PROPOSED ELECTRICAL CODE FOR

LEBANON

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Proposed

E L E C T R I C A L C O D E

for Lebanon

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INTRODUCTION

- The purpose of this proposed Code is to set minimum standards for ordinary Electric Installation in public and private buildings for the protection of such installations, buildings and persons.

- The provisions of this Code shall apply, starting from the origin of the interior installation, whatever it might be.

- No Alternating Current shall be over 250 volts and no Direct Current shall be over 600 volts except for special instruments in which cases special provisions shall apply. The use and choice of conductors are indicated under 221-2 and 221-3.

- The provisions of this Code constitute the minimum that shall be followed, except in unusual circumstances and then with the written approval of the proper responsible authorities.

- No Electric wiring for light, heat or power shall be installed hereafter on a building or structure, nor shall an alteration or extension of existing electric wiring system be made, except in conformity with the provisions of this Code and its subsequent additions and/or alterations.

Careful designers and architects will often use larger size wires, more and better types of equipment than specified.

Installation shall be executed by technicians having enough technical and practical knowledge in this field to be able to execute the works correctly in accordance with these rules.

- The material employed shall be of known and labelled origin and approved either by the appropriate underwriters of its country of origin and/or by the local authorities who have the right to reject any kind of material whatever its origin.

This Code will be periodically revised, as will be judged by the proper authorities.

P A R T I

100 - DEFINITIONS OF TERMS

APPLIANCE : Appliances are current-consuming equipment, fixed or portable, such as heating, cooking and small motor-operated equipment.

BRANCHING CIRCUITS OR BRANCHING : That portion of a wiring system extending beyond the final overcurrent device protecting the circuit.

BUSHING : A bushing is a lining for a hole, intended to insulate and/or protect from abrasion one or more conductors which pass through it.

CABLE : A cable is an assembly of conductors within structural arrangement of the indivudual conductors as will permit of their use separately or in groups.

CIRCUIT : A circuit is a conducting part or a system of conducting parts through which an electric current is intented to flow.

CIRCUIT-BREAKER: A device designed to open under abnormal conditions a current-carrying circuit without injury to itself.

CONDUCTOR : A conductor is a body so constructed from conducting material that it may be used as a carrier of electric current.

CONDUIT : A conduit is a tube or duct especially constructed for the purpose of inclosing electrical conductors.

CONNECTOR : A connector is a device attached to two or more wires or cables for the purpose of connecting electric circuits without the use of splices.

CONNECTOR, PRESSURE (SOLDERLESS): A pressure connector is a connector in which contact of conductor and the connector is obtained without the use of solder, by means of mechanically applied pressure.

CORD : A Cord is a small, very flexible insulated cable.

EXPLOSION-PROOF : Explosion-proof apparatus is apparatus capable of withstanding an internal explosion without injury and without transmitting flame to the outside.

EXPOSED : Exposed means that a live part can be inadvertently touched or approached nearer than a safe distance by any person. It is applied to parts not suitably insulated, guarded or concealed.

FEEDER : Any conductors of a wiring system between the service equipment, and the branch circuit overcurrent device.

FITTING : An accessory such as a locknut, bushing or other part of a wiring system which is intended primarely to perform a mechanical rather than an electrical function.

FUSE : A fuse is an overcurrent protective device with a circuit-opening fusible member directly heated and destroyed by the passage of overcurrent through it.

GROUNDED : Grounded means connected to earth or to some conducting body which serves in place of the earth.

INSULATED : Insulated means separated from other conducting surfaces by a dielectric permanently offering a high resistance to the passage of current and to disruptive discharge.

LIVE : Live means electrically connected to a source of potential difference, or electrically charged so as to have a potential different from that of the earth.

OUTLET : An outlet is a point on the wiring system at which current is taken to supply fixtures, lamps, heaters, motors and current-consuming equipment generally.

PANELBOARD : A panelboard is a single panel, or a group of panel units designed for assembly in the form of a single panel; including buses and with or without switches and/or automatic overcurrent protective devices for the control of light, heat or power circuits of small individual as well as agregate capacity; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front.

PLUG - PLUG ADAPTER : A plug is a device, which by insertion in a receptacle, establishes connection between the conductors of the attached cord and the conductors connected permanently to the receptacle.

RACEWAY : Any channel for holding wires, cables or bus-bars, which is designed expressly for, and used solely for, this purpose.

RECEPTACLE : A receptacle is a contact device installed at on outlet for the connection of a portable lamp or appliance by means of a plug and flexible cord.

SHORT CIRCUIT : A short-circuit is an abnormal connection of relatively low resistance, whether made accidentally or intentionaly, between two points of different potential in a circuit.

SPLICE : A splice is a joint used for connecting in series two lenghts of conductor or cable.

STRANDED - CONDUCTOR : A Stranded conductor is a conductor composed of a group of wires, or any combination of groups of wires.

SWITCH : A switch is a device for making, breaking or changing the connections in an electric circuit.

SWITCHBOARD : A switchboard is a large single panel, frame, or assembly of panels, on which are monnted, on the face or back or both, switches, overcurrent and other protective devices, buses, and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets.

TRANSFORMER : A transformer is an electric device, without continuously moving parts, which transforms electric energy from one or more circuits at the same frequency, usually with changed values of voltage and current.

TUBING, ELECTRICAL METAL : Electrical metal tubing is a thin-walled steel raceway of circular cross-section, constructed for the purpose of pulling in or withdrawing wires after it is installed in place, coated inside and out to be corrosion resistant and connected by means of threadless fittings.

VOLTAGE (of a circuit) : The greatest effective difference of potential between any two conductors of the circuit concerned.

VOLTAGE TO GROUND : In grounded circuits, the voltage between the given conductor and that point or conductor of the circuit which is grounded.

WATT : A watt is a unit of power usually obtained from the product of volts and amperes.

P A R T II

200 - WIRING INSTALLATION METHODS

FOR ORDINARY LOCATIONS

210 - GENERAL

211 - Choice of Material : All material used shall comply with the specifications and be approved by the proper responsible authorities as indicated in the Introduction.

No material, appliance, instrument or apparatus shall be connected to any electrical source other than that for which it is built.

Care shall be taken in choosing the proper material with respect to its use and the conditions under which it will function.

Part III deals with such conditions.

212 -- Subdivision of Installations: Installations shall be devided conveniently, at least into two separate circuits even in the smallest apartment.

This will limit losses, will help detect damages and will facilitate check-ups and maintenance works.

In apartment houses, a good rule is to provide one circuit with an independent circuit-breaker for every 50 square meters of floor area.

Electrical Appliances of high consumption such as Washing machines, Water heaters, Ranges, Refrigerators, Large heaters, etc., shall have their separate conductors taken directly from the source of supply.

213 - Connections : Connections shall be such as to insure proper and continuous transmission of the current. They shall be readily accessible for checking.

No conductor, excepting overhead and protable equipment conductors, shall in any circumstance be subject to any tensile or torsional stress.

220 - CONDUCTORS

221 - General :

221-1 - Insulation : All conductors shall be insulated, except otherwise specified or permitted.

221-2 - Conductor insulation as specified in the following table may be used for any of the wiring methods recognized, except where otherwise specified. They are suitable for 600 volt unless otherwhise specified.

Type Letters follow american denomination

Trade Name	Type Letter	Special Provisions
Rubber-Covered Fixture Wire-	RF-64	Fixture wiring Limited to 300 V.
Solid or Stranded	RF-32	Fixture wiring,and as permitted in section 3I03.
Rubber-Covered Fixture Wire-	FF-64	Fixture wiring Limited to 300 V.
Flexible Stranding	FF-32	Fixture wiring
Thermoplastic-Covered Fixture Wire-Solid or Stranded	TF	Fixture wiring,and as permitted in section 3I03.
Thermoplastic Covered Fixture Wire-Flexible Stranding	TFF	Fixture wiring
Cotton-Covered Heat-Resistant, Fixture Wire	CF	Fixture wiring Limited to 300 V.
Asbestos-Covered Heat-Resistant, Fixture Wire	AF	Fixture wiring. Limited to 300 V.
Code Rubber	R	General use.
Heat-Resistant Rubber.	RH	General use.
Moisture-Resistant Rubber	RW	General use and wet locations.
Latex Rubber	RU	General use
Thermoplastic	T	General use N°14 to 4/0 inclusive. Open work N° I4 to 2,000,000 C.M.

Trade Name	Type Letter	Special Provisions
Moisture- Resistant Thermoplastic	TW	General use and wet locations. No.14 to 4/0 inclusive Open work No.14 to 2,000,000 C.M.
Thermoplastic and Asbestos	TA	Switchboard wiring only
Asbestos and Varnished Cambric	AVB	Dry locations only
Asbestos	A and AA	Dry locations only.Not for general use.In raceways only for leads or within apparatus,Limited to 300 V.
Asbestos	AI	Dry locations only.Not for general use.In raceways, only for leads to or within apparatus. Limited to 300 V.
Asbestos	AIA	Dry locations only. Not for general use.Open wiring. In raceways,only for leads to or within apparatus.
Paper		For underground service conductors,or by special permission
Slow-Burning	SB	Dry locations only. Open wiring;and in raceways where temperatures will exceed those permitted for rubber-covered or varnished cambric-covered conductors
Slow-Burning Weatherproof	SBW	Dry locations only. Open wiring only.
Weatherproof	WP	Open wiring by special permission where other insulations are not suitable for existing conditions.

Trade Name	Type Letter	Special Provisions
Varnished Cambric	V	Dry locations only, Smaller than No.6 by special permission.
Asbestos and Varnished Cambric	AVA	Dry locations only
Asbestos and Varnished Cambric	AVL	Wet locations.
Asbestos and Varnished Cambric	AVB	Dry locations only

221-3 - Size of conductors : Conductors shall be so chosen as to satisfy requirements for voltage drop and heating.

Voltage drop : No voltage drop shall, in the conductor between the origin and the point of use, exceed 3% of the nominal voltage for lighting, and 5% for other uses, and thus, when all appliances, lamps, instruments, apparatus and motors that will be called upon to function simultaneously are functionning.

Heating : The maximum temperature a conductor shall reach will be such that it shall not affect its insulation or the objects it is near to or in contact with.

The maximum allowable temperatures are :

- 50° C for conductors insulated with natural rubber
- 60° C for conductors insulated with vulcanized rubber
- 50° C for conductors insulated with impregnated paper
- 80° C for bare copper conductors
- 80° C for armored cables with mineral insulation

Furthermore, the sizes of the conductors shall be such as not to carry more than a certain current depending upon the type of insulation used, the location and the surrounding temperature.

The tables below, give the allowable currents in different size wires and types, for temperate climates and during continuous normal use.

