ELECTRICITY ACT

CAP 106 LFN 1990

Electrical Installation Regulation 1995

Section 3 and 4 CAP 106 LFN 1990

Commencement: 2nd January, 1996

In exercise of powers conferred on me by section 4 of the Electricity Act and all other powers enabling me in their behalf; I the Minister of Power and Steel with the prior consent of the Head of State, Commander-in-Chief of the Armed Forces, Federal Republic of Nigeria, hereby make the following regulations:

1. Short title

These regulations may be cited as the Regulations for Electrical Installations, 1994, Section 4 of the Electricity Act, cap 106 LFN 1990.

2. Interpretation

In these Regulations the undermentioned expressions shall have the meanings respectively assigned thereto. Otherwise the definitions contained in Nigerian Industrial Standards (Glossary of Term) shall apply.

"accessory" means any device, other than a fitting, associated with the wiring, fittings and consuming devices: for example, a small switch, cut-out, plug, socket, or similar device.

"adaptor, socket-outlet" means an accessory for insertion into a socket-outlet and containing metal contacts, to which may be fitted one or more plugs for the purpose of connecting to the supply, portable light fittings or current-using appliances.

"apparatus" means machines, equipment and fittings associated with generation, transmission, distribution and utilization of electrical energy.

"appliance" means any device which utilizes electricity for a particular purpose, excluding a light fitting or an independent motor.

"authorised inspector" means an inspector employed by the Licensee concerned, save that in any case where the licensee is also the consumer. "Authorised Inspector" shall mean a person appointed for the purpose by the Director of Electrical Inspectorate Services.

"authorised person" means -

(i) the owner or occupier of any premises; or

(ii) a contractor for the time being under contract with the owner, occupier; or

(iii) a person employed, appointed, or selected, by the owner, occupier, or contractor as afore-said to carry out certain duties incidental to the generation, transformation, distribution, or use of electrical energy; such owner, occupier, contractor, or person being a person who is competent for the purposes of the regulation in which the term is used.

"balanced" means a three-wire system of generation or supply is said to be "balanced" when –

(i) in the case of direct current or single phase alternating current systems of generation or supply, loads connected between the middle and each of the outer conductors are equal;

(ii) in the case of three phase systems of generation or supply, the load carried by any combination of two conductors is equal to the load carried by any other combination of two conductors;

(iii) in case of three phase four-wire system of generation or supply in addition to condition in (ii) above, the loads connected between the neutral and each of the "phase" conductors are also equal.

"bonded" means the electrical interconnection of metallic parts order to maintain them at the same potential and to achieve a desired distribution of currents within an earthing system.

"cable" means a length of single insulated conductor (solid or stranded) or two or more of such conductors each provided with its insulation which are laid up together. The insulated conductor or conductors may or may not be provided with an overall mechanical protective covering.

"cable, armoured" means an armoured cable is one provided with a metallic covering of wires or tapes as a protection against mechanical injury.

"cable, bunched" means cables are said to be bunched when more than one is contained within a single duct, conduit or trunking, or when unenclosed, cables are not separated from each other.

"cable coupler" means a means enabling the connection, at will, of two flexible cables. It consists of a conductor a plug.

"cable ducting" means an enclosure of metal or insulating material, other than conduit or cable trunking, intended for the protection of cables which are drawn-in after erection of the ducting, but which is not specifically intended to form part of a building structure.

"cable, flexible" means a flexible cable is one in which the conductor (or conductors) comprise a number of wires, the diameter of the wires and the material of the dielectric being such as to ensure flexibility.

"circuit" means an assembly of electrical equipment supplied from the same origin and protected against over-current by the same protective device(s).

"circuit-breaker" means a mechanical switching device capable of making, carrying and breaking current under normal circuit conditions and also of making, carrying for a specified time, and breaking currents under abnormal circuit conditions such as those of short circuit.

"circuit conductor" means a current conductor forming part of a circuit or final sub-circuit, but excluding the earth-continuity conductor.

"conductor (or a core or cable)" means the conducting portion, consisting of a single wire or of a group of wire of a group of wires in contact with other. For earthed concentric wiring, the term may also denote the metal sheath of a cable.

"conduit" means an approved pipe or tube of standard dimensions and material for electrical use.

"consumer" means any person supplied with electrical energy by the licensee.

"consumer installation" mean consumer's wiring together with any apparatus upon the premises connected to or intended to be connected thereto and situate upon the consumer's side of the Licensee's supply terminals.

"consumer's terminals" mans the point in the consumer's installation at which the incoming supply of energy is delivered to that installation.

"cable, flexible" means a flexible cable is one which the conductor (or conductors) does not exceed 4mm2 in cross-section and comprises a number of wires, the diameter of wires and the material of the dielectric being such as to ensure flexibility.

"core (of a cable)" means the conductor with its insulation or dielectric, but does not include the mechanical covering. Two, three or more cores may be laid up together to form a twin, three-core, or multi-core cable.

"cut-out" comprises all the separate parts-e.g., fuse-element, fuse carrier, fuse-contacts, fuse-extension, and circuit contacts-which together with their mountings and base, form the complete protecting device.

"damp-and dust-proof" applied to apparatus and accessories to denote that the live and other component parts are protected by an enclosure or enclosures being so protected and/or fitted as to prevent the ready ingress of dust and or moisture.

"damp situation" means a situation in which moisture is either permanently present, or intermittently present to such an extent as to be likely to impair the effectiveness of an installation conforming to the requirements for ordinary situations

"dead or de-energised" means free from any electrical connection to a source of potential difference and from electric charge, or not having a potential different from that of the earth.

"dielectric" means that portion of a core cable which is relied upon to insulate conductor.

"Director of Electrical Inspectorate Services" means the Registered Engineer for the time being holding that office under the government of the Federal Republic of Nigeria.

"distribution board" means an accessory containing fuses or circuit-breaker arranges for the distribution to, and protect and control of sub-circuits or final sub-circuit.

"double insulation" a conductor is said to have double insulation when it is provided with insulating material between the conductor and its surrounding envelope or immediate support, as well as between such envelope or support and earth.

"earthed" means connection to the general mass of earth in such a manner as well ensure at all times an immediate discharge of electrical energy without electrical hazards.

"earth electrode" means a metal rod or rods, a system of underground metal pipes or other conducting object, providing an effective connection with the general mass of the earth.

Note: The use of pipes of public gas or water supply undertakings as a sole earth electrode is not permitted in these Regulations.

"earthing-lead" means the conductor connecting the earthing-system to the metal sheathing or apparatus required to be earthed.

"electrical energy" means electrical energy when generated transmission of a message.

"electrical hazard" means danger to life or property from electrical energy.

"electrical supply authority or supply authority" Same as Licensee

“electrode boiler (or electrode water heater)” means apparatus for the electrical heating of water by the passage of an electric current between electrodes immersed in the water.

“final-sub-circuit” A final sub-circuit is that portion of the wiring system extending beyond the final set of fuses and intended to supply electrical energy to current using apparatus, either directly or through an outlet or fused spur boxes.

“flame-proof” is applied to apparatus to denote that the containing case or other enclosure will withstand without injury any explosion of prescribed flammable gas that may occur within it under practical conditions of operation within the rating of the apparatus (and recognized overloads, if any, associated herewith) and will prevent the transmission of the flame such as will ignite any prescribed flammable gas that may be present in the surrounding atmosphere.

“fuse-element” means a fuse element is the actual wire or strip of metal in a cut-out which is designed the moving part of which carries one or more fuses.

“fuse- switch” means a switch the moving part of which carries one or more fuses.

“hazardous location” means any premises including buildings erected thereon, whether enclosed or not, in which explosive, highly inflammable or corrosive substances are produced, manufactured, refined or stored or packed, and in the case of highly inflammable substances are offered for sale, or where the same results in the presence of an explosive highly inflammable or corrosive liquid or gas, and shall be deemed to include electrically operated equipment for the delivery of petrol and paraffin oil, and rooms used for the storage of cinematograph films made of celluloid.

“heating point” means a socket-outlet to which a portable heater is plugged.

“h.o.f.r. sheath (or cable)” means heat-resisting, and flame retardant sheath.

“indirect contact” means contact of person or live stock with exposed conductive parts made alive by a fault and which may result in electric shock.

“installation” means an assembly of associated electrical equipment to fulfill a specific purpose and having certain co-ordinated characteristics.

“insulation” means suitable non-conducting materials enclosing, surrounding or supporting a conductor.

“intrinsic safety” means –

(i) Applied to a circuit, denotes that any electrical sparking that may occur in normal working, under the conditions specified by the certifying authority, and with the prescribed components, is incapable of causing an ignition of the prescribed flammable gas or vapour.

(ii) Applied to apparatus, denote that it is so constructed that when installed and operated under the conditions specified by the Certifying Authority, any electrical sparking that may occur in normal working, either in the apparatus or in the circuit associated therewith is incapable of causing an ignition of the prescribed flammable gas or vapour.

> **Note 1:** The use of the term “In normal working” is intended to cover sparking that may, in normal use, be produced by breaking line current, or a short circuit across the lines in the circuit that is required to be intrinsically safe. It is also intended to cover sparking that may be produced under any condition of fault which in the opinion of the Certify Authority, might arise in practice.

Note 2: For applications other than coal mining, where part of the certified equipment is to be mounted outside the hazardous area or in a flame-proof enclosure the assessment of intrinsic safety may be restricted to cover only such electrical sparking as may occur within the hazardous area or outside the flame-proof enclosure. Any certificate of intrinsic safety issued by the appropriate authority will then define the circumstances to which it applies.

"lighting fitting/luminaire" means equipment which distributes, filters, or transforms the light from one or more lamps, and which includes parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and where necessary circuit auxiliaries together with the means for connecting them to the supply.

Note: For the purposes of this Regulations a batten lamp holder, or a lamp holder suspended by a flexible cord is a luminaire.

"licensee" means any Local Authority, Company, Body, person or persons authorized by the issue of a licence by the Minister, to use, work or operate in accordance with these Regulations, any plant, apparatus or work designed for the supply or use of electrical energy or to supply such energy to or for the use of any other Local Authority, Company, Body, person or persons from any such plant, apparatus or works.

"live (alive)" means an object is said to be alive when a difference of potential exists between it and earth, except in the case of multi-earthed neutral system, all metal connected to the neutral conductor of the supply system, shall be deemed to be alive for the purpose of these regulations.

"machine (electrical)" means a device for converting electrical energy into mechanical energy or *vice versa*, or for converting one form of electrical energy into another.

"machine, drip-proof" means one which has a frame provided with opening for ventilation, so protected as to exclude falling water or dirt.

"machine, enclosed, ventilated" means one in which the ventilation openings in frame are protected with wire screen, expended metal, or other suitable perforated covers having apertures.

"machine, flame-proof" means one in which the enclosing case can withstand, without injury, any explosion of gas that may occur in practice within it under the conditions of operations and prevent the transmission of sparks or flames capable of igniting any inflammable gas or particles, such a coal-dust, or flour or textile flyings, which may be present in surrounding atmosphere.

"machine, protected" means one in which the internal rotating parts and live parts are protected mechanically from accidental or careless contact, whilst ventilation is not materially obstructed.

"machine, totally enclosed" means one so enclosed as to prevent circulation of air between the inside and outside of the case, but not so such an extent as to make the machine air-tight.

"mains feed" means that portion of the wiring between the main switchboard and the electric service line from which supply is obtained.

"the minister" means a Minister charged with responsibility for matters relating to electricity.

"multiple-earthed neutral (m.e.n.)" means the neutral conductor of any low or medium voltage alternating-current-system is said to be multiple-earthed when it is earthed at the point of

supply (that is, generating station, sub-station, or transformer) and at one or more other point along the distribution or service line and at each consumer's premises.

"plug" means a device intended for connection to a flexible cord or flexible cable which can be engaged manually with a socket-outlet or connector or adaptor and which has current-carrying contact pins which may be exposed when not engaged.

"point (in wiring)" means a termination of the fixed wiring intended for the connection of current-using equipment.

"regulation for electricity supply" means regulations made under the Electricity Act, as from time to time amended.

"service fuse" means the device installed by Electricity Supply Authority for automatically disconnecting the installation of a consumer's premises from service line.

"socket-outlet" means a device with protected current-carrying contacts intended to be mounted in a fixed position and permanently connected to the fixed wiring of the installation, to enable the connection to it of a flexible cord or flexible cable by means of a plug.

"space factor" means the ratio (expressed as a percentage) of the sum of the overall cross-sectional area of cables (including installation and any sheath) to the internal cross-sectional area of the conduit or other cable enclosure in which they are installed. The effective overall cross-sectional area of a non-circular cable is taken as that of a circle of a diameter equal to the major axis of the cable.

"spur" means a branch cable connected to a ring or a radial final circuit.

"sub-main" means a branch main connecting a distribution board or fuse-board to a main switch-board.

"switch-board" means the term "switch-board" denotes an assemblage of switch-gear with or without instruments, and includes distribution board, but the term does not apply to a group of local switches in a final circuit.

"switch, double-pole" means a switch suitable for making or breaking a circuit on two poles or phases simultaneously or for making or breaking two separate circuits simultaneously.

"switchgear" means switches, circuit breakers, cut-outs and other apparatus used for the operation, regulation and control of electrical circuits.

"switch, linked" means a switch the contents of which are so arranged as to make or break all poles simultaneously or in a definite sequence.

"switch, single-pole" means a switch suitable for making or breaking a circuit on one pole or phase only.

"switch, triple-pole" means a switch suitable for making or breaking a circuit on three poles or phases simultaneously.

"trench, open" means a trench without covering, or covered by an open grille.

"trunking (for cable)" means a system of enclosures for the protection cables, normally of square or rectangular cross-section, of which on side is removable or hinged.

"voltage" means electrical potential difference expressed in volts: Functionally the range of the more commonly utilized voltages is classified as follows-

i. Extra Low Voltage: All voltages below 100 volts,
ii. Low Voltage: All voltages exceeding 100 volts but not exceeding 250 volts,

iii. Medium Voltage: All voltages exceeding 250 volts but not exceeding 1000 volts,

iv. High Voltage: All voltages exceeding 1000 volts,

v. Extra High Voltage: All voltages exceeding 132,000 volts.

"weather-proof" Fittings, accessories and consuming devices, are said to be weather-proof if they are so constructed that when installed rain, hail and splashing are excluded.

3. The term "**Nigerian Standard Specification**" means a specification for wiring, or other materials, fittings, accessories, appliances or apparatus for electrical purposes, issued under that name by the Nigerian Standards Organisation and where any such specifications is prescribed in these regulations the latest revision thereof, or any specification issued in lieu thereof by that organization is implied.

PART I

Division One – general

1. Application; enforcement and exemptions from regulations

These regulation apply to all Electrical installations connected to any of electrical energy operated under the authority of a licence granted under Electricity Act (and to whe3ther granted before or after the coming into force of these regulations), and to all electrical installations for the installing of which such a licence is required (and whether granted before or after the coming into force of these regulations), but save as provided in the Electricity Supply Regulations nothing herein shall apply to any generating plant which is subject to these regulations.

2. (1) It shall be a condition of every licence granted under the Electricity. Act (and whether granted before or after the coming into force of these regulations) by which any supply Electricity Supply Authority is empowered to supply electricity energy to any consumer that such Supply Authority shall not connect with such line any new installation on the consumer's premises unless and until such installation has been inspected, tested, and certified pursuant to these regulations.

(2) It shall also be a condition of every such licence that the Electricity Supply Authority shall not continue to supply electrical energy to any installation connected with the Supply Authority's electric lines, or to supply electrical energy to any other existing installation or any part thereof is not reasonably free from electrical hazard, and such work in accordance with these regulation as such Electricity Supply Authority directs is not done to render such installation or such part reasonably free: provided that it shall not be necessary for the Supply Authority to require strict compliance with these regulations in the doing of any such work if it is satisfied that such compliance would involve unreasonable expenditure and that the installation can otherwise be rendered reasonably free from electrical hazard.

(3)It shall not be necessary until six months after the commencement of these regulations for the Supply Authority to insist on the use of any material necessary to make any installation comply with the requirement of these regulations if such materials are not in general use or are not readily procurable in Nigeria.

3. In any case where the Electricity Supply Authority is also a consumer of the electrical energy supplied by it, the conditions imposed by the last preceding regulation shall apply to it in its capacity as Supply Authority as if it were supplying electricity to some other consumer than itself, but in such case the Director of Electrical Inspectorate Services or some person appointed

by him in writing in that behalf shall have and may exercise the power mentioned in Regulation 2(1) to inspect, test and certify.

4. Where a Supply Authority changes over from one voltage or system to another the Director of Electrical Inspectorate Services may, be by notice published in the *Gazette*, make such modification as may be specified in such notice of these regulations in their application to the reconditioning of installations for the purposes of such change-over.

5. The Director of Electrical Inspectorate Services may from time to time, by notice in the *Gazette*, approve methods or types of construction or materials not specially provided for in these regulations, and impose such conditions as he deems necessary with respect to the use thereof.

6. (1) In any case where the Director of Electrical Inspectorate services upon application being made to him in writing by any person proposing to make any new installation, is satisfied that strict compliance with these regulations would involve expenditure out of proportion to the degree of freedom from electrical hazard to be secured by compliance, he may modify any such requirements if satisfied that reasonable freedom from electrical hazard can be otherwise secured.

(2) Every such application shall be accompanied by a full statement the reasons why modification is desired and of the nature thereof, and by a certificate by the Supply Authority's engineer that the application is a reasonable one and that in his opinion such modification will not lead to serious increase in the electrical hazard.

(3) In granting any such modification the Director of Electrical Inspectorate Services shall specify what special work (if any) he requires to be done to render the installation reasonably free from electrical hazard.

PART II

Permits for electrical installation

7. Save as provided in Regulations 9 and 10 hereof, no electrical installation shall be commenced until a written permit thereafter has been obtained from the Electricity Supply Authority.

8. (1) A Supply Authority may grant permits for temporary installations-

i. no permit for temporary installation shall be granted for longer period than one month after the date on which such installation is connected the source of supply.

(2) On the expiration of the period for which a permit for temporary installation is granted a further such permit may be granted for a period not exceeding one month. But the total period during which temporary installation may be connected to the source of supply under the authority of successive permits shall not exceed six months from the date on which it was first connected.

9. In any case of emergency due to a breakdown or other accident any authorised person may, without obtaining a permit as required by these regulations, begin any work necessary to repair the installation, but application for such permit must be made to the Supply Authority within twenty-four hours after such work is began.

10. In any case where an Electricity Supply Authority is also the consumer of the electrical energy supplied by it, or is the contractor for any electrical installation work, the Director of Electrical Inspectorate Services or any person authorized by him in writing in that behalf shall exercise and perform the powers, functions, and duties conferred or imposed on the Electricity Supply Authority as such by the foregoing provisions of this part of these installations.

PART III

Requirements for safety

11. Testing

On completion of an installation or an extension or major alteration of an installation, tests should be made with suitable instruments to verify as far as practicable that the requirements of regulations 12 – 18 have been met; that the installation of all conductors and apparatus is satisfactory, and that the earthing arrangements are such that in the event of an earth fault circuit or sub-circuit or apparatus is automatically disconnected from the supply so as to prevent danger.

12. Conductors and apparatus

(1) (i) All electrical conductors shall be of sufficient size and current rating for the purposes for which they are to be used.

(ii) All apparatus shall be suitable for the maximum power demanded by the apparatus when it is in use, and shall be otherwise so constructed, installed, and protected as to prevent danger as far as is reasonable practicable,

(iii) All circuit conductors, including conductors forming part of apparatus, shall be either-

(a) so insulted, and where necessary further effectively protected; or

(b) so placed and safeguarded, as to prevent danger so far as is reasonably practicable,

(iv) every electrical joint and connection shall be of proper construction as regards conductance, insulation, mechanical strength, and protection. Conductors and apparatus operating at voltages between conductors or to earth exceeding 250 volts shall either-

i. be completely enclosed in earthed metal which is electrically continuous and adequately protected as to prevent danger as far as is necessary practicable.
ii. be so constructed, installed and protected as to prevent danger as far as is reasonably practicable.

13. Protection

(1) Every electrical circuit and sub-circuit shall be protected against excess current by fuses, circuit breakers, or other similar devices which –

i. will operate automatically at current values which are suitably related to the safe current, ratings of the circuit, and
ii. are of adequate making and breaking capacity, and
iii. are suitable located and of such construction as to prevent danger from over-heating, arcing or the scattering of hot metal when they come into operation
iv. and as to permit ready renewal of fuse-elements without danger.

(2) Where the earth-fault-leakage current from a circuit due to a fault of negligible impedance from a live conductor to earthed metal is sufficient to operate the fuses or circuit-breakers or other similar devices provided so as to comply. With Regulation 13(1), the current shall be protected against the persistence of earth-leakage currents liable to cause danger by an earth-leakage circuit-breaker or equivalent device.

(3) No fuse, or circuit-breaker other than a linked circuit breaker, shall be inserted in a conductor connected with earth, and any linked circuit-breaker inserted n a conductor connected with earth shall be arranged to break also all the live conductors.

(4) Every single-pole switch shall be inserted in the live conductor only, and any switch connected in the conductor connected with earth shall be linked switch and shall be arranged to break also all the live conductors.

14. Precaution

(1) Where metal work, other than current-carrying conductors, is liable to become charged with electricity in such a manner as to create a danger if the insulation of a conductor should become defective or if a defect should occur in any apparatus-

i. the metalwork shall be earthed in such a manner as will ensure immediate electrical discharge without danger, or
ii. other adequate precautions shall be taken to prevent danger.

15. Isolation

Effective means, suitable placed for ready operation, shall e provided so that all voltage may be cut off from every circuit and sub-circuit and from all apparatus, as may be necessary to prevent danger.

16. Apparatus installation

(1) Every piece of apparatus which requires operation, in normal use shall be so installed that adequate means of access and working space are afforded for such operation or attention.

(2) Every electric motor shall be controlled by an efficient switch for starting and stopping such switch should be readily accessible and easily operated and so placed as to prevent danger.

17. Abnormal conditions

(1)All apparatus and conductors exposed to whether, corrosive atmosphere, or other adverse conditions, shall be so constructed or protected as may be necessary to prevent danger arising from such exposure.

(2) Where a conductor or apparatus is, or is likely to be, exposed to flammable surroundings or, an explosive atmosphere it shall be protected by a flame-proof enclosure or be otherwise do designed and constructed as to prevent danger.

(3) In situation which may normally be wet or damp, where electrical apparatus is present and might give rise to danger and where there are substantial exposed metal parts of other services (such as gas and water pipes, sinks and baths) the earth-continuity conductor of the electrical installation shall be effectively connected electrically and mechanically to all such metal parts and to exposed metalwork of the electrical apparatus which is required by Regulation 3.8 to be earthed.

18. Additional to installations

No addition, temporary or permanent, shall be made to the authorized load of an existing installation, unless it has been ascertained that the current rating and condition of any existing conductors and apparatus (including those of the supply undertaking) which will have to carry the additional load are adequate for the increased loading, and that the earthing arrangements are also adequate.

Division two - Rules to be observed for compliance with Division One

PART IV

Electrical generating plants, transformers and batteries

19. Generators room

(1) Where an electric supply is generated upon the consumer's premises, the generators, except in the case of extra-low voltage plant having capacity not exceeding five kilowatts, shall conform in all respects to the Nigerian Standard Specifications applicable to such machines.

(2) Generators other than flame-proof, force-drought, induced drought, or pipe-ventilated machines shall only be placed in separate compartment that is adequately protected.

(3) Generators shall be placed in positions in which they are not exposed to risk of mechanical injury, or to damage from water, steam, or oil.

(4) Terminals of generators shall be so guarded that they cannot be accidentally touched or short-circuited.

(5) No unprotected woodwork, other than hardwood barriers, or any combustible materials shall be within a distance of 300mm (measured horizontally) from or within 1200mm (measured vertically) above or below the generators.

20. Storage batteries and controls

When apparatus is supplied from secondary batteries, the work of connecting such apparatus to such batteries shall be done in accordance with the provisions of these regulations which would govern the connecting of such apparatus with a generating plant developing the same difference of potential.

21. Battery room

(1) Every battery shall be so arranged that a potential difference exceeding fifty volts does not exist between adjacent cells without adequate protections against electrical hazard, and that each cell shall be readily accessible from the top and from at least one side.

(2) In a lead-sulphuric-acid battery having more than thirty-three cells, and in nickel-iron alkaline battery having more than fifty three cells, shall be supported on glass or vitreous porcelain insulators. Where a battery comprises more than fifty-six lead-sulphuric-acid cells or eight nickel-iron alkaline cells the stands also shall be insulated.

(3) Cells having containers not sealed or not provided with screw-down covers shall be fitted with spray-arrestors.

(4) Suitable means shall be provided for controlling the current with which battery is being charged. Such means shall comprise, as a minimum, an automatic cut-in and cut-out, or alternatively, a circuit-breaker with overload and reverse-current trips.

(5) The room in which batteries are placed shall be thoroughly ventilated.

22. Static transformers and choke coils

(1) Transformers and choke-coils shall be either amply ventilated or else oil-immersed. But in situations where inflammable or explosive gases, dust or flying particles are liable to be present the transformers shall be oil-immerses.

(2) Transformers shall be in accordance with Nigerian Standard Specifications

(3) Auto-transformers, resistances shall not be used to reduce the voltage to low or extra-low voltage.

(a) to supply general wiring in building; or

(b) for any other purpose where the low or extra-low voltage circuit or apparatus has exposed live metal with which it is possible for any person to make contact.

PART V

Temporary installations and installations on construction sites

23. General

Temporary installations and installations on construction sites shall comply in all respects with the requirements of these regulations for permanent installations and in addition with the requirements of the Regulations 24 and 25.

24. Responsibility for installation

Every installation on a construction site, and every temporary installation other than an installation in a private dwelling, shall be in charge of a competent person, who shall accept full responsibility for the safety of the installation, for its use, and for any alternation or extension thereto. The name and designation of such person shall be prominently displayed close to the main switch or circuit-breaker of the installation.

25. Testing

Every installation for which this section applies shall be inspected and tested in accordance with the requirement of Part XII- Testing, at intervals of three months or at such shorter periods as the particular nature of the installation necessitates.

PART VI

Controls of supply to consumers' installation

26. Supply control

(1) Every consumer installation shall be adequately controlled by switch-gear readily accessible to the consumer which shall incorporate-

i. means of isolation, and
ii. means of excess-current protection, and
iii. means of earth-leakage protection

(2) All such installation shall be easily accessible to the consumer and as near as possible to

i. the point or points of entry of the service main in the case of a public supply; or
ii. the generator in the case of private plant.

(3) In the case of a private plant where the building containing the generator is isolated from the building in which the electricity is consumed, a main switch shall be installed at a point at which the main cables enter the latter building. Where more than one building is supplied from a common man, switches shall also be installed at each building.

(4) The means of isolation required by Regulation 26(1) shall comprise a linked switch suitable for operation on load or a linked circuit-breaker arranged to disconnect all having an excess-current release fitted in each live conductor of the supply.

27. A. Protection

(1) The means of excess-current protection required by Regulation 26(1) shall comprise either a fuse in each live conductor of supply or circuit-breaker having an excess-current release fitted in each live conductor of the supply.

(2) Every means of excess-current protection shall be suitable for the maximum short-circuit current attainable.

(3) The characteristics and settings of excess-current protective gear, including fuses and arrangement of the installation, shall be such that discrimination in the operation of the excess-current protection gear is ensured.

(4) Throughout a 2-wire installation connected to a source of supply having one pole connected with earth, all fuses and single-pole control devices, e.g. switch or circuit-breakers, thermostats and the like, shall be connected in the live conductor only. This does not preclude the use of double-pole linked devices controlling both conductors of the supply.

(5) Throughout a 2-wire installation connected to a source of a supply having neither pole connected with earth, every switch or circuit-breaker shall be of the double-pole linked type, and fuses (where installed) shall be fitted in both poles.

(6) Every conductor in the installation shall be protected against excess current by a fuse or circuit-breaker fitted at the origin of the circuit of which the conductor forms part. The current rating of every fuse use for this purpose shall not exceed that of the lowest-rated conductor in the circuit protected, account being taken of the class of excess-current protection afforded by the fuse. Every circuit-breaker used for this purpose shall operate when the circuit protected is subjected to a sustained excess current of 1.5 times the rating (appropriate to this form of protection) of the lowest-rated conductor in the circuit. Sizes of fuse elements for semi-enclosed fuses are given in Table 1 in Schedule 1.

B. Cut-out

(1) For low and medium voltage cut-out shall comply with Regulation 27

(2) It shall be provided with a suitable incombustible and insulating carrier for the fuse of such shape as to protect a person handing it from shock and burns; and contacts shall be provided on the carrier to which the ends of the fuse can be readily attached.

(3) The base shall be provided with fixed circuit contacts of such shape as to retain the carrier in position in the presence of vibration.

(4) The bus-bars, fixed contacts, removable contacts, and fuses shall be so shielded as to protect a person against contact with live metal when the fuse-carrier is being inserted or removed.

28. Switchboard

(1) Switchboards shall be constructed wholly of durable, non-ignitable, non-absorbent materials, and all insulation shall be of permanently high strength and insulation resistance.

(2) All switchboards with metallic frames shall be provided with suitable terminals, to which the earthing lead shall be attached.

(3) The various exposed live parts of switchboards shall be so arranged by suitable spacing or shielding with non-ignitable insulating materials that an arc cannot be maintained between any such parts or between such parts and earth. For voltage not exceeding 250 volts the minimum clearance between the live metal parts of fuses of opposite polarity or phase, or between any live metal and any earthed metal shall be 50mm. For medium voltage the clearance shall not be less than 100mm. Fuses which on blowing expel the gas parallel to the axis of the fuse, and which are of opposite polarity or phase, may be mounted one above the other if an insulating shield is fixed between them.

(4) The arrangements of all parts shall be such that the connections to all instruments and apparatus can be readily traced.

(5) All parts, including connections, shall be readily accessible; and no fuse, circuit-breaker, or switch other than an isolating switch shall be fixed on the back of the switchboard panel if it is necessary to operate the same from behind.

(6) All nuts or parts carrying over twenty-five amperes, shall be effectively locked so that they cannot become loose.

(7) All bus-bars and connections on switchboards shall be in accordance with relevant Nigerian Standard Specifications.

(8) Where a scheme of colouring is employed to distinguish switchboard bus-bars and connections to individual poles or phases, such scheme of colouring shall be in accordance with relevant Nigerian Standard Specifications.

(9) The arrangement of bus-bars carrying alternating currents shall be in accordance with relevant Nigerian Standard Specifications.

(10) Conductors must be symmetrically placed and spaced apart, and so arranged that the course of every conductor may be readily traced.

(11) All circuits, instruments, and important apparatus shall be clearly and indelibly labeled for identification.

(12) Switches shall be so arranged that their blades or moving parts are disconnected from the supply in the off position. They shall be so mounted that the top of the handle is at a height not exceeding 2.3m above floor level.

(13) In every case in which the switches and fuses are fitted on the same pole or phase these switches shall preferably be so arranged that the fuses are disconnected from the supply when their respective switches are in the “off” position.

(14) Where meters, service fuses or other apparatus belonging to the Supply Authority are to be mounted on a switchboard, loops shall be left in the leads of sufficient length to allow the ends of the conductors to be properly connected by the Supply Authority.

(15) Each distribution board shall have fitted in or on its case or cover, or in an adjacent conspicuous position, an indication of the circuit protected by each fuse or circuit-breaker contained therein and of the appropriate current rating for the circuit so protected.

(16) More than one phase supply shall not be brought into a multi-gang switch box.

(17) Where service meters are not mounted on the main switchboard they be mounted on a substantial base.

(18) Where instrument transformers are used, and are easily accessible, all live metal shall be effectively insulated.

29. Final sub-circuits

(1) The number of points which may be supplied by a final sub-circuit of rating not exceeding 15 amperes is limited by their aggregate demand as determined from Table 2 in schedule 1; there shall be no other allowance for diversity in the final sub-circuit and the current rating of the cable must not be exceeded.

(2) All socket outlets in any one room shall be connected to the same phase (or pole of a 3 wire system).

(3) Where an installation comprises more than one final sub-circuit, each shall be connected to a separate way in a distribution board.

(4) The wiring of each final sub-circuit shall be electrically separated from that of every other final sub-circuit. To facilitate disconnection of each sub-circuit for testing, the neutral conductors shall be connected at the distribution board in the same order as that in which the live conductors are connected to the fuses or circuit-breakers.

(5) A final sub-circuit having a rating exceeding 15 amperes shall not supply more than one point. For the purpose of this regulation the following items may each be regarded as one point –

i. a cooker control unit incorporating socket outlet;
ii. a light fitting track system provided that individual light fittings are suitably protected against excess current.

(6) To determine the rating of a final sub-circuit supplying stationary cookers in domestic premises, the current demand of each cooker shall be assessed not less than 30A. The minimum size of cable should be 6mm^2.

(7) Every stationary cooking appliance in domestic premises shall be controlled by a switch separate from the appliance and installed within 2m of the appliance.

30. Diversity

(1) Diversity shall not be allowed for when calculating the size of circuit conductors and switch-gear and circuits other than final sub-circuits, other to the extent specifically permitted by Regulations for final sub-circuits, for cooking appliances.

(2) Diversity may be allowed for when calculating the size of circuit conductors and switch-gear and circuits other than final sub-circuits provided this is justified by known or anticipated conditions.

Note: *Allowance for diversity is a matter calling for special knowledge and experience and the application of diversity should be decided by the engineer responsible for designing each particular installation.*

31. Ring and radial circuit

(1) In domestic installations either radial or ring final sub-circuit conforming with Table 3 may be installed to serve socket outlets complying with relevant Nigerian Standard Organisation's

Specification and Stationary appliances of rating not exceeding 13 amperes provided that the general requirements of Regulations and in case of ring sub-circuits, the special requirements of Regulations 31(5) to 31(11) are met.

(2) Each socket outlet of a twin or multiple socket outlet unit shall be counted as one socket for the purposes of Regulation 31(1) and Table 3.

(3) A stationary appliance connected permanently (i.e. not through a plug and socket outlet) to a radial or ring final sub-circuit conforming with Regulation 31(1) shall be locally protected by a fuse of rating not exceeding 13 amperes and controlled by a switch or protected by a circuit-breaker of rating not exceeding 15 amperes.

(4) The conductor sizes tabulated in Table 3 in schedule 1 are minimum and shall be increased if necessary where circuits are installed in groups or in conditions of high ambient temperature, taking account of the class of excess-current protection provided. In such circumstances it must be ensured that –

i. for radial final sub-circuits, the current rating of the conductors is not less than that of the fuse or circuit-breaker protecting the final sub-circuit, and
ii. for ring final sub-circuits, the current rating of the conductors forming the ring is not less than 0.67 times the rating of the fuse or circuit-breaker protecting the final sub-circuit.

(5) Each circuit conductor of a ring final sub-circuit shall be run in the form of a ring, commencing from a way in a distribution board (or its equivalent), looping into the terminals of socket outlets and joint boxes (if any) connected in the ring and returning to same way of the distribution board.

(6) Except where a ring final sub-circuit is run throughout in metallic conduit, ducts or trunking, or in metal-sheathed cable, the earth-continuity conductor shall also be run in form of a ring having both ends connected to earth at the distribution board (or its equivalent).

(7) Each ring final sub-circuit conductor shall be looped into every socket-outlet or joint box which forms parts of the ring and shall either remain unbroken throughout its length or, alternatively, if the conductor is cut, is electrical continuity shall be ensured by joints complying with the Regulations 50 to 52.

(8) For ring final sub-circuits complying with Regulations 31(1) to 31(4) the total number of spurs shall not exceed the total number of socket-outlets and stationary appliances-connected directly in the ring.

(9) For ring final sub-circuits complying with Regulations 31(1) to 31(4) the total number of spurs shall be connected through fused spur boxes. The rating of the fuse shall not exceed that of the cable forming the spur and in any event shall not exceed 13 amperes. The total current demand of points served by a fused spur shall not exceed 13 amperes.

(10) For ring final sub-circuits complying with Regulations 31(1) to 31(4) non-fused spurs shall be connected to the ring at the terminals of socket-outlets or at joint boxes or at the origin of the ring in the distribution board. Non-fused spurs shall have a current rating not less than that of the conductors forming the ring. Not more than two socket-outlets, or one twin socket-outlet, or one stationary appliance, shall be fed from each non-fused spur.

(11) In domestic premises, a ring final sub-circuit may serve an unlimited number of points but shall not serve an area of more than 100m^2. Where two or more ring final sub-circuits are installed, the socket-outlets and stationary appliance to be served shall be reasonably distributed among the separate ring final sub-circuits.

(12) For industrial, commercial and other non-domestic installations radial and ring final sub-circuits otherwise conforming with the requirements of Regulations 31(1) to 31(10) may be installed where, owing to diversity, the maximum demand of apparatus to be connected is estimated not to exceed the corresponding fuse or circuit-breaker ratings set out in Table 3 in schedule 1.

(13) Provision shall be made so that every portable appliance and portable light fitting can be fed from an adjacent, conveniently accessible socket outlet.

Note 1: *Industrial and commercial premises it may be desirable to provide pilot lamps to indicate when portable non-luminous heating appliances such as smoothing irons and soldering irons, are in operation.*

Note 2: *For hand-held appliances which are likely to be used out of doors or in damp situations, attention is drawn to the added safety which can be obtained by the use of a double-wound transformer having a reduced secondary voltage or alternatively by the use of monitored earthing-continuity circuits.*

31B. Control of socket and appliances

(1) Where the supply is direct current, each socket-outlet shall be controlled by a switch immediately adjacent thereto or combined therewith. Where the supply is alternating current and plug is readily withdrawable, such a switch need not be provided.

(2) An appliance or light fitting connection to an installation other than by means of a plug and socket outlet shall be controlled by a switch or switches which shall be arranged to disconnect all live supply conductors. For an appliance fitted with heating elements which can be touched or into which more than one phase of the supply is introduced, the switch shall be linked switch arranged to break all the circuit conductors.

(3) The switch required by Regulation 31B(2) shall be separate from the appliance or light fitting in a readily accessible position subject to the provisions Regulations 31B (4), 31B(5) or 31B (6) where applicable.

(4) The switch required by Regulation 31B (2) may be mounted on the appliance or light fittings provided the connections are so arranged that the appliance or light fitting can be dismantled for maintenance without thereby exposing any parts which remain live shall be as short as possible, separated from any other conductors or cables by screens of earthed metal or suitable barriers of insulating material and so installed that they are not adversely affected by any heat from the applicable or light fitting.

(5) Where Regulation 168 requires a switch to be situated so as to be normally inaccessible to a person who is using a bath or shower, it is admissible for the switch to be placed in a suitable position outside and immediately adjacent to the normal access door of the room, or to be of the type operated by an insulating cord.

(6) The switch or switches providing control of comprehensive space cooling, or light installations, comprising more than one appliance or light fitting may be installed in a separate room.

32. Motor circuits

(1) Every electric motor shall be provided with means for starting and stopping, the latter so placed as to be easily operated by the person in charge of the motor.

(2) Every electric motor shall be provided with the control apparatus specified in items (i) – (iii) below:

(i) means to prevent automatic restarting after a stoppage due to a drop in voltage or failure of supply, where unexpected restarting of the motor might cause danger.

(ii) where more than one method of manually stopping a motor is provided and danger might be caused by the unexpected restarting of the motor, or of a machine being driven by the motor, means to prevent restarting until every stopping device has been reset.

(iii) means of isolation suitably placed and so connected that all voltage may thereby be cut off from the motor and all apparatus including any automatic circuit-breaker, used therewith. If this means of isolation is remote from a motor, an additional means of isolation adjacent to the motor shall be installed, or alternatively, provisions shall be made for the primary means of isolation to be locked in the "off" position.

(3) Every electric motor having a rating exceeding 0.37kW shall be provided with control apparatus incorporating a suitable device affording protection against excess current in the motor or in the cables between the device and the motor. The Supply Authority shall be consulted regarding starting arrangements for motors requiring heavy starting current.

(4) Cables carrying the starting, accelerating and load current of a motor shall be of rating at least equal to the full-load current rating of the motor when rated in accordance with the relevant Nigerian Standard Specifications.

(5) A final sub-circuit supplying a motor shall be protected in accordance with the requirements of Regulation 27A (60 unless Regulation 32 (6) applies.

(6) Where a starter is provided which affords protection against excess current in a motor and in the cables between the starter and the motor, the rating of the fuse or circuit-breaker protecting the final sub-circuit which supplies the motor may be up to twice that of the cable between the fuse or circuit-breaker and the starter.

(7) The sizes of the cables for motor circuits of slip-ring or commutator induction motors shall be suitable for the starting and load conditions.

PART VII

Conductor and cables

33. Materials and type cable

(1) All conductors for internal wiring other than the outer conductors of earthed concentric systems shall be of annealed copper, and shall conform to Nigerian Standard Specifications.

(2) Every non-flexible cable for use as fixed wiring operating at low and medium voltages shall be selected from one of the following types and shall comply with the appropriate Nigerian Standard Specifications so far as this is applicable. In cables of every type, conductors of cross-sectional area 10mm2 or less shall be of copper or copper-clad aluminum. Any of the types of cable sheathed with p.v.c. or lead, or having a h.o.f.r. sheath, if intended for aerial suspension, may incorporate a catenary wire.

(i) Non-armoured p.v.c. insulated cables,
(ii) Armoured p.v.c. insulated ,
(iii) Split-concentric copper-conductor p.v.c. insulated cables,
(iv) Rubber insulated cables,
(v) Impregnated-paper-insulated, lead-sheathed or aluminum sheath,
(vi) Mineral-insulated metal-sheathed cables

(3) Bus-bars and bus-bar connections on switch boards shall comply with Nigerian Standard Specifications. The requirement does not apply to bus-bar trunking system.

(4) Every conductor for use as an overhead line shall be selected from one of the following types and shall comply with the appropriate Nigerian Standard Specifications:

(i) Hard-drawn copper or cadmium-copper conductors,
(ii) Hard-drawn aluminum and steel-cored aluminum conductors,
(iii) Aluminum-alloy conductors,
(iv) Insulated conductors for overhead power lines.

(5) Every flexible cable and flexible cord for use at low and medium voltages shall be selected from one of the following types and shall comply with the appropriate Nigerian Standard Specifications so far as this is applicable.

This regulation does not apply to a flexible cord forming part of a portable appliance or light fitting where the appliance or light fitting as a whole is the subject of and complies with Nigerian Standard Specifications, or to special flexible cables and flexible cords for combined power and telecommunication wiring –

(i) insulated flexible cords,
(ii) rubber insulated flexible cables,
(iii) P.V.C. insulated flexible cables (non-Armoured),
(iv) Braided traveling cable for lifts,
(v) Rubber-insulated flexible trailing cables for quarries and miscellaneous mines. Such rubber insulated flexible cables and flexible cords, may incorporate a flexible armour of galvanized steel or phosphor-bronze, or a screen of tinned copper-wire braid.

(6) All cables, including flexible cables and flexible cords, for use at extra-low voltage shall have adequate insulation, and further protection if necessary, to ensure that they do not cause risk of fire.

34. Choice of type installation

(1) The type of installation and protective covering if any, of every cable for fixed wiring shall be selected so as to allow compliance with the requirements of this Section as to precaution against mechanical damage by heat fire or explosion, and damp and corrosion.

(2) Cables insulated and/or sheathed with general-purpose p.v.c. shall not be installed in refrigerated spaces or other situations where the temperature is considered consistently below $0^{o}C$.

(3) Single-core cables armoured with steel wire or tape shall not be used for a.c.

(4) Every flexible cable and flexible cord shall be selected from one of the following types –

(i) braided circular,

(ii) un-kinkable,

(iii) circular sheathed,

(iv) flat-twin sheathed,

(v) braided circular twin and three-core, insulated with glass fiber; provided that these types shall be used only in dry situations for light fitting or for other applications where the cord is not subject to abrasion or undue flexing.

(5) Flexible cables and flexible cords, where they are exposed to risk of mechanical damage, shall as a minimum be of a type sheathed with rubber or p.v.c. and where necessary shall also be armoured.

(6) Flexible cables and flexible cords which in normal use are exposed to risk of contact with water shall be of a type sheathed with rubber or p.v.c.

(7) Where flexible cables or flexible cords are exposed risk 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 p.v.c., h.o.f.r. or oil resisting and flame retardant sheath.

35. Voltage rating and conductor sizes

The voltage rating of every cable shall be not less the decleared or nominal voltage of the circuit.

36. (1) The size of every bare conductor or cable conductor shall be such that its current rating as stated in Table 15-33 and or the Preface thereto, after the application of any factors appropriate to the type of cable, the conditions of installation, and the class of excess-current protection provided it is not less than the maximum sustained current which will normally flow through it. This regulation does not apply to certain conductors on switchboards.

(2) No cable having a conductor of nominal sectional area less than $1mm^2$ and no flexible cord having a conductor of nominal section area less than $0.75mm^2$ shall be used

(3) Service mains shall be stranded, and shall have a carrying capacity not less than the maximum demand of the installation, but in no case shall they be smaller than $6mm^2$.

37. (1) Where the maximum demand is not readily ascertainable it shall be assessed as follows –

Lighting	Two-thirds of connected load.
Heating (including cooking and cooling)	Three-quarter of connected load.
Power:	
One motor	Total connected load.
Two motors	Three-quarters of connected load.
Exceeding two and not	

exceeding five motors Two-thirds of connected load.

