حكومة دبي
GOVERNMENT OF DUBAI

هيئة كهرباء ومياه دبي
Dubai Electricity & Water Authority

REGULATIONS FOR ELECTRICAL INSTALLATIONS

2017 EDITION

For generations to come

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INTRODUCTION:

This edition supersedes the REGULATIONS FOR ELECTRICAL INSTALLATIONS - 1997 EDITION. The Revised Edition incorporates the amendments and guidelines issued and posted on DEWA website from time to time.

The objective of the regulation is to provide consumers, consultants, contractors, electrical engineers & technicians with general guide for design, installation, inspection and compliance with DEWA's requirements for electric installations, in order to safeguard person and property from hazards arising from the use of electricity. The regulation however is not intended to substitute detailed specifications nor to serve as an instruction manual for untrained persons. It is essential that all consultants, contractors, electrical engineers & technicians study and abide by these regulations. This of course does not absolve the concerned parties from obtaining other necessary approvals from DEWA.

References are generally made to the seventeenth edition of the IET (The Institution of Engineering and Technology) wiring regulation and International Electromechanical Commission (IEC) documents. Consideration has been given to the prevention of fire and shock hazards as well as proper operation and maintenance of wiring installation and equipment.

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DUBAI ELECTRICITY & WATER AUTHORITY
REGULATIONS FOR ELECTRICAL INSTALLATIONS

SECTION-1
GENERAL REQUIREMENTS

1.1 SCOPE

The regulations apply to the requirements of design, erection, inspection and testing of all electrical installations within premises and any additions, alterations to the existing buildings and installations therein, in the Emirate of Dubai. The premises covers the land and all facilities including buildings belonging to it.

Installations, wherein construction of high voltage substation/s is required, shall be referred to DEWA at the preliminary design stage for incorporating any specific requirements other than referred under section 11 of this regulation.

The regulations are not intended to take the place of a detailed specification or to instruct untrained persons or to provide for every circumstance. Where a difficult or special situation arises which is not covered or allowed for in the regulations, DEWA may be sought to obtain specific advice.

1.2 ELECTRIC SUPPLY

The nominal electric supply voltage from DEWA (IEC 60038) is 230 / 400V ± 10%, 50 HZ, 3-phase, 4-wire with separate neutral and protective conductor (generally metallic armour of the DEWA service cable).The neutral is solidly earthed at DEWA's substations and shall not be earthed elsewhere in the consumers' electrical installations. The design fault level within the substation is 40 kA (fault duration 1-sec), except for fuse protected equipment / circuit.

All equipment, apparatus, materials and accessories used in the electrical installations shall be designed and rated for operation on this electric supply. Appropriate protective devices against over voltages, fluctuations, transients & harmonics, loss of one or more phases and any unforeseen interruptions shall be provided in all consumer installations as deemed essential, in addition to overload, short- circuit and earth leakage protective devices.

1.3 AMBIENT CONDTIONS

All equipment, apparatus, materials and accessories used in the electrical installations shall be suitable for the purpose intended and capable of operating with satisfactory performance in the climatic conditions of Emirate of Dubai which are as follows

- Altitude	:	Sea level (coastal)
- Maximum outdoor ambient temperature (shade)	:	48˚C
- Minimum ambient air temperature	:	2.8˚C
- Maximum ambient air temperature	:	48˚C
- Maximum average over 24 Hrs.	:	37.8˚C
- Maximum average over 1 year	:	26.9˚C
- Relative humidity	:	100 %(max)
- Thunder storms per year	:	Occasional
- Earthquake loading	:	0.07g
- Wind speed	:	45 m/s at 10 m height
- Ground temperature	:	40˚C
- Soil thermal resistivity	:	At depth of 0.9 mtr 2.0 C/m/w Heavy condensation and sand storms also prevail.

1.4 DEWA ENROLLMENT FOR CONSULTANTS AND ELECTRICAL CONTRACTORS

All consultants and electrical contractors are required to enrol with DEWA to undertake the electrical design and/or installation works in any project or premises in the emirate of Dubai. The requirement may also include specific training & certification by DEWA for specialised categories of work, if found essential for ensuring the safety, reliability and quality of the installation. The criteria, procedures and guidelines to be followed for the online enrolment are being issued separately and normally will be published on DEWA website.

Each electrical contractor who undertakes electrical installations shall have the required minimum number of electrical engineers and technicians (whose details are to be included in the enrolment applications / updates), who have adequate knowledge on DEWA Regulations and applicable international standards & safety requirements and are responsible for correct installation, shall supervise and test the entire electrical works prior to connecting power supply.

1.5 WORKMANSHIP

All electrical installations shall be carried out in a neat, orderly workmanlike manner. Careful attention shall be paid to the mechanical execution of the work in connection with any electrical installation.

1.6 STANDARDS FOR EQUIPMENT AND MATERIALS

All electrical installations shall comply with the requirement of the regulations, relevant to DEWA's technical specifications, latest edition of the IET (The Institution of Engineering and Technology) wiring regulations, and any other regulations issued by DEWA from time to time. In case of contradiction, DEWA's regulations shall prevail.

All equipment, apparatus, materials and accessories complying with the current standards quoted in Appendix-1 and/or conforming to relevant IEC(International Electromechanical Commission) and ISO(International Standards Organization) recommendations shall be deemed to satisfy the requirements of the regulations, unless otherwise specified.

1.7 PRIOR APPROVAL FOR ELECTRICAL WORKS

Before the commencement of any electrical installation, large or small, new or additional, the proposed technical details of installations shall be submitted to DEWA, for review and prior approval thereof. Guideline format for preparation of load distribution schedule are provided under Appendix 2.

1.8 APPLICATION FOR GETTING ELECTRICTY

DEWA Building NOC and Building Permit issued by concerned Authority where the plot is located, pre-requisite for submitting application for getting electricity connection.

DEWA Enrolled Consultants / Electrical Contractors are able to submit the on-line Getting Electricity application (One Window System). Details of documents to be uploaded and other guidelines are published on DEWA website.

Customers will be able to track the status of the application, upload additional documents, receive project status notifications, initiation of site technical inspections etc., through the One Window System.

1.9 POWER FACTOR(PF) CORRECTION

The overall power factor of all consumer installation shall be maintained within 0.9 (lagging) and unity (Recommended value 0.95 lagging).

Generally all central air-conditioning plants, window & split type air-conditioning units/ equipment shall incorporate integral means of power factor correction to achieve and maintain a power factor not less than 0.9 lagging throughout their normal working range.

All light fittings with discharge lamps, mercury vapour/ sodium vapour, fluorescent tubes, etc. shall incorporate capacitors to obtain a power factor of 0.9 or above lagging, guidelines on requirement of PF improvement are also given in section 8 of this regulation.

1.10 UNDER VOLTAGE (UV) RELAY WITH AUTO-RESET TIMER

All air-conditioners or air-conditioning units/ plants/ equipment installed within the consumer installation shall be provided with UV relay with auto - reset timer. The guidelines on requirements of UV relays are also given under section 8 of this regulations.

1.11 HARMONICS AND RAPID VOLTAGE CHANGES

Harmonics refers to the amount of distortion that occurs to the voltage or current sine wave and is commonly referred to as electrical noise. In the electrical installation, this can be caused by various sources such as non-linear loads, Variable Speed Drives, Variable Frequency Drives, Capacitor banks, UPS back-up power supplies, fluorescent light ballasts, fan speed controls, halogen lights, low voltage transformers for indoor/outdoor lighting, unfiltered dimmer switches, A/C-D/C power supplies etc. found in various electronic devices such as computers, printers, fax machines, televisions, etc.

A consumer's load is not allowed to cause deviations of the voltage characteristics other than those allowed in BS EN 50160, IEC 61000 and ENA Engineering Recommendation G5/4-1.

The onsite measurements to determine compliance with the harmonics limits (also refer section 8.1.11) and any excess deviations shall be compensated by the consumer at his cost. The following characteristics of a supply voltage shall be taken in to account:

- Power frequency
- Magnitude of the supply voltage
- Supply voltage variations
- Rapid voltage changes and flickers
- Supply voltage dips
- Short interruptions of the supply voltage
- Long interruptions of the supply voltage
- Temporary power frequency over voltages
- Transient over voltages
- Supply voltage unbalance
- Harmonic voltage
- Interharmonic voltage
- Mains signalling voltage

1.12 INSPECTION AND TESTING OF ELECTRICAL INSTALLATIONS

All electrical installations and equipment installed therein, shall be subject to DEWA's inspection, testing and final approval before connecting the electric supply. Contractors shall carryout inspection and testing of the entire electrical installation prior to requesting for DEWA inspection.

Following specific inspection examples as appropriate to the type of installation shall be refered:

a) Distribution equipment

- Security of fixing
- Insulation of live parts not damaged during erection
- Adequacy/ security of barriers
- Suitability of enclosures for IP and fire ratings
- Enclosures not damaged during installation
- Presence and effectiveness of obstacles
- Presence of main switch(es), linked where required
- Operation of main switch(es) (functional check)
- Manual operation of circuit-breakers and RCDs/ ELCBs to prove functionality
- Confirmation that integral test button/switch causes RCD(s) to trip when operated (functional check)
- RCD(s) provided for fault protection, where specified
- RCD(s) provided for additional protection, where specified
- Confirmation overvoltage protection/ Surge protection device (SPDs) provided where specified.
- RCD(s) provided for fault protection, where specified
- RCD(s) provided for additional protection, where specified
- Confirmation overvoltage protection/ Surge protection device (SPDs) provided where specified.
- Confirmation of indication that SPD is functional
- Presence of RCD quarterly test notice at or near the origin
- Presence of diagrams, charts or schedules at or near each distribution board, where required
- Presence of non-standard (mixed) cable colour warning notice at or near the appropriate distribution board, where required
- Presence of alternative supply warning notice at or near
    1. The origin
    2. The meter position, if remote from origin
    3. The distribution board to which the alternative/additional sources are connected

4. All points of isolation of all sources of supply

- Presence of next inspection recommendation label
- Presence of other required labelling
- Selection of protective device(s) and base(s); correct type and rating
- Single-pole protective devices in line conductors only
- Protection against mechanical damage where cables enter equipment
- Protection against electromagnetic effects where cables enter ferromagnetic enclosures
- Confirmation that all conductor connections, including connections to busbars, are correctly located in terminals and are tight and secure

b) Circuits

- Identification of conductors
- Cables correctly supported throughout
- Examination of cables for signs of mechanical damage during installation
- Examination of insulation of live parts, not damaged during erection
- Non-sheathed cables protected by enclosure in conduit, ducting or trunking
- Suitability of containment systems (including flexible conduit)
- Correct temperature rating of cable insulation
- Adequacy of cables for current carrying capacity with regard for the type and nature of installation.
- Adequacy of protective devices: type and fault current rating for fault protection
- Presence and adequacy of circuit protective conductors
- Coordination between conductors and overload protective devices
- Wiring systems and cable installation methods/practices with regard to the type and nature of installation and external influences
- Cables concealed under floors, above ceilings, in walls/partitions, adequately protected against damage.
- Provision of additional protection by RCDs/ ELCBs having rated residual operating current (IΔn) not exceeding 30 mA
    1. For circuits used to supply mobile equipment not exceeding 32A rating for use outdoors
    2. For all socket-outlets of rating 20A or less, unless exempt
    3. For cables concealed in walls at a depth of less than 50 mm
    4. For cables concealed in walls/partitions containing metal parts regard less of depth

- Provision of fire barriers, sealing arrangements so as to minimize the spread of fire
- Band II cables segregated/separated from Band I cables

- Cables segregated/separated from non-electrical services
- Termination of cables at enclosures
    1. Connections under no undue strain
    2. No basic insulation of a conductor visible outside enclosure
    3. Connections of live conductors adequately enclosed
    4. Adequately connected at point of entry to enclosure (glands, bushes etc.)

- Suitability of circuit accessories for external influences
- Circuit accessories not damaged during erection
- Single-pole devices for switching or protection in line conductors only
- Adequacy of connections, including CPCs, within accessories and at fixed and stationary equipment

c) Isolation and switching

- Isolators
    1. Presence and location of appropriate devices
    2. Capable of being secured in the OFF position
    3. Correct operation verified (functional check)
    4. The installation, circuit or part thereof that will be isolated clearly identified by location and/ or durable marking
    5. Warning notice posted in situation where live parts cannot be isolated by the operation of a single device

- Switching off for mechanical maintenance
    1. Presence of appropriate devices
    2. Acceptable location - state if local or remote from equipment in question
    3. Capable of being secured in the OFF position
    4. Correct operation verified (functional check)
    5. The circuit or part thereof to be disconnected clearly identified by location and / or durable marking

- Emergency switching/stopping
    1. Presence of appropriate devices
    2. Readily accessible for operation where danger might occur
    3. Correct operation verified (functional check)
    4. The installation, circuit or part thereof to be disconnected clearly identified by location and/or durable marking

- Functional switching
    1. Presence of appropriate devices
    2. Correct operation verified (functional check)

d) Current–Using Equipment (Permanently Connected)

- Suitability of equipment in terms of IP and fire ratings
- Enclosure not damaged/deteriorated during installation so as to impair safety
- Suitability for the environment and external influences
- Security of fixing
- Cable entry holes in ceilings above luminaires, sized or sealed so as to restrict the spread of fire
- Provision of undervoltage protection, where specified
- Provision of overload protection, where specified
- Recessed luminaires (downlighters)
    1. Correct type of lamps fitted
    2. Installed to minimize build-up of heat
- Adequacy of working space/accessibility to equipment

The inspection & testing certificate format shall be completed through the DEWA Getting Electricity online One Window System. The results include insulation resistance tests, continuity tests, earth electrode resistance tests, etc. as given in 'Inspection & Testing Certificate' in Appendix-3. Verification of the submitted test results will also be conducted during DEWA inspection.

1.13 MAINTENANCE, PERIODIC INSPECTION AND TESTING

Maintenance, periodic inspection and testing of every installation shall be carried out to ensure safety and satisfactory performance. The frequency of periodic inspection and testing of an installation shall be determined by the type of installation, its use ,operation, the frequency of maintenance and external influences to which it is subjected. Industrial and commercial

Installations shall at least be inspected every 2 years by an independent consultant/ contractor. the consultant/ contractor or person responsible for the maintenance, inspection and testing shall report to DEWA by writing any defects found in related parts of the existing installations and their rectification, together with a schedule of test result.

Following examples of items requiring inspection for an electrical installation status report can be referred, as applicable to the respective type of premises.

A visual inspection should firstly be made of the external condition of all electrical equipment which is not concealed.

Further detailed inspection, including partial dismantling of equipment as required, should be carried out as agreed with DEWA
These examples are given below:

a) Electrical intake equipment

- Main/ service cable
- Main Earthing arrangements
- Metering cabling
- Metering equipment

b) Automatic disconnection of supply

- Main earthing/ bonding arrangements
    1. Presence of installation earth electrode arrangement
    2. Adequacy of earthing conductor size
    3. Adequacy of earthing conductor connections
    4. Accessibility of earthing conductor connections
    5. Adequacy of main protective bonding conductor sizes
    6. Adequacy and location of main protective bonding conductor connections
    7. Accessibility of all protective bonding connections
    8. Provision of earthing/ bonding labels at all appropriate locations

c) Distribution equipment

- Adequacy of working space/accessibility to equipment
- Security of fixing
- Condition of insulation of live parts
- Adequacy/ security of barriers
- Condition of enclosure(s) in terms of IP rating etc
- Condition of enclosure(s) in terms of fire rating
- Enclosure not damaged/deteriorated so as to impair safety
- Presence and effectiveness of obstacles
- Presence of main switch(es), linked where required
- Operation of main switch(es) (functional check)
- Manual operation of circuit-breakers and ELCBs /RCDs to prove disconnection
- Confirmation that integral test button/ switch causes RCD/ ELCB(s) to trip when operated (functional check)

- RCD(s) provided for fault protection – includes RCBOs
- RCD(s) provided for additional protection, where required - includeing RCBOs
- Presence of RCD quarterly test notice at or near equipment, where required
- Presence of diagrams, charts or schedules at or near equipment, where required
- Presence of non-standard (mixed) cable colour warning notice at or near equipment, where required
- Presence of alternative supply warning notice at or near equipment, where required
- Presence of next inspection recommendation label
- Presence of other required labelling (please specify)
- Examination of protective device(s) and base(s); correct type and rating (no signs of unacceptable thermal damage, arcing or overheating)
- Single-pole switching or protective devices in line conductors only
- Protection against mechanical damage where cables enter equipment
- Protection against electromagnetic effects where cables enter ferromagnetic enclosures

d) Distribution circuits

- Identification of conductors
- Cables correctly supported throughout their run
- Condition of insulation of live parts
- Non-sheathed cables protected by enclosure in conduit, ducting or trunking
- Suitability of containment systems for continued use (including flexible conduit)
- Cables correctly terminated in enclosures
- Confirmation that all conductor connections, including connections to busbars, are correctly located in terminals and are tight and secure
- Examination of cables for signs of unacceptable thermal or mechanical damage/ deterioration
- Adequacy of cables for current-carrying capacity with regard for the type and nature of installation
- Adequacy of protective devices: type and rated current for fault protection
- Presence and adequacy of circuit protective conductors
- Coordination between conductors and overload protective devices
- Cable installation methods/practices with regard to the type and nature of installation and external influences
- Where exposed to direct sunlight, cable of a suitable type
- Cables concealed under floors, above ceilings, in walls/partitions less than 50 mm from a surface, and in partitions containing metal parts
    1. Installed in prescribed zones or
    2. Incorporating earthed armour or sheath, or run within earthed wiring system, or otherwise protected against mechanical damage by nails, screws and the like

- Provision of fire barriers, sealing arrangements and protection against thermal effects
- Band II cables segregated/ separated from Band I cables
- Cables segregated/ separated from non-electrical services
- Condition of circuit accessories
- Suitability of circuit accessories for external influences
- Single-pole switching or protective devices in line conductors only
- Adequacy of connections, including CPCs, within accessories and to fixed and stationary equipment-identify/ record numbers and locations of items inspected
- Presence, operation and correct location of appropriate devices for isolation and switching.
- General condition of wiring systems
- Temperature rating of cable insulation

e) Final circuits

- Identification of conductors
- Cables correctly supported throughout their run
- Condition of insulation of live parts
- Non-sheathed cables protected by enclosure in conduit, ducting or trunking
- Suitability of containment systems for continued use (including flexible conduit)
- Adequacy of cables for current carrying capacity with regard for the type and nature of installation
- Adequacy of protective devices: type and rated current for fault protection
- Presence and adequacy of circuit protective conductors
- Co-ordination between conductors and overload protective devices
- Wiring system(s) appropriate for the type and nature of the installation and external influences
- Cables concealed under floors, above ceilings, in walls/partitions, adequately protected against damage
    1. Installed in prescribed zones
    2. Incorporating earthed armour or sheath, or run within earthed wiring system, or otherwise protected against mechanical damage by nails, screws and the like

- Provision of additional protection by 30 mA RCD
    1. for circuits used to supply mobile equipment not exceeding 32 A rating for use outdoors
    2. for all socket-outlets of rating 20 A or less unless exempt
    3. for cables concealed in walls at a depth of less than 50 mm
    4. for cables concealed in walls/partitions containing metal parts regardless of depth

- Provision of fire barriers, sealing arrangements and protection against thermal effects
- Band II cables segregated/separated from Band I cables
- Cables segregated/separated from non-electrical services
- Termination of cables at enclosures - identify/ record numbers and locations of items inspected
    1. Connections under no undue strain
    2. No basic insulation of a conductor visible outside enclosure
    3. Connections of live conductors adequately enclosed
    4. Adequately connected at point of entry to enclosure (glands, bushes etc.)

- Condition of accessories including socket-outlets, switches and joint boxes
- Suitability of accessories for external influences
- Single-pole switching or protective devices in line conductors only
- Suitability of circuit accessories for external influences
- Adequacy of connections, including CPCs, within accessories and to fixed and stationary equipment-identify/ record numbers and locations of items inspected
- Presence, operation and correct location of appropriate devices for isolation and switching
- General condition of wiring systems
- Temperature rating of cable insulation

f) Isolation and switching

- Isolators
    1. Presence and condition of appropriate devices
    2. Acceptable location- state if local or remote from equipment in question
    3. Capable of being secured in the OFF position
    4. Correct operation verified
    5. Clearly identified by position and/or durable marking
    6. Warning label posted in situations where live parts cannot be isolated by the operation of a single device

- Switching off for mechanical maintenance
    1. Presence and condition of appropriate devices
    2. Acceptable location -state if local or remote from equipment in question
    3. Capable of being secured in the OFF position
    4. Correct operation verified
    5. Clearly identified by position and/or durable marking

- Emergency switching/stopping
    1. Presence and condition of appropriate devices
    2. Readily accessible for operation where danger might occur
    3. Correct operation verified
    4. Clearly identified by position and/or durable marking

- Functional switching
    1. Presence and condition of appropriate devices
    2. Correct operation verified

g) Current-using equipment (permanently connected)

- Condition of equipment in terms of IP rating, etc
- Equipment does not constitute a fire hazard
- Enclosure not damaged/deteriorated so as to impair safety
- Suitability for the environment and external influences
- Security of fixing
- Cable entry holes in ceiling above luminaires, sized or sealed so as to restrict the spread of fire
- Recessed luminaires (downlighters)
    1. Correct type of lamps fitted
    2. Installed to minimise build up of heat by use of "fire rated" fittings, insulation displacement box or similar.
    3. No signs of overheating to surrounding building fabric
    4. No signs of overheating to conductors / terminations

1.14 EXTENSIONS AND ALTERATIONS

The consumer shall not make any extensions or alterations to his electrical Installation without obtaining prior approval from DEWA

Application for Getting Electricity for additional load or modification shall be made on-line for every Project/ Installation whatsoever, large or small, new or additions, for provision of DEWA's supply lines and equipment, subject to terms and conditions issued by DEWA from time to time.

SECTION - 2
DEFINITIONS

Following definitions shall apply for the purpose of the regulation

Accessory: A device, other than current-using equipment, associated with such equipment or with the wiring of an installation

Active Power: The real component of the apparent power, expressed in watts / kilowatts / megawatts

Ambient temperature: The temperature of the air or other medium where the equipment is to be used.

Apparent Power: The product of voltage (in volt) and current (in amps), It is usually expressed in Kilovolt-Ampere (kVA) or Megavolt-ampere (MVA) and consist of a real component (Active Power) and an imaginary component (Reactive Power)

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

Arm's reach: A zone of accessibility to touch, extending from any point on a surface where persons usually stand or move about to the limits which a person can reach with a hand in any direction without assistance.

Back-up protection: Protection which is intended to operate when a system fault is not cleared or abnormal condition not detected in the required time because of failure or inability of other protection to operate or failure of appropriate circuit breaker.

Barrier: A part providing a defined degree of protection against contact with live parts from any usual direction of access.

Basic Insulation: Insulation applied to live parts to provide basic protection and which does not necessarily include insulation used exclusively for functional purpose.

Basic protection: Protection against electric shock under fault free conditions

Bonding conductor: A protective conductor providing equipotential bonding.

Bunched: Cables are said to be bunched when two or more are contained within a single conduit, duct, or trunking, or if not enclosed, are not separated from each other by a specified distance.

Bus bar trunking system: A type tested assembly, in the form of an enclosed conductor system comprising solid conductors separated by insulating material. The assembly may consist of units such as:

- bus bar trunking units, with or without tap-off facilities
- tap-off units where applicable
- Phase-transposition, expansion, building-movement. Flexible, end-feeder and adaptor units.

Cable cleat: A component of a support system, which consist of elements spaced at intervals along the length of the cable or conduit and which mechanically retains the cable or conduit.

Cable Ducting: An enclosure of metal or insulating material, other than conduit or cable trunking, intended for the protection of cables which are drawn in after erection of the ducting

Cable ladder: A cable support consisting of a series of transverse supporting element rigidly fixed to main longitudinal supporting members

Cable tray: A cable support consisting of a continuous base with raised edges and no covering. A cable tray is considered to be non-perforated, where less than 30% of the material is removed from the base.

Cable trunking: A manufactured enclosure for the protection of cables, normally of rectangular cross section, of which one side is removable.

Central Power system: A system supplying the required emergency power to essential safety equipment.

Circuit: An assembly of electrical equipment supplied from the same origin and protected against over current by the same protective devices.

Circuit breaker: A device capable of making ,carrying and breaking normal load current and also making and automatically breaking ,under pre-determined conditions, abnormal currents such as short circuit currents. It is usually required to operate infrequently although some types are suitable for frequent operation.

Circuit protective conductor (CPC): A protective conductor connecting exposed-conductive-parts of equipment to the main earthing terminal.

Conduit: A part of closed wiring system for cables in electrical installations, allowing them to be drawn in and/or replaced, but not inserted laterally.

Connector: The part of a cable coupler or of appliance coupler which is provided with female contacts and is intended to be attached to the end of the flexible cable remote from the supply.

Connection Point/Point of connection: is the location at which the renewable resource generating unit is connected to the network and where the main meter is installed.

Current carrying capacity of a conductor: The maximum current which can be carried by a conductor under specified conditions without its steady state temperature exceeding a specified value.

Current-using equipment: Equipment which converts electrical energy into another form of energy, such as light, heat or motive power

Demand Factor: Ratio of maximum demand of the system to the total connected load, demand factor will be equal to or less than 1.

Design Current (of a circuit): The magnitude of the current (r.m.s value for a.c) to be carried by the circuit in normal service.

Disconnector: A mechanical switching device which, in the open position, complies with the requirements specified for the isolating function.

Distribution board: An assembly containing switching or protective devices (eg. fuses, circuit breakers, and residual current operated devices) associated with one or more outgoing circuits, fed from one or more incoming circuits, together with terminals for the neutral and protective circuit conductors. It may also include signalling and other control devices. Means of isolation may be included in the board or may be provided separately

District Cooling System (DCS): A district cooling system distributes thermal energy, in the form of chilled water or other media, from a central source to multiple buildings or facilities through a network of underground pipes for use in space and process cooling. The cooling (or heat rejection) is usually provided from a central, dedicated cooling plant, which eliminates the need for separate systems in individual buildings. A district cooling system consists of three primary components: the central plant (which may include the cooling equipment, power generation and thermal storage), the distribution network, and the consumer system (typically comprising of air handling units and chilled water piping in the building).

Diversity Factor: Ratio of sum of individual maximum demands of the different type of load during a specified period to the maximum demand of the power station during the same period. Usually diversity factor will be greater than 1.

Double insulation: Insulation comprising both basic insulation and supplementary insulation.

Duct: A closed passageway formed underground or in a structure and intended to receive one or more cables which may be drawn in.

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

Earth electrode: A conductor or group of conductors in intimate contact with, and providing an electrical connection to earth.

Earth electrode resistance: The resistance of an earth electrode to Earth.

Earth fault current: A fault current which flows to Earth.

Earth fault loop impedance: The impedance of the earth fault current loop starting and ending at the point of earth fault. This impedance is denoted by the symbol Zs.

Earth leakage current: A current which flows to Earth, or to extraneous-conductive-parts, in a circuit which is electrically sound. This current may have a capacitive component including that resulting from the deliberate use of capacitors.

