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| NTPC     | LMI                                                          | LARA |
| TITLE    | <b>Operation and Maintenance Practices of Air Preheaters</b> |      |
| REF. NO. | <b>LMI-07-R0/ BMD/OIN/OPS/MECH/023</b>                       |      |

**LARA SUPER THERMAL POWER PROJECT  
LOCATION MANAGEMENT INSTRUCTION**

**LMI-07-R0/BMD/OIN/OPS/MECH/023**



***Operation and Maintenance Practices  
Of Air Preheaters***

Approved for Implementation by .....

HOP(LARA)

Date:.....

Enquiries to: HOD (Mechanical Maintenance)

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## **Operation and Maintenance Practices of Air Preheaters**

### **1.0 INTRODUCTION**

This document aims at providing adequate guidelines for safe operation and maintenance practices for Air Preheaters. Some best practices for Air Preheaters have been incorporated in this document. With the implementation of the operation and maintenance practices as given in this document stations are bound to have better Air Preheater performance and substantial gain in boiler heat rate and efficiency.

### **2.0 SUPERSEDED DOCUMENTS**

NIL

### **3.0 REFERENCE DOCUMENT**

COS-ISO-00-OIN/OPS/MECH/023 Rev. No.: 01, March 2018

### **4.0 BEST PRACTICES**

The following best maintenance practices are to be adopted for regenerative air preheaters. OEM recommendation for preventive/ overhauling maintenance to be followed. Overhauling protocols / critical dimension are to be recorded / maintained as per OEM recommendations.

#### **4.1 Actions to be taken for free Thermal Expansion:**

- 4.1.1 Rigorous inspection of hangers & supports.
- 4.1.2 Removal of all restrictions after work from areas of possible expansion restriction.
- 4.1.3 Expansion study with help of aluminum finger tips/tabs.
- 4.1.4 Applications of special purpose anti seize compound in specific areas.

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4.1.5 Proper rain guard cover on guide bearing area & support bearing area to avoid Water ingress.

**Responsibility: HOD(MM)**

#### **4.2. Possible Areas to be inspected to avoid Thermal Expansion Restriction:**

4.2.1 Static seal

4.2.2 Guide Bearing spool piece

4.2.3 Air seal housing

4.2.4 Sector plate

4.2.5 Main drive rack pinion drive

4.2.6 Guide bearing sleeve

4.2.7 Rotor post seal

**Responsibility: HOD(MM)**

#### **4.3. Correct Method of Restricting Inter Sector Leakage:**

4.3.1 Rotor levelling within 0.5 mm/ mtr as recommended by OEM.

4.3.2 Sector plate leveling, difference from levelness should be minimum as far as possible.

4.3.3 T-bar leveling & centering within 3 mm.

4.3.4 Seal setting as per manual i.e. Seal Clearance Table by OEM.

4.3.5 Zero leakage through rotor diaphragm Worn out rotor diaphragms to be repaired by grafting new plates & grinding.

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4.3.6 Cold end grills and hot-end supports are to be properly inspected and corrected.

**Responsibility: HOD(MM)**

#### **4.4. Maintenance of Main Bearings:**

- 4.4.1 Proper leveling of bearing housing within 0.5 mm / mtr as recommended by OEM.
- 4.4.2 Monthly oil monitoring for moisture & MI at station level and Quarterly oil monitoring through wear debris analysis at NETRA. In case of any abnormality in the WDA, oil should be replaced and fresh sample should be collected after 15-20 days of operation and sent for analysis. If abnormality in the WDA persists then bearing inspection/replacement should be planned at the earliest.
- 4.4.3 Cooler and filter inspection. Hydraulic testing of oil coolers should be done during every overhaul.
- 4.4.4 Controlling hot air leakage from air seal housing.
- 4.4.5 Protective water shield at support bearing.
- 4.4.6 Oil flow view glass or flow meter to be provided wherever not available.
- 4.4.7 Fibroscopic/ Boroscopic inspection of support bearing assembly may be done during overhauling.
- 4.4.8 Inspection of guide bearing should be during every overhaul.
- 4.4.9 Inspection of Support bearing & Guide bearing by withdrawal of bearing from its position after 10-12 years of operation.
- 4.4.10 Subsequent inspection of Support Bearing & Guide bearing by withdrawal of bearing from its position after another 4-6 years.
- 4.4.11 Further, the inspection and replacement cycle as described above shall be repeated for new replaced bearings.

