Bangladesh Power Development Board

INTEGRATED MANAGEMENT SYSTEM
(BASED ON ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 STANDARDS)

PROCEDURE FOR ELECTRICAL MAINTENANCE – COAL POWER PLANT

1.0 Purpose

a) To establish effective electrical maintenance system for the plant and machinery to ensure continuing process capability
b) To plan and implement electrical maintenance

2.0 Scope

Applies to whole of Integrated Management System of Bangladesh Power Development Board (BPDB)

3.0 Terms & Definition

Definition

None

Abbreviations

BPDB- Bangladesh Power Development Board
MR- Management Representative

4.0 Roles and Responsibility

Tasks in Reference Clause nos.	Responsibility
5.1, 5.2, 5.3, 5.4	Head of electrical maintenance, Concerned technical staff, SDE/AE/SAE,
5.5	MR/Head of the plant

5.0 Procedure

Plan of the maintenance procedures

Following 3 types of maintenance is carried out

- Breakdown maintenance
- Schedule maintenance
- Preventive maintenance

5.1 Breakdown Maintenance

On-Load
Off-Load

- Concerned operation unit report breakdown or abnormality
- Job allocated to concerned official

- Concerned technician/ official/ engineer check the facility and assess the maintenance task
- Maintenance task is approved
- If the maintenance can be done on-load, then it is carried out
- If the maintenance of repair requires to be carried out off load permission of the concerned authority is taken
- Maintenance work is carried out accordingly
- On completion of Maintenance work, required checking is carried Out
- Maintenance work is recorded

5.2 Schedule Maintenance

- Seek permit from operation department on schedule
- Operation gives permit after isolation
- Respective maintenance is done as per procedure
- Safety Issue
    - The safety matters needing attention for inspection of high voltage equipment.
    - Don't remove or jump over the safety railing, if it is necessary to remove the safety railing, there should be supervision people on site, and abide the following rules about safety distances

Voltage levels (KV	Safety distances (m)
10 and less (13.6)	0.7
20-35	1.0
44	1.2
60-110	1.5
154	2.0
220	3.0

    - In case high voltage- equipment occurs earthing fault, don't close to earthing point within 4m indoor and 8m outdoor
- The safety matters needing attention for maintenance of revolving mechanism
    - Forbid working on generator circuit in running
    - When regulating work on generator or wound motor, cleaning brush or slip ring, should abide following rules:
        - The working clothes of service
        - people should be unable any
        - part of it could be twisted by
        - revolving mechanism
        - The coat and cuff should be
        - buttoned up

        - The hair and pigtail should be put inside cap
        - When working, should stand on insulation fusion, don't touch two poles r one pole and earthing art at same time
    - Forbid working on motor circuit in running
- The routine maintenance of generator
    - Check there is on over heat, no abnormal sound on casing
    - Check there in no abnormal sound or smell inside casing
    - Check there is no damage at
    - earthing brush
    - There is no damage and over heat
    - at generator neutral point PT and its disconnect or
    - The earthing resistance of earthing
    - device of generator axle is in
    - normal
    - The principle of judgment and treatment abnormal operation
        - The temperature of stator winding, iron core are higher than normal (10°C higher than average temperature)
            - Check and rule out the possibility of respective parts, units of temperature monitor system like temperature measurement unit and compensation resistance connection cable fault.
            - Check the water outlet circuit's temperature of the corresponding stator winding, if rising too, which shows there is block in the winding's water circuit.
        - The stator leakage detector alarms
            - Watching the condition inside generator through inspection window, if there shows water leakage trace, can reduce water inlet pressure properly, decrease load, run a short 'time after eliminating water leakage, when outage-later, take examination and treatment
        - The rotor leakage detector alarms
            - Watching the condition inside generator through inspection window, if there shows 1w/g steam producing, shut down air cooler one by one, if the detector still alarms, can judge that there is leakage in rotor's water circuit.
    - The treatment principle of common fault
        - The water leakage of stator
            - The break and leakage of sfevw
            - Teflon tube

- Change Teflon tube
- The loosening and leakage of insulation pilot tube connector weld again
- The leakage of other connector wedding point
    - Weld again

