



**Al Andalus Tr. & Elect. Cont.
Co. L.L.C**

Doc. No.	JB-GN / ELECTRICAL
REV.	0.
Date	JANUARY - 2010

METHOD STATEMENT: ELECTRICAL WORKS

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**AL ANDALUS TRDG. & ELECT.
CONT. CO. L.L.C**
Sharjah – U.A.E.

METHOD STATEMENT
FOR
ELECTRICAL WORKS



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1. Scope / Objectives.

- This Method Statement details general procedures to be followed for construction of Electrical Works for Projects.

2. Method Statement / Procedure For Activities.

- 2.1. Fixing under floor sleeves.
- 2.2. Fixing conduits in the slabs.
- 2.3. Expansion Coupler in Slabs.
- 2.4. Fixing conduits with GI boxes in the columns.
- 2.5. Fixing conduits with GI boxes in the walls.
- 2.6. Fixing Enclosures for Distribution boards.
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3. Responsibilities.

- 3.1 Al Andalus Project Manager shall be responsible for the implementation of this method statement.
- 3.2 Al Andalus Project Manager is responsible to co-ordinate with the company PRO and the local bodies for obtaining necessary and essential work permits – if any, for proceeding with the works.
- 3.3 Al Andalus Project Manager / Project Engineer will ensure that the Resources are available to carry out the works as scheduled.
- 3.4 The Project Engineer / Site Engineer are responsible to carry out the works as per approved Shop Drawings, Method statements.
- 3.5 The Site Engineer / Supervisor are responsible to ensure that the work has been carried out as per drawings and inspections are done as per contract.

4. Resource Requirement.

General

Before start of work the following shall be ensured:

- Machinery & tool are suitable for use.
- Availability of suitable quantity of material for the works.
- Use only approved shop drawings & Material.
- MEP coordinated shop drawing is available and approved
- Area clearance obtained from other discipline/ Main contractor.

4.1 Materials

- All materials shall comply with the specifications regarding quality, dimensions, strength, etc. Samples will be submitted for the approval of the Engineer. Making sure all material as per consultant's approval before any installation.



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4.2 Drawings.

- Prepare the workshop drawings showing a complete installation along with section details & obtain consultants approval.
- Prepare the co-ordination Drawings with other MEP works.
- Obtain DEWA approval on Electrical workshop drawings after consultant's approval.
- Sub Station room trench layout and exact location of sleeves shall be obtained from DEWA.

5. Procedure for Electrical Works.

- Now, I would like to mention a brief explanation for each of the mentioned stages.

5.1 Sleeves.

- In the beginning of each project and before casting the retaining wall, we have to Make sure that we already fixed our sleeves for DEWA high voltage cables, Etisalat Cables or for earthing system, officers the size, No and heights of the sleeves as Per their requirements

5.2 Conduits in the Slabs.

- In this stage we have to start our works directly after fixing the shatter, since there are a lot of works to be done before fixing the steel, like marking the location for all the lighting, power, and fire alarm points, then fixing the loop in boxes, making the required holes for the dropped conduits for switches, bells, break-glasses and DB's. After finishing the steel work completely, we will start fixing our conduits as per the approved shop drawings, off course, we have to avoid passing the conduits in the wet areas, we have to minimize the bends for the conduits, and to be fixed properly with the steel, in addition to using expansion couplers where are coming expansion joins. At the end we will us masking tap to close all the end opening of the conduits.

5.3 Expansion Coupler in the slab & Construction Joints.

- The coupler is to be glued with solvent cement at one end and other end to be left loose with the other conduit left inside it. Make sure for no movement of the conduits after the expansion coupler is installed, Installed properly securing to the steel work. And expansion coupler has to be installed near construction joints only.



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5.4 Fixing Conduits and GI boxes in the columns.

- Before casting any column in the site, we have to check if there is any Switch Socket, bell or break glass fixed on the column. If there is any, we have to fix the GI or PVC box in the proper way so that it will be touch with shatter of the. Column from inside and the conduit will be extended to the top of the column.

