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### 1.0 PURPOSE:

To describe a procedure for preventive maintenance of all equipments.

### 2.0 SCOPE:

This procedure is applicable to preventive maintenance of all equipments used in manufacturing blocks at Discovery

### 3.0 RESPONSIBILITY:

#### 3.1 Technician and Electrician

Is the responsible to follow the safety precautions during the preventive maintenance works

#### 3.2 Engineer:

Is responsible to monitor the activity

#### 3.3 Engineering Head:

Is the overall responsibility for whole activity

#### 3.4 User Department:

It is the user department responsibility to release the equipments for preventive maintenance based on annual preventive maintenance schedule.

### 4.0 DEFINITIONS:

#### 4.1 Preventive Maintenance:


Preventive maintenance is maintenance that is regularly performed on a piece of equipment to lessen the likelihood of it failing. Preventive maintenance is performed while the equipment is still working, so that it does not break down unexpectedly.

### 5.0 PROCEDURE :

#### 5.1 Schedule:

Preventive maintenance shall be carried out Once in three months with  $\pm 7$  days of scheduled date or whenever necessary.


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## 5.2 Preventive Maintenance of Reactor

- 5.2.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.2.2 Check the RPM of agitator with digital tachometer to meet the requirement.
- 5.2.3 Check the Rotation of Agitator clockwise or not
- 5.2.4 Check the bearing sound of motor and gear box.
- 5.2.5 Check the condition of gear box oil seal for any leakages or worn out. If required replace with new one
- 5.2.6 Disconnect the Power supply of the reactor by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.2.7 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.2.8 Check the Cable, Terminals, Gland and Push buttons condition of the motor.
- 5.2.9 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.2.10 Check the motor and reactor earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.2.11 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one.
- 5.2.12 If the belts are in loose condition, tighten the belts by adjusting the motor base bolts and check the alignment.
- 5.2.13 Check the couplings and bush bolts, if they are damaged or worn out replace with new.

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5.2.14 Check the gear box oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.

5.2.15 In case the oil is dirty drain it out, clean thoroughly and fill with fresh oil.

5.2.16 Apply the grease in Motor bearings, gear box bearings and Reactor bearing housing.

5.2.17 Check the gland/mechanical seal condition by applying nitrogen or air into reactor and check the leakage by soap water, If the leakage is more, than arrest the leakage by changing the gland rope for gland or tighten the rotary part of mechanical seal.

5.2.18 In case of reactors with mechanical seal, check the surfaces of seal rings. If any damage is found replace with the new rings.

5.2.19 Tighten all the nut bolts of agitator, baffle plate bolts, if damaged replace with new Bolts and nuts.

**Note:** Take all the precautionary measures while working inside the reactor with vessel entry permission.

5.2.20 Check the RT water, Brine, Steam and reactor valves, if damaged replace with new one.

5.2.21 Check the safety valve condition and clean the safety valve ports

5.2.22 Check the Rupture disc condition and clean the rupture disc.


5.2.23 In case of GLR, Check the shell glass lining, flush bottom valve lining by visually, if any damage observed confirm with spark test and take necessary action.

**Note:** Perform the spark testing of GLR on need basis or subject to maximum Period of one year by external certification.

5.2.24 Record the preventive maintenance observation and action

➤ In case of SS reactor : Preventive maintenance checklist for SS Reactor ED004-FM020

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➤ In case of GL reactor: Preventive maintenance checklist for GL Reactor ED004-FM021

5.2.25 Record the preventive maintenance activity in Equipment History record ED010-FM011

### 5.3 Preventive Maintenance of RCVD

- 5.3.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.3.2 Check the Rotation of Cone clockwise and anti clock wise for any abnormality.
- 5.3.3 Check the bearing sound of motor and gear box.
- 5.3.4 Check the condition of gear box oil seal for any leakages or worn out. If required replace with new one.
- 5.3.5 Disconnect the Power supply of the RCVD by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.3.6 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.3.7 Check the Cable, Terminals, Gland and push buttons condition of the motor.
- 5.3.8 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.3.9 Check the motor and RCVD earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.3.10 Check the condition of the seal by applying vacuum in cone.
- 5.3.11 Check the condition of chain sprocket and chain. Lubricate the chain and sprocket.

