




**Bangladesh Power Development Board**  
**INTEGRATED MANAGEMENT SYSTEM**  
**(BASED ON ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018**  
**STANDARDS)**

**PROCEDURE FOR MECHANICAL MAINTENNACE-COMBINDED**  
**CYCLE POWER PLANT**

	<b>INTEGRATED MANAGEMENT SYSTEM</b>	Document No.: BPDB-IMS-PR-024
	PROCEDURE FOR MECHANICAL MAINTENANCE – COMBINED CYCLE POWER PLANT	Revision No.: 00 Effective Date: 01-11-2021
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## 1. Purpose

- a. To establish effective mechanical maintenance system for the plant and machinery for ensuring continuing process capability
- b. To plan and implement mechanical maintenance

## 2. Scope

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

## 3. Terms and Definition

### Definition

None

### Abbreviations

BPDB- Bangladesh Power Development Board  
 MR – Management Representative  
 TR – Trouble Report  
 CF – Clearance Form  
 SDE – Sub Divisional Engineer  
 AE – Assistant Engineer  
 SAE – Sub-Assistant Engineer  
 CE- Chief Engineer

## 4. Roles and Responsibility

Tasks in Reference Clause nos.	Responsibility
5.2,5.3	Head of Mechanical Maintenance
5.2	Concerned Staff
5.3.1, 5.3.3	SDE/AE
5.3.2, 5.3.4	A/E
5.3.1, 5.3.4	Foreman
5.3.6	AE/SAE


## 5. Procedure

### 5.1 Plan of the maintenance procedures

Maintenance is made as guidelines of Manufacturers of the Plant. For those equipment which have no clear guidelines, the maintenance intervals are made as running hours of the equipment.

Safety rules are strictly maintained, and safety equipment is provided to the engineers and staffs during the maintenance work

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Following 3 types of maintenance is carried out

- Breakdown Maintenance
- Schedule maintenance
- Preventive maintenance

### 5.2 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

### 5.3 Schedule Maintenance

- Seek permit from operation department on schedule issue
- Operation gives permit after isolation
- Respective maintenance is done as per procedure following the operation and maintenance manual Gas turbine instruction & maintenance instruction

#### 5.3.1 HRSG Maintenance

##### HRSG proper

##### HRSG Drum

- Checking the Cyclone Separators.
- Checking the Perforated Sheet of Ceiling.
- Checking the sludge in the Drum.
- Checking the Welding parts inside Boiler.
- Checking the Drum cooling line & Phosphate Dosing line.

##### Water level indicator

- Replace mica sealing unit.
- Replace bolt and stud bolt
- Replace water level indicator.

##### Water Wall Tube

- Checking Bulged point on the tube.
- Checking Scale inside the tube.

##### Headers (Economizer, Super heater, Re-heater)

- Sludge on the Header Inside.
- Visual Check of the welding joints of all Header.
- Crack inspection of the Header

##### Super heater

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- Checking crack of the tubes.
- Checking combs.

#### Economizer

- Checking crack of the tubes.

#### Spray Attenuator

- Crack inspection outside (the Attenuator).
- Erosion inside the Spray Nozzle.

### 5.3.2 Compressor Plant

#### Suction & Delivery Valves

- Inspection & Cleaning.

#### Pistons

- Inspection of Piston, Piston Rod & Piston ring.

#### Air Intake Filter

- Replacement of filter.

#### Foundation bolts

- Check Security

#### Oil Filters

- Replacement of filter.

#### Oil System

- Check the oil level.
- Change the oil.
- Drain oil. Clean crankcase internally. Change oil filter. Refill crankcase with new oil.

#### Safety devices

- Check settings for safety valves.

#### Crankshaft

- Inspection of crank shaft.

#### Main bearings

- Inspection of Bearing.

### 5.3.3 Safety Valves:

- Checking & adjustment.
- Dismantling, Cleaning, Repairing/replacement of spares & reassembling.

### 5.3.4 Valves:

- Dismantling, Cleaning, Repairing/ replacing spares & reassembling.
- Greasing.

### 5.3.5 Boiler Structure:

- Checking all sliding guides.
- Checking all Hangers.

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#### 5.3.6 Ducts

- Checking guide vanes.
- Checking cracks.

