

MYANMAR NATIONAL BUILDING CODE

(MNBC 2020)

(BUILDING SERVICES - PART 5A & 5B)

U MYINT THEIN

BE (EP)

PE - 0342 (ELECTRICAL) BS

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MYANMAR NATIONAL BUILDING CODE (2020)

TWG 1	PLANNING,ENVIRONMENT,ADMINISTRATION AND LEGISLATION
TWG 2	ARCHITECTURE
TWG 3	STRUCTURE
TWG 4	SOIL AND FOUNDATION
TWG 5A	BUILDING SERVICES(LIGHTING)
TWG 5B	BUILDING SERVICES (ELECTRICAL AND ALLIED INSTALLATION)
TWG 5C	BUILDING SERVICES (ESCALATOR)
TWG 5D	BUILDING SERVICES (WATER AND SANITATION)
TWG 5E	HVAC
TWG 5F	BUILDING SERVICES (FIRE PROTECTION)
TWG 6	MATERIALS
TWG 7	CONSTRUCTION PRACTICES AND SAFETY

TECHNICAL WORKING GROUP – 5A ,5B , 5C

BUILDING SERVICES (LIGHTING ,ELECTRICAL & ALLIED INSTALLATION,LIFT & ESCALATORS)

No.	Name	Designation	Department
1	U San Tin	Group Leader	Committee for the Quality Control of Highrise Building Projects
2	Daw Than Than Nwe	Deputy Group Leader	Committee for the Quality Control of Highrise Building Projects
3	U Than Tun	Secretary	Committee for the Quality Control of Highrise Building Projects
4	U Than Aye	Member	Committee for the Quality Control of Highrise Building Projects
5	U Aung Thein	Member	Public Works (Retired)
6	U Khin Mg Swe	Member	Electrical Inspectrate(Retired)
7	U Khin Shwe	Member	Electrical Inspectrate
8	U Bo Bo Kyaw Thet	Member	Electrical Inspectrate

No.	Name	Designation	Department
9	U Aye Ko	Member	Electrical Inspectrate
10	U Shwe Yu Kyaw	Member	Public Works (Retired)
11	U Thein Lwin	Member	Public Works (Retired)
12	U Aye Win	Member	Public Works (Retired)
13	U Myint Thein	Member	Public Works
14	U Kyi Hlaing Win	Member	Public Works
15	U Nyan Lin	Member	Public Works (Retired)
16	U Ye Myint	Member	Public Works (Retired)
17	U Tun Tun Oo	Member	Public Works (Retired)

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PART 5A BUILDING SERVICES

Lighting

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3.2 ARTIFICIAL LIGHTING

3.3 ENERGY CONSERVATION OF
LIGHTING

5A.1 SCOPE

This Section covers requirements and methods for lighting of buildings.

5A.2 TERMINOLOGY

Candela (cd) —The SI unit of luminous intensity.

Candela = 1 lumen per steradian

Lumen (lm) — SI unit of luminous flux.

Maintenance Factor (d) —The ratio of the average

illuminance on the working plane after a certain period of use of a lighting installation to the average illuminance obtained under the same conditions for a new installation.

Utilization Factor (Coefficient of Utilization) (μ)— The ratio of the total luminous flux which reaches the working plane to the total luminous flux of the light sources in the interior

Room Index (k_r)— An index relating to the shape of a rectangular interior, according to the formula:

$$k_r = \frac{L.W}{(L+W)H}$$

where L and W are the length and width respectively of the interior, and H_m is the mounting height, that is, height of the fittings above the working plane.

etc:

■ 5A.3 LIGHTING

3.1 Principles of Lighting

3.1.1 Aims of Good Lighting

Good lighting is necessary for all buildings and has three primary aims.

- The first aim is to promote work and other activities carried out within the building;
- the second aim is to promote the safety of the people using the building; and
- the third aim is to create, in conjunction with the structure and decoration, a pleasing environment conducive to interest of the occupants and a sense of their well-being.

5A.3.2 Artificial Lighting

- *3.2.1 Artificial Lighting may have to be provided*
 - (a) where the recommended illumination level have to be obtained by Artificial lighting only.
 - (b) to supplement day lighting where the level of illumination falls below the recommended value.
 - (c) where visual task may demand a higher level of illumination.

