भारतीय मानक

भवनों (सामान्य) की अग्नि सुरक्षा की रीति संहिता : विद्युत-संस्थापन

(दूसरा पुनरीक्षण)

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): ELECTRICAL INSTALLATIONS

(Second Revision)

ICS 91.120;13.220.50

BUREAU OF INDIAN STANDARDS
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Fire Safety Sectional Committee, CED 36

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Safety Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 1961, revised subsequently in 1982. The present revision is based on the subsequent development and modifications in other regulations such as electrical rules of the Tariff Advisory Committee, Indian Electricity Rules, etc, and other Indian Standards. Special precautionary measures for use of aluminium conductors and for use of fluorescent fittings in electrical installations are included in the revision. The other changes relate to the developments in wiring methods and other general aspects.

The requirements of this code are to be treated as supplementary to the requirements of the Indian Electricity Act, 1910 and the Rules of 1956 thereunder and in no case as substitutes. In the preparation of this code, it has been presumed that the electrical installation work is carried out by qualified contractors and electricians under the supervision of competent engineers as required by the Indian Electricity Rules.

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 : 1960 'Rules for rounding off numerical values *(revised)*'. The number of significant places retained in the rounded off value should be the same as that of specified value in this standard.

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): ELECTRICAL INSTALLATIONS

(Second Revision)

1 SCOPE

This standard covers recommendations relating to fire safety of electrical installations in buildings.

2 REFERENCES

2.1 The Indian 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 the standards given in Annex A.

3 GENERAL REQUIREMENTS

3.1 Besides conforming to this Code all equipment shall comply with relevant Indian Standard Specifications (wherever available) as regards construction, temperature rise, current rating, overloads and performance, etc, where an Indian Standard does not exist the various items of electrical equipments should be those approved by the competent authority.

3.2 Execution of work unless otherwise exempted under the appropriate rule of the Indian Electricity Rules, the work of electrical installations shall be carried out by an electrical contractor licensed and under the direct supervision of a person holding a certificate of competency and by persons holding a valid permit issued and recognized by any Indian Government.

3.3 All equipment shall be capable of developing and/or consuming the rated power safely and continuously (unless specifically meant for intermitent use), without undue heating, sparking, noise and vibration.

3.4 All electrical equipment shall be securely mounted on the surface on which they are installed.

3.5 All electrical equipment, fittings, accessories and wiring systems in locations which are exposed to the following shall be of types approved for particular situations and subject to special conditions as laid down in the appropriate clauses of this code:

a) Fumes;
b) Flammable or other gases, vapours or liquids having deleterious effect on equipment and conductors or creating dangerous situations;
c) Dust and fibrous accumulations;
d) Damp or wet locations; and
e) Excessive temperature.

3.6 Manufacturer's name, trade-mark or other description markings by which the manufacturer may be identified shall be placed on all electrical equipment, accessories, electrical cables, etc. Other markings like voltage current and wattage shall also be provided as necessary. Marking shall be of sufficient durability to withstand the environmental conditions.

3.7 The type of wiring installed in a particular occupancy shall be as permitted under the relevant provisions of this standard.

3.8 Where aluminium conductors are used in the electrical installation, special precautionary measures as given in IS 732 shall be followed.

4 POWER EQUIPMENT

4.1 The term power equipment shall be deemed to include motors, motor-generators, control gears, switch gears, rotary convertors, rotary balancers, rotary condensers, phase advancers, frequency changers and any other rotating electric equipment, rectifiers and inverters.

4.2 All electrical equipment located in situations where:

a) The atmosphere is likely to contain flammable/explosive gases or vapours; and
b) Combustible dust, fluff or similar materials like saw mills and other wood working occupancies, cotton/jute/wooden/viscose and

acrylic, nylon 66 fibre mills, flour mill, pulverising works, etc, shall comply with the special requirements in respect of Hazardous Location specified in 13.

4.3 Equipment which depends on natural air for cooling shall be so located and installed that air flow over the exposed cooling surface shall not be prevented by adjacent equipment or walls. For floor mounted equipment, clearance between top surface of the equipment and the adjacent surface shall be provided to dissipate rising hot air.

4.4 Equipment ventilating openings shall be so installed that no obstruction may prevent free air circulation through them; nor shall any material be dumped or allowed to settle on them so as to clog the ventilation openings or interfere in any way with normal cooling of such equipment.

4.5 All equipment of more than 1/4 kW shall be separated from unprotected woodwork by a distance of at least 300 mm horizontally and 1 200 mm vertically. Equipment of 1/4 kW or less, except those of totally enclosed type, shall be suitably guarded to avoid heat being transmitted to readily combustible material in the vicinity.

4.6 Equipment shall be periodically inspected and maintained as per relevant Indian Standards by competent staff who shall keep complete records of all such activities.

4.7 The position of equipment shall be selected with due consideration of accessibility, maintenance and overhaul.

4.8 Equipment terminals shall be rigidly designed and planned according to size and type of machine. Industrial motors shall have a robust metal clad terminal box of adequate dimensions arranged to receive armoured or vulcanized rubber insulated/PVC cables in conduits without unnecessary bends in the cables. All terminal boxes shall be entirely reptile, rodent and insect proof.

5 SWITCHBOARDS

5.1 Switchboards shall be erected in easily accessible and approved positions where cotton fluff, dust or dirt is not present. The switchboard shall be located in dry locations.

5.2 The space around the switchboards shall not be used for storing of clothing or other materials, even for temporary period.

5.3 Each outgoing circuit from the switchboard shall be separately controlled by a suitable automatic circuit breaker or linked switches and cut-outs. In case the electrical installation draws power from a distribution transformer having a capacity of 150 kVA or more, the switches shall be provided with HRC fuses at all fuse points, irrespective of current rating of the circuit. This, however, need not be insisted in case of low tension installation.

5.4 All switches and circuit breakers shall be operated from the front of the switchboard.

5.5 All fuses shall be mounted on the front of the switchboard as far as practicable.

5.6 All screws, bolts and nuts, which secure current carrying parts to the board shall be of brass, copper or similar rustproof material.

5.7 All wires and cables shall be provided with soldered or approved lugs or crimped joints or any other approved means of connection.

5.8 In situations where the atmosphere is likely to contain explosive gases or vapour, switchboards shall be of explosion protected type. Selection of electrical equipment shall be as per IS 5571 (*see also* IS 5572 for classification of hazardous areas). Alternately pressurised air lock enclosures may be provided for switchrooms. Wherever not possible switchroom should be themselves pressured.

5.9 Where the switchboard is erected in a room of a building isolated from the source of supply or at a distance from it, adequate means of control and isolation shall be provided both near the boards and at the origin of supply.

5.10 All switchboard shall be of metal clad totally enclosed type or any insulated enclosed pattern which should be fixed at close proximity to the point of entry of supply.

5.11 In case of outgoing circuits from the switchboard, where the current rating exceeds 63A, connection between the busbar chamber and the automatic circuit breaker or switch fuse or any other control gear shall be made only by solid connections.

5.12 Timber shall not be used in construction of a switchboard.

5.13 All circuits shall be clearly and indelibly labelled for identification in English and vernacular.

5.14 Moulded case circuit breakers shall not be permitted except inside a metal enclosure.

5.15 The neutral of each main and branch main circuit shall be provided with a removable link placed in an easily accessible position, for purpose of testing. The neutral shall not be punched at the back of the board.

6 POWER DISTRIBUTION AND MOTOR CONTROL GEAR

6.1 All equipment shall be of metal clad construction throughout, dust tight, suitably proportioned and of adequate capacity and shall conform to the relevant Indian Standards.

6.2 Equipment shall be accessible at all times, stacks of goods and the like shall not impede access to any part of the equipment.

6.3 Wiring to and from the gear shall be of the armoured, mineral insulated or screwed steel conduit type and provision shall be made to secure the same by approved and efficient mechanical methods. Flexible tubing shall not be accepted for general wiring. It may, however, be used for connections between the terminal boxes of motors and starters, switches and motors but the length shall be restricted to a maximum of 1 200 mm.

