

## **MODERN TRENDS IN BOILER MAINTENANCE**

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### ***INTRODUCTION:***

Plant operation, involves manipulation of the plant equipment as per laid down instructions, with the objective of achieving the desired level of output, plant availability and plant efficiency. The operation always assumes equipment to be in a fit condition for operation by proper maintenance. The boilers are the most vulnerable equipment in the total plant complex and hence require great attention from maintenance point of view.

Maintenance is not confined to the works of inspection, or alignment or replacement of parts done during stoppage of machinery. It should also include all jobs related to the machinery, such as arrangement of necessary spare parts, watching and deriving inferences from the running conditions and making records of operation.

It is to be understood, that people are the key ingredient to a properly operated and maintained facility. Careless staff reductions in facilities may destroy the knowledge and experience base of day-to-day plant operations. Operator training, certification, and hands-on knowledge of the facility, all tend to ensure the highest level of competency in the overall operation and maintenance of a plant.

Achieving continued high performance and high availability of a steam generator, requires the combined effort of the operation and maintenance personnel. The operation staff should maintain recommended parameters for achieving high efficiency. The maintenance personnel should monitor the equipment condition and carry out necessary adjustments or repair to ensure high availability for the equipment. Use and importance of data in this context cannot be over emphasised. Periodic analysis of the data should be done at different stages to check the condition of the equipment and to make operation maintenance adjustment. These records will be useful for:

- Computing the plant economics
- Checking equipment condition
- Failure analysis
- Training of operation staff
- To provide feedback on equipment performance

The operation and maintenance of boiler require certain important rules, to be observed. These rules can be grouped under the 'dos' and 'don ts' of boiler operation and maintenance as given below.

## ***DO S AND DONT S FOR BOILER OPERATION***

### **DO S FOR BOILER OPERATION:**

1. Check and remove any foreign material, tools & tackles, waste cloth and other miscellaneous materials from boiler furnace, drums, headers etc. Ensure all manholes, access doors and openings in the boiler and ducting are securely closed before boiler operation.
2. Remove any restriction, obstructing boiler expansion. Remove temporary supports.
3. All vents & drains are to be operated as per valve operating instructions.
4. Ensure correct functioning of all interlocks and protection of auxiliaries and dampers.
5. Position all dampers in air and gas system in start-up position while starting the unit.
6. Start-up initial fuel feeding in the boiler should be made only after purging the boiler.
7. Check and control the fuel firing rate as per start up curve.
8. Check and maintain drum level always near recommended normal operating level.
9. Check and control boiler water, feed water and steam conditions as recommended.
10. Reduce the load as per the recommended rate. Check and take out the controls on manual only at a point, where good control can be obtained manually.
11. Ensure purging of furnace after every fuel trip.
12. Note down all minor maintenance works like valve leakage, gland leakages etc. during operation and attend to the same in a planned way during shut down.
13. Run the ID and FD fans after boiler shutdown till the flue gas temperature drops down to 100 ° C.
14. Check periodically for vibration and temperature of bearing, noise level, motor current, etc. for rotary equipment. These values are to be recorded and analysed periodically to ensure planned, preventive maintenance.
15. Check for condition of coupling and renew the rubber bushes if worn out.
16. Soot blower should be commissioned after initial boiler start-up and should be operated regularly.
17. Dump the grate after ensuring that there are no big lumps on the grate section to be dumped.
18. Do familiarise with the boiler operating manual and maintain the log book to record boiler operating data and events.

## **DONT S FOR BOILER OPERATION**

1. Do not start the fan with inlet damper open
2. Do not throw oversized wood pieces on the grate.
3. Do not start the boiler without ensuring local drum level measurement / remote indicating instruments are in order.
4. Do not start the feed pump with discharge valve open.
5. Do not start the boiler when the drum level is below the normal level
6. Do not start the boiler without adequate storage of DM / soft water
7. Do not feed raw water into the boiler under any circumstances
8. Do not operate boiler with known tube leaks.
9. Never operate at higher steam temperatures than recommended in the start-up curves as it may harm the superheater
10. Do not mix different type of lubricants from different suppliers. For details of lubrication refer to lubrication chart.
11. Do not keep the peep holes or manhole doors open, when boiler is in operation.

