TEA RESEARCH INSTITUTE OF SRI LANKA

Guideline No: 02/14

OPERATIONAL AND MAINTENANCE PRACTICES FOR TROUBLE-FREE FIREWOOD-FIRED AIR HEATERS

Introduction

In any air heater, the fire grate area, cast iron arch and tube banks have been sized by the designers to have a capacity to achieve certain volume flow rate of hot air within a maximum temperature. The capacity of an air heater is further limited by the quality of firewood. Any attempt to exceed the capacity will essentially lead to unexpected failures and lower efficiencies. Following guidelines indicate desirable operational and maintenance practices that will minimize those failures and lower efficiencies.

Guidelines for operational practices

1. Make sure that air heater and dryer are compatible in terms of the volume flow rate and temperature of hot air. The air heater must be operated within these parameters. The drier inlet temperature should not be forced to exceed the designed inlet temperature by reducing the air flow rate. This will cause to reduce efficiency with the serious risk of overheating of tubes leading to frequent failures.

2. Fire-bars and side tiles should be correctly positioned before lighting the air heater to facilitate proper burning of firewood as required.

3. The fire grate area should not be over-loaded with firewood. If over-loaded, live flame will enter the tubes and tubes ends are most likely to decay fast.

4. For the sake of efficiency and for achieving an air temperature with least fluctuations, cut, split and dry firewood should be used. Firewood shed with adequate space is necessary for stacking cut and split firewood. A 3-month stock of cut and split firewood stacked under cover will reduce the moisture content of firewood to 15-25% level.

5. After lighting the air heater, Main fan should be switched on within a short time to avoid over heating of air heater components. The time varies depending on air heater design and its condition. Initially, Main fan damper should be kept at quarter open position.

6. Ash pit door should be used properly to regulate air for burning firewood in order to ensure efficient burning of firewood.

7. Position of ID fan damper should be adjusted to keep ID fan temperature few degrees above 120 °C (248 °F) while maintaining the required temperature of hot air. Regulating firewood feeding could facilitate to maintain the ID fan temperature.

8. When firewood feeding door is opened, a large volume of air get sucked in resulting in temporarily cooling the flame and live flame entering tubes. To minimize this unavoidable problem, feeding must be done within a short period. To facilitate this, known quantity of firewood should be available at arm’s length from the firewood feeding door.
9. Main fan should never be switched off even temporarily during the operation as it leads to over-heating of air heater components. This has been identified as yet another cause for frequent failure of tubes.

10. Main fan should be operated within a shortest possible time using a stand-by generator whenever power failure occurs. In the absence of stand-by generator, the side doors, man holes and the firewood feeding door should be opened fully to minimize over-heating of air heater parts.

11. Feeding of firewood should be stopped by monitoring availability of dhool from the last batch.

12. After drying is over, cooling down of air heater components should be ensured by operating the Main fan until the inlet air temperature is reduced below 66 °C (150 °F) at the inlet drier thermometer.

Guidelines for maintenance practices

1. Ash should be removed from the ash pit daily or even more regularly.

2. Tube banks and ash collecting boxes should be cleaned daily. A thorough cleaning should be done at least once a week.

3. Flue gas ducting should be cleaned regularly to ensure smooth flue gas flow to chimney. Collapsing underground duct and/or collection of water should be attended to solve the problem permanently.

4. Fire bars and side tiles are arranged for proper burning of firewood. Gaps between fire bars must be maintained to minimize falling of red hot ember to the pit.

5. Firebrick walls should be maintained as per manufacturer’s guidelines.

6. Surroundings of the air heater should be kept clean to avoid airborne dust particles entering into the air heater. Particularly identify areas where debris accumulates and clean them regularly.

7. Smoke test should be done regularly and if leaks are found, repairs must be attended immediately.

8. Operating air heater with sealed tubes must be avoided to prevent damages to other tubes.

9. Regularly check flue gas flow balance through left & right tube banks by observing flame direction in the combustion chamber and if imbalance is found, check and carefully adjust the dampers that are located immediately after the last tube banks.

10. Drier chamber must be maintained in good condition in order to avoid unnecessary load to air heater. Air leaks, missing trays etc. lead to inefficiency.