Earthing: Connection of the exposed-conductive-parts of an installation to the main earthing terminal of that installation.

Earthing conductor: A protective conductor connecting the main earthing terminal of an installation to an earth electrode or to other means of earthing.

Electric shock: A dangerous physiological effect resulting from the passing of an electric current through a human body or livestock.

Electrical installation: An assembly of associated electrical equipment supplied from a common origin to fulfil a specific purpose and having certain co-ordinated characteristics.

Electronic Ballast: A piece of equipment required to control the starting and operating voltages of fluorescent lights. Electronic lighting ballasts use solid state circuitry and can greatly reduce or eliminate any flicker in the lamps.

Emergency switching: An operation intended to remove, as quickly as possible, danger, which may have occurred unexpectedly.

Enclosure: A part providing protection of equipment against certain external influences and in any direction protection against direct contact.

Equipment: Any item for purposes such as generation, conversion, transmission, distribution or utilisation of electrical energy, such as machines, transformers, apparatus, measuring instruments, protective devices, wiring systems, accessories, appliances and luminaires.

Equipotential bonding: Electrical connection maintaining various exposed-conductive parts and extraneous conductive-parts at substantially the same potential.

Exposed-conductive part: A conductive part of equipment which can be touched and which is not a live part but which may become live under fault conditions.

External influence: Any influence external to an electrical installation which affects the design and safe operation of that installation.

Fault: A circuit condition in which current flows through an abnormal or unintended path. This may result from an insulation failure or a bridging of insulation. Conventionally the impedance between live conductors or between live conductor and exposed-or extraneous-conductive-parts at the fault position is considered negligible.

Fault current: A current resulting from a fault.

Final circuit: A circuit connected directly to current-using equipment, or to a socket-outlet or socket-outlets or other outlet points for the connection of such equipment.

Fixed equipment: Equipment designed to be fastened to a support or otherwise secured in a specific location.

Flexible cable: A cable whose structure and materials make it suitable to be flexed while in service.

Flexible cord: A flexible cable in which the cross-sectional area of each conductor does not exceed $4mm^2$.

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

Fuse carrier: The movable part of a fuse designed to carry a fuse link

Fuse element: A part of a fuse designed to melt when the fuse operates.

Fuse link: A part of a fuse including the fuse element(s), which requires replacement by a new or renewable fuse link after the fuse has operated and before the fuse is put back in to service

Green building (GB): Green building is an environmentally sustainable building, designed, constructed and operated to minimize the total environmental impacts.

Grid connection: The connection of a Renewable Resource Generating Plant (RRGP) to electric grid

Heating, ventilation, and air-conditioning (HVAC) system: The equipment, distribution systems, and terminals that provide either individually or collectively, the processes of heating, ventilating, or air conditioning to a building or a portion of a building.

Installed load: is the sum of the nominal power of all power consuming devices in the installation

Insulation: Suitable non-conductive material enclosing, surrounding or supporting a conductor.

Interface Protection: The electrical protection required to ensure that the generating plant or any generating unit is disconnected for any event that could impair the integrity or degrade the distribution network.

Inverter: Device which converts the direct current to alternating current.

Isolator: A mechanical switching device which, in the open position, complies with the requirements specified for the isolating function. An isolator is otherwise known as a disconnector.

Leakage current: Electric current in an unwanted conductive path under normal operating condition.

Live part: A conductor or conductive part intended to be energised in normal use, including a neutral conductor.

Lighting Power Density (LPD): The maximum lighting power per unit area.

Luminaire: Equipment which distributes, filters or transforms the light from one or more lamps, and which includes any parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves, and, where necessary, circuit auxiliaries together with the means for connecting them to the supply. For the purposes of the Regulations a lamp holder, however supported, is deemed to be a luminaire.

LUX: The international system unit of illumination, equal to one lumen per square meter.

LV switchgear and control gear assembly: A combination of one or more low-voltage switching devices together with associated control, measuring, signalling, protective, regulating

devices together with associated control, measuring, signalling, protective, regulating equipment, etc. completely assembled under the responsibility of the manufacturer with all the internal electrical and mechanical interconnection and structural parts. The components of the assembly may be electromechanical or electronic.

Main earthing terminal: The terminal or bar provided for the connection of protective conductors, including equipotential bonding conductors, and conductors for functional earthing, if any, to the means of earthing.

Maximum Demand: is the greatest of all demand which have occurred during a specified period.

Neutral Conductor: The conductor of a 3-phase 4-wire system or the conductor of a single phase installation which is earthed at the source of the supply.

Non-combustible: A non-combustible material is one which is not capable of undergoing combustion and satisfies the performance requirements complying with BS.476.

Nominal voltage: Voltage by which an installation (or part of an installation) is designated. The following ranges of nominal voltage (r.m.s values for a.c.) are defined :

- **Extra low:** Normally not exceeding 50 V a.c. or 120 V ripple free d.c., whether between conductors or to Earth,
- **Low:** Normally exceeding extra-low voltage but not exceeding 1000 V a.c. or 1500 V d.c. between conductors, or 600 V a.c. or 900 V d.c. between conductors and Earth.

The actual voltage of the installation may differ from the nominal value by a quantity within normal tolerances.

Occupancy Sensor: A device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

Overcurrent: A current exceeding the rated value. For conductors the rated value is the current-carrying capacity.

Overload current: An overcurrent occurring in a circuit which is electrically sound.

Peak Power (Wp): The output power achieved by a photovoltaic module under standard test conditions (STC). It is measured in Wp (Watt peak). The sum of the peak power of the photovoltaic modules of either a string or an array determines the peak power of the string and the array respectively (usually measured in KWp). The peak power of photovoltaic array at STC is conventionally assumed as the rated power of the array.

Plug: Accessory having pins designed to engage with the contact of a socket-outlet, and incorporating means for the electrical connection and mechanical retention of a flexible cable or cord.

Point (in Wiring): A termination of the fixed wiring intended for the connection of current-using equipment.

PVC (as insulation or sheath of cable): Polyvinyl Chloride.

Protective Conductor/Earth Continuity Conductor (ECC): A conductor used for some measures of protection against electric shock and intended for connecting together any of the following parts

i) Exposed-conductive-parts.
ii) Extraneous-conductive-parts.
iii) The main earthing terminal.
iv) Earth electrode(s).
v) The earthed point of the source, or an artificial neutral.

Protective earthing: Earthing of a points or points in a system or in an installation or in equipment for the purpose of safety.

Protective equipotential bonding: Equipotential bonding for the purpose of safety.

PV: Solar photovoltaic

PV a.c. module: Integrated module/invertor assembly where the electrical interface terminal is a.c only. No access is provided to the dc side.

PV Array: Mechanically and electrically integrated assembly of PV modules, and other necessary components, to form a dc power supply unit.

PV array cable: Out cable of PV array.

PV array junction box: Enclosure where PV strings of any PV array are electrically connected and where devices can be located.

PV Cell: Basic PV device which can generate electricity when exposed to light such as solar Radiation.

PV d.c main cable: Cable connecting the PV generator junction box to the d.c terminal of the PV Invertor

PV generator: Assembly of PV array.

PV generator junction box: Enclosure where PV array are electrically connected and where devices can be located.

PV installation: Erected equipment of PV power supply system

PV Invertor: Device which converts d.c voltage and d.c current in to a.c voltage and a.c current.

PV module: Smallest completely environmentally protected assembly of interconnected PV cells

PV string: Circuit in which PV modules are connected in series, in order for a PV array to generate the required output voltage.

PV String combiner box: A junction box where strings are connected which may also contain over current protection devices and/or switch disconnections.

PV string Cable: Cable connecting PV modules to form a PV string.

PV supply cable: Cable connecting the a.c terminals of the PV invertor to a distribution circuit of the electrical installation

Rate Current: Value of current used for specification purpose, established for a specified set of operating conditions of a component, device, equipment or system.

Reactive Power: The imaginary component of the apparent power expressed in KVAr or MVAr

Renewable Resource Generating plant (RRGP): Is a set of Renewable Resource generating units.

Refurbish: The substantial alteration of a building or building services to replace or improve the quality of the building. This may occur when a new tenant occupies the building or part of the building.

Renewable Resource generating Unit (RRGU): Is a Generating unit that produces power exclusively from renewable primary resources. This renewable resource generating unit can be part of a generating plant.

Residual current: The vector sum of the instantaneous values of current flowing through all live conductors of a circuit at a point in the electrical installation.

Residual current device (RCD): A mechanical switching device or association of devices intended to cause the opening of the contacts when the residual current attains a given value under specified conditions.

Residual current operated circuit-breaker with integral overcurrent protection (RCBO): A residual current operating device designed to perform the functions of protection against overall load and / or short-circuit.

Residual current operated circuit-breaker without integral overcurrent protection (RCCB): A residual current operated switching device not designed to perform the functions of protection against overload and / or short-circuit.

Residual operating current: Residual current which causes the RCD to operate under specified condition.

Resistance area (for an earth electrode only): The surface area of ground (around an earth electrode) on which a significant voltage gradient may exist.

Ring circuit: A circuit arranged in the form of a ring and connected to a single point of supply.

RRGP Electricity meter: is the electricity meter installed at the common output of all the generating units to measure the total energy produced by the Renewable Resource Generating Plant (RRGP)

Shock current: A current passing through the body of a person or livestock such as to cause electric shock and having characteristics likely to cause dangerous effects.

Short-circuit current: An overcurrent resulting from a fault of negligible impedance between live conductors having a difference in potential under normal operating conditions.

Short-circuit current under standard test condition, Isc STC: Short circuit current of a PV module, PV string, PV array or PV generator under standard test condition

Socket-outlet: A device, provided with female contacts, which is intended to be installed with the fixed wiring, and intended to receive a plug. A luminaire track system is not regarded as a socket-outlet system.

Space Factor: The ratio (expressed as a percentage) of the sum of the effective overall cross-sectional area of cables forming a bunch to the internal cross-sectional area of the conduit, pipe, duct, trunking or channel in which they are installed.

Standard test condition (STC): A standard set of reference conditions used for the testing and rating of photovoltaic cells and modules. The standard test conditions are;

a) PV cell temperature of 25°C;
b) Irradiance in the plane of the PV cell or module of 1000W/m²;
c) Light spectrum corresponding to an atmospheric air of 1.5.

Standby electrical source: Electrical source intended to maintain, for reasons other than safety, the supply to an electrical installation or parts or part thereof, in case of interruption of the normal supply

Stationary equipment: Electrical equipment which is either fixed, or equipment having a mass exceeding 18 kg and not provided with a carrying handle.

Switch: A mechanical device capable of making, carrying and breaking current under normal circuit conditions, which may include specified operating overload conditions, and also of carrying for a specified abnormal circuit conditions such as those of short-circuit. It may also be capable of making, but not breaking, short-circuit currents.

Switchboard: An assembly of switchgear with or without instruments, but the term does not apply to groups of local switches in final circuits.

Switchgear: An assembly of main and auxiliary switching apparatus for operation, regulation, protection or other control of an electrical installation.

Temporary electrical installation: Electrical installation erected for a particular purpose and dismantled when no longer required for that purpose.

Thermal Energy Storage (TES): The temporary storage of energy or heat in a thermal medium.

Wiring system: An assembly made up of cables or busbars and parts which secure and, if necessary, enclosed the cable or busbar

XLPE (as insulation of cable): Cross linked polyethylene.

SECTION - 3
DEWA INCOMING SUPPLY AND TARIFF METERING

3.1 GENERAL

3.1.1 Power supply from DEWA network shall be subject to terms, conditions, fees, tariffs and instructions issued by DEWA from time to time.

3.1.2 The details of nominal electric supply from DEWA and general requirements, for compliance, are specified in Section.1 of this Regulations.

3.1.3 Consumer shall, before commencement of building construction, obtain confirmation from DEWA on availability of power supply.

3.1.4 In general, where the total connected load exceeds 400 KW, provision shall be made within the building or plot for DEWA's substation. In some circumstances a substation may be required for connected loads less than 400 KW. These requirements shall be confirmed in the issue of DEWA's No Objection Certificate which shall be revalidated at the end of period specified by DEWA.

3.1.5 The consumer shall take all steps necessary to keep safe and protect DEWA's supply lines, equipment, metering, etc., provided for and/ or within the consumers' premises from tampering, steeling, unauthorised access or operation, etc., and shall immediately report any violation, defect or damage to any of DEWA's lines or equipment or metering.

3.2 POINT OF SUPPLY

3.2.1 The point of supply which defines the boundary of DEWA equipment, where electricity is made available to the consumer, shall be decided by DEWA. Point of supply shall be made available only at one location, within a plot/ project, unless otherwise approved by DEWA.

3.2.2 The circuit breaker/s and/or main distribution board/s provided at the incoming point of supply shall be designed and rated to suit particular applications and complying with Regulations specified under section 4 and 7.

3.2.3 The main circuit breaker/s at the point of supply (main switch) shall be marked as such and identifiable from other breakers to operate easily in an emergency. Where more than one incoming supply is available, in any premises, each 'Main Switch' shall be marked to indicate which installation or section of the installation it controls.

3.2.4 Where a main LV. distribution panel is connected directly to the low voltage side of the transformer, the main incomer circuit breaker proposed in the LV. panel is recommended

to be totally withdraw-able type 4-Pole type Air Circuit Breaker.

3.2.5 Where consumer's Main Low Voltage distribution board/panel is connected to DEWA's two or more distribution transformers, separate bus-sections with mechanically and electrically interlocked bus-section breakers/isolators (4-pole) shall be provided.

3.2.6 All incoming cable terminations/ Live connections in metering cabinets and other main and sub-main distribution boards shall be adequately shrouded and insulated.All exposed live terminal Connections and bus bars in any low voltage distribution board shall be shrouded and/or insulated.

3.2.7 Consumer's main & sub-main Panels/Distribution Board/s and final distribution boards shall all be installed in locations to which access is available at all times. A minimum space of 1500 mm shall be provided in the front and 750 mm on the sides, to permit safe operation, inspection, testing and maintenance, for cubicle type panels/switch boards. Panels with rear access doors shall have, in addition, a minimum space of 750 mm in the rear. The mounting height (to the top of the board/s) shall normally be 2 meters from the ground/floor level.

3.2.8 All Main Electrical switch rooms and other Sub electrical switch rooms in which capacitor banks are installed shall be air-conditioned. The non-air-conditioned electrical rooms shall be adequately ventilated and provided with necessary heavy duty exhaust fan/s and fire resistant/metallic louvered door/s, as applicable.

3.2.9 Door opening of electrical switch room shall be arranged outwards, be kept free from obstructions and shall not be open towards driveway, staircase, steps, etc.

3.2.10 Adequate level of illumination shall be provided to facilitate safe operation at all times. All electrical rooms shall be provided with safety and emergency fittings as specified under section 4 of this regulation

3.2.11 Incoming supply cable/s to the consumer's main Distribution Board/s shall be totally segregated and identified from the consumer's cables.

3.2.12 Termination of incoming supply cable at the Consumer's Metering Cabinet/Main Distribution Board (MDB) shall be carried out by consumer's contractor, in accordance with section 7 of this Regulation.

3.2.13 Electrical switch room shall not be located below/ beside wet areas such as bathrooms, toilet, kitchen, pantry, storage tanks, air conditioning chillers or other liquid/ hazardous materials or carry any water pipe installation within /on its wall.

3.2.14 Main electrical switch room shall be located near to the plot entrance, in ground floor area. Wherever substation is provided within the building, the main electrical switch room shall be provided in the ground floor area adjacent to transformer room .The dimensional layout of electrical switch room to be maintained as per Appendix-3 of this regulation.

3.2.15 The electrical switch room shall not be used for Storage of any equipment, material etc.

3.3 TARIFF METERING

3.3.1 For individual consumer premises, such as villas, farms, gardens, accommodation blocks etc. the metering cabinet, with main incomer circuit breaker and metering shall be installed outside, recessed, in the compound wall.

3.3.2 Minimum 2 meter clearance shall be maintained between electricity and water service cabinets/ points.

3.3.3 In multiple consumer premises such as residential/ commercial building, industries, large utility complexes, schools, etc. the main and sub-main distribution boards with associated metering shall be installed in separate electrical switch rooms, in locations close to the entrance boundary line and to which access is available at all times for operation, testing, inspection, maintenance and repair. Prior approval shall be obtained from DEWA as specified under Section 1 of this regulation, for every such premise.

3.3.4 All tariff metering will be smart meters, normally be provided by DEWA and restricted to one for each consumer installation, unless otherwise approved/ specified by DEWA.

3.3.5 The minimum space required for installation of KWH meter shall be 300 mm wide and 500 mm high.

3.3.6 A minimum space of 1200 mm shall be provided in the front of KWH meter cabinet/ meters.

3.3.7 The general arrangement and dimensional layout of the metering cabinets and array of meters installed in electrical switch room/s and enclosure along with associated wiring shall be subject to DEWA's approval. The typical arrangement of KWH metering cabinet/KWH meters is given, for guidance, in Appendix 3.

3.3.8 Metering by means of Current Transformers (CTs) shall be installed where the circuit breaker rating at the point of supply is 160 Amps and above. DEWA will provide the Smart kWh meter/s and associated CTs for all tariff metering. (In some circumstances consumer may be permitted to provide the KWH meter and CTs, complying with DEWA Smart

Meters Technical Specifications, as private check meters for energy monitoring purposes.) The basic data schedule for the smart metering is given in Appendix-4. The above meter and CTs shall be tested and calibrated by DEWA prior to installation at site. The CTs shall be located on the bus bars immediately after the circuit breaker/ isolator, where the complete installation is to be metered at. Removable links of adequate length shall be provided in the bus bar of each phase to enable easy maintenance and replacement of CTs. Three CTs shall be provided for each metering.

3.3.9 The Current Transformer of following Rated Transformation ratio shall be used as a standard requirement:

a) 200/5
b) 300/5
c) 400/5
d) 800/5
e) 1600/5
f) 2400/5

3.3.10 Each Current Transformer shall have the following markings:

a) Manufacturer's name and/or trade mark.
b) Rated primary current and secondary current.
c) Rated Frequency and primary maximum voltage.
d) Accuracy Class.
e) Rated output (VA).
f) Terminal (secondary winding) identification (S1, S2)
g) Power flow direction (P_1, P_2)

Manufacturer may include any other markings that he considers to be included.

3.3.11 Transparent viewing window shall be provided in all metering cabinets and doors of enclosures housing the meters with associated distribution switch gear, for facilitating meter reading.

3.3.12 All metering cabinets and enclosures shall be constructed from fire-resistant/ non-combustible material.

3.3.13 When meters are installed in electrical switch room/s, fire-resistant/non-combustible base plates shall be provided. Single core PVC or XLPE insulated & PVC sheathed cables to BS 6004 shall be used for connection to KWH meters, except when installed / segregated within separate metering cabinets.

3.3.14 All metering cabinets/compartments shall be provided with padlocking and wire-sealing facilities on their external door/cover which shall normally be of hinged type. Generally all apparatus, circuit breakers, isolators, bus bars, removable lid section of bus bar - trunking, etc., installed on the supply side of any DEWA's metering shall have provision for sealing by DEWA.

3.3.15 The metering section/compartment in all MDB/s and SMDB/s if and when incorporated within, shall completely be segregated from other sections/compartments.

3.3.16 For consumer premises with group of villas, space/provision shall be made for installing DEWA feeder pillars. Final location of such feeder pillars shall be finalized during estimation by considering cable route, cable route length, road crossing etc.

SECTION - 4
SELECTION OF CABLES, EQUIPMENT, MATERIALS & WIRING SYSTEMS

4.1 GENERAL

4.1.1 All equipment and materials used in electrical installations shall be of good quality. Complying with the relevant section/clause of this regulation as a minimum requirement.

4.1.2 Every item of equipment used in the installation shall be designed and rated for operations on the nominal electric supply voltage declared by DEWA.

4.2 CABLES AND CONDUCTORS

4.2.1 Selection

For general purposes and in normal situations PVC/XLPE insulated, stranded copper conductor cables complying with respective BS 5467, BS 6004, BS 6724, BS 7211, BS 7629, BS 7846, BS 7889, BS 8436 shall be used for all fixed wiring installation of buildings and other premises as applicable.

In flammable/explosive situations, the cables shall be mineral insulated copper sheathed complying with BS EN 60702.

Flexible cables and cords for use in electrical installation shall be PVC insulated and sheathed, stranded copper conductors complying with BS 6004/BS 6500.

Cables for connection between ceiling rose and lamp holder for pendant type light fittings and for enclosed luminaire shall be heat resistant silicone rubber insulated with stranded copper conductor complying with BS EN 50525.

For lifts and similar applications rubber insulated or PVC insulated flexible cables complying with BS EN 50214 shall be used.

KWH meter tails shall normally be single core PVC insulated and sheathed cables complying with BS 6004.

The cables used for control, relays, instrument panels, etc. shall comply with BS 6231.

Single core cables armoured with steel wire or tape shall not be used for ac circuits.

4.2.2 **Minimum Size of Conductors**

The minimum size of conductor used for lighting circuit shall be 2.5 mm^2 and 4 mm^2 for utility socket.

4.2.3 **Current rating, size and Voltage drop**

All cables shall be adequately sized to continuously carry the normal current of the individual circuits based on various laying conditions as applicable and the maximum ambient temperature (BS 7769).

Typical selection of the cables recommended as a minimum for general purpose applications, in the Emirate of Dubai, is given in Appendix.5, Tables 1,2 & 3.

The maximum voltage drop from the point of supply to any point/equipment, appliances and apparatus connected in the wiring installation shall not exceed 4% of the nominal voltage of the electric supply, unless otherwise specified.

4.2.4 **Colour Identification**

The colour identification of insulated cable cores of unarmoured, armoured and flexible cables and of Sleeve, band or disc of bare conductors shall be as given in Appendix. 6.

4.2.5 **Wiring Installations Exposed to High Temperatures**

Any part of the wiring installations such as the individual circuit cables, final connections to equipment, appliances and light fittings shall be suitably rated for their satisfactory performance at temperatures likely to be encountered, by providing heat resistant sleeves/beeds for individual cores and/or heat resistant cables.

The heat resistant sleeves and cables shall be rated for operating temperatures not less than 85^0C, particularly for end connections to luminaries with incandescent and halogen lamps and fixed heating appliances.

4.2.6 **Wiring Installations in Hazardous areas**

All light fittings & wiring accessories and other electrical equipment for use in potentially hazardous atmospheres shall be selected as per the guidelines specified in BS EN 60079.

4.2.7 **Load Balancing**

In all cases where three phase supply is availed, the various categories of connected load

such as lighting, socket outlets, water heaters, single phase air-conditioning units, equipment, apparatus, etc. shall be distributed and connected on Red, Yellow and Blue phases as evenly as possible, to ensure load balance between the phases at all distribution levels.

4.3 WIRING ACCESSORIES AND FITTINGS

4.3.1 Conduits and Fittings

PVC conduits and fittings used in building installation shall be from high impact rigid PVC complying with BS 4607, BS EN 60423 & BS EN 61386 , suitable for use at ambient temperature up to 48^{o} C. The material shall not soften or suffer structural degradation at a temperature of 70^{o} C and shall be non-hygroscopic, fire retardant.

Steel conduits and fittings shall comply with relevant specifications in BS EN 60423, BS EN 61386 and shall be hot dip galvanized to class 4 protection, both inside and outside. Flexible steel conduits and fittings shall comply with BS EN 61386. Conduit systems must be designed and installed so as to exclude moisture, dust and dirt. Small drainage holes must be provided at the lowest part of the system to avoid the accumulation of condensed moisture.

PVC conduits shall be provided with copper/brass terminals.

4.3.2 Trunking

Where applicable, surface and underfloor (duct) trunking and their fittings shall comply with BS EN 50085. Trunking and fittings shall be constructed of steel, hot dip galvanized, both inside and outside or non-combustible insulating material with removable covers. Installation of the trunking shall be carried out strictly as per the manufacturers' guidelines.

The protective conductor must run inside the trunking and not in parallel.

Internal fire barriers shall be provided where very long run trunking /cable tray crosses the floors /walls.

Small insulated cables shall not be installed in perforated trunking/cable trays.

Additional supports shall be provided where cable tray /trunking changes direction or cable drops out of the cable tray.

Refer section 6 of this regulation for installation details.

4.4 CABLE TRAYS & SUPPORTS

Steel cable trays, accessories and supports shall normally be hot dip galvanized or PVC coated and shall be either of the perforated type or ladder.

The cable trays shall have adequate strength and rigidity to support the cables installed. The trays shall be provided with upstands on both sides.

All fittings, bends, tees, elbows, couplers, etc. shall be of substantial sections and of the same quality as the trays. Cables shall be fastened securely by purpose made clips, cleats or saddles

Earth bonding shall be provided between sections / gaps in all cable tray/trunking runs and bolted connections.

Refer section 6 of this regulation for installation details.

4.5 LOW VOLTAGE SWITCHGEAR AND CONTROL GEAR ASSEMBLIES

4.5.1 Main & Sub-Main Distribution Boards

The Main & Sub-Main Distribution Board/s (MDB/s & SMDB/s) which are installed within the consumer installations shall be factory built assembly complying with relevant BS EN 61439/IEC 61439.

The assemblies shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stress as well as the effects of humidity which are likely to be encountered in normal service.

Apparatus forming part of the assembly shall have clearances, creepage distances and isolating distances complying with BS EN 61439/IEC 61439, maintained during the normal and relevant service conditions.

The phase bus bar, neutral bar and earth bar shall be of copper, colour identified as given in Appendix.6. The neutral bar shall be of the same cross section as the phase bus bar.

The Circuit Breakers, Bus Bars, etc. provided in the MDBs and SMDBs shall be designed and rated to suit individual applications at the site conditions. The details and parameters of the individual equipment & components in MDBs/SMDBs, in general, may be appropriately selected and specified as per the typical guidelines given in Appendix 7.

In general, a voltmeter (with R-Y-B 'OFF' selector switch) Ammeter (with CTs as applicable) Max. Demand indicator/recorder, P.F. meter, indicating lamps and associated protective

devices shall be provided in all MDB/s of 200 Amp. rating and above. Provision of these in SMDB/s is not precluded.

The switch gear, equipment and accessories shall generally comply with the standards specified in Appendix – 1, as applicable (BS EN 60670, BS EN 60898, BS EN 60947, BS EN 61439, IEC 61439).

4.5.2 Final Distribution Boards

The distribution Board/s (DB/s) installed for connection of the final Circuits within the electrical installations shall be factory built complying with BS EN 61439/IEC 61439. An integral isolator shall be provided for isolation of the incoming supply.

The circuit breaker accessories, etc. shall generally comply with the standards specified in Appendix.1.

Re-wirable type fuses shall not be permitted in any type of wiring installation. The details of parameters of the individual equipment & components in the DBs, in general, may appropriately be selected and specified as per the typical guidelines given in Appendix 8.

4.6 APPARATUS & ACCESSORIES

4.6.1 Switches

The switches provided for local isolation of electric supply to individual apparatus and/or circuits shall comply with BS EN 60669. The rating of the switches shall be selected based on individual applications, such as for resistive or inductive loads. The minimum current rating shall be 5 A.

