भारतीय मानक
Indian Standard

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चिकित्सा सम्बंधी स्थापनों में विद्युतीय संस्थापनों की अपेक्षाएँ

Requirements for Electrical Installations in Medical Locations

ICS 29.020

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on recommendation of the Electrical Installations Sectional Committee and approval of the Electrotechnical Division Council.

In medical locations it is necessary to ensure the safety of patients likely to be subjected to the application of medical electrical equipment. For every activity and function in a medical location, the particular requirements for safety have to be considered. Safety can be achieved by ensuring the safety of the installation and the safe operation and maintenance of medical electrical equipment connected to it.

The use of medical electrical equipment on patients undergoing intensive care (of critical importance) has called for enhanced reliability and safety of electrical installations in hospitals so as to improve the safety and continuity of supplies which is met by application of this standard. Variations of the standard to further enhance safety and reliability are acceptable.

IS 732 : 2019 'Code of practice for electrical wiring installations' is a necessary adjunct to this standard. In preparation of this standard, considerable assistance has been derived from IEC 60364-7-710 : 2002 'Electrical installations of buildings - Part 7-710 : Requirements for special installations or locations-Medical locations.

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 or analysis, 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 the specified value in this standard.

The composition of the Committee, responsible for the formulation of this standard is given at Annex C.

Indian Standard

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS IN MEDICAL LOCATIONS

1 SCOPE

1.1 The particular requirements of this standard apply to electrical installations in medical locations so as to ensure safety of patients and medical staff. These requirements, mainly, refer to hospitals, private clinics, medical and dental practices, health care centers and dedicated medical rooms in the workplace.

NOTES

1 It may be necessary to modify the existing electrical installation, in accordance with this standard, when a change of utilization of the location occurs. Special care should be taken where intracardiac procedures are performed in existing installations.

2 Where applicable this standard can also be used in veterinary clinics. The requirements of this part do not apply to medical electrical equipment.

3 For medical electrical equipment; refer to the IS 13450 series.

2 REFERENCES

2.1 The standards listed in below 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 listed below. In case the standards are to be referred in this clause they are to be listed as follows:

Indian/International Standard No.	*Title*
IS 732 : 2019	Code of practice for electrical wiring installations (*fourth revision*)
IS 12032 (Part 1) : 1987	Graphical symbols for diagrams in the field of electrotechnology: Part 1 General information
IS 12032 (Part 11) : 1987	Graphical symbols for diagrams in the field of electrotechnology: Part 11 Architectural and topographical installation plans and diagrams
IS13450 (Part 1) : 2018	Medical electrical equipment: Part 1 General requirements for basic safety and essential performance (*second revision*)
IS 14700 (Part 3) (all sections)	Electromagnetic compatibility (EMC): Part 3 Limits
IEC 61000-2 (all sections)	Electromagnetic compatibility (EMC) — Part 2: Environment
IEC 61082-1 : 2014	Preparation of documents used in electrotechnology – Part 1: General requirements
IEC 61557-8 : 2014	Electrical safety in low voltage distribution systems up to 1000 Vac. and 1500 Vdc. — Equipment for testing, measuring or monitoring of protective measures — Part 8: Insulation monitoring devices for IT systems
IEC 61557-9 : 2014	Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. — Equipment for testing, measuring or monitoring of protective measures — Part 9: Equipment for insulation fault location in IT systems
IEC 61558-2-15 : 2011	Safety of power transformers, power supply units and similar — Part 2-15: Particular requirements for isolating transformers for the supply of medical locations

3 TERMINILOGY

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

3.1 Medical Location

Location intended for purposes of diagnosis, treatment (including cosmetic treatment), monitoring and care of patients.

NOTE — to ensure protection of patients from possible electrical hazards, additional protective measures need to be applied in medical locations. The type and description of these hazards can vary according to the treatment being administered. The manner in which a room is to be used necessitates some division into different areas for differing medical procedures.

3.2 Patient

Living being (person or animal) undergoing medical or dental investigation or treatment.

NOTE — The person under treatment for cosmetic purposes may be considered, as far as this standard is concerned, as a patient.

3.3 Medical Electrical Equipment

Electrical equipment provided with not more than one connection to particular supply mains and intended to diagnose, treat or monitor the patient under medical supervision and which:

- makes physical or electrical contact with the patient, and/or
- transfers energy to or from the patient, and/or
- detects such energy transfer to or from the patient.

NOTE — The equipment includes those accessories defined by the manufacturer as being necessary to enable normal use of the equipment.

3.4 Applied Part

Part of the medical electrical equipment which in normal use:

- Necessarily comes into physical contact with the patient for the equipment to perform its function, or
- can be brought into contact with the patient, or
- needs to be touched by the patient

3.5 Group 0

Medical location where no applied parts are intended to be used.