Exceeding five motors One-half of connected load.

(2) Where electrical energy is used for more than one purpose the maximum demand shall be assessed by adding together the figures obtained from the above calculations.

(3) The earthing-lead shall be stranded cable or flat copper, the latter not less than 19mm wide by 3mm. No conductor of a cross-sectional area less than $6mm^2$ shall be used as an earthing lead.

38. (1) Every conductor used as earth continuity conductors shall have cross-sectional area of not less than the cross-sectional area of the largest live conductor but in any case not less than $1.5mm^2$

(2) Cables connected in parallel shall be of the same type, size and length, to ensure proper division of the current.

(3) The size of every bare conductor or cable conductor shall be such that the drop in voltage from the consumer's terminals to any point in the installation does not exceed 2.5 % of the declared or nominal voltage when the conductors are carrying the full load current, but disregarding starting conditions. This requirement shall not apply to wiring fed from an extra-low voltage secondary of a transformer.

(4) Where allowance is made for diversity, it may be taken into account in calculating voltage drop.

General installation

39. Protection against damages

(1) All conductors and cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of service.

(2) Where cables pass through holes in metalwork, precautions shall be taken to prevent abrasion of the cables on any sharp edges.

(3) Non-sheathed cables shall be protected by enclosure in conduit, duct or trunking.

(4) Cables shall not be run in a lift (or hoist) shaft unless they form a part of the lift installation. Cables of lift installations, other than traveling cables, in such a shaft shall be:

(i) armoured, or

(ii) mineral-insulated, metal-sheathed, or

(iii) of a type having a h.o.f.r. or oil-resisting and flame-retardant shaft, or

(iv) enclosed in metal conduit, duct or trunking, high impact rigid p.v.c. conduit, or otherwise effectively protected against mechanical damage.

40. Bending and supports

The internal radius of every bend in a cable shall be not less than the appropriate value stated in Table 4.

41. Every cable installed in or on a building shall be supported by one of the methods described below and supports shall be so arranged that there is no appropriate mechanical strain on any cable termination.

i. for non-sheathed cable, installation in conduit without further fixing of the cables, provided, that precautions are taken against undue compression of the installation at the top of any vertical runs exceeding 5m in length,

ii. for non-sheathed cables, installation in trunking without further fixing of the cables provided, that vertical runs shall not exceed 5m in length without intermediate support,

iii. for sheathed and/or armoured cables installed in accessible positions, supported by clips at appropriate spacings,

iv. for cables of any type, resting without fixing in horizontal runs of ducts or trunking,

v. for sheathed and/or armoured cables installed in horizontal runs which are inaccessible and unlikely to be disturbed, resting without fixing on part of a building provided that the surface is dry and reasonably smooth,

vi. for sheathed-and-armoured cables in vertical runs which are inaccessible and unlikely to be disturbed, support at the top of the run by a clip and a round support of a radius not less than the appropriate valued stated in Table 4,

vii. for sheathed cables without armour in vertical runs which are inaccessible and unlikely to be disturbed, support by the method described in item (vi) above; provided that the length of run without intermediate support shall not exceed 2m for a lead/sheathed cable or 5m for a rubber or p.v.c. sheathed cable,

viii. for rubber or p.v.c. sheathed cables, installation in conduit without further fixing of the cables, provided that any vertical shall be in conduit of suitable size and shall not exceed 5m in length;

ix. for rubber or p.v.c. sheathed cables installed as surface wiring, clips shall be spaced at intervals not exceeding 200mm,

x. support by a catenary wire incorporated in the cable during manufacture, provided that the spacings between supports shall not exceed those stated by the manufacturer,

xi. for flexible cords used as pendants, attachment to a ceiling rose similar accessory by the cord-grip or other method of strain relief provided in the accessory,

xii. for cables of the types described in items (i) and (iii) of Regulation 39(4) in lift shafts, support by clip at spacings not exceeding 1m.

42. Protection against heat

Every cable shall be so selected and installed as to be suitable for operation under such ambient temperatures of its surroundings as are likely to occur, which shall not exceed the appropriate value stated by the manufacturer, account being taken of any transfer of heat from any accessory, appliance (e.g. immersion heater or other appliance) or lighting fitting to which cable or flexible cord is connected.

43. Flammable and explosive locations

If it is necessary to install cables in a situation where flammable and/or explosive, dust, flammable volatile liquid or vapour or gas is likely to be present, or where explosive materials are handled or stored, one or more of the following types of wiring systems shall be used. This

regulation does not apply to cables of intrinsically-safe circuits; nor does it normally apply to adequately ventilated battery rooms or garages –

i. cables in solid-drawn or seam-welded conduit,
ii. lead-sheathed, steel-armoured cable,
iii. mineral insulated cable or copper-sheathed cable,
iv. armoured p.v.c. insulated cable having an overall extruded covering of p.v.c. provided that this type shall not be buried direct in ground which may be contaminated by flammable volatile liquid.

44. Where cables, conduits, ducts or trunking pass through floors, walls, partitions or ceilings, the surrounding hole shall be made good with cement or similar fire-resisting material to the full thickness of the floor, wall, etc. and space through which fire or smoke might spread shall not be left around the cable, conduit, duct or trunking. In addition, where cables, conduits or conductors are installed in channels, ducts, trunking, or shafts which pass through floors, walls, partitions or ceilings, suitable internal fire-resisting barriers shall be provided to prevent the spread of fire.

45. Damp and corrosive situations

(1) Every cable shall be installed where it will not be exposed to rain, dripping water, condensed water, accumulations of water or oil, or corrosive substance; or shall be of a type designed to withstand such explosive.

(2) In damp situations and wherever they are exposed to the weather all metal sheaths and armour of cables, metal conduit, duct, or trunking, and clips and their fixings, shall be of corrosion-resisting material or finish and shall not be placed in contact with other metals with which they are liable to set up electrolytic action; conduit, if of steel shall be galvanized heavy-gauge. This regulation does not normally apply to conduit buried in plaster.

46. (1) Armoured p.v.c. insulated cables and mineral-insulated metal-sheathed cables installed in damp situations or in concrete ducts or wherever exposed to the weather or other risk of corrosion, shall be of a type having an overall extruded covering of p.v.c.

(2) Aluminum-sheathed cables installed in underground pipes or in concrete ducts shall be provided with a corrosion-resistant finish.

47. Segregation of circuits

Where an installation comprises extra low-voltage or telecommunication or fire-alarm circuits, as well as circuits operating at low voltage and connected directly to a mains supply system, precautions shall be taken, to prevent electrical contact between the cables of the various types of circuit.

48. (1) Types of circuit described in these Regulations are divided into categories as follows:

(a) Category I circuits: circuits (other than fire alarm circuits) operating at low voltage and supplied directly from a mains supply system.
(b) Category II circuits: with the exception of fire-alarm circuits, all extra low-voltage circuits; and telecommunication circuits (e.g. radio, telephone, sound-distribution, burglar-alarm, bell and call circuits) which are not supplied directly from a mains supply system.
(c) Category III circuits: fire-alarm circuits.

(2) Cables of Category I circuits shall not be drawn into the same conduit or duct as cables of Category II circuits, unless the latter cables are insulated in accordance with the requirements of these Regulations for the highest voltage present in the Category I circuits.

(3) Cables of Category I circuits shall not in any circumstance be drawn into the same conduit or duct as cables of Category III circuits.

49. A. (1) where a common channel or trunking is used to contain cables of Category I circuits, and Category II circuits, all cables connected to Category I circuits, shall be effectually partitioned from the cables of the Category II circuits, or alternatively the latter cables shall be insulated in accordance with the requirements of these Regulations for the highest voltage present in the Category I circuits. Where a common channel or trunking is used to contain cables of Category I and Category III circuits, the two Categories of circuits shall be separated by continuous partitions of fire-resisting material; provided that this requirement shall not apply where the Category III circuits are wired in mineral-insulated metal-sheathed cable.

(2) In conduit, duct, or trunking systems, where controls or outlets for Category I and Category II circuits are mounted in or on common boxes, switch-plates or blocks, the cables and connections and the two Categories of circuits shall be partitioned by means of rigid fixed screens or barriers. At any common outlets in a trunking system for Category I and Category III circuits, the two categories of circuits shall be separated by continuous partitions of fire resisting material.

(3) Where cores of Category I and Category II circuits are contained in a common multi-core cable, flexible cable or flexible cord, the cores of the Category II circuits shall be insulated individually or collectively as a group, in accordance with the requirements of these Regulations, for the highest voltage present in the Category I circuits, or alternatively shall be separated from the cores of the Category I circuits by an earthed metal braid of equivalent current-carrying capacity to that of the cores of the Category I circuits. Where terminations of the two categories of circuits are mounted in or on common boxes, switch-plates or blocks, they shall be partitioned in accordance with Regulations or alternatively be mounted on separated and distinct terminal blocks adequately marked to indicate their functions

(4) Cores of Category I and Category III circuits shall not in any circumstances be contained in a common multi-core cable, flexible cable or flexible cord.

(5) Metal sheaths and armour of all cables operating at low voltage, and metal conduits, ducts and trunking and bare earth-continuity conductors associated with such cables; which might otherwise come into fortuitous contact with other fixed metalwork shall be either effectually segregated therefrom, or effectually bonded thereto so as to prevent appreciable voltage differences at such possible points of contact. Electrical services shall not be installed in the same conduit or trunking as pipes or tubes of non-electrical services e.g. air, gas, oil or water.

B. Identification of conductors

(1) Every non-flexible single-core and every core of a win or multi-core cable for use as fixed wiring shall be identifiable at its terminations and preferably throughout its length, by the appropriate method described in items (i) to (v) below

This regulation does not apply to special cables designed for heating –

(a) for rubber and p.v.c. insulated cables, the use of core colours in accordance with the requirements of Table 5A of the Schedule 1 or the application at termination of sleeves or discs of the appropriate colours prescribed in the Table.

(b) for armoured p.v.c. insulated cables as an alternative to the method described in items (a) above, the use of numbered cores; provided that the numbers 1, 2 and 3 shall signify live conductors, the number 0 the neutral conductor, and the number 4 the fifth (special-purpose) core, if any;

(c) for paper-insulated cables, the use of numbered cores, provided that the numbers 1, 2 and 3 shall signify live conductors, the number 0 the neutral conductor, and the number 4 the fifth (special-purpose) core, if any

(d) for mineral-insulated cables, the application at terminations of sleeves or discs of the appropriate colours prescribed in Table 5A Schedule 1.

(2) Bare conductors shall be made identifiable where necessary by the application of sleeves or discs of the appropriate colours prescribed in Table 5A Schedule 1 or by painting with those colours.

(3) Any scheme of colouring used in a consumer's installation to identify switchboard bus-bars or poles shall comply with the requirements of Table 5A so far as these are applicable.

(4) The cores of every flexible cable including a flexible cord, shall be coloured throughout in accordance with the requirements of Table 5B Schedule 1. The colour combination, green and yellow is reserved exclusively for identification of earthing conductors and shall not be used for any other purpose. This regulation does not apply to p.v.c. installed parallel-twin non-sheathed flexible cords.

(5) Flexible cables or flexible cords having the following core colours shall not be used; green alone; yellow allow alone; or any bicolour other than the colour combination green-and-yellow mentioned in Regulation 49(4).

50. Terminations

(1) All terminations of cable conductors and bare conductors shall be mechanically and electrically sound.

(2) Every connection at a cable termination shall be made by means of a terminal, soldering socket, or compression-type socket; shall securely contain and anchor all the wires of the conductor, and shall not impose any appreciable mechanical strain on the terminal or socket.

(3) An aluminum conductor shall not be placed in contact with a terminal of brass or other metal having a high copper content, unless the terminal is suitably plated or other suitable precautions are taken to prevent corrosion.

(4) At every cable termination, the insulation shall be removed no further than is necessary for compliance with Regulation 50(2).

(5) At every cable termination, any braid, tape, sheath, or amour over the insulation shall be cut back from the end of the insulation, as may be necessary to prevent undue leakage from live parts of the braid, tape, sheath, or armour. This regulation does not apply to mineral-insulated cables.

(6) In any situation, the exposed conductor and insulation of cables insulated with impregnated paper shall be protected from ingress of moisture by being suitably sealed.

(7) The ends of mineral-insulated metal-sheathed cables shall be protected from moisture by being suitably sealed and the insulation shall be thoroughly dry before the sealing material applied. Such sealing material, and any material used to insulate the conductors where they emerge from the insulation, shall have adequate insulating and moisture proofing properties, and shall retain these properties through the range of temperatures to which the cable is subjected in service.

(8) Soldering fluxes which remain acidic or corrosive at the completion of the soldering operation shall not be used.

51. (1) Where a non-metallic outlet box of thermoplastic material (e.g. p.v.c) is used for the suspension of, or is in contact with, a light fitting, care shall be taken to ensure that the temperature of the box does not exceed 60^0C. The mass suspended from the box shall not exceed 3 kg.

(2) The termination of cables in a situation where flammable and/or explosive dust, flammable volatile liquid vapour or gas is likely to be present, or where explosive materials are handled or stored, shall be avoided wherever possible Otherwise, terminations shall be enclosed in a flame-proof fitting or alternatively, where methods are employed for avoiding the explosion hazard other than by the use of flame-proof equipment the terminations shall be enclosed in a box suitable for such use.

(3) Cable glands shall securely retain the outer sheath or armour of the cables without damage to these, and where necessary shall incorporate adequate means of maintaining earth continuity between the sheath or armour and the threaded fixing component of the glad.

52. Cable joints

(1) Where joints in cable conducts and bare conductors are necessary they shall be mechanically and electrically sound. Joints in non-flexible cables shall be accessible for inspection provided that this requirement shall not apply to joints in cables buried underground, or joints buried or enclosed in non-combustible building material so that no danger can arise. Joints in non-flexible cables shall be made by soldering, brazing, welding, or mechanical clamps, or be of the compression type; provided that mechanical clamps shall not be used for, inaccessible joints buried or enclosed in the building structure. All mechanical clamps and compression-type sockets shall securely retain all the wires of the conductors.

(2) Every joint in a cable shall be provided with insulation not less effective than that of the cable cores and shall be protected against moisture and against mechanical damage. Soldering flues which remain acidic or corrosive at completion of soldering operation shall not be used.

(3) For joints in paper-insulated metal-sheathed cables, a wiped metal sleeve or joints box, filled with insulating compound, shall be provided.

Wiring systems

53. (1) Bare or lightly-insulated conductors may be insulted in building for the following purposes only-

i. earth continuity conductors, earthing leads;
ii. the external conductors of earthed concentric wiring systems;
iii. conductors extra-low voltage systems;
iv. protected rising-main and bus-bar systems;

v. collector wires for travelling cranes or trolleys or for similar purposes.

(2) Bare or lightly-insulated conductors of extra-low voltage systems shall have adequate insulators, and further protection where necessary, to ensure that they do not cause risk of fire.

54. (1) Where bare conductors are used for rising-main and bus-bar systems operating at low voltage, they shall

(a) be so installed that they are inaccessible to un-authoried persons and either be totally enclosed in earthed metal or fixed in a channel, trunking, or shaft specially provided for the purpose; and

(b) be of adequate strength to withstand the electro-mechanical forces that may be set up by prospective short-circuit current; and

(c) be free to expand and contract, as the temperature changes, without detriment to themselves or to any other part of the installation; and

(d) Where they pass through floors, walls, partitions, or ceilings, they shall pass through directly and be protected by enclosure in non-absorbent, non-combustible insulating material, unless earth metal trunking is used.

(2) Bare collector wires of the type described in item (v) of Regulation 53(1) which are necessarily exposed in normal service shall be efficiently protected accidental contact by screens or barriers or by adequate clearance. At each strain position for such wires, suitable straining gear fitted with double insulators shall be provided.

55. Metal sheathed and armoured cables

All metal sheaths and armour of cables and associated accessories shall be earthed in accordance with these Regulations. Where non-metal joints boxes are used with metal-sheath and, or armoured cables, the continuity shall be maintained by a metal bonding strip or similar means having a resistance not higher than that of an equivalent length of metal cable sheath or, (for armoured non-mental sheathed cables), the armour of the largest cable entering the box.

56. Paper insulated cables

Paper insulated cables shall be of a non-draining type which will comply with appropriate Nigerian standard, where migration of the impregnating compound would otherwise be liable to occur.

57. Conduits systems

(1) The conduits for each shall be completely erected before any cable is drawn in. This requirement does not apply to prefabricated flexible conduit systems which are not wired *in-situ*.

(2) Conduits shall be securely fixed, and where they are liable to mechanical damage they shall be adequately protected.

(3) Inspection type conduit fittings such as inspection boxes, draw boxes, bends, elbows, and toes, shall be so installed that they can remain accessible for such purposes as the withdrawal of existing cables or the installing of additional cables.

58. The number of single core rubber insulated, braided and compounded cable, of p.v.c. insulated non-sheathed cables run in one conduit shall be such as to permit of easy drawing in. The number of cables drawn in shall not be greater than the appropriate number given in Table 6 or Table 7 of schedule I as applicable. For types of cables having large overall diameters than

those shown in the Table, appropriate reduction shall be made in the number of cable drawn in. For groups of cables other than those provided in Table 6 and 7, the number and sizes of the cables installed shall be such that a space factor of 40% is not exceeded. The numbers stated in the tables; and the space factor of 40% relate to conduit runs incorporating not more than two 90^0 bends or radius not less than that specified for normal bends or for runs having more bends than this or having opposing adjacent bends for runs containing additional sets or other restrictions, appropriate reduction shall be made in the number of cables installed.

59. (1) The use of solid (non-inspection) conduit, elbows or tees shall be restricted to –

(a) locations at the ends of conduits immediately behind a light fitting outlet box or accessory of the inspection type; or

(b) one solid elbow located at a position not more than 500mm from a readily accessible outlet point provided that all other bends in the conduit run are not more than the equivalent of one right angle.

(2) Ends of lengths of conduits shall be so reamed and where they terminate at boxes, trunking and accessories not fitted with spout entries, shall be so bushed, as to obviate abrasion of cables.

(3) Substantial boxes of ample capacity shall be provided at every junction involving a cable connection in a conduit system. Where non-metallic conduits used, and where metal conduits are terminated, boxes may be of non-absorbent, non-flammable material other than metal. All unused conduit entries shall be blanked off, and all removable covers firmly secured to provide complete enclosure.

(4) Conduit systems not intended to be gas-tight shall be self-ventilating, and drainage outlets shall be provided at any points in the installation where condensed moisture might otherwise collect.

60. Metal conduit: special requirement

(1) Metal conduits and fittings for use in wiring systems shall comply with Nigerian Standard Specifications for rigid steel conduits and fittings; for flexible steel conduits and adaptors and for aluminum or zinc-base-alloy conduits and fittings as appropriate. Where steel pipes are used as conduits, they shall comply with appropriate Nigerian Standard Specifications and shall have a corrosion-resistant finish inside and outside.

(2) Metal conduits systems shall be earthed. All join shall be made mechanically and electrically continuous by screwing or by substantial mechanical clamps, or by inserts but plain slip or pin-grip sockets shall not be used.

(3) For the purposes of these Regulations flexible steel conduits having an outer sheath of insulation material (e.g., p. v. c.) shall be deemed to be metal conduits.

(4) Cables of a. c. circuit installed in steel conduit shall always be so bunched that the cable of all phases and the neutral conductor (if any) are contained in the same conduit.

61. Non-metal conduit: special requirement

(1) Rigid non-metallic conductors and fittings for use there-with shall comply with relevant Nigerian Standard Specifications as appropriate.

(2) Non-metallic systems shall be used only where it is ensured that they are suitable for the extremes of ambient temperatures to which they are likely to be subject in service, and where used, earth continuity conductor shall be installed throughout the system.

(3)The method of support for rigid p. v. c. conduit shall allow for the longitudinal expansion and contraction of the conduits which may occur with variation of temperature under normal operating conditions.

(4) For the purposes of these Regulations, conduits comprising metal parts having an inner and outer covering of insulating materials are deemed to be non-metallic conduits, provided that effective precautions are taken to prevent the metal parts of the conduits at their ends from coming into contact with any other metal parts.

62. (1) Flexible metal conduit and fittings shall comply in all respects with relevant Nigerian Standard Specifications. Flexible non-metallic conduit shall comply with relevant Nigerian Standard Specifications and fittings for use therewith shall also comply with the relevant Nigerian Standard Specifications.

(2) *(a)* Flexible metal conduit shall not be used as the sole means of providing earth-continuity, and earth-continuity conductor complying with the requirements of Nigerian Standard Specifications shall be provided for every part of a system formed by such conduit.

(b) Where necessary, flexible conduit shall be adequately supported.

63. Pre-fabricated, duct and trunking systems

(1) In the prefabrication of conduit systems which are not to be wired in-situ, adequate allowance shall be made for variations in building dimensions so that the conduits or cables are not subjected to tension or other strain during installation. Adequate precautions shall also be taken against damage so such systems during installation and any subsequent building operations, especially against deformation of the conduits and damage to any exposed cable ends.

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

(3) Trunking shall be constructed of metal or non-combustible insulating material.

(4) Cables of a.c. circuits installed in steel ducts or trunking shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same duct or trunking.

(5) Every entry to finished ducts or trunking shall be so placed as to prevent the ingress of water, or be protected against such ingress. All removable covers shall be securely fixed after wiring is completed.

(6) Every outlet for cables from a duct system, every joint in such a system, and every joint between such a system and another type of duct or conduit, shall be so formed that the joints are mechanically sound and that the cables drawn in are not liable to suffer abrasion.

(7) Every bend formed in a concrete duct (whether or not formed by channels or formers retained in position after the concrete has set) shall be of an inner radius not less than four times the diameter of the completed duct.

(8) Ducts cast *in situ* in concrete, by means of a suitable form laid before the concrete is poured, into which cables are to be drawn (whether or not former are retained in position after

the concrete has set) shall be so formed that the radial thickness of concrete or screed surrounding the cross-section of the completed duct is not less than 15mm at every point. Where all or any part of the completed duct is formed by the concrete or the screed rubber-insulated, braided and compound cables, non-sheathed p.v.c.-insulated cables are installed in this type of duct and there is a risk that the duct may become damp, the cable shall be of a type having overall extruded covering of p.v.c.

(9) The number of cables to be installed in ducts shall as will permit easy drawing-in without damage to the cables and shall be such that a space factor of 35% is not exceeded. This space factor relates to runs of ducts incorporating not more than two 90^{o} bends or the equivalent; for runs having more bends than this, appropriate reduction shall be made in the number of cables installed.

(10) The number of cables to be installed in trunking or channels shall such that a space factor of 45% is not exceeded.

64. Flexible cords and cables: special requirements

(1) Flexible cables or flexible cords shall be used for all connections to movable apparatus. For the purposes of this regulation, an electric cooker of rated input exceeding 3kW is deemed not to be movable.

(2) Where armoured flexible cables and flexible cords are used, the armouring shall not be used as the sole means of providing earth continuity conductor shall be provided.

(3) Flexible cables and flexible cords shall not be used as fixed wiring unless contained in earthed metal or other non-combustible and mechanically strong enclosure; provided that this requirement shall not apply to short lengths of sheathed flexible cable or flexible cord used for final connections to fixed apparatus or of connection of control of gear of fluorescent lamps or discharge lamps. Non-sheathed flexible cables and flexible cords shall not be drawn into conduits or ducts.

65. (1) Exposed lengths of flexible cables cord used for final connections to fixed apparatus shall be as short as possible and connected to the fixed wiring by one of the following means–

i. a plug and socket-outlet; or
ii. a fused spur-box having suitable provision for the entry of the flexible cable or flexible cord; or
iii. a switch forming the means of local control of the apparatus; or
iv. a suitable joint box

(2) Where a twin flexible cord supports, or partly supports, a light fitting, the maximum mass supported by the cord shall not exceed the appropriate value indicated below–

Nominal cross-sectional area of conductor $(mm)^2$	Maximum mass (kg)
0.75	3
1.0	5

(3) No flexible extension shall be taken more than 2m across a ceiling to a drop-light. Such flexible extensions shall be supported by an insulated hook fixed to the ceiling.

66. Earthed concentric wiring

(1) Earthed concentric wiring may be used only after approval has been given by-

(a) The Electricity Supply Authority where the supply is obtained from an electric power Board or other public body.

(b) The Director of Electrical Inspectorate services in any other case.

(2) The use of earthed concentric wiring shall in all cases be subject to the following conditions-

i. When the supply is derived from the supply Authority's main it shall be taken from the secondary side of the transformers or converter so arranged that the public supply system is electrically insulated therefrom.

ii. Every earthed concentric installation shall be so arranged that the internal conductor is protected by a single –pole circuit-breaker or switch and fuse placed in a position easily accessible to the consumer and situated as near as possible to–

(a) The point or points of entry of the service main or to the secondary of the transformer, in case of a public supply; or

(b) The generator in any case.

67. Earthed concentric installations

(1) When the supply is direct current the external conductor shall always be the one nearest to earth potential and shall, where possible be negative to the inner conductor; and the difference of potential between ant two points in the external conductor shall not exceed.

(a) Seven volts if the internal conductor is connected to the positive pole of the system; or

(b) One and a half volts if the internal conductor is connected to the negative pole of the system.

(2) From the position or positions at which the installation is earthed, concentric wiring shall be employed throughout up to all fixed positions for fittings or accessories. At all positions where the external conductor ceases to surround the internal conductor the latter shall be separated from the surface upon which the fitting or accessory is mounted by an in-corrodible metal plate or terminal box to which the external conductor is electrically connected. This requirement does not preclude the interposition of wooden block between the metal plate and the fitting or accessory mounted thereon, provided that this metal plate covers the principal recessed in the wooden block.

(3) Where the sheathing of a cable is used as one conductor, the resistance of the sheathing shall not be greater than that of the inner conductor when measured at a temperature of 20^0C.

(4) Joints in the external conductor, however made, shall be of such a nature that the conductivity of the conductor is not reduced.

(5) All circuits, lamps, and appliances shall be controlled and protected by single-pole circuit-breakers, or switches and fuses, which shall be inserted in the internal conductor if the circuit. No circuit-breaker, switch, or fuse, shall be included in the external conductor.

(6) Ordinary accessories may be used, but if lamp-holders having central contacts are employed, such central contacts shall be connected to the internal conductor.

(7) Lamp fittings, may be wired with two separated wires, one being insulated and connected to the internal conductor and the other to the metal work of the fitting.

(8) Twin flexible cords may be used between fixed points and portable or pendant fittings. If such flexible cords terminate in plug-and-socket connections, these connections shall be of either the concentric or the two-pin polarized type.

68. Consumers wiring between buildings

(1) Consumer's wiring intended for operation at low voltage and installed underground for distribution between a building and point of utilization not attached thereto (e.g. another building), shall be in the form of one or more of the following systems, using the types of cable indicated-

In ducts

(i) metal-sheathed and served cable or

(ii) general-insulated, metal-sheathed cable having an overall extruded covering of p.v.c or

(iii) armoured p.v.c insulated cable having an overall extrude covering of p.v.c or

(iv) p.v.c. insulated, p.v.c. sheathed cable or rubber-insulated cable having an oil-resisting and flame-retardant or h.o.f.r. sheath.

In conduits or pipes

(2) *(a)* p.v.c. insulated, p.v.c sheathed cable, or rubber-insulated cable having an oil-resisting and flame-retardant or h.o.f.r. sheath in adequately protected heavy-gauge steel conduit or galvanized steel pipe, provided that the conduit or pipe shall not be used as an earth-continuity conductor, or

(b) p.v.c. insulated sheathed cable or rubber-insulated cable having an oil-resisting and flame-retardant or h.o.f.r. sheath in non metallic conduit.

Laid Direct In the Ground

(3) *(a)* metal-sheathed, armoured and served underground cable, or

(b) armoured p.v.c. insulated cable having overall extruded covering of p.v.c., or

(c) metal-sheathed and served underground cable, or mineral insulated copper-sheathed cable having an overall extruded covering of p.v.c. with mechanical protection by cable cover except where installed under a permanent surface.

69. Consumer's wiring intended for operation at low voltage and installed on exterior surface walls, boundary walls and the like for distribution between a building and a point of utilization not attached thereto (e.g. another building), shall be in the form of one or more of the following systems. Such wiring shall not be installed on fences.

(i) Heavy-gauge hot-dipped galvanized steel conduit (see Appendix 2) or steel pipe systems complying with Regulations 60(1) – (4),

(ii) Mineral-insulated, metal-sheathed cable, preferably having an overall covering of p.v.c preferably black in colour.

(iii) Armoured and served cables or preferably, armoured cables having an overall covering of p.v.c. or an oil-resisting and flame-retardant or h.o.f.r. sheathed overall preferably black in colour.

(iv) Lead-sheathed cables;

(v) insulating cables having a p.v.c. sheath preferably black in colour, or high impact rigid p.v.c. conduit, preferably black in colour

70. Consumer's overhead wiring intended for operation at low voltage and for distribution between a building and a point of utilization not attached thereto (e.g. another building), shall be in the form of one or more of the following systems using the types of cable or conductor indicated. Lengths of span shall not exceed, and heights above ground shall be not less than, the appropriate values indicated in Table 8 Schedule 1–

(i) p.c.v. insulated, p.v.c. sheathed cable, or rubber-insulated cable having an oil-resisting and flame-retardant or h.o.f.r. sheath referable black in colour, without intermediate support; provided that the terminal supports shall be so arranged that no undue strain is placed upon the conductors or insulation of the cable, and provided that adequate precautions are taken against any risk of chafing of the cable sheath,

(ii) P.v.c. insulated, p.v.c. sheathed cable, or rubber-insulated cable having an oil-resisting and flame-retardant or h.o.f.r. sheath, installed in heavy-gauge hot-dipped galvanized steel conduit without intermediate support: provided that the conduit shall be earthed in accordance with part XI and shall be securely fixed at the ends of the span, shall not be jointed in its span

(iii) P.v.c covered overhead line conductors of hard-drawn copper, hard-drawn cadmium copper, hard-aluminum, steel cored aluminum, aluminum alloy, installed on insulators without intermediate support: provided that no part of the span shall be accessible to any person from any building or other place without the use of a ladder or other special device,

(iv) Cables having a sheath of p.v.c. or lead, or an oil-resisting and flame-retardant or h.o.f.r. sheathed preferably supported by a catenary wire,

(v) Special aerial cable incorporating a catenary wire,

(vi) Bare or p.v.c. covered overhead lines having conductors of hard-drawn copper, hard-drawn cadmium copper, hard-aluminum or steel-cored aluminum or aluminum alloy.

71. A. Collector and trolley cables

(1) Bare conductors may be used as collector or trolley wires for travelling cranes and similar appliances and for battery connections.

(2) They shall be supported upon insulators, and so spaced that risk of accidental contact between the conductors themselves or between conductors and walls or any other conducting structure is reduced to a minimum.

(3) The circuit supplying current to such bare conductors shall, except in the case of the regulating cells of batteries, be protected either by a suitable circuit-breaker or by a suitable switch and fuse.

(4) Bare conductors extended to positions liable to lightening-discharge shall be fitted with lightening-arrestors on each pole or phase.

(5) Wall rosettes or brackets used as supports for span-wires shall not be fixed within 300mm of any gas-pipe.

(6) Except as herein before specified, bare conductors shall be used only in positions not ordinarily accessible to unauthorized persons and in such circumstances as my be sanctioned by the authorized inspector.

71B. Cables which are used in connection with the electric bells telephone and signaling apparatus, etc., in a building shall be kept away from and not be installed in the same casing or conduit as the cables used for distribution of the electrical supply throughout the building.

72. Bell and signaling circuits (except telephone circuits) may be operated from the electric lighting, heating, or power supply mains, provided that they are connected to the secondary side of double-wound transformers, having a secondary voltage twelve volts, and further provided that-

(i) Each transformer is mounted on the main switch-board,

(ii) Each transformer is protected on the primary side by a single-pole switch and fuse, and one side of the secondary winding is earthed,

(iii) The conductors when un-enclosed are secured individually by means of insulated stapes, and where subject to mechanical injury the conductors are adequately protected,

(iv) Joints in the conductors are, as far as practicable, avoided, but where they are unavoidable they are staggered, soldered and efficiently insulated,

(v) The conductors are insulated with vulcanized rubber/p.v.c. save that ordinary bell-wire may be used if the transformers are of a capacity not exceeding fifty watts and so designed that on sustained short circuit their impedance is such as to limit the current to such a value as will not burn out the transformer.

73. The control-circuit wiring and accessories in wiring systems having extra-low voltage control shall comply with the following requirements–

(i) Remote controlled switches shall have their live parts enclosed in non-combustible and non-absorbent cases. They shall be fixed in full view in readily accessible positions. The insulation resistance between the supply terminals and the control terminals of the switch shall be not less than 100 Mega ohms;

(ii) All control wiring shall be run entirely apart from the supply wiring;

(iii) The voltage of the control circuit shall not exceed twelve volts. Transformers shall be double-wound with one side of the secondary earthed and shall be mounted on the switch or distribution board, and be controlled by a switch and fuse on the primary side;

(iv) where subject to mechanical injury conductors shall be protected. When un-enclosed they shall be secured with clips having rounded edges or insulated staples. But two or more conductors shall not be secured under the same staple,

(v) Between roof and ceiling, conductors may be fastened to the sides of joists or battens-without further protection. Where buried in plaster or concrete they shall be enclosed in an approved metallic sheathing. All joints shall be accessible, and be efficiently soldered and insulated,

(vi) bushes shall be of substantial mechanical construction. The conductors shall terminal in suitable terminals and be secured by a metal thread screw. Heating circuits shall not be controlled by this system unless fitted with an indicating device.

74. Hazardous locations

(1) Electric wires, fittings, consuming devices and associated equipment installed in hazardous locations in which explosive or highly inflammable substances are produced, manufactured, refined, stored or packed shall be installed and maintained to comply with the following additional requirement–

(i) All electrical conductors shall be enclosed in an efficiently earthed metallic envelope so constructed that in the event of the ignition of an inflammable or explosive material within the metallic envelope, there will be no transmission of flame to the atmosphere surrounding it,

(ii) Each consuming device shall be provided with automatic protective equipment to cut off the electricity in the event of overload or an electrical fault developing, in addition to means for normally cutting off all power to, or, in the immediate vicinity of the device in the event of danger: provided that this paragraph shall not apply to single lights which form part of a group of lights installed and maintained in conformity with this regulation.

(iii) All current consuming devices including lighting fixtures shall be housed in metallic enclosures certified as flame-proof and the enclosures maintained in such a condition that the validity of the flame- proof certificate is not impaired,

(iv) The attachment of all metallic envelopes enclosing cables to consuming devices shall be such as not to invalidate any flame-proof certificate.

(v) Before effecting maintenance or repairs involving the opening of a flame-proof enclosure, all conductors within the flame-proof enclosure to be worked on shall be made dead and earthed, and on completion of maintenance or repair, the apparatus not made until all openings have been closed restoring flame-proofness.

(2) The provision of this regulation shall not apply solely because of the presence of stationery electrical storage batteries of the electro-chemical type or because of the recharging of portable electric batteries.

75. In this regulation **"certified as flame-proof"** means so certified by the Director of Electrical Inspectorate Services, and equipment shall be deemed to be so certified if it bears a label consisting of the letters FLP enclosed in a crown in out-line together with the relevant number of the certificate. The Director of Electrical Inspectorate Services may be notice in writing in any particular case approve an alternative certification as being an adequate substitute for the requirements of this paragraph.

76. (1) In rooms containing stationary electric storage batteries of the lead-acid or alkaline types, or where corrosive gases or liquids which are not explosive or highly inflammable are present–

(i) The system of wiring employed shall be such that all electrical conductors including earthing connections are enveloped in a corrosion-proof non-metallic sheath;

(ii) Where metallic enclosures are necessary used for motors, switch-gear or other accessories, including conductors which are liable to mechanical damage, all exposed metallic surfaces shall be effectively painted or otherwise coated to resisted corrosion;

(iii) All cables entries to requirement or accessible or accessories shall be such that the non-corrosion sheath of conductors enters the terminal chamber of the equipment accessory and the entry hole or holes are fitted with an accessory to exclude the corrosive liquid or gas present,

(iv) All unused entry holes shall be effectively sealed.

(2) (i) Distribution boards shall not be fixed in freezing or cooling chambers–

(ii) Switches shall not be fixed in freezing or cooling chambers,

(iii) No conductors other than those required for the supply and use of current therein shall be installed in freezing chambers and cool stores.

(3) (i) Cable insulated with rubber shall not be used in situations where the temperature of the conductor would exceed 60^0C for short periods, or 50^0C for long periods

(ii) Cable insulated with paper or fibre shall not be used in situations where the temperature of the conductor would exceed 80^0C;

(iii) Where higher temperatures are liable to be experienced, the wiring shall be in accordance with the requirements of the authorized inspector.

77. All cables shall be installed in such a manner as will not damage or weaken the building unnecessarily and with the least possible cutting-away of any structural work.

PART VIII

Equipment fittings and accessories

78. Construction of fittings

Fittings shall be so designed and constructed that the passages for the insulated conductors are of ample size, and are from rough projections and sharp angle, or bends. All outlets shall have-rounded edges or be bushed.

79. Fittings shall be so designed, and the insulated conductors so installed that no stress can be applied by the conductors to any terminal to which they may be connected.

80. Fittings shall be so designed and fixed that neither dust not moisture can readily accumulate on live parts.

81. Where a hanging fitting exceeds 5kg in weight it shall be supported by a metal chain, tube, or rod, or by several flexible cords in such a manner that the maximum weight to which any cord is subjected shall not be greater than that specified in regulation 67(2).

82. Open-type fittings shall be furnished with inflammable shades unless such shades are kept free from contact with the lamps by suitable guards or supports.

83. Enclosed type fittings shall be provided with a removable glass receptacle arranged to enclose the lamp completely, and of such size or construction as to prevent undue heating of the lamp; and if the position of the fitting be such that the glass receptacle is liable to mechanical damage, the glass shall be protected by a suitable wire guard.

84. Fittings whether fixed or portable, shall, whenever exposed to rain, drip or externally condensed moisture, be of the weather-proof type.

85. Fittings for lamp shall be so designed as to provide for adequate dissipation of heat from such lamps.

86. Enclosed fittings shall be used–

i. In places where inflammable or explosive dust or gas is liable to be present or where inflammable goods are stored, and they shall be of strong construction, having air-tight external globes of thick glass provided with substantial guards.

ii. In positions in which the lamp is either near to or can swing in contact with readily combustible materials.

87. The handle of every hand-lamp (not being a hand-lamp made entirely of metal specified in the last preceding regulation) shall be made treated hard-wood, or of some suitable non-ignitable composite insulating material capable of withstanding round usage in service.

88. Where portable fittings, appliance, or accessories are likely to be used, the voltage between any two points in one room or compartment shall not exceed 250 volts, unless the fittings, appliances or accessories between which there may be a higher voltage are so situated that they cannot be brought with 2 meters of each other, or, alternatively, unless the metal frames and sheathing of all such portable appliances and accessories are earthed.

89. Flexible conductors of portable fittings or apparatus shall be connected through wall plugs.

90. Fittings shall be mounted on a base-block.

91. Accessories other than fuses shall be mounted a base-block unless they are completely enclosed in metallic casing, and where the surface of which it is mounted is liable to become damp the base-block shall be rendered impervious to moisture.

92. Ceiling roses

(1) A ceiling rose shall not be installed in any circuit operating a voltage normally exceeding 250 volts.

(2) A ceiling rose shall be connected to the fixed wiring in such a manner that one of its terminal remains alive when the associated switch is off unless that terminal cannot be touched when the ceiling rose is dismantled to the extent necessary for the replacement of the associated flexible cord.

(3) A ceiling rose shall not be used for the attachment of more than one outgoing flexible cord, unless it is specially designed for multiple pendants.

(4) The earthing terminal of every ceiling rose shall be connected to the earth-continuity conductor of the final sub-circuit.

93. Lamp-holders

Lamp-holders for filament lamps shall normally be used only in circuits operating at a voltage not exceeding 250 volts.

94. Every lamp-holder for a bayonet-cap lamp in any damp situation or in any situation in which it can readily be touched by a person in contact with or standing on earthed metal shall be–

i. Earthed, or

ii. Constructed of, or shrouded in, insulating material and for moulded insulated bayonet, fitted with a protective shield.

95. Where centre-contact bayonet or Edison-type screw lam-holders are connected to a source of supply having an earthed neutral conductor, the outer or screwed contact shall be connected to that conductor. Where such lamp-holders are used in circuits having neither pole connected with earth, or in any damp situation in which they can readily be touched by a person in contact with or standing on earthed metal, they shall be provided with a protective shield of insulating material or shall be place or safe guarded, so that neither the lamp cap nor the outer or screwed contact of the lamp-holder can be inadvertently touched when the lamp cap is engaged with that contact.

96. Where arc lamps are used in positions where danger might otherwise arise, they shall be protected either by a metal reflector rigidly fixed beneath the arch or by a globe or lantern. Wherever noxious fumes are likely to be emitted from such a lamp, suitable ventilation shall be provided.

97. Application of transformers

Where a step-up transformer forms part of a consumer's insulation, a linked switch shall be provided for isolating the transformer from all circuit conductors of the supply.

98. An auto-transformer having an output in the extra-low-voltage range shall not be used to supply–

i. any socket-outer, or
ii. any portable appliance, unless the auto-transformer is contained therein, or
iii. earthed concentric wiring, or
iv. any extra-low-voltage circuit which is outside scope of these Regulations, e.g. an electric bell circuit operating at a voltage not exceeding 15 volts.

99. A step-up auto-transformer shall not be connected to an installation obtaining its supply from a system in which none of the poles of the supply is connected to earth.

100. The common terminal of every auto-transformer winding shall be connected to the neutral conductor.

101. Capacitor

Every capacitor, unless incorporated for the sole purpose of radio interference suppression or directly connected across a motor winding, shall be provided with a means, such as a high-resistance leak, for its prompt automatic discharge immediately the supply is disconnected. This requirement shall not apply to small capacitors where no risk of shock can arise.

102. Plugs, socket-outlets and adaptors

Every plug and socket-outlet shall as a minimum comply with requirements set out in items (i) and (ii) below, and in addition comply with the appropriate requirements of Regulations 103 to 106 and Table 9–

i. It shall not be possible for any pin of the plug to be engaged with any live contact of its associated socket-outlet while any other pin of the plug is completely exposed; provided that this requirement shall not apply to socket-out-lets and plugs for extra-low voltage circuits, and

ii. It shall not be possible for any pin of the plug to be engaged with any live contact of any socket-outlet within the same installation other than the type of socket-outlet for which it is designed.

103. In circuits in which one pole is earthed at the source of supply, every socket-outlet and plug shall be of the non-reversible type, with provisions for earthing.

104. Plug and socket-outlets may be used in two-wire circuits operating at a voltage not exceeding 250 volts for the connection of electric clocks, provided that the plug and socket-outlets are designed specifically for that purpose and that each plug incorporates a fuse of rating not exceeding 3 amperes.

105. Every plug containing a fuse shall be non-reversible and so designed and arranged that no fuse can be connected in an earthed conductor.

106. For two-pole-and-earth circuits, the connection of plugs, socket-outlets and connectors shall be in accordance with Table 10 Schedule 1.

107. Where outlets from a socket adaptor have a lower current rating than that of the input, appropriate fusing shall be provided for each outlet of lower rating. Every socket-outlet adaptor used at a voltage exceeding extra-low voltage shall be non-reversible and shall be so designed that the output contacts are arranged in the same phase or polarity as those of the corresponding socket-outlet adaptors intended for use with electric shaves shall incorporate a fuse of rating not exceeding 3 amperes and shall be marked "FOR SHAVES ONLY"

108. Weather-proof plugs and sockets shall be used whenever exposed to rain drip, or externally condensed moisture.

109. Such accessories shall be of specially robust construction, and be provided with efficient means to keep the sockets weatherproof when the plug is removed therefrom. When a loose cover is employed for this purpose it shall be anchored to the socket by means of a chain.

110. When the plug is inserted in its sockets, the combine fitting and its interlocking switch (if any), shall also be weatherproof.

111. In places where petrol-diver conveyances are stored or repaired, plugs and sockets shall be placed not less than 2 meters above the floor level unless an interlocked plug and gas-tight switch is used.

112. (1) Adaptors for use in lampholders shall be constructed of tough, non-ignitable, non-conducting, non-hygroscopic material other than hardwood.

(2) Adaptors for use in screw holders shall be of one of the following types–

i. Combine adaptor with pull-out plug,

ii. Adaptor with a loose screw to prevent twisting of the flexible conductor.

113A. **Cable couplers and connectors**

Cable couplers and conductors shall be mechanically and electrically sound and grounded either in metal which can be earthed or in non combustible insulating material. Where the apparatus to be connected requires earthing, every cable coupler and connector shall have adequate provision for maintaining earth continuity.

114A. Electric signs

Every electric sign shall comply with the following requirements–

(a) It shall be readily accessible for inspection and attention;

(b) It shall be fire-proof, or alternatively the wiring shall be independent, and shall be controlled by a fuse and switch on each live conductor. When more than switch is required the switched shall be linked;

(c) Where elaborate switching and flashing apparatus is installed, a special non-ignitable enclosure shall be provided;

(d) If fixed in the open air.

i. It shall be weather-proof and lamp-holders shall be weather proof;

ii. Only non-ignitable material shall be used in its construction, except for letters and designs, for which hardwood is permissible.

