

#### شركة أبوظبمي للتوزيع Abu Dhabi Distribution Company Electricity Engineering Section

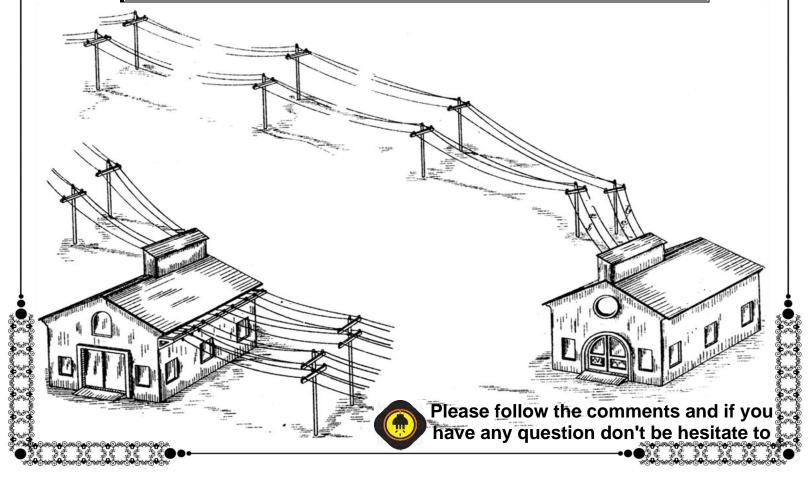
## ELECTRICAL DRAWING CHECK LIST

05-2021

Case ID: Electrical Contractor Name:

PE PE

Drawing Checking Information			
Submission cycle	Date	Installation Engineer Name	
1 <sup>st</sup> Submission			
2 <sup>nd</sup> Submission			
3 <sup>rd</sup> Submission			



# 1.Set up of Drawing

- 1.1. Set up Related Comments.
- 1.2. Drawing Title to be mentioned.
- 1.3. No space for ADDC stamp.
- 1.4. Type of Project to be mentioned and shall match the project name mentioned in the system.
- 1.5. Minimum size of the drawing sheet A1 or A0 required.
- 1.6. Scale of the drawing to be mentioned.
- 1.7. Electrical room location and cable entry approval to be shown as Per MEPS/LDN approval.
- Wall-Mounted MDB location and cable entry approval to be shown AS Per MEPS/LDN approval.
- 1.9. Single Line Diagram, load schedule, lighting layout, power layout, cable route, load schedule and meter schedule shall be submitted.
- 1.10. Drawings or attachments are missing.
- 1.11. Drawings or attachments shall be uploaded as per template title.
- 1.12. Owner name should be written.
- 1.13. Main Contractor name & stamp to be mentioned.
- 1.14. Consultant name & stamp should be mentioned.
- 1.15. Electrical Contractor name and stamp to be mentioned.
- 1.16. The contact details in the system shall be corrected and related to the electrical contractor of the project.
- 1.17. Sector & Plot number should be shown and shall match the system.
- 1.18. Drawing Sheet Number to be marked.
- 1.19. Legend should be added.
- 1.20. Legend and layout are not matching.
- 1.21. All layouts must be clear.
- 1.22. Grid marking required

