N E P A L N A T I O N A L B U I L D I N G C O D E

NBC 207 : 2003

ELECTRICAL DESIGN REQUIREMENTS
for
(PUBLIC BUILDINGS)

Government of Nepal
Ministry of Physical Planning and Works
Department of Urban Development and Building Construction
Babar Mahal, Kathmandu, NEPAL
Reprinted : 2064

NEPAL NATIONAL BUILDING CODE

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This publication represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant legal requirements, including bylaws

तत्कालिन श्री ५ को सरकार (मन्त्रिपरिषद्) को मिति २०६०।४।१२ को निर्णयानुसार स्वीकृत

Government of Nepal
Ministry of Physical Planning and Works
Department of Urban Development and Building Construction
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Preface

This code has been prepared having considered the provisions of Electricity Act 2049 and Electricity Rule 2050 up to date. This includes general guidances for Electrical wiring installation. Prevention of short-circuiting has been emphasized. Utmost importance should be given in the installation of electrical wiring while preplanning and exchanging information among all concerned agencies from the earlier stages of the building works. Due to the limited technical manpower the country's construction industry, the code has been simplified for the ease of use and implementation. It is hoped that with the development of the manpower and modernization of construction processes, it will be possible to release more sophisticated set of electrical wiring installation guidelines in future.

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1. General Requirements

1.1 The installation shall generally be carried out in conformity with the Electricity Act 2049 as amended up to date and the Electricity rules 2050 framed thereunder and also the relevant regulations of Electricity supply authority concerned as amended from time to time.

1.2 For practices of electrical wiring, definitions, design & construction and inspection & testing of installation, IS 732, 732 (part 1) 1982, 732 (part 2) and 1982, 732 (part 3) 1982 shall be referred to respectively.

2. Power Factor Improvement in Consumer's Installation

2.1 Condition of supply of Electricity authority or licensees stipulate the lower limit of power factor which is generally 0.8 and consumer is obliged to improve and maintain the power factor of his installation to conform to this condition

2.2 Execution of work: Unless otherwise exempted under the appropriate rule of electricity rules the work of and electrical installation 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 valid permit issued and recognized by the government.

2.3 For graphical symbols, power factor improvement, safety procedures and practices IS 8270 (Part 1) 1976 & IS 2032; IS 7752 (Part 1) 1975 & IS 5216-1969 shall be referred to respectively.

3. Planning of Electrical installations

3.1 General – The design and planning of an electrical wiring installation involve consideration of all prevailing conditions, and is usually influenced by the type and requirement of the consumer. It is recommended that the advice of a competent electrical engineer be sought at the planning stage with a view to providing for an installation that will prove adequate for its intended purpose, and safe and efficient in its use.

3.2 Co-Ordination-Proper co-ordination and collaboration between the architect, civil engineer, electrical, communication and mechanical engineer shall be effected from the planning stage of the installation. The provisions that will be needed for the accommodation of substation, transformer, switchgear, service cable ducts, rising mains and distribution cables, sub-distribution boards, openings and chases in floors and walls for all required electrical installations, etc, shall be specified in advance.

3.3 While planning an installation, consideration should be taken of the anticipated increase in the use of electricity for lighting, general-purpose socket-outlet, kitchen heating, room heating etc.

3.4 Arrangement of Substation and switchgear rooms :

a) Total Plinth (covered) Area: Electrical substations may normally be required in case of office buildings with a total plinth (covered) area of 5000 m^2; even buildings with smaller plinth (covered) areas with large loading or under local regulations may require a substation. Separate substation building is generally not required it total load is less than 100 kVA. However, a suitable size of lockable space should be earmarked for installing control switchgear in buildings.

b) Load Centre and Centre of Gravity of Buildings : The ideal location for an electrical substation for a group of buildings would be at the load centre and shall be located on the ground floor. In multi-storeyed buildings, the substation shall preferably be installed on the lowest floor level, but direct access from the street for installation or removal of the equipment shall be provided. The floor level of the substation or switchroom shall be above the highest flood level of the locality. In this case the load centre would be somewhere between the geometricl centre and the air conditioning plant room, if provided. The sub station should preferably be located in a separate building and should be adjacent to the generator room, if any. Location of substation in the basement floors should be avoided, as far as possible, In case electric substation has to be located within the main building itself for unavoidable reasons, then it should be located on ground floor with easy access from outside.