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- 5.3.12 Check the gear box oil level, if the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.
- 5.3.13 In case the oil is dirty drain it out, clean thoroughly and fill with fresh oil.
- 5.3.14 Check the manhole gasket, butterfly valve and vacuum bulb condition.
- 5.3.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for RCVD,ED004-FM023
- 5.3.16 Record the preventive maintenance activity in Equipment History record ED010-FM011

#### 5.4 Preventive Maintenance of Multi Miller

- 5.4.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.4.2 Check the Beater direction of rotation clock wise or not.
- 5.4.3 Check the bearing sound of motor.
- 5.4.4 Disconnect the Power supply of the Multi miller by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.4.5 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.4.6 Check the Cable, Terminals, Gland and push buttons condition of the motor.
- 5.4.7 Check the motor starter controls and connections and remove the contactor blades clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.4.8 Check the motor and Multi miller earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.

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- 5.4.9 Remove the “V” belts and check the condition of the belts, If the belt is wornout replace with new one and check the alignment.
- 5.4.10 Check the housing bearing condition and apply the grease.
- 5.4.11 Check the condition of the mesh and locking bolts condition.
- 5.4.12 Check the miller blade wear and beaters condition.
- 5.4.13 Record the preventive maintenance observation and action in Preventive maintenance checklist for Multi miller, ED004-FM024
- 5.4.14 Record the preventive maintenance activity in Equipment History record, ED010-FM011

## 5.5 Preventive Maintenance of Centrifuge

- 5.5.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.5.2 Check the RPM of Basket with digital tachometer to meet the requirement.
- 5.5.3 Check the Rotation of Basket clockwise or not.
- 5.5.4 Check the bearing sound of motor and bearing housing.
- 5.5.5 Ensure the sound and vibrations of the centrifuge is normal and take necessary action if required.
- 5.5.6 Disconnect the Power supply of the Centrifuge by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.5.7 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.5.8 Check the Cable, Terminals, Gland and push buttons condition of the motor.
- 5.5.9 Check the motor starter controls and connections and remove the contactor blades clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals

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- 5.5.10 Check the motor and Centrifuge earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.5.11 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one.
- 5.5.12 If the belts are in loose condition, tighten the belts by adjusting the motor base bolts and check the alignment.
- 5.5.13 Remove the bearing housing covers and check the bearings condition and apply the lubricant, if required replace with new bearing.
- 5.5.14 Remove basket head left hand threaded nut fill the nut with grease and tighten it
- 5.5.15 Repeat the process (5.5.14) as many times till sufficient grease goes in to the rotor housing.
- 5.5.16 Apply grease for clutch bearings and suspension springs of the lugs.
- 5.5.17 Check the main pulley condition and clean the pulley with emery paper, If the pulley is damaged replace it with new one.
- 5.5.18 Check the clutch liners condition and if damaged replace with new liners.
- 5.5.19 Open the dish and check the cladding leak and welding joints, if any damage is noticed, repair it and fix it back.
- 5.5.20 Record the preventive maintenance observation and action in Preventive maintenance checklist for Centrifuge, ED004-FM025
- 5.5.21 Record the preventive maintenance activity in Equipment History record, ED010-FM011