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- 4.4.12 Replacement of Support Bearings & Guide Bearings after 20 years irrespective of condition/WDA or make.
- 4.4.13 In addition to the above criteria, inspection and replacement of bearings based on Wear Debris Analysis (WDA) of Lube oil shall be continued.
- 4.4.14 Replacement of bearings shall be with source-standardized bearings.
- 4.4.15 Sampling location of lube oil for WDA/monitoring shall be done with proper arrangement of sampling tapping with valve as near to oil sump/ bearing housing / gear-box etc. from the drain point.
- 4.4.16 While replacing lube oil, viscosity of fresh oil should be checked to ensure that it is as per specification.
- 4.4.17 When replacing the lubricant in the rotor bearing, the oil level should be checked after the lubricant has been able to heat up and circulate through the system. Failure to do this may result in a false oil level reading, which could lead to the bearing being insufficiently lubricated during service.
- 4.4.18 In-situ inspection should be done by NDT (DPT/UT/MPI) of Guide trunnion near oil deflector plate. Oil deflector plate should be fixed with screws on the sleeve and not to be welded on guide trunnion.
- 4.4.19 Torque tightness of Guide bearing locking plate holding bolts should be ensured. These bolts should be inspected during every overhaul.
- 4.4.20 When doing welding on the air preheater, care should be taken to ensure the ground is made from the rotor structure to the rotor frame and not grounded through the support bearings or radial guide bearings.

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#### **4.5 Maintenance of Ducts & Dampers**

- 4.5.1 Proper scaffolding to be made for inspection of ducts at inlet and outlet of APH for erosion.
- 4.5.2 Replacement of eroded duct, bracing and supports.
- 4.5.3 Replacement of damaged/eroded expansion joints and its cover plate.
- 4.5.4 At APH inlet patching of plates should not be done. All eroded plates should be removed and new plates should be grafted and welded from all the sides to avoid falling of plates during running of APH.
- 4.5.5 The entire length of all the damaged / eroded bracing and supports to be replaced and welded fully to avoid falling of supports. No joints should be allowed.
- 4.5.6 All eroded guide vanes are to be replaced. Patching repair should not be done.
- 4.5.7 Repair/replacement of all dampers and the sealing of these dampers. Flaps and shafts of inlet damper to be repaired / replaced in full if it is eroded. Patch plate on flap is not permitted, it should be repaired by grafting only.
- 4.5.8 Welding of bracings/ diverter/ cover plate to be done checked and re-welding to be carried out on old weld even if bracings/ diverter/ cover plate are found OK.
- 4.5.9 Inspection of gusset plates at both ends of bracings for erosion & replacement of eroded members. Welding of gusset plate with FG/air duct and welding of gusset plate with bracing should be full (stitch welding should not be done).
- 4.6.0 All the redundant supports/ channels/ angles welded during repair work should be removed before giving clearance for trial run of APH.

**Responsibility: HOD(MM)**

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- 4.6.1 After the completion of works, a joint inspection of FG duct, bracings and expansion joint protection plate should be done by BMD, FQA and Operation. A joint protocol to this effect should be made.

**Responsibility: HOD(MM)/ HOD(Opn)/ HOD(FQA)**

## **5.0 BASKET MAINTENANCE**

- 5.1 Water washing of air heaters should be carried out when the gas air heater is out of service and the gas side temperature is cool enough to allow maintenance personnel entry to the gas air heater and adjacent ducts. However, in no case should water be emitted onto the rotor until the metal temperature of the gas inlet element is below 150 deg.C. Coverage of water washing in all the heating elements is to be ensured before completion of water washing. pH value of outlet water may be measured to determine effectiveness of cleaning and to be compared with inlet water pH value. When the clean water starts coming and the difference in pH value of supply & drain water is less than 1 then washing may be deemed to be complete.
- 5.0 Basket drying to be ensured by running draft fans. The recommended minimum drying period is 24 hrs. without fan and 08 hrs. with fans in operation.
- 5.3 During overhauling of boiler 100% APH baskets should be taken out from their position and cleaned with high pressure water jet.
- 5.4 After baskets are cleaned and put back in position, these baskets should be covered with template to avoid any foreign material or dust going into the baskets.
- 5.5 All gaps between baskets and diaphragm are to be closed for better heat recovery and lower erosion rate at the edges by providing Basket-by-pass seals.