c) Layout of Substation : In allocating the area of substation, it is to be noted that the flow of electric power is from supply company's room to HT room, then to transformer and finally to the low voltage switchgear room. The layout of the room shall be in accordance with this flow. The capacity of a substation depends upon the area of the building and its type. The capacity of transformers may be determined based on the following load requirements:

	Load Requirement Per Plinth Area (Watts/m^2)
Normal lighting	20.0
Lighting with lifts, pumps but without central air-conditioning	30.0
Additional capacity for technical buildings like laboratories, hospitals, etc	11.0
Additional capacity for airconditioning	100 (of air-conditioned area)

After calculating the electrical load on the above basis, a load factor of 70 percent is to be applied to arrive at the minimum capacity of substation. The area required for substation and transformer room for different capacities is given in standard Table.

d) High & Low Voltage Switch Room: Incase of substation having one transformer and one source of supply, the owner is required to provide one high voltage switch. In case of single point supply with two or more transformers the number of switch required will be one for incoming supply and one for each transformer. In case of duplicate supply two switches shall be provided with mechanical/electrical interlocking arrangement where necessary in cables with switches. In case the number of incoming and outgoing switches exceed five, bus coupler of suitable capacity should invariably be provided. The floor area required in case of a single switch is roughly 4mX4m and for every additional switch the length would be increased by 1m. The floor area required in respect of low voltage switchgear room may be determined keeping in view the number and type of incoming/outgoing bus coupler switches including likely expansion in future.

e) Room For Stand By Generator: The capacity of standby generating set shall be chosen on the basis of essential light load, essential air-conditioning load, essential equipment load and essential services load, such as one lift out of the bank of lifts, one or all water pumps, etc. Having chosen the capacity and number of generating sets, a space may be provided for their installation from the Standard Table. The generating set should invariably be housed in the substation building to enable transfer of electrical load quickly as well as to avoid transfer of vibration and noise to the main building. The generator house should have proper ventilation, firefighting equipment, etc.

4. Distribution of Supply & Cabling

4.1 In case of connected load of 100KVA and above, the relative advantage of high voltage three-phase supply should be considered.

4.2 Switchgear and fuse gear shall have adequate breaking capacity in relation to the capacity of the transformers ultimately to be connected. Isolation and protection of outgoing circuits forming main distribution system may be effected by means of circuit-breakers, or fuses or switch and fuse units mounted on the main switchboard.

4.3 Control at point of commencement of supply: There shall be a circuit-breaker or miniature circuit-breakers or a load break switch fuse on each live conductor of the supply mains at the point of entry. The wiring throughout the installation shall be such that there is no break in the neutral wire in the form of a switch or fuse unit. The neutral shall also be distinctly marked. The main switch shall be easily accessible and situated as near as practicable to the termination of service line. On the main switch, where the conductors include an earthed conductor of a two-wire system or an earthed neutral conductor, which is to be connected thereto, an indication of a permanent nature shall be provided to identify the earthed neutral conductor.

4.4 Energy Meters: Energy meters shall be installed in residential buildings at such a place which is readily accessible to the owner of the building and the Authority. These should be installed at a height where it is convenient to note

the meter reading; it should preferably not be installed below one meter from the ground. The energy meters should either be provided with a protective covering, enclosing it completely except the glass window through which the readings are noted or should be mounted inside a completely enclosed panel provided with hinged or sliding doors with arrangement for locking. Energy Meter along with Switch disconnector such as MCCB, MCB & Fuse is mandatory.

4.5 Marking of Apparatus: Where a board is connected to voltage higher than 250 V in a three Phase system, all the apparatus mounted on it shall be marked on the following colours to indicate the different poles or phases to which the apparatus or its different terminals may have been connected:

Alternating Current	Direct Current
Three-phases- Red, yellow, blue 1 Neutral-black Earth green	Three-wire system-2outer wire, positive red and negative blue. 1 Neutral-black

Where four-wire three-phase wiring is done, the neutral cable shall be in black colour and the other three wires in red, yellow and blue.