Size W G C M	Rubber Type R Type RW Type RU (I4-6) Thermo-plastic Type T Type TW	Rubber Type RH	Thermo-plastic Asbestos Type TA Var-Cam Type V Asbestos Var-Cam Type AVB	Asbestos Var-Cam Type AVA Type AVL	Impregnated Asbestos Type AI (I4-8) Type AIA	Asbestos Type A (I4-8) Type AA	Slow-Burning Type SB Weather-proof Type WP Type SBW
I4	20	20	30	40	40	45	30
I2	25	25	40	50	50	55	40
I0	40	40	55	65	70	75	55
8	55	65	70	85	90	I00	70
6	80	95	I00	I20	I25	I35	I00
4	I05	I25	I35	I60	I70	I80	I30
3	I20	I45	I55	I80	I95	2I0	I50
2	I40	I70	I80	2I0	225	240	I75
1	I65	I95	2I0	245	265	280	205
0	I95	230	245	285	305	325	235
00	225	265	285	330	355	370	275
000	260	3I0	330	385	4I0	430	320
0000	300	360	385	445	475	5I0	370
250	340	405	425	495	530	....	4I0
300	375	445	480	555	590	....	460
350	420	505	530	6I0	655	....	5I0
400	455	545	575	665	7I0	....	555
500	5I5	620	660	765	8I5		630
600	575	690	740	855	9I0	....	7I0
700	630	755	8I5	940	I005	....	780
750	655	785	845	980	I045	....	8I0
800	680	8I5	880	I020	I085	....	845
900	730	870	940	....	....	....	905
I000	780	935	I000	II65	I240	....	965
I250	890	I065	II30	....	....	....	....
I500	980	II75	I260	I450	....	....	I2I5
I750	I070	I280	I370	....	....	....	....
2000	II55	I385	I470	I7I5	....	....	I405

Size W G C M	Rubber Type R Type RW Type RU (I4-6) Thermo-plastic Type T (I4-4/0) Type TW I4-4/0)	Rubber Type RH	Paper Thermo-plastic Asbestos Type TA Var-Cam Type V Asbestos Var-Cam Type AVB	Asbestos Var-Cam Type AVA Type AVL	Impreg-nated Asbestos Type AI (I4-8) Type AIA	Asbestos Type A (I4-8) Type AA
I4	I5	I5	25	30	30	30
I2	20	20	30	35	40	40
I0	30	30	40	45	50	55
8	40	45	50	60	65	70
6	55	65	70	80	85	95
4	70	85	90	I05	II5	I20
3	80	I00	I05	I20	I30	I45
2	95	II5	I20	I35	I45	I65
I	II0	I30	I40	I60	I70	I90
0	I25	I50	I55	I90	200	225
00	I45	I75	I85	2I5	230	250
000	I65	200	2I0	245	265	285
0000	I95	230	235	275	3I0	340
250	2I5	255	270	3I5	335	...
300	240	285	300	345	380	...
350	260	3I0	325	390	420	...
400	280	335	360	420	450	...
500	320	380	405	470	500	...
600	355	420	455	525	545	...
700	385	460	490	560	600	...
750	400	475	500	580	620	...
800	4I0	490	5I5	600	640	...
900	435	520	555	...	...	...
.000	455	545	585	680	730	...
.250	495	590	645	...	...	...
.500	520	625	700	785	...	...
.750	545	650	735	...	...	...
.000	560	665	775	840		

222 - LAYING AND WIRING METHODS

The following rules are general and shall comply for each case with the provisions of 223.

Electrical conductors shall be so placed as to insure :

- their conservation,
- their independance with respect to other conductors destined for different usage,
- their accessibility,
- their identification,
- their continuous service and the continuity of their insulation.

222-1 - Conservation : The conductors and their insulation must be laid and protected so as to insure them against any physical or chemical effects.

222-2 - Independance : Except for grounding alternating current, electrical conductors shall be electrically and mechanically independent from any other type of conduit, electrical or not, used for other purposes.

Electrical conduits could be laid in the same channel as other conduits provided :

1) This channel is permanently fixed.
2) Every canalization is placed into a continuous metallic envelope;
3) No lead conduit is used for water;
4) Electrical conductors are placed inside steel tubings or are armored;
5) No instrument or apparatus is installed upon any conductor inside the channel.

222-3 - Accessibility : The conductors shall be laid so as to enable one to control their insulation, localize defects, fix and eliminate damages, and replace them if necessary.

222-4 - Identification : Conductors shall be laid out in such a way as to enable their ready identificatio for any purpose.

Neutral conductors should be readily and immediately recognized and distinguished from other conductors.

It is advisable to put identification tags on each wire at different points in order to avoid confusion and loss of time during future work.

Conductors with different color covers are also advised.

222-5 - Continuous Service and Continuity of Insulation : Special care shall be taken at connections of wires among themselves, with apparatus, equipments, and appliances to insure electrical and insulation continuity.

222-5 - Continuous Service and Continuity of Insulation : Special care shall be taken at connections of wires among themselves, with apparatus, equipments, and appliances to insure electrical and insulation continuity.

223 - PARTICULAR RULES FOR ORDINARY

LAYING OF CONDUCTORS

223-1 - Conductors fixed on or in walls and floors : These conduits can be fixed on the face or fixed 15cms or less, away from the finished surface to provide adequate protection without being too far away or inside the partition.

- A. Bare Conductors on Insulators

This kind of wiring is only authorized in places where conductors are out of reach from unqualified persons and away from objects normally manipulated in their neighbourhood.

They shall not be used in commercial garages, theatres, motion-picture rooms, hoist ways and hazardous locations.

The type of conductor could be wire, cable, bar or tube provided it is of approved quality and complies with the provisions of the tables in 221-2 and 3.

They shall be rigidly supported on non-combustible, non-absorptive insulating material.

Bare conductors shall be supported at intervals of at most 100cms.,and be at least 10 cms. away from the finished surface. They shall never be less than 10 cms from each other.

In case of necessity, conductors would be installed closer to the surface a distance never being less than 5 cms.and then special insulation should be provided and support interval shortened.

Nails and screws should be at least one and a half times the height of the insulator and fully the diameter of its hole.

Upon passing through walls and floors, conductors shall be prevented from their direct contact by insulated steel tubes properly reamed to remove rough edges, and fitted with insulating non-combustible, non-absorptive bushings of approved quality and design, each one containing only one conductor and being at least ten centimeters from each other.

Conductors passing through floors shall satisfy the provisions of 223-2.

- B. Insulated Conductors on Insulators.

This type of wiring shall be used only where it is not be exposed to mechanical injury and shoud be used 2c at least above floor level. The choice of conductors shall comply with the tables of 221-2 and 3.

Insulated conductors shall be rigily supported on non-combustible, non-absorptive insulating material.

They shall be supported at intervals of at most :

- 120 cms for conductors of 10 square centimeters section fixed horizontally
- 150 cms for conductors of over 10 square centimeters section fixed horizontally
- 150 cms for conductors of any size fixed vertically.

The spacing of conductors shall be at least 2 cms.

Insulated conductors shall be distant by at least 5cms from any other type of conductor, piping or tubing when runing parallel and 3cms when crossing.

Insulated conductors shall not be laid parallel to and under pipings causing condensation, such as vapor, water or other pipes.

In the proximity of hot conduits, these conductors shall be sufficently far and insulated to prevent their overheating above specified working temperatures.

All joints shall be made next to supports and shall be properly insulated with rubber cloth or any other suitable material of a thickess at least equal to that of the original insulation. Specially made insulated connections can be used if they are of the type approved.

Upon passing through walls and floors, conductors shall be prevented from their direct contact by insulated steel tubes properly reamed to remove rough edges, and fitted with insulating non-combustible, non-absorptive bushings of approved quality and design, each one containing only one conductor and being at least ten centimeters from each other.

- C. Insulated Conductors concealed in Flexible Metallic Tubings.

The choice of conductors shall comply with the provisions of the tables in 221-2 and 3.

The inner diameter of tubings in all their parts, the dimensions of junction boxes and similar accessories will be chosen such as to allow easy insertion and removal of conductors, after these tubes are fixed in place.

The tubings and their accessories shall be of approved quality and type.

Tubings shall be fixed in such a way as not to allow the introduction or the accumulation of water in any point whatsoever.

The mechanical protection of tubings shall be permanently insured ; the tubes shall be joined by casings or boxes of appropriate sizes.

Whenever tubings are cut, proper care shall be taken to remove any chippings or edges that might alter the insulation of the conductors.

At the extremities of tubings, these shall be provided with suitable means to prevent alteration of the insulation by friction; porcelain buishings are strongly advised.

These precautions are not required in case the conductors leave the tubing and enter directly into another kind of protective device without change in direction, or when they enter directly into any device built so as to receive the tubing directly.

When passing near other types of conduits, tubings shall be set at a distance of at least 5cms from such conduits when running parallel, and 3cms when crossing.

Tubings shall not be fixed parallel to and under pipings causing condensation, such as vapor, water or other pipes.

In the proximity of hot conduits, these conductors shall be sufficiently far and insulated to prevent their overheating above specified working temperatures

Connections shall be exclusively made in suitable boxes or similar accessories fitted with readily removable covers to insure easy accessibility.

One tubing shall in principle, only contain conductors of the same circuit.

Visible tubing : These tubings shall be securely held by suitable clamps close enough to provide proper rigidity.

Painting is required at junctions to prevent water from penetrating and also to prevent eventual rusting of tubing.

Concealed Tubing : Tubings concealed in masonry shall be of such a quality as not to be affected by this medium.

In places where tubings are susceptible of being damaged by nails or screws driven into the walls, such tubes, excepting steel ones shall be suitably protected either by steel tubing or by steel angles at least 2 m/m thick and extending at least 1 cm on each side of the tubing.

Such protection is not necessary in case these tubings are 10 cm under the mortar of veneered walls.

Angle and T's are absolutely forbidden except when provided with covers, removable from the finished surface.

- D. Armored Cables :

The choice of the conductor shall comply with the tables in 221-2 and 3.

The metallic armor shall not be used as a means for grounding.

While laying the cables, care shall be taken to prevent injury to the metallic protection.

All bends shall be so made that the armor of the cable will not be injured ; the radius of the curve of the inner edge of any bend shall be not less than 6 times the exterior diameter of the cable.

Armored cable shall be secured by approved staples, straps or similar fittings, so designed and installed as not to injure the cable.

Armored cable shall be fixed at intervals not exceeding 150 cms and within 30 cms from every outlet box or fitting except at lenght of not more than 60 cms at terminals where flexibility is necessary.

Exposed runs shall closely follow the surface of the building finish.

No armored cable shall be used embedded.

When passing near other types of conduits, armored cables shall be set at a distance of at least 5 cms from such conduits when running parallel, and 3cms when crossing.

Armored cables shall not be fixed parallel to and under pipings causing condensation, such as vapor, water or other pipes.

In the proximity of hot conduits, these conductors shall be sufficiently far and insulated to prevent their over-heating above specified working temperatures.

Connections shall be exclusively made in suitable boxes or similar accessories fitted with readily removable covers to insure easy accessibility.

In case the cables are placed in damp locations or exposed to the exterior, these boxes shall be of the type that will prevent penetration and accumulation of humidity and water.

Upon passing through walls and floors, armored cables shall comply with the provisions of 223-2.

At all points where the armor terminates, a fitting shall be provided to protect it from abrasion, unless the design of the fittings or outlet boxes is such as to afford equivalent protection, and in addition, an

approved insulating bushing or its equivalent approved protection shall be provided between the conductors and the armor.

- E. Lead-Sheathed Cables :

Lead-sheathed cables shall not be laid in direct contact with lime or with cement when fresh, nor with any chemical agents that would react with lead.

When such conditions exist, lead-sheathed cables with suitabily treated and impregnated textile plat could be used except in locations subject to fire hazards.

The choice of the conductor size shall comply with the tables in 221-2 and 3.

While laying these cables care shall be taken not to crush or injure the lead sheath.

All bends shall be so made that the lead sheath will not be injured, and the radius of the curve of the inner edge of any bend shall be not less than 6 times the exterior diameter of the cable.

Lead-sheated cables shall be secured by approved staples, straps, or similar fittings so designed and installed as not to injure the cables.

Cables may be put in raceways but shall not be laid embedded.

Cables shall be secured at intervals not exceeding 50 cms, and 25 cms from any outlet box or fitting except at lenghts or not more than 35 cms at terminals where flexibility is necessary.

Exposed runs shall closely follow the surface of the building finish.

When passing near other types of conduits, lead sheathed cables shall be set at a distance of at least 5cms from such conduits, when running parallel, and 3 cms when crossing.

In the proximity of hot conduits, lead-sheathed cables shall be sufficiently far and insulated to prevent their overheating above specified working temperatures.

At all points where the lead sheath terminates, a fitting shall be provided to protect wires from abrasion unless the design of the fitting or outlet box is such as to afford equivalent protection, and in addition, an approved insulating bushing or its equivalent approved protection shall be provided between the conductors and the lead sheath.

Connections shall be exclusively made in suitable boxes (waterproof when necessary) or similar accessories fitted with readily removable covers to insure easy accessibility.

Upon passing through walls and floors, cables shall be separated from their direct contact by properly insulated steel tubes properly reamed to remove rough edges and fitted with insulating non-combustible non-absorptiv approved bushings, and installed according to the provisions of 223-2.

- F; Flexible Cords : Flexible Cords shall not be fixed permanently.

Their use is restricted to appliance as indicated in 225-1-D.