NOTE — Non-metallic conduits conforming to IS 9537 (Part 3) may be used for medium voltage installation, subject to following conditions:

a) The conduits should be supported not more than 800 mm distance and should have suitable joints.
b) Separate earthing conductor shall be run inside the conduit for earthing the equipment to which the conductor is connected.
c) Expansion joints shall be provided where required to compensate for thermal expansion and contraction.

Such non-metallic conduit shall not however be allowed in following locations:

a) In locations less than 2.5 m above walking floor level unless protected against mechanical damage.
b) Where ambient temperature is likely to be above 55^0C at some time or other during year.
c) In concealed places of combustible construction.
d) In locations where the atmosphere is likely to contain flammable gases or vapours.
e) In locations where the surrounding atmosphere is likely to affect the non-metallic conduits.

6.4 The ends of all conduits shall be bushed.

6.5 All unused cable holes shall be effectively closed.

6.6 All current carrying parts, namely terminals, washers and clips shall be of copper, brass or of any other equally non-rusting material, properly tinned at joints.

6.7 All cables shall be provided with soldered lugs or other approved means for connection.

6.8 Where a distribution board or group of distribution boards is/are erected in a room of a building isolated from the source of supply, adequate means of control and isolation shall be provided both near the board and at the origin of supply. Similar means of control and isolation shall be provided even if the source of supply and the distribution board(s) is/are located inside the same compartment but separated from each other by more than 15 m.

6.9 Outgoing circuits shall be clearly marked in English and vernacular, indicating the department or place or item controlled, by each.

6.10 All circuits shall be arranged symmetrically, as far as practicable.

6.11 Each circuit from a main distribution board shall be provided with a circuit breaker, linked switches or cut-outs.

6.12 Looping of conductors and tee joints in power wiring shall be provided with a circuit breaker, linked switches or cut-outs.

6.13 Detachable inspection covers shall be provided to examine connections.

6.14 Woodwork shall not be permitted for mounting of or construction of frame work of any iron-clad switch control or distribution gear.

6.15 Motors shall not be connected to lighting distribution boards.

6.16 Suitable guard enclosures shall be provided to protect exposed current carrying parts of motors and insulations of motor leads where installed directly under equipment or in other locations where dripping or spraying of oil, water or other injurious liquids may occur, unless the motor is designed for such conditions.

6.17 In situations where dust or flying materials may collect on or in motors in such quantities as to seriously interfere with ventilation or cooling of motors, totally enclosed or totally enclosed fan-cooled motors that will not overheat under prevailing conditions, shall be used.

7 TRANSFORMER SUBSTATION, EXCLUDING BELL AND DRAWING FRAME, TRANSFORMER AND TRANSFORMERS OF SMALL CAPACITY

7.1 Every oil-filled apparatus, such as transformer, static condenser, switchgear or oil circuit breaker having an individual or aggregate oil capacity of 2 000 litres or more shall be housed in a locked, weather and fire resistant building and shall be properly ventilated to the outside of the building only. The building housing the oil-filled apparatus shall be separated by a distance of not less than 6 m from all other buildings.

NOTES

1 If the building housing the transformer is within 6 m of the surrounding building there shall not be any door or window opening in the substation or the surrounding building.

2 If the building or compartment housing oil-filled apparatus is communicating with another building or com-

partment, the substation shall be segregated by separating walls of 355 mm thick brick wall or 230 mm thick RCC, carried up to roof level with door openings therein protected by single fireproof doors of 2 h rating.

3 Not withstanding the above, if the substations supplies power to fire pumps, the same shall be segregated from, the adjoining building by 400 mm thick brickwall or 300 mm thick RCC wall without any door opening therein where, however, door openings are absolutely necessary, the openings shall be protected by double fire resisting doors of 2 h rating each. If the substation is attached to a storeyed structure, in addition to segregations, it will also be necessary for the substation to be provided with RCC slab roof.

7.2 Each oil-filled apparatus, such as transformer, bank of static condensers, including high tension circuit breakers, switch and main distribution boards, having an individual or aggregate oil capacity of 2 000 litres, shall also be segregated from all other apparatus by 355 mm thick fire resisting brick wall or 230 mm thick RCC. The separating wall shall be carried right up to the roof level unless the roof is more than 3 m above the highest point of the equipment, in which case the wall shall be carried up to a height at least 600 mm above the top of the equipment so separated.

NOTES

1 This provision need not be applied to furnace and rectifier transformers as also to transformers of testing apparatus or other equipment of which the transformer is an integral part, whether they are oil-filled or not.

2 The requirements given under this rule, however, do not apply to dry type transformers, or transformers having sulphur hexafluoride, non-flammable coolants and having primary voltage not more than 33 kV.

3 If the substation supplies power to fire pumps, separating walls as described above will be necessary between the various items irrespective of the oil contents.

7.3 Each building or compartment housing oil-filled apparatus containing 2 000 litres or more of oil shall be provided with oil drains of at least 150 mm in diameter and soak pits, the latter being not less than 2.5 m away from the substation. Floors shall be sloped not less than 1 in 96 towards oil drains. The soak pits shall be of sufficient capacity to take the entire oil content of the equipment and designed to provide for drainage of liquids to a safe location.

7.4 A minimum clearance of 750 mm shall be provided between the transformer or other apparatus and enclosing or separating walls.

7.5 Substations and switchgear rooms shall only be used to house the intended equipment. Storage of any kind/or any repair work shall not be permitted therein.

7.6 Suitable apparatus shall be provided in approved positions for the control and protection of windings of transformers.

7.7 All transformers shall have suitable isolating equipment on both high and low/medium tension side.

7.8 Cable trenches inside substations shall be filled with sand, pebbles or similar non-flammable materials or covered with incombustible slabs. If a number of cables are taken in a trench, it is desirable that cables are taken on racks.

7.9 All control gears shall be protected against rodents, reptiles and insects.

7.10 It is essential in all transformer houses and in places of similar applications that an efficient and distinctive indicating device be provided to show clearly whether the supply in the main incoming cable is 'On' or 'Off' for the safety of fire-fighting personnel in the event of an outbreak of fire.

7.11 Transformers and equipment installed outdoors, having an individual or aggregate oil content of 2 000 litres or more shall be located in a suitably fenced and locked enclosure separated on all sides by at least 6 m from any building including substation. Separating walls are necessary between transformers having an individual or aggregate oil content of 2 000 litres.

NOTES

1 There should be no door or window opening in the surrounding building, if the transformers are within 6 m thereof.

2 If the transformers are within 6 m of doors and window openings of surrounding buildings then they shall be protected by single fire proof doors and 6 mm thick wired glass in steel frames respectively.

3 Separating walls shall not be necessary in case of transformers having an aggregate oil capacity exceeding 2 000 litres but individual oil capacity of less than 5 000 litres if the distance between transformers and other apparatus is more than 6 m or if the transformers are protected by an approved high velocity water spray system.

4 Where however oil capacity of individual transformer is larger than 5 000 litres separating walls shall be provided unless all equipment/building/plant are located at a clear distance of not less than the following:

Oil Capacity of Individual Transformer (l)	*Clear Separating Distance* (m)
5 000-20 000	8
Over 20 000	15

5 The provisions of **7.1**, **7.2**, **7.3** and **7.11** are not applicable if the transformer is filled with non-combustible insulant liquid.

8 EARTH CONNECTIONS

8.1 All earth connections shall strictly comply with IS 3043.

8.2 In no case shall gas, steam, sprinkler or humidifier pipes be used for an earth connection.

9 WIRING METHODS

9.1 General Requirements

9.1.1 Only such wiring methods as are permissible for a particular situation or location as laid down in rules under this clause, shall be allowed.

9.1.2 Wherever aluminium conductors are used, the special precautionary measures laid down in IS 732 shall be followed.

9.1.3 Conductors shall be insulated except where enclosed or bare conductors are specifically permitted under the rules.

9.1.4 Conductors exposed to oils, greases, vapours, gases, fumes, liquids or other substances having deleterious effects upon the conductor or its insulation shall be of approved type for the purpose.