Where a board has more than one switch, each such switch shall be marked to indicate which section of the installation it controls. The main switch shall be marked as such and where there is more than one main switch, each such switch shall be marked to indicate which section of the installation it controls. All markings shall be clear and permanent.

4.6 Protection against the short circuits :

a) Cascading : Cascading is the techniqe by which circuit breakers with breaking capacity lower than the prospective short circuit current may be installed downstream from a current limiting type of circuit breaker. The breaking capacity of downstream breaker shall be enhanced by the limiting capability of the breaker. Combination shall be applicable to all switchtear down stream and capacity of upstream breakers should be greater or equal to the prospective short circuit current at the point of installation.

b) Co-ordination : the characteristics of the two breakers must be co-ordinated in such a way that the energy let though by the upstream breaker shall not be more than down stream breakers. Condition for co-ordination of breakers shall be such that the downstream breaker having breaking capacity less than the prospective shourt circuit current, shall be permited as long as breaker installed upstream having breaking capacity greater than or equall to prospective short circuit current at the point of installation exists.

c) Discrimination : At the design stage of low voltage installation one must be sure that the co-ordination of automatic protecting devices like MCCB, MCB, ACB and other protective divice should be selected in such a way that a fault opearing at a given point in any installation shall be cleared by the protection device installed immediately above the point of occurrence of fault. Where HRC type fuses are used for back-up protection of circuit-

breakers, or where HRC fuses are used for protection of main circuits, and circuit-breakers for the protection of sub-circuits derived thereform,in the event of short-circuits protection exceeding the short-circuits capacity of the circuit-breakers, the HRC fuses shall operate earlier than the circuit-breakers; but for smaller overloads within the short-circuit capacity of the circuit-breakers, the circuit-breakers shall operate earlier than the HRC fuse blows.

5. Rating of Cables & Equipments:

5.1 The current-carrying capacity of different types of cables shall be chosen in accordance with good practice IS 3961-1967, 1968 and IS 1534 (part 1) 1988 shall be referred to. Cable size shall be 1.5, 2.5, 4, 6, 10, 16, shall be 1.5, 2.5, 4, 6, 10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300, 400, 500 mm^2 .

5.2 The current ratings of switches for domestic and similar purposes are 5 A and 15A.

5.3 The current ratings of isolators and normal duty switches and composite units of switches and fuses shall be selected from one of the following values: 6, 10, 16, 25, 32, 63, 100, 160, 200, 320, 400, 500, 630, 800, 1000 and 1250 A. IS 13947-3 shall be referd.

5.4 The ratings of rewirable and HRC fuses shall be in accordance with good practice. IS 2086-1963 and IS 13703 shall be referred to.

5.5 The current ratings of miniature circuit breakers shall be chosen from the values given below: 6, 10, 16, 25, 32, 40, 63, 80 , 100, 125 A. IS 8828-1996

5.6 Lighting and levels of illumination: Lighting installation shall take into consideration the many factors on which the quality and quantity of artificial lighting depends. The modern concept is to provide illumination with the help of a large number of light sources not of higher illumination level. Also much higher levels of illumination are called for than in the past, often necessitating the use of fluorescent lighting suitably supplemented with incandescent fittings, where required.

5.7 For specific requirements for lighting of special occupancies, reference shall be made to good practice. IS 2672-1966; 4347-1967; 8030-1967 shall be referred to. Electric wiring installations in hospitals shall be done in accordance with good practice. IS 7733-1975 shall be referred to. For guidelines for electrical installation in residential buildings, reference may be made to good practice. IS 4648-1968 shall be referred to.

5.8 Cables: The smallest size of the cable that shall be used, will depend upon the method of laying cable, permissible maximum temperature it shall withstand, the prospective short-circuit current to which the cable may be subjected, the characteristics of the overload protection gear installed, load cycle and thermal resistivity of the soil. IS 1255-1965 shall be referred to. Short-circuit rating curves will serve as an approximate guide for selection of the size of cables.