## 5.6 Preventive Maintenance of Tray dryer

- 5.6.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,


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- 5.6.2 Check the bearing sound of motor.
- 5.6.3 Disconnect the Power supply of the Tray dryer motor by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.6.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.6.5 Check the Cable, Terminals, Gland and push buttons condition of the motor.
- 5.6.6 Check the motor and Tray dryer earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.6.7 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one and check the alignment.
- 5.6.8 Remove the air inlet filter and immerse in polyethylene solvent for cleaning. Take out the filter and clean with compressed air and fix it back.
- 5.6.9 Open the bearing cup of Plummer blocks, clean it thoroughly and apply fresh grease.
- 5.6.10 Check the steam/hot water valves condition and coil heating condition.
- 5.6.11 Check the fan blades and tighten all the blade screws, if any damaged, replace with new.
- 5.6.12 Check the door gasket, hinges and tighten the door hinge bolts.
- 5.6.13 Check the fan mesh and mesh bolts condition.
- 5.6.14 Check the Trays and tray stand wheels condition.
- 5.6.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for Tray Dryer, ED004-FM022
- 5.6.16 Record the preventive maintenance activity in Equipment History record, ED010-FM011

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## 5.7 Preventive Maintenance of Blender

- 5.7.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.7.2 Check the Rotation of Cone clockwise and anti clock wise for any abnormality.
- 5.7.3 Check the bearing sound of motor and gear box.
- 5.7.4 Check the condition of gear box oil seal for any leakages or worn out. If required replace with new one.
- 5.7.5 Disconnect the Power supply of the Blender by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.7.6 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.7.7 Check the Cable, Terminals, Gland and push buttons condition of the motor.
- 5.7.8 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.7.9 Check the motor and Blender earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.7.10 Remove the “V” belts and check the condition of the belts, If the belts is worn out replace with new one and check the alignment.
- 5.7.11 Check the condition of chain sprocket and chain. Lubricate the chain and sprocket
- 5.7.12 Check the gear box oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.
- 5.7.13 In case the oil is dirty drain it out, clean thoroughly and fill with fresh oil.
- 5.7.14 Check the manhole gaskets condition.

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5.7.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for Blender, ED004-FM038

5.7.16 Record the preventive maintenance activity in Equipment History record, ED010-FM011

#### 5.8 Preventive Maintenance of PNF

5.8.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.8.2 Check the dish locking bolts condition and replace them if they damaged.

5.8.3 Check the filter plate & drain nozzle condition.

5.8.4 Check the dish gasket condition if damaged replace with new gasket.

5.8.5 Apply the air pressure up to 1 kg/sq.cm to the shell and jacket for leak observation and valves condition, if leak observed replace with new valves and take necessary repairs for shell and jacket.

5.8.6 Apply the lubricant for top dish bolts & adjustable spring setup of dish.

5.8.7 Check the PNF body earth resistance with Earth Resistance meter (it should be less than 5Ω), if it is more than 5Ω check the earth connections and take necessary action.

5.8.8 Record the preventive maintenance observation and action in Preventive maintenance checklist for PNF, ED004-FM037

5.8.9 Record the preventive maintenance activity in Equipment History record, ED010-FM011


#### 5.9 Preventive Maintenance of VTD

5.9.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.9.2 Check the main door gasket, if it is in loose condition apply adhesive and paste it.

5.9.3 If gasket is damage condition, replace the gasket with new one.

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- 5.9.4 Remove the NRV from line and check the packing's, if damaged replace it.
- 5.9.5 Check the foundation bolts for tightening, if found loose tighten the bolts.
- 5.9.6 Check the door locking bolts for worn out if damaged replace them.
- 5.9.7 Check the trays condition.
- 5.9.8 Check Hot water circulation plate heating condition
- 5.9.9 Check Hot water leakages in water circulation plate
- 5.9.10 Check the vacuum leakages of pipe lines and vacuum trap. Tighten all fasteners of dummies, valves and flange joints, if required replace the gaskets.
- 5.9.11 Check the VTD earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action)
- 5.9.12 Record the preventive maintenance observation and action in Preventive maintenance checklist for VTD, ED004-FM034
- 5.9.13 Record the preventive maintenance activity in Equipment History record, ED010-FM011

#### 5.10 Preventive Maintenance of Boiler


- 5.10.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.10.2 Check the bearing sound of motor and ID (Induced Draft) fan.
- 5.10.3 Disconnect the Power supply of the ID fan motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.10.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.10.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.