- 1.23. Electrical layouts must match with approved architectural drawings
- 1.24. Light and Power Layouts to be colored according to phase color (red, yellow, blue) and all other drawings to be in BLACK color.
- 1.25. Discuss project before re-submitting, for appt. call 800ADDC
- 1.26. The approved drawing sheet shall be uploaded as per each template.
- 1.27. The required changes shall be clouded in each sheet for re-approval.
- 1.28. Separate approval is required for EV charging system.
- 1.29. Separate approval is required solar photovoltaic system.
- 1.30. Approval must be obtain for the use of Earth Electrode in basement, use of structural foundation of piles as Earth Electrode, use of natural components as the lightning protection system from ADDC before commencement of construction. (Forms are available in ADDC website)
- 1.31. North direction shall be shown in cable route layout.
- 1.32. Existing load to be corrected to match the existing load approved by LDN/MEPS.
- 1.33. Future load shall not exceed 50% of the connected load or as approved in MEPS/LDN.
- 1.34. Total connected load to be checked with LDN /MEPS.
- 1.35. Re-approval is required in LDN/MEPS if the load exceeded 10% of connected load from approved LDN/MEPS.
- 1.36. For LV project with loads between 400 and 500kw, the total connected load shall match the load approved in MEPS/LDN.
- 1.37. In title block main contractor, Electrical contractor and consultant name to be mention
- 1.38. MEPS / LDN approval is required to add or Remove Electrical room.
- 1.39. Adjacent plot and North mark to be mention as per municipality site plan.

## ► Part 2

# 2.Main Distribution Board (MDB) and Single Line Diagram (SLD)

- 2.1. MDB/SLD Related Comments:
- 2.2. The electricity intake must not be located on the reverse side of the bathroom or kitchen wall or below bathroom, kitchen, pump room, water tank, under staircase.
- 2.3. Electrical room shall be with adequate size.
- 2.4. Door of electric room to be open outside.
- 2.5. Installation details of main E/R with dimension to be shown.
- 2.6. Clear common access to reach in E/R required.
- 2.7. The location of electric room door shall be changed.
- 2.8. Light fitting in E/R to be installed in front and the rare of MDB instead of direct over the MDB.
- 2.9. Electrical room size to be enough to accommodate MDB and good clearance is maintained from the back side, front side and shall meet EWR requirement.
- 2.10. Enclosure of the MDB is to be tropicalized or ACH (anti condensation heater) are provided within the LV panel if the room is air conditioned.
- 2.11. MDB shall be installed on dry, well-ventilated area and not very closed to window or door.
- 2.12. Electricity intake must be positioned in a dedicated room and typically made from concrete or brick Construction.
- 2.13. Two 6 inch pipes to be provided for ADDC incomer with manhole.
- 2.14. Any water pipe or AC duct passing through electrical room is not acceptable.
- 2.15. One emergency light must be installed in E/R.
- 2.16. Cable route for the outgoing cables to be within the plot limit.

- 2.17. Route of the cables / bus bar riser to be shown and shall be through common area and away from gas line, water pipe, AC duct .
- 2.18. Route of the bus bar to be checked with other services.
- 2.19. Route and termination of 630mm<sup>2</sup> cable from transformer to MDB are to be shown.
- 2.20. IP rating of bus bar to be mentioned.
- 2.21. Number of tap-off points on each bus bar riser not marked.
- 2.22. Rating of tap-off points to match with load and cable size.
- 2.23. Distribution arrangement of load from bus riser to be shown.
- 2.24. Rating of the bus bar of all distribution board to be mentioned.
- 2.25. All tap off breakers shall be Plug-in-type and current limiting type.
- 2.26. The operating handle of the tap off shall be at accessible height.
- 2.27. Bus bar Riser rating must be same as rating of feeding circuit breaker.
- 2.28. Bus coupler (4P) shall be provided between LV panels in the same electrical room.
- 2.29. Correction to be made in single line diagram.
- 2.30. If transformer supply, main breaker is to be ACB, 46 KA (minimum).
- 2.31. All outgoing circuits of distribution boards must be provided with only circuit breakers (such as CBs, MCBs, MCCBs, ACBs, RCDs, RCBOs) and shall not be contain fusses of any kind.
- 2.32. Number of ways in MDB is more and shall be reduced.
- 2.33. ACB to be with drawable type.
- 2.34. Feeding arrangement to be check LV or HV.
- 2.35. Distribution arrangements and number of panels shall be revised.
- 2.36. Distribution arrangement shall be as per the areas, mixed distribution arrangements are not acceptable.
- 2.37. Isc or kA rating of the incomer and outgoing breaker of all distribution boards are to be mentioned.
- 2.38. Length and Voltage drop of bus riser to be shown.