5.5 Fixing Conduits and GI boxes in the columns.

- Before casting any column in the site, we have to check if there is any Switch Socket, bell or break glass fixed on the column. If there is any, we have to fix the GI or PVC box in the proper way so that it will be touch with shatter of the Column from inside and the conduit will be extended to the top of the column.

5.6 Fixing Conduits and GI boxes in the walls.

- After finishing the block work in each floor, we will start marking the location of all the switches, sockets, telephone outlets, TV outlets, break glass and bells as per the approved shop drawings. Then we will start chasing and chipping the marked locations by using the grinder, accordingly we will fix the GI boxes with minimum 5 mm away from the wall to make sure that the box is flush with the plaster. Next day we will terminate the conduits with the GI boxes.

5.7 Fixing DB's Enclosures.

- Usually, we always inform the main contractor, before starting the block work to use a blocks of 200 mm. width instead of 100 mm. and to locate plaster level points only in the location where is coming recessed DB's, so that we can fix the enclosures properly and to ensure the enclosures are completely flush with plaster. The mounted height of the enclosures will be 1300 (bottom of panel).
- Distribution board will be aligned, leveled and securely fastened to the wall.
- The surface mounted panel boards will be fixed at least 25 mm from wall: ensuring supporting members do not prevent flow of air.



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- Distribution board interiors will not be installed in cabinets until all conduits connections to the cabinet have been completed.
- Trim for flush mounted cabinets will be installed in plaster frame, flushed with furnished wall. Trim will be installed plumb and square to finish painting.

5.8 Wiring for lighting & Power Points.

- Before starting the wiring for the above mentioned activities, we have to make sure that the plasterwork is finished completely in that area / floor & there is no more water still on the walls.
- Before start pulling the wires we will be sure that there is no water or any rubbish inside the conduits.
- At the false ceiling area (60 x 60), we have to use a ceiling rose with a heat resistance wire & where are coming a gypsum board ceiling, we have to extend the wires from the slab to the expected level of the gypsum ceiling through a flexible conduits.
- For the light & Power circuits, wires & cables will be used as per the approved material submittal (2.5mm² for the lighting circuits & 4.0mm² for the power circuits). Lighting & Power circuits will be run in separate conduits.
- The wires & cables will be installed in conduits, trunking and ladders as per the approved shop drawings.
- For branch circuit work, originating from light & power panel boards will be arranged as per the approved drawings. Loads on various phases of panel boards will be balanced as per the approved load schedules.
- For avoiding any damaged for the conductors, insulation or jacket of the wire or cable during the pulling stage, and lubricants will be used properly to prevent any stresses on conductors.
- For pulling the wires, we will install 3mm galvanized standard steel wire with wooden blocks fastened at ends in empty service conduits.



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- At every branch circuit outlet & pull-box, every cable passing through will be left slack to allow inspection & for connection to be made. Cables terminating in outlet boxes will be left with at least 250mm extra length for terminations.
- All circuits will be properly labeled during the pulling work to facilitate the terminations at the respective devices.
- After the pulling circuit works completely, all the circuits will be checked & tested if any open circuits, short circuits, earthing continuity & excessive resistance or leakage.

5.9 Fixing Cable trays.

- Cable Trays & Ladders will be “as specified” type as per the approved material submittal.
- All accessories used such as “bends”, intersections, risers, reducers, elbows, etc. “used in cable trays & ladders will be of the same manufacturer as that of the trays & ladders.
- Prior to start any installation of Trays & Ladders, a complete coordination will be carried out with other mechanical services to avoid any interference or interrupted for the service.
- Tray / ladders routes will be marking at the ceiling before start any fixing of these items.
- Each run of cable trays & ladders will be completed before installation of any cables. Each run will be aligned, leveled & securely fastened to the ceiling / wall.
- Supports will be provided to prevent stern on cables entering or leaving tray. Cable trays extending through partitions & walls will be protected by fireproof non-combustible barriers.
- Sharp edges, burns & projection will be removed for fixing the trays & ladders approved suspension rods or steel angle brackets will be used at spacing not exceeding 1.5 meter and generally as shown on the approved drawings. Joints will be positioned as close as practicable to the tray / ladder supports.