3.6 Group 1

Medical location where applied parts are intended to be used as follows:

- Externally;
- Invasively to any part of the body, except where Group 2 applies

3.7 Group 2

Medical location where applied parts are intended to be used in applications such as intracardiac procedures, operating theatres and vital treatment where discontinuity (failure) of the supply can cause danger to life.

NOTE— An intracardiac procedure is a procedure whereby an electrical conductor is placed within the heart of a patient or is likely to come into contact with the heart, such conductor being accessible outside the patient's body.

In this context, an electrical conductor includes insulated wires such as cardiac pacing electrodes or intracardiac ECG electrodes, or insulated tubes filled with conducting fluids.

3.8 Medical Electrical System

Combination of items of equipment, at least one of which, is an item of medical electrical equipment and inter-connected by functional connection or use of a multiple portable socket-outlet.

NOTE — The system includes those accessories which are needed for operating the system and are specified by the manufacturer.

3.9 Patient Environment

Any volume/space in which, intentional or unintentional contact can occur between patient and parts of the system or between patient and other persons touching parts of the system.

NOTE — This applies when the patient's position is pre-determined, if not, all possible patient positions should be considered.

3.10 Main Distribution Board

Board in the building which fulfils all the functions of a main electrical distribution for the supply building are aassigned to it and where the voltage drop is measured for operating the safety services.

3.11 Medical IT Earthing System

IT earthing system having specific requirements for medical applications.

3.12 Safety Extra Low Voltage (SELV)

Voltage not exceeding 42 V between conductor and earth, no load voltage not exceeding 50 V. When safety extra voltage is obtained from supply mains, it is to be through a safety isolating transformer or a convertor with separate winding, the insulation of which complies with the double insulation or reinforced insulation requirement.

3.13 Protective Extra Low Voltage (PELV)

Earthed circuit operating at safety extra low voltage which is separated from other circuits by basic insulation and protective screening, double insulation or reinforce insulation.

NOTES

a) Protective screening is the separation of circuits from live parts by means of earth screen.

b) A protective extra low voltage circuit is also known as PELV circuit.

4 ASSESSMENT OF GENERAL CHARACTERISTICS

The classification of a medical location shall be made in agreement with the medical staff, health organization concerned or body responsible for the safety of workers

in accordance with national regulations. In order to determine the classification of a medical location, it is necessary that the medical staff indicate which medical procedures will take place within the location. Based on the intended use, the appropriate classification for the location shall be determined (the possibility that certain medical locations may be used for different purposes which necessitate a higher group should be addressed by risk management).

NOTES

1 Classification of a medical location should be related to the type of contact between applied parts and the patient, as well as the purpose for which the location is used (*see* Annex B).

2 Applied parts are defined by the particular standards for medical electrical equipment.

5 PURPOSES, SUPPLIES ANDSTRUCTURE

5.1 Types of System Earthing

The TN-C system is not allowed in medical locations and medical buildings downstream of the main distribution board.

5.2 Power Supply

5.2.1 *General*

In medical locations the distribution system should be designed and installed to facilitate the automatic change-over from the main distribution network to the electrical safety source feeding essential loads (according to **5.6** of IS 732).

6 PROTECTION FORSAFETY

6.1 Protection Against Electric Shock

6.1.1 *Protection Against both Direct and Indirect Contact*

6.1.1.1 *SELV and PELV*

When using SELV and/or PELV circuits in medical locations of group1 and group 2, the nominal voltage applied to current-using equipment shall not exceed 25 V r.m.s.a.c.or 60 V ripple free d.c. Protection by insulation of live parts according to **4.2.12.1** of IS 732 and by barriers or enclosures according to **4.2.12.2** of IS 732 is essential.

In medical locations of group 2, exposed-conductive-parts of equipment (for example, operating theatre luminaries), shall be connected to the equipotential bonding conductor.

6.1.2 *Protection Against Direct Contact*

6.1.2.1 *Obstacles*

Protection by obstacles is not permitted.

6.1.2.2 *Placing out of reach*

Protection by placing out of reach is not permitted.

Only protection by insulation of live parts or protection by barriers or enclosures is permitted.

6.1.3 *Protection Against Indirect Contact*

6.1.3.1 *Automatic disconnection of supply*

6.1.3.1.1 *General*

6.1.3.1.1.1 *Disconnection of supply*

In medical locations of group 1 and group 2, the following shall apply:

- For IT, TN and TT systems, the conventional touch voltage U_L shall not exceed 25 V ($U_L \leq 25$ V);
- For TN and IT systems, table 1 shall apply.

Table 1 Maximum Disconnecting Times

(*Clause* 6.1.3.1.1)

TN System		IT System		
Installation Nominal Voltage	Disconnecting Time	Installation Nominal Voltage	Disconnecting Time s	
			Neutral not distributed	Neutral distributed
U_o [a] V	s	U_o/U V		
120	0.35	120-240	0.4	1
230	0.2	230/400	0.2	0.5
277	0.2	277/480	0.2	0.5
400, 480	0.05	400/690	0.06	0.2
580	0.02[b]	580/1 000	0.02[b]	0.08

[a] U_o is the voltage between phase and neutral.

