



भारतीय मानक ब्यूरो

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

BUREAU OF INDIAN STANDARDS

(Ministry of Consumer Affairs, Food & Public Distribution, Govt. of India)

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WIDE CIRCULATION DRAFT

Our Reference: ETD 22/T-22

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 (22815) WC	Guide for Selection of Electrical and Electronic Equipment for Coal Mines (<i>First Revision</i> of IS 9559)

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 eetd@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 eedt@bis.gov.in shall be appreciated.**]

Doc. No.: ETD 22(22815)WC

BIS Letter Ref: ETD 22/T-22

Title: Guide for Selection of Electrical and Electronic Equipment for Coal Mines (First Revision of IS 9559)

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

NOTE- Kindly insert more rows as necessary for each clause/table, etc.

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

(Not to be reproduced without the permission of BIS or used as an Indian Standard)

Draft Indian Standard

**GUIDE FOR SELECTION OF ELECTRICAL AND ELECTRONIC
EQUIPMENT FOR COAL MINES**

(First Revision of IS 9559)

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 1980 for guidance and selection of proper equipment for use in coal mines. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards.

Though a number of standards have been published for the techniques of protection of electrical equipment in hazardous areas, yet the only protection that is still acceptable for the use of electrical and electronic equipment in hazardous locations of coal mines is the technique of flameproof enclosures and intrinsically safe circuits and equipment. It has been felt that IS: 16724:2018 “Explosive atmospheres - Electrical installations design, selection and erection.” is not fully applicable as for selection of equipment in coal mines.

In selecting electrical equipment's other than the flameproof, a number of considerations have to be taken into account keeping in view the common hazards like risks of roof fall or fall of other materials, coal dust, moisture, water, vermin, etc., encountered in the underground situations of a coal mine. In such cases where use of flameproof equipment's is not statutorily or otherwise required, other techniques of protection such a type of protection 'e' may be selected subject to the approval of approving authority. The equipment prescribed above shall offer reasonable degree of protection against the common hazards in underground situations of a coal mine.

Equipment with type of protection 'e' shall not be considered in any case as an alternative to flameproof equipment.

While preparing this standard, the statutory regulations in this country have been kept in mind. However, if there is a conflict between statutory regulations in force in any area and this standard, the provisions of the former will prevail.

The statutory authority in India, for approval of equipment for use in coal mines is the Director General Mines Safety, Dhanbad.

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

GUIDE FOR SELECTION OF ELECTRICAL AND ELECTRONIC EQUIPMENT FOR COAL MINES

(First Revision)

1 SCOPE

This Indian Standard provides guidance for selection of electrical and electronic equipment for use in the underground situations of coal mines in general and the permissibility of the ordinary equipment, flameproof equipment and the intrinsically safe equipment in particular.

2 REFERENCES

2.1 Statutory Requirements

- a) *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 CLASSIFICATION OF COAL MINES

For the purpose of this guide, the following classification of coal mines shall apply.

3.1 Gassy Seam of Degree I— A coal seam or part thereof lying within the precincts of a mine not being an open cast working whether or not flammable gas is actually detected in the general body of the air at any place in its workings below ground or when the percentage of the inflammable gas, if and when detected, in such general body of air does not exceed 0.1 and the rate of emission of such gas does not exceed 1 m³ per tonne of coal produced.

3.2 Gassy Seam of Degree II— A coal seam or part thereof lying within the precincts of a mine not being an open cast working in which the percentage of flammable gas in the general body of air at any place in the workings of the seam is more than 0.1 or the rate of emission of flammable gas per tonne of coal produced exceeds 1 m³ but does not exceed 10 m³.

3.3 Gassy Seam of Degree III— A coal seam or part thereof lying within the precincts of a mine not being an open cast working in which the rate of emission of flammable gas tonne of coal produced exceeds 10 m³.

4 GENERAL

The equipment's generally used below ground in coal mines are for the following purposes:

- a) Electric power supply, transmission, distribution and use;
- b) Transportation of men, mineral and material;
- c) Drilling and blasting;
- d) Signaling and telecommunication;
- e) Illumination;
- f) Drainage and dewatering;
- g) Ventilation;
- h) Environmental monitoring;
- i) Portable instruments/devices; and
- j) Extraction of coal.

