

Scope of the work

The scope of work for the following work is given below:

Operation and maintenance of 11kV, 33kV and 220 kV Substation.

The Operation and Maintenance envisage all the required tasks to ensure

- a) Maximum system availability.
- b) Most efficient, effective and optimum usage of electrical system.
- c) Enhance the life expectancy of equipments.
- d) Regular operation and maintenance of equipments.
- e) Compliance of safety rules and regulations.
- f) Preventive maintenance / scheduled maintenance.
- g) Break down maintenance.
- h) Maintaining uninterrupted power supply.
- i) Maintenance of proper records of operation and maintenance (Log book, Registers, check list etc., shall be approved by CPRI).
- j) Assistance to CPRI in expansions and modification.

I. Operation and Maintenance of Sub-stations.

- a) Switching ON and Switching OFF of 11kV, 33kV and 220 kV Circuit Breakers, Isolators, 11kV incoming and outgoing breakers, HT Panels, Yard Lights etc. as and when required according to load requirements and instructions from Joint Director, EMD.
- b) Maintaining records of all the operations and records of loads such as voltage, current, power factor, frequency, connected load, energy consumption on hourly/daily/weekly/fortnightly/monthly/quarterly/half yearly and yearly basis.
- c) Maintaining records of power failures with reasons.
- d) Observing the yard and control room continuously and reporting any problem or faults to the Joint Director, EMD. which require major / minor improvements/repairs.
- e) Maintaining system handing over and taking over charge sheets.
- f) Current and voltage settings of feeders right from 11kV, 33kV and 220 kV I/C line till the user end (at least till 440 V 3Phase level)
- g) Maintaining records of maintenance.
- h) With prior intimation to Joint Director, EMD., Changing the taps of transformers as and when required.
- i) Co-ordination with operators in KPTCL/BESCOM Substations for efficient, reliable operation of 220kV and 11kV Substation.

- j) Attending the faults and restoration of the power supply without delay.
- k) Follow permit system (Line Clearance) and maintain a permit book to facilitate system maintenance without accident / mishaps.

Taking preventive maintenance such as maintenance of defective insulators, lightning arrestors, cables, transformers, Isolators, Breakers, HT panels, LT panels, Station Transformers, CT, PT, Battery chargers, Battery bank, control room wiring etc., Contractor has to maintain a check list for preventive maintenance & upkeep the system accordingly. However contractor has to prepare a detailed check list covering all the required items and submit for Engineering Officer Cum Officer In-charge approval before being implemented.

The Operation of 11kV, 33kV and 220 kV Switchyard, 11 KV Indoor / Outdoor Sub Station, HT< Switch Gear and Distribution Systems involves deployment of right persons as mentioned above for operation and these persons would be responsible for the work contracted for this purpose. The main jobs will include:

- a. Routine Surveillance of 11kV, 33kV and 220 kV Switch Yard, indoor / outdoor equipments like Control Relay Panels, Station Metering Panel, Switchyard Control Panel, AC & DC Distribution Boards.
- b. Routine Surveillance of 11kV, 33kV and 220 kV Switch Yard Outdoor equipments such as Power Transformers, SF6/Vacuum Circuit Breakers and their respective Field Control Panels, Isolators and their Respective Field Control Panels, Air Compressors, CTs, VTs, LAs etc., Distribution Transformers and all Indoor HT Boards and LT Distribution System.
- c. Routine/Monthly maintenance of 11kV, 33kV and 220 kV over head line/underground cables by trimming the tree branches below the lines.
- d. Filling up of Approved Data Sheets for the different Indoor & Outdoor equipments of 11kV, 33kV and 220 kV Switch Yard, raising deficiency reports and communicating to Joint Director, EMD., EMD.
- e. Recording all tripping of breakers and other events that occur in the order of sequence with the time of occurrence correctly and record them in Log Book.
- f. Carrying out operations correctly and accurately and recording the same in the relevant Log Books.
- g. Strictly following operating instructions given by the Joint Director, EMD.
- h. Observing all safety precautions and ensure safety to men and material and the equipment during the contract period.