9.1.5 Conductors may be permitted to be connected in parallel (electrically joined at two ends to form a single conductor only) if such conductors are of same length, material and cross-sectional area, have same type of insulation and terminated in same manner.

9.1.6 Where cables, conduits, cable ducts or trunkings pass through floors, walls, partitions or ceilings, the surrounding holes shall be made good with cement or similar incombustible material to the full thickness of floor, wall, etc. In addition where conductors are installed in channels, ducts, trunkings or shafts passing through floors, walls, partitions or ceilings, suitable internal fire resisting barriers shall be provided to prevent spread of fire from one side to the other.

9.1.7 Cables of ac circuits installed in steel conduits, shall always be so bunched that the cables of all phases and the neutral (if any) are contained in the same conduit.

9.1.8 Ducts of metal or insulating material and trunking shall be securely fixed and where they are liable to suffer mechanical damage, shall be adequately protected.

9.1.9 Trunkings shall be constructed of metal or non-combustible insulating materials.

9.1.10 Cables, cable ductings or trunking of metallic construction and conduits may be buried underground provided they meet the following minimum earth cover requirement:

Wiring Method	*Minimum Depth of Earth Cover*
Rigid metal conduits	150 mm
Other type of conduits	450 mm
Metallic ductings or trunkings	450 mm (with concrete envelope of not less than 50 mm around the ducting of trunking)
Directly buried cables	600 mm

9.1.11 No wiring system of any kind shall be permitted inside ducts needed for transporting dust, loose materials or flammable vapours.

9.1.12 Electrical services shall not be installed in the same conduit or trunking as pipes or tubes or non electrical services like air, gas, oil, water, etc.

9.1.13 Only PVC sheathed armoured cables or rigid metallic conduits shall be allowed in ducts or plenums used for movement of environmental air.

10 PERMITTED TYPES OF WIRING METHODS

10.1 General

10.1.1 Wiring shall be on distribution board system with main, branch main and final sub-circuit boards fixed at convenient positions and shall conform to IS 732.

10.1.2 Conductors which are not arranged for connection to the same system and circuit or which supply different phases of the same supply, shall be kept apart throughout their entire run. This shall particularly apply to installations in which there are pilot lights in addition to the main lighting and the like.

10.1.3 Conductors for final sub-circuits shall not be enclosed in the same conduit or casing as sub main and branch of main conductors.

10.1.4 Conductors which pass through windows or door frames, wood beams walls, ceilings and floors shall be protected by porcelain tubes or conduits according to the conditions. The tube or conduit shall extend at least 13 mm on both sides of the wall and 25 mm above the floor and below the ceiling.

10.1.5 All conduit ends shall be bushed.

10.1.6 Cables which are unarmoured shall be mechanically protected up to a height of 1.8 m above working floor level or up to the height of switchboard.

10.1.7 Branch main and distribution boards shall be mounted in suitable accessible positions, not higher than 2 m above floor level. Adequate working spaces and freedom from danger shall be provided.

10.1.8 Incoming mains shall be used for control of circuit in conjunction with suitable circuit breakers.

10.1.9 The system of wiring and all other details shall be suitable to the conditions prevailing.

10.1.10 Linked tumbler switches shall not be used for control of circuits.

10.1.11 Flexible leads shall hang vertically downwards from the ceiling rose without any obstructions, shall not be in contact with shafting structural member, pipe work, etc, and shall not be coiled or tied up but cut to correct length.

10.1.12 Flexible leads shall be renewed when they show signs of deterioration. Joints in flexible conductors of pendants shall not be permitted.

10.1.13 Flexible leads shall not be used where they are likely to swing due to ventilation or humidifier apparatus or any other cause; fixed rod or conduit protection shall be used in such cases.

10.1.14 Flexible leads and fittings shall not be allowed to vibrate.

10.1.15 Ceiling roses shall be securely fixed and shall be complete with caps.

10.1.16 Straight or slanting wall batten holder shall not be fitted at switchboard height or on the switchboard.

10.1.17 Shades or reflectors of light points shall not be in contact with structural members, pipe work, etc.

10.1.18 Temporary wiring shall not be permitted.

10.1.19 Pendants in close proximity to humidifiers shall be provided with approved water-tight fittings.

10.1.20 Only rod pendants shall be used in industrial buildings like textile mills, flour mills, saw mills, etc.

10.1.21 In ducts and tunnels only bulk head fittings with wires in conduits or armoured cables shall be used for lighting.

10.1.22 The base of accessories shall be of vitreous materials.

NOTES

1 Bakelite ceiling roses may be permitted in industrial buildings except in areas where the atmosphere is likely to contain explosive gases or vapours.

2 Bakelite switches may be permitted in industrial buildings except in 'Hazardous Locations' as defined later in this code.

10.1.23 Reflector fittings meant to be suspended by chain shall not be suspended by string or any other similar material.

10.1.24 Fittings for lamps in places where considerable dust or fluff is present (such as willowing, lap breaking, waste opening, mixing, blowing, and raising rooms in textile mills, flour mills, saw mills and other wood working factories, etc) shall be of dust tight type conforming to IS 4013.

10.1.25 In situations where the atmosphere is likely to contain explosive/flammable gases or vapours, fittings of flameproof type shall be used unless otherwise permitted under clauses relating to 'Hazardous Locations'.

10.1.26 The run or course of wiring shall be arranged to avoid crossing of belt drives; where such crossing is unavoidable mechanical protection shall be provided against damage by belt breakages.

10.1.27 The paper insulated lead covered cables shall not be brought right through the sealing box without a break. The conductors of paper insulated cables shall be terminated in the trifurcating box and tails of India Rubber (VIR) Conductors sweated by ferrules to the conductors of paper insulated cables shall be brought through the trifurcating box.

10.1.28 All filament lamps shall be so placed or so guarded as to prevent ignition of combustible material. Any shade or guard used for this purpose shall be suitable to withstand the heat of the lamp.

10.1.29 Wiring of lighting circuits shall be on distribution board system and circuit diagrams shall be attached to it.

10.1.30 Conductors shall be run as far as possible along the walls and ceilings, so as to be accessible for inspection.

10.1.31 Where two or more points are mounted, with a voltage differences exceeding 230 V between them, a minimum distance of 2 m between the points shall be maintained to avoid possibility of shocks.

10.1.32 Cord grips shall be provided for pendant lamp holders of bayonet contact type, and chain suspended reflector fittings shall have the cable entries made bell-shaped or bushed to avoid damaging the flexible cables.

10.1.33 Chain suspended fittings, fans, etc, shall be fixed at a distance not exceeding 250 mm away from ceiling rose.

10.1.34 Where long spans occur between beams and supports, battens shall be provided for attachment of conduits, casing, or other wiring or fittings. The runners shall be of well seasoned teak wood, free from shakes, splits, etc, and shall not be less than following dimensions:

Span (m)	*Dimensions* (mm)
1.2 to 1.8	75 × 38
1.8 to 2.4	75 × 50
2.4 to 3.4	75 × 63
3.4 to 4.4	100 × 75

Alternatively, they may be suspended from a catenary arrangement or be supported on steel sections of suitable size.

10.1.35 The wiring for hot air chambers shall be mounted on the walls outside the chamber, as far as possible. The light fittings inside the chambers shall be of oyster type or shall be waterproof fittings.

10.1.36 Where wiring is to be carried along the face of rolled steel joists or stanchions, a wooden or non-conducting backing, preferably of the full width of joists or stanchions shall first be laid on the joist or stanchions and secured rigidly thereto. Wooden pieces for the support of casing or conduit to steel joists or stanchions shall be secured by metal clips with at least two screws.

10.1.37 Scaffolding ropes shall not be tied round conduits, casings or other forms of wiring.

10.1.38 All strands of cables shall be fitted into terminals of switches, fuses, etc; strands of cables shall not be cut. In damp locations, the strands shall be soldered together.