- The water leakage of rotor
    - The leakage of rotor insulation pilot tube (Water is thrown out from small end cap generally)
    - Pult out small (large) end cap, repair according to operation sequence and working procedure stimulated
    - The break and leakage of rotor insulation pilot tube's turning edge (Water is thrown out between the seam of large end cap and axle, then flows into air cooler cabinet via ventilation slot of iron core along stator edge)
    - Pull out small (large) end cap, repair according to operation sequence and working procedure stimulated
    - The loosening and leakage of insulation water pilot tube connector's seal parts of rotor
    - Change parts or tighten it
- The fault of water circuit
    - The block of inlet, outlet water | circuit or partial block by sundries inside winding
        - Forcedly blow by pressured air, acid clean if necessary
- Temperature measuring unit is broken
    - Change the spare unit inside generator
- Slip ring is overheated or worn out
    - The brush is unsuited for use, which is too-hard or not qualified. The brush holder vibrates. Change brush or regulate brush holder
    - Because of electrolytic effect, the slip ring is worn out, mostly negative pole Exchange the polarity between two slip rings periodically

- The routine maintenance of transformer
    - The contents of routine inspection and maintenance
        - Check the oil temperature and level are normal or not
        - Check the cooling system (e g. fan machine) is operating well or not, whether the motor is over heat or not

        - Check whether there exit break, crack, discharge trace or not on the bushing, insulator
        - Check respective connectors of primary circuit contact well, no overheating
        - Periodically {3 month) carry out oil chromatographic analysis
    - The principle of abnormal condition judgment and treatment
        - Abnormal temperature rising of transformer
        - Check transformer load and cooling material temperature.
        - Check cooler normal or not.
        - Check and regulate load enabling temperature not excess supervision value.
    - Oil level of transformer dropping obviously
        - If it is due to oil mini-leakage in long time, should refill oil and arrange maintenance according condition needing • If it is due to oil temperature too low, should regulate cooler operation mood
        - Pay attention to releasing Buchhoiz protection while refilling oil
    - The treatment principle of common fault
        - Buchhoiz relay acting or warning
        - Check. transformer surface. there is any change, whether the equipment is at failure or not immediately.
        - Check the gas within Buchhoiz relay and carry out gas chromatographic analysis
    - Transformer oil flow interrupting
        - Check oil flow relay whether indication is normal or not
        - Check cooler normal power missing of not, standby power putting in or not, if there is fault in cooler, should regulate operation mood
    - Pressure releaser acting
        - Check pressure releaser could be reset or not
        - Check damaged film of pressure releaser spraying large amount oil or not, if there is failure inside transformer should deal with according to transformer accident treatment regulations
    - Silicone changing color
        - Change silicone gel
    - Cooler power missing
        - Check whether the standby power has been put in or not, if it is at failure too, reduce load until reaching the permission value in that case, and closely monitor the transformer winding temperature
- The routine maintenance of high voltage switchgear

- SF circuit breaker
  - The safety matters needing attention of circulate breaker inspection
  - Don't remove or jump over the safety railing, if it is necessary to remove the safety railing, there should be supervision people on site, and abide the following rules about safety distances

Voltage levels (KV	Safety distances (m)
10 and less (13.6)	0.7
20-35	1.0
44	1.2
60-110	1.5
154	2.0
220	3.0

  - It is not allowed staying near the anti-explosion diaphragm of circuit breaker, avoid being harmed by gas leakage or explosion of circuit I breaker
  - While picking up gas sample or deal with leakage in general, should put on gas mask.
  - Should clean the used tools and protect facilities after working. The service people should take a bath
- The contents of routine inspection and maintenance
  - Check the SF6 gas density gauge indication normal, if there is no temperature compensation in the gauge, should carry out pressure conversion according to temperature
  - Check respective pressure gauges of operation system indication normal
  - Check respective parts and pipes of circuit breaker no abnormal sound (the sound of gas leakage and vibration) and smell
  - Check the bushing no break, discharge sound and corona
  - Check on/off position indicator is correct
  - Check anti-dew heater is in normal operation
  - Periodically (2 month) measure micro-water of SF6 gas
- The principle of abnormal condition and common fault judgment and
  - Abnormal condition; SF6 gas pressure dropping, micro-water rising, etc.
    - Refer to specification of manufacturer
- SF6 gas serious leakage and issuing block signal Outage for treatment at once