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- The fitting of trays & ladders such as tees, bends & crossings will be connected with radial to permit cable-bending standards.
- Minimum clearance of 250mm will be maintained between top of tray & ceiling.
- Cable arrangement will be in one layer only, evenly spaced, with minimum spacing of two diameters of the larger of the two adjacent cables, or of a trefoil formation of single core cable circuit.
- Cable trays will provide direct support to the cables without cleats or saddles wherever practicable purpose made straps, cleats or saddles will however be used to maintain a neat or regular disposition of cables. In vertical tray installation or where trays not directly support the cables, load bearing cable cleats or saddles will be employed and securely fixed to the tray. Manufacturer's recommendations will be followed in selection of cable cleats or saddles, on the basis of individual application.
- Earthing jumpers will be installed on trays & ladders between the lengths and where required to ensure effective electrical continuity irrespective of whether a separate protective earth conductor is required or not.

5.10 Laying of L.V feeder Cables.

- After we finished from fixing the cable tray, C-channels in the proper way, we will start pulling the armored cables from the main electrical room to the all electrical rooms one by one and with more care to avoid any damage for the cables, after that it will be tied strongly with the vertical C-channels using cable cleats then it will be terminated to the MDB's, SMDB's through cable glands.
- Use and install cables only as shown on consultants approved shop drawings & as directed by the manufacturer
- Lay cables in one length unless otherwise indicated. Obtain permission from Engineer for all through joints, and where overall length requirement exceeds practical drum size.
- Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.



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- Install cables so that they are orderly and capable of being withdrawn.

Trunking: In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.

Conduit: Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.

- Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.
- Place cables side by side or as indicated. Fix using cable ties so that any cable may be individually removed.

CABLE TERMINATION & GLANDING.

- Ensure all joints and terminations and glanding are made by appropriately qualified Person, using, components and workmanship recommended by the cable manufacturer & as per local authorities & **DEWA** recommendation.
- Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture.
- Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
- Clean arm our thoroughly prior to jointing or terminating. At connections to equipment and switchgear without integral cable clamping terminals, use compression type lugs for bolted terminal connections.
- Do not bunch more than three cores at clamping terminals or bolted connections.
- Mark cable conductor phasing, or other core identification, at each end of all cables.



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- The Contractor shall be responsible for testing all cables before finally making off ends and connecting up.
- Where cable sheaths are used as earth continuity conductors, glands shall have the necessary contact surfaces or straps to provide a low resistance path under fault conditions.
- All cable connections to plant shall be made with approved cable lugs, compression type together with the usage of proprietary tools.
- All glands in outdoor situations and wherever else specified, shall be of weatherproof and water tight type. Gland manufacturers shall be subject to approval. Glands shall be selected to suit location and type of cable used.
- Earthing tags shall be fitted to each gland, on assembly, prior to the lugs being attached. Ensure to order cable glands in kit form complete with earth tag, shroud, locknut, neoprene seal etc.

5.11 Fixing of MDB, SMDB, MCC, & D.B.

General: All materials and equipments will be furnished and install as per the approved shop drawings, material submittal and proposed method statement.

- A copy of approved documents is furnished to switchgear supplier to start with the manufacturing of products in strict conformity to their approved material / technical submittal and the same will be delivered to site within the agreed delivery date.
- The Panel boards will be in accordance with Local Dewa rules & Requirement. "Standard for Panel Boards" and standard for cabinets and boxes. Manufactures 380 / 220V, 3-phase, 4 wires, 50Hz.
- All the equipments will be installed in accordance with the manufactures recommendations / installation instructions and as per the site requirements / approved master project program.