- 2.39. Distribution boards rated 400A and above shall be with ammeter, voltammeter, neon indicating for power factor meter.
- 2.40. All cables running underground must be installed in ducts with ECC in separate duct.
- 2.41. Distance and voltage drop calculations must be provided for all cables (in volts).
- 2.42. The maximum voltage drop from the connection point to the area of final circuit must not exceed 4 % (16V).
- 2.43. Circuit breaker rating shall be match with load and cable size.
- 2.44. In case of feeding different blocks from one LV panel each block must have its own MDB and Electrical room.
- 2.45. Kwh meters to be marked on SLD.
- 2.46. The ratings of KWH meters to be corrected.
- 2.47. Metering arrangement and its location to be as per the meter section requirement.
- 2.48. GRP meter, cabinet shall be from approved ADDC type with shutter door and ventilation area.
- 2.49. Maximum 25mm<sup>2</sup> cable is allowed for 3 phase direct meter.
- 2.50. The earthing system to be done on ground level.
- 2.51. The earthing system in basement is not recommended unless approved by ADDC prior to construction.
- 2.52. ELP protection must be provide on the main incomer as per EWR requirement
- 2.53. For supplying of 500A rating and above at least two independent earth electrodes must be provided.
- 2.54. New meter schedule shall be used.
- 2.55. The number of electrical and water meter shall be same.
- 2.56. Location and installation of meter shall be as per meter section requirement.
- 2.57. Electric room is required for distribution boards 400A and above.
- 2.58. For villa Distribution boards below 400A installed in the Boundary wall, IP65 with double enclosure shall be used.

- 2.59. For Villa Distribution Boards below 400A installed in the boundary wall without an electrical room panel front facing side shall be inside the villa not in outside.
- 2.60. Voltage drop shall be corrected
- 2.61. If the MDB installed in the inner boundary wall, the wall mounted MDB shall be concealed inside the boundary wall with IP65 double enclosure UV rated.
- 2.62. The minimum approved distance between the wall mounted MDB/SMDB and nearest building inside the plot is 2m.
- 2.63. For villa, installation of distribution boards below 400A appear on boundary wall shall be as per inspection section requirements.
- 2.64. For multiple villa the door of main electric room shall be in common area.
- 2.65. Catalogue of Fire Pump to be provided.
- 2.66. Pad Lock shall be provided for Future Load and Spare breakers.

# 3. Sub Main Distribution Board (SMDB)

#### **3.1.SMDB Related Comments**

- 3.2. Distribution board shall not be installed in kitchen wall, bathroom wall or under staircase or pump room.
- 3.3. Size of SMDB room is inadequate (to fix SMDB, TAPOFF units and KWH meters).
- 3.4. Installation details of Sub electrical room to be shown.
- 3.5. Tap off cable glanding to be from the bottom side.
- 3.6. Sub E/R required for 200A and above rated panels.
- 3.7. Armored cable should be used from Tap off to SMDB.
- 3.8. Circuit breaker rating shall match with load and cable size.
- 3.9. Type of outgoing breaker MCB/MCCB to be shown.
- 3.10. Isc or kA rating for SMDB of incoming and outgoing breakers to be mentioned.
- 3.11. Separate ECC is required along with each outgoing cable.
- 3.12. Number of ways must not exceed 18 TP ways.
- 3.13. SMDB to be at center of typical floor, as far as possible.
- 3.14. Location of SMDB E/R to be shown.
- 3.15. Door of Sub E/R to be open to outside.
- 3.16. Location of SMDB Lifts shall be in ground floor.
- 3.17. For group of villas, location of SMDB electric room shall be close to the villa.
- 3.18. Separate earth pit is required if SMDB is more than 30 meters far away from MDB (except high rise building).
- 3.19. Motors / equipment/machine shall be provided with earth leakage protection.
- 3.20. For multiple villas, sub main distribution shall be installed near to villa.