5A.3.3 Energy Conservation in Lighting

- A substantial portion of the energy consumed on lighting may be saved by utilization of daylight and rational design of supplementary artificial lights.
- Energy conservation in lighting is effected by reducing wastage and using energy effective lamps and luminaires without sacrificing lighting quality.

Recommended Values of Illuminance

Table 1 gives recommended values of illuminance commensurate with the general standards of lighting described in this section and related to many occupations and buildings;

These are valid under most of the conditions whether the illumination is by daylighting, artificial lighting or a combination of the two. The great variety of visual tasks makes it impossible to list them all and those given should be regarded as representing types of task.

5A.3.2.2.1 Determination of the Illumination level

-Determination of the luminous flux

The luminous flux (Φ) reaching the working plane depends upon the following:

- 1) lumen output of the lamps,
- 2) type of luminaire,
- 3) proportion of the room (room index) (kr),
- 4) reflectance of internal surfaces of the room,
- 5) depreciation in the lumen output of the lamps after burning their rated life, and
- 6) depreciation due to dirt collection on luminous and room surface.

In practice, it is easier to calculate straightaway the number of lamps or luminaires from:

$$N_{\text{lamp}} = E_{\text{av}} A / \mu d \phi_{\text{lamp}}$$

where

ϕ_{lamp} = Luminous flux of each lamp in lumens,

$\phi_{\text{luminaire}}$ = Luminous flux of each luminaire in lumens,

N_{lamp} = Total number of lamps, and

$N_{\text{luminaires}}$ = Total number of luminaires

μ = the utilization factor in new conditions; and

d = maintenance factor

E_{av} = Average illumination level required on the working plane in lux

A = Area of the working plane in m²

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PART 5B BUILDING SERVICES

Electrical and Allied Installations

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5B.1 SCOPE

This Section covers the essential requirements **for electrical installations in buildings to ensure efficient use of electricity including safety from electric fire and shock.** This Section also includes general requirements relating to lightning protection of buildings and lighting.

5B.2 TERMINOLOGY AND SYMBOLS

Accessory— A device, other than current using equipment, associated with such equipment or with the wiring on an installation.

Apparatus — Electrical apparatus including all machines, appliances and fittings in which conductors are used or of which they form a part.

Appliance— An item of current using equipment other than a luminaire or an independent motor.

Circuit Breaker —A mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions and also of making, carrying for a specified time, and breaking currents under specified abnormal circuit conditions such as those of short circuit.

Earth —The conductive mass of the earth, whose electric potential at any point is conventionally taken as zero.

Earth Continuity Conductor —The conductor, including any clamp, connecting to the earthing lead or to each other those parts of an installation which are required to be earthed.

Fuse —A device that, by the fusion of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted when the current through it exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device.

Voltage, Extra Low (ELV) —The voltage which does not normally exceed 50 Va.c.

Voltage, Low (LV) —The voltage which normally exceed 50 Va.c but not normally exceed 1000 Va.c.

Voltage, Medium (MV) —The voltage which normally exceeds 1000 Va.c but not exceed 33 kVa.c.

Voltage, High (HT, HV)—The voltage which normally exceeds 33kVa.c but not exceed 230 kVa.c

5B.3 GENERAL REQUIREMENTS

- 3.1 The installation shall generally be carried out in conformity with the requirements of *the Myanmar Electricity Rules and Regulations(1985)*.
- 3.2 Materials
All materials, fittings, appliances, etc, used in electrical and allied installations, shall conform to Building Materials' and other related Standards.
- 3.3 Coordination with Local Supply Authority
In all cases, that is, whether the proposed electrical work is a new installation or extension of an existing one, or a modification involving major changes, the electricity supply undertaking shall be consulted about the feasibility, etc, at an early date.
- 3.4 Power Factor improvement in consumers' installation
Conditions of supply of electricity boards or licensees stipulate the lower-limit of power factor which is generally 0.85.

3.5 Execution of work

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

3.6 Safety procedures and practices shall be kept in view during execution of the work in accordance with Standard practice.