5.9 Residual current breaker should be used as to avoid electrocution and fire of from electricity hazards in case of Hospital building.

5.10 Minimum standard size of wiring cable for light and power shall be specified as follows:

- Light circuit --- 2.5 sq.mm PVC insulated copper stranded cable
- Power circuit - 4.0 sq.mm PVC insulated copper stranded cable.

6. Wiring

6.1 General:

6.1.1 Provision for Maximum Load – All conductors, switches and accessories shall be of such size as to be capable of carrying, without their respective ratings being exceeded, the maximum current, which will normally flow through them. Diversity factor shall be considerd.

6.1.2 Estimation of Load Requirements-In estimating the current tobe carried by any conductor the following ratings shall be taken, unless the actual values are known or specified for these elements:

Element	Rating in watts
Incandescent lamps	60
Ceiling fans	60
Table fans	60
Ordinary socket outlet points	1000
Fluorescent tubes:	
Length: 600 mm	25
1200 mm	50
1500 mm	90
Power socket-outlet	3000

6.1.3 Electrical installation in a new building shall normally begin immediately on the completion of the main structural building work and before finishing work such as plastering has begun except in the case of surface wiring which can be carried out after the plaster work. Usually, no installation work should start until the building is reasonably weatherproof, but where electric wiring is to be concealed within the structures as may be the case with a reinforced concrete building, the necessary conduits and ducts shall be positioned firmly by tying the conduit to the reinforcement before concerting. When shutters are removed after concreting, the conduit ends shall be given suitable anti-corrosive treatment and holes blocked off by putties or caps to protect conduits from getting blocked.

6.1.4 Selection of Size of Conductors-The size of conductors of circuits shall be so selected that the drop in voltage from consumer's terminals in a public supply (or from the bus-bars of the main switchboard

controlling the various circuits in a private generation plant) to any point on the installation does not exceed the provision of electricity rule 2050 at the consumer's terminals (or at two bus-bars as these may be) when the conductors are carrying the maximum current under the normal conditions of service.

6.1.5 Layout & Installation Drawing: The electrical layout should be considered after proper locations of all outlets for lamps, fans, and appliances both fixed and transportable, motors, etc. have been selected and best methods of wiring determined. All runs of wiring and the exact positions of all points of switch-boxes and other outlets shall be first marked on the plans of the building and approved by the engineer-in-charge or the owner before actual commencement of the work. The layout of wiring should be designed keeping in view disposition of the lighting system to meet the illumination levels. "Power" and 'heating' sub-circuits shall be kept separate and distinct from 'lighting' and 'fan' sub-circuits. All wirings shall be done on the distribution system with main and branch distribution boards at convenient physical and electrical load centres. All types of wiring, whether concealed or unconcealed should be as near the ceiling as possible. In all types of wirings due consideration shall be given for neatness and good appearance.

6.1.6 Balancing of circuits in three phase - installation shall be arranged before hand. Conductors shall be so enclosed in earthed metal or incombustible insulating material that it is not possible to have ready access to them unless the points between which a voltage exceeding 250 volts may be present are 2 m or more apart, in which case means of access shall be marked to indicate the voltage present. Where terminals or other fixed live parts between which a voltage exceeding 250 V exists are housed in separate enclosures or items of apparatus which, although separated are within reach of each other, a notice shall be placed in such a position that anyone gaining access to live parts is warned of the magnitude of the voltage that exists between them.

6.2 Non-Metallic surface & recessed conduit wiring:

6.2.1 Type and size of conduits-

All rigid non-metallic conduits used shall conform to accepted standards IS1653-1972 and shall be used with corresponding accessories IS 3419-1977; 9537; 9537 (part 1) 1980. All flexible non-metallic conduits shall conform to accepted standards IS 1653-1972 The conduits shall provide adequate mechanical protection for the enclosed cables. The interior of the conduits shall be free from obstructions. Flexible non-metallic conduits shall be used only at terminations, wherever specified. The conduits shall be circular in cross-section. The conduits shall be designated by their nominal outside diameter. The conduit wiring system shall be complete in all

respect including accessories. No non-metallic conduit less than 20 mm in diameter shall be used.