#### 5.3.6 Turbine Maintenance

##### Daily visual inspection

###### Turbine

- Bearing Temperature
- Vibration
- Lube oil Temperature
- Cooling System.
- Steam Leakage

###### Turbine Governing System

- Regulating valve lift
- Regulating valve bearing
- Lubricating System

###### Drip Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

###### Gas Cooling Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

###### Technical Water Pump

- Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

###### Stator Cooling Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

###### Thyristor Cooling Pump

- Bearing Temperature

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- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Sealing oil Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Stand by oil Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Feed water Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Feed Water Pump Oil Cooler

- Oil leakage
- Cooler leakage
- Lubricating oil level

#### Feed water Pump Oil pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Condensate Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Turbine Oil Cooler

- Oil leakage
- Cooler leakage

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#### Dozing Pump

- Bearing Temperature
- Vibration
- Lubricating oil level.
- Cooling System

#### Circulating Water Pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Raw water Pump & Normal Make up pump

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### ABCB Compressor

- Bearing Temperature
- Vibration
- Sealing System
- Lubricating System
- Cooling System

#### Hydrogen Plant

- Cell Conductivity
- Vibration
- Sealing System
- Lubricating System
- Cooling System

### 5.3.3 Schedule maintenance of turbine

#### Drip Pump

- Check and repair Gland Packing.
- Check and greasing the moving parts.
- Monitor the vibration of the pump & take necessary action.
- Inspect the nominal parameter of the pump.
- Repair and overhauling the pump if required.

#### Gas Cooling Pump

- Check and repair Gland Packing.
- Check and greasing the moving parts.
- Monitor the vibration of the pump & take necessary action.
- Inspect the nominal parameter of the pump.

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- Repair and overhauling the pump if required
- Technical Water Pump
- Check and repair Gland Packing.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - Inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if required
  - Check and repair Non-Return Valve
  - Check and repair delivery gate valve & Suction Valve.
- Stator Cooling Pump
- Check and repair Gland Packing.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - Inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if required
- Thyristor Cooling Pump
- Check and repair Gland Packing.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - Inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if required
  - Cleaning of Thyristor cooler and check for leakage.
  - Repair of leakage if required
- Sealing oil & Stand by oil & Starting oil Pump
- Check and repair oil Seals.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - Inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if require
- Feed Water Pump
- Check and repair Hydro-coupling.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if required
- Feed Water Pump Oil Pump
- Check and repair oil Seals.
  - Check and greasing the moving parts.
  - Monitor the vibration of the pump & take necessary action.
  - Inspect the nominal parameter of the pump.
  - Repair and overhauling the pump if required

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#### Condensate Pump

- Check and repair Gland Packing.
- Check and greasing the moving parts.
- Monitor the vibration of the pump & take necessary action.
- Inspect the nominal parameter of the pump.
- Repair and overhauling the pump if required
- Check and repair Non-Return Valve
- Check and repair delivery gate valve & Suction Valve

#### Dozing Pump

- Check lube-oil level
- Inject lube-oil if required
- Check and replace buckets if required
- Repair and overhauling the pump if required

#### Circulating Water Pump.

- Check the vibration of the pump.
- Check and repair bearing seal.
- Check and repair cooling system.
- Repair and overhauling the pump if Required
- Check and repair rotary screen net.

#### Vacuum Pump

- Check and repair Gland Packing.
- Check and greasing the moving parts.
- Monitor the vibration of the pump & take necessary action.
- Check and repair the airline of the pump.
- Repair and overhauling the pump if required.

#### Raw water Pump, Make up pump, Drainage Pump

- Check and repair Gland Packing.
- Check and greasing the moving parts.
- Monitor the vibration of the pump & take necessary action.
- Check and repair the airline of the pump.
- Repair and overhauling the pump if required.


#### Cooling Tower

- Check and clean the nozzle of the cooling tower
- Check and repair the asbestos roof of the cooling tower.
- Mud excavation of cooling tower pond

#### ABCB Compressor

- Check and repair different stages of compressor
- Check and repair safety valves, solenoid valves.
- Check and repair piston ring and compression ring
- Check and repair crank shaft, connecting rod.
- Cleaning of air suction valves.

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- Oil change as necessary.
- Cleaning of radiator tubes and fins.
- Overhauling if necessary.