- The mutual inductor (potential transformer and current transformer)
    - The contents of routine inspection and maintenance
        - Check the oil level of mutual inductor is in normal
        - Check the bushing no crack, discharge sound and corona.
        - Periodically carry out oil chromatographic analysis
    - The principle of abnormal condition and common fault judgment and treatment When finding leakage or other abnormal condition through inspection, consider outage or not
- Arrester
    - The contents of routine inspection and maintenance Daily or periodically check leakage current monitor device, should be in good condition and record the data
        - Daily or periodically check leakage current monitor device, should be in good condition and record the data
        - Check the bushing no crack, discharge sound and corona
        - Check the connection of earthing loop is in good condition
    - The principle of abnormal condition and common fault judgment and treatment
        - When checking, it is happened that the leakage current rises obviously, should shut down and carry out electric test for judgment
- The routine maintenance of auxiliary transformer and an auxiliary switchgear
    - The contents of routine inspection and maintenance
        - Auxiliary transformer (Dry type transformer)
        - Check temperature of transformer indication normal, indoor ventilation device normal Auxiliary switchgear
        - Check the heat condition of respective electric circuit, lay stress on connection part
    - The principle of abnormal condition and common fault judgment and treatment
        - Auxiliary transformer (Dry type transformer) temperature exceeds stipulated value
            - Check ventilation : device normal or not, regulate load and reduce rent
        - Auxiliary switchgear denies opening or closing
            - Check whether energy storage device of circuit breaker, control system or control power is normal or not, closing coil is a fault or not, carry out correspond treatment or change
- The routine maintenance of motor

- The contents of routine inspection and maintenance
  - Check the temperature rise of bearing and body of motor, should accord with the stipulation
  - Check the current of motor normal?
  - Measure the vibration value of respective parts of motor, should accord with the stipulation
  - Listen whether the sound of respective revolving parts of motor is normal or not
- The principle of abnormal condition and common fault judgment and treatment
  - Insulation resistance of stator winding dropping
    - Carry out drying measure
  - Surface of stator winding gathering dust
    - Carry out cleaning measure
  - insulation of leads becoming bad
    - Bind up again
  - Friction between stator and rotor getting mechanical failure (bearing fault) Carry out repairing according to wear-out condition
  - Overheating of motor
    - The possible causes are: motor overload; miss phase operation; mains voltage excessive higher or lower; yet pass of motor blocked or fan broken.
    - The principle of treatment: deal with according to above reasons

- The test items of electric equipment
  - The main test items, cycles, standards of main electric equipment is carried out following the instructions in the manual "Operation and maintenance regulation for Boropukuria 2X1 25MW coal fire power station"
- The periodic maintenance forced service items, quality standards | af and maintenance classes of electric main equipment is carried out following the instructions in the manual "Operation and maintenance regulation for Boropukuria 2X125MW coal fire power station"
- The acceptance of main electrical equipment after maintenance is carried out following the instructions in the manual "Operation and maintenance regulation for Boropukuria 2X1 25MW coal fire power station"
- Maintenance of the items given by operation through defect list :

5.3 Preventive maintenance

- Prepare long-term /attentive maintenance plan , at least for 3
- Concerned authority approves preventive maintenance plan
- Resources and spares are mobilized to carryout preventive maintenance
- Where applicable, plant shutdown is solicited
- Plan/Scheduled maintenance is modified to adjust with the approval of shout down
- Maintenance work is carried out following approved plan
- Necessary checks are performed after maintenance work

5.4 Maintenance Records

- All maintenance jobs are recorded 1 in maintenance tog book
- Machine history cards are maintained and maintenance records, specially breakdown report are recorded
- Equipment check list are prepared : and carrying out routine checks

5.5 Implementation & Review

- Procedure for Maintenance and its effectiveness after implementation will be checked and reviewed during Internal audits.
- Actions are taken on the basis of review.