PART IX

Appliances

113B. heating and cooking appliances

(a) All heating and cooking appliances shall be so constructed and mounted that their supports and those parts which have necessarily to be handle in their operation cannot become heated to a temperature exceeding 55 degrees centigrade. The heating elements shall be of materials durable at the highest temperature to which they attain during use, and be so arranged that they can be readily replaced.

(b) The support and frame of every fixed appliance shall be provided with a suitable terminal to which the earthing lead in this case.

114B. (i) The connection between heating elements shall be effected either by parts of the elements themselves or by material having heat-resisting properties similar to those of the elements;

(ii) the junction between elements and switches or external connecting leads shall be effected without solder by connectors which shall be so placed that the temperature of no part of the switch or terminal connections can rise above 80^0C.

115. All connection between elements or between elements and main terminal shall, unless self-supporting or rigidly fixed in posited, be continuously insulated with suitable non-ignitable material.

116. The hot-plates of all electric cookers shall be iron-clad, and the oven elements shall be so guarded that the cooking utensils cannot be made into contact with them, and so that accidental personal contact cannot be made.

117. (1) Each element shall be protected and controlled by a switch and fuse on the live side.

(2) When a plug-socket is fitted to the appliance it shall have a switch and fuse on the live side, and be so mounted as to secure freedom from electrical hazard. This plug shall have a separate contact connected to earth and any portable apparatus used from this plug shall be earthed in accordance with the requirement of these Regulations.

118. Control

(1) Appliances shall be protected by a fuse on each live conductor

(2) Appliance shall be controlled as a whole by a switch on each live conductor and such switch shall be mounted on the wall adjacent to and within easy reach of such appliance. If more than one switch is so used for any one appliance, all such switches shall be linked.

(3) The wiring to fixed appliances shall be in screwed conduit connected mechanically and electrically to the metal frame of the appliance provided than flexible metallic conduit may be used between the wall and the appliance is connected mechanically to the screwed conduit and the metal frame of the appliance.

(4) For the purpose of this regulation a fixed appliance is one which is obviously intended by size, weight, and construction to be secured in a fixed position.

(5) Heating and cooking appliances shall not be fixed near combustible materials unless the latter are suitably protected.

119. Portable appliances

Portable appliances shall be of such shape or be so weighted that they cannot be easily overturned.

120. Heating points

(1) Heat-points shall each be rated at not less than 1,000 watts, and shall be controlled by a switch of not less than eight amperes capacity. For appliances over 1,800 watts, the heating points shall, except in the case of a multi-earthed neutral system, be controlled by a double-pole switch.

(2) The minimum size of conductor for any heating point shall be $2.5mm^2$

(3) Switches for heating points shall be at a distance not less than 300mm from any switch controlling lighting.

121. Boilers and water heaters-general

Electrode boilers and electrode water-heaters shall be connected to a.c. systems only, and shall be installed in accordance with the general requirements of Regulations 122 to 125 and, according to the type of equipment connected, with the particular requirements of Regulations 127 and 128.

122. The supply to the heater or boiler shall be controlled by a circuit-maker which shall be–

i. Of the multiple linked type arranged to disconnected the supply from all electrode simultaneously, and
ii. So placed with excess-current protective devices in each conductor feeding an electrode, and
iii. so placed that it may easily be operated by the person in charge, and where it is not adjacent to he electrode boiler there shall be a means at hand at the boiler to open the circuit-breaker instantaneously.

123. Adequate means, such as an isolator adjacent to the heater or boiler, or a locking device on the circuit-breaker, shall be provided to prevent the apparatus being made while persons are working thereon.

124. Where the circuit-breaker is remote from the heater or boiler, indicating lamps shall be provided adjacent to or mounted on the boiler, to indicate whether the circuit-breaker is in the “on” or “off” position.

125. The earthing of the heater or boiler shall comply with the requirements for earthing, in addition, the shell of the heater or boiler shall be bonded to the metallic sheath and armour, if any, of the incoming supply cable. The rating of the earthing lead, which shall be connected to the shell of the heater or boiler, shall be not less than that of the largest phase conductor

connected to the apparatus, or, where an earth-leakage protective device is provided, not less than the operating current of than device, subject to a minimum conductor size 2.5mm^2

126. Where an electrode water-heater or electrode boiler is directly connected to a supply at a voltage exceeding low voltage, the installation shall, in addition to complying with the general requirements of Regulations 121-125 include a differential earth-leakage protective device arranged to disconnect the supply from the electrodes on the occurrence of a sustained earth-leakage current in excess of 10% of rated current of the heater or boiler under normal conditions of operation, except that if in any instance a higher value is essential to ensure stability of operation of the heater or boiler, the value may be increased to a maximum of 15%. A time delay may be incorporated in the device to prevent unnecessary operation in the event of unbalance of short duration.

127. Three-phase boilers and water heaters

Where an electrode water-heater or electrode boiler is connected to a three-phase supply, in addition to complying with the general requirements of Regulations 123 to 125, the shell of the heater or boiler shall be connected to the neutral of the supply as well as to the earthing lead. The current rating of the neutral conductor shall be not less than of the largest phase conductor connected to the apparatus.

128. Single-phase boilers and water heaters

Where the supply to an electrode water-heater or electrode boiler is single-phase supply and one electrode is connected to a neutral conductor earthed by the supply authority, in addition to compliance with the general requirements of Regulations 121 to 125, the shell of the water-heater or boiler shall be connected to the neutral of the supply as well as to the earthed lead.

129. Every water heater or boiler having un-insulated heating element immersed in the water shall comply with the requirements of Regulations 130 to 135.

130. The parts of the heater or boiler intended to be connected to the incoming water supply and to the outlet pipe for the heated water, shall be of metal so as to afford the means of earthling required by these Regulations.

131. The heater or boiler when in use shall have an insulation resistance between the element and the metal parts referred to in Regulation 130 above of not less than 0.25 megaohm with water flowing.

132. The heater or boiler shall incorporate an automatic device to prevent a dangerous rise in temperature.

133. All metal parts of the heater or boiler which are in contact with the water (other than current-carrying parts) shall be solidly and metallically connected to a metal water-pipe through which the water supply to the heater or boiler is provided, and the said water-pipe shall be in effective electrical connection with earth by a means independent of the earth-continuity conductor.

134. The heater or boiler shall be provided with an earthling terminal which is in effective electrical connection with all exposed metal parts of the heater or boiler, and this terminal via the earth-continuity conductor of the final sub circuit supplying the heater or boiler.

135. The heater or boiler shall be permanently connected to the electricity supply through a double-pole linked switch which is separate from and within easy reach of the heater or boiler,

and the wiring from the heater or boiler shall be directly connected to that switch without the use of a plug and socket-outlet; and, where the heater or boiler is installed in a room containing a fixed bath, the switch shall in addition be placed outside the room.

PART X

Motors, control gears and lifts

136. Motors shall conform in all respect with Nigerian Standards Specifications

137. Terminals of motors shall be so guarded that they cannot be accidentally touched or short-circuited.

138. Position and safety precautions

Motors shall, whenever possible, be placed in a well ventilated space in which inflammable gases cannot accumulate. Where that is not practicable, the motors shall be of the flame-proof or pipe ventilated type, with inlet and outlet connected to the outside air.

139. Motors shall, wherever possible, be placed in positions in which they are not exposed to risk of mechanical injury or damage from water, steam, oil. Motors necessarily exposed to such conditions shall have suitable types of enclosing frames selected from the standard "specified in Nigerian Standard Specifications".

140. Pipe-ventilated forced-drought, and induced-draught motors shall be supplied with air as cool as possible, and the air-intakes shall be guarded against the admission of dirt or moisture.

141. No unprotected woodwork or other combustible material shall be within a distance of 300mm (measured horizontally) from or within one (1) meter (measured vertically) above any motor, unless such motor be of the totally enclosed, flame-proof, or pipe-ventilated type with inlet and outlet connected to the outer air. A metal plate or tray extending 300mm beyond the base of the machine shall be placed under every open-type machine which is mounted on or over a floor consisting of wood or other combustible materials.

142. Where conductors are run in conduit, or where metal-sheathed cables are used, the conduit or metal sheath, as the case may be, shall terminate in and be properly secured to the motor terminal box; provided that flexible metallic may be used between screwed conduit and the motor terminal box.

143. Trailing cables used in connection with portable motors shall have their protective sheathing terminating in and properly secured to the motor terminal box.

144. Resistances and machine-control gears

(1) The general construction of all resistances and machine-control gear shall be accordance with the appropriate Nigerian Standards Specifications.

(2) All these parts shall be so guarded as to prevent accidental contact therewith.

145. The frame of every resistance and control gear shall be provided with a suitable terminal to which the earthing lead can be connected.

146. Resistances shall be so proportioned and placed that they do not rise to such a temperature as to impair their durability, and they shall be so disposed within their cases that no accessible part of such cases shall rise to a temperature higher than 80^0C.

147. Internal connections, the temperature rise of which may exceed 30^0C shall not be soldered, and all such connections, unless self-supporting or rigidly fixed in position, shall be continuously insulated with non-ignitable material or beads.

148. Suitable terminals with cable sockets shall be provided for the attachment of external leads, and shall be so situated that such leads enter the case below the resistance, and are not exposed at any point to a high temperature.

149. Location of control gears.

(1) All resistance control gear shall, as far as possible, be placed–

(a) In positions in which they will not be exposed to risk of mechanical injury or to damage from water, steam, or oil;

(b) In well-ventilated spaces in which inflammable or explosive gases or dust cannot accumulate.

(2) Where necessarily exposed to such conditions as aforesaid, resistance and control gear shall be completely enclosed; and if liable to be exposed to inflammable or explosive gases or duct, control gear shall be flame-proof.

150. All woodwork or other combustible material which is within distance of 600mm (measured vertically below), or 150mm (measured in any other direction) from the frames or cases containing resistance shall be protected with non-ignitable material.

151. Electric lifts

Every electrically-operated lift shall be operated from a circuit which is independent of the lighting installation.

152. The trailing-cable shall be multi-core, and shall comprise the requisite number of conductors to keep the wiring of the control and each set of safety-devices entirely separate.

153. All cables in the lift or hoist shaft, except trailing-cables, shall be enclosed in screwed metal conduits, the control and motor leads being in separate conduits.

PART XI

Earthing

154. Prevention of danger from earth leakage current

Every item of apparatus and every live conductor shall be effectively prevented, by one of the methods described in items (i) to (iv) below, from giving rise to danger from earth-leakage currents–

(i) enclosure in insulation which is durable and substantially continues, i.e., “all-insulated” construction;

(ii) double insulation;

(iii) earthing of exposed metal parts in accordance with the requirements of this section;

(iv) isolation of metal in such a way that is not liable to come into contact with live parts or with earthed-metal.

155. General provisions

In every installation operating at any voltage, a consumer’s earthing terminal shall be provided adjacent to the consumer’s terminals. Shall be provided and connected to the consumer’s earthing terminal.

156. All metal work of wiring system (other than current-carrying parts), including cable sheathes and armour, conduit, ducts, trunking, boxes, and catenary wires, shall be connected to the appropriate earth-continuity conductors.

157. Exposed metalwork of all apparatus shall be connected to the appropriate earth-continuity conductors.

158. The earthing terminal of every socket-outlet shall be connected to the earth-continuity conductor of the final sub-circuit. Where the earth-continuity conductor is formed by conduit, trunking, duct, or the metal sheath and/or armour of cables, the earthing terminal of each socket-outlet shall be connected by an appropriate conductor to an earthing terminal incorporated in the associated box or other enclosure. For the purpose of this regulation, physical connection of adjacent sections of ducts or trunking is necessary to ensure earth-continuity.

159. At every lighting point with metal fitting, an earthing terminal shall be provided and connected to the earth=continuity conductor of the final sub-circuit.

160. An earthing terminal connected to the earth-continuity conductor of the final sub-circuit shall be provided at every metal lighting switch position unless this takes the form of an earthed metal box having a means of fitting the switch-plane in reliable electrical contact with the box.

161. Metalwork (other than current-carrying parts) and one point of the secondary winding shall be connected to the appropriate earth-continuity conductor, provided that this regulation shall not apply to–

(i) a transformer in which the windings are mounted on separate limbs of an earthed core or are separated by an earthed metallic screen; or
(ii) a double-insulated transformer; or
(iii) the secondary winding of a "high-reactance' transformer serving solely to energise a tesla coil or the heating element of an electric discharge lamp;
(iv) the secondary winding of a transformer in a shaver supply unit; or
(v) a transformer which is an integral part of an item of apparatus, where the apparatus as a whole is the subject of and complies with Nigerian Standards Specification; or
(vi) a transformer used in are welding installations designed in accordance with Nigerian Standards Specification.

162. Isolated metal

(1) Where isolation of metal is adopted for the prevention of dangerous earth-leakage currents, it shall be confined to the following items-

(i) short isolated lengths of metal used for the mechanical protection of cables having a non-metallic sheath, other than over-head spans of conduit between buildings or conduit used for protection of cables in circuits operating at voltages exceeding low voltage in discharge-lighting installations.
(ii) Metal clips used for fixing cables,
(iii) Metal lamp caps,
(iv) small metal parts such as screws or name-plates isolated by insulating material,
(v) metal chains for the suspension of lighting fittings,
(vi) metal lighting fitting using filament lamps installed above a non-conducting floor and so mounted, or so screened in non-conducting material, that they cannot readily be touch by a person standing on or within reach of earthed metal.
(vii) catenary wires where insulated hangers are used

163. Bonding

(1) The consumer's earthing terminal shall be bonded to the metalwork of any public gas services and any water services on the consumer's premises in addition to the connection to the general mass of the earth.

(2) It shall be noted that before the consumer's earthing terminal is bounded to the metalwork of any gas or water service, connection of the earthing terminal to an effective means of earthing should be completed.

164. The bonding connections to any gas or water service shall be made as near as practicable to the point of those services into the premises; provided that where there is an insulating section or insert at that point, the connection shall be made to the metalwork on the consumer's side of that section or insert and, in the case of a gas service on the consumer's side of the gas meter.

165. Copper bonding leads used for compliance with Regulation 163 shall be of cross-sectional area not less than the appropriate value shown in Table 12 subject to a minimum size of 6mm^2. For the purposes of this regulation, the associated circuit conductor shall be the largest conductor connected into the input side of the consumer's switch-gear. Conductors of material other than copper shall have a resistance not exceeding that of the prescribed copper conductor. Connections to the pipes of other services shall be made by means of clamps.

166. The exposed metalwork of all apparatus which is required by these Regulations to be earthed, which might otherwise come into fortuitous contact with extraneous fixed metalwork shall be either effectually segregated therefrom, or effectually bonded thereto so as to prevent appreciable voltage differences at such possible points of contact. Copper bonding leads shall be of cross sectional area not less than the appropriate value shown in Table 1.2, subject to a minimum of 1.5mm^2 where the bonding lead is un-enclosed. Conductors of material, other than copper shall have resistance not exceeding that of the prescribed copper conductor.

167. Bathrooms

In a room containing a fixed bath or shower cubicle, parts of a lamp-holder within a distance of 2.5m from the bath or shower cubicle shall be constructed of, or shrouded in, insulating material. Bayonet-type lamp-holders shall be fitted with a protective shield. As an alternative, totally enclosed light fittings may be used.

168. Every switch or other means of electrical control or adjustment shall be located outside the inner walls of a fixed bathroom normally inaccessible to a person using a fixed bath or shower. This requirement does not apply to insulating cords or cord-operated switches. No stationary appliance having elements which can be touched shall be installed within reach of a person using the bath or shower.

169. In a room containing a fixed bath or shower, there shall be no sock-outlets and there shall be no provision for connecting a portable appliance except for shavers supply unit.

170. In a room containing a fixed bath or shower, electric shavers shall be connected only by means of shaver supply unit where the secondary circuit supplying the output sockets shall be isolated both from the supply mains and from earths.

171. Protection against earth leakage

The earthing of the consumer's installation shall be effected in such a manner that no fault of negligible impedance to earthed metal shall be so sustained as to cause danger and shall be in accordance with the appropriate requirements of these Regulations

172. Protection by fuse or circuit breakers

Earth-leakage protection may be afforded by means of fuses or, excess-current available to operate that the earth fault current available to operate the protective devise and so make the family circuit dead exceeds–

(i) 3 times the current rating of any semi-enclosed fuse having a fusing factor exceeding 1.5, used to protect the circuit (see Table 11). or

(ii) 2.4 times the rating of any cartridge fuse having a fusing factor not exceeding 1.5, used to protect the circuit, or.

(iii) 1.5 times the tripping current of any excess-current circuit-breaker used to protect the circuit.

173. Where the requirement of Regulation 172 cannot be satisfied, earth-leakage protection shall be provided by one or more earth-leakage circuit-breaker for all parts of an installation to which the requirement of earthing applies, installation of the earth-leakage circuit-breakers shall satisfy the test requirements of these Regulations.

174. A current-operated earth-leakage circuit-breaker shall be used only where the product of its operating current in amperes and the earth-loop impedance in ohms does not exceed 40. Where such a circuit-breaker is used the consumer's earthing terminal shall be connected to a suitable electrode.

175. Every voltage-operated earth-leakage circuit-breaker shall be arranged to have its operating coil connected between the consumer's earthing terminal (which may serve the whole or part of an installation) and an earth electrode, the connecting lead shall be insulated.

176. The earth electrode used with any voltage-operated earth-leakage circuit-breaker shall be placed outside the resistance area of any parallel earth which may exist, for example where a water heater is installed. If by subdivision of the earthing system, discrimination in operation between a number of voltage-operated earth-leakage circuit-breakers is to be afforded, the resistance areas of the associated earth electrodes shall not overlap.

177. Every conductor used as an earth-continuity conductor shall satisfied the appropriate requirements stated below–

(i) Where the conductor forms part of the same cable as the associated circuit conductors, other than a flexible cable or flexible cord, conductor shall comply with the relevant requirements for the cable.

(ii) Where the conductor is contained in a flexible cord, it shall have a cross-sectional area not less than that of the largest associated current-carrying conductor,

(iii) Every cable sheath and/or armouring used as an earth-continuity conductor shall satisfy the relevant requirements of standards mentioned in these Regulations;

(iv) Conductors of copper other than those mentioned in item (i) to (iii) above, shall have a cross-sectional area not less than the appropriate value shown in Table 12, subject to a minimum of 1.5mm^2 where the conductor is unenclosed.

Conductor of material other than copper shall have a resistance not exceeding that of the prescribed copper conductor.

178. Installation

The installation of every earth-continuity conductor and earthing lead shall satisfy the appropriate requirement stated below–

i. Every earth –continuity of cross-sectional area 1.5mm^2 up to and including 6mm^2, other than copper strip , shall be protected throughout by installing at least equivalent to that provided for a single-core, non-sheathed cable of appropriate size.

ii. Where the sheet of hearth-continuity conductors is removed adjacent to joints and terminations, earth-continuity conductors of cross-sectional area up to and including 6mm shall be protected by installing slaving.

iii. Bare earth-continuity shall be protected, where necessary, against mechanical damage and corrosion, particularly at terminations.

iv. Every bare earth-continuity of the types other than copper strip shall be identified at terminations as appropriate.

v. All joints in earth-continuity conductors shall be mechanically sound, electrically continuous and protected, where necessary, against corrosion,

vi. Connections to cable sheaths and/or armoring, and to pipes, shall be soundly made by soldered joints or by clamps. Every clamp shall be so installed as to provide reliable connection without damage to the associated cable or pipe.

vii. Copper clad aluminum conductors shall not be used for bonding connections to water pipes likely to be frequently subjected to condensations in normal use, or in other situations where the terminations of the conductors are likely to be exposed to sustained wet conditions. This requirement does not apply to terminations which may be only initially damp during building construction.

179. Earthing leads

Pipe such as gas or water, or members of structural metalwork, shall not by themselves constitute an earth-continuity conductor where this is necessary.

180. The cross-sectional area of every copper conductor used as an earthing lead shall be not less than that shown in Table 12 except that for connection of an earth-leakage circuit-breaker to an earth electrode a cross-sectional area of 2.5mm need not be exceeded. A maximum size of copper conductor of 70mm^2 cross-sectional area need not normally be exceeded except for the earthing of a transformer neutral or electrode boiler. For the purpose of this regulation, the associated circuit conductor shall be the largest conductor connected into the input side of the consumer's switch-gear. Every conductor of material other than copper shall have a resistance not exceeding that of the prescribed copper conductor. Copper-clad aluminum conductors shall not be used for final connections to earth electrodes.

181. Every connection of an earthing lead to an earth electrode or other means of earthing shall be readily accessible and soundly made by use of soldered joints or clamps: a permanent label indelibly marked with the words "Safety Electrical Earth – DO NOT REMOVE", in a legible type not less than 4.75mm high, shall be permanently fixed at the point of this connection.

182. Where protection against dangerous earth-leakage currents by fuses or excess –current circuit breakers is admissible, one of the following methods of earthing shall be employed–

i. where the supply undertaking provides an earthing point which affords a metallic return path to the means of earthing of the supply system, the earthing lead shall connect the consumer's earthing terminal to this point;

ii. where a means of earthing has not been provided by the supply undertaking, the consumer's earthing terminal shall be connected by the earthing lead to an effective earth electrode or electrodes, such as copper strip or rod, which shall be buried in the ground at a position as near as practicable to the consumers earthing terminal and shall satisfy the tests specified in Appendix 3.

iii. where Protective Multiple Earthing (P.M.E) is provide by the supply undertaking, and with the concurrence of the Post Office, the earthing lead shall be connected to the consumer's earthing terminal and, together with the neutral conduction of consumers installation, shall be so arranged that connection to the neutral Conductor of the incoming supply can be carried out by the supply undertaking.

183. The metalwork of public gas services and water services shall not be used as the sole earth electrode of the installation.

184. If more than one plate or tubular earth electrode is employed for one earthing system they shall be efficiently connected together.

185. Every fixed heating and cooking appliance shall for the purpose of earthing. Be provided with a suitable terminal to which the earthing lead shall be connected.

186. In the case of fixed heating and cooking appliances and of motors of over 3.75kW an earthing lead other than the conduit shall be taken direct from the appliance or motor to the nearest earth.

187. (1) Where the multiple-earthed neutral system is used, the earthing lead shall be taken from the neutral bar or stud, and the conduit shall (in addition to being itself earthed) be connected to this earthing lead.

(2) Save as provided in the last preceding paragraph the neutral wire of any system shall not be used as an earthing lead.

188. Precautions in earthing

Pipes conveying gas, hot water, or an inflammable liquid shall not be used as an earthing system.

PART XII

Tests, inspections and certificate

189. General

The contractor carrying out any installation shall notify the electricity supply authority or a licensee in writing of the competition thereof, and except as provided in Regulation 206 hereof, shall not allow the current to be switched on from the source of supply until the installation has been duly inspected and he has been notified that a certificate has been issued pursuant to regulation 201 hereof.

190. Supply authority as the contractor

Where an Electricity supply authority itself contracts to carry out any installation for a consumer, the following special provision shall apply

i. the notice required by Regulation 188 hereof need not be given,
ii. the certificate to be issued pursuant to regulation 211 hereof shall be a certificate by the supply authority to the Director of Electrical Inspectorate Services.

191. Inspection on behalf of the Director Inspectorate Services

Any person authorized writing in that behalf by the Director of Electrical Inspectorate services may at any time, between the hours of 9 a.m. and 6 p.m. on any day of the week other than Sunday, demand admission to the premises of any consumer for the purpose of ascertaining whether the requirements of these Regulations have been complied with.

192. If any consumer refuses to admit such person during such hours, the Electric Supply Authority shall on demand in writing by the Direction Electrical Inspectorate Services disconnect the consumer's installation from source of supply.

193. Tests

The testing and inspection are to be carried out in the sequence–

i. Verification of polarity.
ii. Test of effectiveness of earthing.
iii. Insulation resistance tests.
iv. Test of ring-circuit continuity.

194. Basic Requirement General

Every installation and every major alteration to an existing installation shall, on completion, be inspected and tested in accordance with requirements of this section to verify, as far as practicable that the requirement of these Regulations have been met. In case of a major alteration, both new work and that part of the existing installation related thereto shall be inspected and tested.

195. Polarity Test

A verification of polarity shall be made and it shall be insured all fuses and single pole control devices, are connected in the live conductor only, that centre contact bayonet and Edison-type screw lampholders in circuits having an earthed neutral conductor have their author or screwed or connected to that conductor, and that writing has been correctly connected plugs and socket-outlets.

196. Earth continuity test

A separate test of every earth-continuity conductor shall be made by the contractor and another person responsible for the work, before an installation or major alteration to an installation is put into commission.

Where earth-leakage protection relies on the operation of fuses or excess-current circuit-breakers, the impedance or resistance between the consumer's earthing terminal and remote end of every earth-continuity conductor shall not exceed the appropriate value prescribed.

197. Earth effectiveness test

Where earth-leakage protection relies on the operation of excess-current circuit-breakers, the contractor and other person responsibilities the work shall test the effectiveness of the earthing of each completed install or major alteration by means an earth-loop-impedance test.

198. Where earth-leakage circuit-breaker, relies on the operation earth-leakage circuit breaker, its effectiveness shall be tested as specified Appendix 3.

199. The insulation resistance tests shall be made before a common installation or major alteration is permanent connected to the supply. For these tests large installations may be divided into groups of outlets, each containing not less than 50 outlets. A d.c. voltage not less than twice the normal voltage of the supply (r.m.s. value of a.c. supply) shall be applied for the measurement of insulation resistance, provided that for tests on low-voltage circuits, the test voltage need not exceed 500V d.c.

200. When measured with all fuse links in place, all switches (including, if practicable, the main switch) closed and, except where earthed concentric wiring is installed, all pole or phases of the wiring electrically connected together, the insulation resistance to earth shall be not less than 1 mega ohm.

201. When measured between all the conductors connected to any one pole or phase of the supply and, in turn, all conductors connected to each other pole or phase of the supply, the insulation resistance shall be not less than 1 mega ohm. Wherever practicable, so that all parts of the wiring may be tested, all lamps shall be removed and all current-using apparatus shall be disconnected and all local switches controlling lamps or apparatus shall be closed; where the removal of lamps and/or the disconnection of current-using apparatus is impracticable, the local switches controlling such lamps and/or apparatus shall be open. This test is not applicable to earthed concentric wiring systems.

202. When apparatus is disconnected for the tests under Regulation 200 and 201, the insulation resistance between the case or framework and all live parts of each item of fixed apparatus shall be not less than 1.0 mega ohm.

203. A test shall be made to verify the continuity of all conductors (including the earth-continuity \conductor) of every ring circuit.

204. Certification

Following the inspection and testing required by this section for a completed installation, or major alteration to an existing installation, a completion certificate shall be given by the conductor or other person responsible, or by an authorized person acting on his behalf, to the person ordering the work. The certificate shall be signed by a registered electrical engineer and shall be in the form set out in these Regulations. Any defects or omissions revealed by inspection or test shall be made good before a completion certificate is issued.

205. For a major alteration to an existing installation the person ordering the work shall be notified of any repairs required to that part of the existing installation which is required to be inspected and tested, but completion certificate shall apply only to the new work.

206. Every re-inspection of an installation should be reported upon by means of an Inspection certificate which should be submitted to the consumer and be signed by a competent person who should be a registered electrical engineer.

207. Notwithstanding anything to the contrary in the foregoing provisions of this part of these Regulation, the supply authority may, in case of urgency on the recommendation of the authorized inspector, permit an installation to be temporarily connected with the source of supply notwithstanding that any one or more of the hereinbefore prescribed insulator resistance tests have not been satisfied; provided that no such permit shall be granted unless the installation otherwise generally complies with the requirements of these Regulations, and is certified by the authorized inspector to be reasonably free from electrical hazard; or for a longer period than one month; provided further than the Director of Electrical Inspectorate Services of the recommendation of the supply authority, may extend such period beyond one month.

208. On the expiration of the period or extended period as aforesaid for which temporary connection has been so permitted, the installation shall be disconnected from the source of supply unless before such expiration the authorized inspector has issued his certificate pursuant to the last preceding regulation.

209. Periodic inspections and tests

The results of a periodic inspection and test of an installation, or any part thereof, shall be recorded on an inspection certificate and given by the contractor or by an authorized person acting on his behalf, to the person ordering the inspection. The certificate shall be in the form set out in these Regulations.

210. A notice of such durable material as to be likely to remain easily legible throughout the life of the installation shall be fixed in a prominent position at or near the main distribution board of every installation upon completion of the work. The notice shall be inscribed in indelible characters no smaller than those here illustrated and shall read as follows–

"IMPORTANT" –*This installation should be periodically inspected and tested and a report on its condition obtained, as prescribed in the Regulations for Electrical Installations.*

211. Periodic inspection and tests of electrical installation shall be carried out and recorded on an inspection certificate at intervals of not more than three years.

212. (1) After having inspected and tested an installation the authorized inspector, if satisfied that the work has been done in a workmanlike manner in accordance with the requirements of these Regulations and if the test made as required by the foregoing provisions of this Part of these Regulation have been satisfied, shall certify in writng to the electricity supply authority that the installation has been duly inspected and tested and may be safely connected with the source of supply.

(2) Nothing in any such certificate shall relieve the owner or occupier of any premises from the obligation to bring any installation into conformity with these Regulations if on any subsequent inspection any defects are discovered which render such installation electrically hazardous.

Division four – Special application

PART XII

Agricultural and horticultural installation

213. General

All installation in agricultural and horticultural holdings, except dwellings, shall comply with the requirements of this Part and generally with the Regulations for the Electrical Installations.

214. Switch-gear

Main switch-gear shall not be installed –

i. Within reach of livestock; or

ii. In any position where access to it may be impeded by livestock, account being taken of the conditions likely to arise in the event of panic by the livestock.

215. Control of building

Where an installation serves more than one building, a switch shall be installed in or adjacent to each building for the control and isolation of all those parts of the installation contained in that building. For the purposes of this regulation a glass-house is deemed to be a building and where glass-house are combined in a block, separate means of control shall be provided for each house within the block.

216. For isolated items of apparatus, e.g. pumps, remote from the main installation, a separate means of control adjacent to the apparatus and readily accessible to the person in charge of the apparatus, shall be provided.

217. Presence of different voltage

Means of access to all live parts of switch-gear and other fixed live parts where different nominal voltages exist shall be marked to indicate the voltages present.

218. Control of points

Every point, including every socket-outlet, shall be controlled by a switch or switches, which shall be readily accessible at all times. For motors driving machinery, the switches shall be clearly marked to show the on and off position.

219. Selection of types of cables

Cables sheathed with general-purpose rubber shall be used only for dry, clean situations indoors and for clean situations outdoors.

220. Non-served metal-sheathed paper-insulated cables shall be used only for dry, clean situations indoors and for clean situations outdoors.

221. Bright-wire armoured cables shall not be used out of doors.

222. Non-sheathed twisted-twin flexible cords and non-sheathed parallel-twin flexible cords shall not be used.

223. Cable installation

All cables shall be place out of reach of livestock and clear of all vehicles.

224. Cables having a sheath of p.v.c. or an oil-resisting and flame retardant or h.o.f.r. sheath shall not be placed where they would be liable to contact with liquid creosole.

225. Where additional protection against mechanical damage to cable is required, it shall wherever possible be provided by the use of non-metallic materials, e.g. non-metallic conduit or hardwood, and in any event metal conduit shall not be used.

226. Where long runs of cable must be placed along the sides of building, they shall wherever practicable be placed on the outside of the building, and as high as practicable.

227. Wiring between buildings

Cables buried underground shall be place at a sufficient depth to avoid any risk of damage by implements used for purposes of cultivation of drainage. In any case not less than 600mm, and where considerations of drainage arise a depth of I'm may be necessary.

228. Where conductors or cables are carried overhead, supported buildings or by pole, the minimum heights above ground and maximum length of span specified in Regulation 70 are applicable, provided for this purpose the any position on any horticultural or agricultural holding is deemed to be accessible to vehicular traffic.

229. Steel conduit or pipe shall not be used for spanning gaps between buildings.

230. Exposure to flammable dust

Where apparatus may be exposed to a concentration of flammable dust, such as in situations used for grain milling and mixing, grain drying, some intensive rearing houses, and the like, the apparatus shall satisfy the test requirements of Regulation 74.

231. Garages

Where vehicles are housed, stored or repaired in buildings or other enclosed spaces, every fixed item of apparatus shall be mounted at a sufficient height or in such a position as to be clear of all vehicles.

232. Lamp-holders

All Edison-type screw lamp-holders shall be of the drip-proof type and shall be provided with a protective shield. The requirements of Regulation 93 and 94 for the use of such lamp-holders in damp situations shall apply to all situations in agricultural or horticultural installations.

233. Couplers

Cable couplers shall not be used.

234. Earth leakage

In situations accessible to livestock in and around agricultural buildings, the installation shall so far as is practicable be of "all-insulated" construction.

235. An earthing terminal, connected to the earth-continuity conductor, shall be provided at every outlet point the installation.

236. In situations accessible to livestock, a metal pipe or conduit shall not be used as a sole earth-continuity conductor, though it may be used to supplement a separate earth-continuity conductor.

237. The earthing lead of an agricultural installation shall be adequately protected against disturbance or damage by live stock or by passing mechanical implements. Where the earthing lead is not enclosed in conduit or equivalent mechanical protection, it shall be of the armoured type.

238. Protection against earth-leakage currents by isolation of metal-work, as provided for in items (i), (v) and (vi) of Regulation 162, is not recognized for agricultural and horticultural installations, unless the metalwork is out of reach of livestock and is not liable to accidental contact with passing machinery, implements or vehicles.

239. Wash troughs

Every switch or other means of control or adjustment not forming an integral part of other apparatus shall be so situated as to be out of reach of a person in contact with wash troughs, sterilizing equipment and the

like. Where apparatus having exposed metalwork and incorporating a switch or other means of control of adjustment is adjacent to extraneous fixed metalwork, effectual bonding shall be carried out as that regulation requires; the alternative of effectual segregation is not recognized for agricultural and horticultural installations.

240. Electric fence controllers

Every mains-operated electric fence controller shall be so installed that, so far as is reasonably practicable, it is free from risk of mechanical damage or unauthorized interference.

241. A mains-operated electric fence controller shall not be fixed to any pole of an overhead power or telecommunication line; provided that, where a low voltage supply to an electric fence controller is carried by insulated overhead line from a distribution board, the controller may be fixed to the pole carrying the supply.

242. Any earth electrode connected to the earth terminal of an electric fence controller shall be separate from the earthing system of any other circuit and shall be situated outside the resistance area of any electrode used for protective earthing.

243. Not more than one controller shall be connected to any electric fence or similar system of conductors.

244. Every electric fence or similar system of conductors and the associated controller shall be so installed that it is not liable to come into contact with any power or telecommunication apparatus or wiring, including an overhead power line, telephone or telegraph wires or an aerial, or with all earth-continuity conductor.

PART XIV

Places of public amusement

245. General

(1) The regulations in this part shall apply to theatres, music-halls, motion-picture theatres, and public halls, and embody special requirements in addition to any other requirements of these Regulations.

(2) In case of any dispute as to whether a place is a public hall, the matter shall be submitted to the Director of Electrical Inspectorate Services whose decision shall be final.

246. All fixed wiring shall be enclosed in screwed galvanized conduits.

247. (1) The state-switchboard shall be either of the dead-front type or the accessories shall be of totally enclosed type.

(2) The switch-board shall be fixed in a convenient position preferably overlooking the stage, and inaccessible to all but the switchboard operator.

(3) A platform with proper means of access shall be provided for the switchboard operator. The platform shall be of fire-resisting material, with a hardwood or other insulating floor. The hand-rail of the platform, if of metal, shall not be connected directly or indirectly to earth.

(4) Switchboards and fuse boards shall be fixed in accessible positions where they will not obstruct passage or exit-ways.

248. (1) Resistance shall be mounted on incombustible bases, and shall be so protected and placed at such a distance from any combustible material that no part of the resistance, if broken, can fall on such material, or *vice versa*.

(2) The resistances shall be provided with adequate ventilation.

249. Stage-lighting, including footlights, border-lights and proscenium side-lights shall be so wired that the maximum current on each circuit shall not exceed ten amperes.

250. Cables to battens and floats shall be suspended in such a manner that no stress can be applied by the conductors to any terminal to which they may be connected and shall be either–

(a) Flexible cables covered with tough-rubber compound; or

(b) Vulcanized rubber-insulated cables containing not less than seven strands for each conductor and enclosed in canvass hose; or

(c) Flexible cables covered with a slow-burning braiding approved by the Director of Electrical Inspectorate Services; or

(d) Flexible cables, covered with asbestos, or fire-resisting braiding approved; or

(e) Flexible cables covered with cord braiding.

251. (1)Lamps on battens, footlights, etc., shall be protected by stiff wire guards so arranged that no scenery or other inflammable material can come in contact with the lamps, and shall be properly protected from every liable to cause short-circuit.

(2) No readily combustible material shall be used in connection with any lamps in such a manner that it might come in contact with the lamps or conductors.

252. Every electrical fitting or apparatus of any description shall be so fixed or arranged that in no circumstances can it interfere with the proper working of the safety-curtain.

253. Portable lamps for the orchestra or similar lighting shall be connected to a sub-circuit or sub-circuits to which no other lighting is connected.

Special requirements for motion picture theatres

254. Lighting and electrical installation

The provisions of this part shall apply to every cinematograph theatre, projection or re-winding room and file store-room.

255. Control of lighting

Where the general lighting of the premises can be controlled from within, the projection or re-winding room, there shall also be separate and independent means of control outside of and away from the projection or re-winding room.

256. Electrical installation

Where electrical energy is used for lighting or other purposes within the building the following provisions shall be observed–

(a) except as otherwise provided in Cinematograph Regulations, the installation generally shall be in accordance with these Regulations;

(b) The main supply fuses and switches shall not be accessible to the public. They shall be located where there is ample space and head room and where there is no risk of fire resulting therefrom. In no circumstances shall they be place in a projection room, re-winding room, or film store;

(c) a separate circuit shall be taken from the source of supply for the projector circuit so that no accident to this circuit can affect the general lighting;

(d) each of the main circuits shall be separately protected by an efficient linked switch and by a fuse on each phase;

(e) the general wiring of the building shall be in accordance with these Regulations, except as regards any necessary flexible conductors such as may be required for pendant lamps or movable fittings;

(f) conductors from the switchboard in the projection room to the cinematograph machine shall be enclosed in screwed conduit, and r=terminate in a terminal-box approved by the authorized inspectors from such box to lamp shall be covered with fire-resisting material;

(g) the conductor for cinematograph machines and accessories shall be taken as a separate circuit from the source of supply or from the supply side of the main fuses in the general lighting-circuit; and there shall be efficient switches and fuses inserted at the point where the supply is taken, and in addition an efficient double-pole switch shall be fitted in the conductors within the projection room;

(h) the maximum potential difference across the carbons of the lamp or between any part of the arc-circuit on the cinematograph machine and earth shall not exceed 100volts in any circumstances;

(i) resistances for cinematograph machines shall not be placed inside the projection room.

257. The general wiring shall be carried out in accordance with the following system–

(1) Copper cables installed in screwed galvanized conduit: Provided that–

(a) the conduits shall be mechanically and electrically continuous throughout and shall be efficiently earthed in the manner specified in these Regulations;

(b) the electrical resistance of the conduit in a complete installation, and of the earth connection, shall not exceed the maximum values specified in these Regulations;

(c) where the galvanizing of the conduit or fittings has been damaged by the use of tools or by screwing or threading, the exposed metal shall be painted with an aluminium paint after erection;

(d) metal conduit shall not be buried in the ground. Where it is necessary to bury cables, armoured cables shall be used.

(2) A suitable fire-resisting mineral, insulated and metal sheathed system: Provided that–

(a) The system shall be in accordance with the appropriate Nigerian Standards Specifications

(b) the system shall be installed and tested in accordance with the General Regulations for Electrical Regulations.

258. Projection and rewinding room and film store

All wiring contained in the projection and rewinding rooms and film store shall be carried out in a mineral insulated metal sheathed, fire-resisting system, approved by the Director of Electrical Inspectorate Services. All slack cables shall be heavily covered with fire-proof material.

259. An efficient double-pole main switch shall be fixed within the projection room whereby all current may be cut off from the projector circuit, or circuits within the projection room and an additional double-pole or triple-pole switch shall be fixed for each arc lamp so that the current may be cut off whilst recarboning is taking place.

260. Where two or more projectors are installed and a change-over switch is required, it shall, unless it be a double-pole switch having a secure "off" position, be in addition to and not in substitution for the main switch.

261. All live parts of apparatus within one and a half metre of the projector shall be shielded so that they cannot be accidentally touched. The covers of enclosed switches shall be of metal and, shall be so constructed that the switch handle does not work through an open slot.

262. The lamp or lamps for lighting the projection and re-winding room and film store shall not be connected to the safety lighting and shall be of the bulkhead type.

263. All metal work liable to become accidentally charge, including the projecting apparatus, shall be efficiently earthed. The size of the earth wires shall be in accordance with the requirements of these Regulations.

264. The arc lamp adjusting handles shall be made of insulating material and shall be so constructed and arranged that the hand cannot inadvertently touch live metal.

265. Resistances, in which more than two kilowatts are dissipated, shall be placed in a room or place other than the projector or re-winding room and accessible only by the technical staff. If such room or place is within the theatre, the room or place shall not communicate directly with the auditorium. It shall be well ventilated by ample inlets and outlines connecting directly with the outer air. Switches suitably placed shall be provided whereby the pressure may be cut off from the resistance.

266. Motor generators or electrical generating plant and the main switch-gear shall be in a room or rooms constructed of fire resisting materials. Such room or rooms may also contain resistance and the main supply fuses and switches and shall be well ventilated and shall not communicate directly with the auditorium or any part of the building to which the public is admitted. Such room or rooms shall not be used as a projection room, rewinding room, and film-store.

267. Safety lighting.

Safety lighting, shall be provided in every cinematograph theatre and shall be maintained in good working order and so kept in use that it is adequate to enable the public to see the way out of the premise.

268. Electrical conductors forming part of the safety lighting system shall not be contained in the same conduit or incorporated in the same cable as electrical conductors used for any other purpose.

269. Batteries for safety lighting.

Where the safety lighting is derived from a battery of accumulators, the battery shall be of such capacity and so maintained as to be capable of supplying at normal voltage the full load which will be connected thereto while the public is upon the premises.

270. All electric conductors shall be of adequate size for the current which they have to carry and shall be efficiently covered with insulating material and shall be either placed out of reach of persons in the auditorium and where they are not liable to damage, or protected against injury by suitable casings.

PART XV

Electric discharge and fluorescent light circuits and signs

271. Switches

Every switch not specifically designed to break an inductive load of its full rated capacity shall, if used to control filament lighting and discharge lighting, have a current rating of not less than twice the total steady current which is required to carry out or, if used to control filament lighting and discharge lighting, have a current rating of not less than the sum of the current flowing in the filament lamps, and twice the total steady current flowing in the electric discharge lamps.

272. Circuit loading

Circuits shall be capable of carrying the total steady current *viz* that of the lamp(s) and any associated gear and also their harmonic currents. Where more exact information is not available, the demand in volt-amperes may be taken for the purpose of this regulation as the rated lamp watts multiplied by not less than 1.8. The neutral conductor in every discharge-lighting circuit shall have a cross-sectional area not less than that of the phase conductor(s).

Note: The multiplier referred to in regulation 272 is based on the assumption that a circuit is corrected to a power factor of not less than 0.85 lagging, and takes into account control-gear losses and harmonic currents.

273. Transformer and inductors

Every inductor and high-reactance transformer shall be installed as near as is practicable to its associated electric discharge lamp.

274. Screening

All live parts, including all apparatus and conductors but excluding the lamps except in the neighborhood of their terminal, shall, be provided with effective screens of earthed metal or insulating material, of mechanical strength adequate to withstand the conditions of normal service or alternatively for installations on the exterior of a building, such live parts may be so situated as to be accessible only to authorized persons. Screens of insulating materials used for this purpose shall be non-hygroscopic anti-tracking, and substantially non- combustible.

275. Motor-generators and converters

Every circuit which is energized by a motor generator or double wound converter shall be permanently earthed at a terminal of the motor-generator converter.

276. Maximum permissible voltage

No circuit sha1l use a voltage exceeding 5 kilovolts r.m.s, to earth, measured in open circuit.

277. Transformers of input exceeding 500W

Every circuit at a voltage exceeding low voltage supplied from a transformer having a rated input exceeding 500 watts shall be provided with means for the automatic disconnection of the supply in the event of a short a circuit on an earth-leakage current which exceeds 20% of the normal steady current in the circuit.

278. Ancillary requirement

Ancillary equipment for installations at voltages exceeding low voltages, including inductors, capacitors, resistors, and transformers shall be either totally enclosed in a substantial, earthed, metal container which may form part of lighting fitting, or alternatively shall be placed in a suitably ventilated enclosure of noncombustible material or of fire-resisting construction which is reserved for this equipment. A notice, “DANGER - HIGH VOLTAGE”, shall be placed and maintained on every such container or enclosure that is accessible to unauthorized persons and otherwise, where necessary. The word "DANGER” shall be in block letters not less than 10mm high and the words "HIGH VOLTAGE" in letters not less than 5mm high. The letters shall be in red on a white background and the size of each notice shall be not less than 65mm by 50mm overall

279. Segregation of circuits

No conductor which is in metallic connection with a discharge lamp operating at a voltage exceeding low voltage shall be in connection with any conductor or the mains supply other than by means of any connection with earth complying with these Regulations; provided that auto-transformer delivering, voltage not exceeding 1.5 kilovolts r.m.s. measured on open circuit may be used on a.c 2-wire circuit in which one pole of the supply is connected with earth, subject to the provision of means of isolation of both poles of the supply.

