



MECHANICAL ENGINEERING: BOILER SERVICES

Ensuring boiler systems are fit-for-purpose and operate for full, intended design capability and life according to the original design.

SERVICES

- Piping elevation survey
- Remnant Life Assessment (RLA)
- Performance testing and efficiency calculation
- Failure analysis
- Design consultation and reviews
- Coal-to-gas conversions
- Thermal modelling

SOLUTIONS

Piping elevation survey

Piping elevation surveys offer clients a cost-effective technique for accurately comparing pipe systems to the original design to determine:

- drainage slopes during “hot” and “cold” conditions;
- the effectiveness of piping supports, both rigid and spring types, by recording movements between the hot and cold conditions;
- the effect that malfunctioning supports have on the pipe system and subsequent pipe stresses;
- critical components, inspected using pipe stress analysis; and
- that existing maintenance and inspection philosophies are effective and focus on the correct components.

Our engineering team conducts leading piping elevation surveys, involving the following:

- “Hot” and “cold” piping elevation surveys to verify if a pipe system is operating as per design. Piping elevations are measured during both hot and cold conditions and use slope graphs to determine if condensate drains to the correct points in the piping system.
- All spring, hanging and rigid supports on a particular pipeline are inspected. The results are captured in a database, and typically include: support movements between hot and cold conditions and mechanical condition of all supports. After inspections, a comprehensive hanger testing scope is supplied.
- A theoretical model of the pipe system is created in Caesar II (piping stress and flexibility software program) to evaluate the structural responses and stresses of a piping system to international codes and standards. The stress results are applied to determine the most critical components and to update maintenance and inspection plans to focus on these components in future outages.

Remnant Life Assessment (RLA)

The life of boilers and their piping systems is finite due to the high temperatures and pressures at which they operate. Assessments to ascertain the remnant life of boilers are conducted to assist clients to determine their safety and reliability, and to forecast expenditure by supporting future capital expenditure planning for large-scale replacements and routine maintenance.



Our RLA service involves the following:

- Executing a detailed inspection scope of work targeting the mechanisms most commonly damaged in ageing boiler pressure equipment, e.g. long-term overheating (creep), thermal fatigue, welding defects, internal and external corrosion, erosion, etc.;
- Determining what mechanisms might be present and what inspection techniques should be used to identify the damage;
- Detailing visual inspections to identify anomalies that can be further investigated; and
- Removing samples from components to conduct metallurgical assessments.

Estimating the remaining life and productivity of boilers gives clients knowledge of and confidence in the reliability of their facilities. Our services deliver peace of mind by:

- providing prognostic plant health management;
- maximising plant reliability and availability;
- reducing plant component failure;
- improving budget forecasting and maintenance planning;
- identifying active damage mechanisms early on; and
- enabling the recommendation of corrective actions with confidence.

Performance testing, analysis and efficiency calculation

We assist our clients in validating and optimising their boiler performance. Clients leverage our expertise in mechanical performance testing to detect design flaws, equipment degradation and take corrective actions to improve boiler performance.



Our performance testing services include:

- Verifying compliance of a specification or contractual obligation after the commission of a new plant or after the recommissioning of a modified plant.
- Identifying boiler losses, requiring maintenance for optimal boiler operation.
- Indicating combustion adjustment requirements to conform to the Air Quality Act.
- Reducing operation and maintenance cost.

Bureau Veritas provides on-site services to measure and calculate boiler efficiencies. These tests are typically performed across the complete boiler load range. All measurements are done using calibrated gas analysers that are used as input to calculate the boiler efficiencies across the full boiler load range. All calculations, measurements and instrumentations are in accordance with the British standard BS 845. From the analysis, it is also possible to accurately calculate and compare fuel usage.

Thermal modelling can also be performed as a cost-effective alternative to investigating the performance of boiler components for steady state conditions. Thermal modelling is performed using first order heat transfer models and provides accurate answers in a relatively short modelling period. For cases where more complex, transient conditions need to be analysed or failure of boiler materials needs to be investigated, we have the capability to perform CFD analyses. CFD analyses can also be used to determine erosion rates, the effects of thermal fatigue and to analyse many other damage mechanisms.

We are also able to perform ultimate and proximate coal and ash analyses according to the relevant standards.

Failure analysis

Failure analysis services reduce unplanned outages and ensure component reliability thereby:

- delivering financial savings;
- aiding future predictions of equipment failure; and
- assisting to identify the asset or system that has the highest safety, environmental or financial impact when failing.

Boiler tube and component failures are the leading cause of forced outages in fossil-fired boilers. In order to reduce or eliminate future forced outages due to failure, it is important to determine and correct the root cause that will improve asset reliability.

In addition to evaluating the failure itself, all aspects of boiler operation leading to the failure are investigated to fully understand the cause. Leading failure mechanisms may include:

- Fly ash erosion;
- Short and long-term overheating;
- Soot blower erosion;
- Fatigue; and
- Weld/repair defects.

A comprehensive assessment is the most effective method of determining the root cause of a failure. Our experienced engineers are experts in conducting full-scope investigations to isolate the root cause that led to the failure and proposing appropriate solutions to rectify these problems going forward.

Design consultation and reviews

Bureau Veritas is recognised as an industry leader in the field of boiler component design and other related services.

We have the in-house capability to design boiler components, including super-heaters, reheaters and economisers. Our engineers are knowledgeable and experienced in implementing practical solutions that will result in a sound design capable of meeting all the operational requirements. Our engineers have experience in all the popular fire tube and water tube boiler design codes, e.g. ASME Section I, BS 1113, EN12952, and EN12953. We are capable of performing all pressure parts, thermal, hydraulic and structural design work.

Coal-to-gas conversions

Due to the rising cost of coal and the related emissions, operability and maintenance issues associated with coal fired boilers, many companies are starting to convert their boilers to gas-firing. Gas-fired boilers have significantly higher efficiencies, are easier to operate and provide faster response times during variations in steam demand.



Bureau Veritas has been involved in numerous coal to gas conversions of both fire tube and water tube boilers. Our team of expert engineers are experienced in performing the following design and engineering services:

- Boiler performance and efficiency tests of the coal and gas fired boilers (before and after);
- Size and requirements specification of new FD fans and gas burners;
- Air ducting design;
- Hydraulic investigations to determine the new load demands on ID fans;
- Thermal modelling to determine the optimal sizes of gas-fired super-heaters and economisers;
- Gas pipelines and gas train design;
- Smoke stack design;
- Burner mounting structures and maintenance platforms design;
- Refractory layouts of the burner penetrations design;
- Design of tube manipulations and other pressure parts; and
- Commissioning assistance.

INDUSTRIES

Some of the industries we service include the following:

- Power
- Industrial
- Oil and gas
- Chemical and petrochemical
- Mining
- Power generation
- Processing/manufacturing industry
- Food and beverage