For industrial use the switches shall be metal clad. Weatherproof switches shall be used for all outdoor installations.

Switches installed for control of discharge lighting shall have a current rating not less than twice the steady state continuous current of the circuits.

Gang switch with phase barrier inside the switch boxes shall be provided for large group of lighting.

Weather protected switches (IP55) shall be used for outdoor locations.

Gas sealed switches (BS EN 60079) shall be used for areas like battery rooms, gas storage areas etc, where there is high risk of fire or explosion

DP Switch with neon indicator shall be provided for appliances rated 20A and above, where visual indication of the presence of power is desired.

4.6.2 **Plugs and Socket-Outlets**

The single phase, plugs and socket-outlets used in domestic and commercial installations shall comply with BS 1363. The socket-outlets shall be shuttered, double pole, 3 pin flat with switch.

The 15A plugs and socket outlets used in domestic and commercial installations shall comply with BS 546

The shaver socket outlets shall comply with BS EN 61558 and with BS 4573 (in rooms other than bathrooms)

The 5A plugs and socket outlets for table lamps in hotel rooms which are switched from a dedicated lighting circuit must comply with BS 546

The industrial plugs and socket-outlets shall comply with BS EN 60309 and shall be with a switch, that is integrally built in or attached to it. The rating and type of socket-outlets with plugs provided shall be selected to suit individual applications and shall not be interchangeable for different current ratings.

Weather protected type (IP55) socket outlets must be used for outdoor locations.

4.6.3 **Cooker Control Units**

Every stationery cooking appliance in domestic premises shall be controlled by a cooker control switch complying with BS 4177, separate from the appliance and installed within 2 meters of the appliance. The cooking appliance shall incorporate an integral earthing terminal. The cooker control switch shall be 2 pole for 1-phase and 4 pole for 3 phase appliance and connected to a separate final sub-circuit from the distribution board, through 100mA ELCB.

Use of cooker control unit incorporating a general purpose socket - outlet shall be avoided, to allow grouping of socket-outlet circuits in separate 30 mA RCD/ELCB section.

Breaker rating and wire size for the cooker control unit is to be selected as per the connected load of the appliance.

4.6.4 **Household and similar electrical appliances**

The electrical appliances such as water heaters, cookers, hot plates, etc. which are used in consumer installation shall generally comply with BS EN 60335.

4.6.5 **Control of Water Heaters/ Sauna /Jacuzzi/ washing machines**

Double pole switches (with neon indicator) of appropriate rating shall be provided for control of water heaters / sauna / washing machines. The final connection to the equipment shall be made from a flex outlet plate mounted adjacent to the equipment. The control switch for water heater installed in a bath room or toilet shall be installed immediately outside the bathroom. The control gear for sauna shall be placed outside the sauna room / cabin.

Water heater / sauna / washing machines shall be connected to a separate final sub circuit from the distribution board. The heater shall incorporate an integral earthing terminal adjacent to the phase and neutral terminals. All terminals shall be housed in suitable recess with a splash proof removable cover. Every heater circuit shall be protected by 30 mA RCCB/ELCB.

4.6.6 **Control of Air Conditioning Unit/equipment**

A 15 Amp switched socket outlet shall be provided for room air-conditioners (window type) to connect units only with cooling capacity up to 18000 Btu/hour. Double pole switch, of appropriate rating, with flex outlet mounted adjacent to the unit shall be provided for control of other room air-conditioning units.

Each room air-conditioning unit shall be connected to a separate final sub circuit, from the distribution board.

A maximum of two air-conditioning units (window type) are permitted to connect on a single phase supply. Where three or more units are installed they shall be balanced as nearly as possible over a three phase supply.

Breaker rating and wire size for the air conditioning unit is to be selected as per the connected load of the appliance, subject to minimum 20 Amps with 4 sq. mm circuit wires.

4.6.7 **Extra Low Voltage Safety Apparatus**

The extra low voltage safety apparatus such as electric buzzers & bells, mirror lights & shaver socket outlets for installation in bathroom, light fittings for underwater installations, etc. shall incorporate appropriately rated double wound safety isolating transformer either integrally built-in or mounted separately, with cartridge fuse or MCB in the secondary circuit.

The safety isolation transformer shall comply with BS EN 61558. Segregation of low voltage and extra low voltage circuits shall be in accordance with section 7 of this regulation.

4.6.8 **H.V. Discharge Lighting Equipment**

Every High Voltage discharge lighting equipment & installations shall be rated for voltages not exceeding 5 KV, RMS to earth, measured on open circuit and shall comply with BS: 559.

H.V. discharge lighting equipment, including neon signs for advertising or any other purposes, shall not be installed without prior approval from DEWA.

4.6.9 **Safety and Emergency Light Fittings**

Safety lighting to meet operational requirements shall be provided to suit particular application such as industries, production lines, hospitals, utility complexes, stadiums, shopping centres, auditoriums, etc.

The source of supply for safety lighting shall be either maintained or non-maintained type as appropriate to suit individual applications.

All electrical switch-rooms and operational areas shall be provided with adequate number of emergency light fittings.

The safety and emergency light fittings installed shall comply with BS 5266 and shall be rated for a period not less than 3 hours continuous operation.

The light fitting/s shall normally incorporate necessary battery and charger within.

The safety light fittings shall also incorporate appropriate signs in Arabic and English such as 'EXIT' and directional arrows, as applicable to individual locations.

4.6.9 **Electric Motors and Starters**

Control of Electrical Motors shall comply with BS EN 60204, if the equipment is within its scope

Motor control circuits shall be designed so as to prevent any motor from restarting automatically after a stoppage due to a fall in or loss of voltage, if such starting is liable to cause danger. Where safety depends on the direction of rotation of a motor, provision shall be made for the prevention of reverse operation due to, for example, reversal of phases.

Every electric motor having a rating exceeding 0.37 kW shall be provided with control equipment incorporating means of protection against over load of the motor. Installation of 1-phase motors rated up to 3.7 KW (5HP) and 3-phase motors up to 110 KW (150 HP) only shall normally be permitted unless otherwise approved by DEWA. Where a large number of motors above 150 HP are proposed, the advice of DEWA shall be sought on availing a bulk supply.

All electric motors shall be adequately protected against overload, short circuit, earth leakage and additionally, against loss of one or more phases, voltage fluctuations, etc. as deemed essential to suit individual applications.

Starters shall be provided with overload relays of the thermal type with automatic compensations for variation in ambient temperature between 2.8 ^{o}C and 48 ^{o}C.

The starting equipment to limit the current may consist of any of the following type of device or other approved by DEWA.

a) Adjustable speed drive
b) Intelligent controllers

All motors shall be provided with an isolator, for isolating the motor from the supply during periods of inspection or maintenance. Such means of isolation shall effectively interrupt the supply on all phases. The isolator may be integral with the control gear or separate, but shall be in close proximity to the motor. An emergency stop pushbuttons shall be incorporated in the control gear.

When motor starting gear is energised from an auxiliary circuit, the circuit shall also be isolated during maintenance.

All starters, isolators and pushbuttons shall be clearly marked in Arabic and English stating which machine they control and their function. To avoid confusion, the words 'START' and 'STOP' and not 'OPEN' and 'CLOSED' shall be used.

Motors and their control gear shall be located in well ventilated areas with adequate space for operation, inspection and maintenance.

4.6.11 **Stand-by Generators**

Installation and connection of standby generators in the consumer's installation, for the purpose of maintaining power supply under mains failure conditions, shall be permitted only with prior approval from DEWA.

The change-over circuit breaker or isolator shall have 4 - Poles for 3 - Phase supply and 2 - Poles for 1 - Phase supply to ensure that the phases and neutral of the two systems remain separate and distinct.

The installation shall ensure that there will be no possibility of paralleling generator supply with DEWA supply under any circumstances or conditions.

Adequate mechanical and electrical interlock between the incomer circuit breakers or isolators of both generator and DEWA supplies shall be provided. The full details of the equipment, circuit and wiring diagrams, details of essential loads, etc. shall be submitted to DEWA for approval before commencement of the works.

Provision for connecting mobile generator for maintaining power supply under mains failure conditions, shall be provided in the MDB/LV panel with incomer rating 2500A/1600A. The circuit breaker must be 4- poles type with adequate mechanical and electrical interlock between the incomer circuit breakers of both mobile generator and DEWA supply.

The location of main Electrical room shall be near to the front entrance/approach road and sleeves are to be provided for intake generator cables. This provision is not mandatory for the main LV panel connected with standby generator in Auto/manual change over Mode.

4.7 ASSESSMENT OF CONNECTED LOAD AND MAXIMUM DEMAND

4.7.1 Lighting and small power circuits

All lighting and fan circuits shall generally be installed with maximum load per circuit within 2000 watts. The minimum size of the circuit wires/Earth continuity conductor (ECC) shall be 2.5sq.mm PVC CU with maximum circuit breaker protection 16Amps. A minimum of 100watts shall be considered for each normal lighting & fan point, if light fixtures are not selected at the design stage. Fluorescent lamps may be assessed as 1.8 times the lamp watts.

Wherever fittings with discharge light, compact fluorescent lamps or low volt lamps are installed, the circuit breaker rating, circuit conductor sizes and number of fittings may be suitably selected based on the actual load, including losses, for specific application. Prior approval from DEWA shall be obtained for every installation.

A radial final sub-circuit may be installed to serve a maximum of five 13 Amps, switched socket-outlets in rooms other than Kitchen and controlled by a 20 Amp., circuit breaker in the distribution board. A maximum of ten socket-outlets in rooms other than kitchen may be connected to a ring circuit, controlled by a 30 Amp. circuit breaker.

A current demand of 13 Amps shall be assumed for each 13 Amp. switched socket outlet circuit. A minimum of 200 Watts per point may be considered for each 13 Amps. Switched socket-outlet, installed for general utility purpose, other than kitchen. All twin socket-outlets shall be considered as two separate socket-outlet points, kitchen area may need separate circuits.

A current demand of 15 A shall be assumed for each 15 A switched socket-outlet circuit. However, for general purpose utility socket-outlets, an assumed load of 1000 Watts per socket-outlet installed in commercial and industrial premises and 500 Watts per socket-outlet in residential premises may be permitted.

For stationary appliance and equipment including air-conditioners, the actual load of each appliance and equipment shall be considered as connected load.

Current demand of point such as electric clock and other current using equipment of rating not greater than 5 VA may be neglected.

For multi consumer installation which include commercial type of premises such as Shops, Showrooms, Garages, Workshops, etc. where provision for connection of additional load may be required, the assumed connected load of each spare/space/circuit shall also be indicated in the load distribution schedules submitted for DEWA's approval.

4.7.2 **Maximum Demand**

All distribution boards shall be rated for total connected loads before a demand factor is applied.

The demand load of each final sub-circuit is determined by adding the actual or assumed load of individual points/appliance/equipment, whichever is higher. An allowance for diversity may be permitted where appropriate.

The details of load distribution schedules shall be submitted for DEWA's approval in the format given in Appendix 2,3&4. The total connected load of individual distribution levels/ circuits shall be determined as recommended under section 4 of this Regulation. An appropriate demand factor, worked out by a suitably qualified electrical engineer, shall be permitted; to determine the maximum demand at the main or sub-main distribution level.

The limit of 'Maximum Demand' in KW, permitted at Main Distribution Board (MDB) connected to DEWA's supply feeder/transformer for the distribution of normal residential and commercial premises without connecting large motor loads, is noted below for guidance.

a) 60 Amp Feeder - 30 KW
b) 100 Amp Feeder - 50KW
c) 125 Amp Feeder - 60KW
d) 160 Amp Feeder - 80KW
e) 200 Amp Feeder - 100KW
f) 300 Amp Feeder - 150KW
g) 400 Amp Feeder - 200KW
h) 1000 KVA Transformer - 800 KW
i) 1500 KVA Transformer - 1200 KW

DEWA Transformers supplying Motor / Air-conditioning loads with individual motor / compressor load not exceeding 100 KW shall normally be limited to the following connected load.

a) 1500 KVA Transformer - 950 KW
b) 1000 KVA Transformer - 650 KW

The limits of Total Connected Loads on DEWA Transformers supplying Motors /Chillers with individual load exceeding 100 KW shall be approved, taking in to consideration the technical specification of the equipment which includes the rating, type of starters, maximum starting current, no: of compressors / motors & its stages of operation, etc. to ensure the safety of both Transformers and equipment.

The overload protective device/incomer circuit breaker in the Low Voltage Panels / MDBs shall be suitably set at the corresponding design current.

Since maximum demand can vary on each type of project such as residential, commercial, industrial, etc., other methods, used by an installation designer with suitable degree of knowledge and experience of the diverse applications to a particular installation, is permitted. However, the design method and the proposed diversity at each level of the distribution shall be submitted and also clearly indicated in the design drawings and schedules submitted for DEWA's approval

SECTION - 5
EARTHING AND EARTH LEAKAGE PROTECTION

5.1 CONSUMER'S EARTHING SYSTEM

5.1.1 An earthing system should be of the highest integrity and of robust construction to ensure that it remains safe and will not endanger the health and safety of persons or their surroundings. Every consumer installation shall be provided with separate earthing system within the consumer's plot limits, installed and maintained by the consumer.

5.1.2 Each consumer's earthing system shall comprise of 'Earth electrode/s' main earth lead conductor connected between the 'Earth electrode/s' and the consumer's main earthing terminal/s or earth busbar, Earth continuity conductors (ECCs) shall be provided for every outgoing circuits from the main, sub-main & final distribution boards, equipotential bonding of all metal work & exposed conductive parts and enclosures, etc.

5.1.3 BS 7430 and IEC 60364 shall be referred for guidance.

5.1.4 Selection of the material for an earthing conductor should take into account the compatibility with the material of the earth electrode, and for a conductor installed in the grounds, the corrosive effect of the soil.

5.1.5 The consumer's earthing system shall be connected to DEWA earthing system (incoming supply cable armour/Earth continuity conductor, as approved by DEWA).

5.1.6 MV, LV, ELV Networks, Private Generators & Lightning Protections shall have separate earthing networks and shall not be connected with the main Electrical Earthing System

5.1.7 Earthing System in general must be of low electrical resistance,good corrosion resistance, able to dissipate high fault current repeatedly

5.1.8 An earthing system should be of highest integrity and of robust construction to ensure that it remains safe and will not endanger the health and safety of persons or their surroundings.

5.1.9 The Consumer main earthing connection shall be combined of TN-S system. The exposed-conductive-parts of all the electrical equipment of the installation shall be connected by means of circuit ECCs to the main earthing terminal. The earth fault loop impedance should be sufficiently low for the protective device (fuse, circuit breaker, RCD) to operate in the required time in event of fault to earth.

5.1.10 In all cases the Neutral and Earth Conductors shall be kept separate and not connected together at the main earth terminal or at any other point in the customers' installation.

5.1.11 Where a number of installations have individual earthing arrangements, any ECC common to these installations shall either be capable of carrying the maximum fault current likely to flow through them or to be earthed within one installation only and insulated from the earthing arrangements of any other installation.

5.1.12 Foundation metalwork in concrete may be used as a readymade and effective earth electrode. The total electrode area formed by the underground metalwork of large structure may often be used to provide an earth resistance lower than that obtainable by other methods; overall values well below 1ohm are obtainable. It is important that consideration is given to the possibility of corrosion of the metalwork reinforcement; the products of corrosion occupy a greater volume than the original metal and cracking might occur. In particular, continuous earth currents shall be given attention; a possible source of such current might be incompatible with other buried metalwork, including other types of earth electrode to which foundation metalwork may be bonded (It might be necessary to consider the need for cathodic protection. Damage to the concrete in the form of cracking, due to arcing or the rapid evaporation of moisture, can occur where the long-term duration earth fault currents exceed the carrying capability of the electrode. This situation is unlikely to arise if the electrode has a resistance sufficiently low to avoid dangerous voltages to earth .Where, in structures made of bolted sections, the electrical continuity of the structural joints cannot be relied upon to form permanent and reliable earth bonds it is necessary to install loops bonding across these joints.)

5.1.13 The use of water mains for earthing purposes shall not be permitted. In general, metallic pipes, e.g. for gas, oil, compressed air, or drainage, shall only be bonded to the protective conductors but not used for the sole means of earthing.

5.1.14 Earth electrodes shall not be installed close to a metal fence, unless they are used for earthing that fence; this is to avoid the possibility of the fence becoming live and thus dangerous at points remote from the substation, or alternatively giving rise to danger within the resistance area of the electrode by introducing a good connection with the general mass of the earth.

5.2 CONSUMER'S MAIN EARTH ELECTRODE

5.2.1 In general, minimum one Main Earth electrode shall be provided for each incoming point of supply/consumer's Main Distribution Board (MDB), within the consumer's premises. For installations with main incomer 200A and above, a minimum of 2 earth pits shall be provided.

5.2.2 The 'Earthig systems' shall consist of copper conductors, copper clad or austenitic steel rods of appropriate dimensions , set with driving pin and head driven to a minimum depth of 3 metres. The earth electrode shall be installed inside a 300 mm x 300 mm x 300 mm earth pit with inspection cover. The connection of the earthing conductor to the earth electrode or other means of earthing should be soundly made by the use of compound filled,Encapsulated

or substantial clamps of non-ferrous material (Uncoated buried copper is electro-positive to uncoated buried steel and when interconnected by a current-carrying conductor, these metals form an electrochemical cell that can cause accelerated corrosion of steel)

5.2.3 The consumer's 'Main Earth electrode' shall be installed as near to the main distribution board as possible. Wherever, more than one 'Earth electrode' is installed, within the consumer premises, these shall be spaced at minimum 6 metres apart. For load centers located laterally 50 meters or more from the main DBs, additional back-up earthing may be required near the same.

5.2.4 Chemical treatment of soil has environmental implications and should not be considered as a long term solution in order to meet a specified level of resistance, apart from the risk of corrosion to the earthling system. Coke breeze should also not be used due to its highly corrosive nature.

5.2.5 The main earth electrode resistance shall not exceed 1 ohm, for each incoming DEWA supply/MDB.

5.2.6 The resistance from any point of the Earth continuity conductor to the Main Earth electrode shall not exceed 0.5 ohm.

5.2.7 The consumer's earth electrode resistance and continuity of ECCs shall be periodically checked and maintained as above, to ensure consumer safety (BS 4444).

5.2.8 The lightning protection earthing shall be separate from the earthing of the incoming DEWA supply/MDBs and shall not be interconnected and a minimum distance of 7 meters shall be maintained between the earthing inspection pits.

5.3 EARTH CONTINUITY CONDUCTOR (ECC)

5.3.1 Every circuit in the Main, Sub-Main and final distribution boards shall be provided with a separate, green and yellow (G/Y), PVC insulated copper 'ECC'. The minimum size of ECCs shall be selected as specified in Appendix.9.

5.3.2 The ECCs shall be terminated at electrical equipment, apparatus and distribution switch gear, light fittings, mounting boxes of switches & socket-outlets, etc. with tinned copper lugs, as applicable, at both ends, on purpose made earth terminals.

5.3.3 All bus bar risers installed for electrical distribution in high rise buildings and other consumer installations shall incorporate an adequately sized 'ECC' either integrally within or run separately along the riser.

5.3.4 For guidance on the earthing and ECCs, BS 7430 shall be referred to.

5.3.5 Where conduit and trunking are used, a high standard of workmanship in installation is essential. Joints shall be made such that their current-carrying capacity is not less than that of the conduit itself. Joints shall also have the same properties, as regards to insulation, mechanical strength and protection, as those of the wiring system or conduit of which they are part.

5.3.6 All ECC shall be covered with Green &Yellow PVC insulation and terminated with purpose made lugs or fixings.

5.3.7 Where associated with circuits, all ECCs shall be labelled at their termination points with circuit identification numbers.

5.3.8 All circuit ECCs shall run alongside the associated phase and neutral conductor.

5.3.9 Gas pipes, oil pipes, metallic conduit, support wires or other flexible metallic parts, or constructional parts, shall not be used as an ECC.

5.3.10 ECC shall be suitably protected against mechanical and chemical deterioration and electrodynamics effects.

5.3.11 Where two ECCs are used, the ends of the ECC shall be terminated independently of each other at all connection points throughout the circuit, the distribution boards, junction boxes and socket outlets. This requires an accessory to be provided with two separate earth terminal.

5.3.12 Where the cable incorporates metallic armoring, this should be clamped to the cable gland. The main earth conductors should be so placed so that the metallic cable sheaths can be reliable and readily connected to it by bonds made of to the cable gland.

5.3.13 Earthing conductors shall be accessible for the connection of any detachable earthing devices used with the electrical equipment.

5.3.14 It is essential for the safety of personnel and plant that an earth system shall remain effective throughout the life of the plant. It is difficult in many cases to make a check of continuity after installation; the system should therefore be robust and protected from mechanical damage and corrosion where necessary.

5.4 EARTH LEAKAGE PROTECTION

5.4.1 The earth leakage protection shall be suitably designed and incorporated in each and every consumer installation (BS EN 61140, IEC 61140).

5.4.2 The Earth Leakage Circuit Breakers (ELCBs)/RCCBs shall generally comply with BS EN 61008, BS EN 61009. Recommended values of operating current of ELCBs/RCCBs are specified in Appendix.10.

5.4.3 Operation of the ELCBs/RCCBs, earth leakage detection system, etc. shall be periodically checked and tested to ensure consumer safety.

5.4.4 Earth Leakage sensors / relays with alarm/indicators shall be provided for Fire Pumps, Jockey pumps, Submersible pumps, Sump Pumps, or other essential circuit / equipment with sensor settings appropriate for providing warning before reaching the fault condition.

5.5 EQUIPOTENTIAL BONDING

5.5.1 All metal work of the consumer's installation, other than current carrying parts, including cable armour, metal conduits, metal cable tray & trunking sections, metal accessory boxes, exposed metal works of consumer's appliance, apparatus, equipment, machines, building structures, metallic enclosure and parts, metal water pipes, etc. shall be provided with equipotential bonding conductors.

5.5.2 The cross-sectional area of equipotential bonding conductors shall be selected as specified in Appendix.9.

5.5.3 A main protective bonding conductor shall have a cross sectional area not less than half the cross sectional area required for ECC of the installation and not less than 6mm2. The cross sectional area need not exceed 25mm^2 if the bonding conductor is of copper or a cross sectional area affording equivalent conductance in other metals

5.5.4 The equipotential bonding conductors shall be connected to the main earthing terminal within the consumer's wiring installations and the continuity shall be tested and maintained by the consumer.

SECTION - 6
INSTALLATION OF CONDUITS, TRUNKING, TRAYS & ACCESSORIES

6.1 TRUNKING AND CONDUITS

6.1.1 The type and material of the trunking and conduits shall be selected appropriately to suit individual site locations to comply with Regulations specified in clauses 4.3 under section 4.

6.1.2 The trunking and conduit wiring installations shall be carried out in a neat, orderly workmanlike manner with purpose made accessories such as inspection bends/tees, terminal/draw in boxes, etc.

6.1.3 As far as possible, the trunking and conduit runs from the electrical switch room/s to the individual consumer DB/s shall be routed only within common electrical service routes & riser ducts.

6.1.4 Long trunking and conduit runs from the electrical switch room/s located on ground floor to consumer DB/s located on upper floor/s shall be avoided and armoured cables shall be installed in cable trays.

6.1.5 Cable trunking may be used for housing single core PVC cables at special situations, where installation of conduits is difficult due to space limitations.

6.1.6 Trunking and wiring conduit installation which are surface exposed shall, as far as possible, have straight runs with branches at right angle only.

6.1.7 Draw-in boxes shall be provided in all straight conduit runs exceeding 15 meters. Conduit runs having '90o bends' shall be provided with draw in boxes for every 2 bends.

6.1.8 Trunking and conduit shall be completely installed before any cable is drawn in.

6.1.9 Draw-wires shall be provided in all concealed conduits (and ducts) with the ends left free at the outlet boxes for pulling the wiring cables.

6.1.10 All the trunking and conduit runs shall be free from sharp edges and burs throughout their lengths. Suitable grommets and bushes shall be provided at the terminal outlets.

6.1.11 The trunking and conduit runs shall be supported at regular intervals and the number of cables that may be installed in trunking shall suitably be selected as recommended in Appendix-11 & 12.

6.1.12 Every entry to trunking shall be placed so to prevent the ingress of water and all dead ends shall be closed. Only unbroken lengths of trunking shall be used for crossing partitions and walls.

6.1.13 Where cable trunking passing through walls, floors or other barriers it shall be provided with a continuous cover and an internal fire barrier where fire separation is specified for the premises.

6.1.14 Where a common cable trunking is used for housing both power and communication circuits, or for housing circuits operating at different voltages, the trunking shall be provided with separate compartments for the different types of circuits.

6.1.15 All bends, tees and other accessories of cable trunking shall be of substantial sections and of the same quality as the trunking itself.

6.1.16 The different sections of trunking shall be bonded by copper links although the trunking shall not be used as ECC.

6.1.17 Only galvanized steel or rigid, high impact, heavy gauge PVC conduit shall be used for any installation where conduits are to be installed.

6.1.18 The minimum internal radius of any bend or elbow fitting in a conduit shall be 2.5 times the diameter of the conduit.

6.1.19 All the terminal and intermediate ends of the PVC conduits shall be firmly secured with suitable adhesives as recommended by the manufacturer.

6.1.20 The circuit wires, bunched and installed in all vertical trunking runs shall be clamped/secured within the trunking at regular intervals, not exceeding 2 meters and at the terminal ends.

6.1.21 The standard conduit boxes, draw-in boxes and mounting boxes of light fittings and appliances shall be fixed to the building structure independently of the wiring conduits.

6.1.22 All exposed threads, tool-marks or visible damage to the protective finish of the steel trunking and conduits shall be coated with zinc rich paint immediately after installation

6.1.23 Suitable expansion couplers shall be provided in all trunking and conduit runs at the expansion joints in the building structure and at regular intervals in all runs exceeding 7 meters in length or as recommended by the manufacturer.

6.1.24 Suitable purpose-made boxes with adaptors, ceiling roses etc. shall be provided at all individual outlet points of the wiring installations.

6.1.25 Light fittings used with tungsten filament and halogen lamp shall be suitably segregated and supported from the PVC conduit and terminal outlet boxes to prevent deterioration due to associated high temperature rise.

6.1.26 The conduit runs which are concealed within the building structure such as in-floor, wall, roof, column etc. shall be provided with a minimum screed cover of 10 mm.

6.1.27 When the trunking and conduit runs are installed with chases in the building structure, they shall be firmly fixed at regular intervals with purpose-made crimpets and/or saddles.

6.1.28 The standard conduit boxes, draw-in boxes, floor-outlet boxes etc. shall be installed with its cover/lid flush with the outer finish of the building structure (BS 4662, BS 5733, BS EN 61535).

6.1.29 Only flush type switches, socket outlets and accessories shall be used for concealed wiring.

6.1.30 In surface mounted industrial installations and where situations subject to fire risk, only galvanised steel conduits shall be used. PVC conduits shall not be used for such applications.