5 SUPPLY VOLTAGE FOR TRANSMISSION, DISTRIBUTION AND USE

The voltage employed in underground transmission distribution and use may be as follows:

- a) *Transmission of Power from Surface to Pit Bottom* — 11 kV, 6.6 kV, 3.3 kV, 550 V and 415 V.
- b) *Distribution of Power Underground* — 6.6 kV, 3.3 kV, 1.1 kV, 550V and 415V.
- c) Utilization of Power Underground:
 - 1) Fixed and transportable equipment may be 6.6 kV, 3.3 kV, 550 V and 415 V;
 - 2) Portable equipment - 550 V, and 415 V,
 - 3) Hand-held portable equipment 125 V; and
 - 4) Intrinsically safe dc power supply 110 V ac.
- d) *Underground Lighting* — 125 V between phases with mid-point in case of single phase and neutral point in case of 3 phase system, earthed.
- e) *Signaling* — The voltage for signaling circuits may be:
 - 1) Intrinsically safe systems – up to 15 V ac or 24 V dc,
 - 2) Non-intrinsically safe systems – up to 24 V ac or dc.

However, the voltage in any one circuit shall not exceed 30 V ac or dc.

- f) *Telecommunication* — Only approved intrinsically safe telecommunication equipment shall be used.
- g) *Environmental Monitoring System* — Only approved type of equipment shall be used, taking into account its safety aspects.

6 CONTROLGEAR

6.1 Enclosure— All underground control gears shall be robust in construction and suitable for rough usage except in cases where such control gears are required to be flameproof which shall be of a type approved by the Director General of Mines Safety.

6.2 Protection— The control gears shall have the following protective features and shall be of appropriate rupturing capacity:

- a) Overload protection,
- b) Short-circuit protection,

- c) Earth leakage protection with built-in testing device and re-setting device which may be operated externally,
- d) Interlocked earthing of the outgoing circuit at 3.3 kV and above,
- e) Suitable interlocks for opening the main cover,
- f) No voltage protection for starters, and
- g) Zener barrier protection for intrinsically safe circuits.
- h) Loss of Vacuum/SF6 gas pressure etc.

7 TRANSFORMERS

7.1 The transformers shall be in flameproof construction where statutorily required and shall be of an approved type. For protection of the transformers, suitable circuit-breakers shall be installed both on primary and secondary sides. All transformers shall have their secondary windings star connected to facilitate earthing of the neutral point. In case undergrounded neutral system is used, arrangement of insulation monitoring along with suitable visual and audible signal shall be provided so as to indicate the fall of insulation below a predetermined level.

8 INSULATED CABLES

8.1 The cables for various applications in coal mines should be as follows:

- a) *Transmission and Distribution of Power* — PVC insulated double steel wire armored cables with copper conductor and rated up to 6.6 kV and conforming to IS 1554 shall be used.

Alternately, cross-linked polyethylene insulated thermoplastic sheathed double steel wire armoured heavy duty cables having copper conductor and conforming to IS 7098 may be used.

- b) *Transportable Equipment* — The electrical equipment which is frequently shifted should be provided with pliable armoured flexible, cable conforming to IS 14494.
- c) *Portable Equipment* — The portable equipment operated above 250 V should be provided with screened type flexible cables conforming to IS 14494.

The handle portable equipment operated 250 V should be provided with unscreened type flexible cable conforming to IS 14494.

- d) *Lighting* — The cable used for lighting purpose should be PVC insulated double steel wire armored cables with copper conductor and rated up to 1.1 kV and shall conform to IS 1554.

9 POWER DISTRIBUTION

9.1 The following special features in the underground power distribution should be achieved:

- a) All sub-circuits are controlled individually by a circuit-breaker so as to protect the circuit from heating under overload conditions which may occur by the various working conditions or the fault conditions.
- b) The arrangement of sub-circuits should be such that isolating the branch is readily possible without affecting the healthy branches and easily carry out the repairs to the faulty branch without causing any undesirable consequences such as electric shock, spark or explosion, etc.

- c) Protective devices are so arranged and graded that the faulty circuit is automatically isolated and prevented from being energized by an unauthorized person.

10 MOTORS AND MOTOR STARTERS

10.1 Motors — The requirement of flameproof motors shall be in accordance with regulation 110 of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 as amended from time to time.