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- 5.6 If the spare baskets are to be stored at site for a long time, it is recommended to apply rust preventive oil as specified by OEM.
- 5.7 Before installation, all new heating elements are to be cleaned thoroughly with high pressure water jet / steam.
- 5.8 Soot blower travel is to be set to ensure full coverage of the entire heating element. Actual steam blowing is to be ensured visually. Thermal drain valve be provided at soot blowing steam line. Modifications may be done to provide additional electrical heater for super-heated steam during start up.
- 5.9 Soot blower nozzles should be replaced during every overhaul.

**Responsibility: HOD(MM)**

## **6.0 BASKET REPLACEMENT CRITERIA**

- 6.1 All the APH baskets should be taken out from their position and cleaned with high pressure water jet. After cleaning is over, the decision to replace APH baskets can be taken on the basis of the following visual inspection:
  - a. Erosion from top
  - b. Choking
  - c. Perforation in the elements
- 6.2 Each station must have rolling plan for replacement of Air preheater baskets in set as per following frequency.
  - Outermost two rows of Hot End baskets: Once in every 4years.
  - 100% Baskets (Hot End, Hot Intermediate End & Cold End): Once in Every 8 years.

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- If condition of baskets are found more eroded or choked prior to the replacement cycle, then following criteria to be consider:
  - ✓ After the baskets are taken out from their position and cleaned, if the variation in weight is 20% and more, then the baskets should be replaced.
  - ✓ If the weight of the baskets is found to be more than original weight, after high pressure jet cleaning, then baskets should be replaced.

6.3 Gas side efficiency, air side efficiency measurement using recommended procedure with grid sampling should be calculated before and after overhauling. Trend of these efficiencies may supplement the decision for basket replacement.

$$\begin{aligned}
 & \text{Gas side efficiency for zero leakage} = \frac{\text{Gas temp. in - Gas Temp. Outlet at NL (No Leakage)}}{[\text{Gas temp. in} - \text{Air temp. in}]} \\
 & \text{B Air side efficiency} = \frac{\text{Air temperature rise}}{[\text{Gas temp. in} - \text{Air temp. in}]}
 \end{aligned}$$

**Responsibility: HOD(MM)**

6.4 Inspection of the heating elements of APH should be done on every shut down or minimum once in a year. When the one edge of the element sheet has thinned to approximately 1/3rd of its original thickness, the basket may be reversed (flipped over) for extended element life.

**Responsibility: HOD(MM)/ HOD(Opn)**

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## **7.0 MAINTENANCE OF DRIVE -SYSTEM**

- 7.1 Visual inspection of gears and pinions by opening of top cover and side windows in every overhauling
- 7.2 All oil seals and 'O' rings are to be replaced during capital overhauling (for BHEL supplied gearboxes). For other gearboxes it should be done as per experience or OEM recommendations.
- 7.3 Replacement of Gear box internals (gear/pinion) to be carried out in set. Carbon ring/ seals of Gear box output main shaft to be checked for any damage.
- 7.4 Inspection of input shaft keyway, clutch bearings and bibby coupling should be done in every overhaul.
- 7.5 NOT USED
- 7.6 Inspection of pin rack for run out and excessive wear. Replacement of pins or pin rack to be planned in case of wear in case hardened layer.
- 7.7 Pinion root gap, top and bottom gap are to be maintained as per OEM guidelines.
- 7.8 Inspection of main drive pinion for levelling and wear. Replacement of pinion to be planned in case of wear in the case hardened layer.
- 7.9 Ensure cold air flushing/sealing at rack pinion mating surface.
- 7.10 No lubricant is to be applied on pins or pinion.
- 7.11 Inspection / repair of air motor (liner/blade).
- 7.12 Quarterly monitoring of gear box oil to be carried out for WDA.

