voltage in such circuits.

6.3.2 *Protection against over currents*

6.3.2.1 Every circuit should be provided with over current protective devices so that when the current exceeds the permissible limits it shall be cut off automatically.

6.3.2.2 Automatic overload protection devices should be so designed as to follow sufficiently closely the permissible overload characteristics of the apparatus or circuit to be protected, to ensure that the supply of electricity is cut off before the parts reach a dangerous temperature.

6.3.2.3 Particular care should be taken to ensure that the thermal overload protective device, where provided, does not itself get damaged by the action of the short-circuit. The manufacturers' recommendations for maximum permissible size of fuse or maximum setting of short-circuit release should be followed.

6.3.2.4 In case of any short-circuit, the supply of electricity shall be cut off automatically by means of automatic circuit-breaker or fuses of adequate rupturing capacity.

6.3.2.5 Circuit-breakers provided with short-circuit protective devices shall preferably be of the Lock out and Tag out type.

6.3.3 *Protection against earth-leakage*

6.3.3.1 Earth-leakage protection is very essential to minimize the risk of fire, explosion and shock.

6.3.3.2 Earth-leakage protection shall be provided in all incoming circuits to portable and transportable machinery and also in other associated feeders.

6.3.3.3 Earth-leakage protection shall be in accordance with the provisions contained in the *Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010*. (Reference is invited to regulation 42, regulation 45(2)(ii), regulation 52(v), regulation 54(v), regulation 100 etc. of the *Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010*.)

6.3.3.4 In an ungrounded system appropriate earth fault protection shall be provided.

6.3.3.5 Earth-leakage protective device shall be such that its operation may be tested periodically by fault simulation or through current injection method.

6.3.3.6 Circuit-breakers associated with earth-leakage protection should be provided with a locking device to prevent reclosing. In addition, the resetting device should only be operated by means of a special key which should be with the designated person.

In the event of the circuit-breaker tripping on account of a fault, the designated person should not reclose the breaker unless the fault causing the tripping has been repaired or isolated.

7. PROTECTIVE MEASURES AGAINST RISK OF ELECTRIC SHOCK

7.1 Precaution Against Contact with Live Parts

7.1.1 All exposed live parts, shall be suitably guarded against accidental contact, unless the nature of the work requires them to be bare, for example, trolley wires.

7.1.2 Housing and protective enclosures shall be mechanically strong. Protective enclosures shall be of a type which need special tools for opening. Screens of close mesh type with reasonable clearance from the live parts where allowed to be used in apparatus shall be accessible only to authorized personnel.

7.2 Insulation Resistance

7.2.1 All live parts shall be adequately insulated in relation to the voltage stress to which they are liable to be exposed under fault conditions.

7.2.2 All insulating materials, which are liable to deteriorate if exposed to the atmosphere or by ingress of moisture, shall be effectively sealed so as to prevent diminution of insulating properties.

7.2.3 For recommendations regarding values of insulation resistance, reference shall be made to the Indian Standard IS 2259.

7.3 Protective Earthing

7.3.1 All metallic parts not specially insulated from earth of the electrical equipment and not designed to carry current in normal operation shall be effectively and securely connected to the earth.

7.3.2 Earthing shall be effected by one or more of the following:

- a) Conductive sheath where provided;
- b) Armour of cables;
- c) Conductive sheath and armour of cable when both are provided;
- d) Special conductors forming parts of cables;
- e) External earthing conductor which shall be easily visible; and
- f) Conduits, casing and pipes.

7.3.3 The conductivity of the bonding conductor for earthing any particular apparatus shall be equivalent to at least 50 percent of that of the largest conductor used solely to supply the equipment subject to minimum of equivalent conductivity of copper section of 16 mm².

7.3.4 The connection of the earthing system to the earth shall be done at the surface of the mines. The design of the earthing system at the surface shall conform to IS 3043.

8. INTRINSICALLY SAFE APPARATUS AND CIRCUITS

8.1 Intrinsically safe apparatus and circuits are so designed and constructed that for any sparking, that may occur under service condition in the apparatus or the circuit, is incapable of causing ignition of the prescribed flammable gas or vapour. Obviously intrinsic safety may only be achieved in very low power circuits like telephones, signaling remote control and interlock circuits.