- i. Attending to all emergencies which may arise during the contract period such as equipment failures, fire accidents, etc., shall get acquainted with the operations of all equipments covered under the contract.
- j. Attending to all Telephone calls and issue receipt message promptly.
- k. Preparing daily reports and periodic returns in the prescribed format in duplicate and submit to the concerned Joint Director, EMD.
- l. Assuming responsibility for the equipment & other materials kept at the Sub-station area.
- m. Assuming responsibility for any damages that occur due to mal-operation of equipment and shall make good the loss suffered by CPRI.
- n. To be alert and attending to all operations and events promptly without any delay.
- o. Updating of interruptions Register, Call register, Data Book. Apart from the above, the contractor shall carry out the checks in the document during the contract period daily.
- p. Ensuring routine, preventive and breakdown maintenance works for the Maintenance of 11kV, 33kV and 220 kV Switchyard, 11 KV Indoor/Outdoor Sub Station, HT< Switch Gear & Distribution Systems.
- q. Removing trees/big branches shall be reported to Civil Engineering Division.

Co-ordination with KPTCL/BESCOM/Inspectorate

- r. Co-ordination with KPTCL/BESCOM officials for all related works and giving reports to Joint Director, EMD. regarding, information from KPTCL/BESCOM and Co-ordination with Electrical Inspectorate in all relevant activities.

TECHNICAL AND GENERAL SPECIFICATIONS

1. TOOLS & TACKLES:

All tools and tackles required for the safe and satisfactory operation and maintenance including preventive and break down maintenance of the substation and related equipment will be provided by CPRI. The careful maintenance and management of these tools will be the responsibility of the agency.

2. OPERATIONS:

Hourly:

1. Taking readings of all meters installed at control panels, ACDB, DCDB, Battery Charger etc.
2. Air and Gas pressures of Gas circuit breakers.
3. Oil & Winding temperatures of Transformers.
4. Taking the reading of surge arrester counters of Lightning Arrestors,
5. Checking any sparking or flash over / hotspots in the substation.

Daily:

1. Checking the operation of compressors of Circuit breaker.
2. Visual inspection of Isolators contacts for proper position.
3. Checking oil levels of all bushings, Main & OLTC Conservator, CTs and PTs, etc.
4. Checking oil leakages if any for Transformers, CTs & PTs & taking appropriate action for its timely repair.
5. Checking air / gas / oil leakages if any for Circuit Breakers.
6. Checking the condition of Silica gel.
7. Checking of Battery & Charger DC voltage.
8. Cleaning of premises, Control relay panels etc.
9. Maintaining log books and daily check list.
10. Grass removal from yard and surroundings of the substation
11. Checking Deposition of dust and dirt on Insulators.
12. Checking Locks and doors of substation are in good condition.
13. Checking no leaks have developed in the roof. Ventilating systems.
14. Checking the heating systems are working normally.
15. Checking the prescribed safety aids are in place and in good order.
16. Checking the earthing connections for proper connectivity.
17. Checking the packing of cables entering and leaving the trenches or tunnels within the premises is intact.
18. Checking the ventilating louvers is not damaged.
19. Checking the access roads to the oil filled devices is not obstructed.

20. Draining the air / moisture from air conservators of circuit breakers.
21. Trouble shooting and repair of Electrical circuit's components in case of any abnormal conditions.
22. Checking Yard and control room lighting.

Weekly:

1. Checking Yard and control room lighting circuit.
2. Checking of individual battery voltage, liquid level, specific gravity, contacts, applying of petroleum jelly, etc.

Monthly:

1. Checking Auto/ Manual operations of OLTC.
2. Checking earthing points and their contact tightness wherever required.
3. Checking and sealing of cable entry holes.
4. Preparation of monthly checklist and events log for the month.

Events:

1. Logging auto / manual operations of OLTC.
2. Logging the breakdown events with relay indications etc.
3. Logging shut down events, log of operations during shut down period.
4. Logging of on /off of feeders in the 220kV, 33kV & 11 kV distribution system.
5. Maintaining visitor registers along with their comments and details of their visits.

3. MAINTENANCE

This Maintenance scope (includes both preventive and breakdown maintenance) is indicative only and shall include other maintenance activities required for satisfactory operation. Preventive Maintenance shall be routinely carried out as per the details provided.