**Responsibility: HOD(MM)**

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## **8.0 PREVENTIVE MEASURES TO AVOID APH FIRE**

Please refer LMI 8-R0/ OPN/OD/OPS/SYST/004

**Responsibility: As per referred LMI**

## **9.0 BEST OPERATION AND COMMISSIONING PRACTICES FOR RELIABLE AND LONGER LIFE OF AIR PRE HEATERS**

### **9.1 Before Overhauling**

- 9.1.1 Before starting of water washing, all the duct drains are to be opened. APH hoppers are to be emptied properly.
- 9.1.2 Water washing of air heaters should be carried out when the gas air heater is out of service and the gas side temperature is cool enough to allow maintenance personnel entry to the gas air heater and adjacent ducts. However, in no case should water be emitted onto the rotor until the metal temperature of the gas inlet element is below 150 deg.C. Coverage of water washing in all the heating elements is to be ensured before completion of water washing. pH value of outlet water may be measured to determine effectiveness of cleaning and to be compared with inlet water pH value. When the clean water starts coming and the difference in pH value of supply & drain water is less than 1 then washing may be deemed to be complete.
- 9.1.3 Basket drying to be ensured by running draft fans for at least eight hours.

**Responsibility: HOD (MM)/ HOD(Opn)**

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## **9.2 During Re-commissioning**

- 9.2.1 Before light up, cleanliness of the air heater and removal of all foreign materials should be ensured. Necessary protocols in this effect may be signed jointly by boiler maintenance and operation department.
- 9.2.2 Air heater dampers should be commissioned and made available for operation.
- 9.2.3 Air heater oil carry over probes and inspection ports with lights should be made available for operation.
- 9.2.4 Air heater fire and water washing lines should be charged up to the last valve.
- 9.2.5 Soot blower travel is to be checked jointly to ensure full coverage of all the heating elements. Actual steam blowing is to be ensured visually. Limit switch function to be checked.
- 9.2.6 All oil burners should be always checked for passing and defective ones must be rectified.
- 9.2.7 Fire detection system, for detecting fire at an early stage, should be available when air heater is in service, particularly during startup activities.
- 9.2.8 Air heater interlocks and the functioning of the rotor stoppage alarm should be checked before the air heater is put in service.
- 9.2.9 Reference QP of APH overhauling works to be followed is enclosed herewith.

**Responsibility: HOD(MM)/ HOD(Opn)/ HOD(C&I)**

## **9.3 During Start Up**

- 9.3.1 Boiler cold startup checklist covering all aspect as mentioned above should be signed with the concerned maintenance departments, before boiler light up.

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9.3.2 Maintain proper atomizing medium pressure and oil pressure at the time of light up.

9.3.3 During light up check for proper combustion by observing the flame and exit of the stack. Take corrective action in case of unstable flame.

9.3.4 Air heater soot blowing should be started immediately after boiler light up. Blowing should be done with superheated steam at proper parameter (i.e. blowing pressure 12 ksc). continuously for each air heater (including the idle air heater). During light up, if availability of soot blower is lost and cannot be restored, boiler should be boxed up.

9.3.5 Oil carryover probes should be inspected regularly during light up. (Oil carryover probes should be withdrawn and cooling water isolated once oil firing is stopped)

**Responsibility: HOD(Opn)**

9.3.6 While the boiler and air heaters are in service, all the instruments related to combustion and air heaters should be monitored carefully and any sign of error in the instrument should be attended immediately.

**Responsibility: HOD(Opn)/ HOD(C&I)**

9.3.7 A close watch should be kept on the terminal temperatures of air heaters. Any unusual increase in one or more of these should be investigated immediately.

**Responsibility: HOD(MM)/HOD(Opn)/HOD(C&I)**

#### **9.4 During Normal Operation**

9.4.1 Air motor should be run once in a week for thirty minutes to ensure healthiness. Ensure 6-7 drops of lub oil carried along with compressed air. Further, when air motor being out of use for a long time after operating for short period, operate

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for atleast more than one minute with no load because Darin & dirt/ grit in the air piping may be left in the Air motor.