280. Isolation of circuits

One of the following means shall be provided inside the building for the isolation from all poles of the supply of every self-contained light fitting or alternatively of every-circuit supplying discharge lamps operating at a voltage exceeding low voltage, except that means need not be provided for isolation from the neutral conductor of a 3-phase 4-wire installation–

i. an interlock on the self-contained light titling, so arranged that before access can be had to live parts, the supply is automatically disconnected, such means being provided in addition to the switch normally used for controlling the circuit, or
ii. effective local means for the isolation of the circuit from that supply, e.g. an adjacent plug and socket-outlet conveniently placed such means being provided in addition to the switch normally used for controlling the circuit, or
iii. a switch having a removable handle or a switch which can be locked, or a distribution board which can be locked, arrangements being made to prevent the restoration of the supply by unauthorized persons. Where an installation comprises more than one such switch or distribution board, all keys and removable handles shall be non-interchangeable

281. Fireman’s switch

A fireman's emergency switch shall be provided for the following installations operating at a voltage exceeding medium voltage -

i. Exterior installations.
ii. Interior installations which run unattended (e.g. for window lighting or display purposes).

EXEMPTION – For the purpose of regulation 282 a portable discharge-lighting fitting or sign of rating not exceeding 100 watts and fed from socket-outlet which provides the local means of isolation required by Regulation 282(ii), need not be regarded as forming part of an interior installation operating at a voltage exceeding medium voltage.

282. Every fireman's emergency switch shall -

i. be arranged to isolate the installation from all poles of the supply, except that it need not isolate the installation from the neutral conductor or a 3phase 4-wire supply, and

ii. be colored red and have fixed near it a nameplate marked with the words, ("FIREMAN'S SWITCH") the plate being of minimum size 150mm by 100mm with lettering that shall he easily legible from a distance appropriate to the site conditions but not less than 13mm high, and

NOTE to item (ii) –it is desirable that the name of place should also be marked with the name of the company which installed or (if different) which maintains the installation.

iii. have its ON and OFF positions clearly indicated by lettering legible to a person standing on the ground, and the OFF position shall be at the top, and

NOTE to item (iii) – it is desirable that the fireman, switch be provided with a lock or catch so designed as to prevent the switch being inadvertently or accidentally returned to the ON position.

iv. be fixed in conspicuous position, reasonably accessible to -firemen, and except in the case of an agreement to the contrary with the-local fire-brigade authority, at not more than 2.75m from the ground, and

v. for exterior installations, be outside the building and adjacent to the electric discharge lamp(s), or alternatively a notice indicating the position of the switch shall be placed adjacent to the electric discharge lamp(s) and a nameplate shall be fixed near the switch so as to render it clearly distinguishable, and

vi. for interior installations, be in the main entrance to the building or alternatively in a position to be agreed with the local fire brigade authority, and

NOTE to items (v) (vi) - It is desirable that, whenever practicable all exterior installations on any one building should be controlled by a single fireman's switch similarly, all 'internal installations in anyone building should be controlled by a single fireman's switch independent of the switch or any external installation.

vii. where more than one such switch installed on anyone building be clearly market to indicate the installation or section of the installation which it controls, and the local fire-brigade authority shall be notified accordingly.

283. A fireman's switch may be us to open one or more contactors or circuit-breakers for the total isolation of an installation from the supply, provided that every such contactor or circuit-breaker is arranged to open automatically on failure of the supply to its holding coil circuit.

284. Types of cables

Connections in circuit at a voltage exceeding medium voltage shall be made by cable complying with Nigerian Standard Specifications, except as provided in Regulations 285, 286, 293, and 294. Metal-sheathed, or armored, or metal-sheathed and armored, cable shall be used, except that cable having a non-metallic sheath may be used–

(a) in exterior installations for inter-lamp series connections not exceeding 3m in length which are not likely to suffer mechanical damage, or which are installed in box signs constructed substantially of non-combustible material, and

(b) in interior installations, in self-contained light fitting.

285. Bare or lightly insulated conductors

Bare or lightly-insulated conductors of copper or nickel having a cross-sectional area of not less than 0.4 mm^2 (170.7Imm), may be used for series connections in circuits operating at a voltage exceeding low voltage, e.g. for window signs provided that either –

1. the conductor does not exceed 1 m length is supported at intervals not greater than 500mm, is-not exposed to the likelihood of mechanical damage, and is completely protected by non-combustible, no hygroscopic insulating material which if in the form of glass tubing has a wall thickness not less than 1 mm an overall diameter not less than 5mm and is so arranged as to be reasonably secured against any displacement which would expose any part of the live metal, or.
2. The conductor is in an enclosure to the interior of which only authorized persons can have access.

286. For shop-front fascia installations bare or lightly insulated conductors shall be used only for connections housed within an earthed metal enclosure or for connections between the terminals of electrode housings. For all other connections behind or through fascia panels, including series connections, armored or metal-sheathed or metal-braided cable shall be used.

287. Cables and conductors in circuits operating at a voltage exceeding low voltage shall be supported at intervals not exceeding the appropriate value stated in Table 13 in Schedule 1. Supports for insulated and braided cables and for bare conductors shall be of non-combustible, non-hygroscopic insulating material, e.g. glass or glazed porcelain.

288. Creepagos and clearances

The length in mm measured along the centre line of every support which serves to separate bare mental or cable operating at a voltage exceeding medium voltage the cable being neither metal sheathed nor armored, from earthed metalwork, woodcraft, or surfaces likely to became damp, shall be not less than the value obtained by multiplying the voltage to earth of transformer secondary in kilovolts (r.m.s.) measured on open circuit, by 10.

289. In circuit operating at a voltage, exceeding low voltage the air gap in mm from metal or cables which are neither metal-sheathed not armored, to earthed metal woodwork, or surfaces likely to become damp, shall be not less than the value obtained by multiplying the voltage to earth of the transformer secondary in kilovolts (r.m.s.) measured on open circuit, by 4.

290. Cable installation

In a circuit operating at a voltage exceeding medium voltage, every cable shall be supported close to each terminal connection and in no instance at a distance greater than 150mm, or 300mm if a glazed porcelain electrode-receptacle forming an adequate support for the cable is used.

291. Where a connection is made to a cable in a circuit operating at a voltage exceeding medium voltage, the insulation exposed by removing the metal sheath or braid shall be suitably protected from the effect of ozone.

292. Where likely to suffer mechanical damage, every cable in a circuit operating at a voltage exceeding low voltage shall be armoured or otherwise suitably protected. Non-armoured cable shall not be drawn into metal tubing except where they pass through walls or floor where they may be installed in short lengths of metal conduit which shall be earthed.

293. Where not otherwise readily identifiable, cables in a circuit operating at a voltage exceeding low voltage or their protective covering shall be distinguished by tabs or labels marked "DANGER" securely

attached at intervals not greater than 1.5m. The letters shall be in red on a white background, and shall be not less than 10mm high.

294. Earthed return conductors

The return cable from an electrode to a transformer terminal which is earthed may be a low voltage cable provided that the cross-sectional area of the conductor is not less than 2.5mm^2

295. The metalwork at a rotating device (e.g. the hands or a clock) may be used as a return conductor provided that adjacent un-insulated metalwork -is permanently and effectively earthed

296. Regulation L.N 25 of 1958

The Electric Wiring Regulations Cap. 106 L.F.N of 1990 is here by repealed.

SCHEDULE 1

TABLE 1

Sizes of fuse elements composed of plain or tinned copper wire, for use in semi-enclosed fuse

Current rate of fuse	***Nominal diameter of wire***
A	*mm*
3	0.15
5	0.20
10	0.35
15	0.50
20	0.60
25	0.75
30	0.85
45	1.25
60	1.53
80	1.80
100	2.00

TABLE 2

Assumed current demand of points and other apparatus

Point or other apparatus	***Current demand to be assumed***
(a) 15-ampere socket-outlet	15 amperes
(b) 13-ampere socket-outlet	13 amperes
(c) 5-ampere socket-outlet	5 amperes
(d) Lighting-outlet	Current value equivalent to the connected load, with a minimum of 100 watts per lamp-holder
(e) Electric clock, electric shaver supply unit, shaver socket outlet, bell transformer, and current-using apparatus of a rating not greater than 15 volt-amperes	May be neglected
(f) All other stationary appliances	Normal current

Note 1: In the interest of good planning it is undesirable that whole of the fixed lighting of an installation should be supplied from one final sub-circuit.

Note 2: In the interest of providing the consumer with an adequate installation it is recommended that use should be made of ring final sub-circuit where applicable.

TABLE 3

Radial and ring final sub-circuits

Description and special condition if any		*Minimum copper conductor size or rubber or p.v.c. insulated cable used throughout.*	*Minimum copper clad aluminum conductor size of p.v.c. insulated cable used throughout*	*Minimum copper conductor size of mineral insulated cable used throughout (alternative to Col.2)*	*Rating of fuse or circuit-breaker protecting final sub-circuits.*	*Maximum number of socket –outlets and stationary appliance of rating not exceeding 13 amperes.*
1		2 mm^2	3 mm^2	4 mm^2	5 A	6
(a)	Radial final sub circuit serving one room only of less than $30m^2$ floor area which is not a kitchen……..	2.5	4	1.5	20	Provided that no fixed water heating appliance shall be connected to any of these points.
(b)	Radial final sub circuit, serving rooms other than in (a) above…….	2.5	4	1.5	20	2
(c)	Ring final sub circuit, with spurs if any…….	4.0 2.5	6 4	2.5 1.5	30 30	6 See regulation 31 (8) – (12)

Appliance of 15VA rating or less may be ignored.

TABLE 4

Minimum internal radius of bends in cables for fixing wiring.

Insulation	*Finish*	*Overall diameter*	*Factor to be applied to overall diameter of cable to determine minimum internal radius of bend*
Rubber or p.v.c.(circular copper or circular standard aluminum conductors)	Non-armored	Not exceeding 10mm	3
		Exceeding 10mm but not exceeding 35mm…	4
		Exceeding 25mm…….	6
	Armored	Any …….	6
p.v.c.(solid aluminum or shaped copper conductors)	Armored or non-armored	Any ……	8
Impregnated paper	Lead or corrugated aluminium sheath with or without armour	Any …….	12
	Smooth aluminium sheath with or without armour	Not exceeding 30mm	12
		Exceeding 30mm but not 50mm…….	15
Mineral	Copper or aluminium sheath with or without p.v.c covering	Exceeding 50mm…….	18
		Any …….	6

*The factors are applied to the diameter over the aluminum sheath.

TABLE 5A

Colour identification of cores of non-flexible cables and bare conductors for fixed wiring.

Function	*Colour identification of cores of rubber –or p.v.c. insulated non-flexible cable or of sleeve or disc to be applied to be conductors or cable core.*
Earthing	green-and -yellow
Live of a.c single –phase circuit	Red or yellow or brown or blue
Neutral of a.c single-or three –phase	Black
Phase R of 3-phase a.c. circuit	Red
Phase y of 3-phase a.c circuit	Yellow
Phase B of 3-phase a.c circuit	Blue
Positive of d.c .2- wire circuit	Red
Negative of d.c 2-wire circuit	Black
Outer (positive or negative)of d.c .2wire circuit derived from 3-wire system	Red
Positive of 3-wire d.c circuit	Red
Middle of 3-wire d.c circuit	Black
Negative of 3-wire d.c. circuit	Blue
Fifth (special purpose) core in 5-core armoured p.v.c. cable.	orange

*Identification of conductors Rules 49(1),(2),(3) (4).

TABLE 5B

Colour identification of cores of cables and flexible cords.

Number of cores	*Function of core*	*Colour(s)of core*
1	Live……	Brown (a)
	Neutral……	Blue
	Earthing ……	Green and yellow
2	Live ……..	Brown
	Neutral ……..	Blue (b)
3	Live ……	Brown (c)
	Neutral ……..	Blue (b)
	Earthing……..	Green and yellow
4 or 5	Live ……..	Brown or black (d) (c)
	Neutral……	Blue (b)
	Earthing……..	Green and yellow

TABLE 6

Capacities of steel conduits

Maximum capacities of steel conduits, for the simultaneous drawing-in of single-core p.v.c. cables or rubber cables.

Cable size					*Conduit size and gauge*					
Nominal conductor size mm²	*Number and diameter of wire No/mm²*	*Nominal overall diameter mm*	*16mm or 5/8 in*		*20 mm or ¾ in*		*25 mm or 1in*		*32 mm or 1 ¼ in*	
1	2	3	4	5	6	7	8	9	10	11
	P.V.C cables		*Metric Light*	*Metric Light*	*Metric Light*	*Metric Light*	*Metric Light*	*Metric Light*	*Metric Light*	*Metric Light*
			Maximum number of cables							
1.0	1/1.13	2.9	8	7	13	12	22	19	38	35
1.5	1/1.38	3.1	7	6	12	10	19	17	33	31
1.5	7/0.50	3.3	6	5	11	10	18	16	31	28
2.5	7/1.78	3.5	5	4	9	8	15	13	26	24
2.5	7/0.67	3.8	4	4	8	7	13	11	22	20
4	7/0.85	4.3	3	3	6	5	10	9	17	16
6	7/1.04	4.9	3	2	5	4	7	7	13	12
10	7/1.35	6.2	-	-	3	2	4	4	8	7
16	7/1.70	7.1	-	-	2	-	3	3	6	5
25	7/1.24	9.0	-	-	-	-	2	2	4	4
35	19/1.53	10.1	-	-	-	-	-	-	3	2
50	19/1.78	12.0	-	-	-	-	-	-	2	2
	Rubber cables									
1.0	1/1.13	3.4	6	5	10	8	16	14	28	25
1.5	1.1.38	3.6	5	4	9	8	14	13	27	23

2.5	1/1.78	4.0	4	3	7	6	11	10	20	18
4	7/0.85	5.2	2	2	4	3	7	6	12	11
6	7/1.04	6.0	2	-	3	2	5	4	9	8
10	7/1.35	7.3	-	-	2	-	3	3	6	5
16	7/1.70	8.4	-	-	-	-	2	2	4	4
25	7/2.14	10.1	-	-	-	-	-	-	3	2
35	19/1.53	11.7	-	-	-	-	-	-	2	2

NOTE. – The maximum numbers of cables in the table relate to conduit ruins incorporating not more than two 90^0 bends or the equivalent. Where runs include additional bends, sets or other restrictions, the numbers must be appropriately reduced. This applies particularly where solid conductor cables are to be drawn in.

Table 7

Capacities of p.v.c. conduits

Maximum capacities of steel conduits, for the simultaneous drawing-in of single-core p.v.c. cables or rubber cables.

Cable size				*Conduit size and gauge*		
Nominal conductor size mm^2	*Number and diameter of wire No/mm^2*	*Nominal overall diameter mm*	*16mm or 5/8 in*	*20mm or ¾ in*	*25mm or 1 in*	*12mm or 1 ¼ in*
1	2	3	4	5	6	7
P.V.C Cables			Metric A or B	Metric A or B	Metric A or B	Metric A or B
			Maximum number of cables			
1.0	1/1.12	2.9	7	12	20	34
1.5	1/1.38	3.1	6	11	18	30
1.5	7/0.50	3.3	6	10	16	28
2.5	1/1.78	3.5	5	8	14	20
2.5	7/0.67	3.8	4	7	12	20
4	7/0.85	4.3	3	5	9	15
6	7/1.04	4.9	2	4	7	12
10	7/1.35	6.2	-	2	4	7
16	7/1.70	7.3	-	2	3	5
25	7/2.4	9.0	-	-	2	3
35	19/1.53	10.3	-	-	2	3
50	19/1.78	12.0	-	-	-	2
	Rubber cables					
1.0	1/1.13	3.4	5	9	15	25
1.5	1/1.38	3.6	5	8	13	22
2.5	1/1.78	4.0	4	6	10	18
4	7/0.85	5.2	2	4	6	10
6	7/1.04	6.0	-	3	4	8
10	7/1.35	7.3	-	2	3	5
16	7/1.70	8.4	-	-	2	4
25	7/2.14	10.1	-	-	-	2
35	19/1.53	11.7	-	-	-	2

NOTE. – The maximum numbers of cables in the table relate to conduit ruins incorporating not more than two 90^0 bends or the equivalent. Where runs include additional bends, sets or other restrictions, the numbers must be appropriately reduced. This applies particularly where solid conductor cables are to be drawn in.

TABLE 8

Minimum lengths of span and minimum heights above ground for consumer's overhead wiring between buildings etc.

Types of system, and relevant item of Regulation 7.112	*Maximum length of span*	*Minimum height of span above ground*		
		At road crossing	*In position accessible to vehicular traffic other than road crossings*	*In positions inaccessible to vehicular traffic*
1	2	3	4	5
	m	m	m	m
Cables sheathed with p.v.c. or having an oil-resisting and flame-retardant or h.o.f.r. sheath, without intermediate support (item (i))	3			3.5
Cables sheathed with p.v.c or having an oil-resisting and flame-retardant or h.o.f.r sheath, in heavy-gauge steel conducts (item(ii))	3			3
p.v.c. covered overhead line conductors insulators without intermediate support (item(iii))	30	5.8 (for all types)	5.2 (for all types)	3.5
Cables sheathed with p.v.c .or having an oil-resisting and flame retardant or h.o.f.r.shearth supported by a centenary wire (item(iv))	No limit			3.5
Aerial cable incorporating a centenary wire (item(v))	No limit subject to regulation 7.3(x)			3.5
Bare or p.v.c covered overhead lines installed in accordance with the over head line Regulations (item(vi))	No limit			5.2

TABLE 9

Plugs and socket-outlets for low-voltage circuits

Type of plug and socket-outlet	*Rating (amperes)*
Fused plugs and shuttered socket-outlets, 2-pole and earth for a.c	13[a] (with fuses rated at 3 and 13)
Plugs (fused or non-fused) and socket-outlets, 2-pole and earth	2, 5, 15, 30
Plugs (fused or non-fused) and socket-outlets, protected type, 2-pole with earthing contacts	5, 15, 30
Plugs and socket-outlets (theatre type)	15
Plugs and socket-outlets(industrial type)	16, 32, 63, 125

TABLE 10

Connection of plugs, socket-outlets and connectors

	Corresponding conductor	
Terminal marking	*For circuits having an earthed neutral conductor*	*For circuits in which neither pole of the supply is earthed*
L	Live conductor	
N	Neutral conductor	Live conductors
I or E	Earth-continuity conductor	Earth-continuity conductor

TABLE 11

Maximum earth-loop impedances for earth-leakage protection by semi-enclosed fuses or cartridge fuses rating a fusing factor exceeding 1.5 *(system operating at* 230-250 *volts to earth)*

Current rating of fuse: amperes	*Impedance: ohms*
5	16
10	8
15	5.3
20	4
30	2.7
45	1.8
60	1.35
100	0.8

TABLE 12

Minimum sizes of copper earthing leads, copper bonding leads and copper earthing continuity conductors not forming part of the same cable as the associated circuit conductors.

Nominal cross sectional area of largest associated copper circuit conductor	*Nominal cross sectional area of earthing lead conductor*	*Nominal cross sectional area of earthing lead conductor*	*Nominal cross sectional area of bonding lead conductor*
1	2	3	4

mm^2	mm^2	mm^2	mm^2
1.0	6	1.0	1.0
1.5	6	1.0	1.0
2.5	6	1.0	1.0
4	6	2.5	1.0
6	6	2.5	1.0
10	6	6	2.5
16	6	6	2.5
25	16	16	6
35	16	16	6
50	16	16	6
70	50	50	16
95	50	50	16
120	50	50	16
150	50	50	16
185	70	70	50
240	70	70	50
300	70	70	50
400	70	70	50
500	70	70	50
630	70	70	50

TABLE 13

Support for cables and conductors in circuit operating at voltage exceeding medium voltage.

Types of cable or conductor	*Spacing of supports*	
	Horizontal	*Vertical*
	mm	mm
Bare conductors	500	500
Insulated and braided cables	500	800
Metal-sheathed non-armoured cable	800	1250
Armoured or metal-sheathed armoured cable	1000	1500

TABLE 14

Allowance for diversity

Estimation of the maximum current which will normally flow in an installation. For use in calculating the size of cables and switch-gear except for final sub-circuits.

Purpose of final sub-circuits fed from the wiring to which diversity applies		*Types of installation*			
		Individual domestic installation including Individual flats of a block	*Block of residential flats*	Hotel, boarding houses, lodging houses, etc	Shops, etc e.g. offices and business premises, other than Factories
1.	Lighting	66%	50%	75%	90%
2.	Heating and power appliances (but see 3-8 below)	100% fl up to 10 amperes	100% fl of the largest appliance	100% fl of the largest appliance	100% fl of the largest appliance
		+50% of any load in excess of 10 amperes	+50% fl of 2nd largest appliance	+80% fl of 2nd largest appliance	+75% fl of remaining appliance
		appliance	+33% fl of 3rd largest appliance	+60% fl of remaining appliances	
			+20% of remaining appliance		
3.	Cooking appliances permanently connected	10 amperes	100% fl of largest appliance	100% fl of largest appliance	100% fl of largest appliance
		30% fl of connected cooking appliances in excess of 10 amperes	+50% fl of 2nd largest appliance	+80% fl of 2nd largest appliance	+80% fl of 2nd largest appliance
		+5 ampere if socket-outlet incorporated in unit	+33% fl of 3rd largest appliance	+80% fl of 2nd largest appliance	+80% fl of 2nd largest appliance
			+25% fl of 4th largest appliance		
			+20% of remaining appliances		
4.	Motors other than Kft motors which are subject to special conditions	NO DIVERSITY ALLOWED		100% fl of the largest motor	100% fl of the largest motor
				+50% fl of	80% fl of 2nd largest

				remaining motors	motors
5.	Water heaters (instantaneous type)	100% fl of the largest appliance		To be assessed by a competent person	
		150% fl of 2nd largest appliance		To be assessed by a competent person	
		+25% of remaining appliances		To be assessed by a competent person	
6.	Water heaters (thermostatically controlled)	NO DIVERSITY ALLOWED **			
7.	Socket-outlets and stationery appliances in accordance with Table	100% largest fuse or circuit-breaker rating of individual circuits	100% largest fuse or circuit-breaker rating of individual circuits	100% largest fuse or circuit-breaker rating of individual circuits	100% largest fuse or circuit-breaker rating of individual circuits
		+40% sum of fuse or circuit-breaker rating of other circuits	+40% sum of fuse or circuit-breaker rating of other circuits	+50% sum of fuse or circuit-breaker rating of other circuits	+40% sum of fuse or circuit-breaker rating of other circuits
8.	Socket-outlet and stationery appliances other than those listed above	100% fl of largest point	100% fl of largest point	100% fl of largest point	100% fl of largest point
		40% fl of other points	40% fl of other points	75% fl of points in main rooms (dining room, etc)	75% fl of other points
				40% fl of remaining points	

*****For the purpose of this Table, an instantaneous water-heater is deemed to be water-heater of any loading which heats water only while the tap is turned on and therefore uses electricity intermittently.

******It is important to ensure that the distribution boards are of sufficient rating to take the total load connected to them without the application of any diversity.

SCHEDULE II

APPENDIX I

Completion Certificate

(Prescribed for Electrical Installations of Buildings)

Completion Certificate to be given by the contractor or other person responsible for the construction of the installations, or major alteration thereto, or by an authorized person acting on his behalf.

I certify that the electrical installation at ……

……..

has been inspected and tested, in accordance with the requirements of Federation of Nigeria, Electricity Act and Regulations for Electrical Installations and that, to the best of my knowledge and belief, the installation summarized complies, at the time of my test, with those Regulations current at the date of contract for the work, except as stated.

I recommend that this installation be further inspected and tested after an interval of not more than

…… months.

Signed …….. Date……

For and on behalf of: ……

Address……

Particulars of the installation covered by this Certificate:

New installation ……

Alteration/Extension to existing installation ……

Number of lighting points ……

Number(s) of socket-outlets ……

Details of Stationary appliance/fixed apparatus ……

Details of departure (if any) from the Regulations ……

Comments (if any) on existing installation (where this certificate relates to an alteration or addition)…….

INSPECTION CERTIFICATE

(Prescribed for Electrical Installations of Buildings)

Inspection Certificate to be given by the contractor other person responsible for carrying out an inspection and test of an installation, or part of an installation, or by an authorized person acting on his behalf

I certify that the electrical installation at …….

……. has been inspected and tested, in accordance with the requirement of Federation of Nigerian Electricity Act and Regulations for Electrical Installations and that the results are as indicated below.

I recommend that this installation be further inspected and tested after an interval of not more than three years.

Items inspected or tested

Method of earthing–

Cable sheath ……..

Additional overhead line conductor ……

Protective multiple earthing (P.M.E.) ……

Buried strip/rod/plate ……

Earth-leakage circuit-breaker, voltage operated……

Earth-leakage circuit-breaker, current operated. ……..

The impedance of each earth-continuity conductor is satisfactory ……..

The total earth-loop impedance is satisfactory /unsatisfactory for ready operation of the largest-rated excess-current protective device relied upon for earth-leakage protection. ……

Earth-leakage protection is afforded by a current operated/voltage operated earth-leakage circuit-breaker, the operation of which is effective. ……..

Polarity throughout the installation is correct. ……..

All single-pole control devices are in live conductors only ……..

The installation resistance of the fixed wiring Installation IS not less than 1.0 mega ohm……

Each item of apparatus tested separately is in good serviceable condition, except as stated below.

There is no sign of overloading of conductors accessories except as stated below……..

Apparatus tested includes/does not include portable appliances. ……

Comments (if any) and departure from the Regulations for Electrical Installations ……..

…… ……

Signed and Sealed Date

COREN Reg. No ……..

For and on behalf of: ……..

Address: ……..

Notes on the Application of Diversity

It is impossible to specify in these Regulations the amount of diversity for every type of installation but the figures given in the following table may be taken as a guide. The amount by which they are increased or decreased for each installation should be decided by the engineer responsible for the design of that

installation. The values given in the Table refer to -percentage of connected load, or, where followed by the letters "f. l." to the percentage of full-load current of a heating appliance; motor, or other current-using device, or a socket outlet. In calculating the maximum current, appliance and socket-outlets should be considered in the order of their current ratings, the largest first. For installations such as blocks of flats, the Calculation for diversity in the rising main should be based on the aggregate current rating of all points connected to the system and based on the sum of the normal' demands of the flats obtained applying diversity to each flat.

APPENDIX 2

Notes on precautions against corrosion of metal sheaths of cables and mental conduit ducts and trunking and their fixings

In damp situations, precautions are desirable against corrosion of metal cable sheaths and amour of cables, metal conduit and conduit fittings, metal duct and trucking systems, and associated metal fixings, where these are likely to come into contact with any of the following materials:

i. Materials containing magnesium chloride which are used in the construction of floors and dadoes,
ii. Plaster undercoats contaminated with corrosive salts,
iii. Lime, cement and plaster (e.g. on unpainted walls).
iv. Oak and other acidic woods,
v. Dissimilar metals liable to set up electrolytic action.

Application of bitumen or bituminized paint before erection - or prevention of contact by separation with bitumen felt, is recognized as effectual precautions against corrosion.

Special care is required in the choice of materials for clips and other fittings, for bare aluminum-sheathed cables and for aluminum conduit, to avoid risk of local corrosion n damp situations. Suitable materials for this purpose are the following -

Porcelain,
Aluminum,
Corrosion-resistant aluminum alloys,
Zinc alloys
Iron or steer protected-against rust by galvanizing,
Sherardizing, etc.

Contact between bare aluminum sheaths or aluminum conduits and any parts made of brass pr other metal having a high copper content, should be especially avoided in damp situations, unless the parts .are suitably plated. If such contact is unavoidable, the joint should be completed protected against ingress of moisture wiped joints in aluminum-sheathed cables should always be protected against moisture by a suitable paint, by an impervious tape, or by embedding in bitumen.

APPENDIX 3

Earthing tests and measurements

The following methods shall be used to carry out that test called for in these Regulations –

(1) Test of earth-continuity conductors:

The resistance of earth-continuity conductors referred below are subject also to the requirements for earth loop impedance. Lower values than those stated may be necessary in order to meet the requirements for the total earth loop impedance (see Regulation 173).

(a) A.C. Test:

Tests of earth-continuity conductors shall preferably be made with alternating current at the frequency of the supply and of magnitude approaching 1.5 times the rating of the final sub-circuit under test, except that the current need not exceed 25 amperes. The test shall be made when the normal supply is disconnected from the final sub-circuit under test. One end of the earth-continuity conductor shall be connected to a cable of known resistance, which may be one of the tables of that final sub-circuit. An a.c. voltage not exceeding 40 volts shall then be applied between other end of the earth-continuity conductor and the other end of the cable. Subject to the requirements for total earth loop impedance, it is satisfactory if in this instance the ratio voltage/current, less the resistance of the return conductor does not exceed 1 ohm.

(b) Reduced A.C. test

If it is preferred, e.g. owing to the need to use hand testers, not to apply a test at full current as described above, a lower value of alternating current at approximately frequency of the supply may be used for the testing of an a.c. installation, following in other respects the same procedure.

Subject to the requirements for total earth loop impedance, it is satisfactory if after allowance has been made for the return conductor, a value not exceeding 0.5 ohm for the ratio voltage/current is obtained where steel conduit or pipe forms part or whole of the earth-continuity conductor, or a value of 1 ohm where the earth continuity conductor is composed entirely of copper, copper-alloy or aluminum. it is often more convenient if a hand-generator or other portable device can he used rather than a transformer fed from the supply, as in this- event the live conductors of the various sub circuits, while disconnected from the supply, may be connected for purpose of test to the consumer's earthling terminal and a test can then be carried out between line and earthling conductor at each individual point, such as a socket outlet.

(c) D.C. test of A.C. installation

If it is not convenient to use a.c. for the testing of an a.c. installation, d.c. may be applied instead provided it has been ensured by inspection throughout the whole length of the earth-continuity conductor that no inductor is incorporated. In these circumstances and subject to the requirements tor total earth loop impedance, it is satisfactory, where steel conduit or pipe forms part or the whole of the earth-continuity conductor, if a value of resistance not exceeding 0.5 ohm is obtained, or where the earth continuity conductor is composed entirely of copper, copper-alloy aluminum, a value of resistance not exceeding 1ohm.

(d) D.C. test of D.C. installation

Where a test of an earth-continuity conductor in a d.c. installation is required, this shall preferably be made by means of a current (which may be obtained from a secondary battery and rheostat) of magnitude approaching 1.5 times the rating of the sub-circuit under test, subject to a maximum of 25 amperes. If it ·is preferred 'not to apply a test at full current, a hand-tester may he used. In other respects the procedure set out in (a) above applies and, subject to the requirement for total earth loop impedance, it is satisfactory if the resistance obtained in the test does not exceed 1 ohm.

(2) Earth-loop impedance test:

These tests should be made with the cross bonds required by these Regulations in place. The earth-fault-loop path (line-earth loop) comprises the following parts, starting and ending at the point of fault (see

also Figure 1) – the earth-continuity conductor, the consumer's earthing terminal and the earthing lead, the metallic return path where available, which may consist of the metallic cable sheath or the continuous earth wire or an overhead line or, in the case of protective multiple earthing (P.M.E.) the neutral conductor or, where no metallic return path is available the earth return path and the path through the earthed neutral point of the transformer and the transformer winding and the live conductor.

The method used may show the loop impedance in ohm alternatively it may give a direct indication of the maximum permissible fuse rating or setting of a circuit-breaker, or an indicator where a fuse or circuit-breaker of a given rating will operate satisfactorily under fault conditions.

(a) Tests in line-earth loop:

These tests may be achieved by an instrument which determines the current flowing when a known resistance is connected between the live conductor and consumer's earthing terminal using such an instrument, care should be taken that no ill effects can arise if the earthing circuit is defective

(b) Tests in neutral-earth loop:

Except when the system is earthed by protective multiple earthing (P.M.E.), it is permissible to test the neutral-earth loop instead of the line-earth loop. This may be achieved by a method which injects current into the neutral-earth Loop, preferably by means of a transformer fed from the mains, or alternatively from a.d.c. source the polarity of which is rapidly and continually reversed. The instrument employed must he so designed, or used, that its indications are not affected by neutral currents flowing in the system. In using such an instrument, care should be taken to ensure that no ill effect can arise if the circuit tested is defective. Measurements on systems fed from small transformers may require compensation to include an allowance for the impedance of the winding of transformers, balancers, etc. If a test with rapidly-reversed d.c. is made on an a.c installation it should be ensured, by inspection, that no inductor is incorporated in the earth-continuity conductor.

When a measurement on an a.c system is made with less man 10 amperes a.c. or with rapidly-reversed D.C. and the earth-continuity conductor is wholly or mainly of steel conduit or pipe, the effective value shall be taken as twice the measured value less the value measured at the consumer's earthing terminal. In all other cases the' effective value shall be the measured value subject to any necessary adjustment for impedance of supply transformers, balances, etc., as mentioned above.

(3) Test of earth-leakage circuit-breakers:

For the purpose of this test a voltage not exceeding 45 volts, obtained from a double-wound transformer connected to the mains supply Shall applied across the neutral and earth terminals (or neutral and frame terminal of a voltage operated earth leakage circuit breaker) and /the circuit-breaker shall trip instantaneously. The transformer shall preferably have a short-time rating of not, less than 750 V A. (see Figures 2 and 3).

When, in accordance with the requirements of these Regulations, across-bonding to other services is carried out in an installation where a voltage-operated earth-leakage circuit-breaker is provided, this may result in a direct earth connection of low impedance being introduced in parallel with the path through the earth-leakage circuit-breaker. Thus an increased value of earth-leakage current would need to flow before the circuit-breaker came into operation, and in some instances the cross-bonding may well remedy the deficiency which originally gave rise to the need for the earth-leakage circuit breaker. These effect are not harmful it is common practice to use the best solid earth available (e.g. suitably spaced earth electrodes) in

parallel with an earth-leakage circuit-breaker. The circuit-breaker would still be effective in preventing the exposed metal work of the installation from rising to a dangerous voltage.

(4) Measurement of consumer's earth-electrode resistance:

The following procedure shall be adopted where it is desired measure the resistance of the earth electrode, e.g.-where the installation fails to satisfy the earth-loop impedance test or where desired to check the continuity effect) through an earth electrode. (See also Figure 4).

An alternating current of a steady value shall be passes between the earth electrode X and an auxiliary earth electrode Y placed at such a distance from X that the resistance areas of the two electrodes do not overlap. A second auxiliary earth electrode Z, which may be metal like driven into the ground shall be inserted half-way between X and Y and the voltage drop between X and Z shall be measured. The resistance of the earth electrodes is then the voltage between X and Z divided by the current flowing between X and Y provided that there is no overlap the resistance areas. To check that resistance of the earth electrodes is a true value two further readings shall be taken with the second auxiliary electrode Z moved further from and 6m further to X respectively. If the three results are substantially agreement, the mean of the three readings shall be taken as the resistance of the earth electrode X. if there is no such agreement the tests shall be repeated with the distance between X and Y increased.

The test shall be made either with current at power frequency, in which case the resistance of the voltmeter used must be high (of the other of 200 ohms per volt), or with alternating current from an earth tester comprising a hand-driven generator, a rectifier (where necessary), and a direct-reading ohmmeter.

If the tests are made at power frequency the source of the current used for the test shall be isolated from the power mains (e.g. by a double-wounded transformer), and in any event the earth electrode X under test shall be disconnected from all sources of supply other than that used for testing.

Preface to the tables of current rating and voltage drop

1. Basis of current ratings and values of voltage drop

The current ratings and values of voltage drop for cables and 'bare conductors set out in Tables 15 to 33 with the associated rating factors and notes.

The current ratings and values of voltage drop for cables are applicable only to cables of voltage rating not exceeding 600/1000V (or of voltage rating 600V or 1000V, for mineral-insulated cables).

The voltage drop for any particular cable run must be such that the total voltage drop in the circuit of which the cable forms a part does not exceed the limit prescribed in these Regulations i.e. the total voltage drop between the' consumer's terminals and the other end of the circuit must not exceed 2.5 % of the declared or nominal voltage (for example, 5.75 volts for a phase voltage of 230 volts) when the circuit is carrying the designed full load current. The tabulated current ratings may be used only where the associated values of voltage drop, adjusted in proportion to the actual length of run, do not cause that limit to be exceeded.

Values of voltage drop are tabulated for a current of one ampere for all 1m run, i.e. for a distance of 1m along the route taken by the cables, and represent the result of the voltage drops in all the circuit conductors. For balanced three-phase a.c. circuits the values relate to the line voltage.

For any given run the values need to be multiplied by the length of the run in meters and by the current the cables are to carry. Where the actual current to be carried differs greatly from the current rating tabulated, the result obtained by multiplying the tabulated voltage, drop values in this way are approximate

only; for a more accurate assessment allowance should be made for, the change in conductor resistance with operating temperature.

The values of voltage drop tabulated (except those in Tables 24 - 25 and 32 -33) relate the worst conditions, viz where the phase angle of the cable circuit is equal to that of the load. For cables up to and including 120mm^2 they apply with sufficient accuracy where the power factor of the load lies between 0.6 lagging and 1.0 and for larger cables where the power factor of load does not exceed 0.8 lagging. In all other causes the value may be unduly conservative and more exact calculation is necessary

As explained below, the rating is to be modified where applicable by rating factors in respect of–

Ambient temperature,

Class of excess-current protection,

Grouping,

Disposition,

Type of sheath.

If the conditions of installation of cables depart in more than one respect from those provided for in the appropriate table, it is necessary to apply a separate factor for each special circumstance. In every instance the appropriate factors are to be applied to the current ratings as multipliers.

2. Application of rating factors

(a) For ambient temperature

The current ratings given in the Tables for cables and hare conductors are based on an ambient air temperature of 30^{o}C. Where the ambient air temperature exceeds this figure, the appropriate rating factor referred to below the Table must be applied: on the other hand if it can be established that the ambient temperature will not exceed 25°C, use may be made of the rating factor appropriate to this temperature.

The ambient air temperature may be determined by thermometers placed in free air as close as practicable to the position at which the cables are installed or are to be installed, subject to the provision that the measurements must not be influenced by the heat arising from the cables; thus if the measurements are made while the cables are loaded, the thermometers must be placed about O.5m from the cables, depending on their size, in the horizontal plane, Or 150mm below the lowest of the cables.

(b) Class of excess-current protection

Cables insulated with some thermoplastic materials (e.g., p. v. c.) may sustain serious damage when subject even for relatively short periods, to ·temperature which are appreciably higher than those permissible for continuous operation. Also at such excess temperatures, if sustained, the elastic properties of the smaller sizes of cables having synthetic rubber installation may show a tendency to deteriorate. Therefore the current ratings of cables insulated with p. v. c or synthetic rubbers are determined not only by the maximum conductor temperature admissible for continuous running, but also by the temperature likely to be attained under conditions of excess-current.

In the tables relating to those types cable, therefore, the tabulated ratings are related to the class of excess-current protection afforded for the cables. For the purposes of the Regulations the following classes of excess-current protection are defined–

Close excess-current protection

Excess-current protection which will operate within four hours at 1.5 times the designed load current of the circuit which it protects. Devices affording close excess-current protection include–

i. Fuses fitted with fuse-links of fusing factor not exceeding 1.5:

ii. Miniature, and moulded-case circuit breakers;
iii. circuit-breakers set to operate at an overload not exceeding 1.5 times the designed load current of the circuit.

Coarse excess- current protection

Excess-current protection which will not operate within four hours at 1.5 times the designed load current of the circuit which it protects. Devices affording coarse excess-current protection include:

i. fuses fitted with fuse-links fusing factor exceeding 1.5, but not exceeding 2.5;
ii. Semi-enclosed (rewire able) fuses.

The heading to each table concerned states, whether the tabulated ratings relate to close or coarse excess-current protection. Where the class of excess-current protection to be used differs from that stated in the heading to the table, the appropriate rating factor given below the table must be applied. Examples are given below,

Example 1:

A twin p.v.c. insulated cable having copper conductors is required for a single-phase a.c. circuit having a continuous load current of 60 amperes installed clipped direct to a surface and un-enclosed; From table 15 a 16mm^2 cable is suitable if it is intended that coarse excess-current protection should be provided. If close excess-current protection is to be afforded, a 10mm^2 cable (48A x 1.33 = 64A) is suitable. In either case the normal current rating of the excess-current protective device should be 60 amperes.

Example 2:

A three-core p.v.c.-insulated cable having Copper conductors is required for a three phase balanced a.c. circuit having a continuous load current of 300 amperes, installed singly in defined conditions in air. From Table 19 a 150mm^2 cable is suitable if close excess-current protection is to be afforded. If coarse excess current protection is to be used, a 240mm^2 cable (420 x 0.75 = 315A) is necessary. In either case the normal current rating of the fuse or circuit-breaker should be 300 amperes.

(c) For groups

The ratings given in the tables are for single circuits any. For groups, the appropriate rating factor referred to below the tables must be supplied.

(d) For other dispositions

The ratings given in the tables are valid only for the dispositions of cable referred to in the tables and the notes thereto. Rating factors fur other dispositions of cables in enclosed trenches are given in Tables 34 and 35.

(e) For type of sheath or finish

In the absence of any indication to the contrary it may be assumed that each table is applicable to every type of cable falling with the group described by the heading to the table. Where rating factors for type of sheath and/or armoured and/or finish are stated below a table, they must be applied to the appropriate columns of the table as indicated.

3. Cables run under defined conditions

The current ratings in the columns of the tables headed "Defined conditions" apply to cables run under the conditions defined below.

(a) Single-core cables

(1) Two or three single-core cables are installed one above the other, fixed to the vertical surface at a wall or open cable trench as follows, the distance between the wall and the surface of the cable being at least 20mm in each instance. Cables in which the conductor cross-sectional area exceeds 185mm^2 are installed at a distance between centres of about 90mm.

The ratings for two cables may be applied with safety in instances where such cables are installed in horizontal formation on brackets fixed to a wall, either spaced as indicated above, or touching throughout.

(2)Three single-core cables are installed in trefoil formation, fixed to the vertical surface of a wall or open cable trench, the cables touching throughout and the distance between the wall and the surface of the nearest cable being at least 20mm; or, alternatively, three single-core cables are installed in trefoil 1 formation and laid on a non-metallic floor, the cables touching each other and the floor throughout.

The ratings given apply provided that the sheaths of single-core metal-sheathed cables are electrically bonded at each end of the run. The cables are assumed to be remote from iron steel, or ferro-concrete, other than the cable supports.

(b) Multicore cables

Cables of all types other than single-core cables are installed singly, fixed to the vertical surface of a wall, open cable trench, the distance between the surface of the cable and the wall being at least 20mm in every instance.

For cables spaced by distances less than those described above, the current ratings in the columns headed “Clipped direct to a surfaced ....” should be applied.

4. Types of cable and conditions of installation not provided for in the tables

To reduce the number of tables of current rating that would otherwise need to be included in the Regulations, ratings are not tabulated for types of cable and/or conditions of installation in less common use. Thus ratings for the following types and conditions have been omitted–

i. rubber insulation non-flexible multi core cables,
ii. Cables insulated with varnished fabric (Terylene) or with varnished cambric and heat-resisting fiber
iii. p.v.c. insulated and p.v.c. sheathed circular Cables of conductor size up to and including 16mm^2
iv. Paper insulated cables.
v. p.v.c. insulated cables, non-armoured, copper-clad conductors; circular twin and multi core type, and single core cables of conductor’s size above 35mm^2,
vi. Cables in underground pipes and ducts
vii. Cables buried direct in the ground,
viii. Overhead line conductors,
ix. 400 Hz ratings
x. Cables insulated with heat-resisting P. V.C compound.

SCHEDULE 3

TABLE 15

P.V.C non-armoured single-core (1.0 mm^2 to 35mm^2) (Copper)

Single-circuit current ratings and associated bolt drops for single-core p.v.c-insulated cables,non-armoured with or without sheath

(Copper conductors) 1.0 mm^2 to 35 mm^2

The ratings tabulated apply where the cable is provided with coarse excess-current protection (see item 2(b) of the preface)

For the close excess-current protection, see ratings below

Conductors		*Bunched and enclosed in conduit or trunking***				*Clipped directed to surface or on a cable tray, bunched and unenclosed*			
Nominal cross-sectional area	*No. and dia (mm) or wires (nominal)*	*2 cables, single-phase a.c or d.c*		*3 or 4 cables three-phase a.c*		*2 cables, single – phase a.c or d.c*		*3 or 4 cables, three-phase a.c*	
		Current rating	*Volt drop* per ampere per metre**	*Current rating*	*Drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*
1	2	3	4	5	6	7	8	9	10
mm^2		A	mV	A	mV	A	mV	A	mV
1.0	1/1.13	11	40	9	35	13	40	12	35
1.5	1/1.38	13	27	11	23	-	27	-	23
-	7/0.50	-	30	-	26	16	30	15	26
2.5	1/1.78	-	-	-	-	-	-	-	-
-	7/0.67	18	16	16	14	23	16	20	14
4	7/0.67	24	10	22	8.8	30	10	27	8.8
6	7/1.04	31	6.8	28	5.9	38	6.8	34	5.9
10	7/1.35	42	4.0	39	3.5	51	4.0	46	3.5
16	7/1.70	56	2.6	50	2.2	63	2.6	61	2.2
25	7/2.14	73	1.6	66	1.4	89	1.6	80	1.4
35	19/1.53	90	1.2	80	1.0	109	1.2	98	1.0

*Total volt drop between the consumer's terminals and any other points in the installation must not exceed 2.5%of the nominal voltage.