They may be fixed temporarily and be visible on roofs of dry locations and then subject to the general provisions of D - under armored cables.

They shall not be used to cross walls of floors.

- G. Non Metallic Sheathed Cables : Non metallic-sheathed cables shall not be used in damp and exterior locations as well as in locations containing corrosive liquids and vapors.

The choice of size shall comply with tables in 221-2 and 3.

They may be used for both exposed and concealed work, but shall not be used in any embedded form.

In exposed work :

a) the cable shall closely follow the surface of the building finish.

b) It shall be protected from mechanical injury where necessary by tubings, guard straps or other means.

If passing through a floor, the cable shall be enclosed in rigid conduit or pipe extending as high as the skirting or be at least 11 cms above the finished floor. The edges of said pipe shall be properly reamed and fitted with insulating bushings of approved quality and design to prevent injury to the cable. This installation shall follow the provisions of 223-2.

Bends in cables shall be so made, and their handling shall be such that the protective coverings of the cable will not be injured, and no bend shall have a radius less than 5 times the diameter of the cable.

For conductors of a diameter over 12 m/m, the radius shall be at least 12 times the diameter.

When passing near other types of conduits, non-metallic sheathed cables shall be set at a distance of at least 5 cms from such conduits, when running parallel, and 3 cms when crossing.

Cables shall not be fixed parallel to, and under piping causing condensation, such as vapor, water or other pipes.

In the proximity of hot conduits, these cables shall be sufficiently far and insulated to prevent their overheating above specified working temperatures.

Connections shall be exclusively made in suitabl boxes or similar accessories fitted with readily removable covers to insure easy accessibility.

223-2 CONDUCTORS CROSSING PARTITIONS AND ROOFS, FIXED UNDER CEILINGS AND FLOORS

A - General : Conductors shall have no junction and no branchings in the lenght crossing walls, partitions, ceilings and roofs.

Conductors shall be suitabily protected against mechanical injury, chemical actions and humidity, while laying and during service.

These protections shall be continuous in time and shall extend upont the total lenght of the conductor.

Besides complying with the specifications of 223-1, conductors shall comply with the following general rules.

B - Crossing of Walls, Partitions and Roofs :

In case conductors are laid out in two different modes on either side, this change shall occur outside the crossing.

In case the locations situated on either side are of different nature, the type of laying shall always comply with the requirments of each condition.

C - Special Rules for Particular Locations :

When crossing between two locations presenting a large hygrometric difference, special precautions shall

be taken to prevent intorduction and condensation of moisture inside the crossing.

In case the protecting tubes are not sealed on both sides, they shall be inclined towards the more humid location, and so set as to allow free ventilation of the conductors inside them.

For conductors entering locations containing corrosive or inflamable vapors, the tubes shall always be sealed on the side of the said location.

D - Vertical Crossing of Ceilings : Proper protection of conductors at the level of floors, should be provided against mechanical injuries and against liquids that might spread on the floors.

All conductors crossing floors shall be protected by steel tubes extending the height of the skirting or be a least 11 cms above finished floor.

Raceways, wireways and all other ways shall extend in the same manner.

All such crossings shall be sealed and protected to prevent fire propagation, liquid dripping and gaz exchange.

E - Crossing of Roofs : Conduits penetrating buildings from the exterior shall be so fixed that humidity and water shall not penetrate to the inside.

/

Such conduits shall be chosen to comply with table 221-2 and 3.

They shall not be smaller than N°8 (8.366 sq m/m

These conductors shall enter through the roofs or walls into insulating non-absorptive, non-combustible reversed pipes, one for each conductor.

These fittings shall be properly held and properly rendered waterproof.

224 - ELECTRICAL DEVICES FOR GENERAL USE

224 - 1 General Rules : The rules stated in this present Chapter deal with Electrical Devices, Apparatus and Equipment for general use such as -

- Equipment for protection against overcurrent
- Devices for interruption and establishment of current (switches)
- Devices for connections (junction and branchings)
- Switchboards and panelboards.

A - Rules for the Choice of Equipments :

Equipments shall be chosen with respect to their function and used as indicated on their name-plate data and according to the instructions supplied with htem.

The use of Equipment without or with incomplete name-plate data is prohibited.

Equipment indicating the nature and frequency of current to be used shall not be connected to any current of different nature or frequency.

In case such information is not given and manufacturers indicate that such equipment could be used with any type of current, no restrictions apply.

No device shall be connected to any voltage higher than normal voltage as indicated on name-plate data.

Equipment built to function normally between ranges of voltages shall not be connected to circuits having voltages other than those within the range.

No equipment shall be used on a circuit normally carrying a current of higher intensity than its normal current.

All equipments shall be chosen so as to comply with its particular characteristics, as indicated under 224-2.

All equipments shall be chosen taking into consideration the location in which they will be installed.

All equipments shall be chosen taking into consideration the place they will occupy ; equipments exposed to violent shocks shall be properly protected.

All equipments shall comply with safety regulations and shall be protected and have live parts properly covered or concealed.

B - Rules for the Installation of Equipments :

All equipments shall be installed according to instructions if any.

All equipments accompanied by or needing any means of protection (boxes for concealment of bare conduits etc...) or means of preventing tensile & torsional stresses of connections or conduits shall be installed with these means.

Means of grounding shall be carried out according to the provisions of 226.

Besides considerations of comodity and space, all equipments shall be so installed as to permit easy accessibility for checking their functionning for their maintenance, repair and for checking of connections, without disturbing the installation.

In case the equipments must be shifted, they shall have enough free conductors to allow such shifting.

In case certain equipments are liable to project flames or reach high temperatures either through normal use, misuse or while out of order, they shall be installed far enough from any object they may alter.

All conductors shall be properly protected until penetration inside the equipments.

Metallic protection shall penetrate the instruments and be distant enough inside the instruments from any live part.

Except for instruments built not to be fixed, all equipments shall be rigidly fixed and held in place.

Equipments installed protruding in front of finished surfaces, shall be so installed as to allow all bare conduits or live parts to be, at least, 5cms away from the surface.

Whenever instruments are concealed inside walls or partitions, they shall be installed into boxes fixed to the sides except in case they are provided with such boxes.

Wooden boxes are allowed in case installed in dry locations and not in contact with, or near any other inflamable material.

224 - 2 Particular Rules for Different Categories of Equipments :

A - Equipments for Protection Against Overcurrent :

All conductors leading to any appliance or machine shall be protected against overcurrent.

The rules for the protection of circuits in machines are stated under 224-3 - A.

The rules for the protection of fixed installations follow; both protections could be used jointly if judged necessary.

All conductors shall be protected against overcurrent.

This is done by using fuses, thermal, mechanical or others of any approved type and construction.

Such equipments shall be provided on any branching of conductors leading outdoors, to hot or damp location and those containing corrosive fumes.

Equipments for overcurrent protection shall be chosen according to the characteristics pertaining to their use which are :

- Power of interruption ; that is the highest current an equipment is able to interrupt under a definite voltage without being deteriorated.
- Working characteristics; that is the rating.

a) Fuses . If the allowable current-carrying capacity of the conductor does not correspond to a standard size fuse, the next larger size or rating may be used but not exceeding 150 per cent of the allowable current - carrying capacity of the conductor. Plug fuses and fuseholders shall not be used in circuits exceeding 125 volts between conductors, except circuits of a system having a grounded neutral and no conductor at more than 150 volts to ground. The screw shell of plug type fuseholders shall be connected to the load side of the circuit.

b) Non-Adjustable-Trip Circuit-Breakers. Non-adjustable-trip circuit-breakers, shall be rated in accordance with the current-carrying capacity of the conductor.

c) Adjustable-Trip Circuit-Breakers. Adjustable-trip circuit-breaker of the thermal trip, magnetic time-delay trip or instantaneous-trip types shall be set to operate at not more than 150 per cent of the allowable

current-carrying capacity of the conductor.

- Location and Installation.

All equipment for overcurrent protection shall be located at the origin of the conductors they protect, especially at branching and at reductions of section.

In case of difficulty of installation, such equipment could be fixed at most 1 meter beyond the branching provided this lenght is of the same conductor of the one it branches from.

These equipments shall be located in readily accessible places.

It is good practice to group such equipments in panels and identify them.

B - Devices for Interruption and Switching Current (switches) :

All such devices shall, besides complying to the following, satisfy the provisions of 224-2-A.

A switch shall be placed at the origin of every electrical installation, thus enabeling the interruption of the current.

The power of such switches shall correspond to that of the meter.

In larger installations, switches shall be placed at every major branching.

A switch shall be installed for every circuit in which the current might be interrupted independently of the other circuits of the installation.

Every appliance and machine or group of appliances and machines running simultaneously shall have an individual switch.

Portable appliances with cord can be connected through plugs to convenience outlets provided the provisions of 224-2-C are satisfied.

Furthermore, a circuit-breaker could be in lieu of a switch if it has along with its automatic mechanism, a manual means for cutting the current.

In principle, all switches shall cut off the current on all the conductors they serve, but, it is allowed, if desired :

- 1) no to interrupt grounded conductors ;
- 2) to use unipolar equipment to control lighting circuits in dry locations ;
- 3) to use unipolar equipment for circuits feeding equipment whose power does not exceed 500 watts for a voltage not over 250 V.
- 4) to use unipolar equipment to modify the rates of certain appliances such as ranges, heaters, cranes, etc.

Provided another multipolar switch is installed.

C- Particular Rules to Equipments used for Connections (junction or branching).

The connections of loose conductors with the fixed conductors shall be made through approved junction boxes if the equipments or appliances connected are not to be frequently displaced and so require frequent disconnecting, and if these connections are not subject to any tensile stress.

In case the equipments or appliances are frequently moved and are portable, the connection shall be made through properly selected and installed convenience outlets and plugs.

Connections having loose or mobile conduits shall be made through special approved pressure connectors or others.

Splicing is prohibited.

Clamps are prohibited.

The choice of these equipments for junction and branching shall comply with the provisions of 224-2-A in general and in particular to the following :

a) When the provisions of 226 specify the grounding of the metallic masses of an apparatus fed by an outlet, this outlet shall be of such a type as to ground the apparatus before the current is established and to disconnect after the current is cut.

b) When, in the same installation currents of different types or different tariffs are used, the use of interchangeable outlets and plugs is prohibited, these shall be clearly distinguishable from one another.

c) When the interchange of poles is detrimental to the persons or apparatus, special non-reversible outlets and plugs shall be used.

d) Bayonet type of socket outlets shall only be used in dry locations and for voltages not higher than 250 v and for 4 amperes maximum.

Screw-shell type outlets are prohibited on account of the repeated torsianal stresses to which the flexible conductors are subjected.

Plugs in outlets shall be of the type removable by simple traction except locations presenting fire and explosion hazards, as specified in (228-2 or 233-1).

Outlets shall be securely fixed at heights convenient for the apparatus they serve.

D- Particular Rules for Switches, Switchboards and Panelboards.

In principle, electrical equipment with currents of different nature, shall not be grouped in the same switchboard, panelboard or boxes unless they are clearly grouped and labelled.

In order to avoid confusion, indicating name-plates or tags shall clearly show all necessary data.

Equipment whose functionning or position cannot be observed by the manipulator shall have the different positions of the mechanism clearly labelled.

Such rules do not necessarily apply to lighting fixtures.

Electric equipments shall be properly installed and readily accessible for manipulation, check or repair.

All connections made behind boards shall be readily accessible without displacing these board.

All conductors shall be sufficently distant from one another and from other objects to avoid all danger.

No live piece shall be less than 5cms away from the finished surface.

In case not situated in especially alloted and protected places, panelboards, switchboards and boxes shall be located far from inflamable objects and away from escapes of water vapors, oils or other liquids.

They shall not be installed in locations exposed to dust, fire or explosion risks.

They shall be installed in locations easily and readily accessible to people in charge of their operation.

225 - EQUIPMENTS USING, GENERATING, TRANSFORMING OR ACCUMULATING ELECTRICAL ENERGY.