Breakdown maintenance shall be provided as and when the situation warrants with a failure/fault in the system. The breakdown maintenance shall be attended at the highest priority so as to make good the faulted system and putting into operation. For breakdown maintenance, the contractor shall coordinate/liaison with Joint Director, EMD and the original equipment manufacturer for replacement of parts and services as necessary. During the preventive (routine) maintenance, the contractor shall carry out the following as listed for various system components:

Though the list contains several individual jobs they could be executed in a combined scope as in the servicing or overhauling of the component.

A. Transformers:

Hourly:

- a) Check oil & winding temperatures, check for abnormalities & recording them.
- b) Observe and record Load (amperes) and Voltage. Check against rated figure.
- c) Visual check for overheating if any at terminal connections (Red hots) and observation for any unusual internal noise. This check is must in each shift.

Daily:

- a) Observation of oil levels in (i) main conservator tank (ii) OLTC conservator (iii) bushings and examining for oil leaks if any from the transformer.
- b) Checking the colour of silica gel in the breather and also oil level of the oil seal. If silica gel colour changes from blue to pink by 50% the silica gel is to be reconditioned or replaced.
- c) Visual check of explosion vent diaphragm for any cracks.

Monthly:

- a) Physical examination of diaphragm of vent pipe for any cracks.
- b) Cleaning of bushings, inspect for any cracks or chippings of the porcelain and checking of tightness of clamps and jumpers.
- c) Measurement of IR values of transformer with suitable megger according to the rating of the transformer. Recording of the values specifying the temperature at which measurements are taken
- d) Cleaning of Silica gel breather.
- e) Checking of temperature alarms by shorting contacts by operating the knob.

Quarterly:

- a) Testing of main tank oil for BDV and moisture content.
- b) Testing of OLTC oil for BDV & moisture content.
- c) Testing of Bucholz surge relays & low oil level trips for correct operation.
- d) Checking of all connections on the transformer for tightness such as bushings, tank earth connection.
- e) Lubricating / greasing all moving parts of OLTC mechanism.

Yearly:

- a) Testing of oil for dissolved gas analysis, acidity, tan delta, interface tension specific resistivity.
- b) Tan delta testing for Bushings.
- c) Calibration & testing of oil & winding temperature indicators.
- d) Measurement of magnetizing current at normal tap and extreme taps.
- e) Measurement of winding resistance.
- f) Turns ratio test at all taps.
- g) Overhaul of tap changer and mechanism.
- h) Calibration of tap position indicator.
- i) Filtration of oil or replacement of oil in the main tank/OLTC when the BDV of the oil is found less than the acceptable limit.
- j) Changing the gaskets at all locations as and when leakage is found or the gasket is damaged or else yearly.
- k) Replacing of Buchholz relay, OTI, WTI if found malfunctioning.
- l) OLTC mechanism shall be completely over-hauled for smooth and trouble-free operation.
- m) Replacement of bushing if required.
- n) SFRA test
- o) Core Clamp Isolation test

B. Circuit Breakers:**Hourly:**

- a) Check Air and Gas pressure.

Daily:

- a) Check the operation of compressors /motors. Check timing and sound.
- b) Check gas density in each shift.

Monthly:

- a) Air cleaning with blower.
- b) Cleaning of circuit breaker body and bushings.
- c) Auxiliary contacts cleaning.
- d) Tightening of nuts and bolts.
- e) Checking breaker Operation (Local/Remote operation).
- f) Check anti-condensation protection.
- g) Check of motor control
- h) Checking and sealing of cable entry holes.
- i) Use of anti-corrosion spray where required.

Quarterly:

- a) Check for SF6 leaks.(Gas leakage test)
- b) Oiling and greasing of all moving parts.
- c) Functional check of trip circuit.
- d) Checking the settings of air and gas pressure switches.

Half-yearly:

- a) Checking ON/OFF Timings of Circuit breaker poles.
- b) Complete servicing, lubricating and greasing of all moving parts. Replacement of any defective part.
- c) Measurement of contact resistance and contact gap.
- d) Operation of control and Auxiliary circuits.
- e) Recharge time of operating mechanism after specified sequence.
- f) Checks on specific operations.
- g) Inspection and operation of control circuit.
- h) Measurement of Humidity if necessary.