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- A nameplate will be provided with Manufacturer's name, Panel type and Ratings.
- A Samples of DBs enclosures (Surface and Flush) type circuit breaker arrangements in DBs will be delivered at site for the Consultants / Client inspection and to be proceed with the installation upon obtaining the approval.
- The assembly of distribution boards will be completely wired and rested at the factory ready for installation when received at site. Bracing will be provided to prevent distortion in handling and shipping.
- Distribution boards will be incorporate plug-in type miniature circuit breakers of tripping characteristics B, C or D for lighting, miscellaneous power or motor loads on necessary complete as specified as shown in the approved drawings.
- Interiors will be so designed that circuit's breakers can be replaced without disturbing adjacent units and without removing the main bus connectors.
- All exterior and interior steel surfaces of the Panel Boards will be properly cleaned after completion of work and all rubbish, dust or concrete spatter will be removed from inside and around the Panel Boards by using brushers, vacuum cleaner etc.,

Final Distribution Boards:

A – Fixing of DB's enclosures:(Refer 4.7)

B – Panel Boards Interiors:

- Install the connecting conduits to the panel board, ensuring these conduits will not be used to support the distribution board and all the unused opening will be properly closed.
- The panel Boards will be equipped with circuit breakers with frame size and trip setting as shown in the approved document.

C – Panel Boards Wiring:

- Before pulling wires inside the Panel Board conduits, conduits will be checked to be free of burrs, dry and clean.



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- Wiring will be neatly arranged, accessible and strapped to prevent tension on circuit breaker terminals.
- The arrangement will permit cables to enter bottom and top of the enclosures and connect to their respective terminals without interference.
- Insulation to be removed from the end of each wire and cable with a pocketknife, being careful not to nick the wire conductor.
- Incoming and outgoing feeder panel will be labeled, engraved and a nearly typed schedule inside the boards, will describe all the outgoing final sub-circuits, their rating, the areas and points served.
- Light and power circuits will be arranged in the Panel Boards as per the approved Load Distribution Schedule.
- Tags of feeder cables to identify cable or circuit number and conductor size in accordance with the schedules.

D – Dressing of DBs:

- A professional electrician will be carrying out for this work.
- Cable terminals will be suitable for the specified cable sizes. Adequate space will be provided for cable terminations.
- Dressing of standard cables will be done by using ferrules of sizes suitable for accommodating all stands of the cables.

After finishing the 1st coat near the final DB's, we will start fixing the inside components and numbering, terminating the wires as per the Load Distribution Schedules, in addition to fixing a suitable identification labels to clearly indicate the location and the purpose of each item or circuit.

- The neutral cable is connected to the neutral strip, which is turning in grounded with a bare wire.



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- Armored cable will be strapped properly, a hacksaw is used to cut the cables, a suitable angle to the cable for making a cut through one section of the spiral amour and care will be taken not to cur the wires.
- The glands for various single core and multi core cables will be on the purposed made and suitable for rigid mounting to the enclosure.
- Finally, after the dressing completed, the door will be fixed and covered for protect the panels from any damaged, ensuring that all the engraved labels fixed for the DB sections, main isolator, ELCBs etc.,

Sub-Main Distribution Boards:

- We will start fixing the SMDBs after painting at least 1st coat in the Electrical rooms completed. The fixing height for the SMDB's will be at 800 mm. from finished floor level as per DEWA regulations as well as trunking arrangement for the meters or (at height not exceeding 2 meters to the top of the Panel Boards from the finished floor level)
- As noted earlier, a sample board of SMDB should be approved by the Consultants prior to start installation.
- SMDBs will be wall or floor mounted type depending of the frame size of the board. All the trunking arrangements will be done as per the approved shop drawings.
- In case of floor mounted boards (MCC-R) a depressed floors will be provided with galvanized steel support structures to raise the level of the panel.
- Wiring, cabling and dressing for the SMDBs will be nearly similar to dressing of the DBs and all the connections will have front access only.

Main Distribution Boards:

- After the supplier completes manufacturing the MDB's in his workshop, the Consultants' will be invited for inspection of the Panel Board before delivered to site.