6.1.31 Galvanised steel conduits shall not be used under floor tiles of buildings in concealed wiring systems embedded in walls or floors. PVC conduits shall be used for all such applications.

6.1.32 Where conduit and or conduit fittings are attached to switches, distribution boards, boxes or other equipment, smooth bore mail brass brushes and flanged coupling shall be used.

6.1.33 Except where provision is made for fastening, conduits shall be saddled to the structure of the building within 15 cms of each terminal angle box, bend or other conduit fittings, and at interval not greater than 1.5 meters couplings and through fittings, and at intervals not greater than 15 meters couplings, and through type draw boxes shall be counted as part of a straight run conduit.

6.1.34 Non - metallic conduit shall not be used where exposed to outside ambient temperature, where it may be affected by chemicals to cause deterioration in its construction, in plant rooms, lift motor rooms and lift shafts.

6.1.35 All conduit accessories shall be of substantial sections and of the same quality as the conduit itself.

6.2 FLEXIBLE CONDUITS

6.2.1 Flexible conduits shall not be used for fixed wiring installation in full.

6.2.2 The maximum length of a flexible conduit run shall be 2.5 meters

6.2.3 Metallic Flexible conduits may be used for connecting electrical motors and other equipment subject to adjustment of position and vibration to the fixed wiring

6.2.4 Flexible conduits shall only be run exposed and shall be so positioned that they are not susceptible to mechanical damage. Wherever necessary flexible conduits shall be adequately supported.

6.2.5 The end of flexible conduits shall be securely anchored to the fixed conduit or equipment to which it is attached by approved flexible conduit adaptors that maintain effective mechanical continuity securely in position without distorting it.

6.2.6 The flexible conduit shall not be used as part of the earth conductor. A separate earth conductor shall be installed to comply with the same requirements for rigid conduit installation.

6.3 CABLE TRAYS

6.3.1 Trays for supporting cables are recommended for use in warehouses, industrial plant and equipment room, cable trenches, shafts in buildings, etc.

6.3.2 The type and material of the cable trays shall be selected appropriately to suit individual site locations, and complying with Regulations specified under section 4 of this regulation.

6.3.3 The cable trays shall be supported at regular intervals with purpose made supports and the number of cables installed in the trays shall suitably be selected as recommended in Appendix-11 & 12.

6.3.4 Cable trays installed in outdoor locations, wherein the cables are exposed to the sun shall be provided with sun-shade covers, secured to the trays, with adequate ventilation and as recommended by the manufacturers.

6.3.5 Cables shall be fastened securely by purpose-made clips, cleats or saddles at spacing as recommended in Appendix-11. Cable ties shall not be used to support multicore cables installed on cable trays fitted vertically.

6.3.6 Cable trays shall not be used in locations where they will be subjected to severe physical damage.

6.3.7 Sufficient space shall be provided and maintained around cable tray to permit adequate access for installing and maintaining the cables.

6.3.8 Cable tray systems, cable ladder systems and their fittings shall comply with BS EN 61537.

6.3.9 Cable trays shall have adequate strength and rigidity to provide satisfactory support for the cables contained within them. All sharp edges, burrs and projection shall be removed and the tray shall be finished smooth to prevent injury to cables.

6.3.10 All cable trays shall be equipped with sides of adequate dimensions. All fittings, bends, tees, used shall be substantial sections and of the same quality as the tray itself.

6.3.11 Cable trays shall be installed as complete systems with bends and other accessories and each run of cable tray shall be completed before the installation of cables.

6.3.12 Metallic cable trays shall not be used as an ECC, although sections shall be bonded using copper links.

6.3.13 Cable trays shall be installed so as to provide ease of access to cables through the route.

6.3.14 Where cable tray passing through walls, floors or other barriers it shall be provided with a continuous cover and an internal fire barrier where fire separation is specified for the premises.

SECTION - 7
INSTALLATION OF CABLES, EQUIPMENT, ACCESSORIES AND WIRING SYSTEMS

7.1 ARMOURED CABLES

7.1.1 Armoured cables may be installed either directly buried in ground, drawn through ducts, laid in concrete trenches - cleated to wall, or mounted on cable trays.

7.1.2 Cables shall be installed & used in association with other equipment in accordance with BS 7671. In special environments the appropriate regulations and standards shall be observed.

7.1.3 The current carrying capacity of the cable/s shall be determined only after applying suitable correction factors based on the installation method of the cables

7.1.4 Cables shall be selected ensuring voltage drop within permissible limit as per Section 4 of this regulation.

7.1.5 Only armoured cables shall be used for underground installations. Precautions shall be taken to avoid mechanical damage to the cables before & during installation.

7.1.6 The armoured cables, for underground installation shall normally be laid at 90 cm below the ground level and provided with a layer of at least 15 cm impervious soil around. Where protective covers are required, they shall be carefully centred over the cables, throughout their length. The covers shall be of adequate width to protect the cables, with a minimum overlap of 50 mm on each side. Coloured PVC warning tapes shall be laid above the cable after filling, up to 30 cm below the ground level.

7.1.7 UPVC ducts with HD (Heavy Duty) manhole cover shall be provided for cables passing through drive ways/roads.

7.1.8 The routes of all cables shall be clearly marked by cable route markers/marking tape, at regular intervals not exceeding 10 metres along straight runs and 2 metres at deviations in the route. The route markers shall normally indicate the voltage level in Arabic and English.

7.1.9 Heavy duty conduit shall be provided for motor connections, external applications and locations subject to vibration, risk of mechanical damage or exposure to moisture.

7.1.10 Cables may be installed on cable trays at specific locations and as recommended under section 6 of this Regulations.

7.1.11 In the event of crossing or proximity of underground telecommunication cables and underground power cables, a minimum clearance of 100mm shall be maintained.

7.1.12 Minimum internal radius of bend for cable in fixed wiring installation shall not be less than 8 times the overall diameter of the cable.

7.1.13 No joints shall be permitted on any cable runs in Consumer's fixed wiring installation.

7.1.14 Where cables or wiring system passes through floor, wall, partitions or ceiling, the openings remaining after passage of the wiring systems shall be sealed to the degree of fire resistance required.

7.1.15 Cable glands used for armoured cables shall be of brass compression type, complying with BS 6121, with earth tag and PVC shroud.

7.1.16 All terminations of cable conductors shall be mechanically and electrically sound. Every termination shall be made by means of a terminal or compression type socket/lug, to the approval of DEWA, and shall not impose any mechanical strain on the terminal or socket/lug.

7.1.17 Separate Earth Continuity Conductors (ECCs) shall be installed and terminated for each feeder/circuit, as specified under Section 5 of this Regulation.

7.1.18 Single core cable shall be arranged in trefoil formation. Non-ferrous cable gland plate shall be used for termination of single core armoured cables. The armour shall be connected to earth.

7.1.19 No cables shall run in a lift or hoist shaft unless it forms part of the lift/hoist installation

7.2 DISTRIBUTION BOARDS

7.2.1 All distribution boards either main, sub-main or final DBs shall be installed in locations to which access is available at all times for operation, testing, inspection, maintenance and repair.

7.2.2 Main, sub-main or final Distribution Board/s shall not be installed within bath rooms, toilet, damp or wet locations, bed rooms, kitchen, above sinks, store rooms, high ambient rooms, dangerous or hazardous locations or below any stair case.

7.2.3 All main, sub-main and final distribution boards shall be selected and designed based on the guidelines specified under section 4 of this Regulations.

7.2.4 Each distribution board shall incorporate means for isolation of mains supply in the form of either circuit breaker or incomer isolator as applicable.

7.2.5 Every circuit breaker or fuse within the distribution board shall be identified and labelled to indicate the apparatus or circuit it controls.

7.2.6 Each final distribution board shall only supply the circuits in the same floor area, where the distribution board is located, except for specific applications such as stair case & common corridor-lighting in high rise buildings. Prior approval shall be obtained from DEWA for every application, as specified under Section 1 of this Regulation.

7.2.7 In multi consumer installation, such as commercial or residential buildings, the consumers' distribution board/s shall be installed within the respective consumers' premise (e.g. Shops, Flats, etc.) and shall be near to the entrance of the premise.

7.2.8 Incoming supply cable installed to any distribution board shall be totally segregated and identified from the outgoing circuit cables/wiring.

7.2.9 All distribution boards shall be installed flush or surface mounted at a height not exceeding 2 metres from the finished floor level to the top of the distribution board.

7.2.10 All Low Voltage panels of 1600Amps and above shall be of Form 4 type.

7.3 BUSBAR TRUNKING SYSTEMS (BUSWAYS /BUS RISERS)

7.3.1 Busways shall be permitted for installation only where adequate access is available for inspection and repair throughout their entire length.

7.3.2 The design, manufacture, testing and performance of the busbar trunking system shall be in accordance with the latest edition of BS EN 61439. IP rating shall be considered depending on the location of installation, indoor, outdoor, proximity to wet areas etc. (BS EN 60529).

7.3.3 Each piece of busbar trunking shall be tested before it leaves the factory for 3.5kV Dielectric test for 4 seconds & 1000V Megger test. Test certificates for the same shall be produced during DEWA inspection.

7.3.4 The busbars shall be totally enclosed in a non-ventilated, low impedance sandwich design. The busbar trunking shall be sandwiched throughout its entire length and shall not be flared at tap-points.

7.3.5 Before and after installation at sites, each piece and run of busbar trunking shall be Megger tested at 1000V.

7.3.6 Each busbar riser, proposed for installation in high rise buildings shall be designed to ensure reliability of power supply with maximum 12 floors interrupted during outage of the

respective busbar riser.

7.3.7 Connections to switchgear shall be with flanged end units of specific design and manufactured by the busbar trunking manufacturer.

7.3.8 The busbar trunking shall be properly aligned and securely fixed, not exceeding 1.5m (or as recommended by the manufacturer) centers with adequate support to take the weight of the busbar by means of galvanized fixing brackets; comprising hanger clamp, fixing channel and damping screw, supplied by the busbar trunking manufacturer. Additional supports shall be provided where required and as recommended by the trunking manufacturer.

7.3.9 The busbar trunking system including flanges, elbows, tap-off boxes, supports etc. shall be of the type, size and location as indicated in the DEWA approved drawings.

7.3.10 The busbar shall carry its rated current without exceeding 55°C over an ambient temperature of 50°C at 90% relative humidity in any plane without de-rating and without affecting the DEWA power supply requirements.

7.3.11 Wherever busbar trunking system is installed on the supply side of any DEWA's KWh metering, suitable provision for sealing by DEWA shall be made as specified under section 3 of this regulation.

7.3.12 The phase bus bar, neutral bar and earth bar shall be of copper, colour identified as given in Appendix.6. The neutral bar shall be of the same cross section as the phase bus bar.

7.3.13 The requirement of earth continuity conductor (ECC) and equipotential bonding shall be as specified under Section.5 of this Regulation.

7.3.14 Wherever the busway passes through the wall or floor, it shall be provided with fire barrier/sealing to the degree of fire resistance required.

7.3.15 The tap off unit installed at each floor level in a busbar riser shall be at a height between 50 cm and 180 cm from finished floor level and shall have adequate access for operation, maintenance and replacement.

7.4 WIRING SYSTEMS AND ACCESSORIES

7.4.1 Segregation of circuits, phases and wiring systems

7.4.1.1 All wiring and accessories shall be selected and installed to suit individual locations and complying with relevant Regulations specified in Section-4, in addition to the following requirements.

7.4.1.2 Circuits from different distribution boards shall not be installed in a common conduit or trunking.

7.4.1.3 The circuit wires of different voltage grades shall be segregated with barriers in trunking runs or installed in separate conduits.

7.4.1.4 The circuit wires of individual categories such as lighting, power, emergency, etc. shall be segregated with barriers in trunking runs or installed in separate conduits.

7.4.1.5 Where a residential premise is supplied with a three phase supply, as far as possible, the light fittings, socket outlets, water heaters, cookers and other single phase apparatus installed within any room shall not be connected to more than one phase. Wherever more than one phase cannot be avoided, a minimum distance of 2.0 metres shall be maintained between any outlets, accessory or appliance connected to different phases of the supply.

7.4.1.6 Where switch box contain more than one phase, for group switching, approved switch boxes with phase barriers shall be used and labelled to indicate that 400 Volts exists at the box. All circuit wires shall be colour identified as specified under section 4 in the regulation.

7.4.1.7 Where a wiring system is located in close proximity to non-electrical service, the wiring system shall be adequately segregated and protected against hazards likely to arise from the presence of the other service in normal use. Provision shall be made for safe and adequate access to all parts of the wiring system which may require inspection, maintenance or replacement.

7.4.1.8 Switches controlling light fitting, water heater, etc. shall not be installed in bathroom. In kitchen and in situations where water is regularly used, switches shall not be mounted within 2 metres of any water tap, wash basin or sink. If this is not possible ceiling mounted insulated cord operated switches shall be used.

7.4.1.9 No socket-outlet shall be mounted within 2 metres of any water tap, wash basin or sink in a kitchen. Socket outlets shall not be installed in bathrooms.

7.4.1.10 A track system for luminaires shall comply with the requirements of BS EN 60570.

7.4.2 **Mounting heights of accessories**

All lighting switches, D.P. switches of air conditioning units & water heaters, ceiling fan regulators, shaver socket outlets, etc., generally used in the electrical installation shall be mounted at 125cm from the finished floor level.

All switches shall be mounted in readily accessible positions.

13A switched socket outlets used for general purpose shall be installed at 45cm above the finished floor level. 13A switched socket outlet provided in the kitchen shall be generally at a height of 25cm from the work top.

All accessories shall be suitably selected and installed as recommended in Section-4 of this Regulations.

7.4.3 **Identification labels and notices**

In general all sections of the consumer installation, circuits, protection devices in the distribution boards, etc., shall be provided with suitable identification labels to clearly indicate the location and purpose of each item or circuit. Instructions or Caution notices for correct operation shall also be provided wherever there is a possibility of confusion. All labels may be in both English and Arabic and of letter sizes to suit individual application.

SECTION - 8
POWER FACTOR CORRECTION CAPACITORS AND UNDER VOLTAGE RELAYS

8.1 POWER FACTOR (PF) CORRECTION:

8.1.1 The power factor of every consumer installation shall be within the range of 0.9 lagging and unity (recommended value 0.95 lagging).

8.1.2 In general all Air-Conditioning units/plants/equipment, machines, motors, light fittings with discharge lamps/mercury vapour/sodium vapour/ fluorescent tubes, etc. for use in the Emirate of Dubai, shall be provided with capacitors or other approved means to achieve and maintain a power factor of 0.95 lagging or above, throughout their normal working range.

8.1.3 For commercial premises which requires DEWA service feeders of 200A and above, where individual load compensation cannot be achieved, overall compensation at main or sub-main distribution levels by incorporating capacitor banks with automatic regulated steps, shall be provided. For residential premises the limitation shall be 400A feeder.

8.1.4 The P.F. correction capacitor shall be dry, encapsulated, sealed type. (conform to IEC 61921)

8.1.5 Capacitors shall be enclosed or guarded to prevent accidental contact of conducting metal parts with exposed energised parts, terminals or buses associated with them.

8.1.6 The capacitors installed for P.F. correction shall be provided with means for its prompt automatic discharge immediately when the capacitor is disconnected from the source of supply.

8.1.7 The discharge circuit shall be either permanently connected to the terminals of the capacitor or capacitor bank, or provided with automatic means of connecting it to the terminals of the capacitor bank on removal of voltage from the line. Manual means of switching or connecting the discharge circuit shall not be permitted

8.1.8 The capacitors and associated components such as PF regulator, indicating instruments, contactors (of capacitor switching duty), control switches, etc. shall be designed and rated for operation on the electric supply and ambient conditions specified under Section 1 and selection details recommended in Section-4 of this Regulation. Capacitor units shall be designed for temperature class D.

8.1.9 The current carrying capacity of conductors that connect a capacitor to the terminals of a motor or to motor circuit conductors shall not be less than one third the current carrying capacity of the motor circuit conductors and in no case less than 1.5 times the rated current of the capacitor.

8.1.10 An over current device shall be provided in each circuit for each capacitor bank. A separate over current device shall not be required for a capacitor connected on the load side of a motor overload protective device. The rating or setting of the over current device shall be as low as practicable.

8.1.11 The capacitor banks installed for power factor correction, are major contributors to potential resonance. Such resonance conditions can magnify harmonic levels. Parallel resonance gives rise to a high impedance across the network and can cause voltage and current amplification. Network studies should be carried out to ensure the correct rating of capacitors and their operation without causing resonance. Mitigation measures shall be taken such as installing suitable harmonic filters or reactors. The capacitors shall be suitable for operation under harmonic current conditions. To minimise this risk of harmonic currents, harmonic filter reactors shall be provided in series with capacitors. Tuning of the capacitors, Harmonic filter reactors shall be made below the lowest harmonic order considered in the network.

8.1.12 The contactors used in the capacitor banks shall be able to withstand switching surges.

8.1.13 Suitable means shall be installed to isolate each capacitor, capacitor bank, or capacitor installation from all sources of voltage and to remove from service as unit.

8.1.14 All non-current carrying metal parts of capacitors shall be earthed as specified under Section 5 of this regulation.

8.1.15 Each capacitor shall be provided with a name plate indicating rated voltage, frequency, KVAR, number of phases, discharge device and name of the manufacturer.

8.1.16 The controls and protection device provided in the capacitor bank shall be checked and maintained regularly.

8.1.17 Wherever capacitor bank/panel is installed on the supply side of any DEWA's KWh metering, adequate sealing provision shall be made as specified under Section 3 of this regulation.

8.1.18 In premises, where capacitor banks are not installed and individual equipment are provided with suitable means for power factor correction, a power factor meter is to be provided in the Main Distribution Board (MDB) for displaying the power factor. If power factor deviates from the requirement customers shall arrange a PF correction equipment to maintain the power factor close to 0.95 lagging.

8.1.19 The capacitor bank panel shall be provided with a suitably rated main incomer isolating switch. This shall be a three-pole isolator or MCCB. The handle of the incomer isolator or MCCB shall be interlocked with the door to ensure that the capacitor bank is de-energised when the door is open.

8.1.20 Capacitor Banks shall be provided with forced ventilation and also use double enclosures ensuring adequate ventilation limiting the temperature rise for outdoor /open to sky area installations. Trip mechanism with alarm shall be provided to operate in case of failure of the ventilation/ excess temperature rise.

8.2 UNDER VOLTAGE (U.V.) RELAYS WITH AUTO-RESET TIMER

8.2.1 All air-conditioners or air-conditioning units/plants/equipment installed within the consumers' installation shall be provided with Under Voltage (U.V.) relays with fixed voltage cut off setting at 75% of the nominal supply voltage, within 0.2 seconds and auto-reset timer with adjustable time setting between 5 and 10 minutes.

8.2.2 The circuit breakers/contactors associated with the under voltage (UV) relays, shall have 'auto closing' facility (motorised operation) to restore supply to the chillers/air conditioning units, after normalization of supply voltage, when the relay is reset automatically.

8.2.3 The auto-reset timer of the U.V. relays shall be set at values specified in the schedules, approved by DEWA, to suit individual installation. Necessary provision for sealing may be incorporated in the relay to restrict access for adjustments of the setting.

8.2.4 The U.V. relays with auto-reset timer shall normally be incorporated within the respective air-conditioning unit/equipment or in their control panels. For normal air-conditioners, provision of U.V. relays with auto-reset timer within the consumers' distribution board shall be permitted for individual or group of units. Prior approval shall be obtained from DEWA on every such application.

8.2.5 The U.V. relays with associated controls shall be checked and maintained regularly.

SECTION - 9
CONSTRUCTION SITE INSTALLATIONS

9.1 GENERAL

9.1.1 Application for temporary power supply for construction purposes shall be submitted through online getting electricity, under category 'Construction Supply', well in advance of the power requirement.

9.1.2 Temporary power supply shall be permitted for construction purposes subject to terms, conditions, fees, tariffs and instructions issued by DEWA from time to time.

9.1.3 The consumer shall comply with the safety requirements specified for permanent installation, in addition to the specific requirements on installation at construction sites recommended in this section of the Regulations.

9.1.4 Every assembly for the distribution of electricity on construction sites shall comply with the requirements of BS 4363 and BS EN 61439.

9.1.5 Equipment shall be identified and be compatible with the particular supply from which it is energized and shall contain only components connected to one and the same installation.

9.1.6 Cable shall not be installed across a site, road or walkway unless adequate protection of the cable against mechanical damage is provided.

9.1.7 All cables used on construction sites shall have a metal sheath and/or armour which shall be effectively earthed and continuous.

9.1.8 Every wiring system shall be so arranged that no strain is placed on the terminations of conductors unless such terminations are designed for this purpose.

9.1.9 Each assembly for construction sites shall incorporate suitable devices for switching and isolation of the incoming supply.

9.1.10 Circuit breaker for isolating the incoming supply shall be suitable for securing in off position by padlock or the device shall be installed inside a lockable enclosure.

9.1.11 Safety and standby supplies shall be connected by means of devices arranged to prevent interconnection of the different supplies.

9.1.12 The metering cabinet, distribution board/s or any wiring installations, installed outdoor, shall be of weather proof type IP 65.

9.2 WIRING SYSTEMS AND DISTRIBUTION BOARDS

9.2.1 Cables which are not installed in conduit or trunking must be armoured and adequately protected against accidental or deliberate interference by persons and against the effect of weather.

9.2.2 A means of emergency switching shall be provided on the supply to all equipment from which it may be necessary to disconnect all live conductors in order to remove a hazard.

9.2.3 Equipment shall be located and adequate notices displayed so that emergency disconnection of the electricity supply can be effected without delay. Locking arrangements shall be such that these can be removed in an emergency (e.g. panic bar or keys available in break-out box).

9.2.4 Emergency power off facility shall be provided at a single location where more than one feeder is proposed and main distribution boards are installed at different locations.

9.2.5 Consideration shall be given to the use of a reduced voltage supply (RLV) for portable tools where there is a high exposure to potential damage or where persons are required to operate such equipment in confined spaces or other hazardous circumstances.

9.2.6 BS 7909 shall be referred for temporary electrical systems for entertainments and related purposes.

9.3 EARTH LEAKAGE PROTECTION

9.3.1 In addition to the over current and short circuit protection, every circuits shall be protected for earth leakage.

9.3.2 All final sub circuits connected to 13A switched socket outlets, portable tools or equipment shall be protected with ELCB/RCCB of rated operating current 30mA. 100mA ELCB/RCCB shall be provided for protection of other lighting circuits, fixed equipment, etc. unless otherwise specified.

9.3.3 Consumer shall check and test the earthing systems, operation of ELCBs/RCCBs, wiring installation, etc. regularly to ensure safety of the installation.

SECTION - 10
DISTRIBUTED RENEWABLE RESOURCE GENERATION (DRRG) SHAMS DUBAI

10.1 GENERAL

Connection of Solar PV Systems / Distributed Renewable Resource Generation (DRRG) to DEWA grid shall be subject to DEWA approval. Necessary guideline for DEWA specifications, acceptable standards, procedures and other requirements are published on DEWA website (Shams Dubai section) and updated from time to time, and form an integral part of this regulation.

Since solar energy is a form of renewable energy, which is clean, secure, and limitless and also it produces no emissions and does not affect the environment, DEWA encourage its customers to use solar renewable energy, reducing reliance on diminishing traditional sources of energy, such as gas, oil and coal, ensuring sustainability for future generations.

10.2 SYSTEM DOCUMENTATION REQUIREMENTS

Customers / Consultant and Contractors enrolled with DEWA for activities related to grid connected solar PV Systems (DRRG Solar PV Consultants and DRRG Solar PV Consultants Contractors, also referred to in the sequel as Solar Consultants and Solar Contractors)

Shall refer to DEWA guideline published on the DEWA website for this requirement. Application for Getting Solar Connection shall be submitted on-line and shall include the applicable documents as below:

- Basic system information
- System designer information
- System installer, Operation and maintenance information

10.3 WIRING DIAGRAM, DATASHEETS

A single line wiring diagram, annotated / table form, which include the below information (paragraphs 10.3.1 to 10.3.5) shall be uploaded along with DEWA application.

10.3.1 **Array - general specifications**

a) Module type(s)
b) Total number of modules
c) Number of strings
d) Modules per string

10.3.2 **PV String information**

a) String cable specifications – size and type
b) String fuse specifications (where fitted) - type and voltage/current ratings

10.3.3 **Array electrical details**

a) Array main cable specifications – size and type
b) Array junction box locations (where applicable)
c) D.C. isolator type, location and rating (voltage / current)

10.3.4 **Earthing & Overvoltage Protection**

a) Details of all earth / bonding conductors – size and connection points. To include details of array frame equipotential bonding cable where fitted.
b) Design verification and Details of any connections to an existing Lightning Protection System (LPS) or additionally provided LPS.
c) Details of any surge protection device installed (both on a.c. and d.c. lines) to include location, type and rating.

10.3.5 **AC electrical details, inbuilt and external protections**

a) A.C. isolator location, type & rating
b) A.C. overcurrent protective device location, type & rating
c) Residual Current Device location, type & rating

10.4 CONNECTION AGREEMENT

A connection agreement, as per the format published on the DEWA website, shall be signed by the final customer and uploaded before connection by the Solar Contractor (or Solar Consultant).

10.5 OPERATION & MAINTENANCE (O&M) CONTRACT

Solar Contractor (or Solar Consultant) shall upload copy of the O & M Contract signed by the final customer with a solar contractor through the on-line system prior to the connection.

10.6 INSURANCE

It is recommended to insure the solar generation system and a copy of the insurance contract shall be uploaded on-line for DEWA records.

10.7 LABELLING & IDENTIFICATION

The entire solar installation shall be provided with identification, which shall include the following:

a) All circuits, protective devices, switches and terminals shall be suitably labelled.
b) All D.C. junction boxes (PV generator and PV array boxes) shall be provided with caution labels indicating the risk due to duel source.
c) The main A.C. isolating switch shall be clearly labelled
d) A single line wiring diagram shall be displayed within the respective electrical rooms /panels.
e) Inverter protection settings & installation details as applicable shall be displayed.
f) The procedures for Emergency shutdown shall be displayed.
g) All signs & labels shall be suitably affixed and durable copies of all test and commissioning data shall be available with the customer.

10.8 METERING AND METER PROVISIONING

Contractor shall include provision like meter cabinet at easily accessible location for installing smart meters by DEWA, both for generation (PV generation check meter) and net metering purposes (Tariff meter).

10.9 INSPECTION & TESTING

DEWA will conduct verification and testing of the installation in line with the updated documents published on the DEWA website as 'DEWA Inspection & Testing Requirements for Distributed Renewable Resources Generators Connected to the Distribution Network'.

SECTION - 11
SUBSTATIONS AND HIGH VOLTAGE INSTALLATION

11.1 MV NETWORK DESIGN REQUIREMENTS & GUIDELINES (11KV)

11.1.1 Ring Supply consisting of two feeders (two-feed ring) is mainly granted for power supply as normal feeding arrangement. Three-feed ring arrangement may be adopted for cases where all MV switchgears/ RMUs are installed in one location to ensure the specific supply reliability.