[b] If such disconnecting time cannot be guaranteed, it is necessary to take other protective measures, such as supplementary equipotential bonding.

NOTE — Disconnection of supply when overload or short-circuit conditions occur ,can be achieved by different design methods within the procedures of the general rules in order to satisfy the required safety level.

6.1.3.1.2 *TN systems*

In medical locations of group 1, in final circuits with overcurrent protective devices rated upto 32 A, residual current protective devices with a rated residual operating current not exceeding 30 mA shall be used.

In medical locations of group 2, protection by automatic disconnection of supply by means of residual current protective devices with a rated residual-operating current not exceeding 30 mA shall only be used on the circuits that are supplying only one single equipment:

Final circuits of ME equipment and ME systems shall be for the exclusive use of such equipment.

Except those of the medical IT system, additional protection by residual current protective devices with a rated residual operating current not exceeding 30 mA shall be used in all final circuits as follows:

- medical locations of group 1 with overcurrent protective devices rated 32 A and below;
- medical locations of group 2.

6.1.3.1.3 *TT systems*

In medical locations of group 1 and group 2, the requirements of TN systems (*see* **6.1.3.1.2**) apply and in all cases residual current protective devices shall be used.

6.1.3.1.4 *Medical IT system*

In Group 2 medical locations, an IT system shall be used for final circuits and where the same final circuit is connected to more than one ME equipment or ME system, located within the patient environment, excluding:

- equipment with a rated power greater than 5k VA;
- X-ray equipment;
- the supply of movements of fixed operating tables.

For each group of rooms serving the same function, at least one separate medical IT system is necessary. The medical IT system shall be equipped with an insulation monitoring device in accordance with IEC 61557-8 with the following specific requirements:

- The a.c. internal impedance shall be at least 100 kΩ;
- The test voltage shall not be greater than 25 V d.c.;
- The injected current, even under fault conditions, shall not be greater than 1m A peak;
- Indication shall take place at the latest when the insulation resistance has decreased to 50 kΩ. A test device shall be provided;

NOTE — The necessary additional requirements on IMDs given above are at this time not covered in the equipment standard IEC 61557-8. They will be removed from this publication as soon as they have been treated in the relevant equipment standard.

For each medical IT system, an acoustic and visual alarm system incorporating the following components shall be arranged at a suitable place so that it can be permanently monitored (audible and visual signals) by the medical staff:

- A green signal lamp to indicate normal operation;
- A yellow signal lamp which lights when the minimum value set for the insulation resistance is reached. It shall not be possible for this light to be cancelled or disconnected;
- An audible alarm which sounds when the minimum value set for the insulation resistance is reached. This audible alarm may be silenced.
- The yellow signal shall go out on removal of the fault and when the normal condition is restored.

Monitoring of overload and high temperature for the medical IT transformer is required.

6.1.3.1.5 *Supplementary equipotential bonding*

In each medical location of group 1 and group 2, supplementary equipotential bonding conductors shall be in stalled and connected to the equipotential bonding busbar for the purpose of equalizing potential differences between the following parts, located in the "patient environment":

- Protective conductors;
- Extraneous-conductive-parts;
- Screening against electrical interference fields, if installed;
- Connection to conductive floor grids, if installed;
- Metal screen of the isolating transformer, if any.

NOTE — Fixed conductive non-electrical patient supports such as operating theatre tables, physiotherapy couches and dental chairs should be connected to the equipotential bonding conductor unless they are intended to be isolated from earth.

In medical locations of group 2, the resistance of the conductors, including the resistance of the connections, between the terminals for the protective conductor of socket-outlets and of fixed equipment or any extraneous-conductive-parts and the equipotential bonding bus bar shall not exceed 0.2 Ω.

NOTE — This resistive value can also be determined by the use of a suitable cross-sectional area of the conductor.

The equipotential bonding bus bar shall be located in or near the medical location. In each distribution board

or in its proximity, an additional equipotential bonding bar shall be provided to which the supplementary equipotential bonding conductor and protective earth conductor shall be connected. Connections shall be so arranged that they are clearly visible and easily disconnected individually.

6.1.4 *Fire Protection*

National Building Code of India part 4 Fire and Life safety applies.

7 SELECTION AND ERECTION OF ELECTRICAL EQUIPMENT

7.1 Common Rules

7.1.1 *Operational Conditions and External Influences*

7.1.1.1 *Operating conditions*

7.1.1.1.1 *Transformers for medical IT systems*

It is recommended that the medical IT distribution board is located within 25 m of the point of use. The distribution board should be easily accessible for maintenance which will require it to be located on the same level and the same fire section as the load it serves.

Distribution boards shall be installed outside the group 2 medical locations and should be safely guarded against unauthorized persons.

The rated voltage U_n on the secondary side of transformers shall not exceed 250 V a.c.