**Responsibility: HOD(Opn)**

- 9.4.2 Guide bearing oil level should not be overfilled as it may cause oil spill in guide bearing area and may cause fire. This is to be checked with LOP in stopped condition. Mechanical maintenance should ensure proper marking on the dipstick.

**Responsibility: HOD(MM)/ HOD(Opn)**

- 9.4.3 Guide bearing area should be cleaned on daily basis or as per PM schedule.

**Responsibility: HOD(MM)**

- 9.4.4 Any abnormal sound from rotor, gear boxes or bearings should be intimated to mechanical maintenance immediately.

- 9.4.5 Soot blowing of air heater should be done at least once in a day with proper super-heated steam and with thermal drain valve in service.

- 9.4.6 All efforts must be made to maintain primary air header pressure close to OEM recommendation.

- 9.4.7 Drains after water washing and firefighting lines after the isolating valves are to be kept opened for any accidental in rush of water inside the air pre-heater.

**Responsibility: HOD(Opn)**

## **10.0 DEALING WITH AIR HEATER FIRE**

Please refer LMI 8-R0/ OPN/OD/OPS/SYST/004

**Responsibility: As per referred LMI**

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## **11.0 SPECIAL T&P FOR AIR HEATER MAINTENANCE**

- 11.1 Gang jack (set of 4, Capacity - as per the rotor weight) with hydraulic pump, distributor manifold and all hoses in good working condition and 2 nos. spare jacks in working condition should be also readily available to cater to any failure of the working jacks in use. Hose should be minimum 3 meters long from distributor.
- 11.2 Master level of accuracy, 0.02 or 0.01mm / m.
- 11.3 Torque wrench of appropriate capacity.
- 11.4 Fork lift (min. 2 nos. of capacity 3.0 T approx.) to handle baskets at zero meter.
- 11.5 Electric hoists for handling basket replacement / cleaning works. One hoist for each Air Heater for removing / installing baskets in the Air Heater plus one common hoist for transporting baskets to & fro from zero meter.
- 11.6 Pneumatic wrenches for fasteners, for seal replacement & cold end basket doors removal / installation works.
- 11.7 Aluminum straight edges for seal setting of radial and axial seals.
- 11.8 Two nos. of electrical winch machines per site.
- 11.9 Space to be identified and earmarked exclusively at zero-meter for handling, repair and transportation of baskets.

**Responsibility: HOD(MM)**

## **12.0 SAFETY**

- 12.1 Safety hazards and Precautions to be taken:

All personnel inspecting Air Preheater components should be aware of the following safety hazards so as to prevent injury to personnel:

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- Tripping hazard when entering / exiting the rotor assembly
- Confined space area
- Loose/broken walkways / ledges
- Slipping hazards
- Falling debris hazards
- Hazards from sharp corners/ eroded components

#### 12.2 Safety Checklist for APH Inspection / maintenance:

- All personnel to have proper PPE (Safety shoes, safety helmet, hand gloves, earplugs, nose masks, boiler suit etc.,)
- The area being inspected is properly lit.
- Personnel working at heights should wear safety belt.
- Proper scaffolding or walkways / planking are in place and secure to stand / walk on.
- Erection of scaffolding covering 100% area on Cold end.
- Safety nets should be provided while working at heights.
- All ropes, chains, cables, slings and other hoist equipment must be inspected each time before use.
- Only qualified personnel should be assigned to rigging operation.
- Floor openings should be guarded by a standard rail and toe board or cover.
- Wall openings should have a standard guardrail.
- **Responsibility: HOD(MM)/ HOD (Opn.)**

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### 13.0 QUALITY PLAN

**Refer Annexure-A**

### 14.0 REVIEW

The HOD (Mech Maint.) will be responsible for reviewing this document on a 2 yearly basis, or as and when required.