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- 1st coat painting should be completed in the Main Electrical Room before the panels are delivered to site upon the Consultants inspection and approval of the Panels.
- Cable ladders and cable trays start assembling at main electric room as per the approved layout for incoming and outgoing cable which is top or bottom entries.
- Incoming and outgoing feeder will be installed.
- Dressing and termination for the feeders will be done by a electrical specialist and well experienced and professional electricians.
- The Main distribution boards will be identical to the sub-main distribution boards in all respect except that all equipments and connections will have front and rear access.
- All the meters (CT's meter and check meters) will be installed in the respective main distribution boards after tested and calibrated by DEWA.

Testing:

- On completion of the installation and prior to its being made "Alive" for service, all the electrical test will carried out all sections of the works in the presence of the Consultants' and all the tests will be carried out in compliance with the DEWA regulations and the contract specifications. All the test reports will be submitted to the Consultants' along with the As-built drawings and Operation and Maintenance documents.

The Test includes the Following:

- Mongering incoming line terminals and buses, phase-to-phase and phase-to-ground after disconnecting devices sensitive to megger voltage.
- Test ground connections for continuity and resistance.
- Earth continuity and earth resistance tests.
- Mechanical interlocks will be checked for proper operation.
- Unit compartment doors will be adjusted.



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5.12 Fixing wiring accessories, light fittings.

- After finishing the pre-final coat for the building, we will start fixing the wiring Accessories, light fittings, fire alarm devices. Of course the fitting where is coming in the false ceiling should be fixed in the proper way with more supports if required:

Area of installation - Interior.

- Enclosure pattern - Flush.
- Cover plate finish, all accessories to match - Molded plastic, color - white.
- Ear thing terminal integral within switch box.
- Neon indicator with red lens, illuminated in 'ON' position, for connection units.
- Switch rocker bar color - white.

Area of installation – Exterior/Plant (Pump Room)

- Enclosure pattern - Surface and weatherproof.
- Accessory mounting - Direct to enclosure.
- Earthing terminal integral within switch box.

Installation General.

- All accessories shall be properly aligned with vertical edges; plumb and horizontal edges level and mounted at the height recommended below and shall be to the approval of the Engineer.
- All flush accessories shall have cover plates fitted correctly onto the wall or ceiling or any other services. Any accessories found to be incorrectly aligned after installation will have to be removed and re fixed.



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INTERIOR LIGHTING SWITCHES.

- Rating – minimum 10A.
- Gangs as indicated and shall be grid type.
- Pole configurations - Single pole, double pole, 2 way or intermediate as indicated.
- Local lighting switches for the control of lighting circuits shall be of the following types:
- For single and multi-gang units in locations in the building where installation work is on the surface switches shall be of the surface pattern and shall be mounted in proprietary metal boxes.
- For single and multi-gang units in all areas throughout the building where installation work is concealed, switches shall be of the 10A grid switch type flush pattern and shall be mounted in suitable metal boxes..
- For areas where switches are shown connected to different phases, in the same location, multi-gang switches are to be used with an approved phase barrier and shall also be to the requirement of the local authority..
- An "array" of single gang switches adjacent to each other shall be avoided by using multi-gang switches.

5.13 Telephone / Data System.

- i) Prepare the workshop drawings showing a complete installation along with section details for co-ordination with other MEP works and obtain Consultant Engineers approval on the same.
- ii) Obtain Etisalat / DIC (*Dubai Internet City*) approval for telephone workshop drawing.



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- iii) Install sleeves for main telephone incomer. Install telephone boxes & telephone junctions boxes. Prior co-ordination with Etisalat is required for exact location of telephone main cable entry sleeve.
- iv) Install PVC Conduits embedded in concrete slabs and walls.
- v) Install trunking / cable trays in risers as highlighted in relevant shop drawings.
- vi) Run wires from various telephone / data outlets in to intermediate telephone distribution frames, via trunking / pipes in corridors false ceiling area.
- vii) Run telephone / data cables from intermediate distribution frame panel into main distribution frames in ground floors low current room via trunking / cable riser.
- viii) Install distribution frame panels, telephone / data outlets and terminate relevant wires and cables.

Testing and Commissioning of telephone installations.