7.1.1.1.2 *Medical IT systems for group 2 medical locations*

Transformers shall be in accordance with IEC 61558-2-15, with the following additional requirements:

The leakage current of the output winding to earth and the leakage current of the enclosure, when measured in no-load condition and the transformer supplied at rated voltage and rated frequency shall not exceed 0.5 mA.

Single-phase transformers shall be used to form the medical IT systems for portable and fixed equipment and the rated output shall not be less than 0.5 kVA and shall not exceed 10 kVA.

If the supply of three-phase loads via an IT system is also required, a separate three-phase isolation transformer shall be provided for this purpose without put line-to-line voltage not exceeding 250 V.

7.1.1.2 *External influences*

NOTE — Where appropriate, attention should be given to prevention of electromagnetic interference.

7.2.1.2.1 *Explosion risk*

NOTES

1 Requirements for medical electrical equipment for use in conjunction with flammable gases and vapours are contained of IS 13450 (Part 1).

2 Where hazardous conditions are likely to occur (for example, in the presence of flammable gases and vapours), special precautions may be required.

3 Prevention of build-up of static electricity is recommended.

Electrical devices (for example, socket-outlets and switches) shall be installed at a distance of at least 0.2 m horizontally (centre to centre) from any medical gas-outlets, so as to minimize the risk of ignition of flammable gases.

7.1.1.3 *Diagrams, documentation and operating instructions*

Plans of the electrical installation together with records, drawings, wiring diagrams and modifications thereto, as well as instructions for operation and maintenance, shall be provided for the user.

NOTE — Drawings and wiring diagrams should be in accordance with IS 12032 and IEC 61082-1.

The relevant documents are in particular:

- Block diagrams showing the distribution system of the normal power supply and power supply for safety services in a single-line representation. These diagrams shall contain information on the location of the sub-distribution boards within the building;
- Main and sub-distribution board block diagrams showing switchgear and control gear and distribution boards in a single-line representation;
- Architectural diagrams according to IS 12032 (Part 11);
- Schematic diagrams of controls;
- Instructions for operation, inspection, testing and maintenance of storage batteries and power sources for safety services;
- Computational verification of compliance with the requirements of standards (for example, with Automatic disconnection of supply);
- List of loads permanently connected to the power supply for safety services indicating the normal currents and, in the case of motor-operated loads, the starting currents;
- A logbook containing a record of all tests and inspections which require to be completed prior to commissioning.

7.2 Wiring Systems

Any wiring system within group 2 medical locations shall be exclusive to the use of equipment and fittings in that location.

7.3 Switchgear and Controlgear

7.3.1 *Protection of Wiring Systems in Medical Locations of Group 2*

Total selectivity shall be ensured for any prospective overcurrent: In case of a short-circuit in a final circuit, the incoming circuits of the upstream distribution board shall not be interrupted.

Over current protection against short-circuitand over load current is necessary for each final circuit. Overload current protection is not allowed in the feeder circuits upstream and downstream of the transformer of medical IT-system.

7.4 Other Equipment

7.4.1 *Lighting Circuits*

In medical locations of group 1 and group 2, at least two different sources of supply shall be provided for some of the luminaries by two circuits. One of the two circuits shall be connected to the safety service.

In escape routes, alternate luminaries shall be connected to the safety service (*see* Safety services).

7.4.2 *Socket-outlet Circuits in the Medical IT System for Medical Locations of Group 2*

At each patient's place of treatment, for example, bedheads, the configuration of socket-outlets shall be as follows:

- Either a minimum of two separate circuits feeding socket-outlets shall be installed; or
- Each socket-outlet shall be individually protected against overcurrent.

Where circuits are supplied from other systems (TN-S or TT systems)in the same medical location, socket-outlets connected to the medical IT system shall either:

- be of such construction that prevents their use in other systems, or
- be clearly and permanently marked.

7.4.3 *Architecture of Special Safety Supply System in Operation Theatre*

Operating Rooms require impeccable availability and quality of Electric power to ensure maximum patient safety. There shall be dedicated UPS system to ensure the back-up power for at least 3 hours (*refer* Table 1). In group 2 locations, that is, Operating Rooms, an Isolated Power System panel shall be used for circuits powering medical electrical equipment and systems for survival and surgical applications. The system architecture (as shown below) shall be supplied as integrated solution comprising of electrical switchgear, insulation monitoring device, medical rated transformer (as per NABH and **7.1.1.1** this standard.) connected to building management system on non-proprietary or open protocol communication system. Medical Rated Transformer shall conform to IEC 61558-2-15 and need to be protected against overload and short circuit and temperature monitoring of transformer is needed. Insulation monitoring device shall conform to IEC 61557-8. An audible and visual alarm shall be provided to alert medical and facility personnel. For optimum operation of medical equipment, prevention of electromagnetic disturbance is necessary. The above system shall be tested to attenuate electromagnetic disturbances according to **4.5** of IS 732, IEC 61000-2 and IS 14700 (Part 3).