3.7 Safety provisions given in Part 5F , Fire and Life Safety' shall be followed.

5B.4 PLANNING OF ELECTRICAL INSTALLATION

4.1 General

The design and planning of an electrical wiring installation involve consideration of all prevailing conditions, and is usually influenced by the type and requirement of the consumer.

A competent electrical design engineer should be involved at the planning stage with a view to providing for an installation that will prove adequate for its intended purpose, and safe and efficient in its use.

4.2 Location and Requirement of Substation

- *Location*

- The substation should preferably be located in separate building and could be adjacent to the generator room, if any. Location of substation in the basement floors should be avoided, as far as possible.
- The ideal location for an electrical substation for a group of buildings would be at the electrical load centre on the ground floor.
- The floor level of the substation or switch room shall be above the highest flood level of the locality.
- Substations with oil filled equipment will require great consideration for the fire detection, protection and suppression.

- Substations with oil filled equipment shall not be located in any floor other than the ground floor or a semi-basement. Such substations with high oil content may be housed in a separate service building.
- If dry type transformer is used, it may be located adjacent to medium voltage switchgear in the form of unit type substation. No separate room or fire barrier for the transformer is required, in a substation with oil free equipment. In such a case the room size will decrease.
- The emergency power supply (such as Generating Sets) should not be allowed to be installed above ground floor or below first basement level of building.

- Substations located within a multi-storied building shall not have oil filled transformers, even if it is at the ground level (see Myanmar Fire Department Instruction). Substations with very little combustible material, such as a **Dry type transformer**, with Vacuum (or SF₆) HT switchgear and ACB or MCCB for MV can be located in the basement as well as upper floors in a building with high load density in the upper floors. (Some functional buildings such as hospitals, air traffic control towers, computer centers are likely to have high loading in a few upper floors and in such cases, it may be preferable to provide oil-free substations at upper levels).

Note: In unavoidable circumstances emergency generators , power transformers ,chiller units , water pumps and other heavy equipment machineries can also be installed in the intermediate floor level of a tall building , designated as mechanical service floors , provided that the building can safely withstand both static and dynamic load of the said installed equipment in the event of seismic vibration and similar ones , and that shall be certified by the authority concerned.

5B.5 DISTRIBUTION OF SUPPLY AND CABLING

System of Supply

- All electrical apparatus shall be suitable for the voltage and frequency of supply.
- In case of connected load of 100 kVA and above, the relative advantage of medium voltage three-phase supply should be considered.
- Generally the supply is at 400/230 volts, 11 kV for loads up to 1 MVA and 33 kV or 66 kV for consumers of more than 1 MVA.
- 5.2 Substation Equipment and Accessories

5.2.1 High Voltage Switchgear

5.2.2 Cables

The smallest size of the cable that shall be used, will depend upon the method of laying cable permissible maximum temperature it shall withstand, voltage drop

over the length of the cable, the prospective short-circuit current to which the cable may be subjected, the characteristics of the overload protection gear installed, load cycle and thermal resistivity of the soil.

The LV cables shall either be laid on the cable rack/built-up concrete trenches/tunnel/basement or directly buried in the ground depending upon the specific requirement. It is preferable to use four core cable in place of three and half core to minimize heating of neutral core due to harmonic content in the supply system and also avoidance of overload failures.

<i>Number of Cores</i>	<i>Function of Core</i>	<i>Colour(s) of Core</i>
1	Phase Neutral Protective or Earthing	Brown (Light) Blue Green & yellow
2	Phase Neutral	Brown (Light) Blue
3	Phase Neutral Protective or Earthing	Brown (Light) Blue Green & yellow
4 or 5	Phase Neutral Protective or Earthing	Brown, Black, Grey (Light) Blue Green & yellow

Conductors

Conductors for all the internal wiring shall be of copper. Conductors for power and lighting circuits shall be of adequate size to carry the designed circuit load without exceeding the permissible thermal limits for the insulation. The conductor for final sub-circuit for fan and light wiring shall have a nominal cross sectional area not less than 1.50 mm² copper. The cross sectional area of conductor for power wiring shall be not less than 4.0 mm² copper. The minimum cross sectional area of conductor of flexible cord shall be 1.50 mm² copper.