The following rules concern :

1) Lighting Equipments
2) Electrical Machines and their Devices
3) Lifts and Escalators
4) Electrical Heating and Cooking Appliances
5) Electrical Domestic Appliances
6) Hand-manipulated Electrical Tools
7) Radio Receivers and Amplifiers
8) Electrical Toys
9) Signalization installations
10) Accumulators
11) Emergency Lighting

225 - 1 GENERAL RULES

A - Choice of the Apparatus.

Construction : All Electrical apparatus shall be constructed to insure the safety of the persons and conservation of neighbouring objects.

Factors Affecting Choice : Electrical apparatus shall be chosen with respect to requirements and location.

The characteristics of all apparatus are indicated by their name-plate data.

The use of apparatus carrying no or incomplete name-plate data is prohibited.

The necessary indications will include

a) The use of the apparatus, in case this cannot be told by simple sight.

b) The nature of the current to be used.

c) The frequency in case of an A.C.apparatus.

d) The number of phases, when needed.

e) The rated power, with type of service. (continuous or not)

f) Normal voltage ; or the two limits of voltage.

g) The current or currents corresponding to the rated power in case their value do not follow immediately the preceeding indications.

h) The speed (for motors and generators)

All apparatus shall be chosen with respect to the location or medium in which they will be used, as well as the place they will occupy in the location.

In case an apparatus is not protected for the location it will work in, it shall be supplied with the necessary protection, provided this protection does not prejudice its proper functionning, especially with respect to heating and ventilation.

- Voltage Limitations -

Maximum of 250 volts A.C.

Maximum of 600 volts D.C.

The voltage between conductors shall not exceed 250 v for movable equipment whose power is inferior to 1000 watts, as well as for radio receivers and amplifiers.

Only low-voltage currents shall be used for electrical toys, and electric door openers.

The same applies to portable lamps and tools used in wet or high conductivity locations and outdoors.

B - Installation and Fixing of Apparatus.

All apparatus shall be installed according to their use, construction, and manufacturer's instructions if any.

Special care shall be taken to provide proper ventilation, and artificial ventilation shall be resorted to if judged necessary.

C - Installation of Protection Devices.

Each apparatus or appliance shall be controlled by an individual interrupting device.

This switch is not required in case an automatic circuit-breaker supplied with a manual means of disconnection is used.

This circuit-breaker is required if the apparatus is automatically controlled by relay, thermostat or other means.

However, it is allowed to use one circuit-breaker for controllying several apparatus whose functionning is simultaneous.

It is also allowed to connect a movable apparatus through an outlet and plug combination, subject to the provisions of 224-2-C.

The switch or circuit-breaker shall, in principle, cut off and establish all the electric connections of the apparatus, except fixed grounding.

Unipolar switches or breakers can be used for the following :

a) To control circuits fed between phase and neutral, when this latter is grounded, the breakers being placed on the live conductor.

b) To control incandescent-type lighting in dry locations

c) To control circuits for apparatus whose power does not exceed 500 watts and difference of potential not over 250 volts.

d) To modify the power of some appliances if there is provided another multi-polar breaker or switch.

D - Movable Apparatus and Appliances .

Movable apparatus and appliances shall be connected by means of flexible cords, of approved construction and proper size, chosen according to the provisions of 221-2 and 3.

They shall also comply with the provisions of 226-2 concerning grounding of metallic masses.

In damp, wet, professional, commercial, or agricultural locations, flexible cords shall be of the type covered by a rubber sheath.

Maximum lenght of cords in principle : 2 meters

Over 2 meters : Rubber-Sheathed

In case the use of a long conductor is exceptional, an extension is recommended.

The junction between cords and moving equipment, if not made direct, shall be done through special approved connectors.

225 - 2 LIGHTING

The following provisions concern :

1) Indandescent Lighting

2) Arc Lighting

3) Discharge tube lighting

A - Incandescent Lighting

General : Sockets for incandescent lamps shall be chosen with respect to the normal voltage and power of the lamp.

For series lamps, each individual socket shall withstand the total voltage of the circuit.

When there exists in the same installation circuits of different voltages, there shall be provided adequate distinction among sockets; furthermore, sockets used for different voltages shall not be interchangeable.

The ordinary approved sockets are built to santd 250 v and are built for the following :

Type	Maximum current taken by lamp amperes	Maximum power of lamp watts
Small size Bayonet	1	100
Small size Screw	1	200
Normal size Bayonet	1	200
Normal size screw	2	400
Goliath size screw	15	3 000

Lock-type sockets are not allowed unless they are provided with an insulating envelop with no external metallic parts.

This does not apply to sockets with built-in switch actuaded by pulling a cord or properly insulated chain.

Special sockets with external metallic live pieces are only allowed if installed out of reach.

All precautions shall be taken to prevent the heat generated by lighting fixtures to affect the electrical installation or any neighbouring object.

To this effect :

a) Lamps situated close to inflamable materials shall be provided with means preventing the transmission of heat between the lamps and these materials ;

b) Electrical canalizations passing close to lighting fixtures, as well as those feeding the lamp shall not-under normal service - reach temperatures affecting their insulation.

This temperature is 50° C for natural rubber insulation, and 60°C for vulcanized rubber insulation.

When the temperatures are liable to reach higher values conductors with rubber insulation shall not be used. Instead, the insulation shall consist of Asbestos if the temperature does not exceed 110° C - only used in dry location.

For higher temperatures, procelain, glass, stearite or other substances having similar properties shall be used.

Furthermore, special sockets shall be used in such cases.

Fixed Incandescent Lighting Fixtures : Fixtures shall be of the approved type and installed according to instructions.

Lighting fixtures, whether hanging or rigidly fixed, shall be installed in such a way, that repeated rotation in the same sense shall not cause their fall.

Lighting fixtures hanging from a rod or chain fixed to the roof shall be insulated from said roof except when it is required to ground such fixtures.

In principle, no lighting fixtures shall hang by their conductors. All means of suspension shall relieve the conductors from any tensile stress.

But in dry locations only, the following are allowed :

a) When the lighting fixture does not weight over 0.5 kgr, it may hang by their conductors, if judged strong enough ;

b) When the lighting fixture does not weight over 2 kgr, it may hang by heavy conductors provided all precautions are taken to releive the joints from any tension.

Portable Lighting Fixtures : The use of portable lighting fixtures with external metallic parts is subject to the provisions of 226 and the different divisions of 300.

These fixtures shall be of approved type and construction.

Their conductors shall satisfy the provisions of 225-I-D.

Hand - Lamps: The use of hand-lamps is subject to the following :

- a) In dry locations, the difference of potential between conductors shall not exceed 250 v.
- b) In damp locations, the use of very low voltages is advised.
- c) In wet locations, those whose sides are conductive or impregnated with conductive liquids, as well as outdoors, only very low voltages are allowed.

The construction of these hand-lamps shall comply with the following :

These fixtures shall be provided with an insulating shockproof handle that will protect the hand from any contact with the conductors.

All the metallic parts of the socket, live or not, together with the whole bulb shall be protected against any contact by an efficient and strong protective device ; this device shall be firmly fixed to the handle. If it is metallic, it shall have no contact with any other metallic part of the socket.

The flexible conductors feeding these lamp shall not be subject to any injury at their entrance inside the lamp.

In case a means of hanging the lamp is needed, this shall not be fixed on the conductor close to its entrance

The junction between conductor and lamp shall not be subject to any tension.

The conductors (cords) feeding these appliances shall strictly comply with the provisions of 225-I-D and be of the rubber-sheathed type.

Their lenghts shall not exceed 5 meters.

These conductors shall have no switches in them.

B) Arc Lamps : Arc lamps shall be of approved type and design.

The switch shall be of such design that accidental contact with any live part will be impossible.

All precautions shall be taken to avoid the heat generated by the arc to injure any neighbouring object.

Any circuit feeding the arc lamps shall have at its origin a multipolar circuit-breaker or switch and a protective overcurrent device placed on every conductor.

If stranded conductors are used, they shall be connected to lamp, rheostat and switch terminals by means of approved lugs or connectors, provided that approved pressure connectors shall be used at arc lamp terminals.

C) Lighting by Discharge Tube : Discharge tubes for lighting (fluorescent tubes) shall be of the type and construction approved.

The provisions under 225-2-A shall be followed where and when applicable.

225 - 3 ELECTRICAL MACHINERY AND CORRESPONDING APPARATUS

The following rules concern equipments that transform electrical energy into mechanical energy or vice versa, or into some other form of electrical energy; such as generators, static transformers, rectifiers, static and rotating condensers, etc....

A) General : All electrical machinery shall be of approved type and design;

The choice of the electrical Machinery shall be guided by the provisions of 225-1-A.

Open type or semi-protected machinery shall be installed only in locations reserved for electrical service and shall conform to the provisions of 300-11.

The circuits of machinery exposed to overcurrents shall be protected by appropriate means.

This does not apply to :

- a) Induced circuits in alternating currents
- b) Brake circuits in cranes
- c) Secondary circuits in transformers
- d) Generators or transformers that can withstand short-circuiting
- e) Portable motors whose normal output does not exceed 0.75 K.W. if constantly attended to.

It is strongly advised to use inverse time delay circuit-breakers instead of fuses because these latter usually protect only against large overcurrents.

B) Particular, Rules Concerning Certain Machinery and ther Fixtures.

a) Generators : Generators shall, as far as possible, be placed in specially affected localities or be separated by enclosure inside which only responsible specialized personnel is allowed.

All controls shall be operated by the above-named personnel.

All live parts having differences of potential higher than very low voltages shall be out of reach.

In case of grounding, the provisions of 226 shall be followed.

All precautions shall be taken to prevent excessive overspeeding of the generators when such condition is likely to occur, such as when using hydraulic or thermal turbines, or when the generators are of series type and several of them running in parallel.

Electric generators shall be supplied with :

- Measuring instruments to control voltage and current
- Overcurrent protection devices
- Switches

Furthermore, if not constantly attented to, generators shall be guarded against defective functionning that might cause accidents or damages.

b) Motors : Motors shall be chosen such that their rated power be sufficient for the purpose: a larger power drawn causing a decrease in efficiency and larger starting current.

The ammeter and its switch shall be so installed as not to read the starting current.

In case the spontaneous starting of a motor following a failure of current is liable to cause accidents or in case the recirculation of the current is liable to damage the motor, it shall be supplied with a device that automatically cuts it off from the main source when the supply fails. This device-called no voltage relase-shall be automatic and installed along with the overcurrent protection and starting devices.

Thermal inverse time delay controllers are strongly advised as overcurrent protection for larger motors.

One such protecting device may be installed :

a) to protect several motors installed in the same workshop if the sum total of their rated power is not over 10 KW.

b) to protect all the motors of a workshop if each one is automatically set on starting position in case the current fails.

The starting currents of any motor, shall not be injurious to the installation or any other machinery running on the same source.

The electrical distributor shall examine all motors and installations before supplying the electrical energy, and help the customer solve his problems.

Moving and movable motors, with their appliances, and their cords shall comply with the regulations of the locations in which they are used and their connections shall comply with the provisions of 22 5 - 1-D.

c) Static Transformers : The following rules shall apply only to transformers whose primary voltage does not exceed 250 volts.

A switch shall be installed on the primary circuit only and none on the secondary except in cases of absolute necessity.

When found necessary, grounding shall comply with the provisions of 226.

d) Rectifiers : When the rectifiers, due to their construction and principle, do not prevent the accidental passage of alternating current to the rectified current circuit or the return of direct current into the feeding circuit, they shall be provided with a means preventing these situations, such as reverse under-current cut-outs.

There shall be different and clearly distinct and separated canalization for currents of different nature

The circuits for rectified current shall comply with all the necessary rules applicable.

These circuits are considered to be of very low voltage if the difference of potential is not over 50 Volts and if the original voltage is stepped down by means of a transformer or group of converters.

This does not apply to autotransformers and resistances.

e) Starters and Regulators : Starters and regulators shall be chosen :

a) to fit the location they will be installed in,

b) to fit their working conditions according to their name-plate data or instructions.

Starting rheostats, inductors and transformers shall not cause excess heat injuring any neighbouring object. Sufficient ventilation or thermal insulation shall be provided to prevent damages.