- 3.21. Sub/main DB is not permitted in pump room.
- 3.22. Distribution arrangement shall be corrected.
- 3.23. The name of the panels shall be the same in all the layouts.
- 3.24. For villas Sub electric room required 400 and above rated sub main panel
- 3.25. Minimum 100A SMDB to be provide for the shops-offices.

# 4. Final Distribution Board (FDB)

- 4.1. Final DBs Related Comments.
- 4.2. Rating of MCB's, RCD and wire size to be rechecked.
- 4.3. Method of load calculation to be as per EWR requirement.
- 4.4. Availability of spare breakers required.
- 4.5. Show load on each section. (100mA and 30mA).
- 4.6. Number of ways for the single-phase consumer unit shall not exceed12 ways.
- 4.7. All circuits in the toilet and bathroom shall be fed from same phase & 30 mA RCD.
- 4.8. Flexible Cables are not allowed for internal wiring.
- 4.9. ECC Cable should be provided.
- 4.10. Location of FDB should preferably installed at the entrance to the area they serve. It should not be under staircase, bedroom, kitchen and bath wall.
- 4.11. FDB directly feed from MDB (transformer supply) incomer circuit breaker shall be with minimum 25 kA (Isc).
- 4.12. Final distribution board shall be provided at least two zones of earth leakage protection (30mA and 100mA) or (30mA and 30mA).
- 4.13. Breaker rating for lighting 6-15A for radial circuit 20A, for rings sockets 30A and for water heater window AC and other power points 20A, cooker 30A, to be used.
- 4.14. Number of ways for three phase FDB shall not exceed 14 ways.
- 4.15. The 3-phase load shall be balanced.
- 4.16. Number of connected points of each circuit shall be matching the breaker rating and wire size.
- 4.17. Minimum number of sockets outlets and connection points must be as per EWR.

- 4.18. High level circuits shall be connected separately and not combined with the normal sockets in a single circuit.
- 4.19. Sign Board point to be shown for the shops.
- 4.20. Under floor trunking shall be purpose made metallic trunking for under floor sockets outlet.
- 4.21. Minimum number of sockets outlets and connection points must be as per EWR.
- 4.22. Layouts must match with load schedules.
- 4.23. 15A sockets should not be installed in domestic installation.
- 4.24. Load schedules to be corrected.
- 4.25. Calculation of cooker load shall be 3000watt PLUS the largest ring or actual rating.
- 4.26. Circuitry shall be arranged to make same phase in one room/area.
- 4.27. All sockets outlets and flexible outlets shall be with isolating switch.
- 4.28. Circuit supplying a kitchen must not be to used supply any other area.
- 4.29. Installation of any outlets in Laundry room shall be Water proof.
- 4.30. Domestic water pump must be fed through a 30 mA RCD.
- 4.31. All laboratory sockets outlets in school and health center shall be protected through 10 mA RCDs.
- 4.32. Assume connected load for connected appliance/points shall be as per EWR.
- 4.33. The operating height of DB's to be within arm's reach from a stand position.
- 4.34. Switch and sockets installed externally shall be weatherproof.
- 4.35. Three phase socket outlets must be connected on individual radial circuit.
- 4.36. Load details and calculation shall be corrected.
- 4.37. Flex outlet shall be installed in the pantry.
- 4.38. Minimum number of sockets in Living room shall be 4D and in Bed room 3D.

- 4.39. Socket not permitted inside toilet.
- 4.40. Location of shop Isolator to be shown.