- Transformers

General design objective while selecting the transformer(s) for a substation would be to provide at least two or more transformers, so that a certain amount of redundancy is built in, even if a standby system is provided.

5.3 Reception and Distribution of Main Supply

There shall be a circuit-breaker or miniature circuit-breakers or a load break switch fuse on each live conductor of the supply mains at the point of entry.

5.4 Voltage and Frequency of Supply

It should be ensured that all equipment connected to the system including any appliances to be used on it are suitable for the voltage and frequency of supply of the system. The nominal values of low voltage systems in Myanmar are 230 V ac (1 Ø) and 400 V ac (3 Ø) , respectively, and the frequency 50 Hz.

5.5 Rating of Cables and Equipments

The current-carrying capacity of different types of cables shall be chosen in accordance with Standard practice.

5.6 Installation Circuits

- Selecting and Installing Cables
- Cable insulation types
- Circuit wire sizes

5.7 Lighting and Levels of Illumination

Lighting installation shall take into consideration the many factors on which the quality and quantity of artificial lighting depends.

Energy Conservation

Energy conservation may be achieved by using the following:

- (a) Energy efficient lamps, chokes, ballast, etc for lighting equipment.
- (b) Efficient switching systems such as remote sensors, infrared switches, master switches, remote switches, etc for switching ON and OFF of lighting circuits, etc.
- (c) Properly made/connected joints/contacts to avoid loose joints leading to loss of power.

5B.6 WIRING

6.1 Provision for Maximum Load

6.2 Selection of Size of Conductors

Conduit colour coding

The conduits shall be colour coded as per the purpose of wire carried in the same. The colour scheme shall be as follows:

<i>Conduit Type</i>	<i>Colour Scheme</i>
Power conduit	Black
Security conduit	Blue
Fire alarm conduit	Red
Low voltage conduit	Brown
UPS conduit	Green

5B.7 FITTINGS AND ACCESSORIES

- **Socket-Outlets and Plugs**

Each 16A socket-outlet provided in buildings for the use of domestic appliances such as air conditioner, water cooler, etc, shall be provided with its own individual fuse or miniature circuit-breaker .

- **Lighting Fittings**

- **Fans, Regulators**

- **etc:**

- Lamps

All lamps unless otherwise required and suitably protected, shall be hung at a height of not less than 2.5 m above the floor level. All electric lamps and accessories shall conform to accepted standards.

- Ceiling Fans

Unless otherwise specified, the clearance between the bottom most point of the ceiling fan and the floor shall be not less than 2.4 m. The minimum clearance between the ceiling and the plane of the blades shall be not less than 300 mm.

5B.8 EARTHING

8.1 General

Earthing shall generally be carried out in accordance with the requirements of Myanmar Electricity Rules.

8.2 Earth Electrodes

Earth electrode either in the form of pipe electrode or plate electrode should be provided at all premises for providing an earth system.