11.1.2 For reliable power supply; N-1 offline criterion is considered. Hence, in case of power failure in one of the feeders, the other feeder should be capable to meet whole demand for maximum 6 hours duration.

11.1.3 DEWA standard 11 kV cable sizes are 3/C 300mm2 Copper XLPE, 3/C 240mm2 Copper XLPE, and 3/C 240mm2 Aluminum XLPE.

11.1.4 The maximum sustained load of 11kV feeder is 175A/3MW (for 300mm2 Copper XLPE cables – summer rating).

11.1.5 The maximum sustained load of 11kV feeder is 160A/2.7MW (for 240mm2 Copper XLPE cables – summer rating).

11.1.6 For bulk loads such as furnaces or district cooling requiring direct HV supply (private equipment's), space for metering units at client's premises/substation shall be considered. Necessary documents, drawings and SLD shall be submitted for comments/approval at design stage.

11.1.7 Single unit load demand shall not exceed the maximum sustained current of MV cable/feeder, which is maximum 175A/3MW for 11kV feeder.

11.1.8 Parallel operation of DEWA's MV feeders are not allowed at any circumstances, and accordingly proper interlocking (Electrical & Mechanical) shall be provided where required.

11.1.9 Standby generators are not allowed to operate in parallel with DEWA's network. Therefore, proper interlocking shall be provided where it is required.

11.1.10 The client should maintain power factor between 0.95(lagging) and unity at point of connection with DEWA's MV Network

11.1.11 The client should comply with DEWA's limits of maximum allowable motors' starting currents and corresponding maximum electrical power ratings for the motors as follow:

Motor Electrical Power Rating	Max. Starting Current*
Less than or equal 600 KW	6 X Full Load Current
Above 600 KW and up to 1200 KW	4 X Full Load Current
Above 1200 KW and up to 1800 KW	3 X Full Load Current
Above 1800 KW and up to 2400 KW	2 X Full Load Current
Above 2400 KW and up to 3000 KW	1.5 X Full Load Current

*Maximum permitted current per feeder during motor starting (including other running motors and loads) should not exceed 350 Amp at any circumstances.

11.1.12 Motor specification, starting method characteristics & specifications, number of motor starts per day & operation sequence, SLD drawings etc. shall be submitted for approval at design stage.

11.1.13 For loads that inject harmonics currents into DEWA's network, harmonic (voltage & current) study at point of connection is required and to be submitted for DEWA approval at the design stage, the client has to comply with DEWA's limits of Harmonic Emissions for voltage and current based on IEC 61000. Moreover, detailed specifications and size of equipment including harmonics spectrum shall be provided for DEWA approval.

11.1.14 Harmonics and Flickers site measurements shall be conducted by client after commissioning of project and report of measurements shall be submitted to DEWA. In case the measured values are exceeding DEWA's limits, the client should arrange for proper solution to reduce the harmonic emissions to the permissible limits.

11.1.15 Maximum allowable number of cables per trench for 11kV cables is 20 arranged in maximum two layers. (2.5 to 3-meter trench width on both sides of the road, close to 132/11kV S/S and 2.0/1.5 meters elsewhere depending on load distribution).

11.1.16 Clearance of minimum 2 meters shall be maintained between any MV cable trench and the surrounding heat sources such as 132kV cable trench.

11.1.17 Horizontal spacing between MV cables is 150mm (edge to edge for MV cables) and vertical spacing between layers is 100mm (edge to edge for 11kV cables).

11.1.18 Separate corridor shall be allocated for MV cable laying within project's premises along the road to ensure avoiding crossing between 132kV and MV cables.

11.1.19 Backfilling to be used for MV cables with soil resistivity below 1.6°C-m/W with the following conditions:

a) At maximum moisture content of 2% or less.
b) At 90% of compaction

11.1.20 Single line diagram illustrating the protection schemes along with relay setting calculation shall be submitted for comments and approval at design stage.

11.2 GENERAL REQUIREMENTS FOR SUBSTATION CONSTRUCTION WITHIN PRIVATE PLOT

11.2.1 The substation must be positioned in dedicated room or housing.

11.2.2 Basement substation should have transformer room in 1st basement only.

11.2.3 LV electrical room must be adjacent to substation room/space, if main panel is private.

11.2.4 Wet area above substation shall not be provided. In exceptional unavoidable situation DEWA shall be referred for specific advice refer Appendix. 13.

11.2.5 Single room substation clear height should be 3.7M (minimum) at ground floor. RMU room should have a clear height of 3.0m (minimum) in split/basement substation.

11.2.6 Transformer room height at basement should be 3.0m (minimum).

11.2.7 Finished floor level (FFL) of substation room is to be maintained 0.15m to 0.30m higher than the outside adjacent ground level (towards door side) refer Appendix 14 and 15

11.2.8 Level difference of transformer room at basement level is to be maintained between 0.075m to 0.15m higher than the outside adjacent ground level (towards door side).

11.2.9 Construction of the project should not be commenced prior to obtain the substation approval.

11.2.10 Pocket substations are not allowed to install at petrol station and inside the building.

11.2.11 No expansion joints are allowed in RMU/Transformer room and as well as roof of the room.

11.3 SUBSTATION LOCATION & ACCESS

11.3.1 Substation room/RMU room to be directly located on RTA/Public Road or Sikka.

11.3.2 In case Substation/RMU room is located on Sikka, the sikka should have a minimum clear width of 6.1m. However if the proposed RMU room location is less than 12m away from the main road then the sikka can be accepted with minimum clear width of 3.0m.

11.3.3 24 hours DEWA direct open to sky access from the plot limit to the Substation/RMU room (if setback confirmed in affection plan issued by competent authority) shall be provided.

11.3.4 In case of split room/basement room arrangement transformer room can be located on internal driveway having a clear 3.0m wide & 3.0 high and direct access from RTA road.

11.4 SUBSTATION TYPES AND AREA

11.4.1 Single Room Substation (RMU & Transformer in same room Ground Floor)

Area	33 m^2	For 1x1000/1500 KVA transformer (minimum width of 4.57m)
	55 m^2	For 2x1000/1500KVA transformers (minimum width of 6.1m)
	25 m^2	Extra space for every additional transformer
	10 m^2	Extra space required for four and above transformers (additional equipment's)

11.4.2 Split room Substation (RMU & Transformer In separate rooms Ground Floor)

RMU ROOM (Ground Floor)		
Area	9.0 m^2	• Minimum width of 3.0m towards door side • For one set of RMU controlling 2 Transformer
	7 m^2	Extra space for every additional RMU set
	10 m^2	Extra space required for four and above transformer with minimum width of 5 m (additional equipment's)

TRANSFORMER ROOM (Ground Floor)		
Area	21 m^2	For 1x1000/1500 KVA transformer (minimum width of 4.57m)
	21 m^2	Extra space for every additional transformer.
	42 m^2	For 2x1000/1500 KVA transformer (minimum width of 6.1m)

11.4.3 **Basement Substation (RMU room in Ground floor & Transformer room at basement level)**

RMU ROOM (Ground Floor)		
Area	9.0 m^2	• Minimum width of 3.0m towards door side. • For one set of RMU controlling 2 Transformer
	7 m^2	Extra space for every additional RMU set
	10 m^2	Extra space required for four and above transformer with minimum width of 5 m (additional equipment's)

TRANSFORMER ROOM (Ground Floor)		
Area	21 m^2	For 1x1000/1500 KVA transformer (minimum width of 4.57m)
	21 m^2	Extra space for every additional transformer.
	42 m^2	For 2x1000/1500 KVA transformer (minimum width of 6.1m)

11.4.4 **Open to sky (Private Panel – Dedicated Substation)**

Area	6.1m X 6.1m	(Open to sky) for 1x1000/1500KVA transformer & 1xRMU (Substation with extra-large kiosk)
Additional requirement	• Substation space should be open to sky and to be directly located along RTA/Public Road or Sikka. • LV Room must be adjacent to the substation room. • The height of the compound wall around the substation should not be more than 2.1m • Soak-away should be 3.66m (minimum) away from the substation.	

11.4.5 **Open to sky (Pocket Substation)**

Area	4.57m X 3.66m	(Open to sky) for 1 x 1000KVA
	6.1m X 6.1m	(Open to sky) for 2 x 1000KVA
Additional requirement	• Substation space should be open to sky and to be directly located along RTA/Public Road or Sikka. • Substation's side of size 4.57m or 6.1m should be along the RTA/Public road/service road. • Substation is suitable for releasing supply through individual feeders, each of 400A (maximum rating). • The height of the compound wall around the substation should not be more than 2.1m • Soak-away should be 3.66m (minimum) away from the substation.	

11.4.6 **DEWA Meter/Control room requirement for Direct 11kV Supply**

Area	29.16 m^2 (5.4 m X5.4 m)	• Regular type of RMU room made of block work and RCC slab for two numbers of 11kV feeders. • For every additional feeder approximately 8m2 extra space required.
	6.1m x 6.1m (open to sky)	• Open to sky with FGRP kiosk (to be supplied by DEWA) for two numbers of 11kV feeders. • For additional feeder same space required. • The height of the boundary wall (3 sides) around the RMU foundation substation shall be not more than 2.1m

11.5 SUBSTATION VENTILATION FOR GROUND FLOOR

11.5.1 Substation at ground floor must be naturally ventilated with minimum two side's ventilation with aluminum louver doors and fixed aluminum louvers.

11.5.2 Fixed aluminum louver window(s) should be at 0.6m above outside level.

11.5.3 Transformer room aluminium louver door size to be 3.05m x 2.75m (H). Door details shown in Appendix 16 and Appendix 17

11.5.4 RMU room aluminium louver door size to be 2.44m or 3.05m x 2.75m (H), Refer Appendix 16 and Appendix 17

11.6 FORCED VENTILATION(ONLY FOR BASEMENT TRANSFORMER ROOMS)

11.6.1 Must have minimum two side's ventilation with aluminum louver doors and fixed aluminum louvers window. Fixed aluminum louver window(s) should be at 0.6m above outside level.

11.6.2 Total minimum Grill area is 14.9 m2 for 1000kVA transformer and 18.6m2 for 1500kVA transformer.

11.6.3 Adequate independent mechanical ventilation to be provided as per requirements for transformer room at basement level by providing calculations supporting the adequacy of mechanical ventilation proposed for maintaining the ambient temperature in the substation at maximum of 55C° based on outside air temperature of 48C°. Refer Appendix 18.

11.7 METHODS OF EQUIPMENT TRANSPORTATION TO BASEMENT TRANSFORMER ROOMS

Transportation of Transformer(s) from the main road up to and from the transformer room is Client's responsibility	
Ramp	• The ramp should be straight with minimum width of 3.0 m and clear height of 3.0 m from main road up to Transformer room • Slope of the ramp to be maintained 1:10 (10%) (Maximum) and should be straight without sloped curves and speed breakers (bumps).
Slab cut out opening	• The cut out size to be (3.0 x 3.0 m) and to be adjacent to the main RTA/Public roadside • The area below the cut out at basement must be designated as loading / unloading bay • The area above the cut out is to be open to sky. If above-floor exists, then the clear height is to be maintained 7m (for the boom of the crane to transport the transformer etc.).

11.8 SUBSTATION CABLE ARRANGEMENT (SUBJECT TO DEWA DESIGN)

11.8.1 Cutout at 0.95m depth from outside level (towards road/sikka) should be provided for HV cable entry. Refer Appendix 15

11.8.2 Cable route/arrangement from plot limit to the Substation (if setback confirmed in affection plan issued by competent authority) to be through cable trench with removable slab as per section TT Appendix 19 or cable tray at high level basement.

11.8.3 Cable route/arrangement from RMU room to transformer room for split/basement substations to be through cable trench with removable slab as per section TT, Appendix 19 or cable tray at high level basement.

11.8.4 If cables not passing through traffic area, buried cables or cable ducts along with manholes at both ends can be considered.

11.8.5 Cable trench inside substation should have a clear depth of 0.95m from finished floor of substation. Refer Appendix 15

11.8.6 For basement/split substation, transformer room cable trench depth of 0.50m from finished floor can be considered.

11.8.7 For cable tray arrangement clear depth of 0.95m from finished floor of Substation up to bed of the tray with minimum clear depth of 0.45m between bottom of the slab and the bed of the tray.

11.8.8 Cable installation/maintenance space of minimum 1.2m to be provided at least one side in case of cable tray arrangement.

11.8.9 The cable tray should pass through public/open area and not through any closed area / room (there shall be no services, pipes, etc. below the cable tray).

11.8.10 Cable route from RMU to transformer room is preferred to be straight (Without turns / bends) (the bending radius to be considered R= 0.95m, if any)

11.9 DIRECT 11KV SUPPLY FOR HIGH - RISE TOWERS ABOVE 200M / INDUSTRIAL / PRIVATE LOAD

11.9.1 Intake Arrangement And Protection Requirements

11.9.1.1 Point of supply is the supply intake of MV switchgear for the project which is located adjacent to DEWA metering/control room.

11.9.1.2 Beyond point of supply all the equipment (like switchgear, transformer, cable etc.,) has to be procured, installed, commissioned, operated and maintained by the client of the project.

11.9.1.3 DEWA will not supply, operate or maintain any equipment to be installed above ground level.

11.9.1.4 All equipment (Circuit Breaker, Transformer etc.) procured by client shall have dual ratio (6.6/11kV) unless clearly advised by that it is 11kV.

11.9.1.5 All equipment shall be compliant with international standards (IEC standards).

11.9.1.6 Total losses of transformer shall not exceed 1.5% of rated capacity due to conservation reasons.

11.9.1.7 Incomer of the project shall be switchgear with circuit breaker, with E/F & O/C protection and shall be located adjacent to a DEWA meter/ Control room.

11.9.1.8 LV distribution shall comply with authority guidelines and standards.

11.9.1.9 Only Cast Resin transformers (fire resistant transformers) shall be allowed to be installed in residential / commercial buildings.

11.9.1.10 Technical Justification shall be submitted for availing direct 11kV supply to the high-rise building for locating transformers above ground level/s. This depends on the height of the building, size of load, type of load, etc. Normally, buildings of height 200m or above shall be considered for direct 11kV supply.

11.9.1.11 MV Switchgear shall be suitable for termination of 3x240 mm2 XLPE/PVC/SWA/PE Aluminum/ Cu Cable with heat shrinkable type cable terminations.

11.9.1.12 Termination at the private MV switchgear incomer shall be done by the consumer and terminations at DEWA RMU shall be done by DEWA.

11.9.1.13 Suitable protection and interlocking shall be provided to ensure that a private substation shall not have any negative impact on the DEWA system.

11.9.1.14 There shall be sufficient discrimination between DEWA protection and that of the private substation so that the protection at private substation operates earlier to the DEWA protection during fault.

11.9.1.15 Mechanical and electrical interlocks shall be provided so that the incomers shall not be paralleled. In substations with multiple switchboards, the interlock shall be extended to all the switchboards.

11.9.1.16 The drawings shall use ANSI standard codes for depicting protection relay functions as well as contain a legend.

11.9.1.17 The incomer protection relays shall comply with IEC 60255 and shall be supported by type test and guaranteed routine manufacture's works test certificates. Only certificates confirming that the relay has passed the type tests needs to be submitted to DEWA.

11.9.1.18 The over current relay shall operate correctly for fault currents up to 25 kA.

11.9.1.19 The instrument transformers shall comply with IEC 61869 and be supported by type test certificates and guaranteed routine manufacture's works test certificates. Only certificates confirming that the current transformers have passed the type tests needs to be submitted to DEWA.

11.9.1.20 The incomer current transformer shall be dimensioned so that the protection scheme will operate effectively for a fault current of 25 kA.

11.9.1.21 Reverse power protection shall be provided to ensure that in-feeds to faults within the DEWA 11 kV network are cleared within 3 seconds.

SECTION - 12
GREEN BUILDINGs REGULATIONS

12.1 COMPLIANCE REQUIREMENTS

All electrical installations shall comply with the requirement of the regulations, relevant to DEWA's technical specifications, latest edition of the IET wiring regulations, Green Building Regulations & Specifications (latest edition issued by Dubai Municipality-DM and DEWA) and any other regulations issued by DEWA from time to time. In case of contradiction, DEWA's regulations shall prevail, for the electrical installations.

12.2 SPECIFIC REGULATIONS APPLIED BY DEWA

Following specific clauses of Section 5 in the Green Building Regulations issued by DM is to be incorporated as applicable in the projects' electrical design.

12.2.1 Elevators and Escalators

Escalators must be fitted with controls to reduce speed or to stop when no traffic is detected. Escalators shall be designed with energy savings features as described below:

1. Reduced speed control: The escalator shall change to a slower speed when no activity has been detected for a period of a maximum of three (3) minutes. Detection shall be by photocell activation at the top and bottom landing areas.
2. Use on demand: The escalator shall shut down when no activity has been detected for a period of a maximum of fifteen (15) minutes. Use on demand escalators must be designed with energy efficient, soft start technology. The escalator shall start automatically when required; the activation shall be by photocells installed in the top and bottom landing areas.

   Elevators (lifts) must be provided with controls to reduce the energy demand. To meet this requirement, the following features must be incorporated in traction drive elevators:
3. Use of AC Variable-Voltage and Variable-Frequency (VVVF) drives on non-hydraulic elevators
4. Energy efficient lighting inside the elevator including controls to turn lights off when the elevator has been inactive for a period of a maximum of five (5) minutes

12.2.2 Lighting Power Density – Interior

The average Lighting Power Density for the interior connected lighting load for specific building types must be no more than the watts per square metre of gross floor area given in the Table.

Table – Building Exterior Lighting Power Density

Building Type	Maximum average Watts per square metre (W/ m2) across total building area
Commercial/Public: Offices, Hotels, Resorts, Restaurants	10
Educational Facilities	12
Manufacturing Facility	13
Retail Outlets, Shopping Malls , Workshop	14
Warehouses	8

Lighting Power Densities for building types not listed in the Table should be no greater than those values given in ASHRAE 90.1-2007 Table 9.5.1.or equivalent as approved by DEWA

12.2.3 Lighting Power Density – Exterior

The average Lighting Power Density for the exterior connected lighting load must be no more than the values given in the Table.

Table – Building Exterior Lighting Power Density

Building Type	Maximum Watts per square metre or linear metre
Uncovered parking lots and drives	1.6 W/m²
Walkways less than 3 metres wide	3.3 W/linear metre
Walkways 3 metres wide or greater	2.2 W/m²
Outdoor Stairways	10.8 W/m²
Main entries	98 W/linear metre of door width
Other doors	66 W/linear meter of door width
Open sales areas (including vehicle sales lots)	5.4 W/m²
Building Facades	2.2 W/m² for each illuminated wall or surface or 16.4 W/linear metre for each illuminated wall or surface length
Entrances and gatehouse inspection stations at guarded facilities	13.5 W/m²
Drive-up windows at fast food restaurants	400 W per drive-through

Lighting Power Densities for exterior areas not listed in Table should be no greater than those values given in ASHRAE 90.1-2013 or equivalent as approved by DEWA.

12.2.4 Lighting Controls

For buildings other than villas and industrial buildings:

a) Occupant Lighting Controls must be provided so as to allow lighting to be switched off when daylight levels are adequate or when spaces are unoccupied and to allow occupants control over lighting levels.
b) Common areas which are not regularly occupied, such as corridors and lobbies, should reduce lighting levels to no more than twenty five percent (25%) of normal when unoccupied.
c) It is recommended (optional) that, in offices, the artificial lighting in spaces within six (6) meters in depth from exterior windows must be fitted with lighting controls incorporating photocell sensors capable of adjusting the level of electric lighting to supplement natural daylight only when required. The combined artificial and daylight must provide an illumination level at the working plane between four hundred (400) and five hundred (500) lux. When there is a hundred percent (100%) daylight, the lux levels may exceed five hundred (500) lux.
d) In offices and education facilities all lighting zones must be fitted with occupant sensor controls capable of switching the electrical lights on and off according to occupancy, unless lighting is required for safety purposes
e) In offices, if the average design lighting power density is less than six (6) Watts per square meter of gross floor area (GFA), the control requirements of parts C and D of this regulation need not apply

12.2.5 Electronic Ballasts

For all new buildings, and for new light fittings in existing buildings, high frequency electronic ballasts must be used with fluorescent lights and metal halide of 150 W and less.

High frequency electronic ballasts must be labeled as conforming to an international standard approved by the DEWA / Dubai Municipality

12.2.6 Smart Electricity Metering

For all buildings, meters must be fitted to measure and record electricity demand and consumption of the facility as a whole and to provide accurate records of consumption (other than DEWA Tariff meter for the premises / tenant),

a) For all buildings with a cooling load of at least one (1) megawatt (MW) or gross floor area of 5,000 sq. metre or greater , additional electrical sub-metering (of tariff class accuracy) must be installed to record demand and consumption data for each major energy-consuming system in the building. At a minimum, all major energy consuming systems with a load of hundred (100) kilowatts (kW) or greater must be sub-metered.
b) The building operator shall be responsible for recording details of the energy consumption for the building and ensuring that major electricity uses are sub-metered. Records must be kept for five years.
c) Each individual tenancy in the building must have a sub-meter installed when a building tariff meter is not present. These sub-meters should only be for demand management and electricity cost allocation purposes.
d) Where a Building Management System (BMS) or Central Control and Monitoring System (CCMS) is installed, metering must be connected to allow real-time profiling and management of energy consumption.
e) All meters must be capable of remote data access and must have data logging capability and complying with DEWA smart meter technical specifications and communication specifications. All meters shall be approved by DEWA.
f) Virtual meters using run-hours are not acceptable as sub-meters.

12.2.7 Central Control and Monitoring System

For all buildings with a cooling load of one (1) megawatt (MW) or gross floor area of 5,000 sq.m or greater, the building must have a central control and monitoring system capable of ensuring that the building's technical systems operate as designed and as required during all operating conditions, and that the system provides full control and monitoring of system operations, as well as diagnostic reporting.

At a minimum, the system must control the chiller plant, heating, ventilation and air conditioning (HVAC) equipment, record energy and water consumption and monitor and record the performance of these items

12.2.8 On-Site Renewable Energy –Small to Medium Scale Embedded Generators

Connection of Distributed Renewable Resource Generation (DRRG) to DEWA grid shall be subject to DEWA approval. Necessary guideline for DEWA specifications, acceptable Standards, procedures, etc. will be published and updated on DEWA website from time to time.

All on-site generation equipment and connections must be approved by and meet the requirements of DEWA for connection, in compliance with the Regulations, specified under Section 10.

12.2.9 On-Site Renewable Energy - Outdoor Lighting

For all buildings where the light power density of external lighting exceeds that specified in Regulation 12.2.3, Building Exterior Lighting Power Density, any additional lighting load must be powered entirely through renewable electricity sources such as photovoltaic systems.

APPENDIX 1
REFERENCE STANDARDS

(Refer section 1 of Regulations)

All equipment, apparatus, materials and accessories complying with the updated relevant recommendations in the following standards/documents shall be deemed to satisfy the requirement of these Regulations, unless otherwise specified.

STANDARD	TITLE
BS 476	Fire tests on building materials and structures
BS 546	Specification. Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors
BS 1363	13 A plugs, sockets-outlets, connection units and adaptors.
BS 4177	Specification for cooker control units
BS 4363	Specification for distribution assemblies for reduced low voltage electricity supplies for construction and building sites
BS 4444	Guide to electrical earth monitoring and protective conductor proving
BS 4573	Specification for 2-pin reversible plugs and shaver socket – outlets
BS 4607	Non-metallic conduits and fittings for electrical installations. Specification for fittings and components of insulating material
BS 4662	Boxes for flush mounting of electrical accessories. Requirements and test methods and dimensions.
BS 5266	Emergency lighting.
BS 5467	Electric cables. Thermosetting insulated, armoured cables for voltage of 600/1000 v and 1900/3300 v

BS 5733	Specification for general requirements for electrical accessories.
BS 6004	Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting
BS 6121	Mechanical cable glands.
BS 6231	Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000 V for switchgear and controlgear wiring
BS 6500	Electric cables. Flexible cords rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments
BS 6724	Electric cables - Thermosetting insulated, armoured cables for voltages of 600/1000 V and 1900/3300 V, having low emission of smoke and corrosive gases when affected by fire
BS 7211	Electric cables. Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire
BS 7430	Code of practice for protective earthing of electrical installations
BS 7629	Specification for 300/500 V fire resistant electric cables having low emission of smoke ad corrosive gases when affected by fire. Multicore cables.
BS 7671	Requirements for Electrical Installations. IET Wiring Regulations
BS 7769	Electric cables- Calculation of the current rating

BS 7846	Electric cables. Thermosetting insulated, armoured, fire-resistant cables of rated voltage 600/1 000 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire. Specification
BS 6724	Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire. Specification
BS 7889	Electric cables. Thermosetting insulated, unarmoured cables for a voltage of 600/1000 V
BS 7909	Code of practice for design and installation of temporary distribution systems delivering a.c. electrical supplies for lighting, technical services and other entertainment related purposes.
BS 8436	Electric cables. 300/500 V screened electrical cables having low emission of smoke and corrosive gases when affected by fire, for use in walls, partitions and building voids. Multicore cables
BS EN 50085	Cable trunking and cable ducting systems for electrical installations
BS EN 50160	Voltage characteristics of electricity supply by public electricity networks.
BS EN 50214	Flat polyvinyl chloride sheathed flexible cables.
BS EN 50525	Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U).
BS EN 60079	Explosive atmospheres.
BS EN 60204	Safety of machinery
BS EN 60309	Plugs, sockets- outlets and couplers for industrial purposes

BS EN 60335	Household and similar electrical appliances. Safety.
BS EN 60423	Conduit systems for cable management. Outside diameters of conduits for electrical installations and threads for conduits and fittings
BS EN 60529	Specification for degrees of protection provided by enclosures (IP code)
BS EN 60570	Electrical supply track systems for luminaires
BS EN 60669	Switches for household and similar fixed electrical installations.
BS EN 60670	Boxes and enclosures for electrical accessories for household and similar fixed electrical installations.
BS EN 60702	Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V.
BS EN 60898	Specification for circuit- breakers for overcurrent protection for household and similar installations.
BS EN 60947	Low-voltage switch gear and control gear.
BS EN 61008	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs).
BS EN 61009	Residual current operated circuit- breakers with integral overcurrent protection for household and similar uses (RCBO's).
BS EN 61140	Protection against electric shock. Common aspects for installation and equipment
BS EN 61386	Conduit systems for cable management.
BS EN 61439	Low-voltage switchgear and controlgear assemblies.

BS EN 61535	Installation couplers intended for permanent connection in fixed installations
BS EN 61537	Fasteners.
BS EN 61558	Safety of power transformers. Power supply units and similar.
IEC 60038	IEC standard voltages
IEC 60255	Measuring relays and protection equipment
IEC 60364	Low voltage electrical installations
IEC 61000	Electromagnetic compatibility (EMC)
IEC 61140	Protection against electric shock - Common aspects for installation and equipment
IEC 61439	Low-voltage switchgear and control gear assemblies.
IEC 61869	Instrument transformers
IEC 61921	Low-Voltage power factor correction capacitor banks.