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- 5.10.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.10.7 Check the motor and Boiler earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.10.8 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one.
- 5.10.9 If the belts are in loose condition, tighten the belts by adjusting the motor base Bolts and check the alignment.
- 5.10.10 Open the bearing cup of Plummer blocks, clean it thoroughly and apply fresh grease.
- 5.10.11 Clean the boiler tubes with MS round brush and take out the ash at front side of tubes.
- 5.10.12 Check the door packing rope condition if damaged replace with new rope.
- 5.10.13 Check the leakage in water level gauge cocks if required change the packing.
- 5.10.14 Check the safety valve, feed check valve and stop valve working condition.
- 5.10.15 Check the fire bars for any damages if damaged replace with new fire bars.
- 5.10.16 Check the Mobrey condition
- 5.10.17 Check the function of feed water tank Low level alarm
- 5.10.18 Check the Mud valve and Blow down valve condition
- 5.10.19 Record the preventive maintenance observation and action in Preventive maintenance checklist for Boiler, ED004-FM026
- 5.10.20 Record the preventive maintenance activity in Equipment History record ED010-FM011


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### 5.11 Preventive Maintenance of Cooling Tower

- 5.11.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.11.2 Check the bearing sound of motor.
- 5.11.3 Disconnect the Power supply of the motors by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.11.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.11.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.
- 5.11.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.11.7 Check the motor earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.11.8 Check the motor foundation bolts and fan blades fixing bolts if found loose tighten the bolts or damaged replace with new bolts.
- 5.11.9 Check the motor bearing and lubricate.
- 5.11.10 Check the condition of nozzles /sprinklers.
- 5.11.11 Clean the Fills with water.
- 5.11.12 Clean the cooling tower sump and fill with fresh water.
- 5.11.13 Record the preventive maintenance observation and action in Preventive maintenance checklist for Cooling tower, ED004-FM027
- 5.11.14 Record the preventive maintenance activity in Equipment History record ED010-FM011

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## 5.12 Preventive Maintenance of Generator

- 5.12.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.12.2 Tighten the DG set foundation bolts.
- 5.12.3 Check the battery voltage and distilled water level.
- 5.12.4 Check the Alternator earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action
- 5.12.5 Check the fan belts condition, If the belt is worn out replace with new one
- 5.12.6 Check the bearings condition and lubricate.
- 5.12.7 Check the Engine oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge strip.
- 5.12.8 Remove the Air filter element, clean with compressed air and fix it back.
- 5.12.9 Clean the radiator fins with compressed air.
- 5.12.10 Lubricate the alternator bearings.
- 5.12.11 Check the cable, lugs and glands.
- 5.12.12 Check the MCB switch operation.
- 5.12.13 Record the preventive maintenance observation and action in Preventive maintenance checklist for Generator, ED004-FM028
- 5.12.14 Record the preventive maintenance activity in Equipment History record ED010-FM011

## 5.13 Preventive Maintenance of Water jet vacuum pump


- 5.13.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.13.2 Check the bearing sound of motor.

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- 5.13.3 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.13.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.13.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.
- 5.13.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.13.7 Check the motor and vacuum pump earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.13.8 Check the gland packing, remove the gland follower by loosen the nuts and take out two or three gland packing and arrange new gland packing in place of existing packing. Place the gland follower in position and tighten gland nuts as required.
- 5.13.9 Lubricate pump and motor bearings
- 5.13.10 Check the foundation bolts, if required tighten the foundation bolts.
- 5.13.11 Check the water jet and diffuser condition.
- 5.13.12 Check the vacuum leakages of pipe lines, water jet, and vacuum trap, tighten all fasteners of dummies, valves and flange joints, if required replace the gaskets.
- 5.13.13 Check the condition of NRV, open the line it is connected with the jet and remove the float and check the 'O' ring, if required replace it.
- 5.13.14 Cleaning of the Vacuum pumps Sump whenever required
- 5.13.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for Water jet vacuum pump, ED004-FM029

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5.13.16 Record the preventive maintenance activity in Equipment History record ED010-FM011

#### 5.14 Preventive Maintenance of Air compressor

5.14.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.14.2 Check the bearing sound of motor.