6.2.2 Conduit Acceessories

Rigid conduit accessories shall be normally of grip type. Flexible conduit accessories shall be of threaded type.

6.2.3 Wiring Capacity

The maximum number of PVC insulated conductor cable of 250 voltage grade that can be drawn in one conduit of various sizes is given in following Table .

Size of Cable		**Size of Conduit (mm)**					
Nominal Cross-Sectional Area mm2	**Number & Diameter (in mm) of Wires-**	**Number of cables Max**					
		16	20	25	32	40	50
1.0	1/1.12 *	5	7	13	20	-	-
1.5	1/1.4	4	6	10	14	-	-
2.5	(1/1.8), (3/1.06*)	3	5	10	14	-	-
4	(1/2.24), (7/.85*)	2	3	6	10	14	-
6	(1/2.8), (7/1.4*)	-	2	5	9	11	-
10	(1/3.55#), (7/1.4*)	-	-	4	7	9	-
16	7/1.7	-	-	2	4	5	12
25	7/2.24	-	-	-	2	2	6
35	7/2.25	-	-	-	-	2	5
50	(7/3#), (19/1.8)	-	-	-	-	(2), (2)	(5), (3)

*** For copper conductors only.**
 # For aluminum conductors only.

6.2.4 Bunching of Cables: For ease of maintenance, cables carrying direct current or alternating current shall always be bunched so that the out-going and return cables are drawn into the same conduits.

6.2.5 Conduit Joints: All joints shall be sealed cemented with approved cement. Damaged conduit pipes fittings shall not be used on the work. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes.

6.2.6 Protection against Condensation: The layout of conduit should be such that any condensation or sweating inside the conduit is drained out. Suitable precaution shall also be taken to prevent entry of insects inside the conduit.

6.2.7 Painting: After installation all accessible surfaces of metallic-accessories shall be painted.

6.2.8 Outlets: The switch box shall be made of either rigid PVC moulding or mild steel or cast iron on all sides except at the front. PVC boxes shall conform to accepted standards IS 3419-1976; 9537, 9537(part 1) – 1980 & 5133(part 2) 1969. These boxes shall be free from burrs, fins and internal roughness. The thickness of the walls and base of PVC boxes shall be not less than 2 mm. The clear depth of PVC boxes shall not be less than 50 mm. For METALLIC boxes: The switch or

regulator box shall be made of metal on all sides, except on the front. In the case of cast boxes, wall thickness shall be at least 3 mm and in case of welded mild steel sheet boxes, the wall thickness shall not be less than 1.18 mm for boxes up to a size of 20 cm X 30 cm and above this 1.6 mm MS boxes shall be used. Clear depth of the box shall not be less than 60 mm and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern. All fittings shall be filled in flush pattern.

Non-Metallic Recessed Conduit Wiring System shall have following three requirements also additionally:

a) Fixing of Conduit In Chase: The conduit pipe shall be fixed by means of staples or by means of non-metallic saddles placed at not more than 80 cm apart or by any other approved means of fixing. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves shall be maintained by sending the conduit pipe itself with a long radius, which will permit easy drawing in of conductors. At either side of bends, saddles/staples shall be fixed at a distance of 15 cm from the centre of bends.

b) Types of Accessories to be used: All outlets such as switches, wall sockets, etc, may be either flush mounting type or of surface mounting type.

c) Inspection Boxes-Suitable inspection boxes to the nearest minimum requirements shall be provided to permit periodical inspection and to faciliate replacement of wires, if necessary. The inspection/junction boxes shall be mounted flush with the wall or ceiling concrete. Where necessary deeper boxes of suitable dimensions shall be used. Suitable ventilating holes shall be provided in the inspection box covers, where required.

7. Earthing

7.1 General – The object of an earthing system is to provide as nearly as possible a system of conductors at a uniform potential and as nearly zero or absolute earth potential as possible. The purpose of this is to ensure that in general all parts of apparatus other than live parts shall be at earth potential as well as to ensure that persons coming in contact with it shall also be at earth potential at all times.

