

Failure Analysis of Water Tubes and Fire Tubes Boilers

The Analysis offered by CBA Engineering Support Services would include the following key elements:

- Preliminary Visual inspection
- Data Collection associated to Operation, Maintenance, Inspections, monitoring and Controls & Design
- Second Visual Inspection
- Taking sample for evaluation (if applicable)
- Interviews with Boiler Operator, Maintenance Representative and Manufacturer
- Validation of data
- Recommendation of metallographic and metallurgic and NDT Tests (if applicable)
- Failure Analysis
- Final report

Examples of data and Items would be used for the investigation

Technical specification of boiler

- Construction and design information of boiler and auxiliary equipment such as Deaerator, blowdown system, condensate water return, gas system, water system, combustion system.
- Equipment serial number, manufacturers 'data sheet, design specification data, design calculations, and construction drawings
- Instruction Manual (Operation & Maintenance) provided by the manufacturer.
- Piping and Instrumentation Diagrams (P&ID) or schematic diagrams.

Combustible

- Fuel analysis. Characteristics of combustible (natural gas) used in the boiler,
- Changes associated to the combustible
- Operational parameters of natural gas used in the boiler (Flow rate, Pressure, Temp,) at different loads of the boiler.
- Standards Operational procedure associated to the combustible.
- Historic data of Consumption of Fuel Gas supply (m³/day, m³/month)

Combustion

- Records of measurement of Flue gas analysis (e.g. Temperature of flue gas, Percentage of CO₂ or O₂ in flue gas, Percentage of CO in flue gas.
- Percentage of Excess air (for each load) and control.
- Percentage loading of boiler (e.g. hours maintaining the boiler at the same load).
- Burner characteristics (Manual of operation provide by manufacturer).
- Operational procedures associated to the burner at different loads.
- Piping and Instrumentation Diagram (P&ID) or schematic diagram of combustion process.
- Control of combustion.

Water

- Characteristics of water used at the boiler (Chemical and Physical analysis).
- Operational parameters of water temperature (Temp, flow rates, pressure, etc.) at different points of the process (e.g. before and after deaerator, etc...)
- Condensate return temperatures
- Piping and Instrumentation Diagram (P&ID) or schematic diagrams of water system.
- Historic data of Consumption of water (e.g. L/day, L/month)

Example:

Feed water analysis

Conductivity of Feed water, Feed water TDS ppm, Blow down TDS ppm, Hardness, ppm, Total iron (max) ppm, Total copper (max) ppm, Total silica (max) ppm, Oxygen (max) ppm, Hydrazine residual ppm (if applicable), pH at 25°C, PH of feed water. PH of blow down,

Boiler Water analysis

Boiler water conductivity, Boiler water TDS, ppm, Total iron dissolved solids ppm, Specific electrical conductivity at 25°C (mho), Phosphate residual ppm, pH at 25°C

Silica (max) ppm

Make up water to deaerator: Temp, Flow rate, pressure,

Water Treatment

- Historic and current test (and reports) for control of water.
- Operative manuals and procedures of equipment for water treatment
- Demineralization process (if applicable).
- De-aeration processes in place (procedures and information of equipment)
- Records of repairs, modifications or any other information associated to water treatment equipment
- Construction and design information of all equipment associated to water treatment.
- Equipment serial number, manufacturers 'data sheet, design specification data, design calculations, and construction drawings.
- P &ID diagrams of the process or schematic diagrams of processes.

Boiler Tubes characteristics testing & inspections

- Technical specification of tubes (Material, chemical composition, etc.)
- Historic and current tubes inspection records
- Tube specification (metallurgical characteristics, sizes, materials, resistance, etc.)
- Records of Non-Destructive Tests such as wall thickness of the tubes of the boiler and any other equipment or tank
- Records of internal cleaning of boiler tubes made by third party.

Maintenance

- Records (and reports) of cleaning services to boiler tube made by maintenance personnel.
- Records of repairs and replacement of boiler tubes, components, etc.
- Records of repairs of components or equipment of the boiler system
- Maintenance Log
- Reports of modifications
- Reports of maintenance made by third parties including recommendations.

Operation

- Daily Operation Log (Operating and checklist history).
- Reports of abnormal operations or changes in operation.
- Annual operating hours.
- Periods of time used for maintenance (when the boiler is out of service).
- Method used for assessing the boiler efficiency.
- Shutting down and starting up procedures.

Operational Parameters at different loads (eg. 20% 50%, 75%, 100%) through the time

- Operating steam temperatures.
- Operating steam pressures.
- Feed water temperatures
- Combustion air inlet temperatures.
- Exhaust gas stack temperatures.
- Condensates return temperatures.
- De-aerator water temperatures.

Boiler Inspections

- Record of Inspections in accordance with ABSA requirements including recommendations.
- Record of internal inspections of the boiler

Manuals & Procedures

- Standard operational procedures of the boiler developed by the company and any other equipment such as blown-down system, condensate return, deaerator, etc.
- Maintenance manuals
- Operation and Maintenance Manual of the boiler provided by manufacturer including any other equipment associated to the boiler.

Blowdown

- Blow down rate and quantity.
- Standard operational procedure associated to blow-down system.
- Manual, automatic or intermittent blow-down.
- Method used to assess boiler blow down requirement.
- Description (Schematic diagram) of the automatic blow down control system (if applicable)

Characteristics and briefly description of the industrial process which are using steam and hot water from the boiler.

- Briefly description of the process which use steam or hot water from the boiler
- Steam pressure, Steam temperature and steam flow rate in the industrial process.