5.6 Environmental Aspect, Impact & Controls

Any activity at the plant, whether it is carried out for ensuring quality of service or meeting requirement of the interested parties, there will be some environmental aspects associated with it. It is a requirement of the IMS of BPDB to identify those environmental aspects, evaluate their impact and determine necessary controls.

While carrying out the activities and operation, the employees of BPDB need to exercise appropriate and predetermined controls so as to prevent or mitigate any adverse impact that may be associated with the activity or the process.

Some examples of environmental aspects associated with the procedure for Electrical Maintenance - Coal Power Plant are as below:

Sl Nos.	Aspect	Impact	Controls
1.	Solid Waste(wires, plastics)	Pollution	1. Follow the waste management plan
2.	Discarding of Rare Earth Metals	Depletion of Resource	1. Follow the waste management plan

3.	Transformer Oil Disposal	Soil pollution	1. Work and dispose as per the chemical disposal plan
4.	Use of Chemical	Soil / Water Pollution	1. Work and dispose as per the chemical disposal plan 2. Provide Necessary Training
5.	Packaging Disposal	Waste Generation	1. Follow the waste management plan
6.	Paper Use	Natural resource depletion	1. Reuse of Paper with the blank side
7.	Chemical Filled Cloth (Jute)	Water / Soil Pollution	1. Follow the waste management plan

The table above provides examples only. The IMS team of each site needs to identify the aspect impact and controls related to specific activities and ensures that the environmental performance of the organization is effectively maintained. For this purpose, the procedure “Environmental Aspect Impact Assessment Procedure” is to be followed and forms “Environmental Aspect Impact Register” is to be filled up by the IMS team.

5.3 OHS Hazard, Risk & Controls

Any activity at the plant, whether it is carried out for ensuring quality of service or meeting requirement of the interested parties, there will be some occupational hazards with it related to the occupational health and safety (OHS) to the workers and employees. It is a requirement of the IMS of BPDB to identify those OHS hazards and determine necessary controls.

While carrying out the activities and operation, the employees of BPDB need to exercise appropriate and predetermined controls so as to prevent or mitigate any adverse consequence that may be associated with the activity or the process.

Some examples of OHS hazards and with the procedure for Electrical Maintenance - Coal Power Plant are as below:

SI Nos.	OHS Hazard	Controls
1.	Soldering	1. Provide Necessary training 2. Maintain adequate PPE whilst at worksite 3. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
2.	Energized Components	1. Completely de-energizing equipment, conductors or circuits before an employee begins

		work 2. Maintain adequate PPE whilst at worksite 3. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
3.	Failure of PTW Process	1. Provide Necessary Training 2. Active Supervision of activity
4.	Wrong Use of tools	1. Provide Necessary Training 2. Active Supervision of activity
5.	Wrong use of Lifting equipment	1. Provide Necessary Training 2. Active Supervision of activity. 3.Maintain adequate PPE whilst at worksite
6.	Dropped object	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
7.	Fall	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
8.	Expose to Chemicals	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
9.	Entrapment	1. Provide Necessary Training 2. Active Supervision of activity. 3. Maintain adequate PPE whilst at worksite
10.	Cold Burn	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
11.	Chemical Burn	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite 3. Maintain adequate housekeeping
12.	Manual Handling	1. Provide Necessary Training
13.	Electric Shock	1. Ensure a Permit to Work is issued as per guidance before personnel is sent for work 2. Maintain LOTO Procedure 3. Maintain adequate PPE whilst at worksite
14.	Wrong Startup	1. Alarm 2. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
15.	Improper re-assembly of equipment	1. Provide Necessary Training 2. Active Supervision of activity
16.	Inhaling SF6 gas in case of leakage	Outage for treatment at once

The table above provides examples only. The IMS team of each site needs to identify the OHS hazards and necessary controls related to specific activities and ensures that the environmental performance of the organization is effectively maintained. For this, the procedure Hazard Identification and Risk Assessment Procedure is to be followed and Hazard Identification and Risk Assessment Register is to be filled up by the IMS team.

6.0 References

a) Operation and maintenance regulation for Boropukuria 2 ×125 MW coal fire power station
b) Defect list from operation
c) Audit Report

7.0 Appendix

None

8.0 Revision History

Sl No.	Revision Number	Section	Change Made	Date of Revision