10.2 Gate End Circuit-Breakers Box- Motor starters are sometimes required to be installed at the gate end of a working face and have been designated as Gate End boxes. The requirement of flame proof gate end boxes should be in accordance with regulation 110 of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 as amended from time to time. Specialty of construction is dependent upon job requirement. But the following protective features should generally be adopted:

- a) A separate flameproof isolating chamber with an off-load isolator provided in such a way that the isolator is mechanical and electrical interlocked with the circuit breaker,
- b) Conductors of suitable mechanical duty class utilization category and electrical duty class,
- c) overload protection with sufficient time delay arrangement and enabling overload setting according to the load requirements,
- d) Earth leakage protection with adequate leakage current and time delay settings,
- e) No voltage/Low voltage, phase failure and Phase reversal protection.

11 TRANSPORTATION OF MEN, MINERAL AND MATERIAL BELOW GROUND

11.1 Men and material are transported by winders through vertical shafts of a coal mine. The equipment's are all installed on the surface of the mine with automatic contrivances like over speed prevention, over wind prevention, slow banking, slackness of rope protection, etc.

11.2 The following systems for transportation of mineral and material may be used:

- a) Rope haulages,
- b) Haulage by locomotives,
- c) Conveyors - both belt and chain conveyors, and
- d) Loaders and shuttle cars.

NOTE— The transportation of men is not permitted by these systems.

11.2.1 Rope Haulage Equipment— The smaller haulages may be driven by flameproof squirrel cage induction motor with flameproof direct-online starter or star-delta starters. The connections between motor and motor starter should be carried out through PVC insulated and double steel wire armoured cables of copper conductor in conjunction with cable sealing and dividing boxes. A reversing switch may also be employed to facilitate operation.

For bigger haulages, flameproof slip ring induction motors shall be used with properly rated circuit-breakers for stator control and flameproof air cooled type grid resistance and controllers. Wiring should be done by copper PVC heavy duty cables in conjunction with suitable cable sealing and dividing boxes.

11.2.2 Locomotive Haulage — Only approved types of battery, diesel and electric trolley wire locomotives should be used. In addition, the statutory safety regulation in this regard should also be complied with.

The use of trolley wire locomotive in underground mines are liable to a number of restrictions and their use should be discouraged.

11.2.3 Conveyors — The conveyor belts shall be fire resistant and conforming to IS 3181.

Flameproof squirrel cage motors shall be used for conveyors of higher rating. Conveyors are also very often worked by suitable hydraulic coupling which has obvious advantages over other forms of coupling. Where Variable voltage variable frequency drives (VVFD) are used as prime mover, the motor selected shall be suitable for VVFD application.

As the conveyors are frequently shifted it is desirable that the cable terminal connections are made by approved plug and socket assemblies and pliable armoured flexible trailing cables conforming to IS 14494 are used between motor and starters. The starters for these conveyors shall be of flameproof air break type with provisions of suitable interlocks, sequence control, etc. The interlocks may include Belt sway switches, pull cord switches, zero speed switches, pre start warning, Brake thruster feedback etc.

11.2.4 Loaders and Shuttle Cars— The electric motors and control gears provided in these equipment shall be of flameproof construction and the wiring between the controlling gate-end box and the equipment shall be made by flexible cables with approved plug and socket type connector.

However, both the loader and the shuttle cars shall be of approved type as a whole. The flexible cables used for the shuttle cars shall be in accordance with IS 14494.

12. COAL MINING AND EXTRACTION

12.1 In Indian mines the following equipment are normally used for this purpose:

- a) Hand-held electric coal drill and universal drill machines (UDM);
- b) Coal cutting machines; and
- c) Continuous miner and shearers.

12.1.1 Hand-held coal drills are exclusively used for making holes for blasting. These drills shall, be of flameproof construction and rated between 0.93 kW and 1.1 kW at 125 V.

The power to these drills may be supplied through a flexible trailing cable conforming to IS 14494 with restraining type plug and socket connector. The supply is controlled by a flameproof panel housing a transformer and the protective system. The drill shall be operated by remote control and the pilot circuit shall be intrinsically safe with pilot core protection for both the drill and panel. The flexible cable used shall be of approved type. In case of UDM the power should be controlled by means through a gate end box. The UDM should be operated by remote control and the pilot circuit shall be intrinsically safe with pilot core protection for both the UDM and the gate end box.