10.2 The wiring methods specified in **10.3** to **10.7** shall only be permitted subject to conditions stipulated therewith.

10.3 Conduits

10.3.1 Conduits and fittings shall be of solid drawn and welded steel of heavy gauge screwed type, conforming to IS 2667.

NOTE — Rigid non-metallic conduits conforming to IS 9537 (Part 3) may, however, be used for low and medium tension installations except in locations mentioned under **9.3.5** and subject to the following conditions:

a) Conduits should be supported not more than 800 mm and should have suitable joints;
b) For earthing, separate earthing conductors shall be run inside the conduit from end to end; and
c) Expansion joints shall be provided, where required, to compensate for thermal expansion and contraction.

10.3.2 Solid drawn welded steel conduit shall be permitted under all atmospheric conditions and in all occupancies subject to stipulations laid down in **10.3.3** and **10.3.4.**

10.3.3 In damp situations, such as textile sheds, the conduits shall be hot galvanized or zinc impregnated or treated with special rust-proof paint.

10.3.4 In occupancies like chemical factories, bleach and dye houses, where strong corrosive vapours are present special conduits or conduits with additional coatings of bitumen paint or with a glass wool lagging provided with a protective covering shall be used.

10.3.5 Non-metallic conduits shall not be permitted in the following locations:

a) Where wiring height is less than 2.5 m above working floor level, unless protected against mechanical damage;
b) Where exposed to ambient temperatures likely to be above 55^0C at sometime or other during the year;
c) In concealed places of combustible construction;
d) Where the atmosphere is likely to contain flammable gases or vapour;
e) Where conductor operates at voltage above 650 V; and
f) In locations where surrounding atmosphere is likely to affect the non-metallic conduits.

10.3.6 Flexible conduits shall not be used for general wiring. It may be, however used for connections between terminal boxes of motors and starters, switches and motors but the length shall be restricted to a maximum of 1 200 mm.

10.4 Mineral Insulated and Other Types of Metal Sheathed Cables

10.4.1 Mineral insulated metal sheathed cables and other types of metal sheathed cables are permitted under all atmospheric conditions and in all occupancies except as mentioned hereunder:

a) Where they would be exposed to destructive corrosive conditions.
b) Where directly buried under ground, without suitable protection against mechanical damage and corrosive conditions.
c) Metal sheathed cables of other types shall not be directly buried under ground, nor shall they be used in wet locations unless:
   1) the metallic sheath is impervious to moisture,
   2) a lead sheath or waterproof jacket is provided under the sheath, and
   3) the insulated conductors under the sheath are approved for use in wet locations.

10.4.2 In case of wet locations like in parts of laundries, tanneries, etc, and in locations where walls are frequently washed, a minimum clearance of 6 mm shall be maintained between mineral insulated cable and the wall to which it is affixed.

10.5 Armoured Cables

10.5.1 Armoured cables shall be permitted under all atmospheric conditions and in all occupancies except in commercial garages, storage battery rooms and in locations where they would be exposed to corrosive fumes or gases.

10.6 Tough Rubber and Other Non-metallic Sheathed Cables

10.6.1 Tough rubber or plastic sheathed cables shall not be permitted in the following locations:

a) Where considerable dust and/or fly in generally present (for example cotton and jute mills and other vegetable, fibre processing factories, flour mills, saw mills and other

wood working factories, plastic and rubber goods factories, pulverising works, etc);

b) Where atmosphere is likely to contain flammable/explosive gases or vapours;

c) Where the hazardous trades or processes are carried out (for example, oil mills, paint and varnish factories);

d) Where they would be exposed to mechanical damage (godowns, engine rooms, rope and motor alleys, etc); and

e) Where wet processes are carried out.

10.6.2 These systems shall generally be permitted in office; and residential buildings. Appropriate authorities may however specially permit their use in industrial buildings of types other than those indicated in **10.6.1**.

10.7 Cleated Wiring System

10.7.1 This system shall be permitted for use in industrial buildings for low tension circuits only, with prior approval of appropriate authority.

10.7.2 When installed in bleaching or dyeing sections of a textile mills, the wiring shall be held by porcelain bobbins secured to teak wood battens by brass screws and the whole run inverted.

10.7.3 This system shall not be used for any type of building of permanent nature other than of the kind mentioned in **10.7.2**.

10.8 Cable Trays or Wire or Bus Ducts

10.8.1 All cable trays or wire or bus ducts shall be constructed from earthed sheet metal, enclosed or open troughs with hinged or removable covers housing and protecting either electric wires and cables, installed at site, or factory mounted bare conductors of aluminium or copper and shall be capable of withstanding electro-mechanical stresses.

10.8.2 Such systems shall be permitted under all atmospheric conditions and all occupancies except in following locations:

a) Where exposed to severe mechanical damage;

b) Where exposed to corrosive vapours;

c) Where the atmosphere is likely to contain flammable or explosive vapours;

d) Where wet processes are carried out; and

e) Where it is concealed.

10.8.3 The system shall be securely supported at intervals not exceeding 1.5 m.

10.8.4 Such systems of totally enclosed type shall be permitted to be extended vertically through floors provided they are adequately protected against mechanical damage up to a minimum distance of 2.5 m above working floor level.

10.8.5 Dead ends of all cable troughs or ducts shall be closed.

10.8.6 Extensions and branches of such systems shall also be of the same type.

10.9 Under Floor Cables Trenches (within Buildings)

10.9.1 Such systems may be permitted under all atmospheric conditions and in all occupancies except where exposed to corrosive vapours and locations where flammable/explosive vapours or gases may be present, unless the cables or conductors are specially approved for such use or the trenches are completely filled with sand.

10.9.2 Conductors or cables inside the trenches shall be so mounted on insulated racks or other supports as to be at least 75 mm above trench bottoms.

10.9.3 The top of the trenches shall be covered with removable concrete slabs or chequered plates.

10.9.4 In case of long trenches, it is recommended that trenches of more than 1 000 cm^2 cross-sectional area be divided by incombustible barrier walls at intervals not exceeding 45 m. Such barrier walls shall be of at least 50 mm thickness and of the same height as of the cable trench. The cables shall be carried through holes in these barrier walls, which shall be made good thereafter to prevent passage of fire beyond the barriers (*see also* IS 12459).

NOTE — This provision need not be applied if the trenches are completely filled with sand, pebbles, etc.

10.9.5 The combined cross-sectional area of all conductors or cables shall not exceed 40 percent of the internal cross-sectional area of the trench.

10.9.6 The trench shall be kept free of accumulation of water, dust and waste materials.

10.10 Compartmentation of Cable Tunnels/ Galleries

The requirements for compartmentation of cable tunnels/galleries should be as per IS 12459.

10.11 Flexible Cables and Cords

10.11.1 Flexible cables and cords shall be permitted only as:

a) Pendants;

b) Wiring of fixtures;

c) Connections of portable appliances or lamps;

d) Lift cables;

e) Wirings for cranes and hoists; and

f) Connections to mains-operated electrical stickers and motors mounted on parts of a stationary machine, which undergo to and fro motion during operation.

10.11.2 Where a lighting fitting is supported by one or more flexible cords, the maximum mass to which twin flexible cords may be subjected shall be as follows:

Nominal Cross-Sectional Area of Twin Flexible Cord, mm^2	*Number and Diameter of Lines,* mm	*Maximum Permissible Mass,* kg
0.5	16/0.2	1.7
0.75	24/0.2	2.6
1.0	32/0.2	3.5

10.11.3 Where flexible cables or cords are exposed to risks of contact with oil or petrol or where cable which will not support combustion is required, use shall be made of cables or cords having a PVC or oil resisting and fire retardant sheath.

10.11.4 Flexible cables and cords shall not be used as fixed wiring unless contained in earthed metal or any other non-combustible and mechanically strong enclosure. This requirement need not, however, apply to short lengths of sheathed flexible cable or flexible cord used as final connections to fixed apparatus or for connections of control gear of fluorescent lamps or discharge lamps. Non-sheathed flexible cables and flexible cords shall not be drawn into conduits or ducts.