5.14.3 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.

5.14.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress

5.14.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.

5.14.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals

5.14.7 Check the motor and compressor earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.

5.14.8 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one.

5.14.9 Check the Shaft seal leakage

5.14.10 Check for any air leakage in the line.


5.14.11 Remove air filters and clean with compressed air.

5.14.12 Check the compressor oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.

5.14.13 Check the Safety valve working condition

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5.14.14 Record the preventive maintenance observation and action in Preventive maintenance checklist for Air Compressor,ED004-FM030

5.14.15 Record the preventive maintenance activity in Equipment History record ED010-FM011

### 5.15 Preventive Maintenance of Pumps

5.15.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.15.2 Check the bearing sound of motor and pump.

5.15.3 Check the pump direction from motor end clock wise or not

5.15.4 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.

5.15.5 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress


5.15.6 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.

5.15.7 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals

5.15.8 Check the motor and pump earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.

5.15.9 Check the gland/mechanical seal condition for leakage of water. If Gland leaks, Remove the gland follower by loosen the nuts and take out two or three gland packing and arrange new gland packing in place of existing packing. If mechanical seal leaks then tighten the rotary part of mechanical seal or if any damages of seal replace with new mechanical seal.

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5.15.10 Check the base frame foundation bolts of motor and pump, if required tighten the bolts.

5.15.11 Remove the bearing housing covers and check the bearings condition and apply the lubricant, if required replace with new bearing.

5.15.12 Check the coupling and spider, If the spider is damaged, loosen the motor base bolts and take back the motor and remove the damaged spider and arrange the new spider, fix the motor and also check the alignment of the coupling. If coupling worn out replace with new coupling.

5.15.13 Check the suction strainer, open the strainer mesh and clean with water/ air.

5.15.14 Check the condition of Impeller and casing, if damaged replace with new.

5.15.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for Pumps, ED004-FM031

5.15.16 Record the preventive maintenance activity in Equipment History record ED010-FM011

#### 5.16 Preventive Maintenance of Steam jet vacuum pump

5.16.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,


5.16.2 Check the bearing sound of motor

5.16.3 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.

5.16.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress


5.16.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.

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- 5.16.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.16.7 Check the motor and vacuum pump earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.16.8 Check the gland packing, remove the gland follower by loosen the nuts and take out two or three gland packing and arrange new gland packing in place of existing packing. Place the gland follower in position and tighten gland nuts as required.
- 5.16.9 Lubricate pump and motor bearings
- 5.16.10 Check the foundation bolts, if required tighten the foundation bolts.
- 5.16.11 Check the steam jet condition
- 5.16.12 Check the vacuum leakages of pipe lines, water jet, steam jet, and vacuum trap, tighten all fasteners of dummies, valves and flange joints, if required replace the gaskets.
- 5.16.13 Check the condition of NRV, open the line it is connected with the jet and remove the float and check the 'O' ring, if required replace it.
- 5.16.14 Check the steam line and steam trap working condition.
- 5.16.15 Cleaning of the Vacuum pumps Sump whenever required
- 5.16.16 Record the preventive maintenance observation and action in Preventive maintenance checklist for Steam jet vacuum pump, ED006-FM032
- 5.16.17 Record the preventive maintenance activity in Equipment History record ED010-FM011


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### 5.17 Preventive Maintenance of Chilling plant

- 5.17.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,
- 5.17.2 Check the bearing sound of motor
- 5.17.3 Check the abnormal sound of compressor
- 5.17.4 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.17.5 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress
- 5.17.6 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.
- 5.17.7 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.17.8 Check the motor and compressor earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.17.9 Apply the grease in Motor bearings
- 5.17.10 Check the coupling and tyre, If the tyre is damaged replace with new tyre also check the alignment of the coupling. If coupling worn out replace with new coupling.
- 5.17.11 Check the compressor oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.
- 5.17.12 In case the oil is dirty drain it out, clean thoroughly and fill with fresh oil.
- 5.17.13 Check for any Freon gas leakage in the lines and compressor.
- 5.17.14 De scale the Condenser tubes with round wire brush or chemical
- 5.17.15 Remove air filters and clean.