**The range ratings in columns 3 and 5 relate to cables in metal or non-metallic conduit and trunking. For cables in underground pipes and ducts see item 4(vi) of the preface to the Tables.

Rating factors

For class of current protection

The rating tabulated may be multiplied by 1.11 where close excess-current protection can be assured

For ambient temperature

Ambient temperature	25^0C	35^0C	40^0C	45^0C	50^0C	55^0C	60^0C	65^0C
Rating factor for cables having coarse excess-current protection……	1.02	0.97	0.94	0.91	0.88	0.77	0.63	0.44
Rating factor for cables having close excess-current protection……	1.06	0.94	0.87	0.79	0.71	0.61	0.5	0.35

For groups

For groups of circuits unenclosed the single circuits rating apply provided that

(1) The horizontal clearance between circuits is

(a) Not less than 6 times the overall diameter of an individual cables and

(b) Not less than overall width of an individual circuits except that the horizontal clearance need not in any case exceed 150mm,and

(2) The vertical clearance between circuits is not less than 150mm,and

(3) If the number of circuits exceeds 4.they are installed in a horizontal plane.

In all other cases unless a more precise evaluation of current ratings has been made based on experimental work or calculated data ,the following factors are applicable–

No. of circuits (pairs of cables single –phase a.c or d.c

3 cables per circuits or 4 where one is the neutral, 3-phase a.c	2	3	4	5	6	7	10	12	14	16**	18**	20**
Rating factor	0.80	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.33	0.36

**Not applicable to -3phase

TABLE 16

P.V.C. non-armoured single core (50mm^2 to 630mm^2) (Copper)

Single-circuit current ratings and associated volt drops for single core p.v.c insulated cables non-armoured with or without sheath.

(Copper conductors) (50mm^2 to 630mm^2)

The rating tabulated apply only where the cables has close excess current protection,

(see item 2 (b) of the preface)

For coarse excess-current protection, the rating factors given below must be applied

nominal cross-sectional area of conductor	*Bunched and enclosed in conduit of trunking***					*Clipped direct to a surface or on a cable, tray bunched and unenclosed*					*Defined conditions*						*Conductor*
	2 cables single-phase a.c or d.c			*3 or 4 cable three-phase d.c*		*2 cables single-phase a.c or d.c*			*1 cable three-phase d.c*		*Volt drop per ampere per metre**				*Trefoil (3 cable three-phase)*		
	current rating	*Volt drop per ampere metre**		*current rating*	*Volt drop per ampere per metre**	*current rating*	*Volt drop per ampere per metre**		*current rating*	*Volt drop per ampere per metre**	*current rating*	*Single-phase*	*d.c*	*Three-phase*	*current rating*	*Volt drop per ampere per metre**	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	mV	A	mV	mm^2
50	145	0.97	0.91	100	0.82	175	0.93	0.91	10	0.82	195	0.95	0.91	0.85	170	0.10	50
70	185	0.71	0.63	160	0.62	220	0.65	0.63	200	0.59	240	0.68	0.63	0.62	210	0.59	70
95	230	0.56	0.45	195	0.48	270	0.48	0.45	240	0.45	300	0.52	0.45	0.49	260	0.42	95
120	260	0.48	0.36	220	0.42	310	0.40	0.36	280	0.38	350	0.44	0.36	0.43	300	0.34	120
150	-	-	-	-	-	335	0.34	0.29	320	0.34	410	0.39	0.29	0.39	350	0.29	150
185	-	-	-	-	-	405	0.29	0.24	365	0.30	470	0.35	0.24	0.36	400	0.25	185
240	-	-	-	-	-	450	0.24	0.18	430	0.27	560	0.36	0.18	0.38	480	0.22	240
300	-	-	-	-	-	500	0.22	0.14	500	0.25	660	0.33	0.14	0.35	570	0.19	300
400	-	-	-	-	-	680	0.20	0.12	610	0.24	800	0.30	0.12	0.33	660	0.17	400
500	-	-	-	-	-	800	0.18	0.86	710	0.23	910	0.24	0.086	0.31	770	0.16	500
630	-	-	-	-	-	910	0.17	0.068	820	0.22	1040	0.26	0.068	0.30	880	0.15	630

*Total volt drop between the consumer's terminals and any other points in the installation must not exceed 2.5%of the nominal voltage.

** The range ratings in columns 2 and 5 relate to cables in metal or on -metal conduit and trunking. For cables in underground pipes and ducts see Item 4(vi) of the preface to the Tables.

Rating factors

For class of excess-current protection

Where coarse excess-current protection is afforded the tabulated ratings must be multiplied by 0.75

For Ambient temperature

Ambient temperature	25°c	35°c	40°c	45°c	50°c	55°c	60°c	65°c
Rating factors for cables having close excess-current protection……	1.06	0.94	0.87	0.79	0.71	0.61	0.5	0.35
Rating factors for cables having coarse excess-current protection	1.02	0.97	0.94	0.91	0.88	0.77	0.63	0.44

For groups

For groups of circuits unenclosed, the single-current ratings apply provided that–

(1) The horizontal clearance between circuits is–

(a) not less than six times the overall diameter of an individual cable; and

(b) not less than the overall width of an individual circuit except that the horizontal clearance need not in any case exceed 150mm; and

(2) the vertical clearance between circuits is not less than 150mm; and

(3) if the number of circuits exceeds four they are installed in a horizontal plane.

In all cases, unless a more precise evaluation of current rating has been made on experimental work or calculated data, the following factors are applicable–

No. of circuits (pairs of cables single-phase a.c or d.c)

3 cables per circuits or 4 where one is the neutral, 3-phase a.c	2	3	4	5	6	7	10	12	14	16**	18**	20**
Rating factor	0.80	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.33	0.36

**Not applicable to -3phase

TABLE 17

P.V.C. non-armoured single core (1.0mm^2 to 35mm^2) (Copper)

Single-circuit current rating and associated volt drops for twin and multicore p.v.c. insulated and sheathed cables

The ratings tabulated apply where the cable is provided with coarse excess-current protection (see item 2(b) of the preface)

For coarse excess-current protection, the rating factor given below

Conductor		*Enclosed in conduit or trunking*				*Clipped direct to a surface or on a cable tray, and unenclosed*				*Defined conditions*				*Conductor*	
Nominal cross-sectional area	*No. and dia(mm) of wires nominal*	*One twin cable, with or without earth-continuity conductor single-phase a.c or d.c*		*One three-core cable, with or without earth continuity or one four-core cable, three-phase*		*One twin cable, with or without earth-continuity conductor single-phase a.c or d.c*		*One three-core cable, with or without earth continuity or one four-core cable, three-phase*		*One twin cable, with or without earth-continuity conductor single-phase a.c or d.c*		*One three-core cable, with or without earth continuity or one four-core cable, three-phase*			
		Current rating	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
mm^2		A	mV	A	mV	A	mV	A	mV	A	mV	A	mV	mm^2	
1.0	1/1.13	11	40	9	35	12	40	10	35	-	-	-	-	1.0	Flat cables only
1.5	1/1.36	13	27	12	23	15	27	13	23	-	-	-	-	1.5	
2.5	1/1.78	18	16	16	14	21	16	18	14	-	-	-	-	2.5	
4	7/0.85	24	10	22	8.8	27	10	24	8.8	-	-	-	-	4	
6	7/1.04	30	6.8	27	5.9	35	6.8	30	5.9	-	-	-	-	6	
10	7/1.35	40	4.0	37	3.5	48	4.0	41	3.5	-	-	-	-	10	
16	7/1.70	63	2.6	47	2.2	64	2.6	54	2.2	-	-	-	-	16	
25	7/2.14	60	1.7	53	1.5	71	1.7	62	1.5	86	1.7	72	1.5	25	Circular cable
35	19/1.53	74	1.2*	65	1.0	87	1.2	72	1.0	105	1.2	92	1.0	35	

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of nominal voltage.

Rating factors

For class of excess-current protection

The ratings tabulated may be multiplied by 1.33 where close excess-current protection can be assured

For ambient temperature

Ambient temperature	25^0C	35^0C	40^0C	45^0C	50^0C	55^0C	60^0C	65^0C
Rating factor for cables having coarse excess-current protection ……	1.02	0.97	0.94	0.91	0.88	0.77	0.63	0.44
Rating factor for cables having close excess-current protection	1.06	0.94	0.87	0.79	0.71	0.61	0.5	0.35

For groups

For groups of circuit unenclosed, the single-current ratings apply provided that–

(1) The horizontal clearance between circuits is not less than six times the overall diameter of an individual cable; and

(2) The vertical clearance between circuits is not less than 150mm; and

(3) If the number of circuits exceeds four they are installed in a horizontal plane.

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. of circuits (pairs of cables single-phase a.c or d.c)

3 cables per circuit or 4 where one is the natural, 3-phase a.c	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

** Not applicable to 3-phase

TABLE 18

P.V.C. armoured (1.5mm^2 to 35mm^2)

Single-circuit rating associated volt drops for twin and multicore p.v.c.-insulated cables (copper conductors) (1.5mm^2 to 35mm^2)

The ratings tabulated apply where the cable is provided with coarse excess-current protection

For close excess-current protection, see rating below

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray bunched and unenclosed*				*Defined conditions*				*conductor*
	One twin cable, single-phase a.c or d.c		*One three or four-core cable, three-phase*		*One twin cable, single-phase a.c or d.c*		*One three or four-core cable, three-phase*		
	Current rating	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*	
1	2	3	4	5	6	7	8	9	10
mm^2	A	mV	A	mV	A	mV	A	mV	mm^2
1.5	14	28	13	24	-	-	-	-	1.5
2.5	20	17	17	15	-	-	-	-	2.5
4	26	11	22	9.1	-	-	-	-	4
6	32	7.0	28	6.0	38	7.0	32	6.0	6
10	45	4.1	38	3.6	52	4.1	44	3.6	10
16	58	2.6	50	2.2	68	2.6	58	2.2	16
25	76	17	66	1.5	91	1.7	77	1.5	25
35	92	1.2	80	1.0	112	1.2	94	1.0	35

* Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage

For class of excess-current protection

The ratings tabulated maybe multiplied by 1.33 where close excess-current protection can be assured.

For ambient temperature

Ambient temperature	25^{0}C	35^{0}C	40^{0}C	45^{0}C	50^{0}C	55^{0}C	60^{0}C	65^{0}C
Rating factor for cables having coarse excess-current protection	1.02	0.97	0.94	0.91	0/88	0/77	0.63	0.44
Rating factor for cables having coarse excess-current protection	1.66	0.91	0.89	0.79	0.71	0.61	0.5	0.35

For groups

For groups of cables unenclosed, the single-circuit ratings apply provided–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane.

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. cables	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor……	0.80	0.70	0.65	0.62	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

TABLE 19

P.V.C. armoured (50mm^2 to 400mm^2) (Copper)

Single-circuit current ratings and associated volt drops for twin and multicore armoured p.v.c-insulated cables

(50mm^2 to 400mm^2)

The ratings tabulated apply where the cable is provided with close excess-current protection

For coarse excess-current protection, rating factor below must be applied

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable, tray bunched and or trunking*					*Defined conditions*					*conductor*
	One twin cable, single-phase a.c or d.c			*One three-or four-core cable, three-phase*		*One twin cable, single-phase a.c or d.c*			*One three-or four-core cable, three-phase*		
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	
		a.c.	*d.c.*				*a.c.*	*d.c.*			
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	mm^2
50	150	0.92	0.92	123	0.81	180	0.92	0.92	155	0.81	50
70	180	0.65	0.64	155	0.57	220	0.65	0.64	190	0.57	70
95	225	0.46	0.46	190	0.42	270	0.48	0.46	230	0.42	95
120	260	0.40	0.36	220	0.34	310	0.40	0.36	270	0.34	120
150	290	0.32	0.25	250	0.39	355	0.32	0.25	310	0.29	150
185	340	0.29	0.23	290	0.24	410	0.29	0.23	350	0.24	185
240	400	0.25	0.18	350	0.20	485	0.25	0.18	420	0.20	240
300	460	0.23	0.14	4000	0.18	550	0.23	0.14	475	0.18	300
400	520	0.22	0.11	460	0.17	620	0.22	0.11	550	0.17	400

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

For groups

For groups of cables unenclosed, the single-circuit ratings apply provided that–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane. In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. cables	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor……	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

TABLE 20

Paper, single-core, lend-sheathed (Copper)

Single-circuit current ratings and associated volt drops for single-core cables insulated with impregnated paper, lead-sheathed, with p.v.c oversheath, non-armoured (copper conductors)

The ratings tabulated apply whatever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray, bunched and or trunking*					*Defined conditions*							*Conductor*
	2 cable single-phase a.c or d.c			*3 or 4 cabled three-phase a.c*		*2 cable, flat or vertical, single-phase a.c*			*3 or 4 cables, flat or vertical, three-phase a.c*		*3 cables, in trefoil, three-phase a.c*		
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	
		a.c	d.c				a.c	d.c					
1	2	3	4	5	6	7	8	9	10	11	12	13	14
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mm^2
50	190	0.93	0.93	180	0.82	230	0.94	0.93	220	0.84	205	0.81	50
70	240	0.64	0.64	230	0.61	290	0.68	0.64	280	0.61	255	0.58	70
95	300	0.48	0.47	285	0.48	355	0.58	0.47	345	0.47	315	0.43	95
120	350	0.40	0.37	340	0.39	415	0.48	0.37	405	0.41	370	0.35	120
150	405	0.33	0.30	390	0.35	470	0.42	0.30	460	0.38	420	0.30	150
185	470	0.29	0.24	450	0.31	550	0.36	0.24	535	0.35	485	0.26	185
240	580	0.25	0.18	575	0.28	675	0.38	0.18	670	0.38	580	0.22	240
300	670	0.22	0.14	660	0.26	770	0.36	0.14	760	0.32	670	0.20	300
400	775	0.20	0.11	765	0.23	890	0.31	0.11	870	0.30	775	0.18	400
500	895	0.18	0.09	870	0.21	1000	0.29	0.09	975	0.28	885	0.17	500
630	1030	0.17	0.07	990	0.18	1150	0.27	0.07	1100	0.26	1020	0.16	630
800	1160	0.16	0.05	1100	0.17	1290	0.26	0.05	1220	0.24	1150	0.15	800
1000	1280	0.16	0.04	1190	0.15	1420	0.25	0.04	1330	0.22	1270	0.15	1000

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For ambient temperature

Ambient temperature	25°C	35°C	40°C	45°C	50°C	55°C	60°C	60°C	70°C	75°C
Rating factor	1.05	0.95	0.89	0.82	0.75	0.68	0.61	0.53	0.43	0.3

For groups

For groups of cables unenclosed, the single-circuit ratings apply provided that -

(1) The horizontal clearance between cables is -

(a) not less than six times the overall diameter of an individual cable except that the horizontal clearance need not in any case exceed 150mm; and

(b) not less than the overall width of an individual circuit, except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane.

In all other cases, unless more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. of circuits (pairs of cables for single-phase a.c or d.c 3 cables per circuit or 4 where one is the neutral, 3-phase a.c)	2	3	4	5	6	8	10	12	14	16*	18*	20*
Rating factor	0.08	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.38	0.36

For unserved lead-sheathed cable

Cross-sectional area of conductor (mm^2)	50 to 185	240 to 500	630 to 1000
2 or 3 cables, flat formation	0.95	1.00	1.01
3 cables, trefoil formation	0.93	0.94	0.96

*Not applicable to 3 phase

TABLE 21

Paper, twin and multicore, lend-sheathed or aluminium-sheathed

Single-circuit current and associated volt drops for twin and multicore cables insulated with impregnated paper, lead-sheathed or aluminum-sheathed, armoured, or non-armoured with or without serving (copper conductors)

The ratings tabulated apply whatever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray, and unenclosed*					*Defined conditions see item 3 of preface to tables*					*conductor*
	One twin cable, single-phase a.c or d.c			*One three-or four-core cable, three-phase*		*One twin cable, single-phase a.c or d.c*			*One three or four core cable, three-phase*		
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	
1	2	a.c.3	d.c 4	5	6	7	8	9	10	11	12
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	mm^2
50	165	0.95	0.95	145	0.82	200	0.95	0.95	170	0.82	50
70	205	0.66	0.66	180	0.58	250	0.66	0.66	215	0.58	70
95	255	0.49	0.47	225	0.43	305	0.49	0.47	265	0.43	95
120	295	0.40	0.36	260	0.35	355	0.40	0.36	305	0.35	120
150	335	0.33	0.30	300	0.28	405	0.33	0.30	350	0.28	150
185	390	0.28	0.24	345	0.24	465	0.28	0.24	405	0.24	185
240	460	0.24	0.19	410	0.20	555	0.24	0.19	480	0.20	240
300	525	0.21	0.15	470	0.18	635	0.21	0.15	550	0.18	300
400	610	0.20	0.12	545	0.17	735	0.20	0.12	640	0.17	400

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

**Stranded or solid conductors

Rating factors

For ambient temperature

Ambient temperature	25°C	35°C	40°C	45°C	50°C	55°C	60°C	60°C	70°C	75°C
Rating factor	1.05	0.95	0.89	0.82	0.75	0.68	0.61	0.53	0.43	0.3

For groups

For groups of cables unenclosed, the single-circuit ratings apply provided that–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. cables	2	3	4	5	6	8	10	12	14	16	18	20

Rating factor…….	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

TABLE 22

Light duty mineral, exposed to touch or p.v.c covered (Copper)

Current ratings and associated volt drops for light-duty mineral insulated cables (copper conductors and sheath) exposed to touch or having an overall covering of p.v.c.

The ratings tabulated apply whenever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Two single-core cables, single-phase a.c or d.c*		*Three or four single-core cables, three-phase a.c*		*One twin cable, single-phase a.c or d.c*		*One three-core cable, three-phase a.c*		*One four core cable, three-phase a.c*		*One seven-core cable, all cores fully loaded*		
	Current rating	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	
												1-phase a.c or d.c	*3-phase a.c*
1	2	3	4	5	6	7	8	9	10	11	12	13	14
mm^2	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV	mV
10	22	42	18	36	17	42	14	36	15	36	10	42	36
1.5	27	28	23	24	22	28	18	24	19	24	13	28	24
2.5	36	17	31	14	29	17	24	14	25	14	17	17	14
4	46	10	41	9.0	38	10	32	9.0	33	9.0	-	-	-
6	59	6.9	52	6.0	49	6.9	-	-	-	-	-	-	-
10	80	4.2	70	3.6	-	-	-	-	-	-	-	-	-

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For ambient temperature

Ambient temperature	25°C	30°C	40°C	50°C	60°C
Rating factor for cables exposed to touch……	1.06	1.0	0.85	0.68	0.31
Rating factor for cables having overall p.v.c covering	1.16	1.1	0.91	0.75	0.51

For groups of cables busched

No. of circuits (single-core cables) or number of cables (for twin and multicore cables)	2	3		5	6	8	10	12	14	16**	18**	20**
Rating factor	0.8	0.69	0.65	0.59	0.56	0.51	0.48		0.42	0.41	0.39	0.38

**Not applicable to single-core one-phase

Table 23

Heavy duty mineral, exposed to touch or p.v.c covered (Copper)

Current ratings and associated volt drops for heavy duty mineral-insulated cables (copper conductors and sheath) exposed to touch or having an overall covering of p.v.c

The ratings tabulated apply whatever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Two single-core cables, single-phase a.c or d.c*		*Three or four single-core cables, three-phase a.c*		*One twin cable, single-phase a.c or d.c*		*One three-core cable, three-phase a.c*		*One four core cable, three-phase a.c*		*One seven-core cable, all cores fully loaded*		
	Current rating	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**	
												1-phase a.c or d.c	*3-phase a.c*
1	2	3	4	5	6	7	8	9	10	11	12	13	14
mm^2	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV	mV
1.0	23	42	20	36	19	42	16	36	16	36	11	42	36
1.5	29	28	26	24	24	28	20	24	20	24	14	28	24
2.5	39	17	34	14	32	17	26	14	27	14	19	17	14
4	50	10	44	9.0	41	10	34	9.0	35	9.0	24	10	9.0
6	63	6.9	56	6.0	53	6.9	44	6.0	45	6.0	-	-	-
10	85	4.2	75	3.6	71	4.2	59	3.6	61	3.6	-	-	-
16	110	2.6	99	2.3	94	2.6	78	2.3	81	2.3	-	-	-
25	150	1.7	130	1.4	124	1.7	105	1.4	110	1.4	-	-	-
35	180	1.2	160	1.0	-	-	-	-	-	-	-	-	-
50	225	0.83	200	0.72	-	-	-	-	-	-	-	-	-
70	275	0.59	240	0.51	-	-	-	-	-	-	-	-	-
95	330	0.44	290	0.38	-	-	-	-	-	-	-	-	-
120	380	0.35	335	0.30	-	-	-	-	-	-	-	-	-
150	440	0.28	385	0.24	-	-	-	-	-	-	-	-	-

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factor

For ambient temperature

Ambient temperature	25°C	30°C	40°C	50°C	60°C
Rating factor for cables exposed to touch……	1.06	1.0	0.85	0.68	0.31
Rating factor for cables having overall p.v.c covering	1.16	1.1	0.94	0.75	0.51

For groups of cables busched

No. of circuits (single-core cables) or number of cables (for twin and multicore cables)	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor	0.8	0.69	0.65	0.59	0.56	0.51	0.48	0.44	0.42	0.41	0.39	0.38

Table 24

Bare circular conductors (risers)

Single-circuit current and associated volt drops for bare or lightly-covered solid copper conductors or cross-section installed in vertical trunking with a spacing of 75mm between conductors

NOTE – *Table 24 does not apply t busbars and connections of switchboards*

Conductor		*2 conductors, d.c*		*2 conductors, single-phase a.c*			*3 or 4 conductors, three-phase a.c*		
Diameter	*App. Cross-sectional area*	*Current rating*	*Voltage drop per ampere per metre*	*Current rating*	*Voltage drop per ampere per metre*		*Current rating*	*Voltage drop per ampere per metre*	
					p.f. = 1.0	*p.f. = 0.7*		*p.f. = 1.0*	*p.f.= 0.7*
1	2	3	4	5	6	7	8	9	10
mm	mm^2	A	mV	A	mV	mV	A	mV	mV
10	79	270	0.55	270	0.55	0.66	270	0.48	0.60
12.5	120	370	0.35	370	0.35	0.51	370	0.31	0.45
16	200	510	0.22	510	0.22	0.39	510	0.19	0.36
20	315	700	0.14	690	0.14	0.32	690	0.12	0.30
25	490	940	0.068	920	0.092	0.27	920	0.081	0.25

*Total volt drop between consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For conductors to rubber or p.v.c.-insulated cables–

(a) Current rating factor: 0.9;

(b) Volt drop rating factor–

(i) 0.97 for d.c conductors and a.c conductors with p.f. = 10

(ii) 0.98 for a.c conductors with p.f. = 0.7 (mean value)

Table 25

Bare circular conductors (risers)

Single-circuit current ratings and associated volt drops for bare or lightly-covered solid copper conductors of rectangular cross-section installed in vertical trunking with a spacing of 75mm between conductors when disposed in parallel, or with a spacing of 30mm between conductors when disposed edge to edge

NOTE– *Table 25 does not apply to busbars and connections on switchboards*

Conductor		*2 conductors d.c*		*2 conductors single-phase a.c*						*3 or 4 conductors three-phase a.c*					
Dimensions	*Approximate cross-sectional area*	*Current rating*	*Volt drop per ampere metre**	*Parallel disposition*			*Edge-to-edge disposition*			*Parallel disposition*			*Edge-to-edge disposition*		
				Current rating	*Volt drop per ampere metre**		*Current rating*	*Volt drop per ampere metre**		*Current rating*	*Volt drop per ampere metre**		*Current rating*	*Volt drop per ampere metre**	
					p.f.=1.0	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
mm	mm^2	A	mV	A	mV	mV	A	mV	mV	A	mV	mV	A	mV	mV
16 x 2.5	40	205	1.08	205	1.08	1.02	205	1.08	0.97	205	0.94	0.90	205	0.94	0.86
16 x 4.0	64	270	0.67	270	0.67	0.73	265	0.68	0.69	270	0.58	0.65	265	0.59	0.62
25 x 4.0	100	385	0.44	385	0.44	0.53	385	0.44	0.50	385	0.38	0.48	385	0.38	0.45
25 x 6.3	157	500	0.27	495	0.28	0.42	495	0.28	0.38	495	0.24	0.38	495	0.24	0.35
40 x 6.3	250	740	0.17	730	0.18	0.31	720	0.18	0.30	730	0.15	0.29	720	0.15	0.28
63 x 6.3	400	1080	0.11	1060	0.11	0.23	1000	0.12	0.28	1060	0.10	0.22	1043	0.11	0.23
100 x 6.3	630	1610	0.069	1540	0.075	0.17	1450	0.084	0.22	1540	0.065	0.16	1490	0.070	0.20

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For conductors connected to rubber- or p.v.c.-insulated cables–

(a) Current rating factor: 0.9

(b) Volt drop rating factor–

I. 0.97 for d.c conductors and a.c. conductors with p.f. = 1.0

II. 0.98 for a.c conductors with p.f. = 0.7 (mean value)

TABLE 26

60^0C rubber-insulated flexible cables

Current ratings and associated volt drops for 60^0C rubber-insulated flexible cables, other than flexible cords

Nominal cross-sectional area of conductor	*Maximum diameter of wires forming conductor*	*Current rating*		*Volt drop per ampere per metre*		
		d.c. or single phase a.c (one twin cable with or without earth-continuity conductor or two single-core cables bunched)	*Three-phase a.c (one three-four- or five-core cable)*	*d.c*	*Single-phase a.c*	*Three-phase a.c*
1	2	3	4	5	6	7
mm^2	mm	A	A	mV	mV	mV
4	0.31	13	28	11.0	11.0	9.7
6	0.31	42	36	7.3	7.3	6.6
10	0.41	57	49	4.2	4.2	3.8
15	0.41	76	66	2.7	2.7	2.4
25	0.41	100	85	1.7	1.7	1.6
35	0.41	120	100	1.2	1.24	1.1
50	0.41	150	130	0.85	0.88	0.79
70	0.51	180	160	0.60	0.64	0.56
95	0.51	220	190	0.45	0.50	0.43
120	0.51	250	220	0.35	0.41	0.35
150	0.51	290	250	0.29	0.34	0.29
185	0.51	330	285	0.23	0.30	0.25
240	0.51	380	330	0.18	0.25	0.21
300	0.51	435	385	0.14	0.23	0.18
400	0.51	520	-	0.11	0.21	-
500	0.61	590	-	0.086	0.19	-
630	0.61	680	-	0.067	0.18	-

*Total volt drop between consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

NOTE–the tabulated ratings are not applicable to flexible cables wound on drums. The current rating of a cable on a drum depends upon the type of drum and may be less than one half of the corresponding rating stated in the table.

Rating factors

For ambient temperature

Ambient temperature	25^0C	35^0C	40^0C	45^0C	50^0C	55^0C
Rating factor	1.04	0.91	0.82	0.71	0.57	0.41

TABLE 27

Flexible cords

Current ratings and associated volt drops and masses supportable for flexible cords

Nominal cross-sectional area of conductor	*Maximum diameter of wires forming conductor*	*Current rating d.c. or single-phase a.c or three-phase a.c*	*Volt drop per ampere per metre*		*Maximum mass supported by twin-flexible cord (see regulation 7.105)*
			d.c. or single-phase a.c	*Three-phase a.c*	
1	2	3	4	5	6
mm^2	mm	A	mV	mV	kg
0.5	0.21	3	83	72	2
0.75	0.21	6	56	48	3
1.0	0.21	10	43	37	5
1.25	0.26	13	35	29	5
1.5	0.26	15	31	26	5
2.5	0.26	20	18	16	5
4	0.31	25	11	9.6	5

*Total volt drop between consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

60^0C rubber and p.v.c. cords

For ambient temperature

Ambient temperature	35^0C	40^0C	45^0C	50^0C	55^0C
Rating factor	0.96	0.92	0.87	0.71	0.50

Glass fibre cords

Ambient temperature	35^0C - 150^0C	155^0C	160^0C	165^0C	170^0C	175^0C
Rating factor	1.0	0.92	0.82	0.71	0.57	0.40

TABLE 28

P.V.C non-armoured single-core (aluminium)

Single-circuit current ratings and associated volt drop for single-core p.v.c. non-armoured with sheath (aluminium conductors)

The ratings tabulated apply only where the cable has close excess-current protection

For coarse excess-current protection, the rating factor given below must apply

Nominal cross-sectional area of conductor	*Bunched and enclosed in conduit of trunking***					*Clipped direct to a surface or on a cable tray, bunched and unenclosed*					*Defined conditions see item 3 of preface tables*						*Conductors*
	2 cables single-phase a.c or d.c			*3 or 4 cable three-phase a.c*		*2 cables, single-phase a.c or d.c*			*3 or 4 cable three-phase a.c*		*Flat or vertical (2 cables single-phase a.c or d.c or 3 or 4 cables three-phase a.c)*				*Trefoil (3 cable three-phase a.c)*		
											Current rating	*Volt drop per ampere per metre**					
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**					*Current rating*	*Volt drop per ampere per metre**	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	mV	A	mV	mm^2
16	60	4.5	4.5	52	3.9	72	4.5	4.5	65	3.9	-	-	-	-	-	-	16
25	78	2.9	2.8	67	2.5	94	2.8	2.8	85	2.5	-	-	-	-	-	-	25
35	96	2.1	2.0	83	1.8	115	2.1	2.0	105	1.8	-	-	-	-	-	-	35
50	120	1.6	1.5	100	1.4	140	1.5	1.5	125	1.3	155	1.5	1.5	1.34	140	1.3	50
70	150	1.2	1.0	125	1.0	175	1.1	1.0	155	0.93	190	1.1	1.0	0.95	170	0.90	70
95	175	0.93	0.75	150	0.80	210	0.77	0.75	185	0.69	235	0.80	0.75	0.72	205	0.67	95
120	205	0.80	0.60	175	0.70	240	0.62	0.60	215	0.56	275	0.65	0.60	0.60	235	0.54	120
150	235	0.71	0.49	200	0.64	275	0.51	0.49	245	0.48	320	0.55	0.49	0.51	270	0.45	150
185	-	-	-	-	-	320	0.42	0.39	285	0.40	370	0.46	0.39	0.45	310	0.37	185
240	-	-	-	-	-	380	0.34	0.29	340	0.34	440	0.43	0.29	0.43	370	0.30	240
300	-	-	-	-	-	440	0.29	0.23	390	0.30	510	0.38	0.23	0.39	435	0.25	300
400	-	-	-	-	-	530	0.25	0.18	475	0.27	620	0.34	0.18	0.36	520	0.22	400
500	-	-	-	-	-	620	0.22	0.15	550	0.25	720	0.31	0.15	0.31	610	0.19	500
630	-	-	-	-	-	720	0.20	0.11	640	0.24	820	0.28	0.11	0.31	710	0.17	630

*Total drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For class of excess-current protection

Where coarse excess-current protection is afforded the tabulated ratings must be multiplied by 0.75

For ambient temperature

Ambient temperature	25^0C	35^0C	40^0C	45^0C	50^0C	55^0C	60^0C	65^0C
Rating factor for cables having close excess-current protection	1.06	0.94	0.87	0.79	0.71	0.61	0.5	0.35
Rating factor for cables having coarse excess-current protection	1.02	0.97	0.94	0.91	0.88	0.77	0.63	0.44

For groups

For groups of cables unenclosed, the single-circuit ratings apply, provided that–

1. The horizontal clearance between cables is–
   (a) Not less than six times the overall diameter of an individual cable, and
   (b) Not less than the overall width of an individual circuit, except that the horizontal clearance need not in any case exceed 150mm, and

The vertical clearance between cables is not less than 150mm; and

If the number of cables exceeds four they are installed in a horizontal plane. In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data the following factors are applicable–

No. of circuits (pairs of cables, single phase a.c or d.c 3 cables per circuit or 4 where one is the neutral, 3 phase a.c)	2	3	4	5	6	8	10	12	14	16**	18**	20**
Rating factor	0.80	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.38	0.36

**Not applicable to 3-phase

TABLE 29

P.V.C.-armoured (aluminium)

Single-circuit current ratings and associated volt drop for twin and multicore armoured p.v.c-insulated cables (aluminium conductors)

The ratings tabulated apply only where the cable has close excess-current protection

For coarse excess-current protection, the rating factor given below must be applied

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray, bunched and or trunking*					*Defined conditions*					*Conductor*
	One twin cable, single-phase a.c or d.c			*One three-or four-core cable three-phase*		*One twin cable, single-phase a.c or d.c*			*One three-or four-core cable three-phase*		
	Current rating	*Volt drop per ampere per metre**				*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	
		a.c.	*d.c.*	*Current rating*	*Volt drop per ampere per metre**		*a.c*	*d.c.*			
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	mm^2
16	56	4.5	4.5	48	3.9	66	4.5	4.3	58	3.9	16
25	75	2.9	2.9	64	2.5	87	2.9	2.9	71	2.5	25
35	90	2.1	2.0	78	1.8	105	2.1	2.0	93	1.8	35
50	110	1.6	1.5	94	1.3	130	1.6	1.5	110	1.3	50
70	140	1.1	1.0	120	0.93	165	1.1	1.0	145	0.93	70
95	170	0.79	0.77	145	0.68	195	0.79	0.77	175	0.68	95
120	-	-	-	170	0.54	-	-	-	205	0.54	120
150	-	-	-	190	0.45	-	-	-	230	0.45	150
185	-	-	-	220	0.37	-	-	-	270	0.37	185
240	-	-	-	270	0.30	-	-	-	320	0.30	240
300	-	-	-	295	0.25	-	-	-	365	0.25	360

*Total volt drop between customer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For class of excess-current protection

Where coarse excess-current protection is afforded, the tabulated ratings must be multiplied by 0.75

For ambient temperature

Ambient temperature	**25°C**	**35°C**	**40°C**	**45°C**	**50°C**	**55°C**	**60°C**	**65°C**
Rating factor for cables having close excess-current protection	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35
Rating factor for cables having coarse excess-current protection	1.02	0.97	0.94	0.91	0.88	0.77	0.63	0.44

For groups

For groups of cables unenclosed, the single-circuit ratings apply, provided that–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable, except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane.

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. of cables	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

TABLE 30

Paper, single-core, lead-sheathed (aluminium)

*Single-circuit current ratings and associated volt drop for single-core cables insulated with impregnated paper, lead sheathed**, with p.v.c. oversheath*** non-armoured, (aluminium conductors)*

The ratings tabulated apply whatever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray, bunched and or trunking*					*Defined conditions*							*Conductors*
	2 cable, single-phase a.c or d.c			*3 or 4 cables three-phase a.c*		*2 cable, flat or vertical, single-phase a.c or d.c*			*3 or 4 cables, flat or vertical three-phase a.c*		*3 cables in trefoil, three-phase a.c*		
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre*	*Current rating*	*Volt drop per ampere per metre*		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre*	
		a.c.	*d.c.*				*a.c.*	*d.c.*					
1	2	3	4	5	6	7	8	9	10	11	12	13	14
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mm^2
50	145	1.6	1.6	144	1.3	175	1.6	1.6	170	1.4	155	1.3	50
70	185	1.1	1.1	175	0.96	225	1.1	1.1	215	1.0	200	0.92	70
95	225	0.8	0.77	215	0.72	275	0.82	0.77	270	0.77	245	0.68	95
120	265	0.64	0.61	260	0.58	325	0.68	0.61	315	0.64	285	0.55	120
150	300	0.52	0.51	295	0.50	370	0.58	0.51	360	0.56	325	0.46	150
185	355	0.44	0.40	345	0.44	430	0.50	0.40	420	0.49	380	0.38	185
240	435	0.36	0.33	430	0.39	530	0.47	0.33	530	0.46	455	0.32	240
300	495	0.30	0.24	500	0.34	610	0.41	0.24	605	0.40	525	0.27	300
400	590	0.26	0.19	590	0.29	710	0.34	0.19	700	0.33	615	0.23	400
500	670	0.23	0.15	675	0.25	810	0.30	0.15	790	0.28	710	0.20	500
630	790	0.21	0.12	790	0.22	940	0.26	0.12	910	0.24	830	0.18	630
800	910	0.19	0.09	890	0.19	1070	0.23	0.09	1030	0.21	910	0.17	800
1000	1020	0.17	0.07	990	0.17	1210	0.21	0.07	1140	0.18	1080	0.16	1000

*Total volt drop between the consumer's terminals and any other point in the installation must exceed 2.5% of the nominal voltage.

Rating factors

For ambient temperature

For groups

For groups of cables unenclosed, the single-circuit ratings apply, provided that–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable, except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane.

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. of circuits (pairs of cables, single phase a.c or d.c. 3 cables per circuit or 4 where one is the neutral, 3phase a.c)	2	3	4	5	6	8	10	12	14	16**	18**	20**
Rating factor	0.80	0.69	0.62	0.59	0.55	0.51	0.48	0.43	0.41	0.39	0.38	0.36

For unserved lead-sheathed cables

Cross-sectional area of conductor (mm^2)	**50 to 180**	**240 to 500**	**630 to 1000**
2 or cables, flat formation	0.95	1.00	1.01
3 cables, trefoil formation	0.93	0.94	0.96

**Not applicable to 3-phase

TABLE 31

Paper, twin and multicore, lead-sheathed or aluminium-sheathed (aluminium)

Single-circuit current ratings and associated volt drops for twin and multicore cables insulated with impregnated paper, lead-sheathed or aluminium-sheathed, armoured or non-armoured, with or without serving (aluminium conductors)

The ratings tabulated apply whatever may be the class of excess-current protection provided for the cables

Nominal cross-sectional area of conductor	*Clipped direct to a surface or on a cable tray, bunched and or trunking*					*Defined conditions*					*Conductor*
	One twin cable, single-phase a.c or d.c			*One three-or four-core cable three-phase*		*One twin cable, single-phase a.c or d.c*			*One three-or four-core cable three-phase*		
	Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	
		a.c.	d.c.				a.c.	d.c.			
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	mV	mV	A	mV	A	mV	mV	A	mV	mm^2
50	125	1.6	1.6	115	1.3	145	1.6	1.6	130	1.3	50
70	165	1.1	1.1	140	0.95	195	1.1	1.1	160	0.95	70
95	205	0.81	0.79	170	0.70	240	0.81	0.79	200	0.70	95
120	235	0.64	0.63	200	0.55	275	0.64	0.63	230	0.55	120

150	265	0.53	0.53	225	0.46	315	0.53	0.51	265	0.46	150
185	310	0.44	0.41	245	0.38	365	0.44	0.41	305	0.38	185
240	370	0.36	0.31	290	0.31	435	0.36	0.31	365	0.31	240
300	425	0.30	0.25	335	0.26	500	0.30	0.25	420	0.26	300
400	495	0.26	0.19	435	0.22	585	0.26	0.19	510	0.22	400

*Total voltage drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For ambient temperature

Ambient temperature	25^0C	35^0C	40^0C	45^0C	50^0C	55^0C	60^0C	65^0C	70^0C	75^0C
Rating factor	1.05	0.95	0.89	0.82	0.75	0.68	0.61	0.53	0.43	0.30

For groups

For groups of cables unenclosed, the single-circuit ratings apply, provided that–

(1) The horizontal clearance between cables is not less than six times the overall diameter of an individual cable, except that the horizontal clearance need not in any case exceed 150mm; and

(2) The vertical clearance between cables is not less than 150mm; and

(3) If the number of cables exceeds four they are installed in a horizontal plane.

In all other cases, unless a more precise evaluation of current rating has been made based on experimental work or calculated data, the following factors are applicable–

No. of cables	2	3	4	5	6	8	10	12	14	16	18	20
Rating factor	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43	0.41	0.39	0.38

TABLE 32

Bare circular aluminium conductors (risers)

Single-circuit current ratings and associated volt drops for bare or lightly-insulated solid aluminium conductors or circular cross-section installed in vertical trunking with a spacing of 75mm between conductors

NOTE. – *Table 32 does not apply to busbars and connections of switchboards*

Conductor		*2 conductors d.c*		*2 conductors, single-phase a.c*			*3 or 4 conductors, three-phase a.c.*		
Diameter	*Approximate cross-sectional area*	*Current rating*	*Voltage drop per ampere per metre**	*Current rating*	*Voltage drop per ampere per metre**		*Current rating*	*Voltage drop per ampere per metre**	
					p.f.=1.0	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*
1	2	3	4	5	6	7	8	9	10
mm	mm^2	A	mV	A	mV	mV	A	mV	mV
10	79	205	0.98	205	0.98	0.96	205	0.84	0.85
12.5	120	275	0.63	275	0.63	0.70	275	0.55	0.63
16	200	385	0.38	385	0.38	0.58	385	0.33	0.46
20	315	520	0.24	520	0.25	0.40	520	0.22	0.36
25	490	710	0.16	700	0.16	0.32	700	0.14	0.30

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For conductors connected to rubber- or p.v.c.-insulated cables–

(a) Current rating factor: 0.9

(b) Volt drop rating factor–

I. 0.97 for d.c conductors and a.c. conductors with p.f. = 1.0
II. 0.98 for a.c conductors with p.f. = 0.7 (mean value)

TABLE 33

Bare circular aluminium conductors (risers)

Single-circuit current ratings and associated volt drops for bare or lightly-insulated solid aluminium conductors of rectangular cross-section installed in vertical trunking with a spacing of 75mm between conductors when disposed in parallel, or with a spacing of 30mm between conductors when disposed edge to edge

Conductors		*2 conductors d.c*		*2 conductors single phase a.c*						*3 or 4 conductors single phase a.c*					
Dimensions	*Approximate cross-sectional area*	*Current rating*	*Volt drop per ampere per metre**	*Parallel disposition*			*Edge-to-edge disposition*			*Parallel disposition*			*Edge-to-edge disposition*		
				Current rating	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**		*Current rating*	*Volt drop per ampere per metre**	
					p.f.=1.0	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*		*p.f.=1.0*	*p.f.=0.7*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
mm	mm^2	A	mV	A	mV	mV	A	mV	mV	A	mV	mV	A	mV	mV
16 x 2.5	40	155	1.9	155	1.9	1.6	155	1.9	1.6	155	1.6	1.4	150	1.7	1.4
16 x 4.0	64	200	1.3	200	1.1	1.1	200	1.2	1.1	200	1.05	0.98	200	1.1	0.83
25 x 4.0	100	290	0.77	290	0.78	0.77	290	0.78	0.73	290	0.67	0.68	290	0.67	0.66
25 x 6.3	157	375	0.49	375	0.50	0.56	370	0.50	0.54	375	0.43	0.51	370	0.44	0.48
40 x 6.3	250	550	0.31	550	0.31	0.40	550	0.35	0.39	550	0.27	0.37	550	0.27	0.36
63 x 6.3	400	810	0.20	800	0.19	0.29	790	0.20	0.31	800	0.17	0.27	800	0.17	0.28
100 x 6.3	630	1210	0.12	1180	0.13	0.21	1140	0.14	0.25	1180	0.11	0.20	1160	0.11	0.23

*Total volt drop between the consumer's terminals and any other point in the installation must not exceed 2.5% of the nominal voltage.

Rating factors

For conductors connected to rubber- or p.v.c.-insulated cables–

(a) Current rating factor: 0.9

(b) Volt drop rating factor–

I. 0.97 for d.c conductors and a.c. conductors with p.f. = 1.0

II. 0.98 for a.c conductors with p.f. = 0.7 (mean value)

TABLE 34

Disposition of cables in enclosed trenches

(to be used in conjunction with Table 35)

NOTE. – *Tables 16 to19, 21, 28, to 31 set out current ratings for cables run under defined conditions where such cables are installed in enclosed trenches. Those ratings no longer apply and must be modified by the appropriate rating factors set out in Table 35. The disposition in enclosed trenches of which the factors in Table 35 are applicable, are illustrated below*

Disposition	Conditions	Examples
First	Cables installed on the floor of an enclosed trench 450 mm wide by 300mm deep, including 100 mm cover. Two single-core cables with surface separated by a distance, equal to one diameter, three single- core cables in trefoil and touching throughout. Multicore cables or groups of single-core cables separated by a minimum*distance of 50mm.	
Second	Cables installed in an enclosed trench 450 mm wide by 600 mm deep, including 100 mm cover. Single-core cables arranged in flat groups of two or three on the vertical trench wall with surface separated by a distance equal to one diameter with a minimum *separation of 50 mm between groups. Multicore cables installed singly separated by a minimum *distance of 75 mm. All cables spaced at least 25 mm from the trench wall.	
Third	Cables installed in an enclosed trench 600 mm wide by 760 mm deep, including 100 mm cover. Single-core cables arranged in group of two or three in flat formation with the surface separated by a distance equal to one diameter or in trefoil formation with cables touching. Groups separated by a minimum *distance of 50mm either horizontally or vertically. All cables spaced at least 25 mm from the trench wall.	