10.11.5 Flexible cables or cords shall also not be run through holes in walls, ceiling or floors or through doors, windows or other similar openings. Nor shall they be permitted to be concealed behind walls, ceilings or floors.

10.12 Bare Conductors

10.12.1 Bare conductors are permitted for low tension side, of drawing frame transformer circuits where the potential difference does not exceed 12 volts. Bare or lightly insulated conductors of extra low voltage systems shall have adequate insulation and further protection, where necessary, to ensure that they do not cause risk of fire.

Bare conductors are also permitted for cranes and hoists subject to special conditions laid down in this code for such equipment.

10.13 Lightning Protection and Overhead Lines

10.13.1 The lightning protection system for buildings shall generally conform to IS 2309.

10.13.2 All overhead transmission lines, including compound lines shall not be run above any process or storage blocks or open storage site.

10.13.3 Lightning arresters shall be provided for lines at both ends and at supports where exposed to and liable to damage or injury from lightning. The arresters shall preferably be of the non-horn type for low and medium tension because of likely damage by buds and distortion.

10.14 Wall Plugs and Sockets

10.14.1 All wall plugs and sockets in industrial buildings shall be of metal clad 3 pin pattern separately controlled by a switch, adjacent to the wall socket.

NOTE — This shall not apply in case of wall plug and socket with current ratings of 5 amp and less.

10.14.2 Where it is necessary to earth the metal case of wall plug and/or portable appliances, the connection shall be done with soldered or approved lugs or crimped joints or any other approved means of connection.

11 LIGHTING, FITTINGS AND ACCESSORIES

11.1 Fluorescent Lamp Fittings

11.1.1 These fittings may be one of the following types:

a) *General purpose type* — For use in office, residences and similar locations.

b) *Industrial type* — For use in places where dust, fly or corrosive vapours may be present (*see* Annex B for specification of fittings).,

c) *Flame proof explosion type* — For use in places where flammable/explosive gases and vapours are present.

NOTES

1 Where fumes or corrosive vapours or gases evolved due to chemical action, may be present, the reflector shall be of vitreous enamel or non-combustible plastic and wiring shall be in load-sheathed conductors. Rayon Spinning Sections should have lead coated metal reflectors or equipment.

2 The position of fittings shall be carefully selected to avoid any mechanical damage by belt drives, shafts, etc, and if necessary suitable guards shall be provided. The fittings shall be clear of the humidifier jets.

3 Where flammable/explosive gas or vapours may be present the fittings shall be of flame proof type [*see* IS 5572 (Part 1) for classification of hazardous areas].

11.2 Lighting Switchboard

11.2.1 Main switches and fuses shall be metal clad and branch main board shall be metal clad when used on medium tension circuits.

11.2.2 All equipment shall be of robust construction, of adequate dimensions and thoroughly dust tight.

11.2.3 Each circuit from main distribution centre except fuse distribution board shall be provided

with a circuit breaker of linked switches and cutouts.

11.2.4 Adequate means of control in approved positions shall be provided for distribution boards or a group of distribution boards which are fed from a switchboard or distributing centre and within a reasonable distance therefrom, such as one or more boards erected in a room or building isolated from source of supply.

11.2.5 Each final sub-circuit from a distribution board shall be controlled by a single pole switch connected to the live, outer or phase conductor.

11.2.6 Wood work shall not be used for mounting of or construction of the frame work for iron clad switch, distribution boards and control gear.

11.2.7 All equipment shall be numbered in English and vernacular for ready identification and to indicate the department, place or circuit controlled.

11.2.8 Circuits shall be arranged in symmetry as far as practicable.

12 SPECIAL ELECTRICAL EQUIPMENT AND APPLIANCES

12.1 Radio and Television Sets and Sound Apparatus

12.1.1 The antenna of radio and television sets shall be connected through a double pole change over switch so connected that the antenna and the set completely earthed when not in use of during, thunderstorms.

12.1.2 The antenna shall be provided with a suitable lightning arresters if situated in an area subject to heavy thunderstorms.

12.1.3 All circuits (aerial and all internal wiring) shall be so constructed that contact with any other electric light and power circuits is impossible.

12.1.4 The lead-in conductor shall be of copper and shall be not less than 2 mm in diameter.

12.1.5 The lead-in conductor shall enter the building through a non-combustible and non-absorptive insulating bushing.

12.2 X-Ray Apparatus

12.2.1 The installation and precautionary measures shall comply strictly with Rule 73 of Indian Electricity Rules.

12.2.2 All such apparatus shall be located either in independent detached building or in compartments segregated by 355 mm thick brick walls with each opening protected by a fire resisting door/shutter.

12.3 Electrolyser Apparatus

12.3.1 Motor generator sets and/or separate generators and/or rectifiers together with necessary switch and control gear shall be separated by blank walls or located sufficiently away from the electrolyser.

12.3.2 Circulating pumps and electrical equipment thereof, where mounted in close proximity to the electrolyser, shall be specially treated with anti-corrosive paint at frequent intervals. The electrical apparatus shall be of totally enclosed type or of an equivalent type.

12.3.3 Windings and insulation generally shall be specially treated to resist the corrosive effects of the electrolytic fumes.

12.4 Electrostatic Charge Eliminators

12.4.1 Electrostatic charge eliminating devices shall be provided for all high speed machines and equipment of similar type where static electricity may be developed, specially during dry seasons of the year.

12.5 Cold Storage Buildings

12.5.1 The lighting inside cold storages shall be in heavy gauged screwed steel conduit and water tight fittings shall be used throughout.

12.5.2 Machinery and control gear shall be mounted external to cold storages.

12.6 Electrically Driven Fire Pumps for Hydrant and/or Sprinkler Installation

12.6.1 In industry sufficient spare power shall always be available to drive the fire pump set(s) at all times throughout the year.

12.6.2 The power station and/or substation(s) supplying power for fire pump circuit shall be so placed that any falling masonry and the like from other buildings occasioned by a fire or other cause cannot damage the station and cut off power to the fire pump circuits.

NOTE — It is preferable to locate the sub-station(s) at least 6 m away from all surrounding buildings.

12.6.3 A direct feeder, without any tappings shall be laid from the substation to the pump house to ensure that the supply to the pumping set(s) is entirely independent of all other electrical equipment in the premises viz, even when power throughout the rest of the premises is switched off the supply to the fire pumps remains available uninterrupted. Overhead feeders to sub-stations

supplying power to the fire pumps are not permitted within a horizontal distance of:

a) 15 m of any process building/plant or tanks containing flammable liquids, and
b) 6 m of any other building of tanks containing non-flammable liquids or of storage in open.

In case the feed to such sub-station is by means of under-ground cables, the cables shall not pass under any building or permanent structure.

12.6.4 Where there is more than one sources of power for the operation of pumping set(s), the electrical circuits shall be so designed as to ensure that when necessary the set(s) shall continue to operate without manual operation of any emergency switch, when the supply is interrupted.

12.6.5 Indicator lamps shall be fitted in prominent position(s) both in the sub-station and pump house, which would continuously glow as long as power is available to the fire pump(s). A sound alarm shall also be provided in the event of power failure to the fire pumps.

12.6.6 The pump set(s) shall be of direct coupled type, securely mounted on robust bed-plate(s), if or horizontal type and should be free from vibrations at all variations of load.

12.6.7 The motors of fire pumps shall be either of totally enclosed or drip-proof type, the latter having air-inlets and outlets protected with meshed wire panels to exclude rodents, reptiles and insects.

12.6.8 The motors shall be wound for Class-E insulation and the windings shall be vacuum impregnated with heat and moisture-resisting varnish preferably glass-fibre insulated, to withstand tropical conditions.

12.6.9 Motors wound for high-tension supplies shall have a suitable fixed warming resistance to maintain the motor windings in a dry condition at all times and particularly under monsoon conditions. The resistance shall be fed from medium voltage circuits.