8 SAFETY SERVICES

8.1 Sources

Classification of safety services are given in Annex A.

8.2 General Requirements for Safety Power Supply Sources of Group 1 and Group 2

In medical locations, a power supply for safety services is required which, in case of a failure of the normal power supply source, shall be energized to feed the equipment stated in detailed requirements for safety power supply services with electrical energy for a defined period of time and within a pre-determined changeover period.

If the voltage at the main distribution board drops in one or several line conductors by more than 10 percent of the nominal voltage, a safety power supply source shall assume the supply automatically.

The supply transfer should be achieved with a delay in order to cater for autore-closure of circuit-breakers of incoming supplies (short-time interruptions).

For interconnecting cables between the individual components and sub-assemblies of safety power supply sources, *see* wiring systems.

NOTE — The circuit which connects the power supply source for safety services to the main distribution board should be considered a safety circuit.

Where socket-outlets are supplied from the safety power supply source they shall be readily identifiable.

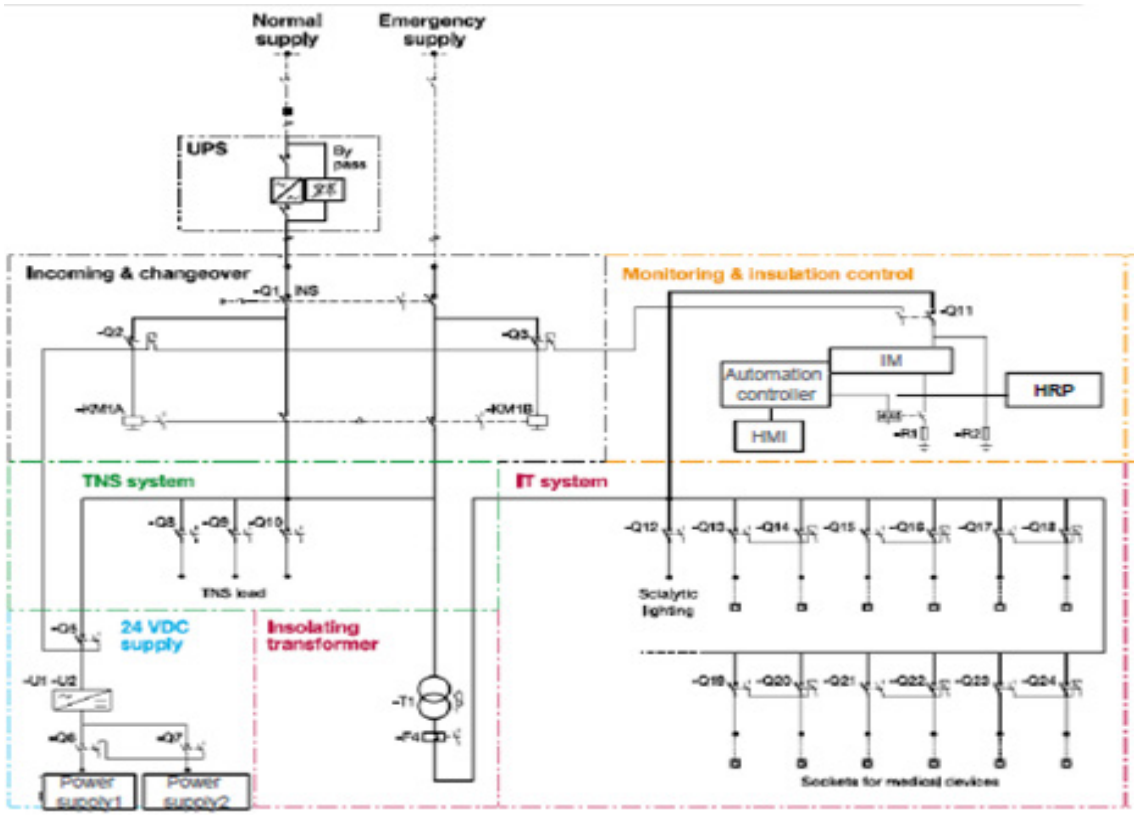


FIG. 1 ARCHITECTURE OF SPECIAL SAFETY SUPPLY SYSTEM IN OPERATION THEATRE

8.3 Detailed Requirements for Safety Power Supply Services

8.3.1 *Power Supply Sources with a Change-Over Period less than or equal to 0.5 s*

In the event of a voltage failure on one or more line conductors at the distribution board, a electrical source for safety services shall be used which is capable of providing power supply for a period of at least 3 h for:

- luminaries of operating theatre tables;
- ME equipment containing light sources or equipment essential to the application.

As an example, this equipment may include:

- endoscopes and essential equipment such as monitor;
- critical life-supporting ME equipment.

The power supply shall be restored within a change-over period not exceeding 0.5 s.

The duration of 3 h battery may be reduced to 1 h, if a power source as diesel generator is installed.

