PROJECT DETAILS

METHOD STATEMENT FOR MEDIUM-VOLTAGE SWITCHGEAR TESTING AND COMMISSIONING

REVISION RECORD

This cover page is a record of all revisions of the document identified above by number and title. All previous cover pages are hereby superseded and are to be destroyed.

Rev. No.	Date	By	Chkd.	Approvals	Description and Page Numbers of Revisions

CONTENTS

1.0 PURPOSE

The purpose of generating this method statement is to define the procedure step by step to implement the correct practices for Pre-Commissioning and Commissioning of Switchgear Panels through the guidelines contained herein so as to ensure that the job execution complies with the requirements of contract specification and project requirements.

2.0 SCOPE

This method statement covers all processes related to Installation of MV switchgear installation as the following:

- Pre-commissioning of the MV/LV Switch Gear procedure.
- Testing and Commissioning of MV switchgear procedure.
- This procedure is to be read in conjunction with the relevant ITP, outlining the responsibility and the quality verification to be performed by various parties.

3.0 REFERENCE

- Approved Shop drawings.
- Specifications
- ISO 9001:2008.
- Project HSE plan
- Project Quality Plan
- Manfacturer's Data sheets & Manufacturer recommendations.
- Regulation of the local Electrical Authority
- Requirements of Civil Defense Department
- Approved Material submittal

4.0 DEFINITIONS:

PQP	: Project Quality Plan
PSP	: Project Safety Plan
QCP	: Quality Control Procedure
HSE	: Health, Safety and Environment
MS	: Method Statement
ITP	: Inspection Test Plan
QA/QC	: Quality Assurance / Quality Control Engineer.
SK	: Store Keeper.
WIR	: Inspection Request
MIR	: Material Request
MV	: Medium Voltage

5.0 RESPONSIBILITIES:

Responsibilities for ensuring that the steps in this procedure shall be carried out are specified at relevant steps in the procedure:

- Project Manager
- Construction manager
- QA/QC Engineer
- Site Engineer
- HSE officer
- SK

5.1 Project Manager

- Project Manager is the overall responsible for the project in terms of work execution, safety, planning & quality. The Project Manager will maintain the planning progress and coordination of works with the main contractor.
- The work progress shall be carried out as per planned program and all the equipment's required to execute the works shall be available and in good condition as per project planned.
- Specific attention is paid to all safety measures and quality control in coordination with Safety Engineer and QA/QC Engineer and in line with PSP and PQP.

5.2 Construction Manager

- Construction Manager is responsible to supervise and control the work on site.
- Coordinating with QA/QC Engineer and site Team and foremen for all activities on site.
- Control and sign all WIR's before issuing to Consultant approval.

5.3 Site Engineer

- The method of statement to the system shall be implemented according to the Consultant project specifications and approved shop drawings.
- Provision of all necessary information and distribution of responsibilities to his Construction team.
- The work progress shall be monitored in accordance with the planned work program and he will provide reports to his superiors.
- The constant coordination with the Safety Engineer to ensure that the works are carried out in safe working atmosphere.
- The constant coordination with the QA/QC Engineer for any works to be carried out and initiate for the Inspection for the finished works.
- He will ensure the implementation of any request that might be raised by the Consultant.
- Efficient daily progress shall be obtained for all the equipment and manpower.
- He will engage in the work and check the same against the daily report received from the Foremen.
- The passage of all the revised information to the Foremen and ensure that it's being carried out properly.

5.4 QA/QC Engineer (MEP):

- The monitoring of executions of works at site and should be as per the approved shop drawings and

project specifications.
- Ensure WIRs and MIRs are being raised for activities in timely manner and inspected by the Consultant.
- Check and insure that all activities / work done / completed prior to offer for Consultant inspection.
- He will follow and carried out all the relevant tests as per project specifications.
- Obtain the required clearance prior to Consultant's inspections.
- Should acquire any necessary civil works clearances and coordination.
- Coordinate with site construction team.
- One who will assist the Consultant Engineer / Inspector during inspection.

5.5 Site Foreman

- The carrying-out of work and the proper distribution of all the available resources in coordination with the Site Engineer on a daily basis.
- Daily reports of the works are achieved and coordinated with the Site Engineer.
- Incorporate all the QA/QC and Safety requirements as requested by the concerned Engineer.
- Meeting with any type of unforeseen incident or requirement and reporting the same to the Site Engineer immediately.