12.1.2 Coal Cutting Machines — The machines consist of a flameproof motor and controller and is connected to its control gear by a screened flexible cable with plug and socket assembly. The control gear and flexible cable used shall be of approved type and complying with IS 14494. The

control gear is intended to be operated on remote control so that pilot core protection could be provided.

12.1.3 Continuous Miner and Shearers — These machines are used for complete coal mining without any need of blasting. Continuous miner is used for board and pillar and room and pillar system. Shearers is used in long wall system. The electrical system and arrangement should be similar to loader/shuttle, car. The hydraulic oil, lubricant, etc., should be fire resistant type.

13 SIGNALLING AND TELECOMMUNICATION

13.1 Signaling and telecommunication shall be carried out by intrinsically safe equipment and circuits.

13.2 Signaling is normally done for the operation of haulage units through two bare wires supported on insulators and running on the haulage plane. Anywhere from the haulage plane, the signaling should be effected by the operator by short-circuiting the two bare wires. This signaling may be of ringing type or hooter type and usually employs a signaling bell transformer of primary 125 V and secondary 15 V ac. Only the secondary side of transformer need be intrinsically safe and primary side may, therefore, be made only flameproof.

14 ILLUMINATION

14.1 Illumination in the underground situation of a mine is also very important particularly at the working faces and at important traffic junctions where tubes are attached or detached. This is a statutory requirement that all lighting fittings shall be of flameproof construction only.

14.2 The voltage of the lights should be limited to 125 V with a special system construction so that if the electric supply be single-phase the midpoint of the system shall be connected to earth or if the supply be three phase the voltage between the phases shall not exceed 125 V and the neutral point of the system shall be earthed.

14.3 Ordinary junction boxes or connectors are not required in the lighting installations as the flameproof lighting fitting is so constructed that it may be operated as a single-way, two-way, three-way or four-way connector.

14.4 Two core copper cable with PVC insulation or paper insulation having metallic armoring earthed should be used for lighting fittings.

15 DE-WATERING OF MINES

15.1 This problem has peculiar features depending on the type of the mine. In case of a quarry, the free run of water from the surface of the mine may be huge. If it is an incline all round percolation from the surface may attain a large value along with the possibilities of water running into the mine through the incline mouths. In shaft mining there is possibility of huge percolation within the shaft itself along with the percolation from the roofs and walls of the mines. For complete dewatering of the mine the pumping system may be divided into the following groups:

- a) Main pumps at the pit bottom for pumping water from a large main sump to the surface of the mine.
- b) Stage pumps installed at different stages of the mine with comparatively limited sump capacity. The stage pumps discharge water to the main sump.

- c) Comparatively smaller pumps may be used to pump water from the working faces to the stage pumps or even to the main sump depending on the development of the mine.

15.2 The rate of accumulation of water in a mine has considerable seasonal variation and, therefore, a number of main pumps may be desirable. One or more main pumps may be operated according to requirement.

15.3 The output of the motors for main pumps may be between 55 and 445 kW depending on the depth of the shaft. Properly designed squirrel cage motors with direct-on-line starters both of flameproof construction may be employed. Depending on the ventilation and proximity of working faces or goaf, totally enclosed fan-cooled motors may also be permitted. There is, however, no objection to the use of properly constructed slip-ring induction motors with suitable control gears. Slip-ring induction motors may be more suitable with higher output and high head pump.

15.4 Output of the stage pumps may be between 15 kW and 75 kW normally and a squirrel cage induction motor with proper enclosure usually serves the purpose.

15.5 Selection of face pumps should be done very judiciously keeping in view the different problems encountered at the coal face. Generally, squirrel cage motors of output 3.7 kW to 11 kW are used to run centrifugal pump at the face. These are generally low-read pumps pumping water from face to the nearest sump.

15.6 Submersible pumps are considered extremely suitable for pumping water from coal faces.

16 VENTILATION

16.1 Ventilation is the backbone of a mine. It is based on proper design and calculations. The ventilation requires main induced or forced draught fan on the surface of the mine along with underground booster fans and a number of face fans.

NOTE — An automatic sequence of operation of these fans is considered essential. Application of suitable electronic devices for the operation of this sequence to be effective during derangement of ventilation for whatsoever causes should also be considered.

16.2 Main fans are usually located at the surface of the mine but within the fan drift encountering the return air of the mine. The driving motor is usually installed outside the drift. In that case an ordinary industrial type motor may be employed. Large fans are usually driven by 3.3 kV synchronous motor or synchronous induction motor which has the advantage of power factor correction.