8.3.2 *Power Supply Sources with a Change-over Period less than or equal to 15 s*

Equipment according to Safety lighting and Other services shall be connected within 15 s to a safety power supply source capable of maintaining it for a minimum period of 24 h, when the voltage of one or more-line conductors at the main distribution board for the safety services has decreased by more than 10 percent of the nominal value of supply voltage and of a duration greater than 3 s.

NOTE — The duration of 24 h can be reduced to a minimum of 3h if the medical requirements and the use of the location, including any treatment, can be concluded and if the building can be Evacuated in a time which is well within 24 h.

8.3.3 *Power Supply Sources with a Changeover Period greater than 15 s*

Equipment other than those covered by **8.3.1** and **8.3.2**, which is required for the maintenance of hospital services, may be connected either automatically or manually to a safety power supply source capable of maintaining it for a minimum period of 24 h. This equipment may include, for example:

- Sterilization equipment;
- Technical building installations, in particular air conditioning, heating and ventilation systems, building services and waste disposal systems;
- cooling equipment;
- cooking equipment

8.4 Safety Lighting Circuits

8.4.1 *Safety Lighting*

In the event of mains power failure, the necessary minimum illuminance shall be provided from the safety services source for the following locations. The changeover period to the safety source shall not exceed 15 s:

- escape routes;
- Lighting of exit signs;
- Locations for switchgear and controlgear for emergency generation sets and form a in distribution boards of the normal power supply and for power supply for safety services;
- Rooms in which essential services are intended. In each room at least one luminary shall be supplied from the power source for safety services;
- Rooms of group 1 medical locations. In each room at least one luminary shall be supplied from the power supply source for safety services;
- Rooms of group 2 medical locations. A minimum of 50 percent of the lighting shall be supplied from the power source for safety services.

NOTE — The values for minimum illuminance, refer National Lighting Code.

8.5 Other Services

Services other than lighting which require a safety service supply with a changeover period not exceeding 15 s may include, for example, the following:

- selected lifts for firemen;
- ventilating systems for smoke extraction;
- paging systems;
- Medical electrical equipment used in group 2 medical locations which serves for surgical or other measures of vital importance. Such equipment will be defined by responsible staff authorized by the management;
- Electrical equipment of medical gas supply including compressed air, vacuum supply and narcosis (anesthetics) exhaustion as well as their monitoring devices;
- Fire detection, fire alarms and fire extinguishing systems.

9 VERIFICATION

The dates and results of each verification shall be recorded.

9.1 Initial Verification

The tests specified below under items a) to e) in addition to the requirements of **6** of IS 732 shall be carried out, both prior to commissioning and after alterations or repairs and before re-commissioning.

a) Functional test of insulation monitoring devices of medical IT systems and acoustical/visual alarm systems.

b) Measurements to verify that the supplementary equipotential bonding is in accordance with Supplementary equipotential bonding.

c) Verification of the integrity of the facilities required with Supplementary equipotential bonding for equipotential bonding.

d) Verification of the integrity of the requirements of Safety services for safety services.

e) Measurements of leakage current of the output circuit and of the enclosure of medical IT transformers in no-load condition.

9.2 Periodic Verification

Periodic verification of items a) to e) of Initial verification shall be carried out in accordance with local/national regulations. If no local/national regulations exist, the following intervals are recommended:

a) Functional testing of changeover devices: 12 months;

b) Functional testing of insulation monitoring devices: 12 months;

c) Checking, by visual inspection, settings of protective devices: 12 months;

d) Measurement verifying the supplementary equipotential bonding: 36 months;

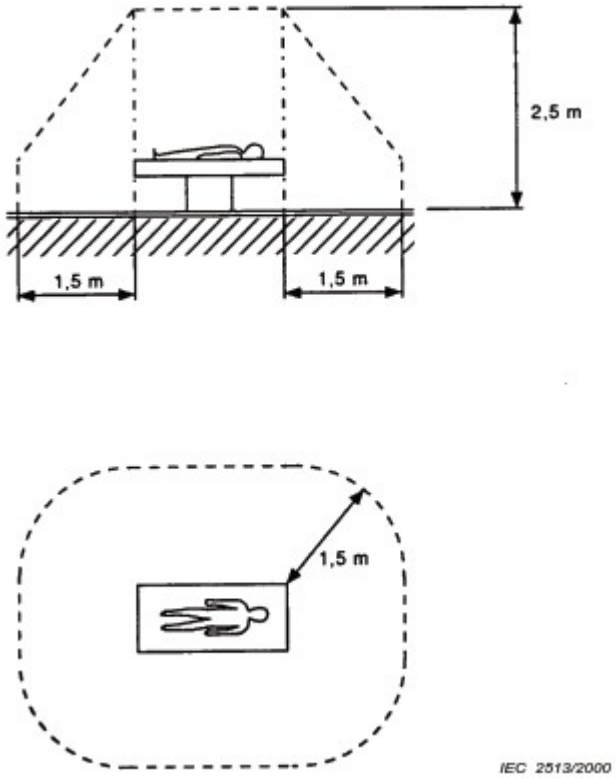
e) Verifying integrity of facilities required for equipotential bonding: 36 months;

f) Monthly functional testing of:
   - Safety services with batteries: 15 min;
   - Safety services with combustion engines: until rated running temperature is achieved: 12 months for “endurance run”;
   - Safety services with batteries: capacity test;
   - Safety services with combustion engines: 60 min;