These equipments could be combined with switches provided the whole combination is of approved type and design.

These shall not dispense the application of the provisions under 225-C. ,whenever warrented.

Starting devices could also be combined with overcurrent devices provided they comply with the provisions of 225-3-B.

C) Elevators and Escalators :

The motors, apparatus and canalizations of such equipments shall be installed according to the particular rules governing them. The following deals with the electrical part of the installation but shall not be in any way prejudiciable to the other requirements.

a) Machinery : The whole machinery (motors, their apparatus, switches, etc...) shall be placed in a dry closed location presenting no fire hazards and accessible only to qualified personnel.

This location shall be considered as reserved for electrical service, shall consequently satisfy the provisions of 3oo-11 and shall be spacious enough to enable specialists to carry on the necessary maintenance and repair works.

The lighting current shall be independent from that of the machinery in every respect, and shall never be taped from any place within or after the switch or circuit-breaker of the machinery.

Furthermore, this machinery room shall be accessible by a means other than the lift.

b) Circuit shutdown : The line feeding the machinery shall be provided with a manual switch situated inside the room and right next to the door. This switch shall simultaneously cut the current on all the poles of all the machinery excepting the alarm and lighting circuits.

No voltage in any circuit shall exceed 250 volts.

c) Installation of canalizations : All conductors except traveling cables shall be placed inside strong metallic tubings or be lead-sheathed or armored.

Alarm and lighting circuits shall be connected to the rest of the system in the machinery room only.

d) Apparatus : All switches, breakers, etc., shall be of approved type and design. They shall be suitably chosen for the particular installations and comply with the provisions of 224-2-A.

The accidental grounding of any circuit shall automatically set the protection devices into action.

e) Accidental charging of metallic masses : In case the installation includes any metallic masses as defined under 226-1, that is any metallic mass normally insulated but suceptible of being accidentaly charged by an insulation default, and liable to be touched by any person in contact with a metallic floor, door or other, this metallic mass shall be suitably protected as under 226-1.

f) Automatic brake : Every elevator or escalator shall be provided with an automatic brake in case of shutdown. If the supply is polyphase, this device shall function even in case only one of the phases fail,and also in case of inversion of phases.

225 - 4 OTHER ELECTRICAL APPLIANCES.

A) Heaters : Fixed heaters shall be so installed and situated that their radiations shall not be obstructed, and flow according to the manufacturer's instructions.

Heating appliances with open wiring shall not be installed in locations exposed to explosion hazards except in case all measures are taken to prevent inflamable objects from coming into contact with the heating elements.

Heating appliances that do come into contact with inflamable substances shall be provided with temperature-limiting devices to prevent accident or damage.

These rules do not concern appliances constantly attended to such as irons.

B) Cooking and Heating Appliances : For home use, these appliances shall be of approved type and constructio

For professional and industrial use, such appliances shall be suitably protected, and a board or sign shall indicate the kind of danger.

No appliance with bare live elements shall be made to work inside locations presenting explozion hazards.

C) Portable Hands Tools : Very low voltage is the only one allowable outdoors and in very conductive locations.

D) Radio Receivers, Amplifiers, etc... :All radio receivers, amplifiers, record players, loud speakers, microphones, etc., shall be of approved type and construction.

They all shall be used in dry locations, except when specially built.

No radio receiver, amplifiers, etc., shall be plugged to a voltage higher than 250 v.

No convenience outlet for such equipment shall be rated for more than 6 Amperes.

No part of the electrical system shall be used as antenna.

No grounding conductor in the installation shall be used to ground the radio receiver if supplied with an areal.

The grounding of a receiver or amplifier by means of a grounding cable for other appliances may be made provided a good connection is made.

E) Electrical Toys : All electrical toys in the hands of children, shall be either :

- low voltage toys,
- or higher voltage toys, in which casethey shall be considered as household appliances, and are only allowed in dry locations.

No metallic connection shall exist between the electrical toys and the higher voltage system : consequently the use of resistances and autotransformers is prohibited.

All connections between the source and the transformer or converter shall be installed according to the provisions of 225-I-D.

F) Signalization, Calls, Telecommunication, Alarm : In case high voltages (over 500) are used these installations shall not be considered as low-voltage installation.

If very low voltages are used (50 and below), no metallic connection shall exist between the higher and lower systems ; consequently the use of autotransformers and series resistances is prohibited.

Whatever the voltages may be, the canalizations of such systems shall be separate from the other electrical canalizations.

If the installation is not concealed, at the crossing of two canalizations (electrical or not), there shall be a space of at least 3 cms between the two or a non-combustible waterproof insulating tubing protecting the conductor shall be used.

The same shall apply in case two canalization are parallel.

In case any element belonging to a signalization, call, telecommunication or alarm system is in mechanical contact with an element of another system, proper insulation shall be inserted between them.

In bathrooms no call buttons or chain shall be within reach of persons in the tub or under the shower.

225 - 5 BATTERIES

A) Portable Batteries : Their charging shall be done in well-ventilated corrosion-resistant locations.

No bare flame shall be used next to the outfit.

B) Stationary Batteries : They shall be situated in places accessible only to authorized personnel, and installed according to the provisions of 300-12.

Each element shall be suitably insulated from its support and from the ground.

Switches shall be provided to enable the disconnection of all the poles from the rest of the installation.

226 - PROTECTION AGAINST ACCIDENTAL CHARGING OF METALLIC MASSES

226 - 1 General :

A) When to ground : In order to prevent the accidental charging of accessible and normally insulated metallic masses, and in order to avoid any danger to persons in contact with such masses, measures for protection shall be carried out :

- in locations where the ground is non insulating
- in locations where the ground or the sides are conductive
- in locations that are damp, wet or impregnated with conductive liquids
- in outdoor locations exposed to rain and weathering
- for special electrical medical equipments (subject to special regulations)

The following floors are considered non insulating or conductive : earth, cement, terrazzo, stone or similar materials.

The following floors are considered insulating: dry wood, linoleum, rubber, asphalt, ceramic and baked tiles with no metallic oxides.

B) Definition of Metallic Masses : Can be considered as normally insulated metallic masses, accessible to persons :

- all metallic parts of electrical apparatus that are held with the hand for operation or are only touched ;
- all metallic envelopes, tubing and armor.

These shall be known as metallic masses.

C) Measures of Protection : The measures of protection shall be chosen from the following :

- insulation of persons with respect to ground and walls
- inaccessibility of metallic masses
- the use of very low voltages
- electrical connection of metallic masses with neighbouring grounded metallic objects liable to the touched simultaneously.

D) Protection by Insulation of Persons with Respect to Ground and Walls: Such protection is allowed in non-insulating locations but is inadequate in damp or wet locations, those impregnated with conductive liquids and outdoors in the open.

In order to provide adequate protection, the ground shall be covered with insulating material with dimensions such that no person could come into contact with the metallic mass without standing on the insulation.

As for walls and partitions, enough space shall be provided between them and the metallic masses in order to prevent simultaneous contact during normal circulation.

E) Protection by Inacessibility of Metallic Masses : There are three methods to provide for such protection :

1 - by using materials with no exterior metallic parts,

2 - by fixing the installations in such a way as to make it impossible, without resorting to special means, to reach for the metallic masses from the ground,

3 - by providing adequate envelop -metallic or not - around the metallic mass.

Such envelop shall be waterproof wherever found necessary, such as in swimming pools and locations where water jets are used.

This method shall also be used in stables and piggeries in case the following is not used :

F) Protection by the Use of Very Low Voltage :

Such protection is provided by the use of maximum voltages

50 volts for direct current

24 volts for alternating current

(Refer to 300-19)

This method shall be used in wet locations and outdoors for hand tools and lamps.

The use of autotransformers and resistances for stepping down the voltage is prohibited.

G) Protection by Grounding : This method of protection consists of :

1 - connecting the metallic masses to the ground,

2 - placing a safety device insuring the grounding of metallic masses as soon as charged due to a defect in insulation.

This method is allowed only for alternating current circuits, and for medical apparatus.

No protection by grounding shall be installed without such a device.

This type of protection shall be installed according to the provisions of 226-2 and verified as stated under 400.

H) Protection by Equipotential Connection : This method consists in connecting electrically the electric masses with neighbouring grounded metallic objects such as :

- water pipes (A.C. - only)
- metallic covers of other electrical canalizations, grounded or connected to underground cables,

- metallic conduits for sewage and others,
- metallic roofs and floors
- metallic frames of buildings.

This method is best suited for kitchens, bathrooms, washrooms, and metallic cabins in cranes.

This connection shall be made through conductors suitably protected against mechanical as well as chemical injuries.

For bare conductors the minimum wire section shall be 10 sq. m/m.

The section of insulated conductors shall be at least equal to that of the feeding electrical conductor.

All connections shall be properly made and protected against weathering.

226 - 2 RULES FOR PROTECTION

BY GROUNDING

A) General : Protection by grounding needs :

safety devices

connection to ground

grounding conductors

B) Safety Devices : When the circuit-breakers installed open the phase circuit for currents inferior to 30 amperes, these shall be considered as satisfactory protection.

If such is not the case, the safety devices shall be apparatus grounding the part of the installation with defective insulation whenever the difference of potential between the ground and the metallic masses exceeds 24 volts.

C) Connection to Ground (Electrodes) :

1 - Nature of Connections:

They could be simple or compound and made :

- by connecting to the neutral if this latter is earthed,
- by using plates, tubes, rods, cables, tapes, grids or other metallic objects burried underground having adequate dimensions and being corrosion resistant,

- by connecting to underground metallic systems such as water - For AC only - or by using any other means recognized suitable and efficient.

The following shall not be used as grounding means :

- central-heating and sevage disposal conduits:
- grounding electrodes used for the protection of circuits of different voltages, by lighting arresters, and those used to ground telephones and radios.

2 - Use of the Neutral Conductor :

This shall be subject to the approval of the distributor of electrical energy who might ask, as added protection the installation of an independent grounding means to prevent any damage or inconveniency caused by an eventual cutting of the neutral conductor.

3 - Use of Underground Systems :

This is allowed only for alternating-current circuits.

In no way are the owners or distributors of the underground system -especially water- and the electrical system-responsible for the installation and maintenance of the grounding system.

When using the water system, a permanent shunt or by-pass shall be used across the meter and its valve.

4 - Use of Burried Metallic Objects (Electrodes)

Never shall use be made of metallic objects simply dipped in water as grounding electrodes.

Electrodes shall be burried in ground as damp as possible.

They shall be as far as possible from places where infiltrations of corrosive substances might occur.

Plates shall preferably be burried vertically.

D) Grounding Conductors : Such conductors are those used to connect the device to be grounded to the grounding means (pipe system or other).

They could consist of a single wire or be made of a major line with branchings.

These conductors shall be of copper and their section chosen to support the currents that might cross them in case of a damage to the insulation.

The minimum sections are :

- For major lines	minimum	28 sq m/m
- Branchings - bare conductors		14 sq m/m
- Branchings - insulated minimum or same as feeder		14 sq m/m

These conductors shall be electrically independent from any other canalization ; they could use the metallic frames of buildings provided electrical continuity is secured throughout and special grounding means as explained above is provided.

No fuse or circuit-breaker shall be used on the grounding conductor unless such devices also shut off the entire electrical supply.

All connections shall be made strong and permanent.

227 - EMERGENCY LIGHTING

227 - 1 Where Required : The provisions of this article shall apply to systems or circuits for supplying emergency illumination only when such systems or circuits are required elsewhere in this code or by municipal, state, or other codes.

227 - 2 Scope : Emergency lighting shall include all required exit lights and all other lights specified as necessary to provide suffident illumination to enable persons to see their way out of the building.

227 - 3 Tests and Maintenance : Systems shall be operated and tested sufficiently frequently to assure their maintenance in proper operating condition, and batteries shall be maintained in fully charged condition.

P A R T III

300 - PARTICULAR RULES FOR SPECIAL LOCATIONS

Some installations or parts of installations indicated below, besides conforming to the provisions of 200, shall conform to the following special rules.