5.14 Fire Alarm System:

- Prepare the workshop drawings showing a complete installation along with section details for co-ordination with other MEP works and obtain Consultant Engineers approval on the same.
- Obtain Civil Defense Department approval on the fire alarm system after consultant's approval.
- Install PVC Conduits embedded in concrete slabs and walls.
- Install trunking / cable trays in risers as highlighted in relevant shop drawings.
- Install approved fire alarm cable from various devices through conduits (Trunking will be used for riser only).
- Install & terminate fire alarm system devices in various areas. This activity will run concurrently with finishes and false ceiling activities.



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- Install fire alarm panel in ground floor and terminate loops and bell circuit wires.
- Protect the fire alarm panels adequately.

Commission and activate system.

Testing & Commissioning the System.

- Invite Civil Defense Department for final inspection.
- Submit commissioning & testing records formats.

5.15 Low Current System:

- Prepare the workshop drawings showing a complete installation along with section details for co-ordination with other MEP works shall be submitted for approval of workshop drawings and obtain Consultant Engineers approval on the same.
- Arrange material submittal to obtain the approval from consultant.
- Place the order with suppliers.
- Install PVC Conduits embedded in concrete slabs and walls.
- Install trunking / cable trays in risers as highlighted in relevant shop drawings.
- Install and terminate low current systems devices in various areas.
- Install wires from various devices into trunking, run down to respective activity to main panel.
- Install main panels and terminate wires.
- Commission and activate the system.

6. Testing and commissioning. (Refer To The Attachments)

- This consists of a Brief Description of Method Statement for the Following.



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1. Final circuits (lighting &Power) and Distribution Boards.
2. Distribution Cables.
3. MDB,s & SMDB,S
4. Earthing and Bonding System.
5. Lightning Protection Test.
6. Fire Alarm System.
7. Fire Alarm Cables.
8. Door Phone System.

6.1 TESTS ON FINAL CIRCUITS (Lighting & Power) AND DISTRIBUTION BOARDS.

- The Following are the tests that will be carried out on final electrical circuits and distribution boards. The observations and readings will be recorded in the appropriate formats.

a) Visual Check

- All the Electrical components such as conduits, wires, trunkings, light fittings, socket outlets etc. connected to the final circuit of the distribution boards are to be visually inspected against any physical damage and for proper installation.
- Check the installation of distribution boards and the internal wiring to ensure electrical and mechanical connections, identification, labeling etc.
- Check that all the metallic components are properly earthed / binded.

b) Polarity Check

- Ensure that single pole switches are installed in the live conductor.

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- Where Screw type lamp holders are in circuit, ensure that the outer or screwed conductor is connected to the neutral conductor.

c) **Continuity of Protective Conductors.**

- The Continuity resistance of the protective conductor from the furthest point to the main earth terminal is to be measured for each final circuit with a DC ohm meter and the value recorded and verified to be within the permissible limit.

d) **Continuity of Ring Final circuit Conductors.**

- The continuity resistance between the open ends of each of the three rings of circuit (i.e. phase, neutral and earth) is to be measured for all ring final circuit conductors with D.C. ohm meter and the value to be verified with the permissible limits.

6.2 **TESTS ON DISTRIBUTION CABLES (POWER & CONTROL)**

- The following are the tests that will be carried out on distribution cables. The observation / readings of the tests will be recorded in the appropriate formats.

a) **Visual Check**

- The installation of the cable to be checked to ensure the correct laying, proper glanding, corrects termination, adequate supports, labeling, identification etc.

b) **Insulation Resistance Test**

- Insulation resistance between cores is to be measured with a 500 V Megger and the readings to be verified with the permissible limits.
- Insulation resistance between cores and armor and earth terminal is to be measured with a 500V Megger and the readings to be verified with their permissible limits.



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c) Phase Rotation Test

- After completion of tests (a) and (b) stated above, the relevant breaker is to be switched on and the phase rotation at the down stream point is to be checked and ensured that it is same as elsewhere (i.e. RYB).

d) Performance Test

- Upon verification of the correct phase rotation to the connected equipment, switch on the isolator (if any) and run the equipment to verify the complete performance of the connected equipment and minimum 24 hrs. To check for any abnormal temperature rise in cables, terminals, switches and protective devices etc.

e) Insulation Resistance

- Insulation resistance between phase, neutral and earth is to be measured with a 500 Volt Megger. (During this test, either all lamps and current using apparatus are to be removed from the circuitry with all switches closed or all local controlling switches to be kept open and lamps and current using equipment need not be removed) and valves to be verified with permissible limits.