7.2 Earthing associated with current-carrying conductor is normally essential for the security of the system and is generally known as system earthing, while earthing of non-current carrying metal work and conductor is essential for the safety of human life, of animals and of property and it is generally known as equipment earthing.

7.3 Earth Electrodes: Earth electrode either in the form of pipe electrode or plate electrode should be provided at all premises for providing an earth system. Details of typical pipe and plate earth electrodes are given in relevent standard figures.

7.4 As far as possible, all earth connections shall be visible for inspection and shall be carefully made; if they are poorly made or inadequate for the purpose for which they are intended, loss of life and property or serious personal injury may result.

7.5 The earthing of electrical installations for non-industrial buildings shall be done in accordance with good practice IS 3043-1966.

8. Inspection and Testing of Installation:

8.1 General: Before the completed installation, or an addition to the existing installation, is put into service, inspection and testing shall be carried out in accordance with the Electricity Rules. 2050. In the event of defects being found, these shall be rectified, as soon as practicable and the installation retested. Periodic inspection and testing shall be carried out in order to maintain the installation in a sound condition after putting into service. Where an addition is to be made to the fixed wiring of an existing installation, the latter shall be examined for compliance with the recommendations of the Code.

8.2 Completion Drawings-On completion of the electric work, initial wiring diagram shall be verified at actual basis of works and submitted to the engineer-in-charge or the owner's representative. All wiring diagrams shall indicate clearly, the main switchboard, the runs of various mains and sub mains and the position of all points and their controls. All circuits shall be clearly indicated and numbered in the wiring diagram and all points shall be given the same number as the circuit in which they are electrically connected. Also the location and number of earth points and the run of each load should be clearly shown in the completion drawings.

8.3 On completion of wiring a general inspection shall be carried out by competent Electrical Engineer in order to verify that the provisions of this Code and that of Electricity Rules, 2050 have been complied with. This, among other things, shall include checking whether all equipments, fittings, accessories, wire/cables, used in the installation are of adequate rating and quality to meet the requirement of the load. General workmanship of the electrical wiring with regard to the lay out and finish shall be examined for neatness that would facilitate easy identification of circuits of the system, adequacy of clearances, soundness, contact pressure and contact area. A complete check shall also be made of all the protective devices, with respect to their ratings, range of settings and co-ordination between the various protective devices.

8.4 Testing of Installation – After inspection, the following tests shall be carried out, before an installation or an addition to the existing instillation is put into service. Any testing of the electrical installation in an already existing installation shall commence after obtaining permit to work from the enginner-incharge and after ensuring the safety provisions.

8.4.1 Switchboards

All earth connections shall be checked for continuity. The operation of the breakers, switches and fueses shall be tested from all control stations. Indication signaling lamps shall be checked for proper working. Contact resistance of main and isolator contacts, cable's contact etc. shall be measured. All high and low voltage switchboards shall be tested for dielectric test as per IS 8623 (part 1) 1977.

8.4.2 Cables

It shall be ensured that the cables conform to the relevant. Standards. Tests shall also be done in accordance with good practice IS 1255-1967. The insulation resistance before and after the tests shall be checked. The insulation resistance between each conductor and against earth shall be measured. The insulation resistance varies with the type of insulation used and with the length of cable.

8.4.3 Wiring Installation

a) The insulation resistance shall be measured by applying between earth and the whole system of conductor or any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring, all lamps in position or both poles of installation otherwise electrically connected together, a dc voltage of not less than twice the working voltage, provided that it does not exceed 500 volts for medium voltage circuits. Where the supply is derived from three-wire (ac or dc) or a poly-phase system, the neutral pole of which is connected to earth either direct or through added resistance the working voltage shall be deemed to be that which is maintained between the outer or phase conductor and the neutral.

b) The insulation resistance in megaohms of an installation measured as in (a) shall be not less than 50 divided by the number of points on the circuit, provided that the whole installation need not be required to have an insulation resistance greater than one megaohm.