12.6.10 Heating apparatus shall also be provided, when necessary, for medium tension motors where they are located below ground level, in order to maintain the motor winding in a dry conditions. Adequate drainage shall also be provided in the pump house in such cases.

12.6.11 The pumping set shall preferably be housed in a separate building located at least 6 m away from all other buildings and at least 15 m away from units and/or storage tanks of plant handling flammable liquids/gases.

12.6.12 The motor rating should be adequate to drive the pump when operating on 150 percent of rated flow.

12.6.13 The fire pump circuit shall be protected at its origin by an automatic circuit breaker, from which either the no volt coil is removed or which is fitted with automatic re-setting type of no-volt coil, and the overload setting shall be so adjusted as to permit the motor to carry on overload of 50 percent of its rated capacity.

12.6.14 Cables for motors of fire pumps and their switchgear shall be armourd or shall be enclosed in heavy gauge screwed steel conduit. Overhead lines shall not be permitted within 6 m of window, door or other opening in any of the protected building or any other building within 15 m of a protected building.

12.6.15 Equipment shall be painted throughout in red or in orange yellow colour.

12.6.16 Pumping sets shall be worked for at least 15 min each week and records of the same shall be maintained.

12.6.17 The incoming cable to the fire pump room shall terminate in an isolating switch fuse unit incorporating HRC fuses and where necessary provided with distribution system.

12.6.18 The starting switchgear for the fire pumps should be suitable direct on line starting but other alternative arrangements are acceptable with the approval of competent authority.

13 REQUIREMENTS FOR SPECIAL OCCUPANCIES

13.1 Hazardous Locations

For the purpose of this code a location shall be regarded as hazardous where any one or more of the following conditions exist:

a) Where flammable gases or vapours may be present in the atmosphere in sufficient quantities to produce explosive or flammable mixtures;
b) Where combustible dust is produced or handled; and
c) Where vegetable or viscose, acrylic and nylon 66 fibres are processed or handled.

13.1.1 In locations where the atmosphere may contain flammable gases or vapours the classification of areas and selection of Electrical

Equipment permitted to be installed therein shall be governed by IS 5572 (Part 1) and IS 5571 respectively. These requirements may, however, be modified in any particular situation as per the provisions of **13.1.3**.

13.1.2 In case of process or operations involving combustible liquid(s), the presence of flammable vapour in the atmosphere may be deemed probable only if the flash point of the liquid(s) is below 32.2^0C. However, locations where combustible/flammable liquids having flash points above 32.2^0C but not above 93.3^0C are handled shall be regarded as hazardous if such liquid is (a) sprayed or (b) present in the form of mist or (c) heat to or above its flash point.

13.1.3 Wherever possible, the hazardous locations where installation of flameproof electrical equipment and fittings is required shall be located either in a detached building or in a compartment segregated from the remainder of the premises at least by a non-combustible fire resisting wall of 2 h rating without any kind of opening. Areas where, however, this is not practicable, shall be demarcated by fencings, railing or boundary lines painted on floor and all electrical equipment and fitting shall be of flameproof type within the hazardous location as also up to a distance from the boundaries of the demarcated area indicated hereunder:

a) Where the processes or operations necessitating the use of flame-proof equipment and fittings are carried out in the open.

   All space within 6 m horizontally in any direction from the demarcating fencing/ railing or boundary line and 3 m vertically above the highest hazard source.

b) Where the processes or operation necessitating the use of flame-proof equipment is carried out in enclosed space of equipment, as in the case of paint spray booths, baking or drying ovens, enamelling or coating equipment, etc.

   All space within 6 m horizontally of open face or door opening of such equipment and 3 m vertically above the roof of such equipment.

13.1.4 Except the wiring of rigid metal conduits and armoured cable wiring, no electrical equipment or fittings shall be permitted where it may be subjected to hazardous accumulation of readily ignitable deposits or residue, as within a spray painting booth or drying oven.

13.1.5 Illumination of spray painting booths or similar coating or finishing equipment through glass panels is permitted, provided the:

a) lighting fittings are of fixed type and installed behind glass panels;
b) glass panel(s) is so sealed, that, it effectively isolates the lighting equipment from the hazardous area;
c) panels are so located that deposits of hazardous residues on them are avoided as far as possible; and
d) glass used for panel is either of the wired or specially toughened type.

13.1.6 Electrical installation in hazardous locations involving presence or use of combustible dust or fibre (vegetable, animal or synthetic) shall comply with the following special provisions:

a) *Wiring methods* — The type of wiring methods permitted shall be as follows:

   Screwed steel or rigid metal conduits, mineral insulated or other sheathed cables, armoured cables and enclosed metal covered cable or bus ducts.

b) *Motors* — Motors shall be either of totally enclosed, or totally enclosed fan-cooled or dust tight type.
c) *Distribution and panel boards* — Location of distribution and panel boards where combustible dust is evolved shall be avoided as far as possible.
d) *Switchgears* — In areas where combustible dust may be present, oil circuit breakers shall be preferred.
e) *Lighting fittings* — Use of incandescent lamps shall be avoided as far as practicable and the fluorescent light fitting used shall be of industrial type.
f) In case of incandescent lamps being used, the fitting shall be enclosed in dust tight enclosures.
g) The leads from ceiling rose to lamp terminals shall be enclosed in conduits.

13.2 Lifts

13.2.1 The installation of lifts and care of electrical installation shall fully comply with relevant provisions of IS 1860 and IS 4666.

13.3 Petrol Station

13.3.1 Electrically operated valves shall be so designed that they can also be manually operated.

13.3.2 The valve or valves shall close automatically when the electric supply ceases.

13.3.3 All fusible links in the circuit supplying the valve or valves shall be in series and on the live lead.

13.3.4 The circuit in which the possible links form a path for the current to the fire valve shall be a

separate final sub-circuit controlled by a switch and by a fuse not exceeding 5A capacity both on the line lead.

13.3.5 Equipment shall be of certified 'flame proof' type unless it is separately mounted and is away from any possible source of fumes.

13.4 Cinematographic Projection and Rewinding Rooms

13.4.1 Where general lighting of the auditorium and exits can be controlled from within the enclosure, separate and independent means of control shall also be provided outside the enclosure and well away from it.

13.4.2 All switches, fuses and connections thereof shall by totally enclosed and iron-clad and all electric lamps and resistances so protected as to avoid their possibility of coming into contact with or in close proximity of films or other combustible materials. Resistance connected with auditorium or stage lighting shall not be located in the projection or rewinding rooms.

13.4.3 The insulating material of all electric cables including leads to lamps shall be covered with fire resisting material.

13.4.4 There shall be no unnecessary and loose electric cable. The 'leads' to the projector lamps shall be taken as separate circuits from the source of supply and from the supply side of main fuses in general lighting circuit. Efficient switches and fuses shall be inserted at the point where the supply is taken, and, in addition, an efficient double pole switch shall be fitted in the cinematograph lamp circuit inside the enclosure. When the cinematograph lamp is working the voltage across the terminals of the double pole switch inside the enclosure shall not exceed 110 volts.

13.4.5 Cables from projector lamps should be taken as separate circuits from the source of supply and from the supply side of main fuses in general lighting circuit. Efficient switches and fuses should be inserted at the point where the supply is taken, and in addition, an efficient double pole switch should be fitted in the cinematrograph lamp circuit inside the enclosure when the cinematograph lamp is working the voltage across the terminals of the double pole switch inside the enclosure should exceed 110 volts.

13.4.6 Resistances shall be made entirely of incombustible material and shall be so constructed and maintained that no coil or other part shall at any time become undully heated. All resistances, with the exception of a resistance for regulating purposes shall be placed outside the enclosure and, if reasonably practicable, outside the auditorium. If inside the auditorium, they shall be protected by a wire guard or other efficient means of preventing accidental contact.

13.4.7 The operator shall satisfy himself before the commencement of each performance that all cables, lead connections and resistances are in proper working order. The resistance shall be inspected at least once during each performance. If any fault is detected, current shall be immediately switched off and shall remain switched off until the fault has been remedied.