#### Hydrogen Plant

- Check the hydrogen purity and take necessary action if required.
- Check the conductivity of sell take necessary action if required.
- Cleaning the cooler and check the leakages.
- Repair the leakage if necessary

#### Feed Water Pump Oil Cooler

- Cleaning of oil Cooler
- Repairing-works of oil cooler if required

#### Turbine Oil Coolers

- Cleaning of oil Cooler
- Repairing works of oil cooler if required

#### FC-400 Filter /Mechanical Filter/Technical Filter

- Cleaning of filters
- Repair of filters if required

#### FC-400 Filter /Mechanical Filter/Technical Filter

- Cleaning of filters
- Repair of filters if required

#### Feed Water Pump oil Filter

- Cleaning of filters
- Repair of filters if required

### 5.3.4 Shut down maintenance of turbine

**Shut down maintenance works is performed according to the defects list prepared by operation division. The following maintenance is also performed**

#### Turbine

- Check and repair turbine bearing as necessary.
- Check and repair turbine regulating valves as necessary
- Check and repair bearing oil seals as necessary.
- Monitor turbine bearing vibration.
- Monitor Temperature of turbine bearing.
- Monitor Thrust pad temperature.
- Check and perform alignment of Turbo-Generator.

#### Turbine Governing System

- Check the governing system and repair as necessary.
- Check the servomotor lift and repair as necessary.
- Check the cam shaft assembly
- Check and perform greasing of HP/IP regulating valves bearing.
- Check and repair HPC/IPC regulating

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#### Main Oil Pump

- Check and repair the journal bearings.
- Check and repair the tooth coupling of the pump.
- Inspect the nominal parameter of the pump.
- Repair and overhauling the pump if required

#### Heat Exchangers

- Cleaning the heat exchangers
- Check and repair leakage
- Repair leakage if require

#### Turbine Condenser

- Check condenser tube for leakage
- Repair leakage if necessary.
- Check and repair vacuum lines as necessary

#### P Heaters

- Check LPH tubes for leakages.
- Repair leakage as necessary.

#### HP Heaters

- Check HPH tubes for coil leakages.
- Repair leakage as necessary

#### Main Ejector

- Check and repair as necessary

#### Starting Ejector

- Check and repair as necessary

#### Different Manual & Electric Valves

- Check the moving of the mechanical drive & valve shit.
- Greasing of the moving parts.
- Check and repair/replacement of gland packing.
- Check and repair internal passing of valve shit.


### 5.3.7 Water Treatment Plant Maintenance

#### Pump

De mineralized water Pump, Partial De mineralized water Pump, coagulated water suction Pump, Aluminum Sulphate ( $Al_2SO_4$ ) re-circulation Pump, Polyacrylamide Recirculation Pump, Caustic Solution Recirculation Pump, Hydrazine re-circulation Pump, Ammonia re-circulation Pump, Phosphate Transfer Pump, Cation First Stage Back wash and Regeneration Pump, Anion & Cation Second Stage and Mixed Bed Regeneration Pump, Anion First Stage Regeneration Pump, Cation Second Stage Back wash Pump, Anion First Stage & Anion Second Stage Backwash Pump, Mechanical Filter Back wash Pump, Clarified water Transfer Pump, Brine Solution re-circulation Pump, Acid Cleaning Pump,

- Lubrication inspection & refill
- Bearing inspection/Replacement
- Gland packing inspection/Change

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- Overhauling
- According to the observation of Operation personnel & Trouble report

### Pump

Aluminum Sulphate (Al<sub>2</sub>SO<sub>4</sub>) Dozing Pump, Polyacrylamide Dozing Pump, Alkali Dozing Pump, Brine Solution Dozing Pump, Phosphate dozing pump

- Lubrication inspection & refill
- Bearing inspection/Replacement
- Overhauling
- According to the observation of Operation personnel & Trouble report

### Tank

Coagulated Water Tank, Clarified Water Tank, De-mineralized water tank, Partially De-mineralized water tank, Poly acryl amide Mixture tank, Poly acryl amide Measuring tank, Aluminum Sulphate mixture tank, Aluminum Sulphate measuring tank, Phosphate solution Preparation tank, Phosphate measuring/ Reserve tank, Acid (H<sub>2</sub>SO<sub>4</sub>) Collector Tank, Acid (H<sub>2</sub>SO<sub>4</sub>) Reserve Tank, Acid (H<sub>2</sub>SO<sub>4</sub>) Measuring tank, Acid (H<sub>2</sub>SO<sub>4</sub>) Mini (Transfer) tank, Caustic Solution Preparation Tank, Caustic Solution Reserve Tank, Caustic Dozing Tank, Ammonia Solution Storage Reserve tank, Ammonia measuring tank, Hydrazine Storage/ Reserve tank, Hydrazine measuring tank, Brine Solution Tank, Acid Reserve & Mixing Tank (For Acid Cleaning),