8.2 An intrinsically safe circuit shall have the same meaning as defined under IS/IEC 60079-11.

8.3 Intrinsically safe apparatus and circuits should be used in the form in which they are certified, as any alteration may vitiate the property of intrinsic safety. Care should be taken when replacing parts that have been damaged or otherwise rendered unserviceable to ensure that the replacements are of ratings identical to those approved.

NOTE — Special attention is invited to the possibility of nullification of intrinsic safety due to changes in design values of devices used to obtain intrinsic safety by coiling of external cables forming part of such circuits. Coiling may introduce hazards and, therefore, the cables should be laid out straight.

8.4 Adequate precaution shall be taken to prevent contact between the conductors of intrinsically safe circuits and those of any other system, so as to avoid possibility of arcing occurring at the point of contact, or of invasion of the intrinsically safe circuits by currents arising from direct or indirect contact or induction. Care should be taken to prevent contact of conductors of intrinsically safe circuits with ground pipe lines and other objects like props, cogs, etc. (Reference is invited to Clause 12.2.2.6 of IS 16724 regarding marking of cables used for intrinsically safe circuits)

8.5 Apparatus which is not intrinsically safe shall on no account be connected in the same circuit with intrinsically safe apparatus. However, use of certified coupling devices for intercommunication between intrinsically safe telephone circuits and other non-intrinsically safe telephone systems is recognized.

9. INSTALLATION

9.1 A set of record plans and technical documentation covering the information listed below shall be kept at each mine and it is necessary that such documents are kept up-to-date. The requirements of the *Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010.*) under regulation 96 should be taken care of when preparing such plans:

- a) Single line diagram right from the point of commencement of power supply to the Mine;
- b) Type and position of all fixed and transportable electrical equipment;
- c) Routes, length and cross section of all fixed power feeders and branch feeder;
- d) Rating of all electrical **plant and equipment** apparatus and supply lines;
- e) Current and time setting of overload relay, earth leakage relay and rating of fuses;
- f) Calculated short-circuit currents at various remote points;
- g) Method of installation of main earthing arrangements; and
- h) The direction of ventilation in underground workings.

9.2 Location of Equipment with Flammable Liquids

9.2.1 Dry type electric equipment shall only be used in belowground mines. On the surface of the mine, wherever use of electrical apparatus containing large quantity of flammable dielectric liquid cannot be avoided; means shall be provided to minimize danger from fire in the event of overflow or leakage of the liquid, and arrangements should be made to prevent any such flammable liquid gaining access to any other part of the mine other than the room or compartment in which the equipment is located or to the soak pit specifically made for this purpose.

9.2.2 Suitable fire-fighting equipment shall be kept immediately adjacent to the room or compartment.

9.2.3 Soak pits and drainage channels of fireproof construction of adequate capacity and filled with clean washed pebbles or ballast to collect any liquid which may leak or may be released under fault conditions from the equipment shall be provided in or around such compartments.

The design of the floor and the drainage channel shall be such that the oil is able to run readily into the soak pit.

9.3 Operating Temperatures — The equipment should be so installed, operated and maintained as to ensure that in no part the permissible maximum temperature is exceeded.

9.4 Portable and Transportable Machine.

9.4.1 Portable and transportable machine(s) should be controlled by approved protective switchgear. The person designated to operate such machine should not leave the machine while it is in operation and should, before leaving the area in which such machine is operating, ensure that the supply is disconnected from the flexible cable which supplies electricity to the machine and when any such machine is in operation, steps should be taken to ensure that the flexible cable is not dragged along by the machine. Also if such machines are used in underground mines these should be operated on remote control from the concerned switchgear with pilot core protection.

9.4.2 Connections to portable and transportable apparatus shall be by bolted or restrained type plug and socket outlets. In coal mines, for flameproof portable and transportable apparatus, the plug and socket shall be of certified and approved type. In the restrained type of cable coupler, the interlocking circuit shall be intrinsically safe.

Where such terminations are provided in portable or transportable apparatus due to space considerations in design, sealing material used shall be of a type which shall not alter the flameproof properties of the enclosure. Special attention shall be paid in the fitting of packing glands for compliance with the minimum length of flame path with the packing material compressed.

9.4.3 Portable electric hand-lamps shall, where practicable, be arranged for operation at a voltage less than 30 volts, the supply being given by a double-wound transformer. Hand-lamps shall be equipped with an insulated handle and strong cover of glass or other transparent material and shall be provided with a strong guard over the cover.