# 5. MCC , A/C Panels and Capacitor Bank

- 5.1. MCC panels related comments
- 5.2. Chiller catalogue must be provided with highlighting the model number.
- 5.3. Cables are under size.
- 5.4. Isolators on roof should be IP65 and suitable for corrosive of the surrounding environment.
- 5.5. The size of MCC room shall be adequate.
- 5.6. Cable tray between MCC panel and the AC unit to be shown
- 5.7. Capacitor bank to be provided with MCC panel in the same room
- 5.8. AC panel / MCC panel inside pump room is not permitted
- 5.9. Route of the bus bar / cables to MCC panel shall be through common area.
- 5.10. Cable routes for the incomer and outgoing of panel to be shown
- 5.11. Chillers isolator to be provided
- 5.12. Starter of chilled water pump to be shown on the drawings
- 5.13. Water pipes not allowed to cross the MCC room
- 5.14. If AC provided in mechanical room should be provided (ACH) in MCC-panel
- 5.15. Cap. Bank to be in separate cubicle
- 5.16. Bus bar riser route is not permitted through open to sky
- 5.17. Kitchen and toilets extract fans to be shown on drawings
- 5.18. Three phase Sockets for cleaning cradle shall not be looped together.
- 5.19. Chillers to be fed directly from AC panel located in the roof instead of from MDB.
- 5.20. Sequence control panel to be provided for stand by operation of chiller or chiller water pumps.

- 5.21. Installation details of MCC room with dimension to be shown.
- 5.22. Pump room should be separate from MCC/AC panel room.
- 5.23. Breaker capacity and size of cable shall be match with chiller load.
- 5.24. For villa capacitor bank may be installed in electrical room failure to prove the power factor between 0.9 lagging and unity (QCC certificate in mandatory to prove)
- 5.25. The KVAR rating to be corrected.
- 5.26. Capacitor Bank must have clearance for ventilation of minimum0.75 m around the panel.
- 5.27. Harmonic filters to be provided in the capacitor bank.
- 5.28. De-tuning of reactor to be 5.6 % for the capacitor bank with harmonic reactor.
- 5.29. A valid date QCC certificate shall be submitted with highlight the model number to prove power factor between 0.9 lagging and unity for residential villas.
- 5.30. The location of MCC room shall be corrected
- 5.31. Total inductive load to be shown.
- 5.32. Capacitor Bank to be provided.
- 5.33. Capacitor Bank to be shown in electrical room.

# 6. Generator , ATS ,Motors and Lighting Poles

- 6.1. Generator, ATS, Motors and Lighting Poles related comments
- 6.2. Separate room to be provided for generator with good ventilation.
- 6.3. Adequate rated circuit breaker to be provided in generator side.
- 6.4. KVA/Kw rating of generator to be shown
- 6.5. Earthing of generator to be shown.
- 6.6. The charge over circuit breakers shall have 4 poles for a three phase generator and 2 poles for single phase generator.
- 6.7. Location of ATS shall be shown in E/R or in a separate room.
- 6.8. The fuel discharge pipe and water discharge pipe should be a safe manor and does not poses a threat to the general public or maintenance staff.
- 6.9. All control panels shall be IP55 with metallic enclosure.
- 6.10. All single phase motor above 1 H.P and three phase motors above3H.P shall have current limiting starter with earth leakage protection.
- 6.11. Machine / Equipment shall be connected in ring earth (Cu strip)
- 6.12. Isolator shall be provided adjacent to all machine / Equipment.
- 6.13. Loop in loop out cut out to be provided in the pole lights.
- 6.14. Pole lights shall be earthed or provided by an earthed equipotential bonded system.
- 6.15. Length and voltage drop for pole lights circuit/ boundary lights circuit to be shown.

- 6.16. Earth leakage protection to be provided for boundary lights/pole lights.
- 6.17. Earth leakage for decorative lightning shall be 10 mA if taken from external lightning cut out.
- 6.18. Generator room shall be provided.
- 6.19. Emergency Push Button Shall be provided for motors.