300 - 1 DRY LOCATIONS

A) Definition : As meant under the following rules, dry locations are those locations that are constantly dry, do not present any particular fire or explosion hazards, and do not contain neither dust nor corrosive vapors; excepting storage-battery rooms as limited in 300-12.

B) Insulation : When, in dry locations, the floor is non-insulating, or conductive, the provisions of 226-1 (Grounding) shall apply.

C) Conductors : All conductors shall be chosen according to the provisions of 221 - 2 and 3.

D) Installation : Bare conductors shall be installed only as feeders in closed channels or shafts made of non-combustible insulating material.

E) Maximum current : The maximum permissible current shall be 160 amperes per square centimeter of cross-sectional area of conductor in unventilated enclosures, and 200 amperes per square centimeter in ventilated enclosures.

F) Placing : Bare conductors shall be placed out of reach from persons and objects usually manipulated around. They shall be properly indicated by visible signs, and protected by special barriers.

G) Supports : Conductors shall be supported as follows :

a; Conductors shall be supported on non-combustible non-absorptive insulating supports of adequate mechanical strength.

b. Conductors shall be so supported that a separation between conductors, and between conductors and ground, of not less than that specified hereunder will be maintained under all conditions of operation.

	Opposite Polarity When Mounted on the Same Surface	Opposite Polarity When Held Free in Air	Live Parts to Ground
Not over 125 volts....	2 cms	1 ½ cm	1 ½ cm
Not over 250 volts....	3 cms	2 cms	1 ½ cm
Not over 600 volts....	5 cms	2 ½ cms	2 ½ cms

At switches, enclosed fuses, etc., parts of the same polarity may be placed as close together as convenience in handling will allow, unless close proximity causes excessive heating.

300 - 2 DUSTY LOCATIONS

A) Definition : As meant under the following rules, dusty locations are those locations where the different elements of their electrical installation are exposed to abundant dust.

In case these dusts are inflammable, the provisions of 300 - 7 (Fire) shall apply.

B) When, in dusty locations the floor is non-insulating or conductive, the provisions of 226-1 (Grounding) shall apply.

C) Conductors : The choice of conductors shall comply with the tables in 221 - 2 and 3.

D) Instruments, apparatus, equipment and outlets :

All instruments, apparatus, equipment and outlets, installed in dusty locations shall be dust-proof.

Ordinary equipment put inside closed boxes are not allowed.

E) Motors : Special care shall be taken to avoid accumulation of dust inside motors.

F) Appliances : All other appliances shall be properly protected against accumulation of dust.

300 - 3 DAMP LOCATIONS

A) Definition : As meant under the following rules, damp locations are those locations in which humidity is apparent intermitently or permanently as mist on the sides or roofs, with no evidence of large drops or impregnation of the sides.

- Some basements, barns, cold storage warehouses, butcheries, sugar and cheese factories, breweries, textile mills, glue and fertilizer plants, tiles and lime factories, as well as locations not conveniently aerated, are considered in general as damp.

Mist usually deposits when the relative humidity exceeds 70 %.

B) In damp locations, the proper provisions under 226 - 1 dealing with the accidental charging of metallic nasses shall be applied.

C) Conductors : Rubber-insulated conductors can be fixed by non-absorptive, waterproof clamps or insulators.

Multiple clamps are prohibited.

Open conductors located close to water pipes or tanks, or in other damp locations, shall be so placed that

an air space will be permanently maintained between them and pipes which they cross. Shall be run over, pipes upon which moisture is likely to gather or which may leak

Besides complying with the requirements of 221 - 2 and 3, non metallic waterproof wiring shall comply with the following.

Subject to the approval of the authority enforcing this code, non-metallic waterproof wiring may be used for exposed work in wet locations where subject to mildly corrosive fumes and vapors, if the voltage does not exceed 300 volts between conductors or 150 volts to ground.

Rubber-sheathed multiple-conductor cable approved for the purpose shall be used. The individual conductors of the cable shall not be smaller than N° 12, except that the cable may contain an approved size of conductor, with or without individual insulation, to be used for equipment grounding purposes only.

D) Supports : The cable shall be supported on insulators approved for the purpose and spaced at intervals not exceeding 1 meter.

The cable shall be securely fastened to all outlet boxes, fittings and cabinets. A moisture-proof

seal shall be provided between the cable and all outlet boxes, fittings and cabinets.

E) Passing Through Walls : The cable shall be enclosed in rigid conduit, electrical metallic tubing, or approved insulating tubing, where passing trough walls, and where so enclosed, the enclosure shall be sealed with a suitable fitting.

F) Cabinets, Switchboards and the like : In damp locations, cabinets and cutout boxes of the surface type shall be so placed or equipped as to prevent moisture or water from entering and accumulating within the cabinet or cutout box, and shall be mounted so there is at least 2 cms air space between the enclosure and the wall or other supporting surface. Cabinets or cutout boxes installed in wet locations shall be weatherproof.

G) Fixture Locations : Fixtures installed in damp locations shall be of vaportight or other types approved for such locations and shall be so constructed or installed that water cannot accumulate in wireways, lampholders or other electrical parts.

Drop lamps in damp locations are prohibited.

300 - 4 WET LOCATIONS

A) Definition : As meant under the following rules, wet locations are thoses locations in which the sides, roofs or floors are impregnated with humidity, where large condensation drops are noticed even temporarily, and are continuously full of vapor.

Washhouses, and cold storage rooms, are considered as wet locations.

Wet locations are also found in cheese factories breweries, tile factories, butcheries, tanneries, dyeworks, swimming places, paper, and chemical products, fertilisers and cellulose factories.

B) Besides the provisions of 300-3 (damp locations) the following rules shall apply.

In case it is not possible, to keep the electrical installations sufficiently insulated, very low voltages shall be used, especially on the accessible parts.

C) Conductors : The choice of conductors shall comply with the tables of 221-2 and 3.

D) Apparatus and Instruments : They shall preferably not be installed in wet locations.

In case of impossibility, specially constructed waterproof equipment shall be used.

A fuse or circuit-breaker shall be fixed at the branching to any wet location.

Circuits-breakers shall be regulated for the lowest value possible.

E) Motors : They shall be of special construction to suit wet locations.

F) Moving Equipment : All moving or mobile equipment shall be used only if functionning on very low voltages. The use of such equipment on higher voltages shall be reduced to the strict absolute necessities.

300 - 5 HIGH CONDUCTIVITY LOCATIONS.

A) Definition : As meant under the following rules, high conductivity locations, are those locations whose sides, floors and objects inside them are conducting by nature or because they are impregnated or covered with conductive substances or liquids.

Such locations are : Salt depots, and fermentation depots. High conductivity locations are also found in cheese factories, breweries, tile factories, butcheries, tanneries, dyeworks, swimming places, paper and chemical products, fertilizers and cellulose factories.

Are also considered as high conductivity locations those whose floors or sides are metallic and those whose sides or floors are covered which metallic debris or dust, especially if damp.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installations : Very low voltages shall preferatly be used in such locations .

If such is not the case, the installation shall

be such that all its parts shall normally be out of reach, the rest of the installations being carried out according to the type of location (dry, dusty, damps or wet).

For the metallic cabins in cranes or similar machinery, besides the provisions under 226-1, it is allowed to have the metallic masses of the electrical equipment be within reach if properly connected to the cabin which are themselves grounded.

The canalizations installed in these locations shall be as short as possible and shall have a strict minimum number of junctions and branchings.

300 - 6 LOCATIONS CONTAINING CORROSIVE VAPORS

A) Definition : Such locations are characterized by the présence of vapors that attack the metal and other substances currently used in electrical installations.

Acetic or acidic fermentaltion caves, scraping rooms and salt depots are considered as locations containing corrosive vapors.

Such locations are also found in some chemical plants, dyeworks and washhouses.

On the other hand, accumulator and electrolysis rooms are subject to the provisions of 300-12.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installation : All precautions shall be taken to protect the electrical equipment from the corrosive vapors.

The precautions are :

a. The choice of material not affected by the vapors.

b. The use of sealed covers not affected by vapors.

c. The periodical application of suitable protective coating ;

d. Steel and iron pieces are only efficient in dry locations and even there, need frequent applications of suitable protective coating ;

e. Ordinary lead-sheathed cables are attacked by nitric and acetic acids as well as by alcaline vapors, but can resist them if their external plat is properly impregnated.

The use of bare conductors shall conform to the provisions of 300 - 1. O, E, F and G.

All installations shall take into account the hygrometric conditions of the locations and be in accordance with them.

300 - 7 LOCATIONS EXPOSED TO FIRE HAZARDS.

A) Definition : As meant under the following rules, locations exposed to fire hazards, are those locations in which hyghly inflamable substances are handled, fabricated, treated or stored in appreciable quantity.

Such localitions are found in textile, cellulose and paper mills, factories where celluloid is handled, in distilleries and spirituous material stores.

Locations exposed to fire hazards are also found in such places as those where wood is worked, where cereals are ground, and also places whose floors are impregnated with oil and some stores in which highly inflamable materials are stored such as paper, cloth and rugs.

Cinemas, theaters, auditauriums, cabarets and all public meeting places are considered as exposed to fire hazards.(See 300-19 for special specifications)

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installation : Installations carried out in locations exposed to fire hazards could be

considered, in general, to be similar to those in dry, camp or wet locations, as the case may be, and shall be installed according to their provisions with the following modifications.

C) Canalizations : Rubber-insulated conductors fixed in insulators, are authorized only if all risks of mechanical injury are excluded .

Mouldings are allowed only in dry locations.

Tubings installed over or next to the metallic parts of the building shall be electrically connected to them at all points of contact and both shall be grounded.

The size of conductors shall be chosen such as the maximum temperature their external cover will reach is not prejudiciable to nearby inflamable substances.

The table of 221-3 is set such that the maximum temperature does not rise beyond 40° C.

In case lower temperature are required, the currents in these tables will be multiplied by the following coefficients :

0,8 to reach a maximum temperature of 30° C.

0,55 to reach a maximum temperature of 20° C.

The following conductors shall not be used in locations exposed to fire hazards :

a. Bare conductors

b. Flexible conductors with inflamable plat

c. Lead-Sheathed cables with impregnated cloth plat.

D) Equipment : All equipment shall be fire-proof and away from risks of mechanical injury.

Outlets, extensions and connections shall be avoided as much as possible.

E) Lighting : The provisions of 225-2 A shall apply only if the incandescent lamps are suitably protected if found necessary. Drop-lamps hanging at the end of conductors shall not be installed.

Arc lamps shall be allowed only if properly protected by a cover insulating them from the atmosphere of the locality.

F) Motors : All motors and their equipment shal be such that no spark or high temperature occur inside the hazardous locations.

G) Heating and cooking appliances : No bare incandescent heating element shall be allowed.

All elements whose temperature is raised to a temperature capable of endangering the security of the inflamable objects are prohibited.

300 - 8 LOCATIONS EXPOSED TO EXPLOSION HAZARDS

A) Definition : As meant under the following rules, locations exposed to explosion hazards are those locations in which are manufactured, transformed or stored in appreciable quantity, solid, liquid or gazous materials susceptible , in case of fire or not, to cause explosions, or in which gazes, vapors or dusts capable of forming with each other or with the air explosive mixtures might accumulate in appreciable quantity.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installations : Electric installations shall be avoided in such locations as much as possible, or else, all fixtures shall be of the explosion proof type.

All metallic covers shall be installed far from the metallic points of the building, or else, shall be electrically connected to them and both grounded.

Arc lamps shall not be used.

Incandescent lamps shall either be place outside these locations and lighting them through thick glass

panels or be placed inside well protected glass-panelled, well aerated niches, or be set inside special explosion-proof devices.

Heating and cooking appliances are prohibited.

The above-mentioned equipment shall not be installed within a radius of less than 10 meters outside the hazardous location.

All electric wiring shall reach the hazardous locations in underfloor cables at least 10 meters long outsid

300 - 9 HIGH TEMPERATURE LOCATIONS.

A) Definition . : As meant under the following rules, high temperature locations are those locations where the temperature of the atmosphere frequently goes over 40° C or is constantly over 35° C.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installations : Such locations can be considered as damp locations due to the sweating of persons working inside. In such cases the provisions of 300-3 (damp) shall apply.