Note:- The mains supply can be switched on to the final circuit to enable further tests to be carried out, which require supply voltage.

f) Earth Fault Loop Impedance Test.

- Earth fault loop impedance is to be checked for each final circuit with an impedance tester. (RCCB to be by passed during test) and the reading is to be verified with the permissible limit.

g) RCCB Test.

- All RCCB (ELCB) are to be checked by means of a RCCB tester with minimum 3 different set currents (One setting above, one below and one rated sensitivity currents of an ELCB) and the trip times are to be recorded. The values to be verified with the permissible limits.



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h) Circuit Performance

- After all the above tests are conducted and observed that they are satisfactory, and operational test to verify the desired performance of the circuits need to be carried out. They are as follows:
- Switch on the MCB in the DB.
- In case of lighting circuits, operate all the switches connected in the circuit one ensures their functioning to the desired light fixture in the desired manner.
- In case of ring / radial circuits, test all the sockets with a test lamp to ensure the availability of power.
- In case of any other fixed equipment, operate the relevant switch and observed the functioning of the equipment.

I) Full Load Current.

- Measure and record the current in all phase of the incoming cables in lighting DB's keeping all the lights "ON".

6.3) TESTS ON MDB's / SMDB's / MCC's

- The following are the tests that will be carried out on the MDB's / SMDB's / MCC's.

a) Visual & Construction Check.

- The general arrangements of the components and wirings are to be inspected to ensure neat workmanship.
- The Complete panel is to be inspected and checked against the shop drawing to ensure that right components of correct ratings are installed and properly labeled and identified.



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- All the bolts / nuts and bus bar connections are to be checked to ensure that all are properly tightened.
- Earthing of components and other related connections are to be verified and ensured.
- All the meters and selector switches are to be checked to ensure that correct selection and ratings.

b) Insulation Resistance Test.

- Insulation resistance between phases, neutral and earth are to be measured with a 500 volts meggar and the valves to be verified with the permissible limits. (During this test, care is to be taken to disconnect components such as lamps, meters etc. Which will get damaged upon application of 500 volts).

c) Interlock Tests.

- Interlocks between NEC (*Normal Electric Connector*) and generator incomers to the essential feeders are to be verified to ensure proper operation.

d) Functional Test.

- To start the functional tests, check the control circuit of each starter / system for its correct operation in regard to switching on actuation of thermal overload and emergency stop – lock etc.
- Switching ON and OFF of all MCCB's, contractors, relays etc. is to be verified for the desired operation.
- The operation of starter for various equipment such as pumps, fans etc. is to be checked to ensure the desired function and currents at various stages of loads are to be recorded.
- The operation of the indicating lamps and meters are to be verified to ensure proper functioning.



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- All equipment which are supposed to be “ ON “ simultaneously are to be run at full load for a minimum period of 2 hrs and check for any abnormal rise in temperature on bus bars, jumper cables, terminals and various devices.

e) Earth Leakage Protection Tests.

- All the earth leakage circuit breakers are to be checked by means of RCCB tester, setting 50%, 100% and 150% of the rates sensitivity currents and the respective trip times to be recorded. The readings are to be recorded. The readings are to be compared with the characteristic values of the ELCB's to ensure their correct operation.
- Where core balance CT's and EL, relays are provided for earth leakage protection, an earth leakage current of known value is simulated by external means and the trip times is to be recorded for 50 %, 100% and 150% of the rated sensitivity currents. The readings are to be compared with the characteristic values of the EL relay (RCCB tester can be used for simulation of earth leakage currents).