## ► Part 7

# 7. Special Locations and System

# Swimming pools and water fountains, Marinas and similar Locations,

- 7.1. Swimming pools and water fountains, Marinas and similar Locations, related comments
- 7.2. Single Line Diagram to be corrected.
- 7.3. Swimming pool / water fountain details shall be submitted as per EWR requirement.
- 7.4. All circuit shall be protected through RCBO (30 mA).
- 7.5. Under water lighting must be supplied by SELV at maximum voltage of 12V ac or 30 DC with ingress protection IPx8.
- 7.6. The underwater junction box to be IP68.
- 7.7. No socket outlet shall be installed within arm's reach of a swimming pool area.
- 7.8. Cable used for swimming pool or fountain is to be rubber sheath cable.
- 7.9. Swimming pool / water fountain which is not ready, reapprove and inspection to be made one it's ready.
- 7.10. Local isolator to be provided for all pumps and pool plant.
- 7.11. Outside socket outlets must be provided with integrate RCD (30 mA) protection.
- 7.12. Local isolator shall be provided for pedestals.
- 7.13. Each circuit supplying pedestals shall have a protection RCD (30mA).

- 7.14. Only 4 socket outlets are allowed on a single pedestal.
- 7.15. Minimum one 16A single phase outlet shall be provided.
- 7.16. Single phase socket outlets shall be blue in color and three phase socket outlets shall be red in color.
- 7.17. A warning sign of existing 400V shall be provided on three phase socket outlet.
- 7.18. All the installations of swimming pools, water fountains, marinas and solar photovoltaic System shall be done as per EWR

# 8. EV Checklist

#### **8.1.EV Related Comments**

- 8.2. All the EVSE installation works shall be completed as per the Electricity Wiring Regulation (Third Edition) Addendum No.01.
- 8.3. EVSE shall be installed in a position to minimize the likelihood of vehicle impact damage
- 8.4. EVSE shall be installed in a position to avoid obstruction to public or private footpaths and it shall not be installed in such a position that cause unnecessary trip hazard.
- 8.5. All Electrical Wiring shall be suitably clipped or enclosed in a containment system.
- 8.6. EVSE shall be installed so as to minimize the distance between the Vehicle Inlet and the charging equipment.
- 8.7. EVSE shall not be installed in locations where potentially explosive atmosphere exists such as petrol stations. Where it is required to have EVSE equipment in such locations it must be installed outside the hazardous zone.
- 8.8. Precautions shall be made to ensure that live parts are either not accessible or cannot be touched during installation, operation and maintenance.
- 8.9. Charging facilities shall be provided with a system to prevent unauthorized usage.
- 8.10. EVSE shall he installed with sufficient space around it to allow for adequate ventilation and cooling of the equipment (e.g. d.c charging equipment incorporating rectifiers).
- 8.11. EVSE and all associated equipment shall have a minimum IP rating of IP44 for indoor locations and a IP55 for outdoor locations.
- 8.12. Prior approval from ADDC is required for the fuse of mode-3 charging at homes and with a maximum rating of 32A.

