
	Torrent Power Ltd. - Distribution	Doc. No.: TPDF02-DIS01-OCP-025
	OCP- Maintenance of Switching station and Substation	Rev. No. /Dt: 01 / 01.12.2022

DOCUMENT CONTROL


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Document owner:	General Manager (HV Cell)	
Prepared by / Modified by	Mr. Amit Magdum Manager HV Cell	07.11.2021
Reviewed by	Mr. Shilajit Ray Mr. Satish Shah Assistant General Manager HV Cell	22.11.2021
Approved by	Mr. Snehal Shah Mr. Abdulrashid Shaikh General Manager HV Cell	30.11.2021
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Amendment Details:

Sr.	Issue No.	Rev. No.	Date	Amendment Details	Reviewed by	Approved by
1	1	0	01.12.2021	First Issue	Shilajit Ray Satish Shah	Snehal Shah Abdulrashid Shaikh
2	1	1	01.12.2022	First Revision done (Clause 12.5)	Shilajit Ray Satish Shah	Ankit Saha Abdulrashid Shaikh

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1. PURPOSE

- 1.1. Maintenance of Switching station and Substation

2. SCOPE OF DOCUMENT

- 2.1. The scope of this document is to define a procedure for following activities:
 - (1) Erection Maintenance and Testing of Power Transformer (only in SMK)
 - (2) Routine repair & maintenance of 11kV (only in SMK) & 22kV VCB panel including bus bar
 - (3) Testing of 11kV (only in SMK) & 22kV panels including circuit breaker
 - (4) Attending flash over & Hot spot in 11 KV (only in SMK) & 22kV panels
- 2.2. The process document aims to define the guidelines to ensure the process efficacy and effectiveness as required by the Integrated Management System.

3. FIELD OF APPLICATION


- 3.1. This procedure is used for Maintenance and testing of 22kV panels, 11kV panels (at SMK only) & 22/11kV Power Transformers (at SMK only) in TPL-D's Franchisee areas of Bhiwandi & SMK.

4. FREQUENCY

- 4.1. Incomer, Bus couplers, Busbar
 - (1) Annually \pm 3months, Condition based & B/D maintenance as and when required
- 4.2. Power Transformer maintenance: Annually
 - (1) Annually \pm 3months, Condition based & B/D maintenance as and when required
- 4.3. OLTC maintenance for power TR: Every 3 year
 - (1) Every 3 year \pm 3months, Condition based & B/D maintenance as and when required

5. AUTHORITIES AND RESPONSIBILITY

- 5.1. The Head of Department is responsible for implementation of this procedure for effectiveness
- 5.2. The Head of HT O&M/Projects at respective locations are responsible for execution of this procedure
- 5.3. The authorized person of HV Cell is responsible for execution of the work in accordance with this procedure.

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6. REFERENCES

- 6.1. MERC Regulations (with its latest amendments)
- 6.2. Central Electricity Authority (Measures Relating to Safety & Electric Supply) Regulations 2010 (with its latest amendments)
- 6.3. OEM Manuals/guidelines for maintenance testing of 22/11kV panels & 22/11kV Power Transformers
- 6.4. CBIP Manuals/guidelines
- 6.5. System diagram books & GIS for network layout
- 6.6. OCP # TPDF02-STO01-OCP-006 (Operational Control Procedure for Handling, Collection, Storage and Management of Hazardous Waste)
- 6.7. OCP # TPDF02-STO01-OCP-007 - Waste Management of Non-Hazardous Waste

7. SPECIFIC COMPETANCY REQUIREMENTS


- 7.1. Tech/Jr. Exe/Exe/AM/M should have Knowledge of
 - (1) Erection & Maintenance of substation equipment
 - (2) Safe working practices and use of PPE
- 7.2. Tech/Jr. Exe/Exe/AM/M shall have authority for electrical isolation and issue of PTW/EHV Isolation & Earthing permit

8. INTERFACE WITH OTHER DEPARTMENTS/SECTIONS, IF ANY

- 8.1. Control Room
- 8.2. Distribution NPC department / Call centre
- 8.3. Safety Department
- 8.4. Store Department
- 8.5. HR and Security Department

9. TOOLS AND TACKLES

- 9.1. Equipment
 - (1) High voltage test set
 - (2) Air Blower/Vacuum cleaner
 - (3) Timing test set
 - (4) Thermography Camera

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- (5) Insulation Resistance Tester
- (6) Primary Injection test set
- (7) Clamp meter
- (8) Digital multi meter
- (9) Oil BDV Test set
- (10) Oil sampling bottle
- (11) Winding Resistance Meter
- (12) CRM test kit.