c) Control rheostats, heating and power appliances and electric signs, may, if desired, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or framework, and all live parts of each rheostat, appliance and sign shall be not less than that specified in the relevant Standard specification or where there is no such specification, shall be not less than half a megaohm.

d) The insulation resistance shall also be measured between all conductor connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or to the neutral or to the other pole of phase conductors of the supply. Such a test shall be made after removing all metallic connections between the two poles of the installation and in these circumstances the insulation resistance between conductors of the installation shall be not less than that specified in (b)

8.4.4 Efficiency of Earthing:

The earth resistance of each electrode shall be measured. Earth resistance of earthing grid shall be measured. All electrodes shall be connected to the grid and the earth resistance of the entire earthing system shall be measured. These tests shall preferably be done during the summer months.

8.5 Completion Certificate-On completion of an electrical installation (or an extension to an installation) a certificate shall be furnished by the contractor, counter-signed by the certified electricla engineer under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form

9. Lightning Protection of Buildings.

While every structure, theoretically, has a chance of being struck by lightning, the degree of this chance varies depending on a number of associated factors, such as lightning incidences, surroundings and types of terrain. For a certain group of occupancies, which form a source of danger, such as those housing explosive factories of stores or flammable materials, complete protection against lightning shall be provided. In other cases, it may be necessary to decide whether this protection is called for, under a given set of circumstances. There are a number of factors, affecting the risk of the structure being struck by lightning and consequential effects of a stroke, which are capable of assessment. There would be other factors, which are not capable of such assessment in relative terms. Yet these may over-ride all other considerations; for example, a requirement that there should be no avoidable risk to life, or the overwhelming importance or value of the structure. In such cases lighting protection shall always be provided. In other cases, however, it may be desirable to make a decision on an assessment in terms of the chances of the structure being struck. For this purpose, various factors denoting chances of the structure being struck by lightning and the total effect of these factors shall be assessed.

10. Telecommunication and other services:

Layout arrangements, EPABX, methods for internal block wiring and other requirements regarding provisions of space, etc, may be decided depending as the number of phone outlets and other details in consultation with Engineer/Architect and user.

References : **National building code of India 1983**
Electricity Act. 2049
Electricity Rule 2050
Regulations relating to electrical wiring installations in buildings (CTEVT) 1997.

FORM OF COMPLETION CERTIFICATE
(CLAUSE 8.5)

I/ We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complies with Electricity Rules 2050.

Electrical Installationt at ……

Voltage and system of supply …….

Particulars of Works:

a) Internal Electrical Installation.

	No.	Total load	Type or system of wiring
i) Light point.			
ii) Fan point.			
iii) Plug point.			
3-pin 5 A.			
3-pin 15 A.			

b) Others.	Description	hp/kW	Type of starting.
1) Motors:			
i)			
ii)			
iii)			
2) Other plants:			

c) If the work invloves installations of over head line and/or underground cable.

1) i) Type and descriptionof overheadline.
ii) Total length and No. of spans.
iii) No. of street lights and its description.

2) i) Total length of underground cable and its size.
ii) No. of joints:

End joint:

Tee joint:
Straight through joint:

Earthing.

i) Description of earthing electrode
ii) No. of earth electrodes
iii) Size of main earth lead

Test Results:
a) Insulation Resistance

i) Insulation resistance of the whole system of conductors to earth……..Megohms.

ii) Insulation resistance between the phase conductor and neutral.

Between phase R and neutral……..Megohms.
Between phase Y and neutral ……..Megohms.
Between phase B and neutral……Megohms.

iii) Insulation resistance between the phase conductors in case of polyphase supply.

Between phase R and phase Y……..Megohms.
Between phase Y and phase B……..Megohms.
Between phase B and phase R……..Megohms.

b) Polarity test:
Polarity of non-linked single pole branch switches

C) Earth continuity test:
Maximum resistance between any point in the earth continuity conductor including metal conduits and main earthing lead……..Ohms.

d) Earth electrode resistance:
Resistance of each earth electrode.

i)……Ohms.
ii)……Ohms.
iii)……Ohms.
iv)……Ohms.

Signature Of Electrical Engineer

Name and Address

Singature Of Contractor

Name and Address