5.6 Safety Officer

- The implementation of all safety measures in accordance with the HSE plan and that the whole work force is aware of its proper implementation.
- The implementation of safety measures is adequate to maintain a safe working environment on the work activity.
- Inspection of all the site activities and training personnel in accident prevention and its proper reporting to the Construction Manager and the Project Manager.
- The site is maintained in a clean and tidy manner.
- Ensure only trained persons shall operate the power tools.
- Ensure all concerned personals shall use PPE and all other items as required.
- Ensure adequate lighting is provided in the working area at night time.
- Ensure high risk elevated areas are provided are barricade, tape, safety nets and provided with ladders.
- Ensure service area/inspection area openings are provided with barricade, tape, and safety nets.
- Ensure safe access to site work at all times.
- Temporary power supply for T & C shall be taken through standard rated MCBs and RCBs.
- Power supply used to take temporary power supply shall not have any joints.

5.7 Store Keeper (SK)

- Responsible for overall Store operations in making sure to store the material delivery to the site and keep it in suitable area that will keep the material in safe from rusty and damage.
- One who will acknowledge the receiving of materials at site in coordination with QA/QC and concerned Engineer.

5.8 Third party Supplier

- Do all the procedure for the Pre-commissioning of the panel witnessed by sub-contractor, Main contractor and Consultant Engineer.
- Do all the preparation that required for the testing and commissioning.
- Provide certified staff for handling the testing of the Panel.
- Provide all required tools for the Testing and commissioning with assistance from the sub-contractor.
- Handle the testing and the commissioning for the MV panel and get final approval authorized departments.

6.0 EQUIPMENTS

- Tool Box.
- Portable Hand Tools.
- Insulation Tester.
- Digital Multi-meter.
- Measuring Tape.
- Ladder.
- Safety requirements tools such as safety shoes, safety helmet, safety glasses, fluorescent vest, and safety gloves to ensure maximum ability of safe work and dust mask when require.

7.0 PROCEDURE

7.1 Safety

- Ensure only trained/ Authorised & licensed persons only shall operate the power tools and do the Testing job.
- Ensure that all personnel's dealing with live electricity shall be certified and competent.
- Ensure that Temporary live cable management plan shall develop and implemented.
- Necessary PPE to be worn while working in energized to be worn while working in energized circuits.
- Ensure adequate lighting is provided in the working area at night time and if inside the building area to be well illuminated.
- Safe lifting and shifting of switch gear and its related hazards and risks shall be identifying.
- Ensure service area/work area openings are provided with barricade, tape, safety nets and warning signage to be provided (Danger: High voltage).
- Ensure LOTO procedure to be followed and implement comprehensive logout & tag out during execution of work.
- Emergency response plan & procedure shall be developed and established as per the site condition during the execution of activity.
- PTW to be applied and obtained to start work on the required area.
- Calibrated Instruments only to be used.
- Temporary power supply for T & C shall be taken through standard rated MCBs and RCBs.
- Power supply used to take temporary power supply shall not have any joints.

7.2 Site Planning & Preparation

- As per the approved shop drawing and specifications involved, the preparation and site planning should be matching the methodology of works according to the prepare suitable circumstance to work as per schedule and planning.
- Survey the work area for any pre-existing safety hazards and render harmless if possible.
- Ensure all materials, tools and resources are available.
- Ensure that the previous stage is inspected and approved by Consultant prior to start the pre-commissioning and commissioning of 11-kV Switchgear.
- Ensure latest approved shop drawings are issued to the site team prior to proceed the activity.

7.3 Work Methodology

- Preliminary Checks for Pre-commissioning and Commissioning Procedure of Switchgear
- Check the readiness of the area.
- Check whether equipment is installed as per approved drawings and design.
- Check and ensure the following items are checked prior to Pre-Commissioning and Commissioning.
- Availability of access to all equipment's and components required to testing and commissioning and servicing.
- Check the installation of all devices and materials are must be as per approved Shop drawings, material sybmittal and project specifications.
- The areas are free from dust and construction debris.
- Check all the instruments must have valid calibration certificates.

7.4 Pre-Commissioning Procedure of Switchgear

7.4.1 Cables:

7.4.1.A Physical Check

- Check the cable installation and ensure the following are in accordance with the approved shop drawings and applicable Codes and Standards and REGULATORY BODY requirements;
  - Spacing between cables and depth of lying.
  - Cable tiles, warning tapes.
  - Cable identification and labelling.
  - Bending radius
  - Glanding and gland Earthing.
  - No physical damage.

7.4.1.B Voltage check of the MV cable

Apply the voltage 1 KVDC for 1 minutes, test voltage as per related Codes and Standards:

- Use approved and valid certified test equipment.
- This test requires coordination with the manufacturer of transformer; switchgear etc. if the MV cable ends at a transformer or switchgear (disconnect main transformer and all CT, PT).
- Insulation resistance test using approved insulation tester (2.5KV Megger).
- Continuity test using approved resistance tester.
- Phase rotation test (in the LV side of PTs).