9.2. The team shall carry following tools & tackles.

- (1) Tool kit
- (2) Extension Board with ELCB
- (3) Insulating Tape (For 22/11kV Bus & Cable)
- (4) Cleaning Agents / Spray
- (5) Torque wrench
- (6) Live Line Detector
- (7) Earthing device
- (8) Barricading tape
- (9) Antitracking spray

9.3. Stationery and Documents

- (1) All forms enlisted as attachments


9.4. Following are to be considered as Hazardous waste

- (1) Used oil, oil soaked items
- (2) Hazardous & non-hazardous waste generated during the activity is to be dealt with as per the OCP # TPDF02-STO01-OCP-006 to TPDF02-STO01-OCP-008, 015. Any deviation shall be recorded in the checklist as additional information.

10. PERSONAL PROTECTIVE EQUIPMENTS / SAFETY TOOLS

Following PPEs shall be used to carry out work at site.

10.2. Safety shoes

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10.3. Safety helmet

10.4. Insulated Hand gloves

10.5. Safety belt full body harness with double lanyard

Following PPEs shall be used to carry out work as per site conditions and job requirements

10.6. Gum boot

10.7. Face Visor

10.8. Leather Hand Gloves

10.9. Dust Mask

11. SIGNIFICANT RISK PARAMETERS

11.2. Quality Management System: Low

11.3. Impact on Environment: High

11.4. Health and Safety Risk: High

11.5. Energy Management: Low

11.6. Asset Management Risk: High


12. PROCEDURE

12.1. JOB PREPARATION

- (1) Prepare Maintenance activity as per asset patrolling/survey report, Complaint from NPC or Other department.
- (2) Check the necessary data and aforesaid report regarding network, distribution transformer, switch gear etc.
- (3) Ensure and provide for illumination in sub-station if require.
- (4) Communicate with Control Room / LV Cell regarding Maintenance of Substation scheduled & related feeder status.
- (5) Issue of necessary materials.
- (6) Transport manpower, materials, tools and tackles to site.

12.2. Isolation Process

- (1) For isolation equipment from the system follows the procedure as per OCP No: TPDF02-DIS01-OCP-024 for Distribution Network Isolation and Normalisation as per the switching requirement.

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- (2) Authorized person issue “Permit to Work” as applicable to competent person after required isolation and local earthing

12.3. Vacuum circuit breaker maintenance / Testing

- (1) Test the tripping of the breaker with the help of relays
- (2) Ensure that VCB isolated as per operation OCP No: TPDF02-DIS01-OCP-024
- (3) Barricade the area where work to be carried out
- (4) Follow the OEM instruction manual for Maintenance of 22/11 kV panel.
- (5) Check the closing and tripping coils for proper connections
- (6) Measure both coil resistance
- (7) Check spring charging operation electrically & manually
- (8) Check CLOSE/OPEN operation of the VCB both electrically, and manually.
- (9) Check tightness of all Connecting bolts.
- (10) Test all three Vacuum Interrupter by High voltage set as per instruction manual.
- (11) Test the tripping of the breaker with the help of relays.
- (12) Carry out CB operation timing measurement

12.3. Attending flashover in Panel board


- (1) Note down all the conditions, switch positions, power system status etc.
- (2) Open the circuit side covers after ensuring isolation of cable and find the reason and point of flash.
- (3) Disconnect the cable if require.
- (4) Dismantle CT/PT, if required after disconnecting CT / PT secondary wires.
- (5) Clean circuit side compartment with Cleaning Agents / Sprays.
- (6) Clean all components (CT/PT/Mono block) with Cleaning Agents.
- (7) Replace all the components those have been damaged due to flash.
- (8) Apply Heat in compartment by Room Heater/Halogen/ Heat Blower.
- (9) Apply Anti-Tracking Paint/Spray.