NOTE:

BS - British Standards
IEC - International Electro technical Commission
BS EN - British Standard European Norm

APPENDIX 2

(Refer Section 1.7 of Regulations)

PROJECT: VILLA/BUILDING/..... **DETAILS OF CONNECTED LOAD, MAX. DEMAND & kWh METERING** AREA:..... .....

PLANNED COMPLETION DATE:..... OWNER:..... PLOT No.:.....

LVP/MDB/SMDB.....(.....OF.....) CONSULTANT:..... LOCATION OF LVP/MDB:.....

CIRCUIT/ FEEDER SMDB/ DB NO.	SP/ TP	ACB/ MCCB/ ISOLATOR RATING (AMPS)	FAULT DUTY kA	CABLE SIZE, TYPE AND NO. OF CORES			ECC SIZE 1C, mm^2	LENTH OF CABLE (Mtrs.)	CONNECTED LOAD (KW)			TOTAL CONN-ECTED/ INSTALLED LOAD (TCL) * KW	MAX. DEMAND/ OPERAT-IONAL LOAD (MDL) KW	PROPOSED TYPE & No. OF kWh METERS			REMARKS
				NO. OF CORES 1C/2C/ 4C	TYPE XLPE/ PVC/ SWA	SIZE			R-PH KW	Y-PH KW	B-PH KW			1-PH (1)	3-PH (2)	* LV/ HV CT (3)	
INCOMER																	
OUT GOING:																	
MDB CONNECTED TO:DEWA LV DB/Transformer SMDB CONNECTED TO: MDB..... TOTAL CONNECTED LOAD PER PHASE:☛																	☛TOTAL

DEMAND FACTOR ..... MAX. DEMAND .....KW * OVERALL TOTAL CONNECTED/INSTALLED LOAD (TCL).....KW Total Build-up area.....

CONSULTANT/CONTRACTOR:..... TEL:..... FAX:.....

* TCL – shall include all loads proposed to be installed including standby, spare and future load provisions.

Type of Meter (Rating of Incomer) : (1) Up to 60A (2) Up to 125A (3) LV CT..../...A /HV CT ..../..A (* 200/5Amps CT Metering)

(1 Phase) (3 Phase)

CL MD 29.03.2012.dar

App. No. E/F.....

PROJECT: VILLA / BUILDING / .....

LOCATION OF DB : .....

DB No.: .....

LOAD DISTRIBUTION SCHEDULE

(1 - Phase)

FED FROM: MDB / SMDB ..... / METER ENCLOSURE

RATING OF INCOMER	RATG. OF ELCB	SL. No.	CIR No.	MCB RTG. IN AMPS	CCT WIRE SIZE mm²	ECC WIRE SIZE mm²	ROOM/ AREA	CONNECTED LOADS/POINTS													WATT/ UNIT	LOAD PER CIRCUIT - WATT			REMARKS
								LTG	C. FAN	EX. FAN	SH. S/O	13 A S/O	W/H	H/D	COO-KER	15 A S/O	'W' A/C	'S' A/C	WAT. PUMP				R	Y	B	
		1	C1																						
		2	C2																						
		3	C3																						
		4	C4																						
		5	C5																						
		6	C6																						
		7	C7																						
		8	C8																						
		9	C9																						
		TOTAL																							

CABLE SIZE: 1 X 2/3/4C ..... mm² CU.PVC/XLPE/SWA/PVC + 1 X 1C, ... mm² CU. PVC, ECC
OR
CABLE SIZE: 2 X 1C. ..... MM² CU. PVC + 1 X 1C, ... MM² CU. PVC, ECC

C. FAN = Ceiling Fan , EX. FAN = Exhaust Fan , SH. S/O = Shaver' Socket - outlet, W/H = Water Heater, H/D = Hand Dryer, 'W' = Window type & 'S' = Split type

APPENDIX 2

(Refer Section 1.7 of Regulations)

APPENDIX 2

(Refer Section 1.7 of Regulations)

PROJECT: VILLA / BUILDING / ..... LOCATION OF DB: .....

DB NO. : ..... (Sh ..... of .....)

LOAD DISTRIBUTION SCHEDULE

(3 - Phase)

FED FROM: MDB / SMDB ...../ METER ENCLOSURE

RATING OF INCOMER	RATING OF ELCB	SL. NO.	CIR NO.	MCB RTG IN AMPS	CCT WIRE SIZE mm^2	ECC WIRE SIZE mm^2	ROOM/ AREA	CONNECTED LOADS/POINTS												WATT/ UNIT	LOAD PER CIRCUIT - WATT			REMARKS
								LTG	C. FAN	EX. FAN	SH. S/O	13A S.S/O	W/H	H/D	COO-KER	15A S.S/O	'W' A/C	'S' A/C	WAT. PUMP		R	Y	B	
		1	R1																					
		2	Y1																					
		3	B1																					
		4	R2																					
		5	Y2																					
		6	B2																					
		7	R3																					
		8	Y3																					
		9	B3																					
		10	R4																					
		11	Y4																					
		12	B4																					
		13	R5																					
		14	Y5																					
		15	B5																					
		16	R6																					
		17	Y6																					
		18	B6																					
																				TOTAL				

CABLE SIZE:1 X 2/3/4C .... mm^2 Cu./PVC-XLPE/SWA/PVC + 1 X 1C, ... mm^2 Cu, G/Y PVC,ECC

O R

CABLE SIZE:2/4 X 1C, ... mm^2 Cu. PVC + 1 X 1C, ... mm^2 Cu. G/Y, PVC,ECC

C. FAN = Ceiling Fan, EX. FAN = Exhaust Fan, SH. S/O = `shaver' socket - outlet, W/H = Water Heater, H/D = Hand Dryer, `W' = Window type & `S' = Split type.

APPENDIX 2

(Refer Section 1.7 of Regulations)

DETAILS OF MAXIMUM CURRENT ON TRANSFORMER WITH CHILLER/MOTOR LOADS

PROJECT: ..... OWNER:..... Plot No..... Area : .....

LV Panel No. ..... Rating: .....

Sr. No.	Type of Load (Chiller Motor, etc.,)	kW	No. of compressors per Chiller	Starting Current of one compressor/Motor and duration	Running Current of one compressor/Motor	Full Load Current with all compressors/Motors running + other loads (Amps)	Max. current when largest compressor starts + all other compressors/motors and other loads running (Amps)	Remarks (Model No., Make, type of starter, etc.,)
Total								

Consultant: …….. Tel.:…….. Fax :……

Signature and Stamp

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APPENDIX 3
INSPECTION & TESTING CERTIFICATE

(Refer section 1.12 of Regulations)

I being the person responsible from "---------- (company Name) ----------" for the inspection & testing of the electrical installation ,particulars of which are submitted to DEWA and approved under Reference "----------" having exercised reasonable skill and care when carrying out the inspection & testing hereby CERTIFY that the works for which my company is responsible is to the best of my knowledge and belief in accordance with the DEWA approved documents and regulations and also the relevant clauses of the latest IET (The Institute of Engineering and Technology) Wiring Regulation.

1. The minimum value of insulation resistance measured using test voltage 500 Volts D.C is ------- M. Ohms, from the below tests (Any surge protective devices or other equipment are likely to influence the verification test or be damaged shall be disconnected before the test).

    - Between phase conductors.
    - Between phase conductor and the protective conductors connected to the earthing arrangement.
    - Between phase and neutral conductors.
    - Between protective conductors and with phases and neutral together.
    - Separation of live parts from those of other circuits and earth (protection by electrical separation /SELV/PEL as applicable).

2. The maximum value of electrode resistance to earth, measured individually is -------- Ohm.
3. Continuity of each protective conductors are verified and found correct.
4. Continuity of ring circuits including protective conductor of 13 amps switched socket outlets are verified and found correct.
5. Verified that every single pole control and protective device is connected to phase conductors only.
6. Wiring of all socket outlets and similar accessories are verified and found correct.
7. Verified that lamp holders have the outer or screwed contacts connected to the neutral conductor.
8. All barriers, degree of protection of enclosures (IP rating, etc.) are verified and found to be correct.
9. Visual verification and tests on all the ELCBs are performed and found to be correct.
10. Under Voltage (UV) Relays with associated contactors /motorized breakers are verified and found to be correct.
11. Power factor correction means/equipment, etc. are verified and found correct.

12. Verified all terminations, connections, color identifications, circuit identifications, caution labels, notices, operating Instructions, and found to be correct.
13. All equipment, fittings, accessories, conductors, circuit breakers, etc., are verified for correctness as per approved drawings and specifications and found to be correct.

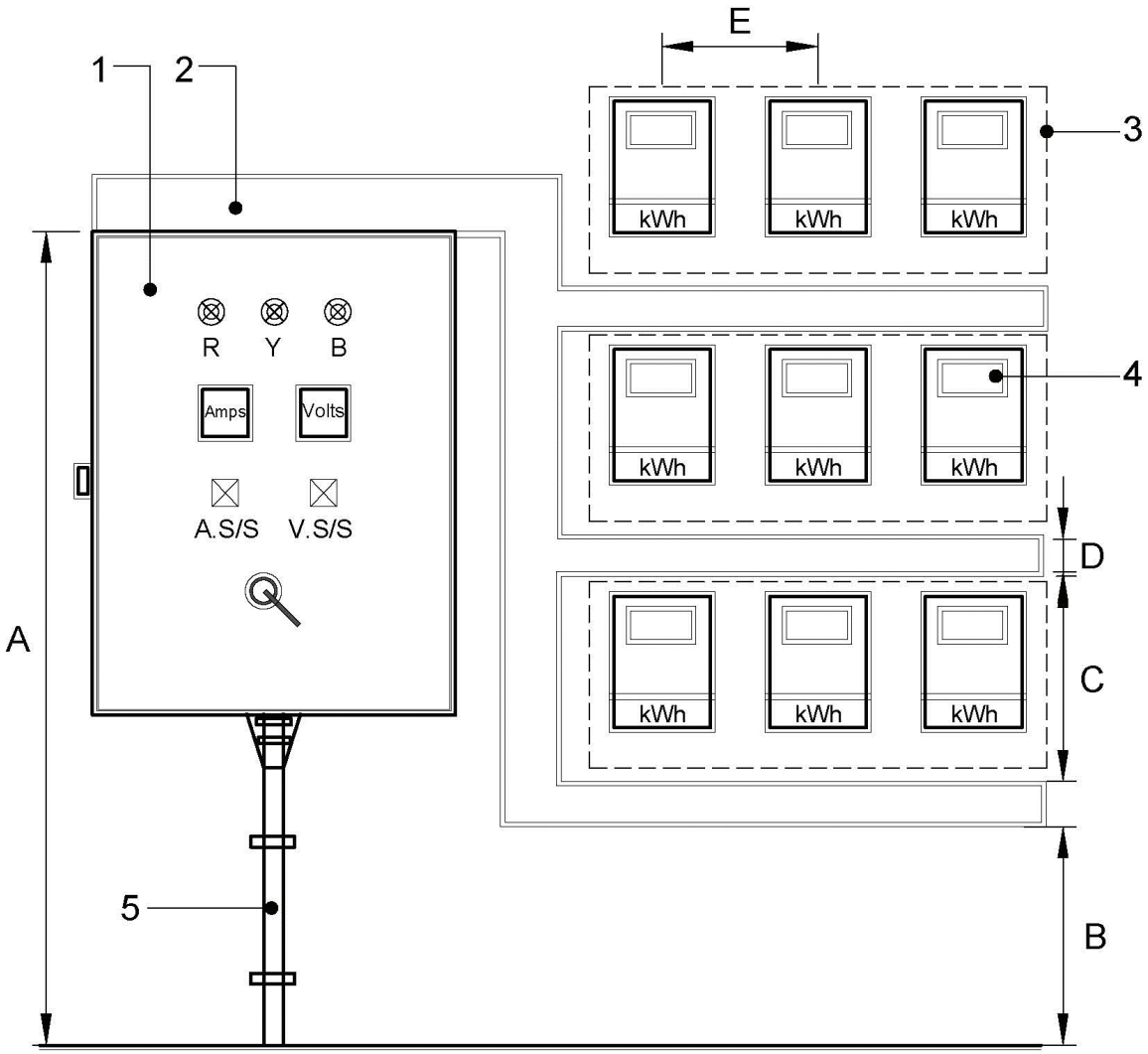
The above inspection & testing is conducted by me /under my supervision on dates from: ---------- to ----------

By submitting this inspection and testing certificate through DEWA on-line system I acknowledge that this document will be treated as a signed inspection & testing certificate from me and my company.

Inspection & testing certified by: _____
Company: _____
Telephone: _____
E-mail: _____

APPENDIX 3
A-TYPICAL ARRANGEMENT OF kWh METERS IN ELECTRIC SERVICES ROOM

(Refer to sections 3 & 6 for regulations)



Dimensions in cm				
A	**B**	**C**	**D**	**E**
180	60 (Min.)	50	10	30

Description :

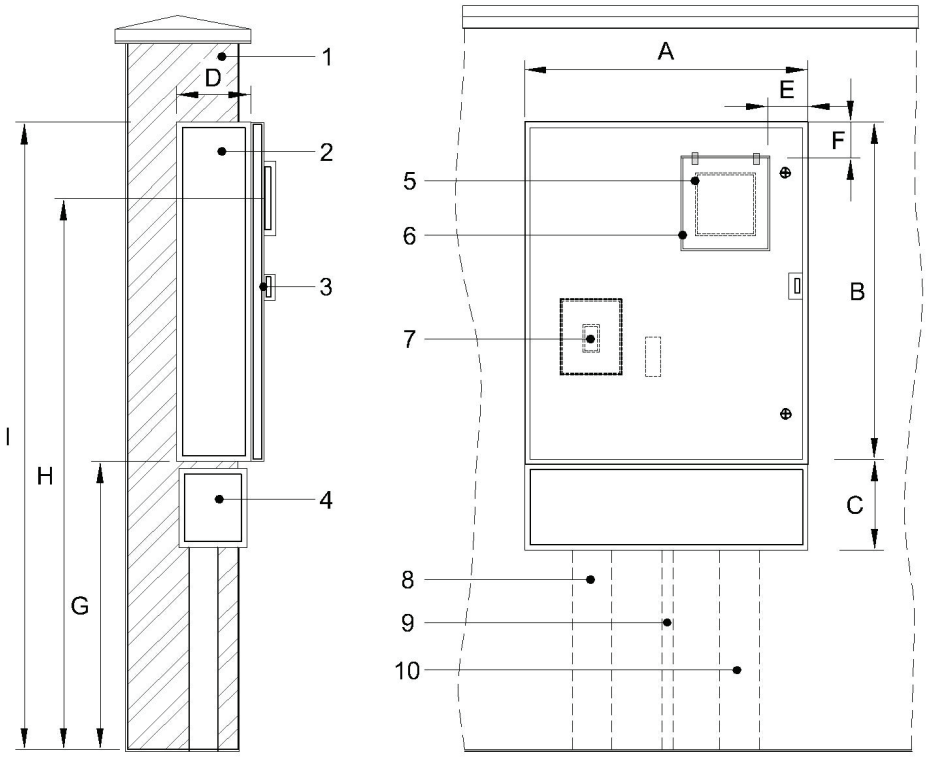
1) Main / Sub-main Distribution Board
2) PVC / GS trunking
3) Non-combustible type board / plate for fixing kWh meters
4) kWh Meter
5) Supply Cables

Notes :

- Layout indicates only the minimum space, maximum number of rows and arrangement, etc. of kWh meters.
- Earthing details, outgoing circuits & conduit terminations, etc. are not indicated.
- Minimum 2 mtr. clearance shall be maintained between electricity and water service cabinets / points.

APPENDIX 3
B-TYPICAL ARRANGEMENT OF METERING CABINET ON COMPOUND WALL

(Refer section 3 of the regulation)



Type of kWh Metering	Dimensions in cm								
	A	B	C	D	E	F	G	H	I
Direct Connected Metering (Up to 125Amps)	60	80	25	20	06	06	80 (Min.)	160 (Max.)	180 (Max.)
CT. Operated Metering (5A Meter & CT Ratio up to 400/5 Amps)	80	100	30	25	08	08	80 (Min.)	160 (Max.)	180 (Max.)

Description :

1) Compound wall
2) Weather proof (IP 55) metering cabinet
3) Hinged door with provision for wire sealing & pad locking (hole size: min. 10mm dia.)
4) Cable (Gland) box
5) Transparent meter viewing window (min. 5mm thickness, size: 15cm x 15cm).
6) Protection cover with hinges on top (size: 20cm x 20cm)
7) Position of incomer breaker
8) 15 / 10 cm PVC pipe sleeve for service cable.
9) Conduit/s for earthing conductors (ECC)
10) 15 / 10 cm PVC pipe sleeve for load cable

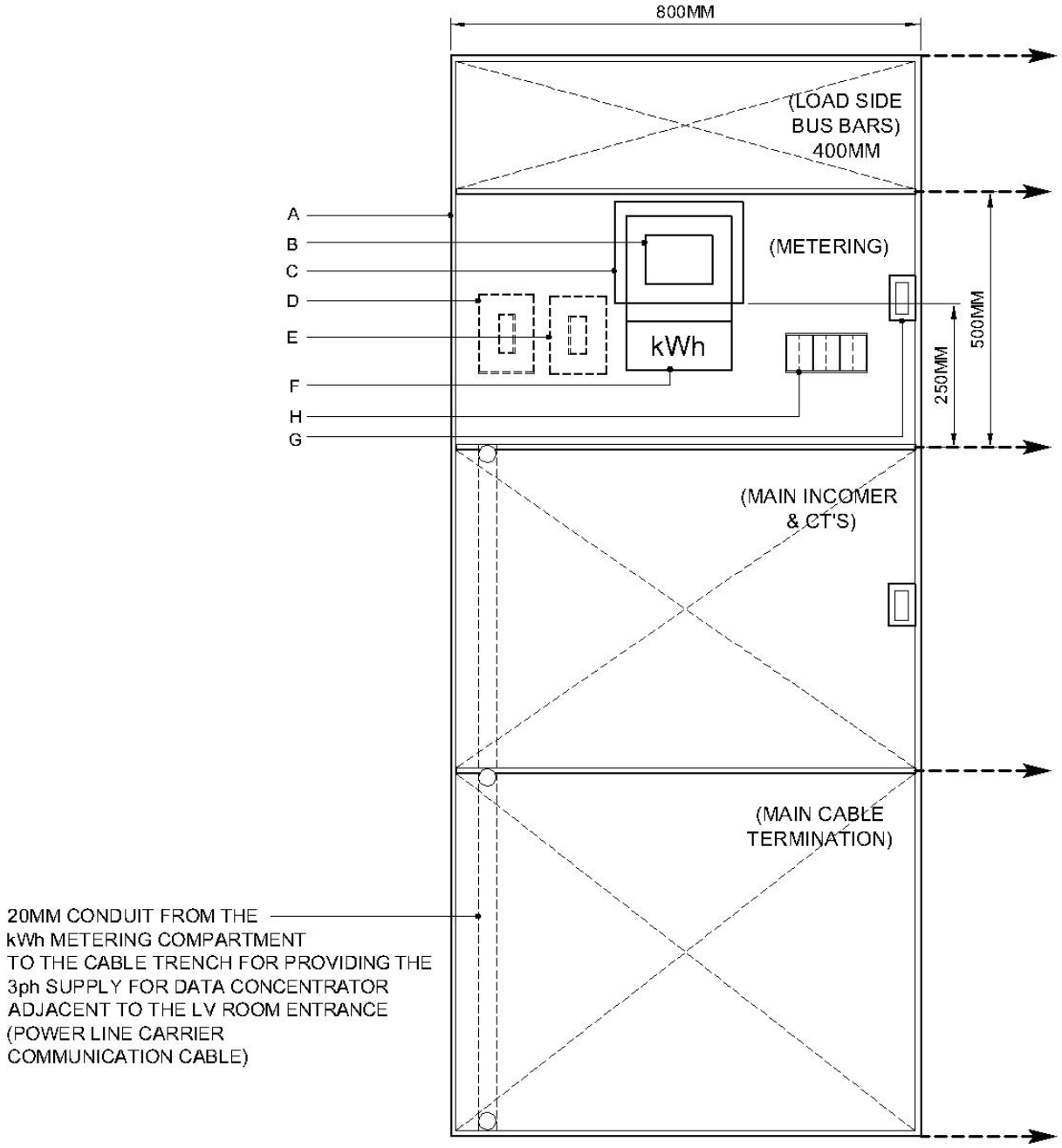
Notes :

- CT operated metering: Provide sealable type VT fuses in sealable enclosure
- Minimum 2 mtr. Clearance shall be maintained between electricity and water service cabinets / points.

APPENDIX 3
C-ARRANGEMENT OF METERING IN MAIN LV PANEL

(Main Incomer Compartment / Section)

(Refer section 3 of the regulation)



A	B	C	D	E	F	G	H
CT Operated kWh Metering Compartment	**Meter Viewing Perspex** (Size: 12.5cm x 12.5cm)	**Protection Cover with Hinges on Top** (Size: 15cm x 15cm)	**Sealable Type 3Nos VT Fuse Carriers in Sealable Enclosure for Data Concentrator**	**Sealable Type 3Nos VT Fuses in Sealable Enclosure for kWh Meter**	**kWh Meter**	**Pad locking Arrangement** (Hole Size: 10mm dia.)	**CT's Shorting Terminal Block in Sealable Enclosure** (RS1&RS2 / YS1&YS2 / BS1&BS2)

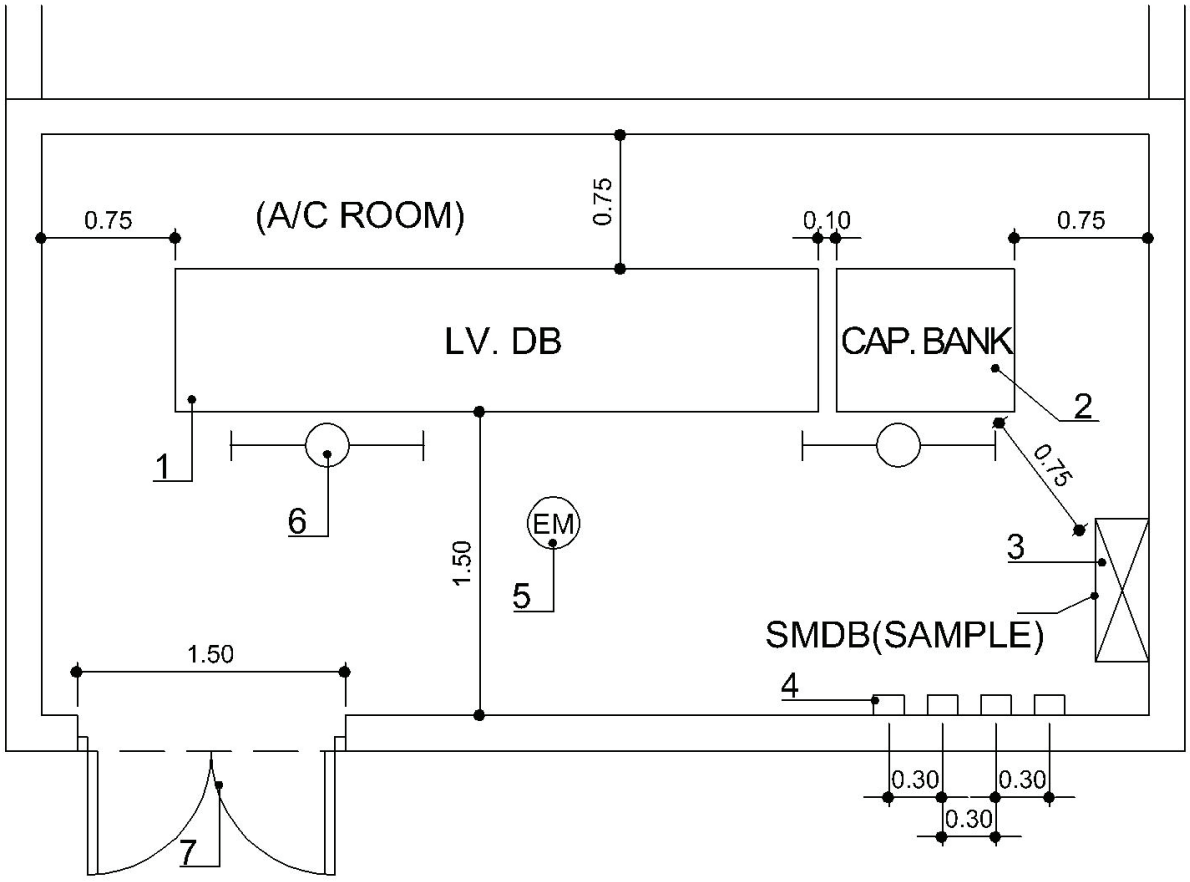
Notes :

- Meter viewing Perspex (min: 5mm thickness) with hinged type protection cover.
- CT operated metering & Data concentrator: Provide sealable type VT fuse carriers in sealable enclosure

APPENDIX 3

D-1 TYPICAL ELECTRICAL SERVICES ROOM WITH 1 NO. CUBICLE TYPE LV. SWITCHBOARD / PANEL.

(Refer section 3 of the regulation)



Description :

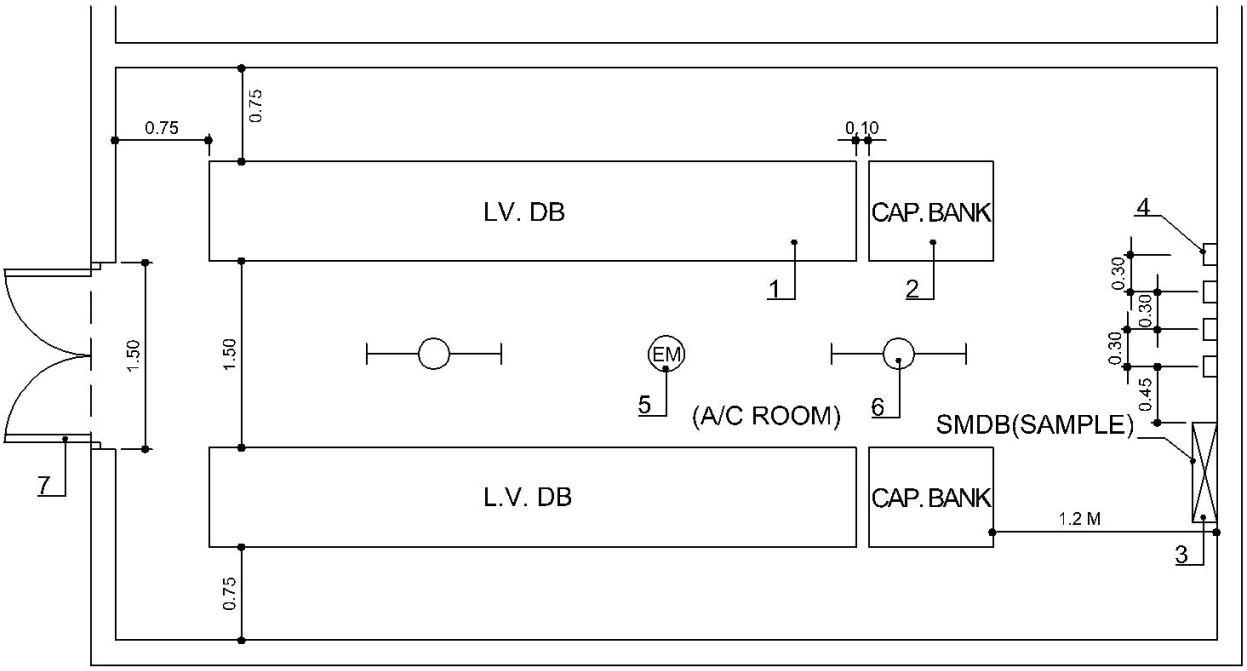
1) LV Switchboard / Panel.
2) Capacitor Bank.
3) Sub Main Distribution Board (Sample).
4) KWh meters.
5) Non-maintained, minimum 3 Hrs. rated, self contained emergency light.
6) Light fitting.
7) Non-combustible door.