All equipment shall be such that the temperature does not affect its insulation.

Bare conductor are allowed, subject to the provisions of 300-1.

The maximum allowable temperatures for the proper conservation of the insulation are stated under 221-3.

300 - 10 BUILDINGS PARTICULARLY EXPOSED TO LIGHTING EFFECTS

A) Definition : As meant under the following rules, particularly exposed to lighting effects are those buildings situated in sectors known to be particularly exposed to said effects and in which the electric installations are fed by areal conductors.

Electrical installations fed by underground conduits do not need special precautions.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of Installations : In case the building is isolated or fed by a long areal installation a lighting arrester shall be installed on every exposed conductor except on the neutral if grounded.

These arresters shall be placed outside or inside, as near as possible to the place where the line enters the building.

Outdoor arresters shall be of proper outdoor design and shall not function haphazardly through the actio of foreign matters, dust or humidity.

Indoor arresters shall be so installed as not to create any fire danger when functionning.

The grounding installation of arresters shall be in principle reserved solely for this use and be at least 3 meters away from any other grounding conductor of different nature.

In case of impossibility of such separation the grounding could be common on condition the conductors be kept separated from each other until the grounding electrode.

In case several buildings constitute a block and the electric lines feeding them are short, they could be collectively protected by a single group of arresters as indicated above.

Neutral conductors shall be grounded at most 200 meters away from the entrance of conductors into the building, and be installed as prescribed under 226- 2.

The grounding conductors shall be at least 28 m/m2 in section for copper conductors and 50 m/m2 for steel or others.

Lightning-protection accessories such as gap electrodes and choke coils if used, shall have an insulation from ground or from other conduits at least equal to the insulation required at other points of the circuit.

If isolating switches or disconnecting devices are used, they shall withstand in full open position, a voltage test between live parts 10 per cent in excess of the maximum voltage test they will withstand to ground.

They shall be installed in such places as, when manipulating them, one shall stand on insulating material and shall have no exposed live parts within reach if not standing on insulating material.

The same applies to convenience outlets.

D) Protectors-Receiving Stations :

Each conductor of a lead-in from an outdoor antenna shall be provided with a lightning-arrester approved for the purpose, except where the lead-in conductors from antenna to entrance to building are protected by a continuou metallic shield which is permanently and effectively grounde Lightning arresters shall be located outside the building, o inside the building between the point of entrance of the lead-in and the radio set or transformers, and as near as practicable to the entrance of the conductors to the building. The lightning arrester shall not be located near combustible material nor in a hazardous location.

300 - 11 LOCATIONS RESERVED FOR AN ELECTRICAL SERVICE.

A) Definition : As meant under the following rules, location reserved for an electrical service are those locations inside which electrical equipments function, and are accessible only to qualified personel in charge.

Such locations are : machine rooms, transformer stations, rooms containing distribution boards, and the like. Battery rooms fall under 300 - 12.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Canalizations : Bare conductors are allowed where the ground is non-conductive, at the places where they are within reach, and when suitably protected against accidental contact.

The same tube or conduit may be used to house several conductors if properly insulated and protected against overcurrent and short-circuits.

D) Apparatus, Instruments and Electrical Machiner

Apparatus, instruments and electrical machinery with bare conductors are allowed, but arround these apparatus

there shall be enough ground insulation so that a person or persons could not touch said conductors without standing on the insulated part of the ground.

E) Emergency Lightning : Location reserved for an electrical service shall be provided with an emergency lightning system as prescribed under 227.

300 - 12 BATERY ROOMS AND ELECTROLYTE ROOMS

A) Arrangement of the Rooms : Batteries and electrolyte trays shall be put in special rooms whose access is only authorized to the personel in charge of their service and maintenance.

Such locations shall have sufficient ventilation, natural or artificial to clear out all gazes as soon as formed

All measures shall be taken to prevent such gazes from reaching neighbouring location where they might cause damage.

All risks of frost shall be discarded.

The rooms shall be arranged so that all parts within shall resist the action of the electrolyte and its vapors.

The floor shall have sufficient slope to drain liquids that may fall on it.

All metallic objects shall be suitably protected and their use reduced to the strict minimum.

B) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

C) Execution of the Installations : Batteries shall be arranged as indicated under 255.

Bare conductors, open wirring, or conductors in rigid conduits, or electrical metallic tubing shall be used as the wiring method.

Varnished cambric-covered conductors shall not be used.

Bare conductors shall not be taped and shall be out of accidental reach.

Cells in lead-lined wood tanks where the number of cells in series does not exceed 25, shall be supported individualy on glass or porcelain insulators.

If the number of the cells in series exceeds 25, the cells shall be supported individualy on oil insulators.

In case needed for passage between tanks, aisles shall not be less than 60 cms wide.

Tanks shall be arranged so that no difference of potential between any 2 points liable to be accidentaly touched, exceeds 150 volts.

Switches, breakers and the like shall preferably be situated outside such locations or else shall be made of corrosion-resistant substances.

Artificial lighting shall be provided only by incandescent lamps protected by globes.

No bare heating elements or apparatus liable to give sparks shall be installed inside such locations.

This does not apply to instruments used to charge portable storage batteries if any.

300 - 13 BATHROOMS, SHOWERROOMS, SWIMMING POOLS

A) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

B) Execution of the Installation : In private location, bath and showerrooms shall be considered as damp location, consenquently the electrical installations in them shall conform to the provisions of 3oo-3.

In public places, bathrooms, showerrooms and swimming pools shall be considered as wet locations ; consequently the electrical installations in them shall conform to the provisions 3oo-4.

No part of the electrical installation shall be within reach from the tub, from under the shower or from the pool.

No moving electrical equipment shall be handled while the bath tub, shower, or pool are being used.

C) Protection against Accidental Charging of Metallic-Masses : This protection shall comply with the the provisions of 226-10.

It is especially required for electric water-heaters.

D) Calls : Calls shall be installed according to the provisions of 225-4 - F.

300 - 14 STABLES, SHEEPCOTS, AND PIGGERIES.

A) Conductors : The choice of conductors shall comply with the tables in 221-2 and 3.

B) Execution of the Installations : Stables, sheepcots and piggeries shall be considered as wet locations containing corrosive vapors and so the electrical installation in them shall comply with the provisions of 300-4 (Damp) and 300-6 (Corrosive vapors).

Except for the fixed-lightning fixtures, no other electrical installation shall be made save those absolutely necessary.

C) Protection Against Accidental Charging of Metallic Masses : Metallic masses normally insulated from live pieces shall, as well as these latter, be out of reach unless the voltage used is very low.

D) Canalizations : All canalizations above doors and opening shall be avoided due to the excessive condensation of corrosive vapors in such places.

Bare conductors are prohibited.

Electrical installations could be made of insulated conductors mounted on insulators provided they are out of reach from persons and animals.

All conductors shall be protected against corrosion.

Mechanical protection by metallic tubing is only allowed for very short lengths, both ends of the tube being sealed.

Lead-sheathed conductors with impregnated plat are best suited for locations with low roofs.

Conductors passing through partitions and walls shall have their protecting tube sealed at both ends.

All boxes shall be filled with insulating mater

E) Apparatus : In case they cannot be avoided, switches, fuses, junction and branching boxes, shall be of t type used for wet locations, with no accessible metallic parts, and made of corrosion-resistant material.

A fuse or interruptor shall be installed accord to the provisions for 300-4.

All circuits installed in such locations shall have multipolar switches, subsequent to them, unipolar-switches can be installed in addition.

F) Lighting : Only incandescent lighting is allowed.

Lamps shall be incased into sealed lanterns, made of corrosion-resistant material.

All lanterns shall be fixed, if not fed by a very low voltage.

No drop lamps are allowed.

Only very low voltage hand lamps are allowed.

G) Hand-Tools : Only very low voltage electrical hand tools are allowed.

300 - 15 PRIVATE AND PUBLIC GARAGES,

GAZ STATIONS, DEPOTS FOR

COMPRESSED COMBUSTIBLE GAZES.

A) Definitions : Are considered as garages, those locations where only motor vehicles are parked with no combustible material outside their reservoirs.

Locations where combustible materials are store even though parts of garages, are considered as gaz station or depots.

B) Conductors : The choice of conductors shall comply with the tables 221-2 and 3.

C) Execution of Electrical Installations or Gar

All the elements of the electrical installation in a garage shall be out of reach from the vehicles.

All lighting fixtures above the place where the vehicles are supposed to park shall not be lower than 2.5 meters from the ground.

All outlets and switches shall be at least 1.5m high.

Places for washing and pits are considered as wet locations and so their electrical installations shall conform to the provisions of 300-4.

Hand lamps and hand tools shall be of very low voltage type.

D) Execution of Installations in Gaz Stations:

These locations are considered as presenting explosion hazards and so their electrical installations shall conform to the provisions of 300-8.

E) Execution of Installations Depots for compressed combustible gazes.

These locations are considered as presenting explosion hazards and so their electrical installations shall conform to the provisions of 300-8.

300 - 16 OIL BURNERS ROOMS.

The choice of conductors shall comply with the tables in 221-2 and 3.

These rooms shall in general be considered as dry locations.

In case their sides are damp or the atmosphere is hot, then their electrical installations shall conform to the provisions of 300-3 or 300-9.

In any case all the installations shall comply with the following :

Electrical conductors shall be placed inside metallic tubings at least 1 m/m thick, or be lead-sheathed.

There shall be placed, outside the room at every incoming conductor, a multipolar switch.

300 - 17 TEMPORARY INSTALLATIONS

Some tolerance is allowed in the application of the above rules for temporary installations as long as the installations do not endanger the security of people and objects.

If the material used is not new, it shall be very carefully checked and recognized in very good condition

The protection of metallic masses shall be strictly carried out whenever required as per 226 with no tolerance whatsoever.

All conductors shall be insulated either with vulcanized rubber with impregnated plat, or be rubber-sheathed conductors.

The resinstallation of metal-protected cables shall be avoided.

Junctions shall be reduced to the minimum.

Overcurrent protection shall conform to the provisions of 224-2-A. There shall be provided at the beginning of the installation a general switch, to shut down all the installation immediately.

All temporary installations, when not in use shall be totally disconnected and in case no more attended t removed.

300 - 18 VERY LOW VOLTAGE INSTALLATIONS

A) Definition : As meant under the following rules, very low voltage installations are those whose voltag do not exceed per phase :

- a) 50 volts-Direct Current between conductors ;
- b) 24 volts-Alternating current between conductors or between any conductor and the ground.

B) Execution of Installations: Live parts could be left without protection as long as they are efficiently insulated from each other and with respect to the ground.

Very low voltage installations shall never be connected to any part of an installation of higher voltage. They shall not be fed by resistances or auto-transformers.

All connections shall be strong, durable and shall not be subjected to any tensile or torsional stresses.

C) Canalizations : Conductors may be have reduced insulations or may be bare, provided the type of installation conforms with the type of location.

However, such conductors shall not be put inside metallic tubings in damp or wet locations.

One single tubing may house several conductors;

The minimum section of copper conductors is 0.4 sq/m/m.

All very low voltage conductors when crossing or neighbouring other conductors of different nature, shall meet the requirements of these latter conductors with respe to their mode of installation.

D) Apparatus : All indoor conductors shall be protected against overcurrents, as prescribed under 224-2-A

Wood used as insulator, shall only be allowed in dry locations and for voltages not over 12.

E) Particular Rules to Some Categories of Locations : In dusty locations, all precautions shall be taken to avoid the accumulation of dust in the equipment.

In damp or wet locations the conductors shall b installed in such way as not to be prejudiciable to their insulation.

The use of conductors with reduced insulation inside metallic tubing is prohibited.

All equipment shall be special damp-proof.

In locations exposed to fire or explosion hazar very low voltage installations are subject to the provision of 300-7 and 300-8.

300 - 19 THEATERS, CINEMAS, AUDITORIUMS, CABARETS, ETC....

These locations shall be considered as exposed to fire hazards. They shall comply with whatever requirement stated in this code, where applicable especially those under 300-7 (Fire).