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- (10) Reconnect all components (CT/PT/Mono block) & CT/PT Secondary wires.
- (11) Test the circuit side compartments by AC Pressure Testing / IR Test Set as per instruction manual.
- (12) Carry out Primary Injection Test as per instruction manual, if work is carried out on CT secondary or CT is replaced.
- (13) Test the Cable by HV DC Test Set as per instruction manual if require.
- (14) If Cable Termination is faulty, arrange for new termination
- (15) Check and replace Panel Heater & Heater circuit.
- (16) Ensure healthiness of total power circuits.
- (17) Clean area by removing all debris and materials

12.4. Bus-bar maintenance

- (1) Ensure that the Circuit Shutters in all the panels are closed and locked with tie/lock if circuit side is live.
- (2) Open the bus-bar compartments of all the panels.
- (3) Remove moisture, if found, by using heat blower / lamp / Halogen
- (4) Remove the dust by using vacuum cleaner.
- (5) Physical inspection of total bus-bar compartment is to be done.
- (6) Remove the shrouds (bus-bar cover) of the bus-bar and check the connections.
- (7) Clean the shrouds (bus-bar cover).
- (8) Replace the nut & bolt if found overheated / burnt.
- (9) After checking and replacing the nut bolt connection, re-fix the shrouds (bus-bar cover).
- (10) If shroud (bus-bar cover) is not available, then HV insulating tap is to be used.
- (11) Physical inspection of all bus-bar mono block/spouts.
- (12) If crack or heating is found in any mono block/spouts, replace it.
- (13) Clean the mono block/spouts by cleaning agent.

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- (14) Check the AC supply to heater circuit if applicable.
- (15) If supply is not available, restore it.
- (16) Check the heaters provided in the bus-bar compartment and put all the heaters in service.
- (17) Ensure proper vermin proofing of the bus-bar compartment. Apply m-seal putty, silicon sealant, aluminium foil etc. where space is there.
- (18) Take AC pressure test/IR test of the bus-bar as per instruction manual.
- (19) If circuit side is isolated and earthed, take Bus to Circuit CRM through CB.
- (20) After physical checking, close the cover of the bus-bar compartment while ensuring proper tightness of nut-bolts.

12.5. Bus-bar Fault/Flash

- (1) Physical Inspection.
- (2) Check the breaker trolley.
- (3) Check the mono block/spouts.
- (4) If required clean the breaker & bus-bar compartment using cleaning sprays.
- (5) If breaker trolley is damaged (Jaws, flexible, bottle) attend/replace it.
- (6) If breaker vacuum interrupter is suspected to be damaged, take the High voltage test as per Instruction manual.
- (7) If minor pitting is observed on bus/Monoblock (spouts), use cleaning spray & clean it.
- (8) If more pitting / heating is found, replace the mono block.
- (9) Check all connection of busbar.
- (10) Replace the nut-bolt if found burnt / overheated.
- (11) If shroud is not available, apply HV insulating tap.
- (12) Take AC pressure test/IR test of busbar as per Instruction manual.


12.6. Testing of 22/11 KV panel

- (1) Breaker Testing (HV test set)
 - (a) Keep CB in open condition/isolate it from system. Connect the high

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voltage terminal of the instrument to one of the contacts (Fix or Moving) of one phase of the breaker and earth terminal to other contact of same phase