System of Earthing

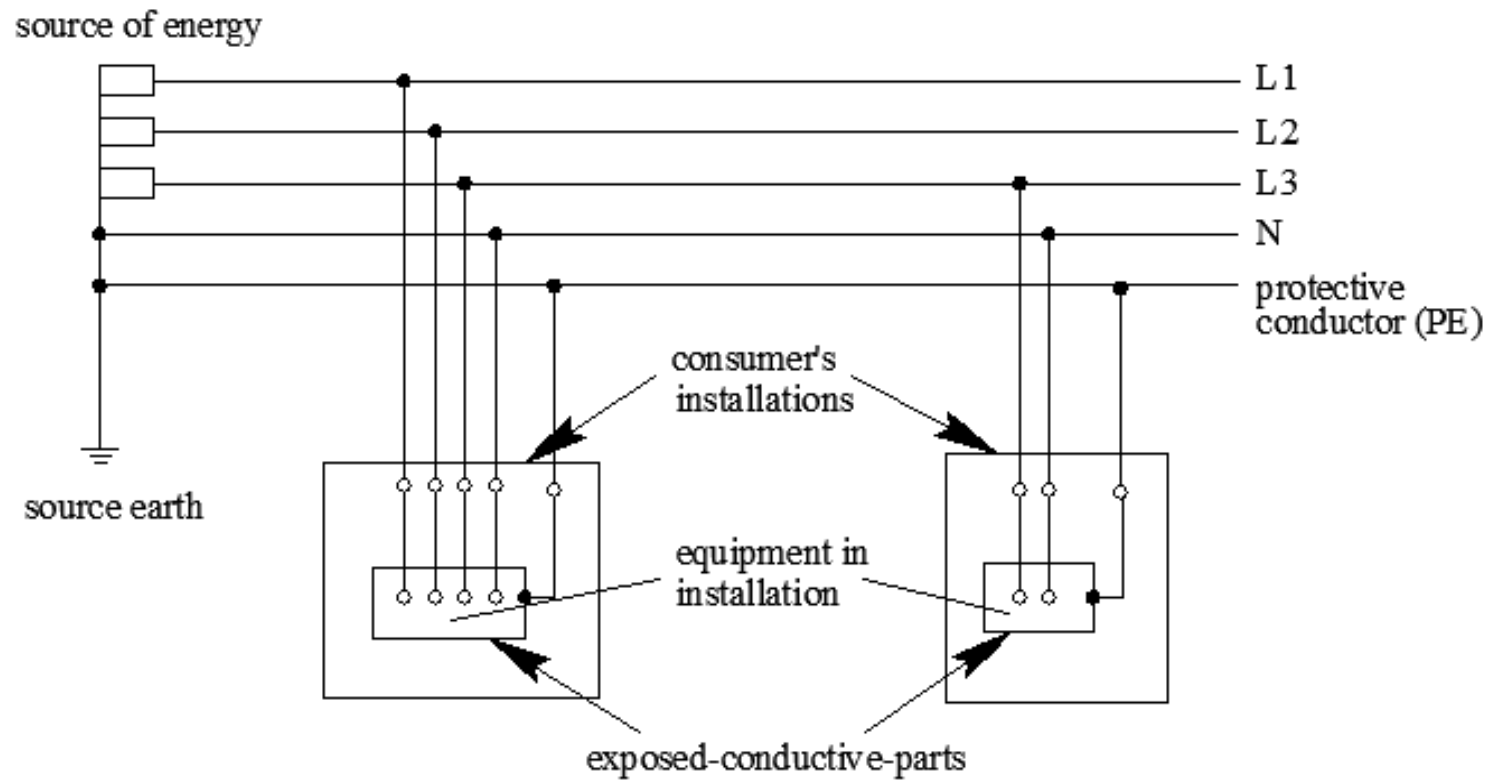
Equipment and portions of installations shall be deemed to be earthed only if earthed in accordance with either the direct earthing system. In all cases, the relevant provisions of Myanmar Electricity Rules shall be complied with.