### 15.0 DISTRIBUTION LIST

| SL NO. | DATE OF ISSUE | ISSUED TO          |
|--------|---------------|--------------------|
| 1      |               | AGM(MM)            |
| 2      |               | AGM (C&I)          |
| 3      |               | AGM(FQA)           |
| 4      |               | DGM(EEMG)          |
| 5      |               | AGM(O)             |
| 6      |               | GM(Maint.)         |
| 7      |               | GM(O&M)            |
| 8      |               | GGM(LARA)          |
| 9      |               | NTPC Lara Intranet |

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## 16.0 CHECK LIST

| SN        | DESCRIPTION                                                                                                                                                                                                         | YES/ NO | REMARK |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|
| <b>1.</b> | <b>CHECKS FOR FREE THERMAL EXPANSION OF APH</b>                                                                                                                                                                     |         |        |
| 1.1       | Inspection of hangers/ supports of pipes/ ducts done                                                                                                                                                                |         |        |
| 1.2       | Expansion study using aluminium finger tips/ tabs (if done/ required)                                                                                                                                               |         |        |
| 1.3       | Rain Guard cover in Guide Bearing area provided                                                                                                                                                                     |         |        |
| 1.4       | Rain Guard cover in Support Bearing area provided                                                                                                                                                                   |         |        |
| 1.5       | Thermal expansion restriction Checked in following area:<br>Static Seal<br>Guide Bearing spool piece<br>Air seal housing<br>Sector plate<br>Main drive rack pinion drive<br>Guide bearing sleeve<br>Rotor post seal |         |        |
| <b>2</b>  | <b>CHECKS FOR RESTRICTING INTER-SECTOR LEAKAGE</b>                                                                                                                                                                  |         |        |
| 2.1       | Rotor levelling within 0.5 mm/ mtr                                                                                                                                                                                  |         |        |
| 2.2       | Sector plate levelling done                                                                                                                                                                                         |         |        |
| 2.3       | T-bar levelling & centring within 3 mm                                                                                                                                                                              |         |        |
| 2.4       | Seal setting done as per Seal Clearance Table by OEM                                                                                                                                                                |         |        |
| 2.5       | Rotor diaphragms checked                                                                                                                                                                                            |         |        |
| <b>3</b>  | <b>CHECKS FOR MAINTENANCE OF MAIN BEARING &amp; LOS</b>                                                                                                                                                             |         |        |

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|----------|--------------------------------------------------------------------------------------------|--|--|
| 3.1      | Proper levelling of bearing housing within 0.5 mm / mtr                                    |  |  |
| 3.2      | Monthly oil monitoring for moisture & MI at station level                                  |  |  |
| 3.4      | Quarterly oil monitoring through wear debris analysis at NETRA                             |  |  |
| 3.5      | Sampling of oil from drain point                                                           |  |  |
| 3.6      | Replacement oil viscosity checked                                                          |  |  |
| 3.7      | Cooler and filter inspection done                                                          |  |  |
| 3.8      | Guide bearing locking plate holding bolts tightness ensured                                |  |  |
| 3.9      | Fibrosopic/ Boroscopic inspection done (during overhauling)                                |  |  |
| 3.10     | Inspection of guide bearing (during every overhauling)                                     |  |  |
| 3.11     | Inspection of guide bearing by withdrawal from its position after 10-12 years              |  |  |
| 3.12     | Inspection of guide bearing by withdrawal from its position after 4-6 years from 3.8 above |  |  |
| 3.13     | Replacement of Support & Guide bearing after 20 years                                      |  |  |
| 3.14     | In-situ inspection by NDT (DPT/UT/MPI) of Guide trunnion                                   |  |  |
| <b>4</b> | <b>CHECKS FOR MAINTENANCE OF DUCTS &amp; DAMPERS OF APH</b>                                |  |  |
| 4.1      | Inspection of duct at inlet & outlet for erosion                                           |  |  |
| 4.2      | Replacement of damaged/eroded expansion joints and its cover plate done                    |  |  |
| 4.3      | Damaged/ eroded bracing/ support complete replacement done                                 |  |  |