Yearly:

- a) Touch up painting wherever required.
- b) Checking contact resistance of Breaker main contacts.
- c) Checking of circuit breaker position level by using spirit level indicator.
- d) Mechanism checking and lubrication to all moving parts.
- e) IR values of Power and Control Circuits.
- f) Operating circuits power consumption during operations.
- g) Verification of correct rated operating sequence.
- h) Checking and adjustment of Track alignment and Interlocking mechanism.

Repairs:

- a) Filling the breaker with SF6 – The CB may be filled only by or under the supervision of qualified personnel and in accordance with the SF6 filling curve. SF6 filling kit and SF6 gas cylinder to be provided by CPRI .

C. Lightning Arrestors

Daily :

- a) Checking the readings of surge arrestor counters.

Monthly :

- a) Cleaning of porcelains Insulators of LA.

Quarterly:

- a) Removing of bird nests, if any.
- b) Monitor the total leakage current (capacitive and resistive current) and resistive current.
- c) Records of the number of operations of the Arrestor should be maintained and if more number of operations are seen then the same should be informed to the concerned authority.

Yearly:

- a) Testing of counters

Repairs:

D. Isolators

Daily:

- a) Visual Inspection

Monthly:

- a) Clean the porcelain insulators and inspection for cracks and chip off.
- b) Check for tightness of nuts and bolts, drive tube locknuts, drive lever and phase coupling plan bolts etc.,

Quarterly:

- a) Open the disconnecter and earthing switch and inspect the contacts. (Wipe the contact surface with solvent).
- b) Check for contact surface coating/wearing.
- c) After maintenance and inspection, smear the contact surface lightly coated with contact lubricant (petroleum jelly).
- d) Check for split pins in clevis replace the same if damaged.
- e) Lubricate all clevis pins.
- f) Check contact gap, if found inadequate replace contact spring.

Half Yearly:

- a) Maintenance of Drive Mechanism:
 - i. Apply grease on the teeth of the spur gear and GEAR box / Lead screw and guide nut in case of lead screw type.
 - ii. Oil auxiliary switch linkage and pivot on the guard aperture for manual operation.
 - iii. Cleaning of auxiliary switch contact & greasing with silicon grease
 - iv. Check that all the electrical components are firmly fixed and let the contactors operate freely.
 - v. Check all electrical connections for tightness.
 - vi. Check all mounting bolts for tightness.
 - vii. Apply grease to mechanical interlock - cam groove, if the disconnecter is with earth switch.
- b) Check interlocks.
- c) Adjustment of limit switch if it is required.
- d) Main Contacts
 - i. Cleaning and lubrication of main contacts
 - ii. Check Alignment.
 - iii. Main contact resistance measurement
 - iv. Tightness of nuts, bolts and pins etc.,
- e) Cleaning of support insulators and checking of insulator cracks, if any.

- f) Earth Switch
 - i. Checking and Alignment of earthing blades
 - ii. Cleaning of contacts
 - iii. Checking of Contact resistance
 - iv. Operation of earthing switch.
- g) Checking of aluminum/Copper flexible conductor.
- h) Checking of earth connections of structures and marshalling box.
- i) Marshalling Box
- j) Visual check of auxiliary contacts.
- k) Cleaning and terminal tightness.
- l) Checking of space heaters and illumination.
- m) Checking of healthiness of gaskets, else replace the gaskets.

Lubricants recommended:

For Contact Surface - Clean contact surface with plain cloth and apply contact grease

(Petroleum jelly).

For External drive linkage - Shell Alvania grease

E. Current Transformers

Daily:

- a) Visual Check
- b) Check for Oil leakage

Monthly:

- a) Clean the porcelain insulators and inspect for cracks and chip off.
- b) Secondary connection of the CT should be intact.

Half yearly:

- a) Check the I.R. value of each Current Transformer and keep record.
- b) Check the Pressure Diaphragm. If pressure diaphragm is defective, replace it with new one as per the procedure explained in the instruction manual.
- c) If the insulation resistance of the current transformer is low it can be improved by oil filtration under vacuum.
- d) Attending to oil leakage in the CT. If it is due to failure of gaskets, the gaskets need to be replaced. (Gaskets should be provided by the contractor)

yearly:

- a) Accuracy test, FS, on metering core,
- b) Ratio and phase angle error, composit error test on Protection core,
- c) Turns ratio and Knee point voltage test on Special core.