- Performance test

Energise the cable temporarily, apply load for 2 hours and verify complete performance. Check for any unusual temperature rise in cables, terminals and protective devices.

7.4.1.C HV Panel, RTU, DCP, Fibre patch panel, fibre optic cables MV cable:

- Contractor shall commission the MV Panel, DCP, and RTU Panel by one commissioning Consultant as per REGULATORY BODY approval. Fibre optic cable shall be commissioning up to the primary substation.

7.4.2 Pre-commissioning for the MV Switchgear panel:

7.4.2. A Visual inspections Date Remarks Sig.

- Ensure the absence of all foreign bodies inside the switchboard.
- Check the outer appearance (absence of any traces of shocks, peeling paint) -carry out any touch-ups if needed.
- Check the compliance with the protection index (leak tightness of the functional units, various sealing points, etc.).

7.4.2. B Mechanical Checks Date Remarks Sig.

- Operating and interlocking tests on the access doors and mobile panels.
- Tests for the figure lock systems.
- Mechanical tightening inspection (electrical jointing, power and Earthing circuits etc.).
- Operating manoeuvres on the moving parts:
  - Plugging-in and withdrawing,
  - Arming, closing and tripping.

7.5 Testing & Commissioning for the MV- Switchgear:

7.5.1 BUSBAR TORQUE TEST

- After installation of the switchboards, all the bus bar bolts are torque tested as per manufacturer's recommendations with a torque wrench.

7.5.2 BREAKER TO BREAKER RESISTANCE

- Breaker-to-Breaker Resistance Measurement:

- Breaker-to-Breaker resistance is measured by connecting a micro-ohm meter between adjacent panels by applying 100A DC for 10 seconds for each phase. The above said is repeated for other phases and other breakers also.

7.5.3 CT TESTING

1. **Insulation Resistance Measurement: (500V Megger)**

- Measuring insulation resistance of C.T secondary windings using 500V megger.

2. **Polarity check:**

- The DC voltage test momentarily imposes a small DC voltage on one side of a CT (Primary) and the direction of the momentary deflection of a meter on the opposite side (Secondary) of the CT is noted and compared with polarity marks.

3. **Winding resistance Test:**

- The secondary winding resistance of the CT is measured using the Ductor for each phase.

4. **Ratio Test:**

- Applying the current in the primary and by measuring the secondary current do the ratio test. Then dividing the value of the primary current by the secondary current checks the ratio of the CT. (This is to be done for all phases).

7.5.4 VT TESTING

1. **Insulation Resistance Measurement:**

- Measuring insulation resistance of VT primary to earth by using 5000V Megger.
- Measuring insulation resistance of VT secondary to earth by using 500V Megger.
- Measuring insulation resistance of VT primary to secondary by using 1000V Megger.

2. **Polarity check:**

- The check is made by imposing a small DC voltage on VT (Primary) to the earth and the direction

of the momentary deflection of a sensitive voltmeter on the opposite side (Secondary) to the earth of the VT is noted.

3. Winding resistance Test:

- The primary and secondary winding resistance of the VT with respect to their neutrals is measured using the Ductor for each phase.

4. Ratio Test:

- Applying the three-phase voltage on the primary side and by measuring the secondary voltage for each phase does the ratio test. Then dividing the value of the primary voltage by the secondary voltage checks the ratio of the VT.

7.5.5 RELAY TESTING

- All the relays are to be tested by secondary injection through CT and VT terminals using the secondary injection kit according to the manuals & test formats given.

7.5.6 HIGH VOLTAGE TEST

1. High Voltage Test:

- High voltage test is done by applying 80% of factory-tested voltage.
- While doing the HV test the steps to be followed are:-

1. All CTs circuits are shorted.
2. All VTs must be isolated.
3. All the CBs are made into service.
4. For doing 'R' phase the other phases are shorted and earthed.
5. Before HV IR test 5kV megger is to be done.
6. HV test as said above done for 1 minute and the leakage current is recorded from the kit.
7. After HV IR test 5kV megger is to be done.

The above said is also repeated for other phases also.

7.5.7 PRIMARY INJECTION TEST

- Primary injection is done by applying current in primary of the CT and measuring the current up to the last point of the secondary circuit by making all the CT circuits through. This test is

proving the secondary circuit of CTs is proper.

7.5.8 FUNCTIONAL CHECKS

1. Functional test is to be done according to the drawings given. This test is proving interlocks; operations, tripping & alarms are as per the design: Injection Test (Primary and Secondary)
2. Insulation Test
3. Partial Discharge and Ultrasound Test
4. Infrared Thermoelectric Detection
5. Manufacturer Recommended Test

8.0 ATTACHMENTS

- Inspection and Testing Plan
- Check List – Pre-commissioning
- Check list - Testing and Commissioning Reports
- Risk Assessment