13.5 Accumulator or Battery Service Stations

13.5.1 Charging shall be carried out in well ventilated situations and no smoking or naked lights shall be allowed.

13.5.2 Accumulators/batteries shall stand directly or non-ignitable, non-absorbing, non-conducting material, such as glass, porcelain or glazed earthenware. These materials shall rest on a bench which shall be kept dry and shall be insulated from earth, or constructed of wood. It shall be of slat formation and treated with anti-sulfuric enamel.

13.5.3 The accumulators shall be so arranged on the bench that a potential difference exceeding 12 volts shall not exist between adjacent cells. The bunching of accumulators or arranging them in circular formation shall not be allowed.

13.5.4 All combustible material within a distance of 60 cm measured horizontally, or within 2 metres measured vertically, from any accumulator shall be protected by asbestos sheets.

13.5.5 The charging circuit shall be provided with double pole switches and fuses, and, where a motor generator is employed the motor shall be provided with double pole switches and fuses and an automatic battery cut-out shall be placed in the generator circuit. Any sub-circuit shall be provided with a fuse rated at not more than 7 A in each live conductor.

13.5.6 Charging control panels shall be of durable non-ignitable, non-absorbent, non-conducting material and together with the rectifiers, transformers and supports for resistances of lamps, shall preferably be fixed to brick or similar wall. If, however, they are fixed to wood work, such wood work shall be covered with hard-asbestic sheets or similar fire-resistive material.

13.5.7 If accumulators are charged through resistance coils or lamps, such resistance coils or lamps shall be at least at distance of 60 cm from the nearest accumulator.

13.5.8 All wiring shall be securely mounted and protected against mechanical injury and efficient terminal or connections shall be provided from which the connections to the accumulators can be made. Rubber or P.V.C. insulated wiring, if on insulators shall not be run in such a position that a fire arising at any accumulator could reach it. All conductors connecting supply terminals to the accumulators shall have either rubber or tough compound insulation without a tape or braid.

13.5.9 If the supply is taken from mains having one conductor earthed, the lamps or other resistances shall be connected on non-earthed lead and the accumulators connected direct to earthed conductor. Precaution shall be adopted to prevent the attendant receiving shocks.

13.5.10 Celluloid-cased accumulator shall not be kept on charge at any time without an attendant.

13.5.11 Spring-jacks shall be used for final connection to the accumulator terminals.

13.5.12 All insulators shall be kept as dust free as practicable.

13.6 High-Rise Buildings

13.6.1 All electric distribution cables/wiring shall be laid in a separate fire resistant duct. The duct shall be sealed at every floor with non-combustible materials having the same fire resistance as that of the duct. Low and medium voltage wiring running in shafts and in false ceiling shall run in separate conduits.

13.6.2 Separate circuits for water pumps, lifts and staircase and corridor lighting and blowers in pressurising system shall be provided directly from the main switchgear panel and these circuits shall be laid in separate conduits so that fire in one circuit will not affect the others. Master switches controlling essential service circuits shall be clearly labelled.

13.6.3 Staircase and corridor lights shall be on separate circuits and shall be independently connected so that it could be operated by on switch installation on the ground floor easily accessible to fire fighting staff at any time.

13.6.4 A standby electric generator shall be installed to supply power to staircase and corridor lighting circuits, fire lifts, the electrically operated fire pumps, pressurising fans and blowers in case of failure of normal electric supply.

13.6.5 If more than 200 litres of oil are contained in any oil immersed electric gear a retaining sill threshold shall be provided around the gear or at the door.

14 GODOWNS

14.1 General

Wiring shall either be in rigid steel conduits or armoured cable. Wall brackets shall be eliminated and rod pendants and batten holder fittings shall be erected for the lamps which shall be of a type protected against mechanical damage. Industrial type fluorescent light fittings shall, however, be permitted. The fittings for lamps shall be fixed at sufficient height above the highest level of bulk or other goods which are stored in the godown. The circuit shall be controlled by a linked switch and cut-outs which shall be placed outside the godown in a convenient portion.

14.2 Raw Jute Godowns

14.2.1 The supply of electricity shall be at low voltage, that is, not exceeding 250 volts.

14.2.2 All wiring shall be encased in screwed steel conduits, the horizontal portions of which shall be sloped to allow condensed moisture to collect at set places where drainage outlets shall be provided. Such outlets shall be properly secured, against entry of insects, etc.

14.2.3 The cable used shall not be of less than 3/.029 size of 250-V grade and shall be of single core, rubber or PVC insulated, taped and branded.

14.2.4 No joint boxes or cut-outs of cables shall be allowed inside the godown.

14.2.5 The conduit shall be affixed to (not recessed into) walls or roofs of godowns by means of saddles grouped on walls or roofs, the distance between saddles not exceeding 750 mm. All conduits must be laid externally on the outside walls or roofs of the godown except those lengths which are required to carry the cables to light fittings. In the latter case, the conduit should be run above the level of highest stacking.

14.2.6 Only bulkhead light fittings of approved design with C.I. frames of robust construction and bulkhead glasses protected with thick steel lined guards shall be used.

14.2.7 Each lighting fittings shall be affixed to the wall or at not more than 450 mm below the roof of the godown. In case of a sprinklered godown each lighting fitting shall either be above the level of the sprinkler heads or not less than 300 mm below that level, it being understood that in no case shall a light fitting be installed low than 750 mm above the maximum stacking height.

14.2.8 All lights in the godown shall be controlled by one or more double pole metal-clad switches and

fuses situated outside the godown in a convenient place and effectively protected from weather.

14.2.9 An indicator light controlled by the switch(es) shall be provided on the switch panel to show whether the lights inside the godown are on or off when the godown is closed and locked.

14.3 Strong Rooms

14.3.1 Permanent lighting shall be provided by means of concealed wiring or solid drawn conduit wiring with the main switch located outside.

14.4 Nitrocellulose (and Chemicals Having Similar Fire Hazard Characteristics) Godowns

14.4.1 Lamps in nitrocellulose storage rooms shall be rigid fixtures of glass enclosed and gasketted type or flameproof fluorescent fittings. Lamps shall be controlled by a switch having a pole in each unearthed conductor. This switch shall be located outside the room and provided with a pilot light to indicate whether the switch is 'on' or 'off'. This switch shall disconnect from all sources of supply all unearthed conductors terminating in any outlet in the room.

14.4.2 No socket outlets, electric motors, heaters, portable lights or other portable electric equipment shall not be located in nitrocellulose storage rooms.

15 TESTING

15.1 The electrical installation in a new building or an addition to an existing installation shall be tested as per IS 732 before it is put to service. The installation shall also be checked periodically as decided by the appropriate authority.

15.2 The following tests shall be carried out as required by the appropriate authority:

a) Full load and/or flash tests of rotating machinery, transformers, condensers, rectifiers, etc.
b) Insulation resistance tests of rotating machines, transformers, condensers, regulators, cable circuits, etc, by meggers of appropriate voltage.
c) Lighting circuits shall be tested in following manner:
    1) All switches 'on' and consuming devices in circuit, both poles connected together to obtain resistance to earth;
    2) Between poles with lamps and other consuming devices removed and switches 'on'; and
    3) With lamps and other consuming devices in position but switches 'off'.
d) Earth continuity tests.
e) Power circuits to be tested between phases or outer and middle or neutral wires and to earth.

15.3 The appropriate authority shall have the right to vary the foregoing tests or carry out further tests as may be considered necessary.