- Inspection/ Repair
- Cleaning
- Painting
- According to the observation o; Operation personnel & Trouble report

### Filter

Mechanical filter, Cation First Stage filter, Anion First Stage filter, Cation Second Stage filter, Anion Second Stage filter, Mixed Bed filter, Phosphate solution Filter, Brine solution Filter,

- Inspection/ Repair
- According to the observation of Operation personnel & Trouble report


### Clarifier

- Inspection/ Repair
- According to the observation of Operation personnel & Trouble report

### Ejectors

- Inspection/ Adjustment
- Replacement
- According .to the observation of Operation personnel & Trouble report

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### Stairs, railing, platforms, ladders etc. if necessary

- Inspection/ Repair/Replacement.
- According to the observation of Operation personnel & Trouble report

### Valves

- Inspection/ Repair
- Replacement
- According to the observation of Operation personnel & Trouble report

### 5.4 Preventive maintenance

- Prepare long-term preventive maintenance plan, at least for 3 years for major facilities
- 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 shut down
- Maintenance work is carried out following approved plan
- Necessary checks are performed after maintenance work

### Maintenance Records

- All maintenance jobs are recorded in maintenance register
- Machine history cards are maintained and maintenance records, specially breakdown reports, are recorded.

### Actions are taken on the basis of review.

### 5.5 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 Mechanical Maintenance-Combined Cycle Power Plant are as below:

SI Nos.	Aspect	Impact	Controls
1.	Disposal of Metal / Plastics parts, which are not recycled	Soil pollution	1. Follow the waste management plan
2.	Oil / Lubricants	Soil pollution	1. Work and dispose as

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	disposal		per the chemical disposal plan
3.	Usage of Chemical during overhaul	Soil / Water Pollution	1. Work and dispose as per the chemical disposal plan 2. Provide Necessary Training
4.	Oil filled clothes (Jute)	Soil pollution	1. Follow the waste management plan
5.	Oil Spill	Soil pollution	1. Use Secondary Containment
6.	Water for cleaning	Water Pollution	1. Discharge as per 'Effluent water Quality' guidelines
7.	Electrode disposal	Soil pollution	1. Follow the waste management plan
8.	Carbon Powder - Soil Pollution	Soil pollution	1. Follow the waste management plan
9.	Water bearing chemical discharged from radiator	Soil / Water Pollution	1. Discharge as per 'Effluent water Quality' guidelines

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.

### 5.8 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 Mechanical Maintenance-Combined Cycle Power Plant are as below:

SI Nos.	OHS Hazard	Controls
1.	Burn from steam pipe leakage	1. Regular Inspection and maintenance

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		2. Provide First-Aid Training
2.	Failure of PTW Process	1. Provide Necessary Training 2. Active Supervision of activity
3.	Wrong Use of tools	1. Provide Necessary Training 2. Active Supervision of activity
4.	Wrong use of Lifting equipment	1. Provide Necessary Training 2. Active Supervision of activity. 3. Maintain adequate PPE whilst at worksite
5.	Dropped object	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
6.	Fall	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
7.	Expose to Chemicals	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
8.	Entrapment	1. Provide Necessary Training 2. Active Supervision of activity. 3. Maintain adequate PPE whilst at worksite
9.	Cold Burn	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite
10.	Chemical Burn	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite 3. Maintain adequate housekeeping
11.	Manual Handling	1. Provide Necessary Training
12.	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
13.	Wrong Startup	1. Alarm 2. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
14.	Improper re-assembly of equipment	1. Provide Necessary Training 2. Active Supervision of activity
15.	Noise	1. Staff must wear Earmuff whilst at worksite

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<b>16.</b>	Heat Stress	1. Provide Necessary training 2. Schedule proper work plan
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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) Trouble report (TR)
- b) Clearance form (CF)
- c) Operation and maintenance manual, Gas turbine instruction & maintenance instructions
- d) Audit Report
- e) V-6 Boiler maintenance Article- 4. 3
- f) V-6 Boiler maintenance Article- 2. 8
- g) V-6 Boiler maintenance Article- 2.9
- h) V-6 Boiler maintenance Article- 2. 3
- i) V-6 Boiler maintenance Article- 2.4 ' V-6
- j) Boiler maintenance Article- 2.5
- k) V-3 Air compressor and N2unit

### 7.0 Appendix

None

### 8.0 Revision History

SI No.	Revision Number	Section	Change Made	Date of Revision

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