In all cases at least 50 percent to 100 percent of the rated power shall be taken over.

g) Measurement of leakage currents of IT transformers: 36 months;

h) Checking of the tripping of RCDs at $I\Delta N$: not less than 12 months.



NOTE Dimension shown are not prescriptive

Figure 710A — Example of patient enviroment (IEC 60601–1–1)

FIG. 2 EXAMPLE OF PATIENT ENVIRONMENT

ANNEX A

(*Clause* 8.1)

CLASSIFICATION OF SAFETY SERVICES FOR MEDICAL LOCATIONS

Table A-1 – Classification of safety services necessary for medical locations

(*see also* to **5.6** of IS 732)

Class 0 (no-break)	Automatic supply available at no-break
Class 0.15 (very short break)	Automatic supply available within 0.15 s
Class 0.5 (short break)	Automatic supply available within 0.5 s
Class 15 (medium break)	Automatic supply available within 15 s
Class >15 (long break)	Automatic supply available in more than 15 s

NOTES

1 Generally it is unnecessary to provide a no-break power supply for medical electrical equipment. However, certain microprocessor-controlled equipment may require such supply.

2 Safety services provided for locations having differing classifications should meet that classification which gives the highest security of supply. Refer to Annex B for guidance on the association of classification of safety services with medical locations.

3 The notation "within" implies "≤".

ANNEX B

(*Clause* 4)

EXAMPLES FOR ALLOCATION OF GROUP NUMBERS AND CLASSIFICATION FOR SAFETY SERVICES OF MEDICAL LOCATIONS

A definitive list of medical locations showing their assigned groups is impracticable, as the use to which locations (rooms) might be put will differ between countries and even within a country.

The accompanying list of examples is provided as a guide only.

Table B-1 – List of Examples

Medical location	Group			Class	
	0	1	2	≤ 0.5 s	> 0.5 s ≤ 15 s
1. Massage room	X	X			X
2. Bedrooms		X			
3. Delivery room		X		X[a]	X
4. ECG, EEG, EHG room		X			X
5. Endoscopic room		X[b]			X[b]
6. Examination or treatment room		X			X
7. Urology room		X[b]			Xb
8. Radiological diagnostic and therapy room, other than mentioned under 21		X			X
9. Hydrotherapy room		X			X
10. Physiotherapy room		X			X
11. Anesthetic room			X	X[a]	X
12. Operating theatre			X	X[a]	X
13. Operating preparation room		X	X	X[a]	X
14. Operating plaster room		X	X	X[a]	X
15. Operating recovery room		X	X	X[a]	X
16. Heart catheterization room			X	X[a]	X
17. Intensive care room			X	X[a]	X

Table B-1 (*Concluded*)

Medical location	Group			Class	
	0	1	2	≤ 0.5 s	> 0.5 s ≤ 15 s
18. Angiographic examination room			X	X[a]	X
19. Hemodialysis room		X			X
20. Magnetic resonance imaging (MRI) room		X			X
21. Nuclear medicine		X			X
22. Premature baby room			X	X[a]	X

[a] Luminaries and life-support medical electrical equipment which needs power supply within 0.5 s or less.

[b] Not being an operating theatre.

Explanations of terms listed in Table B-1:

1. *Massage room*
2. *General ward (bedrooms)*

Medically used room or group of rooms in which patients are accommodated for the duration of their stay in a hospital, or in any other medical establishment.

3. *Delivery room*

Room in which the birth takes place

4. *Electrocardiography room (ECG), electroencephalography room (EEG), electrohystero-graphy room (EHG)*
5. *Endoscopic room*

Room intended for application of endoscopic methods for the examination of organs through natural or artificial orifices.

Examples of endoscopic methods are bronchoscopic ,laryngoscopic, cystoscopic, gastroscopic and similar methods, if necessary performed under anesthesia.

6. *Examination or treatment room*
7. *Urology room (not being an operating Théâtre)*

Room in which diagnostic or therapeutic procedures are performed on the urogenitaltract using medical electrical equipment, suchas X-ray equipment, endoscopic equipment and high-frequency surgery equipment.

8. *Radiological diagnostic room (radiological diagnostic and therapy room)*

Room intended for the use of ionizing radiation for display of internal structures of the body by means of radiography or fluoroscopy or by the use of radio-active isotopes or for other diagnostic purposes.

Therapy room

Room intended for the use of ionizing radiation to obtain therapeutic effects.