- (b) Switch ON 1-phase AC supply of the instrument
 - (c) Apply selected voltage from the instrument slowly, increase the voltage approximately at the rate of 2kV/sec
 - (d) It should withstand the applied voltage for 60 seconds
 - (e) Decrease the voltage to zero
 - (f) Switch OFF 1-phase AC supply of the instrument
 - (g) Discharge the breaker contact by earthing Rod.
 - (h) Repeat test procedure for other phases
 - (i) Disconnect high voltage terminal and earth terminal of the instrument from the breaker
 - (j) Rack in the breaker in test position in the panel
- (2) For Bus-bar Testing (HV Test)
- (a) Switch off /isolate all bus feeding switchgears
 - (b) Insert the Testing Plug on bus-bar side, if required.
 - (c) Connect the high voltage terminal of the instrument to one of the phases of the busbar and earth terminal to earthing grid.
 - (d) Switch ON 1-phase AC supply of the instrument.
 - (e) Apply selected voltage from the instrument slowly, increase the voltage approximately at the rate of 2kV/sec
 - (f) It should withstand the applied voltage for 60 seconds
 - (g) Decrease the voltage to zero
 - (h) Switch OFF 1-phase AC supply of the instrument
 - (i) Discharge the busbar contact by earthing Rod.
 - (j) Repeat test procedure for other phases
 - (k) Disconnect high voltage terminal and earth terminal of the instrument

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- (l) Remove Testing Plug

12.7. Inspection & maintenance of Station Battery Charger and Battery.


- (a) All Battery Chargers and Batteries should be inspected atleast quarterly. Pilot cell should be inspected on daily basis.
- (b) Verify that the charger has been set correctly and is operating properly.
- (c) Verify all the cells are charging correctly.
- (d) Verify that the environment temperature is at or near optimum temperature.
- (e) Measure the internal cell resistance to verify the state of health by identifying low-capacity cells.
- (f) Remove sulfation and apply wax on the terminals of batteries if noticed.

12.8. Routine Maintenance of Power Transformer

- (1) Ensure that Equipment isolated as per operation OCP no-TPDF02-DIS01-OCP-024.
- (2) Take oil samples from top and bottom valve of main tank& take the BDV of oil samples.
- (3) Check for oil leakages. If found, attend by tightening or replacing gasket/O ring/relevant accessories or applying sealant.
- (4) If there is an explosion vent, Check for any cracks or damage in the diaphragm or any oil in the glass
- (5) Clean HV bushing, LV bushing if require, top cover, Buchholz relay, PRV,MOG etc. using cotton waste, wire brush and etc.
- (6) Check silica gel in the breather and replace if required. Replace oil of breather cup.
- (7) Check the Conservator Oil Level and top up oil after taking oil BDV if required.
- (8) Check alarm & tripping test of Buchholz, PRV, RPRR and OSR after bypassing fire prevention scheme, if applicable.
- (9) Check temperature settings of OTI for alarm and WTI for alarm, tripping & cooler control system.
- (10) Annual maintenance of switchgears/protection (relaying) system testing of it

12.9. Restoration process

- (1) Ensure man and materials and barricading removed from the area.
- (2) Ensure the conditions, interlocks; system in the prevailing condition is same as per status before starting the work.

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12.10. Housekeeping


- (1) The team shall always keep the site free from the accumulation of waste materials and debris and upon completion of work shall clear away and dispose all the surplus materials, rubbish and temporary works of whatsoever nature and kind. The team shall ensure clean and tidy site.
- (2) The team shall collect all the waste materials and dispose of the same as per the Operational Control Procedure for Handling, Collection, Storage and Transportation of Hazardous Waste & Non-Hazardous waste from point of generation to designated stores as per OCP # TPDF02-STO01-OCP-006 to TPDF02-STO01-OCP-008, 015

13. IMPACT ANALYSIS OF SIGNIFICANT RISKS


- (1) Details of Quality Issues involved
 - (a) Incompetent manpower (Improper Maintenance)
 - (b) Incompetent manpower (Poor workmanship)
- (2) Details of Quality Assurance plan
 - (a) Ensure work to be carried out as per Checklist

13.3. Health and Safety

- (1) Details of Health and Safety Hazard involved
 - (a) working/travelling in extreme weather condition
 - (b) Animal/ insect bite
 - (c) Working in congested area
 - (d) Use of faulty Tools
 - (e) Negligence of use of safety PPEs / Non usage of PPEs/ Use of faulty PPEs
 - (f) Contact with Live terminal/ cable/ wire/ busbar
 - (g) Working in unhygienic area
 - (h) Fall of external object
 - (i) Poor illumination
 - (j) Slips, trips and Falls of Persons