Notes :

- All dimensions noted are in meters and not to scale.
- Minimum front clearance – 1.5 mtrs.
  Rear & side clearance – 0.75 mtrs.
- The minimum clear space shown at the sides and rear of the panel is for switchboards with rear access requirements only.

APPENDIX 3
D2- TWO LV PANELS ARRANGEMENT IN LV SWITCH ROOM

(Refer section 3 of the regulation)



Description :

1) LV Switchboard / Panel.
2) Capacitor Bank.
3) Sub Main Distribution Board (Sample).
4) KWh meters.
5) Non-maintained, minimum 3 Hrs. rated, self contained emergency light.
6) Light fitting.
7) Non-combustible door.

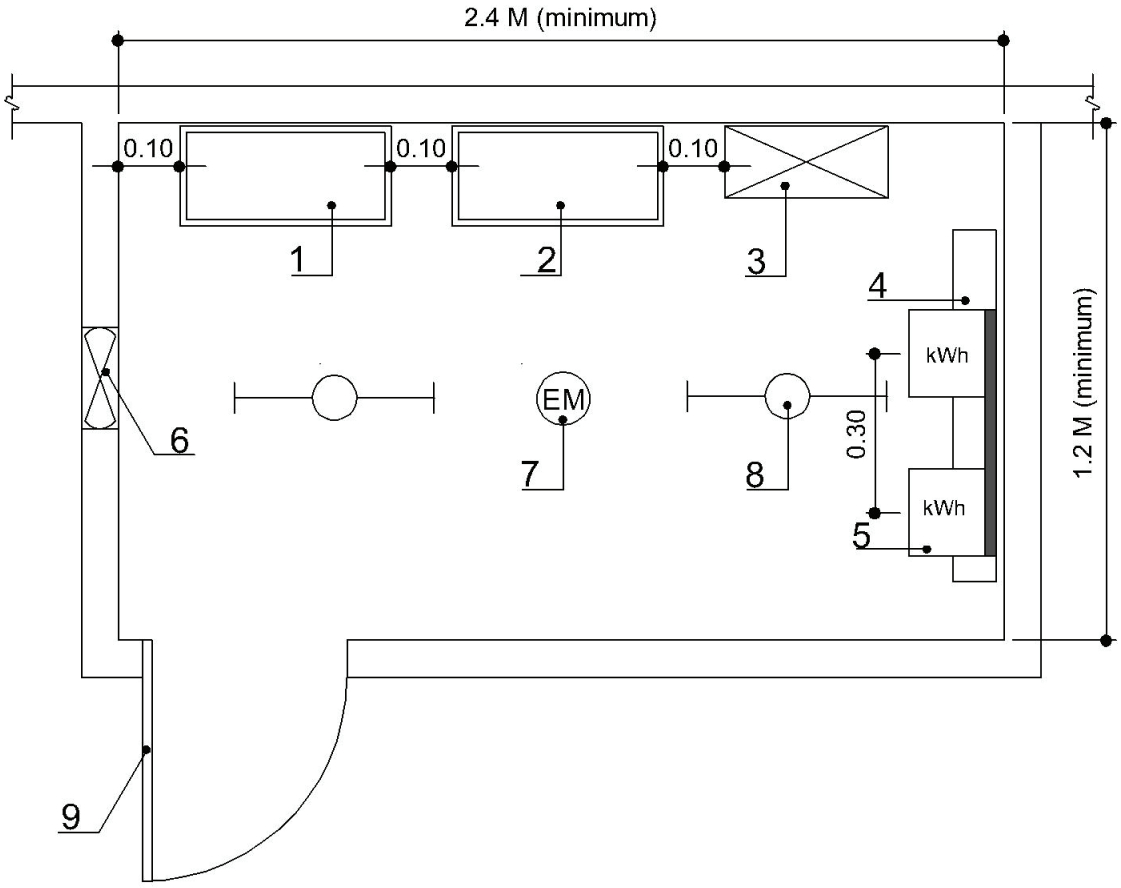
Notes :

- All dimensions noted are in meters and not to scale.
- Minimum front clearance – 1.5 mtrs.
  Rear & side clearance – 0.75 mtrs.
- The minimum clear space shown at the sides and rear of the panel is for switchboards with rear access requirements only.

APPENDIX 3

E - TYPICAL ELECTRICAL SERVICE ROOM WITH 1 NO. MDB (MAX. 400 AMPS RATING)

(Refer section 3 of the regulation)



Description :

1) Main Meter.
2) Main Distribution Board.
3) Capacitor Bank.
4) PVC/GS trunking.
5) kWh meters.
6) Exhaust fan (for non –air conditioned room)
7) Non-maintained, minimum 3 Hrs. rated, self-contained emergency light
8) Light Fitting
9) Non-combustible door (Louvered type for non-air conditioned room)

Notes :

- All dimensions noted are in meters and not to scale
- Only minimum dimension permitted for electrical room is shown in the layout. Each electrical room shall be designed to accommodate the MDBs / SMDBs, kWh meters, etc. Prior approval shall be obtained for construction

APPENDIX 4
DATA SCHEDULE FOR ELECTRICITY METERS AND CURRENT TRANSFORMERS

(Refer Section 3 of regulations)

A. Electricity Meters:

Sr. No.	Description		
1.	Type of Meters		Static type Kilo Watt-hour Meter
2.	Reference voltages & frequency		Refer clause 1.2, Section 1
3.	**Accuracy Class**		
	Meter Application	System Rating	
3.1	Direct Metering on LV system	< or = 120 A	1
3.2	CT Metering on LV system	> 125 A	0.5S
4.	**Register**		
4.1	Type of register		LCD
4.2	No. of digits		8 (minimum)
4.3	Height of numerals		8 mm (minimum)
4.4	LCD Screen Size		80 mm x 20 mm (or) approved by DEWA
5.	**Service Conditions**		
5.1	Operating temperature range (minimum)		700C
5.2	Relative Humidity		100%
5.3	Transport & Storage temperature range (minimum)		850C
6.	Type of meter communication		Modular type with detachable communication module (to choose wired or wireless communication system)
7.	Meter communication ports		Optical, M-Bus, RS485, etc

B. Current Transformers:

Sr. No.	Description	
1.	Rated Secondary Current	5A
2.	Maximum primary voltage	600 V
3.	Rated Frequency	50 Hz
4.	Rated primary Current (only one is applicable)	160A, 200A, 300A, 400A, 800A, 1600A or 2400A
5.	Rated burden	5 VA
6.	No. of Phases	1
7.	Accuracy Class CT Application System Rating CT metering on LV system > 125A	 0.2S
8.	Medium of installation	Air
9.	Size of Busbars (Primary) Rated Primary Current a) 160A, 200A, 300A b) 400A c) 600A, 800A d) 1200A, 1600A e) 2400A	 Busbar Size 20 mm x 10mm 30 mm x 10 mm 50 mm x 10 mm or 2 Nos. x 30mm x 10mm 2 Nos. x 60mm x 10 mm 2 Nos. x 80mm x 10mm

APPENDIX 5
SELECTION OF CABLES

(Refer section 4 of regulations)

Recommended size of cables for use in fixed wiring installation,
for general purposes, and in normal situations, in the Emirate of Dubai.

TABLE - 1

Single - Core PVC insulated, non-armoured, Stranded copper Conductors

Size of cables, in 'concealed' conduits		Max. rating of MCB/MCCB (Amps)	Max. Load current/demand (Amps)
2 x 1C, 1 Phase (mm2)	3/4 x 1C, 3 Phase (mm2)		
2.5	2.5	10/15	10/15
4	4	20	20
6	6	25	25
6	10	30	30
10	16	40	40
16	25	50	50
25	25	60	60
35	50	80	80
-	70	100	100
-	95	125	125
-	120	150/160	150/160

For general notes refer page 107

TABLE - 2

Multi core armoured PVC insulated, copper Conductors

Size of 1 No., 3/4 C PVC/SWA/PVC Cable installed in normal situations (mm2)	Max. rating of MCB/MCCB (Amps)	Max. Load current/demand (Amps)
2.5	10/15	10/15
4	20	20
6	30	30
10	40	40
16	50	50
25	60	60
35	80	80
50	100	100
70	125	125
65	160	160
120	180	180
150	200	200
185	250	250
240	300	300
300	350	350
400	400	400

For general notes refer page 107

TABLE - 3

Multi core armoured XLPE insulated, Copper Conductors

Size of 1 No., Cable installed in normal situations (mm2)	Max. rating of MCB/MCCB (Amps)	Max. Load current/demand (Amps)
10	50	50
16	60	60
25	80	80
35	100	100
50	125	125
70	160	160
95	200	200
120	225	225
150	250	250
185	300	300
240	350	350
300	400	400

For general notes refer page 107

Common notes for Tables 1,2 & 3

1. Assess initial demand with safe diversity and anticipated demand in future, if any, as applicable to individual circuits, for selection of cable size, breakers rating, etc.
2. Assess individual fault levels and select MCBs/MCCBs accordingly.
3. Refer manufacturer's catalogues and select MCBs/MCCBs, cable sizes, etc. for specific applications, considering inductive/capacitive loads, laying conditions, voltage drop, correction factors, etc.

APPENDIX 6
COLOUR IDENTIFICATION OF UNARMOURED, ARMOURED AND FLEXIBLE CABLE CORES AND BARE CONDUCTORS

(Refer section 4 of regulations)

1. Non - flexible cables and bare conductors:

Function	Colour Identification
Earth Continuity Conductor (ECC)	Green and Yellow
Neutral Conductor in 1 and 3-phase circuits (N)	Black
Phase conductor in 1-phase circuits	Red or Red (R) Yellow (Y) Blue (B) as applicable
Phase conductor in 3-phase circuits R - phase Y - phase B - phase	 Red Yellow Blue

2. Flexible Cables and Cores:

Function	Colour of Core
Live	Brown
Neutral	Blue
Earth	Green and Yellow

APPENDIX 7
SPECIFICATIONS OF MDBs/SMDBs

(Refer section 4 of Regulations) **MDB/SMDB No. :**

I. REFERENCE STANDARDS	BS EN 61439/ IEC 61439
II. RATING OF INCOMING SUPPLY BREAKER/ISOLATOR+ (+On-load)	200A [ ] 300 [ ] 400A [ ] 800A [ ] 1600A [ ] 2500A [ ] BREAKER [ ] ISOLATOR [ ]
III. CONSTRUCTION	
1. Mounting	Wall [ ] Floor [ ] Pedestal [ ] .....[ ]
2. Degree of protection of the enclosur for installation	Indoor-IP41/42 [ ] Outdoor-IP54/55 [ ] .....[ ]
3. Painting/Finish (Internal/External)	Stove enamelled [ ] Epoxy [ ] Polyester [ ] Galvanized [ ] .....[ ]
4. Front Cover (+Neoprene)	Hinged [ ] Bolted [ ] Panel lock [ ] Gasketted+ [ ]
5. KWH Meter reading provision	Glass Window [ ] Gasketted [ ]
6. Cable Tray	Top [ ] Bottom [ ] Top & Bottom [ ]
7. Ventilation	Louvers [ ] .....[ ]
8. Sealing/pad locking provision	Compliance with Regulation 3.3.10 [ ]
IV INTERNAL LAYOUT/ARRANGEMENT & FAULT RATING	
1. Segregation of live parts :- Incoming supply terminals/lugs	Barrier [ ] Shroud [ ] Firmly secured [ ] *Separately mounted & Removable by tool [ ]
Bus bar, tap-off connections & terminals (*Separate and independent of each other)	Firmly secured [ ] *Separately mounted & Removable by tool [ ]

Neutral & Earth Bus-bars & Terminals	Separately mounted with adequate working clearances/spacing from incoming supply terminals/lugs [ ]
2. Arrangement of bus-bars and tap-off connections to outgoing circuit breakers	Rigid, firmly secured, supported, direct and as short as possible [ ] Adequately sized [ ] Min. No. bolted joints [ ]
3. Rating/size of phase & neural bus-bars & terminals (at max. 50 oC ambient)	Rated for max. 70 oC internal ambient, consistent with the rated incoming supply breaker/isolator [ ] Tinned electrolytic Copper [ ]
4. Rating of Main Incomer and Bus bars DEWA's	.....[ ]
- Min. fault rating	40 KA [ ] .....[ ]
5. Min. & Max. rating of outgoing circuit breakers	.....[ ]
-Min. fault rating	35 KA [ ] .....[ ]
6. Provision of min. working clearance/space for Incoming supply cable terminations	200A 300A 400A
200A/300/400 Incomers Cms 800/1600A/2500 Incomer Cms Outgoing circuit cables	25 [ ] 35 [ ] 45 [ ] 75 [ ] With/without cable box [ ] Adequate [ ]
7. Provision of supports/facility for dressing/clamping outgoing circuit cables	Channels [ ] Trunking [ ] .....[ ] Max. Height 2.0 M (From FFL) [ ]
8. Operational access/convenience for switchgear Incoming supply circuit breaker/isolator Outgoing circuit breaker	From Outside of Hinged Door/Bolted Cover [ ] Restricted/Lockable [ ]

9. Maintenance access/replacement convenience for switchgear components	Breaker [ ] CTs [ ]4 KWH Meter [ ] Gland plate [ ]
10. Provision for termination of Cu./ XLPE/AWA(S.C.)	Non-Ferrous glands plate [ ]
V. IDENTIFICATION	
1. Rating of Incoming supply & Outgoing circuit breakers:- (vis-a-vis the rating specified - Refer approved Single Line Diagram No.: .....)	Thermal [ ] Discrimination [ ] Fault [ ]
Type of circuit breakers :- Incoming Outgoing	 ACB [ ] MCCB [ ] F/S [ ] MCCB [ ] F/S [ ] C/L MCCB [ ]
2. Colour codes for internal, main circuits wiring :- Phase Neutral Earth	 Red / Yellow / Blue [ ] Black [ ] Green and Yellow [ ]
3. Terminal ferrules for control/auxiliary circuits	KWH Meter [ ] Indicating Instruments[ ] Other.....[ ]
4. Permanent labels, engraved, 'trafolite' or similar	Board Designation [ ] Controls [ ] Circuit Designation [ ] Indications [ ] Warning Notice/s [ ]
VI EARTHING	Compliance with Regulation Section - 5..... [ ]
1. Rating/size of Earth bus-bar & terminals	Adequate, consistent with the min. fault rating specified under IV.4 and IV.5 [ ] Adequate No. & size to terminate Main & Circuits ECCs [ ]
2. Earthing of conductive parts	Enclosure [ ] Hinged Door [ ] Cable Glands [ ]

3. Termination of ECCs	Copper lugs [ ]
VII METERING	Compliance with Regulation Section - 3..... [ ]
1. Standard indicating instruments	Volt Meter with selector switch [ ] Power Factor Meter [ ] Ammeter [ ] Current Transformers [ ] Indicating Lamps [ ]
2. KWH Meters/CTs	Tested & Calibrated in DEWA [ ]
3. Wiring/Connections of CT Meter	'Load' side of Incoming supply breaker [ ]
4. Protection of CT meter wiring (*Allow 6 spare fuse cartridges in the MDB)	Current Coil[ ] Voltage Coil[ ] 'Sealed' type fuse*[ ] Heat resistant / High voltage grade .....[ ]
5. Mounting height from FFL	Max. 2 Mtrs. [ ] Min. 0.8 Mtr. [ ]
6. Mounting (if door/cover mounted)	Hinged door mounted [ ]
7. CTs for Tariff Metering	Exclusive[ ] Accuracy Class 0.2S [ ] Matching Ratio [ ]
VIII TESTS/CERTIFICATION	
1. Type Test	As specified by the Consultants/Owner [ ]
2. Routine Tests & Checks : Visual checks Screwed/Bolted Connections Operational checks Dielectric test	Certificate for review/reference [ ] Compliance with specifications [ ] Tightness [ ] Mechanical/Electrical [ ] 2500/2125V (85%) [ ]

REMARKS

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APPENDIX 8
SPECIFICATIONS OF DBs

(Refer section 4 of Regulations) **DB No. :**

I. REFERENCE STANDARDS	BS EN 61439, BS EN 60947, IEC 61439
II. RATING OF INCOMING SUPPLY BREAKER/ISOLATOR+ (+On-load)	40A [ ] 60A [ ] 100A [ ] 125A [ ] ..... [ ] BREAKER [ ] ISOLATOR [ ]
III. CONSTRUCTION	
1. Mounting	Wall [ ] Pedestal [ ] Surface [ ] Recessed [ ]
2. Degree of protection of the enclosure for installation	Indoor-IP41/42 [ ] Outdoor-IP54/55 [ ] ..... [ ]
3. Painting/Finish (Internal/External)	Stove enamelled [ ] Epoxy [ ] Polyester [ ] Galvanized[ ] ..... [ ]
4. Front Cover (+Neoprene)	Hinged [ ] Bolted [ ] Panel lock [ ] Gasketted+ [ ]
5. Cable Tray/Conduit entry	Top [ ] Bottom [ ] Top & Bottom [ ]
6. Assembly	Factory Assembled [ ] ..... [ ]
IV. INTERNAL LAYOUT/ARRANGEMENT & FAULT RATING	
1. Segregation of live parts :-	Barrier [ ] Shroud[ ] Firmly secured [ ] *Separately mounted &
Incoming supply terminals/lugs	Removable by tool [ ]
Bus bar, tap-off connections & terminals (*Separate and independent of each other)	Barrier [ ] Firmly secured [ ] *Separately mounted & Removable by tool [ ]

Neutral, Earth Bus-bars & Terminals	Separately mounted with adequate working clearances/spacing from incoming supply terminals/lugs & Outgoing terminals of MCBs/FS [ ]
2. Arrangement of bus-bars and tap-off connections to outgoing circuit breakers/Neutral bus-bars	Segregated for each :- Group of MCBs/TP ways [ ] ELCB Section [ ] Rigid, firmly secured, supported, direct and as short as possible [ ] Adequately sized [ ] Min. No. bolted joints [ ] Min. No. of looped Connections [ ]
3. Rating/size of phase & neural bus-bars & terminals (at max. 50 oC ambient)	Rated for max. 70 oC internal ambient, consistent with the rated incoming supply breaker/isolator [ ] Tinned electrolytic Copper [ ]
4. Min. fault rating of circuit breakers	6 KA (As per designed downstream short circuit current)
5. Provision of supports/facility for dressing clamping outgoing circuit cables	Channels [ ] Trunking [ ] ..... [ ]
6. Operational access/convenience for Switchgear. Incoming supply circuit breaker/ isolator Outgoing Circuit Breakers	Max. Height 1.8 M (From FFL) [ ] From Outside of Hinged Door/Bolted Cover [ ] Restricted/Lockable [ ]
7. Maintenance access/replacement convenience for switchgear components	Breaker/s [ ] Isolators [ ] ELCB/s [ ] U.V. Relays [ ]
8. Provision for termination of PVC/SWA/PVC/XLPE/SWA/PVC Cables	Gland plate [ ] Cable gland [ ]
9. ELCBs/RCCBs	Window A/C [ ] Split A/C [ ] Lighting [ ] Small Power [ ] Others..... [ ]

10.U.V. Relays with auto-reset timer	Window A/C [ ] Split A/C [ ] Others..... [ ]
V. IDENTIFICATION	
1. Rating of Incoming supply & Outgoing circuit breakers:- (vis-a-vis the rating specified - Refer approved Single Line Diagram/ Distribution Schedules)	Thermal [ ] Fault [ ] Discrimination [ ]
Type of circuit breakers :- Incoming Outgoing (C/L-Current Limit)	Isolator [ ] MCCB [ ] C/L MCCB [ ] C/L MCCB [ ] F/S [ ] C/L [ ] For general loads, Type'1'/'L' [ ] for Motor load, Type '2'/'G'/.....[ ]
2. Colour codes for internal, main circuits wiring :- Phase Neutral Earth	 Red / Yellow / Blue [ ] Black [ ] Green and Yellow [ ]
3. Terminal ferrules for control/auxiliary circuits	Indicating Instruments [ ] Others..... [ ]
4. Permanent labels, engraved, 'trafolite' or similar	Board Designation [ ] Controls [ ] Circuit Designation[ ] Indications [ ] Warning Notice/s [ ] ELCB/U.V. Relay Section[ ]
VI. EARTHING	Compliance with Regulation Section.5..... [ ]
1. Rating/size of Earth bus-bar & terminals	Adequate, consistent with the min. fault rating specified under IV.4 [ ] Adequate No. & size to terminate Main & Circuits ECCs [ ]

2. Earthing of conductive parts :	Enclosure [ ] Hinged Door [ ] Cable Glands [ ]
3. Termination of ECCs	Copper lugs [ ]
VII. TESTS/CERTIFICATION	
1. Type Test	As specified by the Consultants/ Owner..... [ ] Certificate for review/reference [ ]
2. Routine Tests & Checks : Visual checks Screwed/Bolted Connections Operational checks Dielectric test	 Compliance with specifications[ ] Tightness[ ] Mechanical/Electrical[ ] 2500/2125V (85%) [ ]

REMARKS

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APPENDIX 9
EARTH CONTINUITY CONDUCTORS (ECCs) & EQUIPOTENTIAL BONDING CONDUCTORS

(Refer section.5 of Regulations)

Cross - sectional area of phase/neutral conductor (S) **mm 2**	**Minimum cross-sectional area of ECC (G/Y PVC insulated copper conductors)** **mm 2**	**Minimum cross-sectional area of equipotential bonding conductors** **mm 2**
S < 16	S	$\frac{S}{2}$ (not less than 6)
16 < S < 35	16	10
S > 35	$\frac{S}{2}$	$\frac{S}{4}$ (need not exceed 25)

APPENDIX 10
EARTH LEAKAGE PROTECTION

(Refer section 5 of Regulations)

Recommended value of operating current of ELCB/RCCB in Consumer installations:-

Sr. No	Circuit/equipment/ apparatus	Rated operating Current (mA)
1.	13A switched socket outlets	30
2.	Water heaters/Coolers/Dish washer	30
3.	Refrigerator/Washing machine and similar apparatus	30
4.	Domestic water pumps	30
5.	Jacuzzi pumps	10
6.	Under water lighting	10
7.	15A switched socket outlets (general purpose)	30
8.	General lighting	30/100
9.	Flood lighting	100/300
10.	Window/Split type Air Conditioner	100
11.	Fan coil/Air Handling-units/VAV	100
12.	Package type A/C unit	100/300
13.	Chiller	100-500-1000
14.	Irrigation pump	100
15.	Electric Cooker	100
16.	Industrial machine	100/300
17.	Elevators/Escalators/Hoist	300/500
18.	Neon sign	300

Notes: -

1) Grouping of circuits under one ELCB/RCCB is permitted for lighting circuits, general purpose switched socket outlets, single phase equipment/appliance, etc. In such cases maximum number of circuits proposed under each group shall be suitably selected considering the type of project such as Residential, Commercial, Industrial, etc. and the possible interruptions.
2) Wherever un-interrupted power supply is required for equipment/circuits of fire protection, drainage(such as ,Fire pump, Jockey pump, sump pump, springer pump,, pressurisation pump, smoke extract fan etc...)Suitable earth leakage detection system with indication and/or alarm is permitted.
3) For industrial installation which are designed with co-ordinated operational system of plants and machines, the earth leakage protection shall be suitably selected considering the safety and operational requirements.

APPENDIX 11
SPACING OF SUPPORTS FOR TRUNKING, CONDUITS AND CABLES

(Refer section 6 for Regulations)

Recommended maximum spacing of Clips, Cleats, Saddles or supports

1. TRUNKING:

Method of installation	Spacing of support in cm	
	Steel	Rigid PVC
Horizontal	150	100
Vertical	180	120

2. CONDUITS:

Method of installation	Spacing of support in cm	
	Steel	Rigid PVC
Horizontal	120	100
Vertical	150	120

3. ARMOURED CABLES:

Method of installation	Spacing of support in cm	
	Overall dia. 2 cm - 4 cm	Overall dia.exceeding 4 cm
Horizontal	35	60
Vertical	60	80

APPENDIX 12
NUMBER OF CABLES THAT MAY BE INSTALLED IN TRUNKING, CONDUITS AND TRAYS

(Refer Section 6 of Regulations)

1. TRUNKING:

Where single core insulated cables are installed in surface mounted metal or PVC trunking, the space factor shall normally not exceed 40 percent. Suitable correction factor shall be applied to the corresponding current carrying capacity, based on the number of circuits installed within the trunking.

2. CONDUITS:

Nominal cross sectional area of Conductors	Size of Conduit in mm		
	20	25	32
	Maximum number of cables drawn		
1.5	7	12	-
2.5	5	9	12
4.0	3	6	9
6.0	-	5	8
10.0	-	3	6
16.0	-	-	4
25.0	-	-	3

The size of conduits selected shall allow drawing the cables freely within, without damaging the insulation.

3. CABLE TRAY:

1. Where single core insulated & sheathed cables are installed in ventilated cable trays, the sum of the combined cross - sectional area of all cables installed in the tray shall not exceed 50% of the interior cross sectional area of the cable tray. Suitable correction factor shall be applied to the corresponding current carrying capacity based on number of circuits and method of installation (touching or spaced).

2. Where multicore cables are installed in ventilated cable trays the sum of the dia-metres of all cables installed shall not exceed 60% of the cable tray width and the cables shall be installed in a single layer. Suitable corrector factor shall be applied to the corresponding current carrying capacity based on the number of cables and the method of installation (touching & spaced).

APPENDIX 13
GENERAL CONDITIONS/REQUIREMENTS FOR PROVISION OF ATTIC SLAB ABOVE SUBSTATION AND LV ELECTRICAL ROOM.

(Refer section 11 of Regulations)

In principle there shall not be any wet facilities above the substation/Ring Main Unit Room/LV electrical room. Only in exceptional unavoidable cases this may be allowed at the discretion of the Authority and the following requirements must be fulfilled:

1. A Reinforced Concrete Attic slab above the entire substation/Ring Main Unit Room/LV electrical room shall be provided.

2. The entire attic slab and floor slab above including the vertical sides above attic slab shall be waterproofed by an approved system.

3. The consultant shall be fully responsible for supervision of the waterproofing works, during execution and testing of waterproofing.