*Larger spacings to be used where practicable

TABLE 35

Rating factor for cables in enclosed trenches

NOTE. - *The rating factors tabulated below relate the dispositions of cables illustrated in table 34 and are applicable to the current rating and volt drops for "defined conditions" given in Tables 16 to 19,21 to 22 and 29 to 32*

Nominal cross-sectional area of conductor	*Rating factor*									
	First disposition				*Second disposition*			*Third disposition*		
	Two single-core cables, or one 3 or 4-core cables	*Three single-core cables, or two twin cable*	*Four single-core cables or two 3 or 4-core cables*	*Six single-core cables, four twin cables or three 3- or 4-core cables*	*Six single-core cables, four twin cables or three 3- or 4-core cables*	*Eight single-core cables, or four 3 or 4-core cables*	*Twelve single-core cables, or 3- or 4-core cables*	*Twelve single-core cables, or eight twin cables 3-or 4-core cables*	*Eighteen single-core cables, twelve twin cables, or nine 3- or 4-core cables*	*Twenty-four single core cables, sixteen twin cables, or twelve 3- or 4-core cables*
1	2	3	4	5	6	7	8	9	10	11
mm^2										
4	0.93	0.90	0.87	0.82	0.86	0.83	0.76	0.81	0.74	0.69
6	0.92	0.89	0.86	0.81	0.86	0.82	0.75	0.80	0.73	0.68
10	0.91	0.88	0.85	0.80	0.85	0.80	0.74	0.78	0.72	0.66
16	0.91	0.87	0.84	0.78	0.83	0.78	0.71	0.76	0.70	0.64
25	0.90	0.86	0.82	0.76	0.81	0.76	0.69	0.74	0.67	0.62
35	0.89	0.85	0.81	0.75	0.80	0.74	0.68	0.72	0.66	0.60
50	0.88	0.84	0.79	0.74	0.78	0.73	0.66	0.71	0.64	0.59
70	0.87	0.82	0.78	0.72	0.77	0.72	0.64	0.70	0.62	0.57
95	0.86	0.81	0.76	0.70	0.75	0.70	0.63	0.68	0.60	0.55
120	0.85	0.80	0.75	0.69	0.73	0.68	0.61	0.66	0.58	0.53
150	0.84	0.78	0.74	0.67	0.72	0.67	0.59	0.64	0.57	0.51
185	0.83	0.77	0.73	0.65	0.70	0.65	0.58	0.63	0.55	0.49
240	0.82	0.76	0.71	0.63	0.69	0.63	0.56	0.61	0.53	0.48
300	0.81	0.74	0.69	0.62	0.68	0.62	0.54	0.59	0.52	0.46
400	0.80	0.73	0.67	0.59	0.66	0.60	0.52	0.57	0.50	0.44
500	0.78	0.72	0.66	0.58	0.64	0.58	0.51	0.56	0.48	0.43
630	0.77	0.71	0.65	0.56	0.63	0.57	0.49	0.54	0.47	0.41

ELECRTRICITY SUPPLY REGULATIONS

[S.I. 6 of 1996]

Under section 3

[2nd January, 1996]

[Commencement]

ARRANGEMENT OF REGULATIONS

Preliminary interpretation and application

REGULATION

61. Electric line clearance to ground.
62. Electric lines crossing waterways.
63. Minister's decision is final.
64. Proximity to railway lines.
65. Proximity to post and Telegraphs lines.
66. Proximity to air field.
67. Proximity to radio or television aerial.
68. Approval in specific instances.
69. Location of electric lines.
70. Stay wires.
71. Cradle guard and earth bars.
72. Connection to earth.
73. Automatic protection and isolation of circuit.
74. Licensee to pro0vide safety appliances.
75. Safety precautions to be taken, etc.
76. Railway crossings by overhead lines.
77. Road crossing by overhead lines.
78. Service lines.
79. Numbering and danger notices.
80. Anti-climbing devices.
81. Protection from mechanical damage.
82. Earthing of metal work.
83. Earthing at pole-mounted sub-station.
84. Placing electric cable below ground with respect to telegraph lines.
85. Exchange of plans.
86. Breaking up streets.
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PART X

Electric lines and apparatus generally other than consumer installations

ELECTRICITY SUPPLY REGULATIONS

[S.I.6 OF 1996]

Under Sections 3 and 4

{2nd January, 1996}

[Commencement]

Preliminary, interpretation and application

1. Citation

These regulations may be cited as the Electricity supply Regulation, 1994 under sections 3 and 4 of the Electricity Act.

(Cap. E7)

2. Interpretation

In these Regulation except where the context otherwise requires-

''Act'' means the Electricity Act;

[Cap E7]

''**Administrative Authority''** means the body for the time being responsible for the provision, operation or maintenance of a service, e.g. rail, road water, telephone, etc;

''**aerial line''** means a line continuously held above ground, and suspend at intervals by suitable supports;

"**alive" or "live''** means a term applied to a conductor or circuit when a potential difference exists between it and earth;

"amenity undertaking ''means an undertaking so designated by the minister and duly noticed by notice in the official Gazette. In particular, community or township which cannot be operated economically and in respect of which a government, federal or state, grants a subsidy to off-set partially or wholly operation losses sustained by the license exclusively in connection with the said undertaking;

''**apparatus**" means machine, equipment and fittings associated with generation, transmission, distribution and utilization of electrical energy.

''approved'' means acceptable to minister and or the director of the electrical inspectorate Services or approved pursuant to any regulation made under the Act **or** any code adopted pursuant to the Act.

''area engineer'', so applied to an officer of the Posts and Telegraph department means the registered engineer in charge of the area in which the workers of the licensee are placed or to be placed;

''area of supply'' means the area within which the licensee is for the time being authorized to supply and or distribute and utilize electrical energy;

''armoring'', as applied to cables and electric lines, means a metal covering usually the form of a tape or wire applied protect it from mechanical damage;

''authorized inspector'' means a person employed and duly authorized in writing by the licensee to carry out the duties imposed upon the licensee by virtue of these Regulations;

''authorized person'' means—

(a) a competent person over 18 years of age;

(b) he must possess technical knowledge and appointed in writing by the licensee to carry out specific work on his system or apparatus;

(c) the certificate of appointment shall state the class of work the person is authorized to carry out and the section of the system to which it apples;

''automatic'' means something which is self-acting or operate by its own mechanism without personal intervention;

''bonding'' or **''bonded''** means the electrical interconnection of the metallic part in order to maintain them at the same potential and to achieve a desire distribution of current s within an earthing system;

''bulk supply of electricity'' means a supply of electricity to any authority, company, body, person or person licensed to distribute and utilized electricity;

''cable'' means a length of single insulated conductor (solid or stranded) or two or more of such conductors each provided with its own insulation which are laid up together. The insulation conductors may or may not be provided with an overall mechanical protective covering;

''circuit'' means a number of conductors connected together for the purpose of carrying current;

"circuit-breaker" means a device designed to open under abnormal condition as a current carrying circuit and the term as used in these regulations applies only to the automatic type designed to trip on a predetermined overload of current;

"clearance" means the distance between objects at a point where one or both objects are free to move;

"competent person" means a literate person with sufficient technical knowledge and experience to avoid danger;

"conductor" means an electric line or other means used for the purpose of carrying electric power;

"conduit" means any approved pipe or tube of standard dimensions and material for electrical use;

Consumer means any person supplied with electrical energy by the licensee;

Consumer installation means the consumer's wiring together with any apparatus upon the premises connected to or intended to be connected thereto and situate upon the consumer's side of the licensee's supply terminals;

Cross-arms means a horizontal member usually of steel, wood, or concrete attached to a supporting structure (pole and lattice tower) and equipped with means for supporting the conductors;

"current-carrying capacity of a bare conductor used in the overhead construction" means the current that will result in a total bare conductor temperature of 100^{o}c with a wind velocity of 2km/hour and full sunshine or in the case of an insulated conductor, it is the current that will result in a conductor temperature limit, consistent with the insulation class;

Dead or de-energize means free from any electric connection to a source of potential difference and from electric charge, or not having a potential different from that of the earth;

Director of electrical inspectorate services means the registered engineer for the time being holding that office under the government of the federal republic of Nigeria;

Distribution system means a distribution system in which the neutral conductor is connected to the earth at more than one point;

Distributor means an electric line from which electrical energy can be supplied to consumers;

Double insulated means that the appliance having accessible metal parts is provided with protective insulation in addition to the normal functional insulation, in order to protect against electric shock in the case of a breakdown of the functional insulation;

Earth means a conducting connection to the general mass of earth in such a manner as to ensure at all times an immediate discharge of electric power without danger;

Effectively earthed means connected to earth through an earthing connection of sufficiently low impedance and having sufficient current carrying capacity to prevent the building up of voltage which may result in undue hazards to connected equipment or to any person;

Electric line means a wire or wires or conductors used for purpose of conveying, transmitting or distributing electrical energy;

Enclosed means surrounded by a protective barrier to prevent accidental contacts with live parts;

Feeder means a line which supplies a point of distributing network being tapped at any intermediate point;

Generating station means an assemblage of equipments, including the necessary housing, where electric power is produced from some other forms of energy;

Horizontal clearance means the horizontal distance between two vertical planes passing through the adjacent surfaces of two items of plants such as conductors, cables or pipe lines;

Isolated means that an object is not readily accessible to persons unless special means for access are used;

Inspecting engineer means a registered engineer holding that office under government including his deputy and his assistants;

Insulated means separated from other conducting surfaces by a dielectric substances or air space offering a high resistance to the passage of current and to disruptive discharge through the substances or air space;

Joint-use means the simultaneous use by two or more administrative authorities;

Leakage current means that current flowing g in the earth connection of a system or circuit and resulting from the passage of current from the conductor to earth through the insulation resistance and capacitance under normal operating voltage conditions, with or without the consumer's load connected to the supply;

Licensee means any local authority, company, body, person or persons authorized by the issues of a license by the minister, to use, work or operate in accordance with these regulations, any plants, apparatus or works designed for the supply or use of electrical energy or to supply such energy to or for the use of any other local authority, company, body, person or persons from any such plant, apparatus or works;

Live – see alive

Mains means a conductor or assemblage of conductors used for the transmission and distribution of electrical energy;

The minister means a minister charged with the responsibility for matters relating to electricity;

Neutral conductor means a conductor which forms a continuous return path for a supply line and which is usually earthed;

The Nigerian standards specification means a specification issued by the Nigerian standards organization;

Over-current protection means the electrical protection afforded by devices applied to a current and arranged to disconnect the protected circuit or equipment when the current exceeds a predetermined value for a predetermined time;

Over head line means an electric line situated above ground usually with the conductors supported on separate insulators;

Pole means a single vertical support of suitable material installed and used exclusively for the support of power and communication circuits and equipments;

Regulations for electrical installations means regulation made under the provision of the principal act or any act in substitution thereof in force from time to time regulating the standards of electric wiring on consumer's premises;

Right – of – way means a strip of land reserved for the use of power communication lines; **Riser or up riser** means the vertical runs of conductors or cables mounted on a pole connecting the underground system to the over head system;

Safe is a term applied for a conductor, circuit or apparatus which is dead and solidly earthed;

Sag means the vertical distance from a particular point in a conductor to a straight line between its own points of support, with no wind loading;

Separation (clearance spacing) means the distance between two objects at points where both of them are fixed;

Service line means a line connecting a consumer's installation to a distributor;

Stranded means two or more wires twisted together;

Street box means an underground substation and an underground switching station;

Structures mean poles or towers;

Substation means an assemblage of equipments at one place, including any necessary housing, for the conversion, transforming or control of electric power;

Supply authority means a company, corporation or body licensed under the provision of a special act to use, work and operate apparatus designed to generate, transmit, transform, distribute and to sell electrical energy to the public either in bulk to individual consumers;

Supply terminals means the end of the service lines situated upon any consumer's premises at which the supply is delivered;

Switchboard means an assemblage of switchgear with or without instruments;

Switchgear means switches, circuit breakers, cut-out and other and other apparatus used for the operation, regulation and control of electrical circuits

Switch stations means a substation for controlling the distribution of electrical energy by means of switch gear without transforming or conversion;

System of distribution means a mode of distribution of electrical energy characterized by the kind of current, the number of conductors, and in the case of alternating current, the number of phases;

Transformer substation means a substation containing static transformers for the purpose of transforming alternating electric power in one circuit into alternating power in another circuit;

Underground structure means any buried construction or structure including the underground portion of poles, piers, buildings foundation and similar equipments;

Voltage means a difference of electric potentials expressed in volts. Functionally the range of the more commonly utilized voltage is classified as follows-

i. Extra-low voltage- means all voltages below 100 volts
ii. Low voltage – means all voltages exceeding 100 volts but not exceeding 250 volts;
iii. Medium voltage- means all voltages exceeding 250 volts but not exceeding 1000 volts;
iv. High voltage- means all voltages exceeding 1000 volts;
v. Extra high voltage- means all voltages exceeding 132,000 volts;

Works means and includes electric lines, building machinery, engines, and also matters and things of whatever description required to supply electricity and to carry out the objects set out in the license granted under these regulations.

PART I

Regulations describing the conditions on which licenses may be issued and the fees payable thereon

3. Systems of supply

The following system standards shall apply–

i. frequency – The frequency of alternating current systems shall be 50 hertz

(2) Standard A.C. voltages – shall be 230 volts between phase conductor and neutral conductor and 400; 3,300; 6,600; 11,000; 33,000, 66,000; 132,000 and 333,000, 750,000 volts between any two-phase conductors of three-phase system.

4. Standard types of supply

(1) Two-wire system (whether direct current or single-phase alternating) at a normal voltage not exceeding 230 volts at the consumer's main switchboard subject to regulation 4(6).

(2) Three-wire direct current system at a nominal voltage exceeding 460 volts between each outer conductor and intermediate conductor measured at the consumer's main switchboard.

(3) Two-wire direct current system at a voltage not exceeding 650 volts with the negative pole earthed.

(4) Three-phase four-wire alternating current system at a normal voltage not exceeding 400 volts between phases and 230 volts between each phase and neutral conductor measured at the consumer's main switchboard subject to regulation 4(6) and 4(7)

(5) Three-phase three-wire alternating current system at a normal voltage not exceeding 400 volts and as prescribed in regulation 3 (2)

(6) The voltage shall be maintained within six per cent above or below the normal voltage at the consumer's main switchboard and on complaint by any consumer that the variation in voltage exceeds the limits specified, or on the instructions of the inspecting engineer, the license shall connect a portable voltmeter to be provided and maintained by the licensee, to record the voltage between the service line. If the variation thus recorded are caused within and by the licensee's system and exceed the above limits, the licensee shall take immediate steps to comply with this regulation.

(7) The frequency shall be maintained within one and half per cent above or below the standard of 50 hertz

(8) This regulation shall not apply to plants which do not electrical energy to consumers other than the licensee.

(9) The Standard System shall not be departed from without the specific authorization of the Ministry.

5. Voltage supply

(1) For the purposes of supply (otherwise than from direct current with the negative pole earthed) the nominal voltage shall not (except in the case of motors) exceed 230 volts at the consumer's main switchboard, and for supply to services exceeding 10 kilowatts connected load the nominal voltage shall not exceed 400 volts at such switchboard.

(2) Supply of power for industrial purposes may be given at high voltages not exceeding 33,000 volts either for transformation or for direct supply to motors or any other agreed voltage between the Supply Authority and the consumer, subject to the standard voltage in these Regulations.

Provided that the transforming apparatus and control gear are so enclosed as to be inaccessible except to authorized persons.

6. Location of power and communications overhead lines

(1) So far as may be reasonably practicable the licensee shall leave one side of each street free for telegraph lines, and where the street is continuous the licensee's lines shall be kept to the side of the street for the whole distance.

(2) Where electric distribution lines are on one side of the street and telegraph lines on the other and service is required to be given from either to the other side, the licensee and the Director of Telecommunications shall give each other reasonable facilities as far as possible to effect supply.

(3) Where possible, electric service lines shall pass over telegraph lines and telegraph service lines shall pass under electric lines.

7. Conditions of service

Every person within the area covered by the licensee to whose premises electrical energy can be supplied from the licensee's distribution lines shall be entitled to a supply under the following terms and conditions–

(a) Where the length of service inside a consumer's boundary does not exceed fifty meters in the case of overhead lines or twenty meters in the case of underground lines (the distance in each case being measured along the route of the service lines) such service lines shall be provided free by the licensee;

(b) Except where special arrangements in that respect are made between a licensee and a consumer, the licensee shall erect an overhead or underground service line according to whether his distribution lines passing the consumer's premises are overhead or underground;

(c) If the service lines are required for a greater distance than fifty meters or twenty meters aforesaid, as the case may be, inside the consumer's boundary, the consumer may, at the discretion of the licensee, be required to bear the cost of such additional length. Service lines paid for by the consumer shall remain his property;

(d) If an additional pole is required owing to the point of attachment to the consumer's installation being too low to give the overhead clearance prescribed in those regulations over a street without the use of such a pole, the cost of such pole shall be borne by the licensee;

(e) Where an additional pole or poles are required on a consumer's premises to give the necessary overhead clearance on the consumer's premises the cost of such extension pole or additional pole or poles shall, if the licensee so demands, be paid by the consumer. All such poles paid for by the consumer shall remain his property.

PART II

Regulations governing licensee who is a supply authority

8. Application before commencing work

(1) Before commencing any works–

(a) application shall be made in writing to the Minister;

(b) application shall be accompanied by plans showing the location of the lines to a scale not less than 1.250,000. All locality plans shall have the north point marked thereon.

(2) In showing the voltage of the electric lines the following colours shall be used on all plans–

(a) Blue to indicate 330,000 volts;

(b) Black to indicate 132,000 volts;

(c) Green to indicate 33,00 volts

(d) Red to indicate 11,00 volts;

(e) Yellow to indicate 415 volts.

9. Minister's approval

(1) Approval must be given in writing by the Minister prior to the commencement of any new works, other than service lines.

(2) If the Minister's decision is not advised to the applicant within thirty days he may appeal direct to the Minister.

(3) This approval will in no way relieve the applicant of these responsibilities to any local authority or other authority affected.

10. Notice of completion

(1) The licensee shall give at least fifty days' notice to the Director, Electrical Inspectorate Services, of the intention of commencing supply within a new area of supply or of the bringing into use any new works and to request for an inspection of same.

(2) The licensee shall not use the initial installation or any portion thereof until he receives from the Director, Electrical Inspectorate Services notice in writing that the inspecting engineer has certified to such works as having been satisfactorily carried out.

(3) Application for inspection shall be accompanied by the plan drawings of the lines including all records and relevant information to enable the inspecting engineer to carry out all necessary inspections.

11. Obligation to supply

Licensees shall, upon being required to do so by the owner· Or occupier of any premises not previously supplied with electrical energy, and situate within the Licensee's Area of Supply give and continue to give a supply of electricity to such consumer's installation subject to the requirement and conditions of these Regulations.

12. Continuity of supply

(1) Where -

(a) the Licensee commences to supply energy in pursuance of his License , he shall maintain continuously, and within the permissible variations stated in Regulation 4(6) and (7) and during the period of the Jay for which he has agreed to supply any consumer, sufficient energy for the use of all such consumer for the time being entitled to be supplied;

(b) for the purposes of testing or for any other purposes whatsoever connected with the proper working of the Area of Supply, or in the case of emergency affecting or liable to affect the proper working of any other Area of Supply to which the Licensee directly or indirectly provides a supply of electricity, the supply of energy may be discontinued by the Licensee for such period as may be necessary Subject (except in the case of emergency) to not less than 24 hours notice being given by the Licensee to all consumers liable to be affected by such a discontinuance.

(2) Any interruption of supply in excess of 12 consecutive hours shall be reported to the inspecting engineer in writing within 30 days.

(3) If the licensee's Works are of insufficient capacity to enable a satisfactory supply of electrical energy to be maintained, the licensee shall forthwith proceed to extend with additional Works of greater capacity as required, to give a satisfactory supply of electrical energy.

13. Records to be kept

(1) From the date of commencement of supply the licensee shall keep such records as necessary to supply the Minister such information as he may require from time to time.

(2) The licensee shall keep a record of each installation connected to the system showing –

(a) by whom the installation was made;

(b) the name of the inspecting engineer who inspected the installation;

(c) detailed records of all tests proving' compliance with the Regulations.

(d) an acceptable large scale plan showing all works other than service lines.

(e) records of all periods of interruption of supply.

14. Extensions and alterations

(1) Unless otherwise authorized by the Minister in writing, the licensee shall, before commencing any extension to the work not included in the Approval given by the Minister, give at least 30 days prior notice to the Director, Electrical inspectorate Services and also the Nigerian Postal Services Senior Telecommunication Engineer in charge of the area, of his intention to carry out the extension:

Provided that service lines may be erected without such notice.

(2) Before commencing any alteration to the Works already licensed, the Licensee shall give at least thirty (30) days prior notice in writing to the Minister and the Nigerian Postal Services of his intention to carry out such alteration.

(3) Subject to no objection from the minister being received within 30 days of the date of the notification. The Licensee may proceed with the construction of the extension and or alteration to the licensed Works.

15. Maintenance

Licensee shall make regular inspection of the whole of his works authorized by his license, and shall maintain the same in good order and condition so as to ensure at all times compliance with these Regulations.

16. Safety precautions

(1) The Licensee shall ensure that adequate precautions are taken to safeguard all personnel.

(2) The-Licensee shall produce and issue regulations governing the precautions to be taken for the safety of persons engaged in the construction, operation and maintenance of all Works in his Area of Supply in conformity with the National Electricity Supply Code.

(3) The Licensee shall provide and maintain in good condition sufficient equipment to ensure the safety of persons engaged, in the pursuance of his License.

(4) This regulation shall in no way relieve the Licensee of his responsibilities in respect of any other obligations.

17. Subsequent inspections

(1) A licensee shall afford access for inspection, by an inspecting engineer, at all reasonable hours to all parts of the works appertaining to his license, and amendments thereto and make available evidence of compliance with these Regulations.

(2) If any defect is found to exist: it shall be remedied forthwith and if in the opinion of the Inspecting Engineer such defect is serious; he may direct the Licensee forthwith to cease using defective Works until such defect is repaired or remedied to the satisfaction of the inspecting engineer.

(3) If during the inspection of the works, the whole, or any part thereof, is found to be unsafe, the inspecting Engineer shall instruct the Licensee in writing to discontinue the use of such works; such works shall not be brought back into use without the written consent of the inspecting engineer.

(4) Fees for subsequent inspections will only be payable if the works are found to be not In compliance with these Regulations.

18. Standards of materials, designs and construction

The licensee's works shall comply with the Nigerian National Standards or other standards as approved by the Minister in respect of equipment, materials, design and construction.

19. Fees

Fees payable in connection with initial inspection of works and extensions and or alterations thereto, and subsequent inspections shall be at the rates prescribed by the Minister on the advice of the Director of Electrical Inspectorate Services.

20. Assignment

(1) A license and the benefits and obligations there under, shall not he assigned or delegated by the Licensee without the express consent in writing of the Minister.

(2) The Minister may give such consent subject to such terms and conditions as he thinks fit to impose.

21. Decision of Minister

The Minister shall on the advice of the Director of Electrical Inspectorate Services be the sole judge of the fact whether the requirements of these Regulations have been compiled with, and he may from time to

time cause enquiry to be made into any matter connected therewith, in such manner as he thinks fit, and his decision shall be final.

PART III

Regulations prescribing the issue of a private license and governing a licensee

22. Application for license

(1) These regulations shall apply throughout the Federation of Nigeria and shall govern the grant or assignment or extension or suspension or revocation of a license issued under the provisions of subsection (a) of Section 4 of the Electricity Act or any Act in substitution thereof.

[Cap. E7.]

(2) The provisions of these Regulations shall also apply to any works or installations owned and used by the Federal Government or a State Government for the generation, supply or use of electrical energy.

23. Application for license

(1) Every application for a license, whether for sole source of Supply or emergency supply, shall be in writing and in the form set out in the First Schedule hereto, and shall be accompanied by the fee prescribed by section 41 (1) of this Electricity Supply Regulation as amended from time to time and together with a prepared plan.

[First Schedule]

(2) In Second Schedule, the supply authority in the area concerned shall be consulted to say whether they can undertake the functions of the said application either at all or within a reasonable time in the case of sole source of supply whether they have any objection in the case of generating plant installed for emergency purposes only.

[Second Schedule]

(3) Where the application involves the placing of any works or electric lines on or across under or over, any public place, the applicant shall furnish evidence at the time of his application that -

(a) notice in writing shall be served on the following -

(b) the local authority concerned; and

(c) the Local Water Supply Authority;

(d) the Director of Telecommunications; and

(e) the owner of any other electrical line interested in the proposed works;

(f) that the proposed works are not objected to or are approved subject to certain conditions being observed.

For the purposes of Regulation 23 (3), it shall be sufficient evidence if certified copies of any notice served and of any counter notice received by the applicant are attached to the application.

24. Minister may require additional information

(1) Before considering any application for a license the Minister or any officer duly authorized by him in that behalf may by notice in writing require the applicant to furnish such additional information as he may require.

(2) Where an applicant fails to furnish such additional information within sixty days of service of any written notice, the application shall be deemed to have lapsed and any fee paid shall be forfeited.

25. Terms of license

Licenses shall be in the form prescribed in Schedule I hereto and may be granted for a term not exceeding twenty-five (25) years or such shorter term as the Minister may decide.

26. Amendment of licenses

(1) Licenses when once issued may be amended or extended on written application to the Minister. Any such application must be accompanied by the license to which the application relates together with the fee prescribed by Regulations as amended from time to time. The Minister, in his absolute discretion may refuse to grant any such application or may order that the license be amended or extended in conformity with the application subject to any conditions he may see fit to impose.

(2) Where a license is ordered to be amended, the terms of such amendment or extension shall be enforced thereon.

27. Assignment

(1) A license and the benefits and obligations there under shall not be assigned or delegated by the licensee without the expressed consent in writing of the Minister.

(2) The Minister may give such consent subject to such terms of conditions as he thinks fit to impose.

28. Use of plant to cease under certain conditions

(1) If during the term of a license authorizing the use of a private generating plant a public supply of electricity can be made available by the supply authority with or without the need for a capital contribution, providing in the latter case, the contribution required is reasonable when related to the magnitude of the supply, the supply authority may serve ninety days' notice in writing on the licensee, informing him that they are able to supply him with electrical energy and require him to cease operating the generating plant forming part of the licensed installation at the expiration of the said notice, otherwise than for stand-by use in the event of emergency. Every such notice shall specify the rate or rates of charges and other conditions upon which the supply of electricity will be made available and the date of availability.

(2) The licensee may within thirty days (30) of the receipt of any notice under the provisions of the preceding paragraph refer the matter to arbitration as provided for under the Supply Authority Act.

(3) The licensee shall subject to a public supply being available to his premises cease to use the generating plant at the expiration of the notice referred to in Regulation 28(1) otherwise than for use in the event of an emergency.

(4) In the event of the public supply not being connected to the premises by the date specified in the notice served in conformity with Regulation 27(1) it shall be lawful for the licensee to continue the use of his generating plant for a period of thirty (30) days following the date on which the public supply is actually available.

29. Sale of electricity prohibited

Unless with the expressed permission of the Minister, and under the conditions stipulated by him, nothing in these regulations shall authorize any licensee to supply, sell, exchange or barter a supply of Electrical Energy however derived with any other person provided that a supply for domestic purposes supplied free to any residential quarters within the area of supply Specified in the Second Schedule to the license shall not be deemed to be a contravention of this regulation.

[Second Schedule]

30. Services of notices

Every application under the provisions of Regulation 22(1) and Regulations 26 and 27 shall be in writing and addressed to the Minister.

31. Consent deemed given

Where an applicant for a license has served notice in conformity with Regulation 23(2) such notices shall be deemed to have been approved if at the expiration of thirty days following the date of service thereof the recipient has failed to take notice thereof.

32. Plans

(1) Plans showing the area of supply to be covered by the license shall be by black lines on a white back-ground on durable material and be prepared, to a reasonable scale with the area to the licensed colored by a wash or cross hatching.

(2) Plans shall be furnished in quadruplicate and shall be supported by a survey description of the area to be licensed. For the purpose of this Regulation the consent of the landlord where the applicant is a tenant should be obtained.

33. Suspension or revocation

(1) A license when once issued may be suspended or revoked if the Minister is satisfied that the installation has not been carried out, operated or maintained in strict conformity with any regulations made under the provisions of the Electricity Act.

(2) The licensee may at any time during the currency of a license surrender it for cancellations, where upon all rights and privileges conferred upon the Licensee shall cease to have effect.

34. Penalties

Any person who operates or manages an unlicensed electrical installation or who being licensed supplies electricity to some other person outside the Licensed area of supply authorized by the license shall upon proof of the offence in a court of summary jurisdiction be liable to a fine not exceeding two hundred naira or to a term of imprisonment not exceeding six months or both fine and imprisonment.

35. Continuing offence

(1) Any person who continues to Contravene these regulations subsequent to conviction under the provisions of Regulation 34 of these regulations shall on proof of the continuing offence in a court of summary jurisdiction be liable to a fine of five naira for each day or part of a day on which the offence continues and in addition to a fine not exceeding four hundred naira or to imprisonment for a term not exceeding twelve (12) months or to both fine and imprisonment.

(2) Any penalties imposed under the provisions of this regulation shall be in addition to penalties imposed under the provision of Regulation 34 thereof.

(3) These Regulations are supplement to and in no way supersede or replace any other regulation made under Section 4 of the Principal Act.

PART IV

Regulations appertaining to electr1cal apparatus

36. Minister's approval

Before commencing any works the approval of the Minister shall first be obtained in accordance with regulation 9.

37. Standards of design

(a) factors of safety shall not be less than those quoted in these Regulations;

(b) Materials shall be suitable for the purposes and conditions for which they are to be used.

(c) Electrical clearances shall be such as to eliminate all hazards and shall not be less than those quoted in these Regulations.

38. Safety

(1) All apparatus shall be protected electrically and mechanically so as to eliminate danger to life and property.

(2) Apparatus shall be situated and protected in such a manner as not to constitute a hazard

(3) Precautions shall be taken to ensure that apparatus is protected against over voltage, over current and earth leakage conditions.

(4) Metal work enclosing, supporting, or otherwise associated with Apparatus unless designed as a conductor, shall be maintained in an electrically and mechanically safe condition.

(5) Apparatus shall be designed, constructed and situated so as to avoid interference and nuisance and shall be suitable for the purpose of which it is being used.

(6) Apparatus shall be adequately rated to meet all conditions of service operation.

(7) Apparatus shall be constructed, used and maintained in accordance with regulations governing the precautions to be taken for the safety of person engaged.

39. Maintenance

The Licensee shall make Inspections of the Works authorized by his license at such interval, and make such records, as required by these Regulations.

40. Report of accidents, interruptions and breakages

(1) The Licensee shall give notice to the Director of Electrical Inspectorate Services of-

(a) any accident caused by electric lines, electrical apparatus, or electrical equipment connected with the Licensee's plant;

(b) Any other accident in connection with the Licensee's plant which has caused or which might have caused loss of life or personal injury;

(c) any accident to the Licensee's plant caused by explosion or fire;

(d) any fire on a consumer's premises due to electrical causes;

(e) any interruption exceeding twelve hours' duration to any part of an electric line or work other than service lines, and duration of Such interruption;

(f) broken supports and wires.

(2) The licensee shall retain for a period of not more than 7 days after notice has been given to the Director, Electrical inspectorate Services, aforesaid, all broken supports and damaged ends of broken wires, and an insulators damaged or broken by the accident or other happening to which the notice relates, or which caused such accident or happening by reason of the being defective, so that they may be inspected by an Inspecting Engineer, or an officer of the Post and Telegraphs Department or the Railway Administration

(3) The notice required to be given to the Director of Electric Inspectorate Services under Regulation 40 (I) hereof in respect of the matter mentioned in sub paragraphs thereof shall be given forthwith after the accident or other happening.

(4) All notices shall specify the steps taken to prevent a recurrence of the accident or other happening.

41. License fees

(1) The rate of fees to be paid on the issue of licenses covering the respective installations shall be determined by the Ministry subject to amendments from time to time.

(2) On the commencement of these regulations, the fees as stipulated by the Ministry shall be payable at the issue or renewal of the licenses.

(3) For the purposes of this regulation the installed capacity of an installation shall be deemed to be -

(a) The aggregate rated output of all generating or transforming plan whichever is the greater; or

(b) Where generators or transformers do not form part of the installation, the aggregate rated capacity of all current consuming devices comprising the installation; and

(c) Where the rated output of generating or transforming plant or input to current consuming devices is expressed as kilo-volt-amperes or kilo-volt-ampere shall be deemed one kilowatt.

PART V

Safety regulations for supplies and uses of electrical energy; and equipment as affecting new installations

42. Conditions of direct-current supply to earth return

(1)In this case the negative conductor at the generating stations will be connected to an effective earth.

(2) A single-pole fuse or automatic circuit breaker shall be inserted in the positive conductor, and arranged to operate within five seconds with an over-load not exceeding 200 per cent of the rated full load current. The overload within these limits shall be at the discretion of the licensee. Such fuse or circuit breaker shall be placed in a suitably locked or sealed receptacle of fireproof construction fixed at a convenient height at the point of supply.

(3) At the distributing point of a lighting circuit there shall be inserted in the positive conductor a Single-pole switch, together with a fuse arranged to operate within five seconds with an overload of 200 per cent of the rated full load current of such circuit.

(4) In a motor circuit there shall be provided in the immediate vicinity of each motor connected thereto a single pole switch and fuse or circuit-breaker arranged to operate within three seconds with an overload not exceeding 200 per cent of the rated full-load current of the motor so controlled. The overload within these limits shall be at the discretion of the licensee.

(5) Each motor shall also be provided with an automatic no-voltage release and a series resistance for starting.

(6) The negative conductor shall be continuous throughout its length without a switch, fuse or circuit-breaker.

43. System earthing

(1)In medium and low voltage alternating current systems the connection of circuit with earth shall be made in accordance with the Nigerian Standard Code of Practice on Earthing (NCP 9) and the following requirements-

(a) the intermediate conductor of a medium or, low voltage three-wire single phase system, and the neutral conductor of a medium three-phase four-wire system, shall be earthed in multiple. That is, at the point of supply (the generating station, sub-station or transformer) every fifth pole and the terminal poles of the distribution line. The consumer's earth must not be connected to the neutral conductor.

(b) the resistance between any point of the intermediate or neutral conductor and earth shall not exceed 2 ohms.

(c) the neutral point of a medium voltage three-phase three-wire system shall be effectively earthed at the point of supply.

(2) In high voltage three-phase alternating current systems, the connections of the circuit with earth shall be made in accordance with Regulations 44 and 45.

44. Star-connected systems with earthed neutral

(1)The neutral point shall be earthed at the point of supply. - That is, the generator neutral point or the neutral point of the transformer secondary where change of voltage occurs - and it may be earthed at any other point, provided that no interference of any description is caused by such earthing.

(2) In the event of an appreciable harmonic current flowing in neutral connection such as to cause interference with communication circuits generator or transformer neutral shall not be earthed, but a suitable earthen transformer shall he used.

(3) In unattended generating stations or sub-stations supplying overheat lines earth leakage relays shall be provided, so that in the event of a leak earth occurring either the faulty line will be cut out or the whole of the system supplied from this station or sub-station rendered dead.

(4) These leakage relays if connected to individual feeders or lines shall be set to operate with a time lag not exceeding five seconds with a current exceeding ten per cent of the full load rating of the feeder or line, or, connected between the neutral point of the generator or transformer and ear at a current not exceeding one ampere.

(5) Where under any conditions the use of earth leakage relays may impracticable such relays may, with the written consent of the Director Electrical Inspectorate Services be omitted: (it is suggested that addition devices be considered).

(6) In continuously attended generating stations or sub-stations a visual and audible indication may be used to supplement the automatic disconnect of supply. In each case immediate steps shall be taken to remove the fault disconnect the faulty feeder or line.

45. Delta-connected systems or star-connected systems with isolated neutrals

(1) In the case of delta connected systems or star-connected system with isolated neutrals earthing transformers or other means approved by Director Electric & Inspectorate Services shall be provided to give an artificial, neutral point which shall be earthed. Earthing equipment shall be of sufficient capacity to ensure the effective operation of the protective apparatus; simple leakage protection or indication shall be provided for these systems to I specified in Regulations 44(')) and 44(9) for systems with earthed neutrals.

(2) High Voltage single-phase systems derived from Delta or Star connected systems shall be earthed in a manner approved by the Directorate of electrical Inspectorate Services.

(3) Where any part of supply system other than on a consumer premises, is normally connected with earth, no switch, fuse, or circuit-breaker shall be Inserted in the earthed conductor or in any conductor connected there and the connection with earth, shall be efficiently maintained except when interrupted for the purpose of periodical tests.

(4) Notwithstanding anything contained in the last preceding regulation, systems including more than one generator operating in parallel may have the neutral conductor of a three-phase star-connected generator disconnected when necessary to prevent the circulation of local currents provided that where all the generators are located in one power- house, at least one generator in operation shall have its neutral point connected to earth: provided further that where the generators are contained in more than one power-house, and the power-houses are inter-connected, a neutral point shall be provided at each power house and earthed and all such neutral points shall be so arranged that no earthed- circulating current will flow between the power-stations.

(5) When the return current of any individual distribution transformer does not exceed two amperes, and the transformer supplying the lines and any distribution transformer supplied by such lines are not less than 10 kilometers from any telephone exchange, the earth may, with the previous consent in writing of the Director of Telecommunications, be used to carry the return current of the distribution transformers.

(6) If the insulation of any circuit of any system is faulty, immediate steps shall be taken to make good the insulation before the current is again placed in service.

PART VI

Regulations appertaining to overhead lines and restriction to placing electric lines above ground

46. Overhead lines

(1) Except under and in accordance with the terms of a written authority granted by the Minister, no electric lines (other than service lines) shall be placed above ground and no support carrying electric lines shall be erected unless such line or support complies with the provisions of these Regulations.

(2) Any electric line or support so placed or erected shall be so contained that it complies with the provisions of these Regulations.

47. Support

(1) Every support carrying electric lines shall be made of wood, steel or reinforced concrete or any combination of any of such materials or any other approved materials and in the case in which wood or steel is used in the construction of the support, such wood or steel or any other approved materials shall be, so far as is reasonably practicable, protected against decay, corrosion or other deterioration.

(2) Every support shall be so constructed and placed as to withstand the transverse, horizontal and vertical loads calculated in accordance with regulation 48 without exceeding the material's strength limits as set out in regulation 53.

(3) In no case shall the strength of a support in a direction parallel to the overload line be less than one quarter of the strength in a direction transverse to the said line.

(4) All overhead electric lines shall be attached to suitable insulators carried on cross-arms or brackets of suitable materials and cross-section, and they shall be so attached to the insulators, or guarded, that they cannot fall away from the supports in case they become detached from the insulator, but will fall on the cross-arm or insulator support.

(5) All lines at angles shall be attached to the insulator so that the insulator, and not the binding wire, takes the strain.

(6) The minimum diameter of wooden supports shall be in accordance with the relevant Nigerian Standards.

48. Loads on supports

The transverse load on any support carrying an electric line shall be calculated in accordance with the requirements of regulation 47 (2) and the appropriate wind pressure on any electric line shall be calculated in accordance with its average height above ground throughout its span, and the wind pressure on the leeside side of lattice steel or other compound structures shall be deemed to be one half of the pressure on the leeward side. The vertical loads on supports shall comprise the weight of the supports themselves and any insulators and fittings attached thereto, together with the loads imposed by the electric lines and their fittings.

49. Foundations

The foundations shall be so constructed and placed, taking into account the reaction of the soil at all times of the year in which they are embedded to the load that they are to carry, as to withstand the transverse, horizontal and vertical loads calculated in accordance with regulation 48 without exceeding the material strength limits set out in regulation 53.

50. Materials of electric lines

Every electric line shall be made of copper, aluminum or steel or any alloy or combination of any of such materials, subject to the approval of the Minister.

51. Minimum size of electric lines

Every electric line shall have a copper equivalent cross-section area of not less than 16mm^2 and an ultimate tensile strength of not less than 4kN.

52. Insulation of electric lines

(1) Every electric line, other than an earth wire permanently connected with earth, shall be insulated by glass or porcelain insulators to support, suspend or terminate the electric lines and designed and constructed for the voltage at which it is to operate;

(2) effectively insulated with respect to any part thereof, which is ordinarily accessible from the ground or from a building or structure;

(3) otherwise effectively insulated by a means approved by the Minister.

53. Factors of safety

Overhead electric line supports, in conjunction with stays and struts if provided, shall withstand the longitudinal, transverse and vertical loads due to fittings, conductors and wind loadings under the most adverse temperature conditions and with the factors of safety herein under specified-

(a) live and earth conductors, based on the ultimate tensile strength of the material …….. 2.5

(b) mid-span joints and termination based on the ultimate tensile strength of the conductor (comparative safety factor between the ultimate tensile strength of the mid-span joint and the ultimate tensile strength of the conductor) …… 0.95

(c) complete insulator units based upon the electro-mechanical strength of the material (comparative safety factor between the ultimate tensile strength of the insulator string and the ultimate tensile strength of the conductor) …… 0.5

(d) stay wires and auxiliary materials based on ultimate tensile strength .. 2.0

(e) insulator metal fitting based upon elastic limit …… 2.5

(f) lattice steel supports (or other compound structures) based on the crimping load of members in compression, the elastic limit of members in tension and the shear or bearing deformation at joints …….. 2.0

(g) steel tubular poles based on the ultimate breaking strength in handling of the material …… 2.0

(h) impregnated wood poles in accordance with Nigerian Standard No. 43 based on 90% of the strength corresponding to the ultimate extreme fibres stress or for poles supported with stays 90% of the crippling strength …… 3.5

(i) impregnated wood poles in accordance with Nigerian Standard No. 43 and supported with stays based on 90% of crippling strength …… 3.5

(j) all untreated poles based on 90% of the strength corresponding to the extreme fibre stress …… 7.0

(k) all untreated poles supported with stays based on 90% of crippling strength …….. 7.0

(l) all types of concrete poles based on the strength corresponding to failure …….. 2.5

(m) foundation for supports against overturning lateral shearing, toe compression and uprooting under maximum simultaneous working loads based on soil bearing strength ……. 2.5

(n) under a single broken electric line or earth wire condition the factors of safety for supports and foundations shall not be less than-

i. support: 50% of the factors of safety given in regulations 53 (f) to 53 (1);

ii. foundations: 50% of the factors of safety given in paragraph (m) of this regulation.

54. Temperature and pressure

(1) For design purposes the average minimum and maximum ambient temperatures shall be 5°C and 45°C respectively.

(2) Unless otherwise authorized by the Minister in writing the following working conditions shall be assumed for design purposes-

(a) Minimum ambient temperature of overhead line conductors ……. $5^{o}C$

(b) Maximum temperature of overhead line conductors ……. $100^{o}C$

(c) Average ambient temperature of overhead line conductors ……. $35^{o}C$

(d) For all design purposes the reference temperature shall be the minimum temperature …… $5^{o}C$

55. Wind pressure

(1) Wind pressure per square metre of whole projected and of tubular and circular supports-

Up to 15m in height 83kN

From 15m to 30m 166kN

From 45m to 90m 242kN

From 90m to 155m 332kN

Above 135m 415kN

(2) Wind pressure per square metre on full projected area of rolled steel members of the windward face plus 50% of the full projected are rolled steel members on the leeward side of all other supports using figures in regulation 55 (1) -

Up to 15m in height 124.5kN

From 15m to 45m.....249.0kN

From 45m to 90m.....373.5kN

From 90m to 155m.....498.0kN

Above 155m 622.0kN

(3) Wind pressure per square metre on full projected area of electric lines and aerial earth wires-

Up to 15m in height 83kN

From 15m to 90m 166kN

From 45m to 135m..... 242kN

From 90m to 135m 332kN

Above 135m..... 415kN

56. Spacing of electric lines

The minimum design clearance between conductors of circuits shall be those tabulated below-

Voltage	*Normal equivalent span*	*Phase to phase clearance*	*Phase to structures/ earth clearance*
400 volts	45 metres		25mm
3,300 volts	45 metres		130 mm
6,600 volts	45 metres		130 mm
11,000 volts	90 metres		180 mm
33,000 volts	90 metres	1,200 mm	300 mm
66,000 volts	190 metres	1,800 mm	600 mm
132,000 volts	210 metres	2,400 mm	1,200 mm
330,000 volts	450 metres	6,000 mm	2,400 mm
750,000 volts	—	—	—

(a) Where double circuit construction is employed all clearance shall refer to the circuit of the high voltage;

(b) every one kV phase to earth above 190 kV to earth (330kV between phases), 12.55mm to vertical and earth/structure clearances and 3 metres to horizontal clearance;

(c) values obtained under regulation 56 *(b)* shall apply to a normal equivalent span of 450 metres;

(d) up to an increase of 50% of the normal equivalent span length the clearance shall be increased by 300 mm for every 30 metres increase in span or proportion thereof. Phase clearance in respect of equivalent spans in excess of this shall be subject to the approval of the Minister.

57. Dual voltage construction

Where one circuit exceeding 400 volts and another circuit not exceeding 33,000 volts, between phases, are erected on the same supports the following conditions shall apply-–

(a) lines in excess of 400 volts shall be erected at the higher level and lines at 400 volts or less shall be erected at the lower level;

(b) the maximum distance between line supports shall not exceed fifty metres and there shall be no intermediate supports carrying electric lines at 400 volts or less;

(c) the minimum horizontal and vertical clearances between electric lines of the same circuit voltage shall not be less than those tabulated in regulation 56.