- 8.13. For areas accessed by the public only Mode-3 and Mode-4 can be used.
- 8.14. EVSE shall be supplied by a separate & dedicated radial circuit.
- 8.15. One socket-outlet or Vehicle Connector shall be used to charging only one EV.
- 8.16. EVSE shall be installed such that the main operating controls and any socketoutlet are between 0.75m and 1.2m above ground.
- 8.17. The use of Mode-1 charging is not permitted.
- 8.18. Each a.c. charging point in Mode-2 charging shall incorporate an interlocked socket-outlet that does not exceed 32A rating.
- 8.19. Mode-2 charging cables must have an In-Cable Control Box
- 8.20. Each a.c. charging point in Mode-3 charging shall incorporate a vehicle connector or a type -2 socket outlet complying with BSEN 62196-2
- 8.21. For Mode-4 charging, a connector complying with IEC 62196 type 4 is to be used with the use of a tethered cable.
- 8.22. For Mode-3 and Mode-4, Mechanical or Electrical locking system shall be provided.
- 8.23. Every charging point shall be individually protected by a 30mA RCD. The RCD shall disconnect all live conductors, including the neutral.
- 8.24. Local isolator with enclosure shall be provided, supplying the EVSE circuit.
- 8.25. Circuit breaker and cable size shall match with load.
- 8.26. For every charging point if the component of the residual current exceeds 6mA, a Type B RCD (30mA) complying with IEC 62423 shall be used.
- 8.27. For domestic usage, mode -2 charging is recommended
- 8.28. Residential villas a minimum of one EV charging point is recommended
- 8.29. Type S RCD shall be used for the protection at the origin of the circuit
- 8.30. EVSE components shall comply with the relevant reference standard provided in EWR.
- 8.31. Length and voltage drop of the cables are to be shown
- 8.32. Site Plan and all the layout shall be submitted
- 8.33. Single line diagram shall be submitted
- 8.34. Feeding arrangement shall be obtained
- 8.35. Copy of manufacturer's installation and operational instructions supplied with equipment's shall be submitted

8.36. Type of socket outlet shall be determined as per manufacturer's instructions.

8.37. Separate meter shall be provided for EV charger.

# 9. PV Checklist

9.1.PV Related Comments:

- 9.2. Self-regulating license / exemption is required from EWR for the owner or producer
- 9.3. Only Certified solar PV integrator shall be involved in the design and specification of the Small solar PV system.
- 9.4. Licensed contractor are also to be certified by ADDC in compliance with EWR and particularly regulation 9.10 in connection with solar PV system.
- 9.5. ADM permits shall be submitted.
- 9.6. Detailed plan of project electricity connection points are to be submitted.
- 9.7. Site setting out plan showing details of proposed works PV panels layout, meter location are to be submitted.
- 9.8. Connected load and maximum demand schedules at each connection point are to be shown.
- 9.9. Single line diagram shall be submitted.
- 9.10. Details on PV modules for each kind used in the plant shall be submitted
- 9.11. Details on inverters for each kind employed in the plant shall be submitted
- 9.12. Materials (PV modules, inverters, etc compliance with EWR) certificate shall be submitted.
- 9.13. Details of layout indicating location of Electrical Rooms, MDB/SMDB, DB, inverters, etc are to be submitted
- 9.14. Wiring layout shall be submitted
- 9.15. All PV D.C. cables shall be double insulated and black in color
- 9.16. Each inverter shall be provided with a type B RCD (IEC62423)
- 9.17. 4P isolator shall be provided on d.c side and AC side of the inverter.
- 9.18. Labeling alone PV d.c cables shall be provided to indicate the polarity and associated dangers at every 5 to 10m
- 9.19. Local isolator with enclosure shall be provided adjacent to MDB to feed solar PV system.

- 9.20. Single phase inverters must be interlocked and configured to behave as an integrated multiphase invertors providing a reasonably balanced output
- 9.21. Phase balance relay shall be provided for single phase inverters note to get unbalance output
- 9.22. Regular and routine maintenance of the small-scale solar PV installation and its corresponding components shall be carried out by owner/ producer
- 9.23. The owner/ producers are to be ensure that the frequency of the required maintenance of corresponding tests are conducted in compliance with EWR.
- 9.24. The wiring of solar PV systems shall withstand external influences such as wind, temperature and solar radiation.
- 9.25. The current carrying capacity for solar PV system d.c. cables shall be at least 1.25 times Short Circuit Current (ISC) under standard test conditions at any location.
- 9.26. To minimize voltages induced by lightning, the area of all wiring loops shall be as small as possible.
- 9.27. PV modules may be connected in series up to the maximum allowed operating voltage of the PV module and the PV inverter, whichever is lower.
- 9.28. The d.c. side of the solar PV system shall be protected by the use of class II equipment.