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5.17.16 Record the preventive maintenance observation and action in Preventive maintenance checklist for Chilling plant, ED004-FM035

5.17.17 Record the preventive maintenance activity in Equipment History record ED010-FM011

#### 5.18 Preventive Maintenance of Oil ring vacuum pump

5.18.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.18.2 Check the bearing sound motor and pump

5.18.3 Disconnect the Power supply of the motor by removing the fuse and confirm the power supply is isolated and check the status board at Electrical feeder.

5.18.4 At work place keep the status boards with details like Under Breakdown/Under Maintenance/ Men at Work/Work is in Progress

5.18.5 Check the Cable, Terminals, Gland and Push Buttons condition of the motor.

5.18.6 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals

5.18.7 Check the motor and vacuum pump earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.


5.18.8 Remove the “V” belts and check the condition of the belts, If the belt is worn out replace with new one.

5.18.9 Check the oil level in vacuum pump

5.18.10 Check the pulley condition

5.18.11 If the belts are in loose condition, tighten the belts by adjusting the motor base bolts.

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5.18.12 Check the foundation bolts of base frame, motor and pump, if required tighten the bolts.

5.18.13 Remove the bearing housing covers and check the bearings condition and apply the lubricant, if required replace with new bearings.

5.18.14 Check the vacuum leakages of pipe lines and vacuum trap, tighten all fasteners of dummies, valves and flange joints, if required replace the gaskets.

5.18.15 Record the preventive maintenance observation and action in Preventive maintenance checklist for Oil ring vacuum pump, ED004-FM036

5.18.16 Record the preventive maintenance activity in Equipment History record ED010-FM011

#### 5.19 Preventive Maintenance of Agitated Nutch Filter and Dryer

5.19.1 Before starting of activity wear the safety PPE (Personal Protective Equipment) like Helmet, Goggles, Safety Shoe, Hand gloves, etc.,

5.19.2 Check the RPM of agitator with digital tachometer to meet the requirement.

5.19.3 Check the Rotation of Agitator in both directions for abnormalities.

5.19.4 Check the bearing sound of motor and gear box.

5.19.5 Check the condition of gear box oil seal for any leakages or worn out. If required replace with new one.


5.19.6 Check Hydraulic power pack working condition.

5.19.7 Check up & down travel of agitator and opening & closing of the discharge valve operation by hydraulic power pack.

5.19.8 Check oil level in the (power pack) Hydraulic System Gearbox.


5.19.9 Check Hydraulic power pack motor direction (should be clockwise loading from motor fan side or as directed)

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- 5.19.10 Disconnect the Power supply of the Equipment by removing the Fuse and confirm the power supply is isolated and check the status board at Electrical feeder.
- 5.19.11 At work place keep the status boards with details like Under Breakdown/Under Maintenance.
- 5.19.12 Check the Cable, Terminals, Gland and Push buttons condition of the Equipment.
- 5.19.13 Check the motor starter controls and connections and remove the contactor blades and clean thoroughly with CTC (carbon tetrachloride) and fix it back in place. Tighten all the connections of motor and starter terminals
- 5.19.14 Check the motor and ANFD earth resistance with Earth Resistance meter (it should be less than  $5\Omega$ ), if it is more than  $5\Omega$  check the earth connections and take necessary action.
- 5.19.15 Check the foundation bolts condition.
- 5.19.16 Check the gear box oil level, If the oil level is low, fill the oil up to the 3/4th marking on the gauge glass.
- 5.19.17 In case the oil is dirty drain it out, clean thoroughly and fill with fresh oil.
- 5.19.18 Apply the grease in Motor bearings, gear box bearings.
- 5.19.19 Check the mechanical seal condition by applying nitrogen or air and check the leakage by soap water, If the leakage is more, than arrest the leakage by tighten the rotary part of mechanical seal or check the surfaces of seal rings. If any damage is found replace with the new rings.
- Note:** Take all the precautionary measures while working inside the ANFD with vessel entry permission.
- 5.19.20 Check the discharge manhole O-Ring condition.
- 5.19.21 Check the filter cloth condition.