(c) The vertical separation between the 400 volts or less circuit and the higher voltage circuit shall not be less than-

a. 400 volts up to 11,000 volts …… 1 metre
b. 400 volts to 33,000 volts ……. 1.3 metre

(d) where the circuit of the higher voltage is fully insulated the clearance in (d) above may be reduced by 50%.

58. Parallel spacing of circuits on separate supports

The minimum distance between the nearest conductors of circuits erected on separate supports such that they run along parallel routes shall be not less than that required to enable the safe maintenance of either circuit to be carried out without de-energizing the circuit that is not being maintained, and the horizontal separation shall be greater than the height of the highest support.

59. Mid-span crossing of electric lines

Where electric circuits cross at mid-span positions the following conditions shall apply-

(a) the circuit of the higher voltage shall always cross over the circuit of the lower voltage;

(b) no circuit shall cross at an angle of less than 30 degrees; and

(c) the minimum clearance between the nearest conductors of different circuits at the point of crossing, including "aerial" earth wire, shall not be less than that tabulated below PLUS the maximum design sag of the conductor of the lower circuit at the point of crossing;

Lower Circuit (Voltage between phases)					*Upper Circuit (Voltage between phases)*				
	Earth wire	**400**	**3,300**	**6,600**	**11,000**	**33,000**	**66,000**	**132,000**	**330,000**
Earth wire	30	20	30	30	30	120	60	120	240
400V	20	120	120	120	120	120	150	180	270
3,300V	30	—	—	120	120	120	150	180	270
6,600V	30	—	—	120	120	120	150	180	270
11,000V	30	—	—	—	120	—	150	180	270
33,000V	30	—	—	—	—	—	150	180	270
66,000V	60	—	—	—	—	—	150	210	300

132,000V	120	—	—	—	—	—	—	240	360
330,000V	240	—	—	—	—	—	—	—	480
750,000V	—	—	—	—	—	—	—	—	—
	(cm)	*(cm)*	*(cm)*	*(cm)*	*(cm)*	*(cm)*	*(cm)*	*(cm)*	*(cm)*

(d) where the circuit of the higher voltage is fully insulated the minimum clearance calculated in accordance with 59 (c) above may be reduced by 50%.

60. Clearance of electric lines to buildings

A line may be erected over or adjacent to a building provided that-

(a) the radial distance in metres from the point of attachment of the suspension insulator (or conductor if attached to a fixed insulator) of the lower conductor, to any part of the building is not less than-

conductor sag at maximum design temperature plus length of suspension insulator string plus A, where A is a constant dependent on the voltage between phases of the conductors of the line-

400 volts to 11,000 volts …… 2.4 metres
33,000 volts …… 3.0 metres
132,000 volts ..... 4.0 metres
330,000 volts ..... 6.0 metres
Over 330,000 volts ..... 8.0 metres

(b) where the conductors of the circuit are fully insulated the constant "A" may be reduced by 50%.

61. Alternative provision

(1)Where the condition of regulation 60 *(a)* cannot be met, the line shall be erected so that the minimum horizontal distance in metre of the nearest conductor in still air is not less than-

(Conductor sag at maximum design temperature plus length of suspension insulator sting) plus B, where "B" is a constant dependent on the voltage between phases of the conductors of the line-

400 volts - 11,000 volts..... 2.4 metres
33,000 volts ..... 3.0 metres
132,000 volts …….. 4.0 metres
330,000 volts …….. 6.0 metres
Over 330,000 volts ..... 9.0 metres

(2) Where the conductors of the circuit are fully insulated the constant "B" may be reduced by 50%.

(3) In the case of specially designed fully insulated serial cables clearance to buildings may be reduced at the discretion of the Minister.

(4) No building or other structure shall be erected under or adjacent to an electric line without adhering to the provisions of these Regulations.

62. Electric line clearance to ground

(1) The height above ground of any electric line under the most adverse operating conditions shall not, except with the written authority of the Minister, be less than the height appropriate to the system voltage and situations tabulated below-

Ground clearance in metres			
System voltage between phases	*Over streets and roads and public open spaces and other places of vehicular traffic*	*Along streets and roads and other places accessible to traffic*	*In positions inaccessible to vehicular traffic not streets or roads*

400 volts	5.8 metres	5.2 metres	5.2 metres
3,300 volts	5.8 metres	5.5 metres	5.5 metres
6,600 volts	5.8 metres	5.5 metres	5.5 metres
11,000 volts	5.8 metres	5.5 metres	5.5 metres
33,000 volts	6.0 metres	6.0 metres	5.8 metres
66,000 volts	7.0 metres	7.0 metres	5.8 metres
132,000 volts	7.0 metres	7.0 metres	5.8 metres
330,000 volts	7.0 metres	7.0 metres	5.8 metres
750,000 volts			

(2) Fully insulated service lines operating at a voltage not exceeding 400 volts may be terminated on buildings at a height of not less than 2.7 metres from ground level provided that the street clearance at any point of its span is not less than 5.8 metres.

63. Electric lines crossing waterways

(1)The height of an electric line under the most adverse conditions, above the highest recorded water level, over harbours, rivers and waterways, shall not be less than that required by the appropriate authorities for physical safety clearance plus a minimum electrical safety clearance of 3 metres of I metre per 78 kV or phase to neutral voltage of the electric line, whichever the greater.

(2) The licensee shall at least thirty days and not more than ninety days prior to the placing of such work serve written notice on the appropriate authorities specifying the intended use of the works, the voltage of operation and such other information that the authorities may require him to supply.

(3) Every notice served in conformity with regulation 63 (2) shall be accompanied by a plan of suitable scale indicating the site of the crossing, the location of all supports, stays, struts, switches, transformers and other apparatus intended to be used.

(4) The authorities may within 21 days of the receipt of such a notice of intention served under regulation 63 (2) serve a counter notice on the licensee -–

(a) objecting to the siting of the works specifying the reason in the counter notice; and

(b) requiring protective features to be fitted, such features to be specified in the counter notice.

64. Minister's decision is final

Where mutual agreement is not reached the matter shall be referred to the Minister whose decision shall be final.

65. Proximity to railway lines

The provision of regulations 63 (2) to 64 shall apply where the licensee intends to place an electric line, other than a service line, in the proximity of, over or under a railway line.

66. Proximity to post and telegraphs lines

(1) The provision of regulation 63 (2) to 64 shall apply where the licensee intends to place an electric line, other than a service line, in the proximity of, over or under Posts and Telegraphs line.

(2) Other than in the case of a fully insulated services line all electric lines, except with the written authority of the Minister, shall cross over Post and Telegraphs lines with a minimum clearance, under the most adverse operating conditions at the point of crossing of –

System Voltage between phases	*Clearance*
Not exceeding 400 volts - insulated	0.6 metres
Not exceeding 400 volts - un-insulated	0.2 metres
Over 400 volts but not exceeding 33,000 volts	1.8 metres
Over 33,000 volts but not exceeding 132,000 volts	2.4 metres
Over 132,000 volts but not exceeding 330,000 volts	4.0 metres
Over 330,000 volts but not exceeding 750,000 volts	7.0 metres

(3) So far as may be practicable the licensee shall leave one side of each street free for telegraph line and where the street is continuous the licensee's line shall be kept to the
same side of the street for the whole distance.

(4) Except with the permission of the Posts and Telegraphs Authorities all overhead lines shall be placed on the opposite side of the street to that on which any telegraph lines are erected, and where the erection or operation of the electric lines necessitates an alteration of an existing telegraph line, and such alteration is approved by the Posts and Telegraphs Authorities, the expense of the alteration shall be borne by the licensee; provided that where existing telegraph lines of the Posts and Telegraphs Authorities occupy both sides-of the street that Authority shall bear the cost of putting all telegraph lines on the one side of the street or if agreeable to the licensee, consent to an arrangement for the joint use of poles on both sides of the street.

(5) Where electric lines are on one side of the street and telegraph lines on the other, and service is required to be given from either side to the other, the licensee and the Posts and Telegraphs Authorities shall give to each other reasonable facilities as far as possible to effect supply. Where possible electric service lines, unless fully insulated, shall pass over telegraph lines and telegraph service lines shall pass under electric lines.

67. Proximity to airfield

The provision of regulations 63 (2) to 64 shall apply where the licensee intends to place an electric line in the proximity of an airfield.

68. Proximity to radio or television aerial

The provision of regulations 63 (2) to 64 shall apply where the licensee intends to place an electric line, other than a service line, in the proximity of a radio or television aerial.

69. Approval in specific instances

Notwithstanding the foregoing, where the regulation clearance are so attainable the Minister may, in specific instances, authorize the use of reduced clearances subject to such additional safety precautions in the form of warning notices, warning lights or crash bars, as he may deem necessary.

70. Location of electric lines

(1) The provisions of regulation 63 (2) shall apply where the licensee proposes to erect any electric line above or below ground and he shall serve written notice on the Town Planning Authorities, town councils and any other Government Department, company, body or persons concerned.

(2) The provisions of regulations 63 (2) to 64 shall apply in respect of location of electric lines in relation to waterways.

(3) The provisions of regulations 63 (2) to 64 and 77 shall apply in respect of the location of electric lines in relation to railway lines.

(4) The provisions of regulation 67 shall apply in respect of the location of electric lines in relation to Posts and Telegraphs lines.

(5) The provisions of regulation 67 shall apply in respect of the location of electric lines in relation to airfields.

(6) The provisions of regulation 68 shall apply in respect of the location of electric lines in relation to radio or television aerials.

(7) Prior to the placing in position in any street, the location of each cable or other work to be placed below ground and every support for overhead lines including struts and stays, and of any street boxes or works to be placed above ground, shall be approved by an authorized officer of the local authority or where the local authority does not maintain or repair the street, the Road Authority.

71. Stay wires

(1) Stay wires connected to wooden supports carrying electric lines of all voltages, and also stay wires connected to concrete supports carrying electric lines at 400 volts or less shall be insulated to prevent danger from leakage. For this purpose, an insulator of the same or greater rating as the insulator supporting the electric lines, shall be inserted in the stay wire not less than three metres vertically above ground and below the level of the electric line.

(2) Stay wires connected to steel supports or any other supports made of an electrically conducting material shall be insulated.

(3) Where a stay wire crosses over a road or street a minimum distance of 5.8 meters to ground level shall be maintained.

(4) All stay wires shall be of galvanized steel and stranded.

(5) Stay insulators shall have a mechanical strength equal to or greater than that of the stay in which it is installed.

(6) Where a stay wire is installed in a public place or in any other location in which it may constitute a hazard, it shall be—

(a) Effectively protected against mechanical damage by the installation of a concrete surround; or

(b) Covered with a protective guarding consisting of double wooden or metal battens at 50mm wide, or a metal pipe at least 50mm in diameter, securely fastened around the stay wire and extending from ground level a point not less than 2 metres vertically above ground level;

(c) The concrete surrounds and the protective guarding shall be painted white.

72. Cradle guards and earth bars

Cradle guards and earth bars are not necessary but where they are to be installed under the provisions of regulations 63 to 68 the cost of such installation shall be borne by the supply authorities concerned.

73. Connections to earth

(1) Earthing connections and earth electrodes shall be of copper or galvanized steel.

(2) Stranded or circular earthing leads shall have a minimum copper equivalent cross- sectional area of not less than 16 mm squared.

(3) Flat earthing leads shall have a minimum copper equivalent cross-sectional area of not less than 50 mm squared and a minimum thickness of 3 mm.

(4) Earth electrodes shall be in the form of plates or rods of the following minimum sizes –

(a) Copper plates: 300mm x 300mm x 3mm thick;

(b) Galvanized steel plates: 300 mm x 300mm x 3mm thick;

(c) Copper rods: 16 mm diameter;

(d) Galvanized steel rods: 25 mm diameter.

(5) Earthing leads shall he capable of carrying for a period of five seconds the full fault current of the system to which they would be subjected.

(6)The earthing requirements in regulation 73 shall be read in conjunction with the Nigerian Code of Practice on Earthing No. NCP 9.

74. Automatic protection and isolation of circuit

(1) Means shall be provided at the origination of every main circuit to automatically cut off the supply of energy in the event of –

(a) a passage of current of such magnitude and duration as would be liable to damage the line or its associated joints and fittings;

(b) Leakage of current to earth in excess of the amount permitted by for example Regulation 43.

(2) Equipment which shall ensure improved reliable power supply under transient conditions shall be fitted to transmission lines.

(3) Every automatic device shall be provided with means so that it can be locked in the "OFF" position to prevent unauthorized interference. During the time that the device is locked to the "OFF" position, the relevant keys for the lock shall be kept in safe custody in the manner prescribed in regulation 76 (3).

75. Licensee to provide safety appliances

(1) Licensees shall provide rubber gloves, protective covers for live conductors, insulated stands, safety belts and other appliance to ensure safety of their employees in the execution of their duties. All such appliances shall be contained in good order and safe condition for use. Unserviceable appliances shall be withdrawn from use and destroyed. Rubber gloves, rubber mats and safety belts and harness shall comply with appropriate Nigerian Standard Specifications.

(2) It shall be the responsibility of the person appointed by the licensee to be in charge of work upon lines or apparatus to ensure that the appropriate safety appliances are –

(a) available for the use of workers at the place of work;

(b) used by workers as may be necessary to prevent danger;

(c) in good order and when used for their intended purposes there is no risk of danger to the user.

(3) Where due to non-compliance with this regulation, an accident involving death or injury to any person or persons occurs and it is proved that although provided by the licensee, the safety appliances were not available for use, or being available for use were not used, the person appointed to be in charge by virtue of regulation 74 (2) hereof shall be guilty of an offence and on conviction shall be liable to a fine of #300 or six months imprisonment.

76. Safety precautions to be taken, etc.

(1) All works shall be carried out after a permit to work has been issued.

(2) Apparatus, lines or other works forming part of the licensee's system shall not be altered, repaired or otherwise worked upon until they shall have been made dead and earthed in the manner hereinafter provided for or where the work is to be done on parts of the apparatus lines of works not ordinarily alive, part of which might be inadvertently touched, is screened or otherwise protected to prevent danger and the part to be worked upon, if of metals, is effectively connected to an efficient earth.

(3) The engineer in charge of undertaking or other responsible person appointed by him shall cut off all energy from the apparatus or cables to be worked upon by withdrawal of the appropriate fuse or opening of switchgear or isolators provided for the purpose. Switchgear or isolators shall be secured in the open position by locking and the key of the lock retained by the engineer or an authorized person until he is satisfied that all workmen have been withdrawn and that it is safe to re-energize the works. The engineer or an authorized person shall personally unlock the gear and close the appropriate switch or isolator. Where fuses are withdrawn to isolate the supply, they shall be retained in safe custody by the engineer or an authorized person until he is satisfied that the fuses may be replaced to re-energize the works.

(4) Workers shall not be permitted to handle any apparatus, lines or works designed to be electrically charged until all conductors have been bonded together and earthed to an efficient earth which earthing connection shall remain in place until work has been completed and all workers withdrawn. The engineer or an authorized person shall be responsible for establishing the earth connection and the removal thereof.

(5) The provision of this regulation shall not apply to work on distribution mains operated at low or medium voltage for the purpose of connecting or disconnecting consumers' service lines, subject to these being in compliance with regulation 75 (1) and the person actually working on live lines being accompanied by a competent person qualified to render assistance (including artificial respiration) in the event of emergency.

77. Railway crossings by overhead lines

(1) An overhead conductor may not cross a railway track at a more acute angle than 60° unless special permission is obtained from the General Manager of the Railways.

(2) Minimum clearances shall be as follows–

(a) 132 KV circuits over rail top 7.3 meters-

(b) 330 kV circuits: over rail top 8.4 metres;

(c) minimum height above rail level of the lowest wire or any portion of a guard or cradle guard under conditions of maximum sag: 6 metres.

(3) No supporting structure shall be situated nearer to the centre line of the track than the total height of the supporting structure plus 2.5 meters.

(4) When the railway line is in a cutting, the supporting structure must be at a distance from the edge of the cutting not less than its total height.

78. Road Crossings by overhead lines

An overhead conductor may not cross a road at a more acute angle than 45°, unless special permission is obtained from the Director of the Electrical Inspectorate Services.

79. Service lines

(1) Aerial lines forming part of a service line shall be connected to line conductors at a point of support only and shall originate from insulators (other than insulators to which the line conductors are attached) and at the termination or consumers' premises shall be made off on to insulators secured to the structure of the premises by brackets or other suitable metal works.

(2) Where it is not possible to attach service lines to the structure of the building the service line shall be terminated at a pole adjacent to the consumer's building and the lead- in taken from the pole.

(3) Every part of aerial services lines (other than the conductor connected building with earth) including parts which although not normally accessible from a building are accessible with the use of a ladder, scaffolding or other special appliance attached to the building, shall be covered with durable insulating material or protected by other means approved by the Director, Electrical Inspectorate Services to ensure that live metal cannot be inadvertently touched.

(4) Every part of a service line other than aerial lines shall be covered with insulating material which is durable and adequate for the intended voltage of operation.

80. Numbering and danger notices

(1) All supports shall be numbered with addition of symbol or alphabetical letter to identify the line.

(2) In the reticulation of a township the supports shall be numbered in accordance with the grid of the master plan.

(3) All supports carrying high voltage conductors shall have danger notices attached. These danger notices shall be of metal enameled or painted white and/or conventional with lettering and/or conventional signs in scarlet as approved by the Director, Electrical Inspectorate Services.

(4) Where the lines are erected on the side of a road the notice shall be so fixed that it is plainly visible from the road.

81. Anti-climbing devices

For the purposes of preventing climbing of lattice structure by unauthorized persons, anti-climbing devices shall be attached to all supports and to all stay wires, where the stay wires are so arranged as to facilitate unauthorized climbing.

82. Protection from mechanical damage

Where lightning conductors, earthing leads, or other uninsulated conductors are run down poles they shall be protected by a wooden casing or other insulating material for a distance of three meters from the ground.

83. Earthing of metal work

(1) Where lines are operated at high voltages all metal work, other than conductors (and metal cross-arms on wooden poles), shall be permanently and efficiently connected with earth. For this purpose a continuous earth wire shall be provided and connected with earth at three points in every kilometre, the spacing between the points being as nearly equidistant as possible or alternatively the metal work shall be connected to an effective earth at each individual support.

(2) Where any special equipment on a pole includes metal work accessible from ground level which normally has to be handled by an operator when the line is alive (i.e. a switch-operating handle), such metal-work shall be connected to an earth mat, so situated as to include within its area the whole of the ground on which the operator would normally stand.

84. Earthing at pole - mounted substations

On transformer poles, the electrode used for earthing the steelwork shall be situated outside the resistance area of the earthed electrode connected to the low voltage neutral. This may necessitate earthing the low voltage neutral being earthed at the first low voltage pole.

85. Placing electric cable below ground with respect to telegraph lines

Where telegraph lines are placed below ground in any street and the licensee desires to place his works below ground in the same street they shall be placed on the opposite side of the street to the telegraph line unless the Director of Telecommunications expressly authorizes in writing a relaxation of this requirement. Any such relaxation shall be subject to such conditions as to the provision of minimum separating distance and protective features which in his discretion he deems it desirable and necessary to impose for the protection of the telegraph cable.

86. Exchange of plans

Where it appears that works of the licensee or telegraph lines have been placed below ground, the licensee or the Director of Telecommunications may on Written application require the licensee or the Director of Telecommunications, as the case may be, to furnish a plan of a suitable scale indicating the nature, course and depth of any existing works placed below ground. Any request made under the provision of this regulation, shall be compiled with within thirty days of the original application. Plans shall be black or coloured lines on a white background having the true and magnet north legibly marked.

87. Breaking up streets

(1) A licensee shall not break up streets for the purpose of placing new works, including works in replacement of existing works, unless they shall have served notice of their intention on the responsible administrative authority for the repair of any street to be broken in addition to the local authority.

(2) Every notice required to be served under the provision of this regulation shall be served at least thirty days but not more than nine days prior to the date on which it is intended to break up any street or streets, and shall be accompanied by a plan of a suitable scale indicating the course, nature, width and depth of all intended excavations and the purpose thereof.

(3) The local authority or the road authority responsible for normal maintenance of the street or both may within 21 days of receipt of a notice served under the provisions of regulation 87(1) serve a counter notice on the licensees requiring them to amend the scheme the reason thereof being stated in the counter notice.

(4) Where no counter notice is served on the licensee as provided for the works shall be deemed to be approved and it shall be lawful for the licensee to proceed with the works on the expiration of the term specified in the notice served under regulation 87 (1).

(5) Streets shall only be broken up in strict conformity with the original theme or any amendment thereof required by counter notice served under regulation 87 (3).

(6) Where the licensees are of the opinion that the requirements of a counter notice served under regulation 87 (3) are unreasonable and they are unable to reach an amicable settlement with the local authority or the road authority or both, the matter shall be referred to the Minister whose decision shall be final and binding on both parties.

88. Licensee liable for reinstatement of streets broken up

The road authority will reinstate any street broken up by the licensee and charge them the cost of so doing.

89. Location of cable, boxes etc., to be agreed

Prior to placing in position in any street, the location of such cables or other works to be placed below ground, and of any street boxes or works to be placed above ground, shall be approved by the local authority or where the local authority does not maintain or repair the street, the road authority.

90. Protection of a water authority

Where a piped water supply is provided in any area in which the licensee proposes to place any new works, the water authority not being a local authority, shall be deemed, for the purposes of this Part to be a local authority, and the provisions of regulations 87 and 89 together with the following special conditions, shall apply–

(a) on receipt of the notices, required to be served under the provisions of Regulations 87 the Water Authority shall within twenty-one (21) days, furnish a plan of a suitable scale indicating the course, depth and any other relevant information relative to water mains likely to be effected by the proposal. Where no plan is furnished by the Water Authority within the said twenty-one Jays it shall be deemed that no mains exist,

(b) on receipt of the plan referred to in regulation 90*(a)* hereof the licensee shall take such steps as may be necessary to ensure that, in placing their works, the separating distance between the respective works is either not less than one metre or where this separating distance is impracticable such lesser distance as may be mutually agreed to in writing by the respective parties.

(c) in the event of any differences or dispute an arising between the parties the matter shall be settled in the manner provided for in Regulation 87(6).

91. Works affecting Posts and Telegraphs Department

(1) Where the licensee intends to place any new high voltage works within 150 metres of any telegraphic or telephone line operated by the Posts and Telegraphs Department the licensee shall at least thirty days and not more than ninety days prior to the placing of such works serve written notice on the Director of Telecommunications specifying the intended use of the works, the maximum power it is intended to handle, its voltage of operation and such other information the Director of Telecommunications may require the licensee to furnish.

(2) Every notice served in conformity with regulation 91 (1) shall be accompanied by a plan of a suitable scale indicating the course, nature and depth of all intended excavations, switches, transformers, and other apparatus intended to be used.

(3) The Director of Telecommunications may within 21 days of the receipt of a notice of intention served under regulation 91(1) hereof serve a counter notice on the licensee requiring them to-

(a) re-route their works;

(b) provide protective features to be specified in the counter notice between his works and the intended works;

(c) provide guarding between his works and those of the licensee which guarding he may himself provide at the expense of the licensee if he so advises the licensee in the counter notice.

92. Lines of other licensees

The provisions of regulation 91 shall apply where the licensee intends to erect works in the proximity of other licensee's lines or works and for the purpose of this regulation the Director of Telecommunications shall be deemed to mean owners of the other undertaking.

93. Lines crossing or erected on railway or navigable waterway

Where it is intended to erect any works along or across whether under or over any railways or a navigable waterway, notices similar to the provisions of regulation 91 shall apply for the purpose of this regulation, the Engineer-in-Chief shall be deemed to mean the General Manager of the Railway or the management of the navigable waterway, as the case may be.

94. Bringing into use of new works

(1) A licensee shall not bring new works into use until the works have been inspected and if necessary tested by an inspecting engineer to determine compliance with this Regulation, in particular the earth test results shall comply with regulation 43.

(2) At least fourteen days prior to the date on which it is desired to bring into use any works aforesaid the licensee shall serve notice on the Director, Electrical Inspectorate Services sending a copy to the area inspecting engineer, specifying the date on which the works or any part thereof will be completed and ready for inspection. Every such notice shall be accompanied by-

(a) a plan and description of the works as erected;

(b) copies of any notices and plans served under the provisions of Regulations 87, 90, 91, 92 and 93.

(c) copies of any counter notices received.

(3) On receipt of a notice under the provisions of regulation 94 (2) of the inspecting engineer shall inspect the relevant works and if he is satisfied that there is compliance with be regulations to certify in writing sending the original certificate to the licensee and a copy to the Director, Electrical Inspectorate Services: Provided that any certificate issued under the provisions of this regulation shall not be deemed to relieve the licensee of any of their obligations under the provisions of the Principal Act or of these Regulations.

(4) On the representations of the licensee that the bringing into use of the new works is imperative and urgent and cannot be delayed, the Director, Electrical Inspectorate Services if he is satisfied that there is

urgency may in his absolute discretion by writing under his hand authorize the licensee to bring the works into use prior to inspection–

(a) Provided always that any works so brought into use as herein Provided for shall be subjected to inspection and test not later than three months following the date they were brought into use:

(b) provided further that where the inspection and tests disclose that the works do not comply with the requirements of these regulations, any defects so disclosed shall ht: made good within twenty-one days of the date of the inspection tailing which the works shall be taken out of use and remain unused until the defects are remedied to the satisfaction of the Inspecting Engineer

95. Cables

All cables, whether for A.C. or D.C. and for all voltages, shall be insulated as required and manufactured in accordance with appropriate Nigerian Standard Specifications. Where steel armouring is employed, it shall be effectively earthed and bonded at all joint boxes so as to be electrically continuous.

96. Trenching and protection from damage

(1) The cables shall be laid at a depth of not less than 1 metre below surface level and in cases where two or more power cables are laid in the same trench a minimum distance of 300 mm should be maintained between the cables.

(2) To prevent the cables being damaged by stones the cables shall be laid in a bed of sifted soil or sand and to prevent mechanical damage the cables shall be protected by inter-locked tiles sufficiently wide to give a minimum of 50 mm on each side of the cable and laid approximately 150 mm above the cables.

(3) The cable route shall be indicated at surface level with cable markers at suitable intervals, particularly at positions where the cable changes direction.

97. Cables entering the ground

Where cables enter or leave the ground they shall be protected from a point at least half a metre below the ground level to a height above ground as may be considered necessary

98. Railway crossings by underground cables

All proposals in respect of railway crossings shall be submitted to the General Manager in accordance with regulation 65. All cables shall be drawn into non-metallic pipes, such as earthenware, fibre, asbestos, etc., which must be laid at a minimum depth of 1.3 metre below rail level measured to the top of the highest pipe, and shall be surrounded by not less than 250 mm of concrete. The pipes should extend at least 300 mm beyond the sleeper ends and be bushed to prevent chafing and ingress of stones.

99. Road crossings by underground cables

Where cables have to cross under roads, they must be drawn into non-metallic pipes such as fibre of asbestos. These pipes must be laid at a minimum depth of I metre below surface of the road measured to the top of the highest pipe and cable tiles shall be laid as in regulation 96 (2). The end of the pipes should be packed with a suitable bushing to avoid chafing and the ingress of stones.

100. Proximity to water and petrol pipes

Cables shall not be laid at a distance of less than 1 metre from pipes carrying water or petrol.

101. Street boxes

(1) The covers of street boxes shall be so secured that they cannot be opened except by means of a special appliance and such boxes shall be inspected by the licensee, from time to time, for the presence of gas and suitable action shall be taken to check the influx and accumulation of gas.

(2) High voltage lines shall not pass through the same street box as other electric lines unless they are enclosed in a strong metal casing effectively earthed.

(3) Street boxes containing high voltage lines shall not contain water, gas or other service pipes, or electric lines belonging to another licensee.

PART VII

Regulations appertaining to substations and switching stations

102. Provisions

(1) Where energy at high voltage is transformed, converted, regulated or otherwise controlled in substations or switch stations, the following provisions shall have effect–

(a) outdoor substations and outdoor switch stations (unless the apparatus is completely enclosed in a metal casing connected with earth, the said apparatus also being connected with the system by suitable electric cables) shall be efficiently protected by fencing not less than 2.5 metres in height or other means so as to prevent access to the electric lines and apparatus therein by any unauthorized person. The said fencing, if of metal shall be earthed separately from the sub- station earth. All metallic gates shall be effectively bonded to the fencing;

(b) the works of the licensee shall be labeled with an appropriate danger notice, with the name of the licensee and with the address, and telephone number, of their local office at which an officer or servant of the licensee will be in attendance:

(c) any metal work accessible from the ground level which normally has to be handled when the line is alive, (i.e. a switch operating handle), shall be connected to an earth mat, so situated as to include within its area the whole of the ground on which the operator would normally stand;

(d) suitable provision shall be made, either by connecting with earth a point of the system at the lower voltage or otherwise, to guard against danger by reason of the said system becoming accidentally charged above its normal voltage by leakage from or contact with the system at the higher voltage.

103. Substations situated inside building

(2)

(a) Where a substation or switch station is situated in any building so that a fire in the substation or switch station might involve risk to the said building and the said sub- station or switch station contains oil-immersed transformers or switches involving the use of oil in a tank receptacle or chamber, provision shall be made for the draining away or removal of any oil which may leak or escape from the tanks, receptacles or chambers containing the same; special precautions shall be taken to prevent the spread of any fire resulting from the ignition of the oil from any cause; and adequate provision shall be made for the extinguishing of any fire which may occur.

(b) Spare oil shall not be stored in any such substation or switch station.

104. Protection

All transformers shall be protected by primary fuses or overload circuit-breakers fitted adjacent to the transformers.

PART VIII

Transformation and control of energy at high voltage

105. Substations

Substations to be supplied at high voltage shall be established in suitable places and shall be in the sole occupation and control of the licensee. In the case of any substation established on the premises of a consumer, arrangements shall be made in conformity with the proviso to regulation 107 for that particular

consumer to manage the substation. In the case, it shall be in the sole occupation of the consumer aforesaid but jointly controlled by the licensee and the consumer.

106. Automatic protection and isolation of circuit

(1) Means shall be provided at the origination of every main circuit to automatically cut off the supply of energy in the event of-

(a) the passage of a current of such magnitude and duration as would be liable to damage the line or its associated joints and fittings:

(b) Leakage, of current to earth in excess of the amount permitted by these regulations.

(2) The means provided in compliance with paragraph (1) of this regulation shall be circuit-breakers constructed and installed in conformity with the relevant Nigerian Standard and they shall be capable of interrupting, without damage to the equipment or danger to the operator.. system short-circuit currents likely to be handled under conditions of use to which they are subjected; and further shall similarly withstand, without damage to the equipment or danger to the operator, the currents flowing if closure is made on to a line or circuit which is short circuited.

(3) Every automatic device shall be provided with means so that it can be locked in the "OFF" position to prevent unauthorized interference. During the time that the device is locked in the "OFF" position the relevant keys for the lock shall be kept in safe custody in the manner prescribed by regulation 76 (3).

107. General conditions as to transformation and control

(1) Where energy at high voltage is transformed, converted, regulated or otherwise controlled in substations or switching stations (including outdoor substations and outdoor switching stations) or in fife-resisting casings on the premises of a consumer, the following provisions shall have effect–

(a) sub-stations and switch stations shall preferably be erected above ground but where necessary constructed underground there shall be due provision for ventilation and drainage.

(b) outdoor substations and outdoor switch stations shall (unless the apparatus is completely enclosed in a metal casing connected with earth, the said apparatus also being connected with the system by suitable electric cable) be enclosed within chain link or woven wire or mild steel unclimbable fencing manufactured in strict conformity with the appropriate part of the relevant Nigerian Standard not less than 2.5 metres in height so as to prevent access to the electric lines and apparatus therein by any unauthorized person.

(c) fire-resisting casings on the premises of a consumer, preferably of metal connected with earth, shall completely enclose all electric lines (other than over- head lines) and apparatus on the premises designed to be electrically charged at high voltage and shall be secured so as to prevent access to electrically charged parts by an unauthorized person;

(d) wherever energy at high voltage is transformed, converted, regulated or otherwise controlled, the works of the licensee shall be labeled with an appropriate danger notice which shall state the name of the licensee and the address and telephone number, if any, of their local office at which an officer or servant of the licensee will be in attendance at all times.

108. Further constructional details in certain cases

(1) The following provisions as to constructional details shall have effect where energy at high voltage is transformed, converted, regulated or otherwise controlled.

In street boxes or similar structures or in fire-resisting casings on the premises of a consumer–

(a) all doors or covers shall be so secured that they cannot be opened except by means of a key or special appliance;

(b) the enclosed conductors and apparatus shall be so constructed, protected and arranged that when the door or cover giving access to an operating handle of a switch panel is opened, it shall not be possible for the person opening the door or cover to come into accidental contact with metal electrically charged at high voltage;

(c) Unless the conditions of supply are such that the whole of the enclosed conductors and apparatus may be made dead at the same time for the purpose of cleaning or for other work thereon, the conductors and apparatus shall he so separated that they may be made dead in sections, and the sections shall he so separated by divisions or earthed Screens from all adjacent live metal that work on any section made dead may be carried on by an authorized person without danger;

(d) Every fusible cut-Out shall be so constructed and placed that they can he operated or renewed as the case may be by an authorized person without danger.

(2) Where air break isolating switchgear either fused or unfused is employed for the purpose of isolating or sectionalizing circuits the several isolators shall be ganged so as to interrupt all lines of the circuit simultaneously.

109. Precautions against risk of fire.

(1) In delivering energy to a substation or switching station including an outdoor sub- station or outdoor switch station) or to the premises of a consumer, the licensee shall exercise all due precautions so as to avoid risk of causing fire.

(2) When a substation or switching station is situated in any building so that a fire in the sub-station or switching station might involve risk to the said building and the said substation or switching station contains oil-immersed transformers or switches involving the use of oil in tanks, receptacles or chambers, provisions shall be made for the draining away or removal of any oil which may lead or escape from the tanks, receptacles or chambers containing the same.

(3) Special precautions shall be taken to prevent the spread of any fire resulting from the ignition of the oil from any causes and adequate provision shall be made for the extinguishing of any fife which may occur.

(4) Spare oil shall not be stored in any such substation in switching station.

110. Provision for faults between transformer windings

Where energy is transformed, suitable provisions shall be made, either by connecting with earth a point of the system at the lower voltage or otherwise, to guard against danger by reason of the said system becoming accidentally charged above its normal voltage by leakage from or contact with the system at the higher voltage.

PART IX

Regulations appertaining to power stations and sub-station switchboard

111. Switchboards

(1) All power-house and substation switchboards, including the frames to which they are attached, shall be made of fireproof material.

(2) No live conductor shall be exposed on the front of any switchboard and the back of any switchboard of which bare live metal is mounted shall be made inaccessible (except to authorized persons) by means of earthed screens or otherwise.

(3) Every door leading to the back of a switchboard shall be provided with a spring or other approved device which shall ensure that the door remains open upon when not properly shut or locked.

(4) A rubber mat of not less than 6 mm thickness or any other suitable non-hydroscopic insulating material or insulating stand shall be provided for the protection of operators in front of switchboards of every power-house and substation. A similar arrangement shall also be provided in the screened-in space at the

rear of every power-house and substation switchboard (not being of the totally enclosed iron-clad cubicle type).

(5) All panels shall have marked thereon, near each switch, the name of the feeder controlled by such switch.

112. Connection with earth

All power-house and substation switchboards shall be provided with at least two different and independent earth connections, connected in parallel, to which all metal frames, all metal instrument cases (unless otherwise protected) and other metal parts thereof shall be connected. Means shall be provided to test the earth electrode resistance of these earth connections individually.

113. Power station

(1) Isolating links shall be lifted in the leads of each panel of all switchboards so that the panel can be made dead when necessary.

(2) These provisions in regulation 113 (1) shall not apply–

(a) where the circuit-breaker can be withdrawn from all sources of supply (e.g. truck-type cubicles);

(b) where the switchboard consists of one panel and it can be made dead by opening a switch outside and adjacent to the sub-station;

(c) where there is a single panel supplied from one generator.

114. Clearances to bare conductors in open spaces

Every power-house or substation switchboard shall be erected in such a position as to provide, in front and behind the switchboard, the clear unobstructed spaces hereunder mentioned, namely–

(a) medium and low voltage switchboards - an overhead clearance, (except in screened spaces dealt with in Regulation 114) of not less than 2 metres from the floor to any bare conductor under which it is necessary to pass, and a passage-way in front of the switchboard with at least 1 metre horizontal clearance from the face of the switchboard or any hare live metal affixed thereof;

(b) high and extra-high voltage switchboard: other than operating desks or panels working solely at medium, low or extra-low voltage an overhead clearance (except in screened .spaces dealt with in Regulation 114) of not less than 2.4 metres from the floor to any bare conductor under which it is necessary to pass, and a passage-way in front of the switchboard with at Least 1 metre horizontal clearance from the face of the switchboards;

115. Horizontal clearance in passage ways

In screened spaces where only skilled men would be employed when the switchboard is alive (unless all live metal other than that being worked on is suitably screened)–

(a) an overhead clearance of not less than 2 meters from the floor to any bare conductor under which it is necessary to pass;

(b) a horizontal clearance of not less than 2 meters for high or extra high voltage and not less than 1.2 meters for medium or low voltages where it is possible to pass between any live conductors less than 2 meters above the floor;

(c) a horizontal clearance of not less than one meter between any live conductor less than 2 metres above the floor and any wall, screen or other similar object;

(d) for all voltages in excess of 11,000 volts such clearances as are approved by the Director of Electrical Inspectorate Services.

116. Clearances to bare metal in screened spaces

(1) When a passage-way is provided behind any switchboard the horizontal clearance shall be the same as that specified for the front of the board, and shall be measured from any screen erected at the back of the switchboard.

(2) Every high and extra-high voltage conductor situated within reach of any working platform or in any switchboard passage-way shall be so placed or protected as adequately to prevent danger.

(3) Adequate precautions shall be taken to prevent any conductor or apparatus from becoming accidentally or inadvertently electrically charged when persons are working thereon.

(4) Where necessary to prevent danger insulating stands or screens shall be provided and kept permanently available and shall be maintained in a sound condition.

(5) Fire-buckets of suitable capacity, filled with clear, dry sand and ready for immediate use extinguishing fifes, and suitable fire extinguishers filled with non-conducting fluid, shall be kept in a convenient situation adjacent to the electrical apparatus and conspicuously marked.

117. Power houses and substations enclosures

(1) All power-houses and all substations shall be enclosed and due precautions taken to render them inaccessible to unauthorized persons.

(2) Where barbed wire is used for such purpose the wire shall be attached to supports or battens spaced not more than 2 metres apart. The distance between barbed wires shall not exceed 200 mm.

(3) Every fence which is used as an enclosure under this regulation (whether or not such fence is constructed or barbed) shall have three barbed wires spaced not less than 150 mm or more than 200 mm apart, fixed to supports on top of the fence and leaning outward at an angle of approximately 45° or such other protective arrangement as the Director of Electrical Inspectorate Services may approve.

(4) The gates of all enclosures shall be constructed to prevent access by climbing.

(5) All those parts of power-house or substation premises in which electrical apparatus is placed shall be adequately lighted to prevent danger.

(6) The entrance doors of unattended power-houses or substations shall where practicable be provided with a spring or other approved device, which shall ensure that the door remains wide open when not properly shut and locked.

(7) Ladders stored in the vicinity of or fixed to pole substations shall be of the shut-up type and kept security closed and padlocked when not in use and otherwise made inaccessible to unauthorized persons.

(8) Every passage-way and enclosed space shall have a firm and even floor.

(9) Adequate means of access, free from danger, shall be provided for every enclosed space or passage-way, and such means of access, enclosed spaces, and passage-ways shall be adequately lighted to prevent danger.

(10) Spaces at the back of switchboards shall be kept free of rubbish and shall not be used for storage purposes.

(11) Wiring in power-houses or substation buildings shall be carried out in accordance with the Regulations for Electrical Installations.

(12) Where platform type of construction is used, and space sufficient for any person to stand on the platform is provided, a substantial handrail shall be built around the platform.

(13) If the handrail is of metal it shall not be connected to earth.

(14) Earthed metal (e.g. pipes containing cables) shall not be attached metal handrails, and when attached to handrails other than metal shall be so placed or protected that any person on the platform cannot accidentally be in contact with live metal and such earthed metal at the same time.

(15) Handrails shall be lifted at a height not less than 1 metre or more than 1.5 metres above the platform.

(16) Metal screens fitted to handrails shall not be connected with earth.

118. Notice on electric shock treatment

Such instructions as the Director of the Electrical Inspectorate Services may from time to time approve as to the treatment of persons receiving electric shocks shall be added in a conspicuous place in every power-house and substation.

119. Electric line and apparatus for high voltage completion and control

(1) Electric lines of the licensee for use at high voltage shall be placed in positions, properly jointed and duly completed and examined before they are brought into use for the purposes of the supply of energy.

(2) Except as otherwise provided in these Regulations, every electric line as aforesaid shall during its use be in the sole charge of the licensee:

Provided that for any purpose connected with the efficiency and safety of the sup. ply of energy to a particular consumer, the licensee may make arrangements with the consumer for control by an authorized person of the electric lines on the premises of the consumer through which energy is supplied to the premises.

120. Insulation resistance test

(1) Electric lines and apparatus of the licensee for use at high voltage shall not be connected to a system for the purposes of the supply of energy unless the insulation of the electric lines and apparatus has withstood either–

(a) the test prescribed in that behalf in the appropriate Nigerian Standard then Current: or

(b) in case where no such tests have been prescribed, the continuous application between conductors and earth during a period of not less than fifteen minutes of alternating current either at testing voltage equal to at least one and one –quarter times the normal working voltage to which the electric lines of apparatus will be subject under conditions of supply, or at a testing voltage equal to the aforesaid working voltage with the addition of 10,000 volts, whichever be the higher.

(2)Provided that for the purpose of such alternatives tests–

(a) the testing voltage between the outer conductor and earth in cases where the outer conductor of an electric line having concentric conductors is to be connected directly with earth shall be 1 ,000 volts;

(b) the aforesaid working voltage between any phase of an altematll1g current system and earth in cases when the neutral conductor of the said system is not to be connected with earth shall be deemed to be the voltage between phases;

(c) the duration of the test may be reduced to one minute in the case of apparatus for use at high voltage subject to the testing volts being increased so as to equal not less than one and one-half times the aforesaid working voltage. or aforesaid working voltage with the addition of 20,000 volts whichever be the less;

(d) direct current may be used instead of alternating current subject to the testing voltage being increased so as to exceed by at least fifty per cent the corresponding testing voltage prescribed for alternating current.

(3) If the testings prescribed in this regulation are made prior to the said electric lines and apparatus being placed in position for the purposes of the supply of energy, the said electric lines and apparatus after having been placed in position and before being connected to the system shall have withstood a further test for resistance of insulation either by the application of the tests prescribed in this regulation whenever reasonably practicable, or by the application of a testing voltage of not less than 1,000 volts between conductors and also between conductors and earth during a period of not less than one minute.

(4) Where any electric line has been disconnected from a system for alteration or repair such electric line or apparatus shall not be reconnected to the system until the licensees have applied the test prescribed in paragraph (3) of this regulation and have satisfied themselves that the insulation of the electric line or apparatus and the phase sequence of the system are in sound condition.

121. Electric line to be metal-sheathed: precautions against excess leakage

(1) The following provisions shall apply to electric lines of licensee for use at high voltage–

(a) the conductors shall be enclosed in metal sheathing which shall be electrically continuous and connected with earth and the conductivity of the metal sheathing shall be maintained and reasonable precautions taken where necessary to avoid corrosion of the sheathing.

(b) in the event of a failure of insulation occurring between one conductor and the metal sheathing at any point along the electric line as foresaid the impedance of the relevant circuit together with the appropriate source impedance shall be such that with the full voltage input, the current resulting from such failure shall be not less than twice the value of the current for which a suitable fusible cut-out of adequate rupturing capacity; or

(c) Other suitable over-current device has been set to operate:

(d) Of the current required to operate a suitable discriminative fault current, relay: provided that the operation of the aforesaid overload preventive device or of the discriminative fault current relay shall cause the automatic operation of a circuit-breaker of adequate breaking capacity;

(e) the relevant circuit hereinbefore referred to means the complete circuit from the source of supply tom the point of failure of the insulation, including any connection with earth of the system of which the electric the lines as aforesaid forms part and any current limiting device inserted in such connection with earth, and the source of supply means the point at which energy is given to the system of the circuit of which the electric line as aforesaid forms part.

(2) Nothing in the provisions of regulation 123 (1) hereof shall preclude the employment in generating stations, substations and switch stations (including outdoor substations and outdoor switch stations) or conductors for use at high voltage which are not enclosed in metal sheathing, or preclude the use of electric lines laid before the prescribed date to which the provisions of regulation 129 apply.

(3) This regulation shall not apply to overhead lines unless the Director, Electrical Inspectorate Services otherwise prescribes in any particular case.

