Bangladesh Power Development Board

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

PROCEDURE FOR OPERATION AND CONTROL OF AUXILIARY SYSTEM-HFO

1.0 Purpose:

a) To determine and plan its processes and define the functions that are necessary for providing generation of electric power that can continue to meet the needs and expectations of customers
b) To plan and control in accordance with the organization's strategy
c) To run the processes under controlled conditions
d) To monitor, measure and review activities.
e) To ensure a method for safe and quality auxiliary operation.

2.0 Scope

Applies to all HFO power plant 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	Shift engineer

5.0 Procedure

5.1 Plan of the operational procedures

Auxiliary processes consist of followings:

a) Water treatment plant

b) Auxiliaries of boiler

c) Auxiliaries of Turbine

d) Auxiliaries related to cooler

Operation of water treatment plant

Intake Pump Station: Source of raw water from River water or Deep Tub-well water. When river water salinity lower than accepted limit of water treatment plant,

but saline period river water salinity higher (>1500µ) than accepted limit of WTP cannot use river water then we use Deep tub-well water.

Clarifier: No of unit 2, production capacity each unit 120 m^3/hr Coagulant used for dosing Ferrous sulfate and Auxiliary chemical used caustic soda. pH value maintained $\geq$ 8.3

Sand Filters: No. of units 4, Filtration process by gravity, No. of unit in operation at a time 2, Filtering chamber double. Production capacity 120 m3/hr max. Filling material gravel.

- Ion Exchanger units: Cation Unit: Use Cation exchange resin, no. Of units 2. Production capacity 60 m3/hr max. Each, regenerate used I 03 m3 HCI per regeneration.
- Anion unit: Use Anion exchange resin, no. of units 2, production capacity 60 m3/hr. each, Regenerate used NaOH 0.6 m3 per regeneration.
- Mixed Bed unit: Use Anion and Cation exchange resin both, no. of units 2, production capacity 40 m3/hr. each, Regenerant used NaOH and HCI per regeneration.
- Treated Water Storage Tanks No. of unit 2. Capacity 100m3,

5.2 Auxiliaries of Boiler

Combustion Air System: Combustion Air is flowed to the burner through the steam air heater & by the induced draught Fan (IDF). There are two Induced draught Fans (IDF), two steam air heaters & two Re-generative air pre heaters (Rotating). Ambient temperature air is sucked by the IDF & firstly heated that air up-to 1100 C by the steam air heaters & that air is again heated by the Re-generative air pre heaters up-to 2500 C for combustion as per instruction of manufacturer manual.

Feed Water system with Pump: There are three feed water pumps (1900 KW.) Controlled with the Voith Coupler (Hydraulic Coupler). Each Pump's Maxm flow quantity is 200 ton/h & Maxm pressure is 200 kg/cm2. Feed water is sucked from the feed tank which Maxm temperature is 1730C & Maxm pressure is 08 kg/cm2. The pressure is controlled by the steam of R.S # 3 (Steam source is cold re-heated steam) or R.S # 1 (Steam source is Extraction #6). Feed water is passed through the High pressure Heaters (Two Nos.) & Economizer to Boiler Drum. After Economizer the feed water temperature is 3500C as per instruction of manufacturer manual.

Instrument Air system: There are two compressors with heater for instrument air. There are two main air reservoirs & a auxiliaries reservoir which pressure is maintained 04 kg/crn2 to 06 kg/cm2.

Air-pre heater system: There are two rotating Air-pre heaters. Ambient temperature air is sucked by the IDF & firstly heated that air up-to 1100 C by the steam air heaters then that air is heated by that Air-pre heaters through flue gas. After. Air pre heater the temperature is 2500 C.

Circulating water system (CWP): There are two Circulating water pumps (1300 KW.). Each pump's Maxm flow quantity is 19800 ton/h & Maxm pressure is 1.3 kg/cm2. Mainly the circulating water is used in condenser for the purpose of condensation of low pressure turbine's exhaust steam. The Maxm rated temperature of Circulating water is 450 C. Circulating water is also used for the cooling purposes of main Lube oil -cooler, Filter water cooler, Hydrogen condensate water cooler, feed water pump's lube oil coolers & feed water pump's motor coolers.

Flue Gas System: The flue Gas is produced in the combustion chamber which Maxm temperature 10000 C-12000 C. The flue gas is passed through the super heaters, Re-heaters, Economizers, Re-generative air heaters etc. The induced draught fans (IDF) suck the flue gas & pass it to the atmosphere at 1730C. Some flue is backed to the combustion chamber by the recirculation fan for the tilting up of the burner's.

Circulating water Booster Pump: There are two raw water booster pumps for boosting up the circulating water's pressure up-to 03 kg/cm2 ~ 3.5 kg/cm2. The delivery water of raw water booster pump is used for the main Lube oil cooler, feed water pump's lube oil coolers & feed water pump's motor coolers.