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5.19.22 Check the shell nozzle valves, RT water, Hot water, Steam and Service valves condition, if damaged replace with new one.

5.19.23 Record the preventive maintenance observation and action

➤ In case of ANFD :Preventive maintenance checklist for ANFD ED004-FM058


5.19.24 Record the preventive maintenance activity in Equipment History record ED010-FM011

## 6.0 FORMATS / ANNEXURE(S):

6.1	Preventive maintenance checklist for SS Reactor	: ED004-FM020
6.2	Preventive maintenance checklist for GL Reactor	: ED004-FM021
6.3	Preventive maintenance checklist for RCVD	: ED004-FM023
6.4	Preventive maintenance checklist for Multi miller	: ED004-FM024
6.5	Preventive maintenance checklist for Centrifuge	: ED004-FM025
6.6	Preventive maintenance checklist for Tray Dryer	: ED004-FM022
6.7	Preventive maintenance checklist for VTD	: ED004-FM034
6.8	Preventive maintenance checklist for Blender	: ED004-FM038
6.9	Preventive maintenance checklist for PNF	: ED004-FM037
6.10	Preventive maintenance checklist for Boiler	: ED006-FM026
6.11	Preventive maintenance checklist for Cooling tower	: ED006-FM027
6.12	Preventive maintenance checklist for Generator	: ED006-FM028
6.13	Preventive maintenance checklist for Water jet vacuum pump	: ED006-FM029
6.14	Preventive maintenance checklist for Air compressor	: ED006-FM030
6.15	Preventive maintenance checklist for Pumps	: ED006-FM031
6.16	Preventive maintenance checklist for Steam jet vacuum pump	: ED006-FM032
6.17	Preventive maintenance checklist for Chilling plant	: ED006-FM035

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6.18 Preventive maintenance checklist for Oil ring vacuum pump : ED006-FM036

6.19 Preventive maintenance checklist for ANFD : ED004-FM058

## 7.0 CHANGE HISTORY:

Revision No.	Effective Date	Details of Revision	Ref. CCF No.	Remarks
00	01.08.2009	New SOP	---	---
01	07.02.2012	Preventive maintenance schedule was revised to once in every three months from every one month.	---	---
02	26.07.2012	Equipment History Record introduced.	---	---
03	17.07.2014	1) Schedule changed. 2) Spark test procedure was removed from SOP. 3) Included spark test by external to maximum period of one year. 4) Preventive maintenance procedure for Blender and PNF introduced	---	---
04	10.09.2014	1) All Process equipments preventive maintenance checking points arranged in sequence as per the activities performed during Preventive Maintenance. 2) Following Electrical check points are introduced for all Process equipments in all Preventive maintenance checking points. i) Disconnect of power supply	---	---

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Revision No.	Effective Date	Details of Revision	Ref. CCF No.	Remarks
		ii) Motor cable, terminals and gland condition iii) Motor starter contactor blades cleaning iv) Motor and equipment earth resistance checking 3) Records are included in records column 4)MT-007 SOP removed and included in MT-004		
05	01.01.2017	1. SOP format changed in line with SOP-QA-001-04 2. SOP MT-006-02 merged with this SOP 3. Forms MT-F-001, MT-F-006, MT-F-011 removed and Form MT-F-033 removed 4. Procedure for preventive maintenance of water ring vacuum pump removed 6. Preventive maintenance definition included 7. Title name changed in to “Preventive maintenance of all equipments”	ED-CRF-006/16	---
06	17.08.2017	1. SOP format changed in line with SOP-QA-001-05	CCF/GEN/17007	---
07	21.10.2017	1. ANFD Preventive Maintenance Procedure incorporated and Preventive Maintenance Check list for ANFD (ED004-FM058-00)	CCF/GEN/17029	---

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