F. Voltage Transformers

Daily:

- a) Check Oil level and check for any leakage
- b) Chattering sounds

Monthly:

- a) Cleaning of Bushing
- b) Checking for Oil level & topping up of oil if required
- c) Checking of secondary fuse & fuse contacts.

Half yearly:

- a) Check the I.R. value of each Voltage Transformer and keep records.
- b) Check the Pressure Diaphragm. If the pressure diaphragm is defective, replace it with new one as per the procedure explained in the instruction manual.
- c) If the insulation resistance of the Voltage transformer is low it can be improved by oil filtration under vacuum.
- d) Attending to oil leakage in the VT. If it is due to failure of gaskets, the gaskets need to be replaced (Gaskets should be provided by the contractor)

Yearly:

- a) Accuracy test on metering core.

G. Switch Yard

(All equipment including structures that are not covered elsewhere)

- a) Checking the yard at periodic intervals and attend to any unusual observations, defects, sparks, loose contacts, red hot spots and loose bolts and nuts etc., and informing the concerned authority. The records of operational persons shall also be consulted for this purpose.
- b) Checking the earth resistance of earthing half-yearly.
- c) Checking the Protection and control circuit of each equipment monthly.
- d) Checking of operation and interlock of all equipments monthly.
- e) The premises should be kept neat and clean.

H. Control & Relay Panels:

Daily:

- a) Check for any tripping chattering in the electrical parts, abnormal noise, overheating in the panels.
- b) Check whether indication lamps, annunciator lights, bell, buzzers and hooter are working.
- c) Check all terminal cubicles for healthy contacts, minor repairs/services/cleaning etc.
- d) Observe the annunciation window, and there is any alarm then consults the concerned authority.
- e) Check panel for proper closing.
- f) Cleaning of relay cases of dirt etc.
- g) Cleaning the panels, relay covers, blowing dust from inner side of panels.
- h) Voltage of DC supply.
- i) Physical checks of all wiring & connections.

Monthly:

- a) Check for the proper working of all ammeters, voltmeters, relays, contactors malfunction etc.
- b) Clean the panels from inside with the help of the blower/ vacuum cleaners.
- c) Check all the cables for overheating, tightness of the glands, lugs & crimping.
- d) Check the fuse-link & fuse holders.
- e) Check the control wiring of the panel along with the controls for the proper functioning and tripping at the preset parameters.
- f) Tightening of all earthing connections.

Yearly:

- a) Check the operation of MCB, relays, Etc.,
- b) Testing and calibration of relays.

Repairs:

- a) The following items can be replaced and made the circuit functional with MCB, Contactors, Cable termination with glands, relays. selector switch, indicating lamps, voltmeter, ammeter, fuse holders etc. (All material to be provided by CPRI).

I. 11 KV Panels :

Daily:

- a) Visual inspection
- b) Check whether indication lamps, selector switch, ammeter, MF meters Etc., are working.
- c) Checking and ensuring the closing of all the panel doors etc.,
- d) Check whether all relays, are functioning properly.

Quarterly:

- a) Visual inspection of panels.
- b) Checking of control scheme for healthiness.
- c) Visual Checking of Panel Meters.
- d) Checking of heater circuit & rectification if required.
- e) Checking handles and doors & rectification if required.
- f) Checking and sealing of cable entry holes.
- g) Tightening of all earthing connections.

Yearly:

- a) Measurement and recording of IR values for Main Bus bar.
- b) Checking of all terminations for tightness.
- c) Checking of CT, PT and Relays connections for tightness.
- d) Testing of all panel Relays and Meters CT & PT.
- e) Measurement of insulation resistance value of circuit breaker.
- f) Measurement of breaker closing and tripping time.
- g) Vacuum test
- h) Measurement of contact resistance
- i) Checking of control circuit
- j) Visual inspection of earth connections and checking of tightness
- k) Checking of mechanical and electrical interlocks, interlocks within the switch board to ensure proper functioning of the same.
- l) Checking and sealing of cable entry holes

Repairs:

- a) During the time of operation any of the items mentioned above are found malfunctioning then they must be replaced. (All materials will be supplied by CPRI and tools should be provided by the contractor)

J. LT Panel:

Daily:

- a) Visual inspection
- b) Check whether indication lamps, selector switch, TNC & all meters are working.
- c) Checking and ensuring the closing of all the panel doors etc.,
- d) Check whether all relays, are functioning properly.