Classification of Earthing System

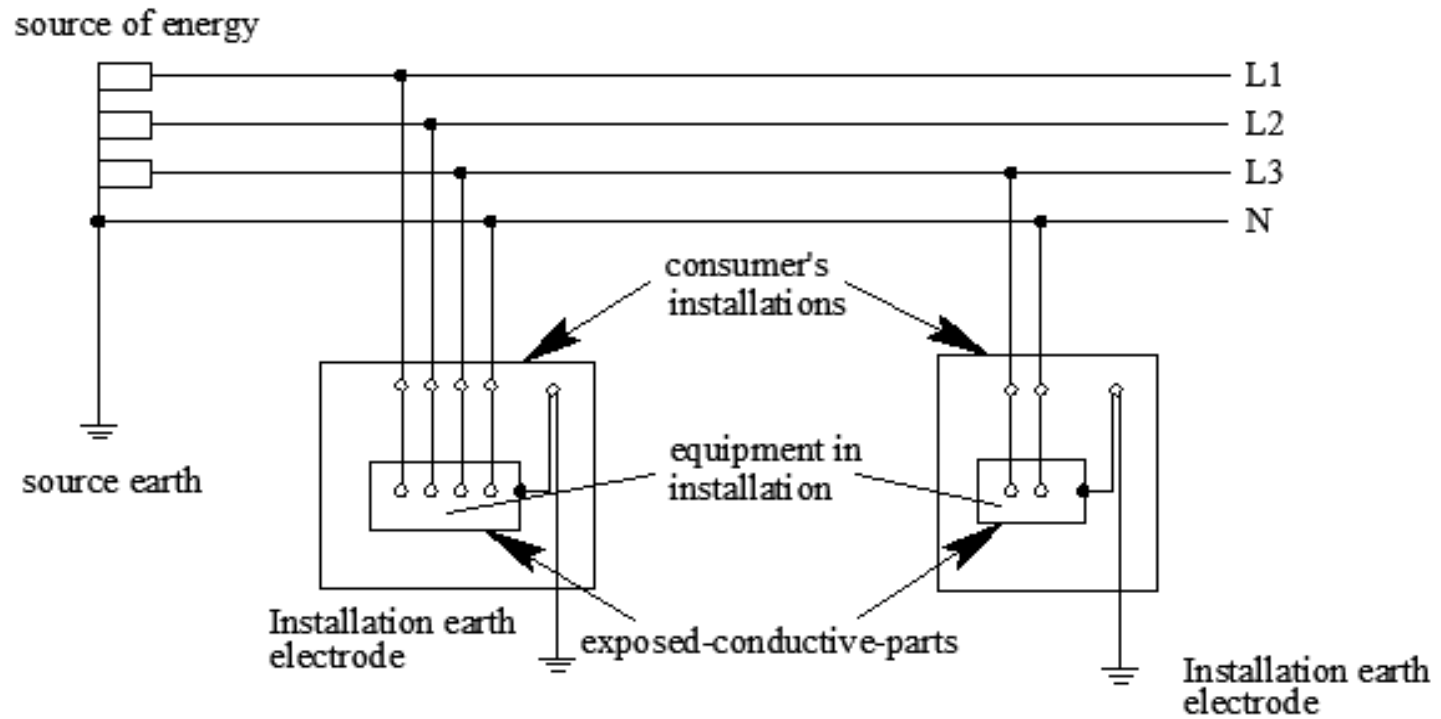
(a) TT System

(b) TN System

Primarily to be used TT & TN-S System.



TN-S System



TT-System

5B.9 INSPECTION AND TESTING OF INSTALLATION

9.1 General Requirements

- Before the completed installation, or an addition to the existing installation, is put into service, inspection and testing shall be carried out in accordance with the Myanmar Electricity Rules. In the event of defects being found, these shall be rectified, as soon as practicable and the installation retested.
- Periodic inspection and testing shall be carried out in order to maintain the installation in a sound condition after putting into service.
- Completion Drawings

On completion of the electric work, a wiring diagram shall be prepared and submitted to the engineer-in-charge or the owner. All wiring diagrams shall indicate clearly, the main switch board, the runs of various mains and submains and the position of all points and their controls.

All circuits shall be clearly indicated and numbered in the wiring diagram and all points shall be given the same number as the circuit in which they are electrically connected. Also the location and number of earth points and the run of each load should be clearly shown in the completion drawings.

9.2 Inspection of the Installation

General

On completion of wiring a general inspection shall be carried out by competent personnel in order to verify that the provisions of this Code and that of Myanmar Electricity Rules, have been complied with.

Item to be Inspected

- *Substation installations*
- *Low voltage installation*
- *Overhead lines*
- *Lighting circuits*

9.3 Testing of Installation

- *Transformers*
- *Cables*
- *Wiring installation*
- *Earthing*
- *etc:*

5B.10 Telecommunication & other miscellaneous services

5.11 LIGHTNING PROTECTION OF BUILDINGS

11.1 Basic Considerations for Protection

{see International Standard practice for details
[IEC 62305]}

- Need for Protection
- Estimation of Exposure Risk
- Sample Calculation of Need for Protection

➤ References for Electrical Design & Installations

IEC - International Electro-Technical
Commission

BS - British Standards

SS - Singapore Standards

CP - Code of Practice (Singapore)

IS - Indian Standard

CONCLUSION

- Myanmar National Building Code (MNBC) 2020
Section

- Part 5A (Building Artificial Lighting)
- Part 5B (Building Services , Electrical and Allied installation)

Above MNBC is ready to use as a Building Code.

THANK YOU

QUESTION
&
ANSWER