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| 4.4      | Sealing of dampers checked                                                                            |  |  |
| 4.5      | Joint inspection of duct, bracing, expansion joint by BMD, Operation & FQA carried out with protocol. |  |  |
| <b>5</b> | <b>CHECKS FOR BASKET MAINTENANCE</b>                                                                  |  |  |
| 5.1      | Water washing in hot condition with FG temp. below 150°C                                              |  |  |
| 5.2      | Stop wash on difference in pH value of inlet/ outlet water less than 1                                |  |  |
| 5.3      | Ensure all duct drains are open                                                                       |  |  |
| 5.4      | Basket drying done                                                                                    |  |  |
| 5.5      | 100% APH baskets HP jet cleaning during overhauling                                                   |  |  |
| 5.6      | Cleaning of new basket before installation                                                            |  |  |
| 5.7      | Soot blower nozzle replaced (every overhaul)                                                          |  |  |
| <b>6</b> | <b>CHECKS FOR MAINTENANCE OF DRIVE -SYSTEM</b>                                                        |  |  |
| 6.1      | Visual inspection of gears and pinions (every overhaul)                                               |  |  |
| 6.2      | Replacement of Gear box internals (gear/pinion) if done whether done in SET                           |  |  |
| 6.3      | Inspection of input shaft keyway, clutch bearings and bibby coupling (every overhaul)                 |  |  |
| 6.4      | Inspection of pin rack for run out and excessive wear                                                 |  |  |
| 6.5      | Inspection of main drive pinion for levelling and wear                                                |  |  |
| 6.6      | Cold air flushing/sealing at rack pinion mating surface                                               |  |  |
| 6.7      | No lubricant applied on pins or pinion                                                                |  |  |
| 6.8      | Inspect Air Motor                                                                                     |  |  |
| 6.9      | Quarterly monitoring of gear box oil carried out for WDA                                              |  |  |

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| <b>7</b> | <b>CHECKS BEFORE RE-COMMISSIONING OF APH</b>                    |  |  |
| 7.1      | Cleanliness of the air heater ensure                            |  |  |
| 7.2      | Dampers commissioned                                            |  |  |
| 7.3      | Oil carry over probe & inspection port lights working.          |  |  |
| 7.4      | Air heater fire and water washing lines charged                 |  |  |
| 7.5      | Soot blower travel ensured to all heating element               |  |  |
| 7.6      | Oil burners OK                                                  |  |  |
| 7.7      | Fire detection system OK                                        |  |  |
| 7.8      | Air heater interlocks and the rotor stoppage alarm OK           |  |  |
| <b>8</b> | <b>CHECKS BEFORE START UP OF APH</b>                            |  |  |
| 8.1      | Proper atomizing medium pressure and oil pressure<br>MAINTAINED |  |  |
| 8.2      | Air heater soot blowing in service                              |  |  |
| 8.3      | Oil carryover probes check at regular interval                  |  |  |
| <b>9</b> | <b>CHECKS BEFORE NORMAL OPERATION OF APH</b>                    |  |  |
| 9.1      | Air motor test run once a week for 30 min.                      |  |  |
| 9.2      | Guide bearing oil level checked                                 |  |  |
| 9.3      | Soot blowing of air heater done at least once in a day          |  |  |
| 9.4      | Drains after water washing and firefighting lines are open      |  |  |