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- (k) Consumer aggression
- (l) Flash Over during switching operation
- (m) Hit by handles/tools due to slippage/ mishandling
- (n) Contact with sharp edges
- (o) Accident due to improper isolation
- (p) Person working at site without TPL supervision
- (q) Electric shock due to improper earthing of welding / Other electrical tools
- (r) Working in bending position / Awkward Posture
- (s) injury due to welding work
- (t) Fall of person from Height
- (u) Skin contact with oil
- (v) Fire in distribution Transformer
- (w) Contact with Partially charged capacitor
- (2) Health and Safety Precautions required
 - (a) Use of Face wiser / full mask helmet during switching
 - (b) Use Live line Tester, hand gloves, safety shoes, helmet during local earthing through earth lead
 - (c) PPE Checking and Toolbox Talk
 - (d) Safety shoes, Safety helmet, Isolation OCP / checklist
 - (e) Use extension board with ELCB for LT supply
 - (f) Verify calibration report of testing equipment and tools audit before work
 - (g) CBM of equipment, personnel awareness, Checking of Vacuum interrupter bottle continuity before inserting VCB in Service
 - (h) Toolbox talk in presence of all crew members and instruct not to work outside the barricaded area
 - (i) Obtain Outage Code/LCP from System Control Room before work.

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DO LOTO on isolated network & use live line detector & Earth the isolated network. Communicate to workers regarding working area before work During Toolbox talk

- (j) Use of Safety shoes/Gum Shoes, Torch
- (k) Follow Guideline of MSDS/COSHH
- (l) Follow Safe work instructions.

13.4. Environment


- (1) Details of Environmental impact
 - (a) Resource depletion
 - (b) Air Pollution
 - (c) Land Contamination
 - (d) Land pollution
- (2) Precautions to minimize Environmental impact
 - (a) Ensure that Material consumption Monitored during and after work
 - (b) Ensure that all oil waste, plastic waste, metal waste, wooden waste etc. Collected and submitted to the store/scrap yard for proper disposal as per relevant Waste Management OCP-TPDF02-STO01-OCP-006 to TPDF02-STO01-OCP-008, 015).

13.5. Energy Management

- (1) Details of energy use involved
 - (a) Consumption of auxiliary power by testing equipment & tools
- (2) Precautions to minimise energy use
 - (a) Switch off supply when not in use during work

13.6. Asset Management

- (1) Details of Asset related risks
 - (a) Loss of Equipments
 - (b) Frequent Small Duration Forced Outages
 - (c) Sustained Forced Outage requiring Major Repair
 - (d) Frequent Planned Outages
 - (e) Overloading of equipment

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- (f) Mishandling by handling equipment
- (g) Derating
- (h) Ageing/ Corrosion/ Rusting
- (2) Mitigation plan for asset related risks
 - (a) Maintenance as per OEM guideline
 - (b) Work to be carried out under authorised person supervision
 - (c) Deployment of skilled person
 - (d) Any deviation such as damage, loss of the asset-SAP Notification (Fault Notification) to be generated for further action

14. LIST OF ATTACHMENTS

Sr.	Document /Record Description	Reference No.
1.	Equipment Isolation & Earthing / SAP Outage Code	TPDF02-DIS01-OCP-024 / SAP ID – YMPD072
2.	Permit to Work format	TPDF02-SAQ02-OCP-005-F02
3.	Power TR & OLTC Maintenance checklist	TPDF04-DIS01-OCP-025-001
4.	22/11 kV Power Transformer Testing Report	TPDF04-DIS01-OCP-025-002
5.	22_11 kV Switchgear Panel - Maintenance & Testing	TPDF02-DIS01-OCP-025-003
6.	TPDF04-DIS01-OCP-025-F04 -Substation Switching daily Checklist	TPDF04-DIS01-OCP-025-004
7.	Deviation Format	TPDF02-DIS00-FOR-001

***** End of Procedure *****