## ***REPAIR WORKS FOR BOILERS***

Repairs to steam generating equipment must meet existing requirements. The operating and inspection engineers, after inspection, have to establish the nature and amount of repair required to return the boilers to normal operation. All repair work in pressure part should have the approval of the concerned (IBR) statutory authorities. After the approval, pressure part repair work has to be undertaken only with qualified welder. The drawings and design documents should be referred to confirm the material of construction, tube sizes, and edge preparation etc. before start of the repair work.

### ***REPAIR OF FURNACE AND BOILER TUBES:***

1. The minimum replacement tube length should be not less than 150 mm. A damaged tube should be cut off at least for a length of 75 mm each side of the defective area.
2. Backing rings must be used in welding heat absorbing tubes carrying water or a mixture of steam and water
3. If a backing is not used, the first pass of the weld must be made by inert gas-arc or oxy-acetylene.
4. Prior to welding, clean the tube ends to bright metal, inside and outside for atleast 40 mm from the weld area. Remove all deposits of oxide, boiler water salts and slag to avoid gas or slag inclusions in the weld.

5. Allow for shrinkage in welding. The weld metal and parent metal are melted in the welding process and the molten metal shrinks as it solidifies. A butt weld in a tube will shorten the total tube length of about 1.5 mm.
6. As a general rule, first complete the weld at the lower end of the replacement tube. Do not start welding upper end of the replacement tube until both the replacement and existing tubes have cooled to ambient temperature.
7. The longitudinal cracks may have been caused by overheating the tube. In this case, the tube would have swollen and hence reduced the wall thickness. In the welded furnace wall construction, it is difficult to accurately measure the tube diameter or circumference to detect minor swelling. If visual inspection indicated swelling and reduction of the tube wall thickness at the crack, a complete replacement of the damaged tube length is the best solution.
8. A circumferential crack suggests a failure due to excessive stress applied by expansion restriction, bending or fatigue. Such crack can be repaired by welding. However, unless the cause of failure is diagnosed and corrected, another similar failure will occur at or near the original crack.
9. Blisters on furnace wall or boiler tubes are caused by internal deposits. They commonly occur in boilers operated with a high percentage of make-up in the feed water.
10. A blister forms because an internal deposit increases tube metal temperature to the point metal creep occurs. As the heated area swells, the internal deposit cracks off and the tube metal temperature returns to normal. The process may be repeated several times before the blister ruptures.
11. A leak in an inaccessible tube in a boiler tube bank is not uncommon. Make sure of the location of the leak. Very often it is through a rolled joint. If the leakage is heavy, the leak has probably continued for a period enough to damage the tube seat. In this case, re-rolling the tube end is not likely to correct the trouble. Seal welding the tube end is the only way to correct this.
12. It is permissible to weld a replacement tube length in any accessible boiler tube. If the tube spacing is too close to permit welding access on the back side, window welding can be used.
13. It is permissible to plug the ends of an inaccessible tube and leave it in place.

Boiler maintenance requires many special tools and the maintenance personnel should be well versed with the usage of the same. Many new diagnostic tools, like video boroscopes are now available for internal inspection of inaccessible regions of tube clusters. Infra red camera systems can continuously monitor vulnerable spots for growth of hot spots. Ultrasonic and special sonic

pickups can detect at a very early stage, any insipient tube leaks that are developing. Special furnace maintenance (movable) platform can reduce furnace repair durations significantly. Adoption of such modern tools along with specialised training for the maintenance personnel will go a long way in increasing the boiler availability.