Quarterly:

- a) Visual inspection of panels.
- b) Checking and sealing of cable entry holes.
- c) Checking of D.C. supply & control switchgear.
- d) Checking of Indication lamps, replacement if required.
- e) Checking of Indication Meter and rectification/replacement if, required.
- f) Checking/replacement of fuses if required.
- g) Checking of Bus bar connection, Tightening of nut bolts, cleaning of bus bar if, required.
- h) Cleaning and Tightening of bus bar in the bus bar chamber.
- i) Tightening of all earthing connections.
- j) Checking and sealing of cable entry holes.
- k) Cleaning of the inside and outside panels using blowers and vacuum cleaner.

Yearly:

- a) Checking of D.C. supply & control switchgear.
- b) Checking & ensuring the closing of the wall panels/panel doors including the supply of necessary material if required.
- c) Cleaning of circuit breakers, lubricating the moving parts as per maintenance procedure
- d) Checking of alignment in racking mechanism of breakers for free and smooth movement of circuit breakers
- e) Checking of contact wearing of circuit breakers
- f) Checking of mechanical/ electrical interlocks, interlocks within the switchboard to ensure proper functioning of same
- g) Functional operations check of limit switches, auxiliary contacts Etc.,
- h) Visual inspection of earth connections and checking of tightness
- i) Measurement of insulation resistance value of circuit breakers
- j) Measurement of contact resistance of circuit breaker poles
- k) Measurement of circuit breaker closing and tripping time
- l) Functional operations check of circuit breaker
- m) During operation, any of the items found malfunctioning must be replaced. All materials will be provided by CPRI.

n) Measurement and recording of IR values for Main Bus bar.

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o) Checking of all terminations for tightness.

p) Checking of CT, PT and Relays connections for tightness.

q) Testing of all panel Relays and Meters, CT & PT.

K. 415V Distribution System (Main DBs and DBs):

Daily:

a) Visual inspection & proper doors closing.

b) Check whether indication lamps, selector switch, ammeter, MCBs etc are working.

Quarterly:

a) Check if all the panels are ingress protected.

b) Checking of termination of incoming and outgoing cables

c) Routing of cables for new loads if required (only flexible cables and indoor).

d) At the time of adding new cable proper tags and ferruling must be done.

e) Cleaning of the panel.

f) Checking and sealing of cable entry holes.

g) Tightening of all earthing connections.

Repairs:

If any component is found malfunctioning it has to be replaced. Material will be provided by CPRI.

L. CABLE NETWORK:

Monthly:

a) Visual inspection of cables.

b) Checking all cable terminals & joins for overhauling /loose connections and tightening, terminating, rejoining, if required termination will be done by the contractor and material will be provided by CPRI.

c) Checking and recording of IR values of all cables with Megger of suitable range.

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M. EARTHING SYSTEM:

Daily:

- a) Watering and proper closing of earth pit chamber

Quarterly:

- a) Checking of all earthing connections, joints and cleaning and tightening thereof.
- b) Checking and recording of earth resistance of all points, pits and taking corrective action to improve it, if required.
- c) Identification marking and updating the details of the indication board

N. METERS:

Yearly:

- a) Checking of each meter (analog/digital) for its correct operation.
- b) Calibration of indicating/ measuring meter.

O. PROTECTIVE RELAYS:

Quarterly:

- a) Visual inspection and cleaning from outside.

Yearly:

- a) Checking of each relay for its correct operation by secondary injection.
- b) Cleaning of relay contacts by cleaning agent.
- c) Calibration of relay.
- d) Checking of current/voltage setting as per recommended setting.
- e) Checking of time characteristic as per recommended setting.

Q. ENERGY METERS

1. Note down the energy meter reading as per scheduled time and monitor the power consumption.
2. Submit daily report /log books on power consumption.

Duty of Trained Engineer

1. To carry out the check as required,
2. Carrying out the preventive maintenance check as per the manufacturers guidelines.
3. Submit the daily report as required by the Joint Director, EMD.
4. To attend break down/ maintenance works.