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| Sl. No. | Component / Operation                                                                                                             | Type of Check    | Class | Quantum of Check | Ref. Document / Acceptance Norm       | Format of Record | Agency |   |   |   | Remarks                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|------------------|-------|------------------|---------------------------------------|------------------|--------|---|---|---|-------------------------------------------------------------------------------------|
|         |                                                                                                                                   |                  |       |                  |                                       |                  | A      | B | C | O |                                                                                     |
| 1.0     | Check & Clean Baskets by HP water jet( Hot End, Hot Intermediate, Cold End)                                                       | Visual / Lamp    | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P | W |                                                                                     |
| 2.0     | Check For Erosion / damage / Welding                                                                                              | Visual /         | Major | 100%             |                                       |                  |        | W | P |   |                                                                                     |
| 2.1     | Protective water shield at support bearing & Guide Bearing                                                                        | Visual           | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P |   |                                                                                     |
| 2.2     | Baskets Frame, Support grills (gratings), Expansion Cover plate, Support structure, Rotor diaphragm, Duct Bracing and Damper flap | Visual           | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P |   |                                                                                     |
| 2.3     | Mating Duct Plate & Thickness                                                                                                     | Visual / D-metre | Major | 100%<br>60%      | O & M Manual/ Drg.                    | Log Sheet        | V      | W | P |   | Thickness to be checked for erosion prone area.                                     |
| 2.4     | Expansion Bellow Before & After APH                                                                                               | Visual / ATT     | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P | W | ATT to be carried out after completion of work.                                     |
| 2.5     | Fire water, APH wash, Soot Blowing Nozzles and its Manifold, Oil Carryover probe                                                  | Visual           | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P |   |                                                                                     |
| 2.6     | All seals including Static seals.                                                                                                 | Visual           | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        |        | W | P |   |                                                                                     |
| 3.0     | Inspection, Servicing And Clearance Measurement                                                                                   |                  |       |                  |                                       |                  |        |   |   |   |                                                                                     |
| 3.1     | Guide bearing and support bearing (Measurement of critical dimension as per manual)                                               | Visual,          | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        | W      | W | P | W | Blue matching of adapter sleeve with trunnion shaft on replacement of Guide Bearing |
| 3.2     | Drive inspection & alignment                                                                                                      | Visual, Measure  | Major | 100%             | O & M Manual/ Drg.                    | Log Sheet        | W      | W | P |   |                                                                                     |
| 3.3     | Lubricant Wear debris test                                                                                                        | WDA              | Major | 100%             | Quarterly/Ann um as per OS guide line | Log Sheet        | W      | W |   |   | To be done at NETRA Pre OH is also required                                         |
| 3.4     | Rotor levelling                                                                                                                   | Measure          | Major | 100%             | O & M Manual /Drg.                    | Log Sheet        | W      | W | P |   | Rotor leveling within 0.5                                                           |

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|-----|-------------------------------------------------|-----------------|-------|------|---------------------|-----------|---|---|---|----------------------------------------------------------------|
|     |                                                 |                 |       |      |                     |           |   |   |   | mm / mtr<br>or<br>as OEM                                       |
| 3.5 | Sector Plate levelling                          | Measure         | Major | 100% | O & M Manual / Drg. | Log Sheet | W | W | P | difference from levelness should be minimum as far as possible |
| 3.6 | Seal clearances                                 | Measure         | Major | 100% | O & M Manual/ Drg.  | Log Sheet | V | W | P |                                                                |
| 3.7 | Free Thermal Expansion *                        | Visual, Measure | Major | 100% | O & M Manual /Drg.  | Log Sheet |   | W | P | Expansion study with help of aluminum finger tips              |
| 3.8 | Soot blower Lance & Nozzle, Oil Carryover probe | Visual, Measure | Major | 100% | O & M Manual /Drg.  | Log Sheet |   | W | P | W                                                              |
| 4.0 | Servicing of ALCS & checks**                    | Visual, Measure | Major | 100% | O & M Manual /Drg.  | Log Sheet | V | W | P | W                                                              |

**LEGEND:**

A – FQA & EIC, B – Execution department, O – Operation department, C – Contractor, P – Perform, W – Witness, V – Verification

Note: 1. Checks shall be applicable as per the scope of work identified by EIC.

2. It is the responsibility of the contracting agency to offer 'A' class checks to witness by FQA and EIC & 'B' class checks to witness by Execution department and 'O' class by Operation department. The complete protocols are to be made on real time basis.

3. Welding electrodes shall be of NTPC approved make and brand only.

\* To ensure Free Thermal Expansion, after fixing all seals sector plates are to be lifted for 10-15mm to check the freeness of guide bearing Spool and afterwards proper levelling to be carryout.

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### **Dos & DON'Ts**

1. Use appropriate tools & tackles for handling & repair of various parts of APH.
2. Lubricating oil analysis should be done before oil top up.
3. O&M manual to be followed for any repair/ maintenance of the APH.
4. All person involve in repair/ maintenance of the APH must use proper PPEs.
5. Before start of any work all person involve must be given instructions through pep-talk about risk/ hazards of the task.
6. Stoppage of APH must be ensured before taking up any repair/ maintenance of APH.