Furthermore, the following shall apply :

Emergency, lighting, according to special codes shall be provided. Its installation shall conform to the provisions of 227.

In principle, placesaccessible to the public shall have no installation of a voltage higher than 250.

Higher voltage conductors, if suitably protecte and perfectly safe may be used, subject to special rules.

Any electrical device, machinery and apparatus shall be installed in a special location reserved for electri service and shall comply with the provisions of 300 - 11.

In case such locations are adjacent to location accessible to the public, no direct communication shall exist between them.

Stages, and locations where setting or films are stored shall be considered as locations exposed to fire hazards and consequently the provisions of 300-7 shall apply to their electrical installations.

Transformers containing oil are allowed only if voltages over 250 are used provided a safe means of draining any oil is available together with a fire-extenguishing device that would function automatically in case of fire.

Metallic tubing shall be not less than 1 m/m thi

P A R T IV

400 - CHECKING AND MAINTENANCE OF INSTALLATIONS -

CERTIFICATES - TESTING

The proper responsible building officials shall, during the installation of an Electric Wiring System, make or cause it's inspection to be made, to insure proper compliance with the previsious of this Code.

Upon completion of the work, the proper responsible officials shall, within a reasonable time after the completion of the Electrical wiring, make or cause to be made a final inspection and make such tests as may be necessary to determine that it conforms with this Code and its rules.

Upon satisfaction, a certificate shall be delivered.

Reinspection of any Electrical wiring installati will be made upon request from the proper authorities and in case found defective, all previously given certificates shall be annuled.

No connections shall be made to the main supply of current unless the required certificates of inspection and approval have been delivered.

The following items shall be particularly check

A) Insulations resistance

B) Groundings - when required-

C) Overcurrent protection devices

D) Junctions

E) When necessary, the measures taken to prevent disturbances in the general distribution system.

A) Insulation Resistance Test : All wiring shall be so installed that when completed the system will be free from short circuits.

The insulation is measured with respect to the earth and between conductors. This test is carried out with a direct current having a difference of potential of 500 volt a least ; the positive pole being connected to the ground when testing with respect to it. Grounding conductors shall then be disconnected.

While measuring the installations or circuits being tested, they shall be disconnected from the source of energy feeding them.

The insulation resistance of every part of an installation between two successive fuses or circuit-breakers shall be at least 250 000 ohms, between conductros as well as with respect to ground.

During future checks this same number must be reached in either dry or damp locations . When in damp location the insulation resistance fall to 50 000 ohms, immediate repairs shall be carried out.

In order to allow comparison of values obtained during successive checks, it is necessary as much as possib to carry out these checks in the same identical conditions.

Factors effecting measurements are :

1 - The place where it is taken,

2 - The groundings disconnection of the measuring instruments,

3 - The value of the testing voltage, metereological and particularly hygroscopic conditions.

B)- Testing for Groundings and Equipotential Connections : This test shall verify that wherever a metallic mass as defined under 226-1 is put under an electri charge the corresponding safety arrangement shall immdiatel function.

This test could be carried out only by qualifie persons who will purposely connect a charged conductor - fo a very short time- to metallic mass.

The protection is recognized efficient if the safety arrangement works immediately.

C) Overcurrent Test : This test is carried out to verify the power of interruption and the functioning characteristics of overcurrent protection devices.

Care shall be taken to verify that such apparatus are chosen and installed according to the provisions of 224-2-A.

For further checks, it is only necessary to see that the sizes of fuses and the adjustable-trip circuit-breakers have not been altered - as long as no changes or additions have been made to the installation.

D) Checking for Connectors : Connectors shall be checked for their installation . Contacts shall not be loose and no overheating shall develop during use.

E) Testing for the Means to prevent Disturbances in the Distribution System : The testing of these means follows the provisions of 225-1-A, 225-2-D and 225-3-B.

In order to verify that the starting current of a motor does not exceed the limit prescribed under 225-3-B, use shall be made of an ammeter.

This starting current shall be calculated first, and the ammeter needle set at this value in order to prevent the effect of intertia on it.

Then the motor is started. The needle shall not deviate more than set, during the starting time.

Tests and checks are only valid when the starting and running voltages are nearly equal to the normal voltage of the installation. When such is not the case, the test is repeated, taking as check current that resulting from the actual voltage, the function being considered as linear.

Care shall be taken between successive tests to allow for the proper cooling of all apparatus. The use of hot-wire ammeters and volt-meters is prohibited.

F) Maintenance of the Installation : Electrical installations shall at all time be in good condition.

Every part of an installation, every apparatus, instruments, equipment or appliance whose proper running is suspected shall be checked and, if need be, repaired.

In case protective devices function without any apparent cause, they shall be immediately checked and, if need be, repaired.

P A R T V

500 - PROPOSED SYMBOLS FOR WIRING PLANS

The Symbols proposed below represent what will be ordinarily used in buildings. While they do not cover all symbols, the variations can be accomodated by following the basic symbols in which case the name of the apparatus shall be mentioned.

Symbols do no represent values and the latter must be added when, and as required.


Automatic Alarm


Battery (Long line is always positive)


Bell

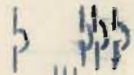

Bell Indicator (N = Number of ways)

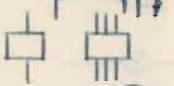

Bell and Indicator


Buzzer


Cord Call


Wall - type Call


Circuit - Breaker (air)


Circuit - Breaker (Oil or other)


Clock or Clock outlet


Crossing of Conductors connected


Crossing of Conductors not connected


Contact (closed)


Contact (open)

——— Electric Conductor : Distinction between power and control circuits may be made by using heavy and light lines respectively. Distinction between circuits may be made by using different color lines.

– – – – Future Conductor

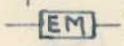
AC or ∿ Alternating Current

DC Direct Current

 Main Cut-out- Lighting

 Main Cut-out- Power

 Disconnecting Device (coupling or plug-type contact)

 Emergency Light

EM Emergency Source of supply

Ex Explosion-proof Fitting

 Fan of Fan Outlet

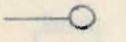
 Fuse

 Fuse Element

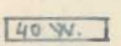
 Junction of Conductors

 Junction Box

 Incandescent Lamp

 Bracket Light

 Exit Light

 Fluorescent Light

 Night Light

 Lightning Arrester

 Incoming Line


Outgoing Line


Duplex Convenience Outlet (or Receptacle)

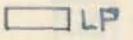

Floor Outlet

Generator or Motor Outlet (N = Number of H.P.)

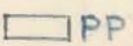
Special Purpose Outlet or Special Connection


30 Amp. Outlet (portable equipment)

Weatherproof Outlet



Lighting Panel



Power Panel


Main Service Entrance, Metering, & Distribution Panel


Bracket Point-Lighting

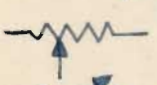

Ceiling Point-Lighting


Ceiling Point-Power


Earth Point


Floor Point-Lighting

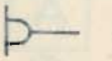

Floor Point-Power


Resistor, adjustable

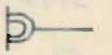

Resistor, continuously adjustable

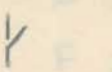

Resistor, fixed

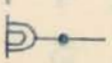
Illuminated Sign

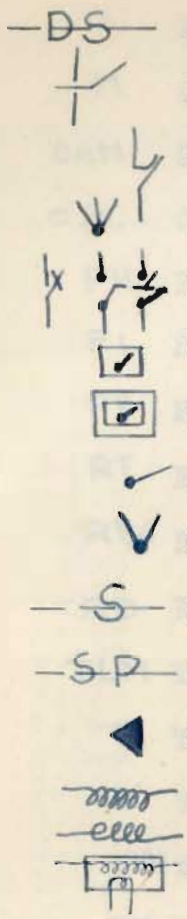

Lighting Wall-Socket


Lighting Wall-Socket and Switch combined


Power Wall Socket


Disconnecting Switch (one pole)


Power Wall Socket and switch combined



Automatic Door Switch

Double-throw Switch

Switch with Horn Gap

Intermediate Switch

Knife Switch

Main Switch - Lighting

Main Switch - Power

One - Way Switch

Two - Way Switch

S Wall Switch

SP Wall Switch with Pilot Light

Telephone or Telephone Outlet

Transformer

Bell-ringing Transformer

Instruments and Meters

Note :

Letter or letters shall be placed within circle or rectangle to indicate type of instruments.

A or A Ammeter

AH Ampere Hour Meter

CMC Contact Making Clock

D Demand Meter

F Frequency Meter

G Galvanometer

GD	Ground Detector
I	Indicating
M	Integrating
OHM	Ohmmeter
OSC	Oscillograph
PH	Phase Meter
PI	Position Indicator
PF	Power Factor Meter
RF	Reactive Factor Meter
REC	Recording
RD	Recording Demand Meter
TLM	Telemeter
T	Temperature Meter
V	Voltmeter
WH	Watt Hour Meter
W	Wattmeter

In case of conflict with any other symbol spell out :

Adaptations

Instruments showing Terminals :

Ammeter

Voltmeter

Wattmeter


Direct Current Watt Hour Meter

600 - METRIC EQUIVALENTS OF AMERICAN WIRE GAUGE

(For Copper Conductors).

A.W.G.	Diameter.		Cross - Sectional Area.		
			Circular		
	in.	m.m.	Mils.	sq.in.	sq.m.m.
0000	.4600	II.683	2II,600	.I66I90	I07.2I9
000	.4096	I0.404	I67,772	.I3I770	85.0II
00	.3648	9.266	I33,079	.I04520	67.432
0	.3250	8.255	I05,625	.082958	53.52I
I	.2893	7.348	83,694	.065733	42.408
2	.2576	6.543	66,358	.052II7	33.624
3	.2294	5.827	52,624	.04I33I	26.665
4	.2043	5.I89	4I,738	.03278I	2I.I49
5	.I8I9	4.620	33,088	.025987	I6.766
6	.I620	4.II5	26,244	.020612	I3.298
7	.I443	3.665	20,822	.0I6354	I0.550
8	.I285	3.264	I6,5I2	.0I2969	8.3666
9	.II44	2.906	I3,087	.0I0279	6.63I3
I0	.I0I9	2.588	I0,384	.008I553	5.26I4
II	.0907	2.304	8,266.5	.00646II	4.I684
I2	.0808	2.052	6,528.6	.005I276	3.308I

A.W.G.	Strand.	Diameter in.	Diameter m.m.	Cross-Sectional Area Circular Mils.	Cross-Sectional Area sq.in.	Cross-Sectional Area sq.m.m.
	6I/.I28	I.I5	29.2I0	1,000,000	.785398	506.660
	6I/.III	.998	25.350	750,000	.589049	379.996
	37/.II6	.8I3	20.650	500,000	.392699	253.330
	37/.II0	.772	I9.60I	450,000	.353429	278.663
	37/.I04	.728	I8.49I	400,000	.3I459	202.664
	37/.097	.68I	I7.297	350,000	.274889	227.997
	I9/.I36	.678	I7.22I			
	37/.090	.630	I6.002	300,000	.2356I9	I5I.998
	I9/.I26	.628	I5.95I			
	37/.082	.575	I4.605	250,000	.I96350	I26.665
	I9/.II5	.573	I4.554			
0000	I9/.I06	.528	I3.4II	2II,600	.I66I90	I97.2I9
	7/.I74	.522	I3.259			
000	I9/.094	.470	II.938	I67,772	.I3I770	85.0II
	7/.I65	.464	II.786			
00	I9/.084	.4I8	I0.6I7	I33,079	.I04520	67.432
	7/.I38	.4I4	I0.5I6			
0	I9/.075	.373	9.474	I05,625	.082958	53.52I
	7/.I23	.368	9.347			
I	I9/.066	.332	8.433	83,694	.065733	42.408
	7/.I09	.328	8.33I			
2	7/.097	.292	7.4I7	66,358	.052II7	33.624
3	7/.087	.260	6.604	52,624	.04I33I	26.665
4	7/.077	.232	5.893	4I,738	.03278I	2I.I49
5	7/.069	.207	5.258	33,088	.025987	I6.766
6	7/.06I	.I84	4.574	26,244	.0206I2	I3.298