16 INSPECTION

16.1 All electrical inspections shall be inspected periodically and proper vigilance shall be kept. Any faults or defects that are notice shall be attended to and the defects rectified immediately.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
732 : 1989	Code of practice for electrical wiring installations (*third revision*)	4666 : 1980	Electric passenger and goods lifts (*first revision*)
1860 : 1980	Code of practice for installation, operation and maintenance of electric passenger and goods lifts (*first revision*)	5571 : 1979	Guide for selection of electrical equipment for hazardous areas (*first revision*)
2309 : 1989	Code of practice for the protection of buildings and allied structures against lightning (*second revision*)	5572 : 1994	Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installations (*second revision*)
2667 : 1988	Fittings for rigid steel conduits for electrical wiring (*first revision*)	9537 (Part 3) : 1983	Conduits for electrical installations: Part 3 Rigid plain conduits of insulating materials
3043 : 1987	Code of practice for earthing	12459 : 1988	Code of practice for fire-protection of cable runs
4013 : 1967	Dust-tight electric lighting fittings		

ANNEX B

(*Clause* 11.1.1)

FLUORESCENT LAMP FITTINGS

B-1 GENERAL PURPOSE TYPE FITTINGS

B-1.1 The general design of reflectors shall be of suitable type and material. The material shall be any suitable metal or plastic. If plastic of a combustible nature is used, it shall not be in contact with any electrical conducting part and shall not ignite by the radiation from the lamp.

B-1.2 The auxiliary equipment, that is, choke coil, power-factor condenser and stating unit (comprising thermal switch, radio-suppresser condenser) shall comply with relevant Indian Standards Specifications and shall preferably be mounted on the lamp fitting itself in a dust-tight enclosure, but if any item is mounted separately it shall be mounted on parts made of non-combustible material.

B-1.3 The wiring connections between the equipment, that is, chockes and condensers, shall be in PVC insulated wiring, properly clamped as necessary.

B-1.4 The suspension shall be made by two conduits or rods or robust chains, spaced to share equally the weight of the fitting.

B-1.5 The lamp or tube holders may be of plastic material provided these are of efficient and approved design, and that each tube is securely held by suitable metal spring clips at each end.

B-1.6 Earthing of the fixture shall be made with an unbroken conductor, the suspension chains (where employed) shall not be regarded as an approved means of earthing.

B-1.7 Fluorescent fixtures may be suspended from conduit wiring junction boxes as a means to prevent exposure of conductors from the fitting to the wiring in the conduit. The connection inside the junction box shall be made to a porcelain junction base. Plain procelain connectors shall not be permitted in the box.

B-2 INDUSTRIAL TYPE FITTINGS

B-2.1 Mild steel trough suitably enamelled or painted or any other robust reflectors shall be used which may, if necessary, have upward lighting slots.

B-2.2 The auxiliary equipment, that is, choke coil, power-factor condenser and starting unit (comprising thermal switch and radio-suppresser condenser) shall conform to relevant Indian Standards and shall be mounted on suitable framework in a separate detachable dust-proof non-ventilated box, with tight fitting covers securely fixed by machine screws and bolts to the main trough.

B-2.3 The wiring connections between the equipment housed in the choke and condenser box shall be vulcanised rubber insulated flexible cabling or approved PVC insulated conductors in heavy gauge, welded or solid-drawn steel conduit, or run internally and properly clamped.

B-2.4 Suspension shall be made by two conduits spaced to share equally the weight of the fitting. Each conduit rod shall be provided with a spring loaded ball-and-socket joint ceiling plate at the top, and the other end shall be bolted to the trough.

B-2.5 Lamp or tube holders shall be made of plastic, provided an efficient and approved design is employed and each tube is held with suitable metal spring clips at each end.

B-2.6 Earthing of fixtures shall be made with an unbroken conductor.

B-2.7 Fluorescent fixtures may be suspended from conduit wiring junction boxes, as a means to prevent exposure of conductors from the fitting to the wiring in the conduit. The connection inside the junction box shall be made to a porcelain junction base. Plain procelain connectors shall not be permitted in the box.

B-2.8 The chokes of all fluorescent fittings shall be mounted on incombustible material.

B-2.9 Incoming twin twisted flexible conductor shall enter the side of the box through a dust-tight bushed hole.

B-2.10 The lighting tubes and reflectors shall be kept clean to obtain maximum efficient light. Cleaning shall be carried out by competent personnel.

ANNEX C

(Foreword)

FIRE SAFETY SECTIONAL COMMITTEE, CED 36

Chairman	*Representing*
Shri J. N. VAKIL	Tariff Advisory Committee, Mumbai
Members	
SHRI K. RAVI (*Alternate* to Shri J. N. Vakil)	
DR A. K. BHALLA	Ministry of Defence (CEESO), New Delhi
DR K. S. UPPAL (*Alternate*)	
SHRI M. M. KAPOOR	Engineers India Ltd, New Delhi
SHRI RANA PRATAP (*Alternate*)	
SHRI S. N. CHAKRABORTY	Tariff Advisory Committee, Chennai /Calcutta
SHRI P. K. MAJUMDAR (*Alternate*)	
CHIEF FIRE OFFICER	Municipal Corporation of MumbaiMumbai Fire Brigade), Mumbai
SHRI S. M. DESAI	In personal capacity (*B-4/5 A.G. Khan Road Municipal officers Society, Worli, Mumbai*)
SHRI RAMESH DHOBLEY	Bhabha Atomic Research Centre, Mumbai
SHRI S. K. DHERI	Delhi Fire Service, Government of Delhi, New Delhi
SHRI R. C. SHARMA (*Alternate*)	
SHRI K. P. SHARMA	Ministry of Railways, New Delhi
ASSTT SECURITY COMMISSIONER (*Alternate*)	
FIRE ADVISORY	Ministry of Home Affairs, New Delhi
DY FIRE ADVISOR (*Alternate*)	
SHRI J. S. GAHLAUT	State Bank of India, Mumbai
SHRI P. N. GHOSH	In personal capacity (*J-1916, Chittaranjan Park, New Delhi 19*)
SHRI C. P. GOSAIN	Central Public Works Department, New Delhi
SHRI S. C. GUPTA	Lloyd Insulations (India) Pvt Ltd, New Delhi
SHRI SANJEEV ANGRA (*Alternate*)	
SHRI S. K. SHANGARI	Engineer-in-Chief's Branch, New Delhi
LT-COL A. T. PARNAIK	
SHRI G. B. MENON	In personal capacity (*A-5, Puzhakkara Padam, Vennala, Cochin*)
MEMBER (HYDRO - CONSTRUCTION MONITORING)	Central Electricity Authority, New Delhi
CHIEF ENGINEER (HTD-II) (*Alternate*)	
SHRI V. B. NIKAM	In personal capacity (*4/34, Haji Ali Municipal Officers Cooperative Housing Society, Mumbai*)
SHRI D. PADANABHA	Tata Consulting Engineers, Mumbai
SHRI B. S. VENKATESH (*Alternate*)	
SHRI P. N. PANCHAL	In personal capacity (*46, Block E-1, Pocket-11, Sector 15, Rohini, Delhi*)
RETD DY INSPECTOR GENERAL (FIRE) CISF	
PRESIDENT	Institution of Fire Engineers (India), New Delhi
SHRI V. M. RANALKAR	Ministry of Petroleum and Natural Gas
SHRI R. N. CHACHRA	Metallurgical and Engineering Consultants (India) Ltd, Ranchi
SHRI A. R. KHAN	Bharat Heavy Electricals Ltd, Bhopal
SHRI NATARAJAN (*Alternate*)	
DR T. P. SHARMA	Central Building Research Institute, Roorkee
DR GOPAL KRISHNAN (*Alternate*)	
SHRI R. SUNDARAJAN	National Thermal Power Corporation Ltd, New Delhi
SHRI S. K. CHATTOPADHAYAY (*Alternate*)	
SHRI M. S. TYAGI	Ministry of Labour (Regional Labour Institute, Kanpur), New Delhi
SHRI P. K. SAKSENA (*Alternate*)	
MANAGING DIRECTOR	Loss Prevention Association of India Ltd, Mumbai
SHRI T. V. MADHUMANI (*Alternate*)	
SHRI K. K. SHARMA, Director (Civ Engg)	Director General, BIS (*Ex-Officio Member*)

Member Secretary
S. CHATURVEDI
DY DIRECTOR (CIVIL ENGG), BIS

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