9.5 Cables

9.5.1 Cables used for underground working in mines shall be of copper conductor and of the type suitable for the purpose and location.

Flexible cables used with portable and transportable apparatus should be in accordance to IS 14494. PVC cables used should be in accordance with IS 1554.

9.5.2 Cables laid in mines shall be suspended freely from metal or wooden supports with provision for normal sagging. They shall be so installed as to ensure maximum protection against mechanical damage from causes such as dangerous sagging due to their own weight, traffic and vibration. The run of cables shall be avoided in haulage roadways as far as possible.

9.5.3 In mines, only in exceptional cases, cables shall be laid in ducts of fireproof constructions which provide effective protection against mechanical damage.

9.5.4 Cables which pass through brick walls shall not be embedded or concreted at such points.

9.5.5 At terminations and joints, conductors shall be firmly secured and terminated or connected together. At terminations only locked or bolted terminals shall be used.

9.5.6 Terminals or jointing part shall be at least equivalent to the cables as regards conductivity and insulation. It shall not be possible for the conductor to be damaged by terminal and jointing parts.

9.5.7 All cable ends shall be effectively sealed to prevent diminution of its insulating properties.

9.5.8 Where paper insulated cables run vertically, for instance shaft cables, and where the temperature is likely to be high, precautions shall be taken to guard against the troubles which may arise due to bleeding of the oil compound from the cable ends. Cables for such situations shall be specified in particular at the time of procurement.

9.5.9 Provision shall be made so that the cores of the cable may be efficiently sealed to prevent moisture percolating down the strands of the cable conductors. If the conductors are taken direct through insulators to the outside of the sealing box or where separate bare stranded conductors are connected to the cable cores (*see* Fig 1), the conductors should be sweated solid from a point well below the level of the compound in the sealing box to a point at least 13 mm outside the insulator.

NOTE — Where sweating is not permitted some other means of jointing should be adopted.

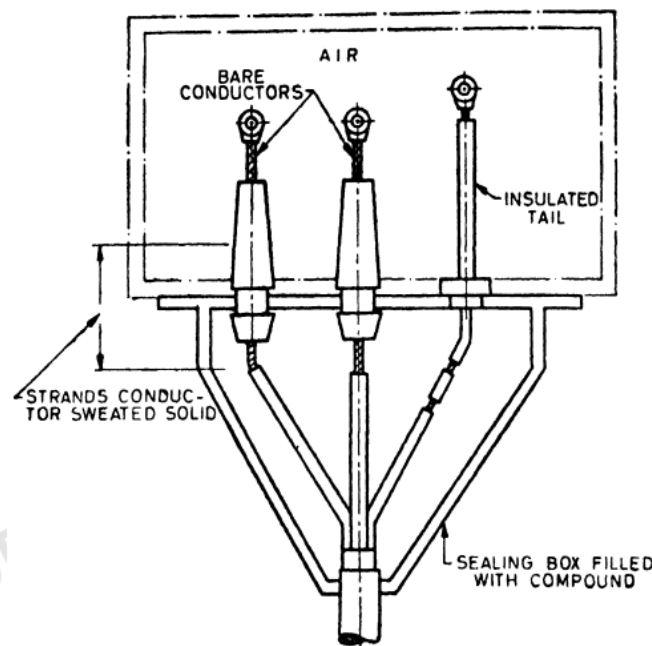


FIG. 1 METHOD OF TERMINATING CABLE TAILS

9.5.10 Short firing cables used in mines should be in accordance with IS 5950.

9.5.11 Flexible cables used for miner's cap-lamps should be in accordance with IS 2593.

9.6 Communication and Signaling Systems

9.6.1 Voice Communication

9.6.1.1 Telephone communication shall be provided for all working districts, at main haulage stations, pit bottoms, underground sub-stations, central surface substation and all other essential service facilities including the dispatching station.

9.6.1.2 Circuits between stations of a communication system installed in a gassy mine, here flameproof equipment is required, shall be intrinsically safe and covered by a certificate from the appropriate authorities.

9.6.1.3 No communication system using a ground-return circuit shall be permitted in any mine.

9.6.1.4 Voice communication (with the exception of radio and carrier system) system voltage shall not exceed 50 volts in mines.

9.6.1.5 Suitable surge arresting equipment, properly grounded, shall be provided at the points where telephone circuits enter the mine.