4. All pipes, joints, trap, etc. running in wet areas shall be wrapped with approved Waterproofing membrane.

5. The void between floor and attic slab shall be minimum 60cms clear height. Access to the void above attic slab shall be 120cm x 60cm fitted with aluminum louvered door. The void shall not be used for any other purpose and shall have permanent lighting arrangement. Drain pipe to be provided for the attic slab to drain out any water leakage through floor slab. Tiles are not compulsory above attic slab.

6. The consultant shall forward complete floor plans showing location of Wet Area and substation/Ring Main Unit Room/LV electrical room. Extent of attic slab shall be clearly marked in the plans. Typical cross sections through the Wet Area/ substation/Ring Main Unit Room/LV electrical room and Attic Slab shall be shown in the drawings including waterproofing arrangement/systems/materials.

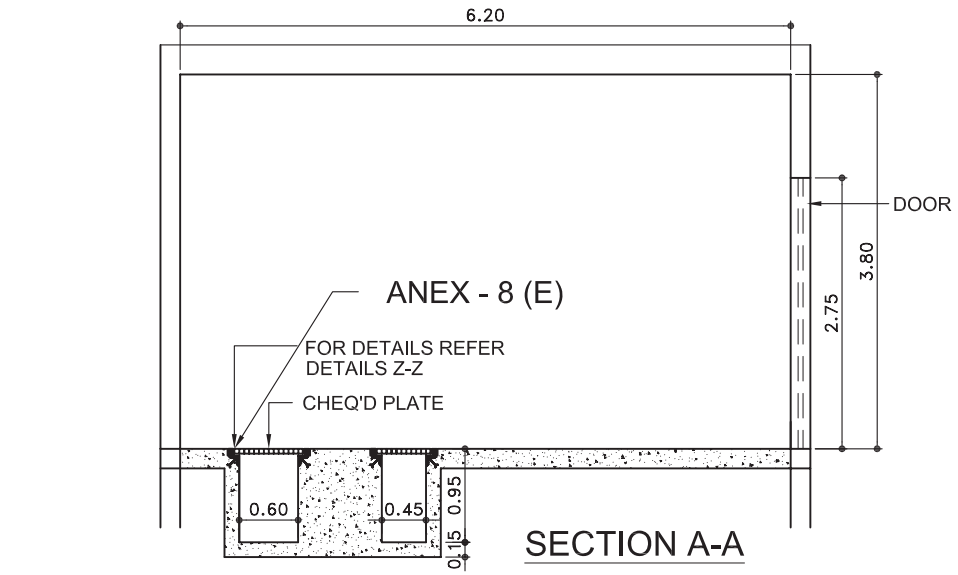
7. Refer checklist below for attic slab construction:

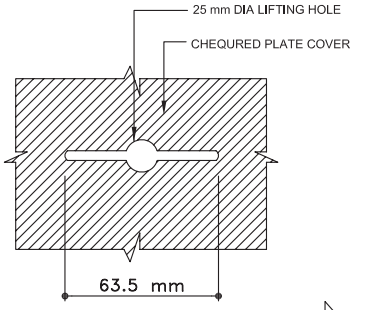
Sr. No	Description
1	Reinforced concrete attic slab above entire substation/ring main unit/LV
2	A clear depth (void) of 600mm between attic slab and floor slab.
3	An access aluminum louvered door of 1200x600mm to above clear depth (void) from outside substation
4	Water proofing of attic slab , floor slab above attic slab and vertical side walls
5	Water proofing of attic slab , floor slab above attic slab and vertical side walls
6	Drain pipe of 1.5" dia projecting out of the attic slab

7	Water proofing of all pipe joints, traps etc running in wet areas
8	Lighting inside the void space
9	Drawings showing the above details attached
10	Guarantee letter
11	No high pressure and vertical pipes are to pass in the void area
12	PVC tray to be provided and slope is 1:100 towards the drain pipe

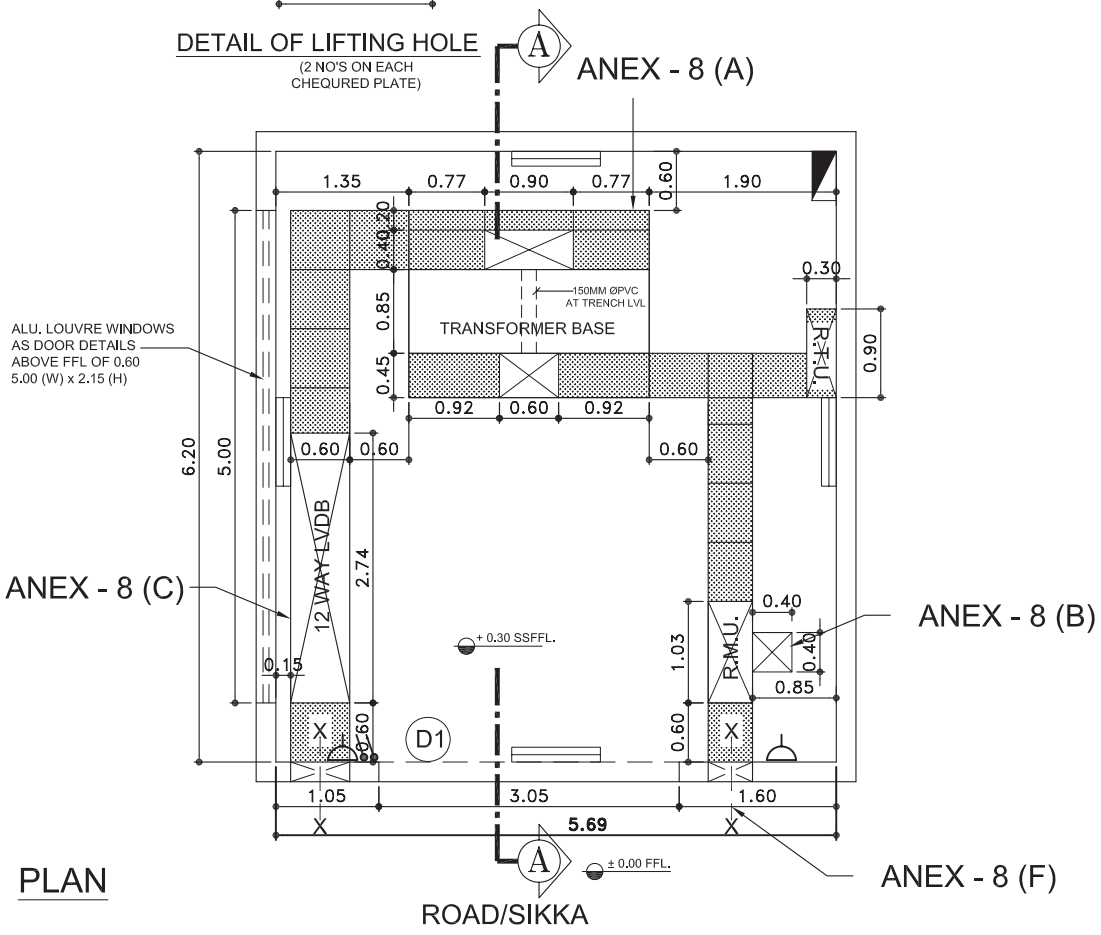
APPENDIX 14
GENERAL DIMENSIONAL DETAILS OF SUBSTATIONS WITHIN BUILDINGS

(Refer section 11 of Regulations)





DETAIL OF LIFTING HOLE
(2 NO'S ON EACH
CHEQURED PLATE)

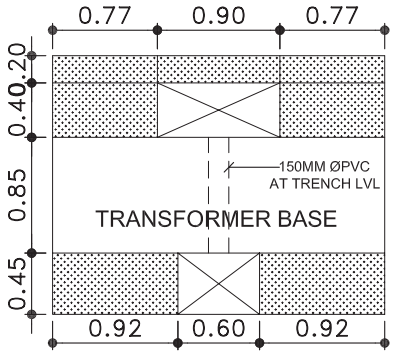


PLAN

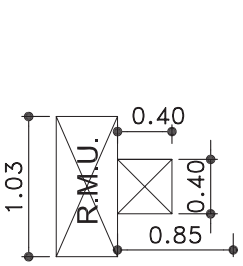
ROAD/SIKKA

APPENDIX 15
DETAILS OF SUBSTATION DOORS

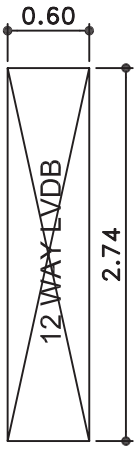
(Refer Section 11 of regulations)



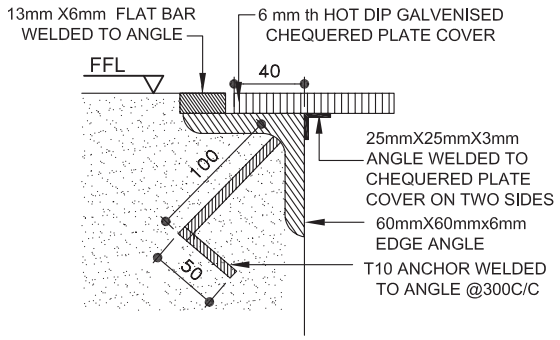
ANEX - 8 (A)



ANEX - 8 (B)

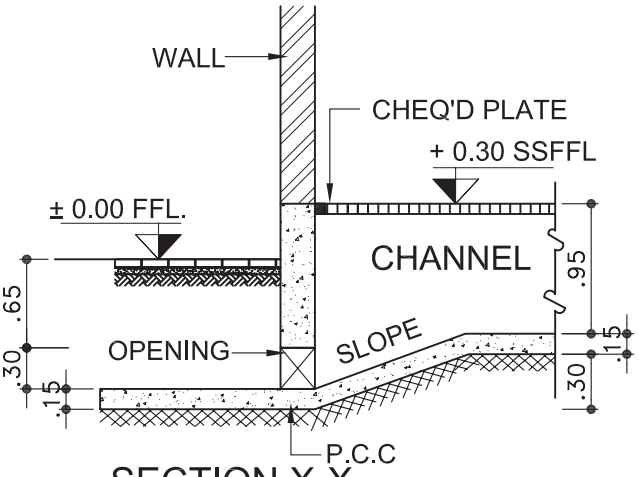


ANEX - 8 (C)



DETAIL Z-Z (TYPICAL SECTION)

ANEX - 8 (D)

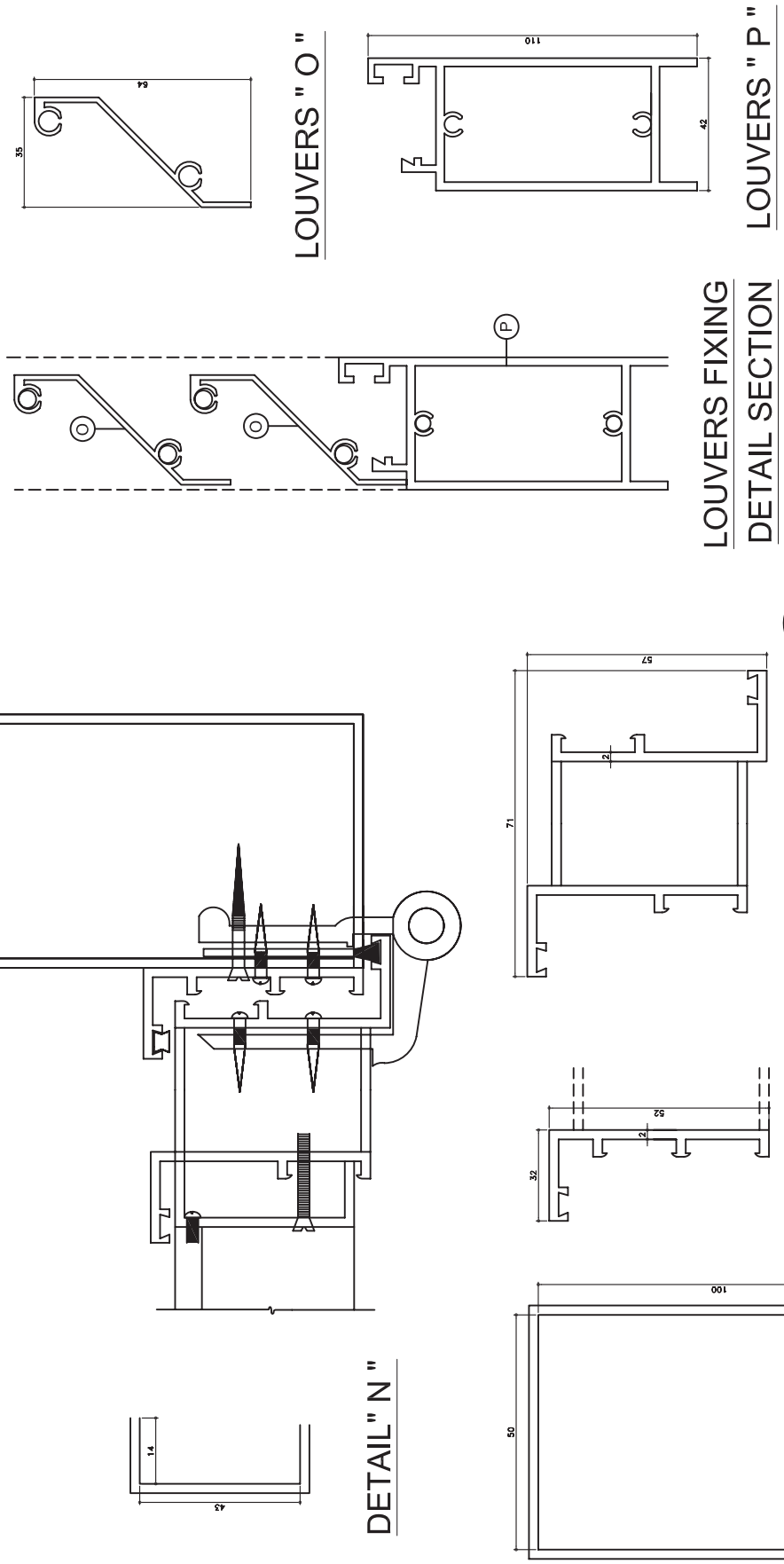


SECTION X-X

ANEX - 8 (E)

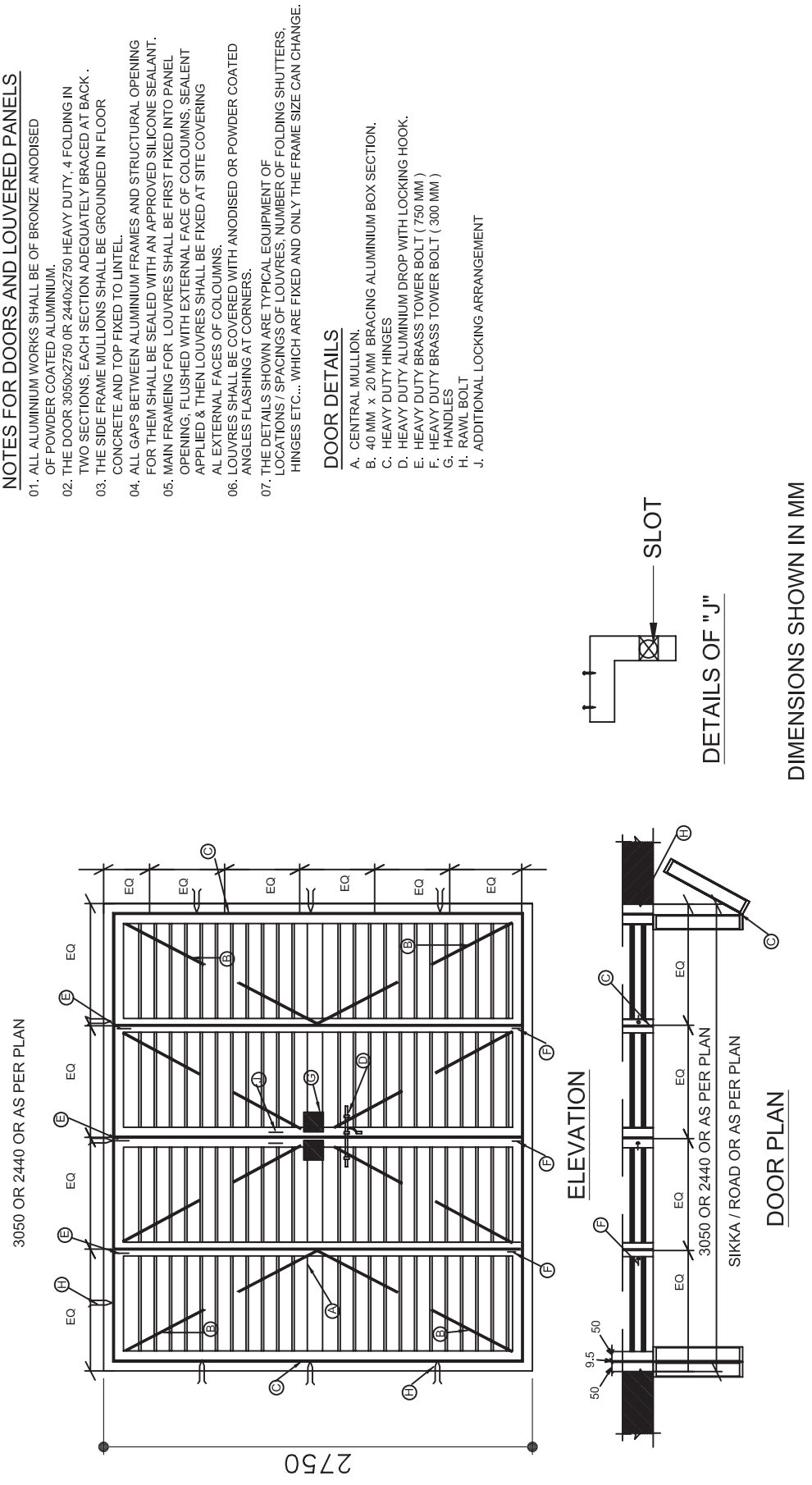
APPENDIX 16
DETAILS OF SUBSTATION DOORS

(Refer Section 11 of regulations)



APPENDIX 17
DETAILS OF SUBSTATION DOORS

(Refer Section 11 of regulations)



APPENDIX 18
FORCE VENTILATION FOR TRANSFORMER ROOM AT BASEMENT

(Refer section 11 of regulations)

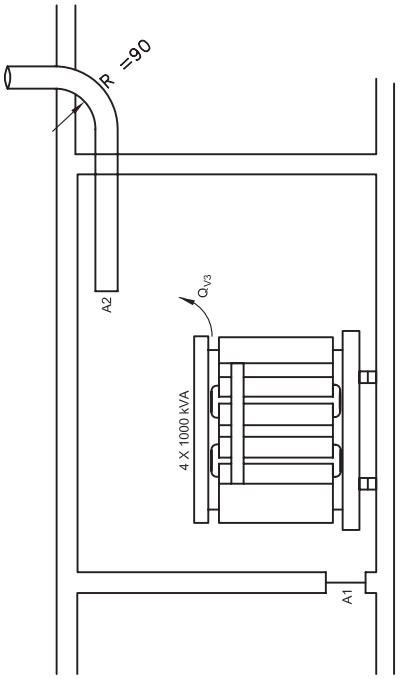
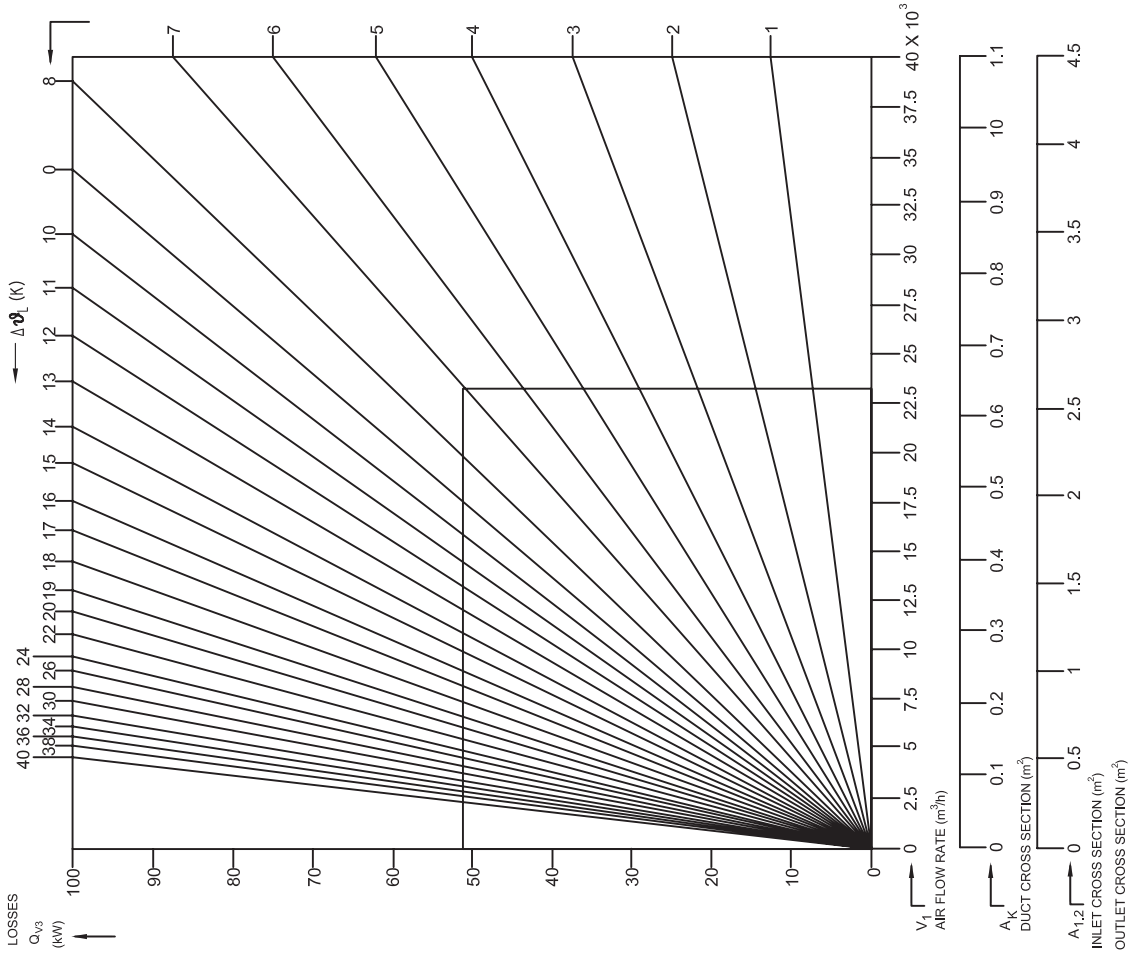


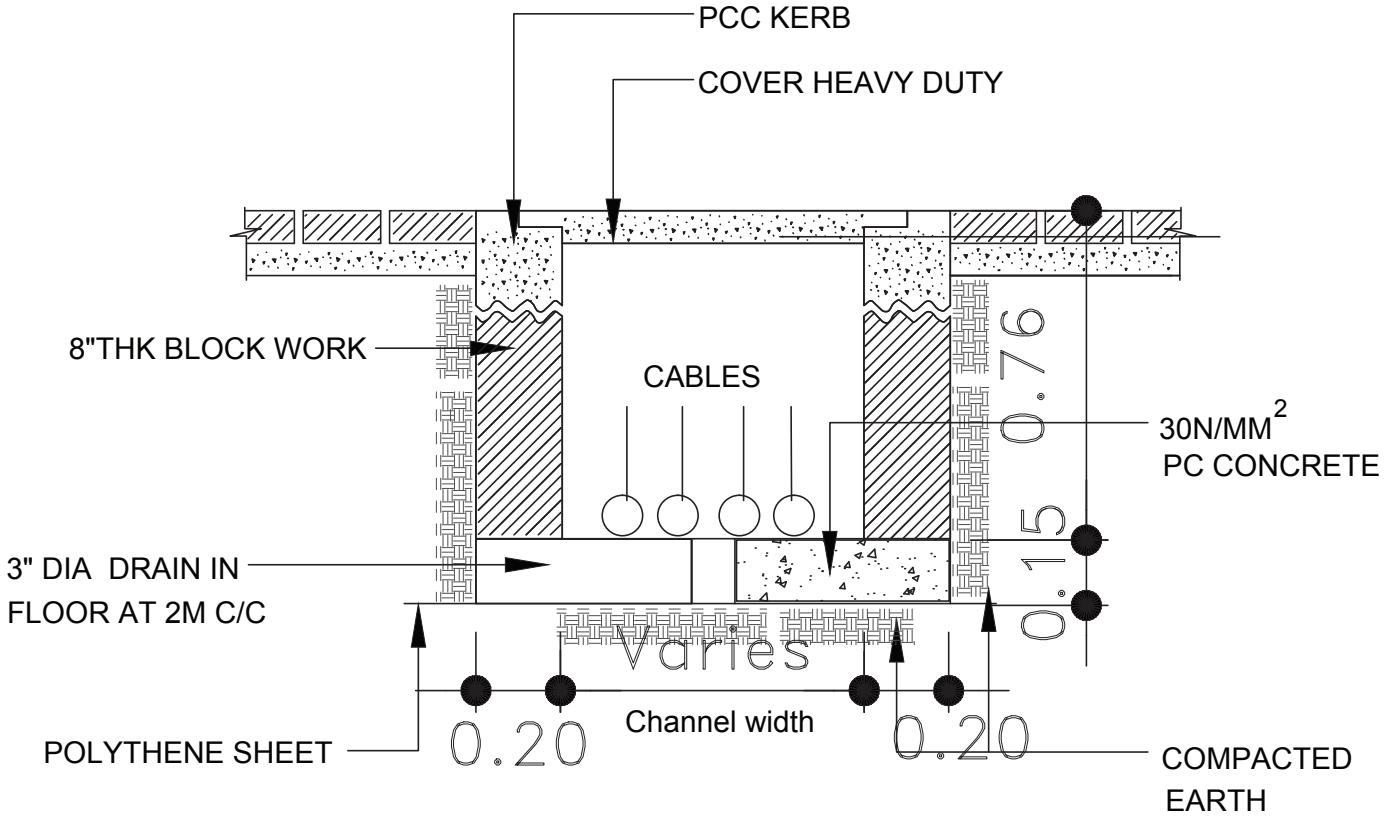
DIAGRAM OF THE FORCED VENTILATION SYSTEM FOR WORKED EXAMPLE

WORK EXAMPLE
THE INSTALLTION COMPRESS :
4 TRANSFORMERS OF 1000 kVA EACH
TOTAL LOSSES
$Q_{V3} = \Sigma P_V = 4 \times 12.9\ kW = 51.6\ kW$
THE MAXIMUM AMBIENT AIR INLET TEMPARATURE IN DUBAI IS 48°C
THE TEMPARATURE DIFFENCE OF $\Delta\vartheta_L = 7k$
THE FOLLOWING VALVES ARE OBTAINES FROM THE FIGURE
COOLING AIR FLOW RATE 23,000 m^3/h
DUCT CROSSING SECTION .055 m^2
AIR VELOCITY 10m/g
AIR INLET CROSS SECTION 2.6 m^2



APPENDIX 19
CABLE LAYING ARRANGEMENT IN CONCRETE TRENCH (SECTION T-T)

(Refer section 11 of regulations)



SECTION T-T

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