16.3 Booster fans are located in below ground situations and should have flameproof squirrel cage motors and control gears wired up by wire armoured cables in conjunction with suitable cable sealing and dividing boxes.

16.4 Face fans are usually composite with the driving motor and have flameproof construction. As the equipment is largely transportable the wiring between the motor and starter has to be made by pliable armoured or screed protected trailing cable conforming to IS 14494 and using bolted type cable couplers.

17 BLASTING

17.1 The exploders/Detonators duly certified and approved by Chief Inspector of Mines of the Directorate General of Mines Safety should be used.

17.2 Drilling and Blasting — For drilling and blasting, hand-held power drills operating up to 125 V, 3-phase, 50 Hz and flameproof enclosures in accordance with IS/IEC 60079-0 and IS/IEC 60079-1 shall be used.

18. ENVIRONMENTAL MONITORING

18.1 The requirements of the environmental monitoring system for underground use are as given for guidance:

a) Methane Sensor

- 1) *Measuring range*: 0.5 percent and 0 to 100 percent (set by a selector switch). The least count shall be 0.01 of full scale division (FSD).
- 2) *Accuracy*: ± 2 percent of FSD.
- 3) *Power supply*: AC operation with provision for automatic change-over to battery operation in case of failure of ac supply and type protected. Available power underground in Indian mines is
 - i) 525 V, 3-phase, 50 Hz; and
 - ii) 110 V, Single phase, 50 Hz supply.
- 4) All electrical power sources/circuitry shall comply with IS/IEC 60079-0 and IS/IEC 60079-1 in terms of enclosures and IS/IEC 60079-11 in terms of intrinsic safety.
- 5) Battery life shall be sufficient to cater power requirements for one week.

b) Carbon Monoxide Sensor

- 1) *Measuring range* — 0 ppm to 100 ppm with provision to measure up to 1000 ppm with a flip on selector.
- 2) *Sensitivity* — 1 ppm (at the lower scale). Other parameters relating to power needs are same as at (a) above.

c) Air Velocity

- 1) *Measuring range* — 0 to 3 m/s with provision to measure up to 15 m/s.
- 2) *Accuracy* — ± 10 percent.
- 3) Other parameters relating to power needs remain the same as at (a) above.

d) Oxygen — In the general body of air (mine climate) 5 to 20 percent.

e) Temperature and Humidity — RH up to 98 percent and temperature up to 50°C in the general body of the air.

f) Carbon Dioxide — 0.05 percent to 10 percent in the general body of the air.

g) Meter Panel — There should be three meters, one each for methane, carbon monoxide and air velocity measurement with selector switches incorporated with each of the meters to enable selective monitoring of different points.

h) Data Logging — Three separate multipoint data recorders shall be panel mounted with electric chart drives to record separately methane and carbon monoxide at 5 minutes'

interval and air velocity once in 15 minutes. Spare pinions shall also be provided as optional attachments to vary the frequency of recording, if so needed.

- i) Alarm Annunciator System — A solid state audio-visual (blinking) alarm annunciator system for instantaneous indication of (a) concentration of methane- (b) carbon monoxide beyond the limits of safe level, and (c) velocity of air flow in the ventilation system, below the acceptable limit.

Limits for the three parameters being as follows:

- | | |
|---------------------|---|
| (a) Methane | 1 percent to 25 percent |
| (b) Carbon monoxide | 50 ppm |
| (c) Air velocity | 3 m/s (or any other fixed value gap record, 4 m/s to 5 m/s) |

19 PORTABLE INSTRUMENTS/DEVICES

19.1 All portable instruments/devices should be type protected instruments or devices which are operating on battery should be intrinsically safe according to IS/IEC 60079-11 and those operating on 110 V; ac, 50 Hz; single phase should be in the flameproof enclosure. The enclosures of the apparatus which contain only intrinsically safe circuits, shall be totally closed in accordance with **IP 55** of IS/IEC 60529.

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 3181: 1992	Conveyor belts - Fire resistant conveyor belting for underground mines and such other hazardous applications - Specification (Second Revision)
IS: 7098	Cross - Linked polyethylene insulated thermoplastic sheathed cables
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)
IS/IEC 60529: 2001	Degrees of protection provided by enclosures (IP Code)