9.6.1.6 No apparatus which is not of approved type shall be connected to a circuit in which apparatus of an approved type is required to be used, except that an underground telephone system of the intrinsically safe type may be connected at surface to another system which is not approved as intrinsically safe through the medium of a certified intrinsically coupling unit.

9.6.1.7 Where radio frequency sources are used in hazardous area of a mine or near blasting circuits, the radio frequency power thresholds shall be in accordance to IS/IEC 60079-0 standard.

9.6.2 *Signaling System*

9.6.2.1 Where electrical signaling is used, the voltage used in any one circuit shall not exceed 30 V peak ac.

9.6.2.2 Apparatus used for signaling purposes in mines shall be of approved type designed for protection against moisture and mechanical injury. In gassy mines, the circuits adopted for the system shall be with features of intrinsic safety.

9.6.2.3 The construction of contact-makers, such as signal switches shall be such as to prevent the accidental closing of the circuit.

9.6.2.4 Adequate measures should be taken to prevent signal and telephone wires coming into contact with other cables and apparatus.

9.6.3 *Conductors*

9.6.3.1 Bare conductors for signalling lines may be used if the circuit employed is certified as intrinsically safe and the conductors are installed at a safe distance (0.3 m) from power cables.

9.6.3.2 Where power cables or apparatus are installed, conductors and cables shall be installed on opposite sides of roadways or haulage roads.

10. COMMISSIONING

10.1 Reference is invited to the various latest Indian Standards for different electrical equipment which set out the inspection and test schedules before commissioning.

10.2 Before a flameproof apparatus is put into services, a close inspection shall be made for the presence of flaws or cracks and all joints shall be inspected for tightness; in the case of flanged joints, the gaps shall be checked to ascertain that they do not exceed the permitted gap dimensions.

11. MAINTENANCE

11.1 General

11.1.1 Only a regular and organized scheme of maintenance work, planned to cover all its details, may ensure continued satisfactory operation of electrical equipment with a minimum of liability to faults or to the dangers resulting from general neglect.

11.1.2 Proper and systematic organization of maintenance work, planned after completing a review of the entire electrical system and based upon time-tables intended to cover the required maintenance operations, is an essential preliminary to a good maintenance scheme. The recommendations given by the OEM should be followed.

11.2 Safety of Personnel

11.2.1 All electrical equipment shall be regarded as capable of giving rise to danger. Access to parts which may be live should, therefore, normally be prevented preferably by physical means of protective enclosures. To avoid danger, such equipment shall be accessible only to authorized persons.

11.2.2 Simple code-of-safety rules such as the 'permit-to-work' system, lock out and tag out, etc., are essential when undertaking maintenance work.

11.2.3 Switchgears controlling main power supply should be provided with earthing switch for effective earthing and safe discharge of stored energy before commencement of maintenance work on apparatus and supply lines.

11.2.3 To ensure that the equipment is dead before work commences and also they remain so effectively, even if a circuit supplying them is inadvertently restored the power conductors shall be first discharged and then connected to the earth till such time as the maintenance work is in progress.

11.3 Safety of Equipment

11.3.1 Many of the features, which contribute to the safety of electrical equipment, are inherent in the original design. A clear appreciation of the various risks involved may enable the maintenance staff to initiate steps which might prove to be of great value in preventing the damage that a fault might cause.

11.3.2 The presence of moisture also constitutes potential danger to electrical apparatus. If equipment is damp or if normal temperature variation results in condensation, steps should be taken to correct this condition.

11.4 Maintenance of Electrical Equipment in Mines

11.4.1 The equipment shall as far as possible be kept free from dirt and dust which, in course of time, are likely to impair the safety of the equipment.

11.4.2 Manufacturers' instruction books which detail the special attention required during maintenance of particular equipment along with the Indian Standards for guidance in regard to maintenance of electrical equipment, in general should be available to maintenance staff in each mine.

11.4.3 Every flexible cable attached to a portable or transportable machine shall be examined periodically by the person authorized to operate the machine. If such cable is used underground, it shall be examined at least once in each shift by the authorized person. A damaged or defective cable should be immediately replaced by a cable in good condition. Such periodic examinations by the operator shall be supplemented by thorough examination by the authorized maintenance staff at weekly intervals. These examinations shall be as detailed as practicable and cover all accessible parts of the cable, such as the plug and the socket assembly at switch and machine end, surface of the cable and any couplers used.