122. Connection with earth of high voltage systems

(1) The following provisions shall apply to the connection with earth of systems for use at high voltage-

(a) unless otherwise allowed by the Director, Electrical Inspectorate Services and subject as hereinafter provided, a point of every such system shall be connected with earth;

(b) the connection with earth shall, subject as hereinafter provided, be made at one point only in each system and the insulation of the system shall be efficiently maintained at all other parts, and provided that the insulation of the system need not be efficiently maintained at all other parts in the case of a system where the connection between the neutral point and earth incorporates an inductive resistance so designed as to ensure the immediate suppression of any arc between a conductor and earth and so designed also to ensure that upon the occurrence of a leakage to earth from a live conductor there is an immediate reduction of the voltage of the conductor to earth potential or approximately earth potential;

(c) in the case of a system as aforesaid comprising electric lines having concentric conductors, external conductor shall be the one to be connected with earth;

(d) where a system having a point connected with earth is used for affording a supply of energy at high voltage to an electrode boiler which is also connected with earth , the following conditions shall have effect;

(e) the metal-work of the electrode boiler shall be efficiently connected to the metal sheathing and metallic armouring (if any) of the high voltage electric line whereby energy is supplied to the electrode boiler;

(f) the supply of energy at high voltage to the electrode boiler shall be controlled by a suitable automatic circuit-breaker so set as to operate in the event of the phase currents becoming unbalanced to the extent to 10 per cent of the rated current consumption of the electrode boiler under normal conditions of operation:

Provided that if any case a higher setting is essential to ensure stability of operation of the electrode boiler, the setting may be increased to but shall in no circumstances exceed 15 per cent of the rated current consumption of the electrode boiler under normal conditions operation;

(a) an inverse time element device may be used in conjunction with the aforesaid automatic circuit-breaker to prevent the operation thereof unnecessarily on the occurrence of unbalanced phase currents of momentary or short duration;

(b) the licensee shall serve a notice on the Director of Telecommunications and on the area engineer at least thirty days prior to the date on which such supply of energy is to be afforded specifically the location of every point (including the earth connection of the electrode boiler) at which the systems is connected with earth.

(2) It shall not be permissible for the licensee to inter-connect electrically, systems for use at high voltage which are each connected with earth at one point, or except as hereinbefore provided, to connect any such system with earth at more than one point, unless electrical inter-connection as aforesaid or connection with earth at more than one point is for the time being approved by the Director, Electrical Inspectorate Services with concurrence of the Director of Telecommunications and is made in accordance with the conditions, if any, of that approval.

(3) Nothing in this regulation or in any approval by the Director, Electrical Inspectorate Services thereunder shall affect any rights or remedies of the Director of Telecommunications in relation to injury to or injurious affection of his telegraph lines, or confer any exemption from any liability or penalty in respect of any such injurious affection.

PART X

Electric lines and apparatus generally other than consumer installation

123. Standard of construction of electric lines

The standard of construction of electric line of the license shall unless otherwise allowed by the director of electrical inspectorate services, be at least that prescribed in the appropriate Nigeria industrial standard current at the time of their manufacture.

124. Protection against excess energy

Every circuit of the licensee (other service line from distribution mains) shall be protected against excess energy by a suitable fusible cut-out or automatic circuit breaker of adequate breaking capacity, fusible cut-outs or automatic circuit breakers shall not be inserted in any conductors permanently connected with earth.

125. Precautions against shock and fire

In the use of delivery of energy, licensee shall exercise all due precaution so as to avoid the risk of causing electric shock or fire, and shall be responsible for all electric lines, fittings and apparatus belonging to them or under their control being maintained in a safe condition.

126. Protection from lightning

Every electric line or any support therefore exposed to liability or injury from lightning shall be efficiently protected against such liability.

127. Precautions against metal works becoming electrically charged

(1) Where any electric line of the licensee (including a service line up to the supply terminals) at the time it is placed in position, crosses or is in dangerous proximity to any pipe, line or other metal precaution shall be taken by the licensee to prevent such pipe, line or other metal from becoming electrically charged.

(2) Any metal work, enclosing, supported or otherwise associated with electric line and apparatus unless designed to serve as a conductor, shall where necessary to prevent danger be connected with earth.

128. Overhead lines

Overhead lines of the licensee (including overhead service lines up to the supply terminals) shall be erected and maintained in accordance with the provisions of these regulation save in so far as the same are expressly excluded from application thereto.

Nothing in the regulation shall relieve the licensee from the obligation of obtaining any necessary consent to the placing of an electric line above ground.

129. Bituminous, etc., installation or protection

(1) Where the licensee has prior to the prescribed data brought into use an electric line (other than an overhead line) which is not completely enclosed in a continuous metallic sheathing connected with earth, and is insulated or protected *in situ* by composition or material of a bituminous character-

(a) any pipe conduct or the like into which such electric line may have been drawn or placed shall unless other arrangements are approved by the Director of Electrical Inspectorate Services in any particular case, be effectively sealed at its point of entry into any street box so as to prevent any flow of gas from or into the said pipe, conduct or the like into or from the said street box; and

(b) such electric line shall be periodically inspected where accessible, and the result of each such inspection shall be duly recorded by the licensee.

(2) It shall not be permissible for the licensee after the prescribed data to bring into use any further electric line as aforesaid which is insulated or protected, in-situ by any composition or material known to be liable to produce noxious or explosive gases on excessive beating.

130. Receptacles for electric lines and apparatus

All conducts, piles, casing, street box, and similar structures used by the licensee as receptacles for electric lines or apparatus shall be constructed of durable material, and where placed under carriageways shall be of ample strength to withstand heavy traffic and be placed at least 750 mm below the finished surface of main roads; and reasonable means shall taken to prevent the accumulation of gas in such receptacles.

131. Underground shaft, etc.

Where access to any electric line is obtained through a man-hole, or underground shall passage or the like not subject to regular inspection, no persons shall enter any such manhole, shaft, passage or the like until the same shall have been tested by the licensee for the presence of noxious or explosive gases, and until any such gases discovered as the result of such test shall have been dispelled.

132. Precautions against failure of supply

(1) The lay-out of the electric line of the licensee for the supply of energy throughout their area of supply shall under normal working conditions be sectionalized and so arranged, and provided where necessary with

fusible cut-outs or automatic circuit breaker as to restrict within reasonable limits the extent of the undertaking affected by any failure of supply.

(2) During and in connection with the installation, extension, replacement, repair and maintenance of any of their works, the licensee shall take all reasonable precautions to avoid any accidental interruptions of supply, and also to avoid danger to the public or to any employee or authorized person when engaged on any operation as aforesaid.

(3) The licensee shall send to the director of electrical inspectorate services notice of failure of supply of such kind as the director of electrical inspectorate services may from time required to be notified to him and such notice shall be sent by the quickest practicable means after the failure occurs or as the case may be after the failure becomes known to the licensee, and shall be in such form and contain such particular as the Director of Electrical Inspectorate Services may from time to time prescribe.

133. Provisions for telegraph lines

In localities where no telegraph lines, either above or below ground, exist, the licensee shall place his works (other than consumer's service lines) on one side of any street and where the street is continues the works shall be kept to one side of the same street for the whole distance.

134. Where telegraph lines exist

Except by permission in writing of the Director of Telecommunication all overhead electric lines shall be placed on the opposite side of the street to that on which any telegraph lines are erected; and where the erection or operation of the overhead electric line necessitates an alteration of any existing telegraph lines (including the provisions of guarding, covered wires or protective devices), and such alteration is approved by the Director of Telecommunications. The expense of the alteration shall be borne by the licensee:

Provided that where existing telegraph lines occupy both sides of a street at any place, or a route in a continues street crosses from one side of a street to the other, the Posts and Telegraph Department shall bear the cost or consent to an arrangement for the joint use of poles.

135. Placing of electric cables below ground

Where telegraph lines are placed below ground in any street and the licensee desires to place his work below ground in the same street they shall be placed on the opposite side of the street to the telegraph line unless the Director of Electrical Inspectorate Services expressly authorizes in writing a relaxation of these requirements. Any such relaxation shall be subject to such conditions as to the provision of minimum separating distance and protective features, in his absolute discretion be deems it desirable and necessary to impose for the protection of the telegraph cable.

136. Exchange of plans

Where it appears that work of a licensee or telegraph lines have been placed ground, the licensee or the Director of Telecommunications may on written application require the Director of Telecommunications or the licensee as the case may be to furnish a plan to a scale of not less than one to two thousand five hundred (2500) indicating the nature, course and depth of any existing work placed below ground. Any request made under the provisions of the regulation shall be black or colored lines on a white background having the true north and magnetic north legibly marked.

PART XI

Supply to premises of consumers installations

137. Service lines into consumer's premises

Any service line of the licensee which is taken into the premises of a consumer at a point below the level of the ground shall be taken into the premises in such manner as to prevent as far as reasonably possible any influx of gas at the point of entry.

138. Identification of conductors of service lines

The separate conductors of service lines shall be permanently marked by colouration, or in accordance with Regulations for Electrical Installation label as close as practicable to the supply terminal so as to indicate In a distinctive manner the polarity of the conductors or the neutral and live phase conductors as the case may be.

139. Protection of consumer's installation against excess energy

For protection against excess energy, a suitable fusible cut-out or automatic circuit breaker of adequate rupturing capacity completely enclosed in a suitable locked or sealed receptacle of solid fire resisting construction shall be inserted by the licensee in every service line as close as practicable to the supply terminals and in a position which, in the opinion of the licensee is suitable for the purpose.

Provided that no such fusible cut-out or automatic circuit breaker shall be inserted in any conductor which is permanently connected with earth:

Provided also that where a supply of energy is given at high voltages, provision shall be made whereby the consumer is enabled to cut off all voltage from the supply terminals without risk of danger.

140. Licensee's lines, etc., on consumer's premises

(1) The licensee shall be responsible for all electric lines and apparatus placed by them on the premises of a consumer and either belonging to the licensee or under their control (whether forming the whole or part of the consumers installation or not) being installed and maintained in a safe condition and suitable for their respective purposes and being so fixed and protected as to prevent so far as is reasonably practicable, leakage to any adjacent metal.

(2) The standard of construction and installation adopted by the licensee in complying with paragraph (1) of this regulation in so far as it relates to the whole or any part of a consumers installations shall not be lower than which the licensee would be prepared to accept under the Regulations for Electrical Installations.

(3) The obligation imposed by paragraph (1) of this regulation in regard to the maintenance of any electric lines and apparatus as aforesaid situated on the consumers side of the supply terminals and forming the whole or part of a consumer installation shall be subject to the terms of any agreement entered into between the licensee and the consumer with respect to the letting on terms or hire-purchase of the said whole or part of the consumers installation.

(4) Nothing in this regulation shall relieve the owner or occupier of any premises, being a consumer within the meaning of these regulations. From any obligation imposed on him by the Regulations for Electrical Installations.

[S.I. 5 of 1996.]

141. Inspection and test of consumer's installation prior to connection; licensee to appoint installation inspectors

(1) Licensee shall appoint in writing one or more competent persons to inspect consumers installations.

(2) The licensee shall not permanently connect a consumers installation supplied at low or medium voltage with their electric lines unless and until the said installation has been inspected and duly tested as aforesaid to determine compliance with the provisions for the Regulation for Electrical Installations.

[S.I. 5 of 1996.]

(3) The results of every test and inspection made in conformity with regulation 140(2) shall be recorded in writing and authenticated by the signature of the person appointed in conformity with paragraph (1) of this regulation.

(4) The provisions of this regulation shall not apply to consumers installation coming within the provisions of the Minerals and Mining Act (cap. 226), or the National Film and Video Censors Board Act, or where the installation to be supplied is another undertaking, instead the licensee shall make happy themselves that the installation complied with the appropriate writing regulations if any or that the installation has been approved by an inspector duly appointed to administer the appropriate wiring regulations applicable to the particular installation, before commencing to give a supply.

[Cap. M12. Cap. N40]

142. General conditions as to supply to consumers

(1) The licensee shall not be compelled to commence or subject to the provisions, of regulation 145, to continue to give a supply of energy to any consumer unless they are reasonably satisfied in respect of the consumer's installation.

(2)That all conductors (including flexible conductors) and apparatus (including portable apparatus) are sufficient in size and capacity for the purposes for which he supply of energy is to be used and are constructed, installed and protected so as to prevent danger so far as is reasonably practicable; and that all single- pole switches are inserted in live conductors only.

(3) that every distinct circuit is protected against excess energy by means of a suitable fusible cut-out or automatic circuit breaker of adequate rupturing capacity suitably located and of such construction as to prevent danger from overheating, arcing or the scattering of hot metal when it comes into operation and such as permit the renewal of the fusible metal without danger

(4) That every electric motor is controlled by an efficient switch or switches for starting and stopping and that the said switch or switches is or are so placed as to be readily accessible to and easily operated by the person in charge of the motor.

(5) Provided that installation shall be deemed to fulfill the requirements of this regulation if it complies with the provisions of the regulation for electrical installation or where applicable regulations governing electrical installations made under the provisions of-

(a) the National Film and Video Censors Board Act [Cap. N40]); or
(b) the Minerals and Mining Act [Cap. M12];
(c) any other Act.

143. Supply at low voltage from more than one pair of conductors of system at medium voltage

(1) The licensee shall not commence a supply of energy at low voltage to any consumer from more than one pair of conductor of a three-wire or multi-phase system at medium voltage unless-

(a) the total rating in kilowatts of the apparatus (including electric lamps) connected or intended to be connected to the consumer's wiring exceeds 10 kilowatts; and
(b) the giving of the supply at low voltage from more than one pair of conductor of a system as aforesaid is necessary to avoid variation in excess of the limits allowed by regulation 162(2) in the voltage declared to that consumer or to any other consumer supplied from the same distributing main.

(2) The licensee shall not in any case be compelled to commence, or subject to the provisions of regulation 146 to continue to give a supply of energy at low voltage to any consumer from more than one pair or conductors of a system as aforesaid unless they are reasonably satisfied in respect of the consumer's installation-

(a) that the supply terminal are arranged in separate parts in such a manner that so far as is reasonably practicable there shall be no danger of shock at medium voltage;

(b) that the consumers wiring connected to the separate pairs of supply terminals is kept separate and distinct, or complies with the conditions applicable to a supply at medium voltage prescribed by regulation 144;

(c) that in the case of any room containing the different pairs of conductors all socket outlets are connected to one and the same pair of conductors.

(3) Provided that any consumer's installation which complies with the provisions of the regulations for electrical installations shall be deemed to fulfill the requirements of regulations 142(2).

[S.I. 5 of 1996.]

144. Supply at medium voltage

(1) The licensee shall not be compelled to commence or subject to the provisions of regulation 146, to continue to give a supply of energy at medium voltage to any consumer unless they are reasonably satisfied in respect of the consumer's installation-

(a) that shall metal work enclosing supporting or associated with the consumers installation, other than that designed to serve as a conductor is where necessary, to prevent danger connected with earth;

(b) that the consumer's wiring is either completely enclosed in metal which is electrically continuous and adequately protected against mechanical damage or, alternatively, is so constructed, installed and protected as to prevent danger so far as is reasonably practicable.

(c) that the supply of energy to each motor or separate piece of apparatus is controlled by an efficient cut-out switch placed in such a position as to be readily accessible to and easily operated by the person in charge of the said motor or apparatus and so connected in circuit that by its means all voltage can cut-off from the motor or apparatus itself and from any regulating switch, resistance or other device associated therewith.

(2) Provided that an installation shall be deemed to fulfill the requirements of this regulation if it complies with the provisions of the regulations for electrical installation or where applicable regulations governing electrical installation made under the provisions of-

(a) the National Film and Video Censors Board Act [Cap. N40]); or

(b) the Minerals and Mining Act [Cap. M12];

(c) any other Act.

145. Supply at high voltage

(1) The licensee shall not commence a supply of energy at high voltage to any consumer unless-

(a) all conductor and apparatus intended for use at high voltage and situated on the premises of the consumer are inaccessible to the consumer, and all operations in connection with the said conductors and apparatus are carried out by the licensee by arrangement with the consumer; or

(b) the consumer gives to the licensee a guarantee in writing that every portion of the consumer's installation which is for use at high voltage will be maintained in an efficient state and if so required, to the satisfaction of the licensee that in case where the said portion of the consumers installation is not enclosed in a building or other structure to which access can only be obtained by means of a key or special appliance, an authorized person will be available to cut off the supply in the event of emergency; and that instructions as to the treatment of person suffering from electric shock will be affixed on or in the premises of the consumer.

(2) The licensee shall not in any case be compelled to commence or subject to the provisions of regulation 146 to continue to give a supply of energy at high voltage to any consumer unless they are reasonably satisfied in respect of the consumer's installation-

(a) that no metal work designed to be electrically charge at high voltage will normally be exposed so that it can be touched.

(b) that all conductors for use at high voltage (other than overhead lines) are completely enclosed in metal which is electrically continuous and adequately protected against mechanical damage;

(c) that no metal work enclosing, supporting or associated with the consumers installation, other than that designed to serve as a conductor, is where necessary, to prevent danger connected with earth;

(d) that the supply of energy to each motor or separate piece of apparatus is controlled by an efficient cut-off switch placed in such a position as to be readily accessible to and easily operated by the person in charge of the said motor or apparatus and so connected in circuit that by its means all voltage can be cut off from the motor or apparatus itself and from any regulating switch resistance or other device associated therewith;

(e) that shall windings at high voltage of motor or other apparatus within reach from any position in which a person may require to be are efficiently protected so as to prevent danger;

(f) that where transforming apparatus is used, suitable provision is made either by connecting with earth a point of the circuit at the lower voltage or otherwise, to guard against danger by reason of the said circuit becoming accidentally charge above its normal voltage by leakage from or contact with the circuit at the higher voltage;

(g) that unless the condition are such that the whole of the conductors and apparatus for use at high voltage may be made dead at the same time for the purpose of cleaning or for other work thereon, the said conductor and apparatus are so arranged that they may be dead in sections are separate by dividers or screens from all adjacent metal which is live that work on any section made dead may be carried on by an authorized person without danger;

(h) that an adequate gang way or working space is provided in front of any switch-board (other than panels for controlling circuits at low voltage) and at parts of the installation where live conductor can be exposed;

(i) that adequate means are provided for preventing access by the public or any unauthorised person to any part of the consumers installation which is designed to be electrically charged at high voltage.

(3) The licensee shall give to the factory inspector of the district concerned notice of their intention to commence a supply of energy at high voltage to any premises to which the Factories Act applies.

146. Supply for luminous tube sign on outside of premises

(1) The licensee shall not knowingly commence or subject to the provisions of these Regulations, continue to give a supply of energy to any consumer who proposes to transform or is transforming the energy to a higher voltage for the purposes of luminous tube sign or the like on the outside of any premises unless either they are satisfied with respect to consumers installation that-

(a) efficient cut-off switch on the lower voltage side of the transforming apparatus are provided both inside and outside any premises on which the said sign is placed and in such position as to be readily accessible and easily operated without danger in any emergency and so connected in circuit that by their means all high voltage can be cut off from the sign itself and from any regulating switch resistance or other device associated therewith;

(b) no metal work designed to be electrically charged at high voltage will normally be exposed so that it can be touched.

(c) all conductor for use at high voltage (other than overhead lines and service wires) connecting the parts in a luminous tube sign or the like are completely enclosed in metal which is electrically continuous and where necessary to prevent danger adequately protected against mechanical damage, and that the said conductors are so arranged as to give a clear space of not less than 100mm between the outside of their metallic covering or and the outside covering of any other electric line not forming part of the consumers installation or any part;

(d) all metal work enclosing supporting or associated with the consumers installation, other than that designed to serve as a conductor, is where necessary to prevent danger connected with earth;

(e) all winding at high voltage of apparatus within reach from any position in which a person may require to be efficiently protected so as to prevent danger;

(f) in respect of the transforming apparatus, suitable provision is made to guard against danger by reason of the circuit at lower voltage becoming accidentally charged above normal voltage by leakage from or contact with the circuit at higher voltage;

(g) unless the conditions of supply are such that the whole of the conductors and apparatus may be made dead at the same time for the purpose of cleaning or for other work thereon, they are so arranged that they may be dead in sections, and that such sections are so electrically isolated from all adjacent metal which is live that work on any section made dead may be carried on by an authorized person without danger;

(h) adequate means are provided for preventing any unauthorized person from coming into contact with any part of the consumer's installation which is designed to be electrically charged at high voltage and that an appropriate danger notice is displayed at points of access thereto; or

(2) Where the consumers in writing that the installation has been installed and will be maintained in compliance with the provisions of the Regulations for Electrical Installations the installation shall be deemed to fulfill the requirements of this regulation save in so far as these Regulations specifies any requirements not contained in the Regulations for Electrical Installations.

(3) Provided that where it can be shown that in the event of an accident involving death or injury to any person or persons, the consumer had failed to install or maintain the installation in compliance with any written guarantee shall be liable to prosecution under the provisions of these Regulations.

147. Disconnection of supply in certain circumstances

(1) where a supply of energy is being afforded to a consumer and the licensee after making such examination as the circumstances permit have reasonable ground for supposing that a leakage likely to cause fire hazard or endanger life exists at some part of the installation or that the said installation or any part thereof fails to fulfill any requirements of regulations 142 to 146 inclusive, the following provisions shall (subject as provided in paragraph (2) of this regulation) have effect-

(a) in any case where the licensee are prima facie satisfied that immediate action is justified as a work of emergency in the interest of the public safety or in order to avoid undue interference with the efficient supply of energy to other consumers they may as a work of emergency forthwith discontinue the supply of energy to the consumers installation and shall give immediate notice in writing of the discontinuance to the consumer, specifying the matter complained of:

(b) in any other case, the licensee may by notice in writing require the consumer within reasonable time after the service of the notice to permit an inspecting engineer to inspect and test the said installation at any time between the hours of 7:30a.m and 3:30p.m. if the consumer does not give all due facilities for inspection and testing, or if as the result of any such inspection and testing, the inspection engineer makes a report confirming the existence of a leakage from the consumers installation or report that the said installation or any part thereof fails to fulfill any requirements regulations 142 to 146 inclusive, the licensee may forthwith by notice in writing specify the matter complained of, and if the consumer fails to show to the reasonable satisfied of the licensee within such reasonable period as may be specified in that behalf in the notice that the said matter has been remedied, the licensee may on the expiration of the said period but subject as hereinafter provided discontinue the supply of energy to the consumers installation, giving immediate notice in writing of such discontinuance to the consumer.

(c) any difference which may arise between a consumer and the licensee in regard to any matter complained of or as to the period specified for remedying the same in any notice as aforesaid shall be settled in manner provided for by regulation 148:

(d) in the exercise of the powers conferred by paragraph (1) *(b)* of this regulation, the licensee shall not discontinue the supply of energy pending the settlement of any difference referred to in paragraph (1) *(c)* of this regulation, and shall in no case discontinue the supply of energy to the whole of the

consumer's installation, where it is practicable to disconnect that portion in respect of which any matter is complained of:

(e) Provided that nothing in this regulation shall prevent the licensee from exercising the powers conferred by paragraph (1) *(d)* of this regulation in the event of the development of a condition of emergency as therein provided;

(f) where in pursuance of this regulation the licensee have discontinued the supply of energy to the consumers installation or any part thereof, the licensee shall not recommence the supply of energy until they are reasonably satisfied in respect of the consumer's installation that all requirements of regulations 142 to 146 inclusive have been fulfilled or until it has been determined or decided in the manner provided for by regulation 148 that licensee is not entitled under regulation 142 to 146 inclusive to decline to recommence the supply and thereupon the supply of the energy shall be recommenced by the licensee.

(2) The foregoing provisions of this regulation shall extend so far as applicable and with the necessary adaptations to any electric lines and apparatus situated on the consumers side of the supply terminals and belonging to the licensee or under their control within the meaning of regulation 140 and where the supply of energy has been discontinued in pursuance of the said provisions , the licensee shall subject to the respect to the letting on terms of hire or hire- purchase of any such electric lines and apparatus, forthwith remedy the defect in the said electric lines and apparatus and recommence the supply of energy.

148. Notices by licensee to consumers where connection is declined or it is intended to disconnect supply

(1) In any case where the licensee in pursuance of this part of these Regulations decline to connect a consumer's installation or any part thereof with their electric lines or to commence or continue to give a supply of energy thereto or decline to recommence the supply of energy after the same has been discontinued, they shall serve on the consumer a notice in writing sating their reasons for so declining.

(2) Any difference which may arise between a consumer and the licensee either with reference to any notice under paragraph (1) of this regulation or under regulation 147 or with reference to any consumers installation to which the provisions of regulations 140(1) and 141 (2) apply, shall be determined by an inspector nominated by the Director of Electrical Inspectorate Services on the application of the consumer or his authorized agent or of the licensee, as the case may be. The Director of Electrical Inspectorate Services shall prescribe the fee to be paid to such inspector and the inspector shall determine which of the parties shall bear the costs of (including the prescribed fee) or any portion of such costs.

(3) Provided that in the case of any consumers installation (or any part thereof) which was connected with the electrical lines of the licensee and supplied with energy prior to the prescribed data it shall not be competent for an inspector nominated under this regulation to determine that the licensee were or are entitled under regulations 141 to 145 inclusive to refuse a supply of energy thereof if the inspector is satisfied that-

(a) the said installation has continued to function satisfactorily up to the material time;

(b) the installation is to be or is being continued in use only within the limits of the maximum power for which it was originally intended; and

(c) there are no grounds for supposing that the installation will fail to continue to function satisfactorily for a further reasonable period without risk of danger

(4) If the licensee or the consumer or his authorized agent are or is dissatisfied with the determination of the inspector, they or he may appeal to the Minister and thereupon the Minister shall enquire into and decide upon the matter of the appeal and his decision shall be final and building on all parties.

(5) This regulation and regulation 146 shall be endorsed on every notice given by the licensee to a consumer under the provisions of either of the aid regulation, or alternatively the notice shall be accompanied by a copy of each of the said regulation.

PART XII

Meters

149. Meters to be tested for accuracy

(1) Every meter intended to be used by the licensee for the purpose of ascertaining charge for electrical energy supplied by him to a consumer shall prior to its installation be tested to determine compliance with the provisions of regulations 157 and 158.

(2) Any meter failing to comply with the requirements of regulations 156(2) (iii) hereof shall be used until it shall have been adjusted and found by retesting to register within the prescribed limits.

150. Testing stations to be established

(1) For the purpose of determining the accuracy of meters in compliance with regulation 149, the licensee shall establish either a central area or both central and area meter testing stations.

(2) Every testing station established in compliance with this regulation shall be provided with standardized precision measuring instruments for the purpose of determining the following measurements-

(a) potential as volts;
(b) current as amperes;
(c) power as watts;
(d) frequency of supply in hertz;
(e) time in tenths of a second;
(f) any other measurements which the director of electrical inspectorate services may deem to be essential.

(3) Precision instruments shall have been standardized by comparison with standard instruments at either standardizing institution in the country of manufacture or by comparison with some other standard instruments known accuracy approved by the Director of Electrical Inspectorate Services. Every sub-standard instrument shall have a dated certificate of calibration covering its entire scale range and except a timing device, its accuracy shall be within the limits of error prescribed by the I.E.C. where current or potential transformers are used with an instrument they shall be class AL and their ratio and phase angle errors shall not exceed the values prescribed by the appropriate I.E.C. standard or other Nigeria Standard.

(4) Terminal markings of meters and associated transformers shall be marked to correspond with actual connections made at the time of calibration and certification. Certificates of calibration shall be valid for a period of five years from the data of issue. No sub-standard meter shall be used at a testing station within a valid certificate of calibration.

(5) Every such testing station shall be approved by the director electrical inspectorate service in writing under his hand. Any approval so given may be revoked at the sole discretion of the director of electrical inspectorate service if he has reason to believe that the station is no longer capable of performing the functions for which it was established.

151. Appointment of competent person to have charge of meter testing station

The licensee shall appoint a competent person having the qualifications prescribed by order of the minister on the advice of the director of electrical inspectorate services. Where no such qualifications have been prescribed the director of electrical inspectorate services shall be satisfied that the person so appointed is competent to have charge of the meter testing station.

152. Records to be kept by competent person

The person appointed in conforming with regulation 151 shall ensure that test records in accordance with regulations 155 and 156 for all meter tested at the station of which he is in charge are well kept.

153. Meters to be subject to periodical testing

(1) At least once in every fifteen years every meter installed on consumers premises for the purpose of ascertaining charges for electrical energy supplied shall be removed to a meter testing station and tested for accuracy. In the event of any meter so removed being found to register not within the prescribed limits, it shall not be reused until it has been adjusted and found to register within the prescribed limits.

(2) Provided that the requirements of this regulation shall be deemed to have been complied with in the case of a meter which at the prescribed date has been in service for a term exceeding fifteen years, if the meter is removed from the consumers premises not later than three years after the prescribed date.

154. Meters to be marked with date of testing

(1) every meter installed upon the premises of a consumer for the purpose of ascertaining charge for energy supplied shall have affixed to it in such a position that it is readily seen but cannot be defaced a label on which is printed, written or punched legible character or other mark indicating the year of certification in conforming with regulation 149.

(2) provided that the provisions of this regulation shall not have effect in the case of-

(a) meter installed at the prescribed date; until seven years following the prescribed date; and

(b) meter installed subsequent to the prescribed date.

155. Inaccuracy of meters

(1) If any consumer disputes the accuracy of any meter or meters used for the purpose of determining the charge of energy supplied to him, he may by written notice served on the licensee (accompanied by a deposit of #5) required the licensee to cause the meter to be tested and certified as to its accuracy. On receipt of such notice from a consumer the licensee shall forthwith cause a meter having known errors to be connected in series with the suspect meter to determine whether the latter's accuracy is within the prescribe limits and shall supply the consumer with copy of the test results not later than 28 days from the date of the termination of the testing period.

(2) In the event of the test disclosing that the registration of the meter is not within the prescribed limits. The licensee shall immediately refund the deposit paid by the consumer and adjust his account for the period of charge immediately preceding the date of the notice given by the consumer under the provisions regulation 154(1) hereof and in addition make adjustment in respect of the registration of the meter between the last meter reading thereof at the date of removal from the consumer's premises for certification.

(3) Where the registration of the meter or meters is found to be within the prescribed limits, except as provided for in regulation 154(4) the consumer shall have no further claim against the licensee and the deposit paid to the licensee shall be forfeited.

(4) In the event of a consumer being dissatisfied with the licensee's test of his meter he may by written notice require the Director of Electrical Inspectorate Services to investigate the matter and give his ruling. The Director of Electrical Inspectorate Services' ruling shall be final and binding on both parties. The cost of any additional test made by or on the instructions of the director of electrical inspectorate service shall be borne by the consumer or licensee or both as may be directed by the Director of Electrical Inspectorate Services.

(5) Written or printed extracts of this regulation shall be kept at every office of the licensee at which monies due for electricity supplied are receivable and on complaint by a consumer regarding the alleged inaccuracy of a meter a copy thereof shall be handed to the complainant. If the complainant cannot read or

understand the remedies to which he is entitled, the office in charge of the pay station shall explain the rights and remedies open to him and if so requested by the complainant prepare the written notice required by virtue of paragraph (1) of this regulation for him to affix his signature or mark.

156. Precautions in transporting meters

Licensee shall ensure that all reasonable precautions are taken when transporting meters between the testing station and area offices and between area offices and consumers' premises or *vice versa* to ensure that the accuracy thereof is not disturbed by careless handing.

PART XIII

Prescribed tests and accuracy of meters

157. Prescribed test and accuracy of meters

(1) Every meter shall before installation on consumers premises for the purposes of determining charges; be subjected to the tests herein prescribed and shall not be used unless the results of such tests disclose that there is compliance with the requirements of regulation 158(3).

(2) Meters shall be subjected to test in the sequence set out; where intended for operation in conjunction with current or potential transformers or both current and potential transformers due allowance shall be made in respect of the ratio and angle errors of the relevant transformer-

(a) in the case of integrating meters
   i. high voltage test.
   ii. non-registration with voltage alone.
   iii. accuracy of registration at loads as follows -
   light load one intermediate load and full load all at unity power.
   factor full load at 0.5 power factor lagging
   iv. dial test.
   v. insulation resistance.

(b) in the case of integrating meters fitted with a maximum demand attached test as per subparagraphs (a) (i) to (iii) of this paragraph followed by a test to determine accuracy of registration of the maximum demand attachment followed by test as per subparagraphs (a) (iv) and (v) of this paragraph.

(c) in the case of thermal type maximum demand indicators the following test shall be carried out-
   i. high voltage test
   ii. accuracy of registration,
   iii. insulation of resistance

158. High voltage test

(1) High voltage test, meters and, if used, instrument transformers shall be subject to and withstand without injury the test voltage prescribed by the relevant I.E.C conditions.

(2) Non-registration with voltage alone – with the current circuit disconnected, the potential coils shall be energized at a potential ten per centum in excess of the name plate voltage it should be ascertained that the rotor disc stops rotating before completing one revolution.

(3) Accuracy of registration (integrating meters) – for the purpose of this test, meter may either be individually or in the case of whole current meters, be tested in batches. Where the latter method is used the potential and current elements of the meters shall be energized separately and the phase angle as between the two circuits shall not vary by more than plus 60 minutes from the true phase displacement equivalent to the power factor of the prescribed test. The accuracy of registration for the particular type of meter specified

in this first column of the subjoined table shall be within the limits prescribed by the relevant Nigerian Standard and in no case worse than the tables as listed below.

TABLE 1

Limits of percentage error

Single phase 2-wire whole current Value of current as percentage of basic current	*Power factor*	*Error limit per cent*
From 10% up to rated maximum current	1.0	+-2.0
2%	1.0	+-2.5
From 20% up to rated maximum current	0.5 lagging	+-2.0

TABLE 2

Limits of percentage error

Single phase 2-wire prepayment Value of current as percentage of basic current	*Power factor*	*Error limit per cent %*
5%	1.0	+-2.5 – 3.5
10%	1.0	+-2.0 – 2.5
From 20% up to and including rated maximum current	1.0	+-2
30%	0.5 lagging	+-2.0 – 2.5
From 40% up to and including rated maximum current	0.5 lagging	+-2

TABLE 3

Limits of errors

Polyphase or 4-wire 3-phase Conditions of test		
Current expressed as a fraction of marked curren	*Power factor*	*Limit of percentage error*
5% to 125%	1.0	+2.0
10%	0.5 lag	+2.0
20% to 125%	0.5 lag	+2.0

TABLE 4

Limits of error for meters fitted with maximum demand indicators

Whole current or transformer operated type Conditions of test		
Current expressed as a fraction of the marked current	*Power factor*	*Limit of percentage error*
5%	1.0	+2.0 – 3.0
10%	1.0	+2.0 – 2.5
20% to 125%	1.0	+2.0 – 2.0
10%	0.5 lag	+2.5 – 3.0
20%	0.5 lag	+2.0 – 2.5
40% to 125%	0.5 lag	+2.0

(4) for the purpose of determining that the energy register fitted is of the correct type and appropriate to the meter to which it is fitted, meters shall be tested by the application of a load, not exceeding rated full load, for such a periods as will cause the register to advance by not less than ten complete revolutions of the lowest reading dial.

For the purpose of this test, meters of the same type and current rating may be hatch tested and comparisons made with a previously calibrated sub-standard by a percentage equivalent to the percentage error or registrations as determined by the tests prescribed by regulation 157(3) hereof, after due allowance has been made for the inaccuracy of the sub-standard meter

(5) Insulation resistance – meters and instrument transformer if used, shall have an insulation resistance not less than the values prescribed by the relevant I.E.C. or Nigerian Standard. The insulation resistance shall be measured immediately prior to issue of the meter and accessories from the testing station.

(6) Thermal type maximum demand indicators – registration of meter shall not –

(a) exceed 85% of the load actually applied prior to the expiry of 50% of the demand integration period; or

(b) at the expiration of the demand integration period, the recorded demand shall not vary by more than plus or minus three per centum of the applied load, when tested in the following manner – a steady current equivalent to one quarter of the name plate rating shall be applied for a period of the time equal to the demand integration period, the registration being noted after the expiry of half the demand integration period and again at the end of said period. Immediately following the expiration of the demand integration period with a current equivalent to one quarter load, the current passing shall be increased to the equivalent of one half and at the end of the demand integration period. Thereafter without pause similar tests shall be made at three quarters and at marked plate rating of the indicator.

(7) Any terms and expressions in regulations 157 and 158 not specifically defined by regulation 2 of these Regulations shall be deemed to have the same meaning as is assigned to them in the relevant Nigerian standards.

PART XIV

Conditions of supply to consumers where distributing mains of adequate capacity exist

159. Persons entitled to demand and supply

(1) Licensee shall upon being required to do so by the owner or occupier of any premises not previously supplied with electrical energy situate within 90 meters from any distributing mains of the licensee used for general supply, give and continue to give a supply of electricity to such premises subject to the following conditions-

(a) every owner or occupier of premises requiring a supply of electricity shall serve a written notice on the licensee specifying the premises for which the supply is required, the nature and the extent of the electrical installation and appliances to be utilized and the day on which the supply is required; which date shall not be earlier than 14 days after the date of the notice; and shall enter into a written contract; of which a copy shall be furnished to the owner or occupier, as the case may be; to pay for such supply of electricity at the appropriate published rate of charge for the time being charged to ordinary consumers in the area and if required by the licensee to deposit such sum of money by way of security for payment to them of all meters which may from time to time become due to them by the consumer in respect of electric lines to be erected under the provisions of subparagraph(*c*) or (*d*) of this paragraph or current to be supplied;

(b) the electrical installation provided within the premises to be supplied complies with the requirements of the appropriate regulation, then in force covering electrical installations on consumers' premises and has been inspected and tested and so certified by an inspecting engineer duly authorized for this purpose;

(c) the cost of so much of the overhead service line exceeding 50 meters as may be laid on the private property of such owner or occupier shall if the licensee so required be defrayed by such owner or occupier;

(d) where the service is by underground cable the cost of so much of the service line exceeding 20 meters as may be laid on the private property of such owner or occupier shall if the licensee so require be defrayed by such owner or occupier;

(e) where is necessary to erect a pole on the property of the owner or occupier to secure clearance over a street or from the works of the posts and telegraphs department or other authorised licensee the cost of the said poles shall not be included in any charge payable under the provisions of subparagraph (*c*) this section;

(f) the licensee shall be bound to afford a supply of electricity to consumers requiring a supply under the provisions of this regulation within 28 days of the delivery to them of the contract by the consumer as required by subparagraph (*a*) of this paragraph or where the provisions of subparagraph (*c*) or (*d*) of this paragraph are applicable within 28 days of payment of the deposit referred to in subparagraph (*a*) of this paragraph.

(2) Where the premises to be supplied have previously received a supply of energy the provisions of regulations 155(1) shall apply and in addition the following conditions –

if required by the licensee the owner or occupier of the premises to be supplied shall pay the published tariff connection fee. Where the nature and extent of the installation is substantially the same as when previously supplied, provided that the service line has not been dismantled the licensee shall be bound to give a supply within 14 days of the date of receipt of the application subject to there being compliance with all other conditions set out herein;

where the nature and extent of the installation is such as to require the provision of additional service lines or to increase the capacity thereof, the provisions of subparagraph (*c*) or (*d*) of paragraph (1) shall apply.

160. Where no distribution mains exist

(1) Requisition of supply – where in any street or part of a street, no distribution mains for the purpose of general supply have been provided by the licensee or where the general supply distribution system is more than one hundred meters distant, two or more owners or occupier of premises or the local authority may serve a requisition in writing on the licensee specifying the premises for which the supply is required, the nature and extent of supply required, requiring them to provided mains for the purpose of general supply throughout any street or part of a street. Every such requisition served on the licensee shall be signed by the persons making it or by the chairman of the local authority as the case may be.

(2) The licensee may as soon as possible after the service of such requisition serve a notice on the person by whom such requisition was submitted stating that they decline to be bound by such requisition unless such persons or some of them will guarantee-

(a) to reimburse the licensee the entire cost of providing the general supply mains and any other necessary works to give a supply or a proportion thereof at the sole discretion of the licensee; or

(b) to reimburse the licensee, by an annual service charge in addition to any charge payable at published tariff rates. The said annual charge to be based on the entire cost of providing the supply or such proportion thereof as the licensee may determine together with interest charge thereon at a rate not exceeding current bank loan rate and depreciation charges not exceeding five *per centum* per annum. The said annual service charge to be payable for a term not exceeding twenty years; or

(c) to reimburse the licensee a proportion or the entire cost of providing the general supply mains and ancillary works the balance or such proportion thereof as the licensee may determine in the manner provided for in subparagraph (*b*) of this paragraph.

(3) Where a notice as provided for in paragraph (1) of this regulation has been served the requisition served in conformity with paragraph (2) of this regulation shall not be binding on the licensee unless within twenty eight (28) days after the service of such notice on all the persons signing the requisition or in the

event of the matter being submitted to arbitration the delivery of the arbitrator's award, there shall be tendered to the licensee an agreement severally executed by such persons or some of them guaranteeing to reimburse the licensee in the manner provided for in subparagraph (*a*) or (*b*) or (*c*) of paragraph (2) of this regulation or determined by arbitration under this section, or unless sufficient security for payment to the licensee of all monies which may become due to them under such agreement be offered to the licensee within the period limits for the tender of the agreement as aforesaid.

(4) If any difference should arise between the licensee and any person signing the requisition as to the reasonableness of the sum specified by the licensee in their notice or as to the sufficiency or nature of the security such difference shall be determine by arbitration.

(5) All mains the subject of any requisition which has been binding on the licensee shall be provided as soon as possible after the delivery to them of the agreement and sufficient security for the payment to the licensee of all monies which may become due to them.

(6) Nothing in this regulation shall apply to a consumer requiring a supply by special agreement.

PART XV

General

161. Saving in respect of amenity undertaking

(1) where the licensee are operating an undertaking declared by notice in the official *Gazette* to be an "amenity undertaking" and where compliance with regulation 159 (1) (f) or regulation 160 (5) would involve over loading of the electric lines or plant to the detriment of other consumers already supplied with electricity and further makes it difficult or impossible to maintain supply within the limits of voltage and frequency prescribed by regulation 160 (2), the licensee may make representations in writing to the minister that they are unable to comply with the requirements of regulations 159, 160 and this regulation unless the mains or the plant or both mains and plant are enlarged.

(2) If the minister is satisfied that the representations are just and proper he may by notice in the Official *Gazette* relieve the licensee of compliance with the said parts of regulation 159 and 160 for such period as in his absolute discretion he considers just and reasonable.

(3) provided that any relief given o a licensee under the provisions of this regulation be for a term not exceeding twelve months from the date of the publication of the notice in the *Gazette*, however on written application by the licensee, relief for further terms not exceeding twelve months may be given to the licensee by the minister in his absolute discretion by further notice or notices in the Official *Gazette*.

162. Declared type of current, frequency and voltage at supply terminals

(1) Before commencing to given a supply of energy to consumer, the licensee shall declare to that consumer –

(a) the type of current, whether direct or alternating which they propose to supply;

(b) in the case of alternating current, the number of phases and also the constant frequency at which they propose to deliver the energy to the supply terminals; and

(c) the constant voltage at which they propose to deliver the energy to the supply terminals

(2) The type of current, the number of phase and the frequency in the case of alternating current and the voltage declare as aforesaid shall be constantly maintained subject to a permissible variation as regards voltage not exceeding six per centum above or below the declared voltage and as regards frequency to a variation not exceeding one and half per cent above or below the declared frequency provided that the permissible variation in frequency is such that the variation in time recorded by a standard synchronous electric clock to be maintained in proper working order at each and every electric generating station at which

alternating current is generated shall not a anytime be more than sixty seconds fast or sixty seconds slow by comparison with time signals transmitted by radio broadcast from Federal Radio Corporation of Nigeria system.

(3) Notwithstanding subparagraph (1) (*a*) of this regulation, licensee shall supply electricity on the alternating current system at a frequency of fifty hertz and at one of the following standard system voltage 230, 400, 3,300, 6,600, or 11,000, 33,000 volts unless specifically authorized in writing by the Director of Electrical Inspectorate Services to supply electricity on some other system or at some frequency or voltage which authorization will only be given in exceptional circumstances.

163. Licensee to provide constant supply

(1) From the time when the licensee commence to supply energy through any distributing mains, they shall maintain continuously a supply of energy sufficient for the use of all consumers for the time being entitled to be supplied from that distributing mains.

(2) provided that notwithstanding the provision for the continuity of supply of energy above contained it shall be lawful for the licensee to discontinue such supply for such period as may be reasonably necessary for any of the following reasons or purposes –

(a) for the purpose of testing or effecting repair to the distributing mains or plant;
(b) for the purpose whatsoever connected with the proper working of the undertaking;
(c) for the purpose of making new connections;
(d) on account of a breakdown or damage to plant;
(e) in order to prevent damage to plant and distributing mains and to prevent danger to the public, which damage or danger is likely to be caused by *force majeure* or civil commotion.

(3) For the purposes of examinations and test carried out by virtue of regulation 94, and provided that where discontinuance of supply shall be due to subparagraph (2)(a) to (c) of this regulation all consumers by whom such discontinuance shall be affected shall be entitled to not less than 24 hours' notice in writing from the licensee of his intention to discontinue the supply.

PART XVI

Penalties for breaches of licenses and regulation

164. Penalties

1) If any licensee –
   (a) fails to use and maintain the work's constructed pursuance to its license in such a manner as to secure to the area of supply the full benefit of the undertaking; or
   (b) fails to observe any of the requirements of these regulations, he commits an offence against these regulations and is liable for each such offence to a fine of one hundred naira.
2) Where the minister is of opinion that any offence by a licensee, as aforesaid, is sufficiently serious to warrant the revocation of the license; he may direct that a notice specifying such offence, and requiring the licensee to take such steps as may be necessary to prevent a continuance of the offence, be served on the licensee, and if at the expiration of 90 days after such service the Minister is satisfied that such steps have not been taken he may revoke the license.

165. Revocation

The Electricity Supply Regulations are hereby revoked.

[Cap. 106. L.F.N. 1990]