Leakage Failure Analysis in a Power Plant Boiler

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Abstract

The boiler "Four Tubes" in a boiler occupies a very important position, according to incomplete statistics of a thermal power plant accident occurrence of unplanned outage, the boiler "Four Tubes" leakage caused by unplanned outage times 60%. Seriously study the boiler "Four Tubes" leakage causes and corresponding preventive measures that are put forward have some practical engineering significance.

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Key words: four boiler; tube leakage; failure; prevention measures

1. Main text Corrosion Failure

1.1 Failure caused by internal corrosion [1]

The internal corrosion of boiler pressure parts mainly has four forms: steam corrosion, oxygen corrosion, corrosion and corrosion under the scale.

One is steam corrosion. Steam surface metal at higher than 400 °C iron contact with steam to form Fe3O4 film, this is the steam corrosion.

Two is oxygen corrosion. The boiler feed water and oxygen in the process of electrochemical corrosion of the cathode polarization, electrochemical etching speed, the higher the temperature, the corrosion is block. Preventive measures: feed water deaerator, control water content; control the coal economizer tubes of water speed of not less than 0.3m/s, to prevent air bubbles trapped in the pipe wall.

Three is alkali corrosion. When the temperature is high, accelerated electrochemical corrosion, the higher the temperature, the greater the more strongly alkaline, corrosion.
Four is the corrosion under the scale. Evaporation wall sometimes sedimentary water slag iron oxide and copper oxide, high temperature and iron with electrochemical methods to react, corrosion of steel [2]. Such as boiler spare, because the vertical superheater not as internal water, internal corrosion of superheater will be quite serious. Stop making a long time in the boiler should take corresponding measures, such as hot water, compressed air blowing, preservatives and other measures for the protection of boiler pressure parts.

1.2 Failure caused by external corrosion [3]

Tube exerted, external medium to long time corrosion on a pipe. Solutions should strengthen insulation antiseptic treatment.

2 Erosion induced leakage failure

2.1 Failure caused by external erosion[4]

External scouring by pressure parts of leakage is mainly because the external medium wall flushing of the pipeline, such as steam boiler ash ejector by the installation position is not correct, sootblower nozzle deformation or blowing dust device not back, to wash out of the economizer, super-heater, water wall tube soot blower, resulting in leakage caused by.

Preventive measures: strengthen the anti-wear maintenance checks on water wall tube blowing dust device location, and check the sootblower nozzle position, angle change. Operation according to the ash, appropriate to reduce the soot blowing frequency, prolong the time of hydrophobic soot blowing.

2.2 Failure caused by internal erosion [5]

Pipeline internal medium erosion is one reason the pipeline leakage on pipe wall, because of the medium inside the tubes for high temperature and high pressure steam, steam flow rate soon, steam flow rate can reach 30-50m/s, high-speed medium erosion on the tube wall, especially advantageous for serious pipe bend. Because the coal economizer tube in high temperature water flow velocity is slower, the erosion of the coal economizer occurred less, but the superheater, reheater elbow, water wall high elbow internal scour the situation more.

3 Overheating caused by leakage failure

3.1 Failure caused by long-term overheat

Long-term overheat boiler tube in the long-term than the allowable tube wall temperature environment, the oxidation resistance of the tube wall decreased, oxidation corrosion rate increased greatly, at the same time, the mechanical properties of furnace tube basic allowable stress and physical characteristics is also reduced, the tube cannot reach the stress that should bear, will lead the tube to burst. Long tube explosion explosive export general trumpet-shaped, edge is thick, and the tube wall is similar to [6].
3.2 Failure caused by short-term overheating

Furnace tube internal heat circulation is not smooth, no effective heat transfer, makes the temperature of tube wall greatly exceed the permissible maximum temperature. Pipe under high temperature mechanical properties, physical properties, the allowable stress and oxidation resistance will be greatly reduced, the furnace tube is cannot withstand the media pressure inside the tubes, tube explosion. Short-term burst pipes burst generally trumpet-shaped, very thin edge. The causes are: pipe within the pipe blockage, could not form normal thermal cycle caused by; pipe (water wall, screen too prominent, contact) high temperature flue gas, pipeline absorbs radiant heat increasing, the tube wall temperature rise, short-term overheating tube furnace tube.

4 Failure caused by Operation adjustment [7]

4.1 Failure caused by startup, shutdown not meeting requirements

Cold water when the water temperature or inlet velocity is not in conformity with the provisions; startup boost heating or loading speed too fast; shutdown cooling too fast, release early, will make the furnace tube is uneven, excessive thermal stress resulting in boiler tube leakage.

4.2 Failure caused by operation load changing too quickly

The boiler load mutation operation, hand pressure suddenly increased, easy to make the original heating water wall tube water circulation weak slow or stagnant; on the other hand, weakened combustion furnace, in the outage of spray combustion water wall device around the tube heat load dropped sharply, may also cause water circulation stagnation phenomenon that some tube.

4.3 Failure caused by Running regulation improper

Operation of the burner is not adjusted properly, causing the flame centre excursion, or furnace coking phenomenon, are easy to make the water wall tube, superheated steam and reheated steam local overheating damage.

5 Other failure causes

5.1 Failure caused by design defects [8]

Due to lack of design and technical force, in the pipeline design, thermal calculation, there are some defects in design, so that the boiler pressure parts can not be long-term and stable operation, left the accident hidden danger to plant, power plant overhaul opportunity only by inspection, analysis and transformation, to the extent possible, a result of reduce design defects.

5.2 Failure caused by welding quality [9]

Welder welding level is not high, there is sand hole, crack, weld undercut, the weld has potential risks, causing the weld leakage squib.

Pipeline aligning is not in accordance with the provisions. In strict accordance with the pipe weld
requirements, ensure weld quality.

Preparation. Pipe break forms rather strict, break the form and size also has strict requirements, pipe diameter, wall thickness, the medium temperature pressure, welding and other factors vary.

Without preheating before welding without heat treatment. Some pipe before and after welding is required, such as alloy steel need to be preheated before welding, after welding heat treatment in need, to improve material weld ability, eliminate large internal stress of weld.

5.3 Failure caused by foreign bodies when installation

Four tubes of a boiler have many weld joints, in the manufacture, transportation, installation of pipelines, pressure, maintenance when there are errors, foreign body remains in the bearing internal components.

Preventive measures: strict implementation of the construction supervision procedures, improve the installation process quality, improve the quality of construction personnel.

5.4 Failure caused by Misuse of pipe

Boiler pressure parts using what steel is selected according to bearing temperature, pressure and the flow of the medium.

Preventive measures: equipment installation, strictly the quality pass, pipes for pressure parts must meet the design requirements. Analysis of pipe material in the pipe segment replacement, to prevent misuse. Grinding the explosion-proof inspection and a full range of pressure parts by maintenance opportunity, pay particular attention to the pipe creep and tube wall colour change.

Conclusion

The above simple analysis of the main types of boiler "Four Tubes" leakage, through the analysis of leakage on the pressure components of the boiler, the boiler "Four Tubes" installation, maintenance, operation and provide help and reference. To reduce the accident rate of four tube boiler, making the equipment to obtain the "controllable, in control", to ensure long-term stable and safe and economic operation of boilers.

References

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