11.5 Special Precautions for Maintenance of Flameproof Equipment

11.5.1 Details of design considerations of such safe apparatus are given in IS/IEC 60079-1 standard. The supervisor-in-charge of maintenance of this apparatus shall have thorough knowledge about the basic principles of their design so as to have a clearer insight into the problem of maintenance of such apparatus. For the purpose of guiding the maintenance personnel in the fundamental principles of construction of flameproof enclosures, **11.5.2** to **11.5.4** bring out some of the important features.

11.5.1.1 Any alteration of a flameproof enclosure is prohibited.

11.5.2 For air-filled apparatus the structural gaps between the joint surfaces and the diametral clearances for operating rods and spindles shall be in accordance with IS/IEC 60079-1 standard.

11.5.3 Diametric clearance of shaft and plain or labyrinth gland for motors and other rotating machinery with a length of flame path along the joint not less than 25 mm shall not be more than 0.5 mm.

NOTE — The flame paths and clearances mentioned in **11.5.2** and **11.5.3** are subjected to changes as and when IS 60079-1 is revised.

11.5.4 Painting shall, in general, excluding flame paths be necessary to preclude rusting and corrosion. Aluminum paint shall, however, not be used, since this may give rise to dangerous frictional sparking on impact.

11.5.5 Great care should be exercised in the handling of parts of flameproof electrical equipment as any damage to them would destroy the flameproofness of the equipment.

11.5.6 Before replacing a cover, the flanges shall be cleaned and lightly greased (preferably with silicon grease).

11.5.7 The force used when tightening up bolts, nuts and screws shall not be more than is necessary, to ensure that no appreciable gap exists at the flanges. The heads of set-screws in bottomed holes shall not stand proud of the shroud due to accumulation of dirt in the bottom of the blind hole.

11.5.8 Damaged or missing bolts and set-screws shall be replaced by others of correct diameter, thread, length, type of head and quality of steel.

11.5.9 The flameproof gap is the most important features of any flameproof enclosures and greatest care and attention shall be paid when dismantling and reassembling equipment. Further, no attempt shall be made to insert feelers when the circuit is live.

Since the cable sealing box and gland constitute a closure on the terminal box, the flameproofness of the terminal box shall be ensured only when the sealing box is completely filled with compound as intended.

In general, the use of conduits and conduit stopper boxes in coal mines is permissible only for connection to two more pieces of apparatus mounted on the same base plate, framework or foundation, or in conditions where disturbance of the conduit by relative movement of the parts is not to be expected.

11.5.10 The bearings of switch spindles clearances of shaft glands of the fixed or labyrinth type shall be regularly inspected and lubricated.

11.6 Special Precautions for Maintenance of Intrinsically Safe Equipment

11.6.1 Intrinsically safe circuits shall, under no circumstances, come into direct or indirect electrical contact or induction with other circuits. Special care shall be taken when examining wiring inside equipment to ensure that segregation of the circuits exist.

11.6.2 The safety of the circuit is much dependent upon the inductance present and it would not be very easy to check at site the trustworthiness of the safety devices which absorb part of the energy. Any damaged electrical component shall be replaced by identical one obtained from the manufacturer.

ANNEX A
(Clause 2)**LIST OF STANDARDS**

| <i>IS No.</i> | <i>Title</i> |
|----------------------|---|
| IS 1554: 1988 | Specifications for PVC insulated (Heavy duty) Electric Cables |
| IS:2259:1963 | Methods of test for determination of insulation resistance of solid insulating materials |
| IS 2593 : 1984 | Flexible Cables for Miners' Cap-lamps |
| IS 3043: 2018 | Code of practice for earthing (Second Revision) |
| IS 5950 : 1984 | Specification for shot firing cables (For Use Other Than In Shafts) (First Revision) |
| IS 14494 : 2019 | Elastomer insulated flexible cables for use in Mines - Specification (First Revision) |
| IS 16724 : 2018 | Explosive atmospheres - Electrical installations design, selection and erection |
| IS/IEC 60079-0:2017 | Explosive Atmospheres Part 0 Equipment — General Requirements (Third Revision) |
| IS/IEC 60079-1:2014 | Explosive Atmospheres - Part 1 : Equipment Protection by Flameproof Enclosures "d" |
| IS/IEC 60079-11:2011 | Explosive Atmospheres Part 11 Equipment Protection by Intrinsic Safety "i" (First Revision) |