How to Conduct a Boiler Performance Test
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The performance test in a boiler evaluates the practically achievable boiler efficiency. Performance tests are also carried out to prove boiler guarantees. As guarantees involve contractual conditions, the procedure involved are more elaborate than the test for evaluating performance.

Conducting a boiler performance test can be for understanding the current level of performance of the boiler, for any trouble shooting of the boiler for performance deviations, and for proving the performance guarantees. These entire three requirements can be met by the procedure adopted for performance guarantee testing. Before starting the performance guarantee test we have to understand the contact requirement fully, understand fully the performance level of the boiler, keep in mind the normal areas of concern, decide the right time for the test, organize the test instruments, make sure all local measurement grid points are in order, install all test instruments at the specified areas, do a trial test, and declare the guarantee test.

Understand the contact requirement
- Understand all guarantees well including those agreed including added any after contract finalization
- Talk to performance designer as to whether he has taken any calculated risk during the proposal
- Look at the penalty for each guarantee and be clear about the severity levels
- Be clear on the demonstration guarantee - what each means
- Look at rejection clauses in the contract
- Study the performance guarantee proposal submitted and approved

Understand fully the performance level of the boiler
- Make sure you have log readings of each load under which guarantees are agreed
- Evaluate the performance of the boiler and correct it to design fuel
- Be sure you are using the contracted and approved code for PG test
- Make sure you are evaluating all unaccounted losses and check how far you are eating into the manufacturers margin
- If required, inform the site of the findings from log data and ask them to retune and give another set of data

The normal areas of concern
- Oxygen and flue gas temperature at boiler outlet - only single point measurement for regular log reading
- Do a grid measurement during commissioning and check whether the point is close to the average grid value for the all loads guarantee is made
- Coal sampling and testing - total moisture evaluation is very critical and has to be done as per procedure in the standard being followed
- Power consumption readings - Equipment agreed to be included and current, voltage and power factor readings to be taken
- Percentage combustibles measurement in bottom ash - fly ash normally no problem faced

Decide the right time for the test
- Make sure the ambient conditions are conducive for PG test - avoid rainy season
• Complete the performance evaluation of the boiler and make sure the guarantees are met with correction to design conditions as per contracted code
• Decide test team - it is a good practice to have a performance engineer in the team if the boiler is first of its kind
• Make out clear responsibility for each team member - never exceed five (four in the team is good) excluding the performance engineer
• Evolve strategy for achieving the guarantee if there is any concern in any area

Test instruments
• Make sure all instruments planned to be used have valid calibration certificate and from a third agency of repute
• The multi point measurement probes for temperature and flue gas sampling are made ready and are as per standard
• All the thermocouples must be individually calibrated and should be within the expiration of calibration period
• Flue gas analysis equipment for oxygen, carbon-dioxide, and pollutants like NOx and SOx must be calibrated with calibration gases provided by supplier
• The flue gas measurement by Orsat must also be organized - leakage of air into flue gas during sampling is a major concern. All efforts to avoid this should be taken by checking and rechecking

Local measurement grid points
• Location of grid is very important as in a large duct there will be high amount of imbalance and stratification
• Care must be taken while providing the grid tapping points for proper access to insert the long probes
• Avoid tapping points near a direction change, void region, or near the tapping point hole
• The number of points for grid must be as per code used for PG test
• The power consumption measurement points and connections must be identified and connection procedure ensured

Installation of all test instruments
• All probes for APH inlet and outlet gas temperature and flue gas sampling must be assembled with thermocouple
• Each thermocouple on the probe should be close to the gas sampling hole if not at the sampling hole
• Connection to the measurement device (data logger or local measurement) should be carefully checked for any deviation or defect
• The gas sampling probe should be connected by flexible tubing to the sampler trough a bubbler
• The sampling must be done by a pump and all air ingress points in the connection network may be fully checked and sealed
• The gas temperature is measured at each point but the gas can be sampled from all points as a composite one
• Connect the other grid temperature measurements in areas like air temperature entering air preheater, temperature and oxygen at ID inlet
• All the air and flue gas pressure should be measured using a standard water tube manometer
• All pressure gauges, if pressure drop guarantee is there, must be done
• All steam, water temperature must be done through a calibrated thermocouple through a thermowell
• All thermocouple must be appropriately corrected for cold junction compensation
The ambient temperature, both wet and dry bulb, must be taken close to the air intake point of FD and PA fan at the required frequency.

- The readings in the control room must be separately logged with a required frequency.
- The coal, flyash, bottom ash and mill rejects must be collected at the required frequency and equipment.

**Trial test**

- At the required load condition wall blow the boiler and also do the soot blowing if needed - look at contract clause for any prerequisites.
- Tune the combustion for the lowest allowed excess air and lowest achievable APH outlet gas temperature.
- Allow the boiler to stabilize for about one hour and start the trial test.
- Take all readings at the required frequency as per the standard.
- Check the total moisture in coal and the combustibles in ash. If proximate analysis of is available which is within 24 hours this can be taken for immediate checking of the trial reading - correct the same for design coal.

**The guarantee test**

- If results of trial test are OK, then declare Performance Guarantee test, make sure a customer representative or consultant as per contract is a witness for all readings and data logged - Sign the log data then and there from all including customer rep or consultant.
- Normally all PG test are run for four hours unless otherwise agreed before test.
- Collect all samples, coal, mill reject, fly ash and bottom ash make in to three portions one for customer, one for your use and the other as reference sample in case needed.
- The reference sample is signed and sealed by both supplier and customer (Also consultant if involved in test).
- Do the test at all the agreed load.
- Make sure that all log readings and samples are properly signed, labeled and packed properly to avoid mix-up.
- Get the total moisture reading done for each test and a signed copy got from the customer or his assigned agency.
- If any deviation is noticed during any test because of load fluctuation or any other reason then record the same in that particular log sheet for reference in future.
- Make a final minutes of meeting with customer / consultant about the test carried out, any special observation, and when the report will be submitted.

Source:

http://www.brighthubengineering.com/power-plants/55816-how-to-conduct-a-boiler-performance-test/