9. *Hydrotherapy room*

Room in which patients are treated by hydrotherapeutic methods Examples of such methods are therapeutic treatments with water, brine, mud, slime, clay, steam, sand, water with gases, brine with gases, inhalation therapy, electrotherapy in water (with or without additions), massage thermotherapy and thermotherapy in water (with or without additions).

Swimming pools for general use and normal bathrooms are not considered as hydrotherapy rooms.

10. *Physiotherapy room*

Room in which patients are treated by physiotherapeutic methods.

11. *Anesthetic room*

Medically used room in which general inhalation anesthetics are administered.

NOTE — The anesthetic room comprises for instance the actual operating theatre, the operating preparation room, the operating plaster room and treatment room.

12. *Operating Théâtre*

Room in which surgical operations are performed.

13. *Operating preparation room*

Room in which patients are prepared for an operation, for example, by administering anesthetics

14. *Operating plaster room*

Room in which plaster of Paris or similar dressings are applied while anesthesia is maintained.

NOTE — Such a room belongs to the operating room group and is usually spatially connected to it.

15. *Operating recovery room*

Room in which the patient under observation recovers from the influence of anesthesia.

NOTE — Such a room is usually very close to the operating room group but not necessarily part of it.

16. *Heart catheterization room*

Room intended for the examination or treatment of the heart using catheters. Examples of applied procedures are measurement of action potentials of the hemodynamic of the heart, drawing of blood samples, injection of contrast agents or application of stimulants.

17. *Intensive care room*

Room in which bed patients are monitored independently of an operation by means of medical electrical equipment Body actions may be stimulated if required.

18. *Angiographic examination room*

Room intended for displaying arteries or veins, etc. with contrast media.

19. *Hemodialysis room*

Room in a medical establishment intended to connect patients to medical electrical equipment in order to detoxicate their blood.

20. *Magnetic resonance imaging (MRI)*

21. *Nuclear medicine*

22. *Premature baby room*

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Electrical Installations Sectional Committee, ETD 20

Organization	*Representative(s)*
Engineers India Limited	Ms Sumita Anand (***Chairman***)
Areva T and D India Limited, Noida	Shri Saha Biswajit
Brihan Mumbai Electric Supply and Transport Undertaking, Mumbai	Shri H. V. Vagal Shri P. S. Naik (*Alternate*)
BSES Rajdhani Power Limited, New Delhi	Shri Chander Kant Sood Shri Rajiv Sharma (*Alternate*)
Central Electricity Authority, New Delhi	Shri Upendra Kumar
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Verma Shri D. K. Tulani (*Alternate*)
Defence	Shri Girish Joshi
Delhi Metro Rail Corporation Limited, Delhi	Shri Anand Kumar Mr Manuj Singhal (*Alternate*)
Department of Telecommunications, Ministry of Communications and Information Technology, New Delhi	Shri Vinod Kumar Hirna Shri Saurabh Chaturvedi (*Alternate*)
Development Consultants Limited, Kolkata	Shri Pradeep Banerjee Shri Das Ranjit K. (*Alternate*)
Directorate General Factory Advice Service and Labour Institutes, Mumbai	Shri Tanoj Tandon Shri H. M. Bhandari (*Alternate*)
Electrical Contractors Association of Maharashtra, Pune	Shri Sanjay Kolhatkar Shri Sunil Bhure (*Alternate*)
Electrical Installation Engineers' Welfare Association, Coimbatore, Tamil Nadu	Shri S. Manivannan Shri S. Gopalakrishnan (*Alternate*)
Engineers India Limited, New Delhi	Ms Shalini Verma Mr Rohit Kumar Singh (*Alternate*)
GETCO, Vadodara	Shri A. S. Shah Shri M. A. Prajapati (*Alternate*)
Garden Reach Shipbuilders and Engineers Limited, Kolkata	Shri Soumitra Bhaduri Shri T. K. Guha Roy (*Alternate*)
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Government of Orissa, Chief Electrical Inspectorate, Bhubaneswar	Shri G. C. Choudhury Shri S. K. Habibur Rehman (*Alternate*)
Government of Tamil Nadu, Chief Electrical Inspectorate, Chennai	Shri P. Manohar Shri M. Sakthivel (*Alternate*)
Havells India Limited, Noida	Shri Manoj Kumar Gupta Shri Rakesh Kaushik (*Alternate*)

Organization	*Representative(s)*
Indian Electrical and Electronics Manufacturers Association, New Delhi	Shri Shri J. Pande Shri S. Gopa Kumar (*Alternate* I) Shri Uttam Kumar (*Alternate* II)
International Copper Association India, Mumbai	Shri Debdas Goswami Shri Hemant Sali (*Alternate* I) Shri Amol Kalsekar (*Alternate* II)
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National Thermal Power Corporation Limited, New Delhi	Shri Ravish Chandra Jha
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Shri Ritwik Anand
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