Filter Water Pump system: There are three Filter Water Pumps. The delivery pressure of this pump is 3.5 kg/cm2. This pump's delivery water is store in a vessel passing through the filter water coolers situated in 25 meter height. This water is semi Demi water collected from the water treatment plant. This filter water is used for the cooling purpose of bearing cooler, gland cooling & sealing oil coolers.

Circulating screening system: Every Circulating water pump has two band screen of net driven by the electric motor. The band screen moves vertically through two rails with the help of rollers. There are also used a back wash pump for cleaning the band screen.

Lube water Pump system: Lube oil is cooled by the Lube oil coolers. The coolant is used the delivery water of for the lube oil cooler water booster pump which pressure is 03 kg/cm2 ~ 3.5 kg/cm2. This water is circulating water from the delivery of Circulating water pump.

5.3 Auxiliaries of Turbine

Condensate Supply System (Condensate Pump): There are 03 (three) condensate water pumps. Each pump is 200 KW. 6.6 KV & maxm pressure is 30 kg/cm2. Normally two condensate pumps are running when the unit is in running condition. The suction of the condensate pump is the hot well of condenser. There is a filter in the main suction pipe line. The condensate water is passed through the Seal steam condenser, Ejector for condenser, LPH # 1 & 2, Gland steam condenser, LHP# 3, 4

& 5 into dearator (Feed water tank). The condensate water temperature is depends on vacuum system & load.

Circulating water system (CWPJ: There are two Circulating water pumps (1300 KW.). Each pump's Maxm flow quantity is 19800 ton/h & Maxm pressure is 1.3 kg/cm2. Mainly the circulating water is used in condenser for the purpose of condensation of low pressure turbine's exhaust steam. The Maxm rated temperature of Circulating water is 450 C. Circulating water is also used for the cooling purposes of main Lube oil cooler, Filter water cooler, Hydrogen condensate water cooler, feed water pump's lube oil coolers & feed water pump's motor coolers.

Condenser Evacuation System: The Condenser is evacuated by the steam ejector. There three steam ejectors. One is starting ejector. It is normally used in the initial starting. The other two ejectors are running ejectors, it is normally running when the unit is in running condition. The steam pressure is 10.5 kg/cm2 & maxm temperature is 3500C. Below 1850C the ejectors may not work properly. Again the ejected steam from condenser is condensed by the Ejector for condenser & the condensate water is backed to-the condenser.

Lube oil Supply system: In running condition lube oil is supplied by the mechanical main pump. The pressure of the mechanical pump is 12 kg/cm2. Normally the lube oil pressure is 1.3 ~ & temperature is maintained to 380 C ~ 400 C. Lube oil pressure is controlled by a pressure reducing valve & temperature is controlled by the lube oil coolers. In the initial starting time lube oil is supplied by a starting oil pump which pressure is also 12 kg/cm2. In shutdown condition lube oil is supplied by a A.C Run out pump which pressure is maxm 1.4 kg/cm2 When the A.C power is failed the lube is supplied by a D.C emergency pump. Lube oil of mechanical main pump, starting oil pump and A.C Run out pump is passed through the lube oil coolers but lube of. D.C emergency pump is by-passed the lube oil coolers. After the lube oil coolers there is a duplex filters for filtering the lube oil.

Turning gear system: There is turning gear system driven by an A.C motor situated between the Generator & Low pressure turbine. The RPM of the turning gear is 62. It is normally used in the initial starting of the units after the shutdown of the unit. After shutdown turning gear is started for cooling the turbine shaft uniformly. To start the turning gear a jacking oil pump is used to lift the turbine & generator rotor. The jacking oil pump's pressure is 60 -65 kg/cm2.

Gland steam system: In-running condition Gland steam of high pressure turbine (Both side) & Medium pressure turbine (Both side) is collected by an electric actuator and passes it into the gland steam condenser. In the gland steam condenser the steam is condensed and condensate water is passed into the condenser controlled by a trap. But in the initial starting time steam is feed into the Gland steam of high pressure turbine (Both side) & Medium pressure turbine (Both side) by another electric actuator for sealing & this steam is collected into is seal steam condenser.

Seal steam system: Seal steam is used in the both side of low pressure turbine for sealing the condenser. The source of this steam is R.S *#2* which pressure is 10.5 kg/cm2 & temperature is 2200C. Seal steam pressure is 10 kpa & controlled by an electric actuator. After sealing, the steam is collected into the seal steam condenser. The condensate of the seal steam condenser is backed to the condenser & no-condensate is exhausted into the atmosphere by a fan called air fan

5.4 Auxiliaries related to cooler

Main lube oil cooler: There are three lube oil coolers. Normally two of them are put in operation. Cooling water for lube oil cooler is river water collected from the delivery of the circulating water pump. To boost up the cooling water pressure there is a raw water booster pump. The delivery pressure of the booster pump is 03 kg/cm2~3.5 kg/cm2.