6.4) TESTS ON EARTHING AND BONDING SYSTEM

a) Visual Check

- All the earth electrode in the earth pits is to be visually inspected proper installation and connections.
- All the protective conductors from the earth electrode to the main boards and distributions are to be visually inspected for proper installation and connections.

b) Measurement of Earth Electrode Resistance

- The earth electrode resistance of each earth pit is to be measured with a Meggar after removing the protective conductor connection and the readings to be recorded and verified with the permissible limit.



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c) Continuity Test.

- The continuity resistance of protective conductors is to be measured D.C. ohm meter and values to be recorded and verified with the permissible limits to ensure proper earthing.
- The continuity resistance between the main earth terminal at the distribution board and the metallic frame works of farthest equipment to be measured a D.C. ohm meter and the value to be recorded and verified with the permissible limit to ensure proper bonding.

6.5) TESTS ON LIGHTNING PROTECTION SYSTEM.

- The following are the tests that will be carried out on the lightning protection system.

a) Visual Check.

- The whole of the lightning protection system installation is to be visually inspected to ensure proper joints of copper tapes with accessories and earth electrodes in the earth pits.
- All the joints are to be cleaned & lightened to maintain good continuity resistance.
- All cladding to be checked by the Sub – Contractor that it is electrically connected.

b) Measurement of Earth Electrode Resistance.

- The earth electrode resistance of each earth pit is to be measured with an earth meggar after removing the lightning system continuity conductor connection and the readings are to be recorded and verified with permissible limits.

c) Continuity Test.



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- The Continuity resistance between lightning protection conductor at the selected farthest points and the earth electrode is to be measured with a D.C. ohm meter and the readings to be verified with the permissible limits.
- The continuity resistance between the lightning protection conductor and the metallic frame works bonded with the lightning protection system is to be checked with a D.C. ohm meter and the reading to be verified with the permissible limits.

6.6) TESTS ON FIRE ALARM SYSTEM.

- The following are the tests that will be carried out on the Fire Alarm System.

a) Visual / Wiring Check.

- All the cables connected to the fire Alarm system control panel and battery is to be inspected and checked for proper connections as recommended by the manufacturer.
- The whole of the installation in general is to be checked to ensure proper installation.

b) Functional Test.

- After restoring the power supply to the panel, the necessary adjustments and settings are to be made so that the panel is put into operation.
- Once the panel is in operation, all the detectors / break glasses are simulated to be activated by giving smoke and the display of zone nos. of the detector activated is witnessed on the panel and the operation of the LED on the detector is to be noted. Further, the indication on the repeated control panel is to be checked and verified for correct functioning.
- During the above testing the sounder circuits and bells should be checked and ensured that they function correctly.
- Faults such as power supply failures, battery, and open circuit of zones are simulated and the respective visual indications on the panel by means of LED are to be checked and ensured for proper functioning.



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- The interlocking of F.A. System with various mechanical systems such as AHU's etc., is to be checked for various Fire Conditions in various zones.

c) TESTS ON FIRE ALARM CABLES

- The following are the tests that will be carried out on the Fire Alarm Cables. The observations / readings of the tests will be recorded in the appropriate format.

a) Visual Check.

- The installation of the cable to be checked to ensure the correct laying proper termination, adequate clipping, labeling identification etc.

b) Insulation Resistance Tests.

- Insulation Resistance between cores is to be measured with a 500 volts meggar and the readings to be verified with the permissible limits.

7. TEST REPORTS

7.1) Distribution Boards and Final Circuits.

7.2) MDB's and SMDB's, Motor Control Centers.

7.3) Power Cables.

7.4) Earth Electrode Resistance.

7.5) Fire Alarm System.

7.6) Inter Com System.

8. Manpower.

- Site Engineer	- Gang Mans
-Supervisor	- Electricians
	- Helpers



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9. Records.

No.	Document
1.	Inspection Request
2.	Area clearance form

10.Approvals

- Project Manager
- Engineer





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TEST REPORT FORMATS

1. Distribution Boards and Final Circuits.
2. MDB's and SMDB's Motor Control Centers.
3. Power Cables.
4. Earth Electrode Resistance.
5. Fire Alarm System.
6. Intercom System.
7. Low Current System
8. Generator Set

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