Feed pump motor cooler: Cooling water for feed water pump motor cooler is river water collected from the delivery of the circulating water pump. To boost up the cooling water pressure there is a raw water booster pump. The delivery pressure of the booster pump is 03 kg/cm2 ~ 3.5 Kg/cm2.

Feed water pump working oil cooler: Cooling water fcr feed water purnp working oil cooler is river water collected from the delivery of the circulating water pump. To boost up the cooling water pressure there is a raw water booster pump. The delivery pressure of the booster pump is 03 kg/cm2 ~ 3.5 kg/cm2.

Generator H_2 Cooler: Cooling water for Generator H2 cooler is river water collected from the delivery of the Circulating water pump. The cooling water pressure for Generator H2 Cooler is the same of delivery pressure of the circulating water pump (0.75 kg/cm2 ~ 010,kg/cm2)

Filter water cooler: Cooling water for filter water cooler is river water collected from the delivery of the circulating water pump. The cooling water pressure for filter water cooler is the same of delivery pressure of the circulating water pump (0.75 kg/cmZ-01.0 kg/cm^2)

Sealing oil cooler: Cooling water for sealing oil cooler is the semi Demi water collected from the water treatment plant into a underground sump. There are three Filter Water Pumps. Normally one is running. The delivery pressure of this pump is 3.5 kg/cm2. This pump's delivery water is store in a vessel passing through the filter water coolers situated in 25 meter height. This filter water is used for the cooling purpose of sealing oil coolers..

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 Operation & Control of Auxiliary Systems-HFO are as below:

Sl Nos.	Aspect	Impact	Controls
1.	Electricity Consumption	Global Warming	1. Ensure Components are running efficiently
2.	Use of lubricant	Soil Pollution	1. Follow the waste management plan 2. Work and dispose as per the chemical disposal plan
3.	Oil Leakage	Soil Pollution	1. Regular Inspection and monitoring
4.	Water Use for Cooling	Water Use	1. Ensure that there is no leakage for water delivery
5.	Paper Use	Natural resource depletion	1. Reuse of Paper with the blank side
7.	Recruitment of incompetent people	Inadequate knowledge on operation and environmental management may lead to unnecessary environmental pollution	1. Awareness training given periodically to relevant staffs on environmental management issues 2. On-job training related to environmental awareness given to staffs and workers.

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.

5.6 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 Operation & Control of Auxiliary Systems-HFO are as below:

Sl Nos.	OHS Hazard	Controls
1.	Leaking Gas Supply Pipeline	1. Check LEL detector Status
2.	Possibility of flamable gases/fumes in engine room chamber	1. Follow the 'Prevention of Fire and Explosion' Procedure
3.	High Noise Level	1. Staff must wear Earmuff whilst in the Engine room
4.	Slipping due to water spillage on floors	1. Maintain adequate housekeeping. 2. Maintain signage if there is any spill.
5.	dropping / falling object	1. Maintain adequate PPE (e.g. Helmet) whilst at worksite
6.	Electric shock / Electric Arc	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
7.	Fire / Explosion at worksite	1. Follow the 'Prevention of Fire and Explosion' Procedure
8.	Heat Stress	1. Ensure Heat Stress Training for all the employees 2. Ensure a good work plan
9.	Getting Stuck in moving / Rotating Parts	1. Ensure protocols are maintained, such as not leave loose long hair, or loose long dress 2. Proper signage 3. Maintain barrier / mark area so that when personnel enter that zone, he/she is obliged to take adequate precautions
10.	Chemical Spillage / Burn	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite 3. Ensure good House Keeping
11.	Burn from contact with hot surface	1. Use of Guards to ensure contact can't be made directly 2. Provide Caution Sign 3. Maintain adequate PPE whilst at worksite
12.	Fumes and gases	1. Maintain adequate PPE whilst at worksite

		2. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
13.	Light from welding	1. Provide Necessary Training 2. Maintain adequate PPE whilst at worksite 3. Proper Supervision
14.	Unhygienic work environment e.g. canteen, toilet etc.	1. Maintain adequate housekeeping.
15.	Cuts from Material Handling / movement	1. Maintain Material handling Procedure 2. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
16.	Poor Visibility due to improper lighting	1. Maintain adequate housekeeping. 2. Installing adequate Lighting
17.	Lifting heavy objects	1. Maintain Material handling Procedure 2. Ensure a Permit to Work is issued as per guidance before personnel is sent for work
18.	Dusty environment	1. Ensure adequate housekeeping
19.	Fire on transformer	1. Regular Inspection and maintenance 2. Follow the 'Prevention of Fire and Explosion Procedure

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) Auxiliary manual of WTP

7.0 Appendix

Nil

8.0 Revision History

SI No.	Revision Number	Section	Change Made	Date of Revision

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