

Operational issues between exhaust gas boilers and SOx scrubbers

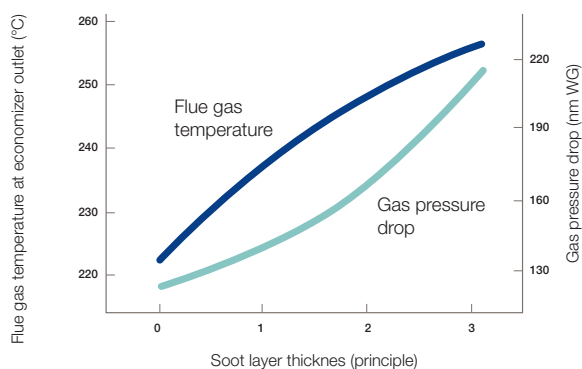
Most oceangoing vessels are fitted with exhaust gas boilers, which recover waste heat from the engine exhaust gas in order to accommodate the steam demand during a voyage. Designed according to the steam requirements at sea, the exhaust gas boilers are optimized for heat recovery and to maintain a low back pressure on the main engines.

Due to recent changes, however, there may be new operational considerations for exhaust gas boiler systems. In order to comply with the 2020 global sulphur cap imposed by IMO, many shipowners have decided to retrofit their vessels with an exhaust gas scrubber. This creates two potential scenarios that may need to be dealt with.

Scenario 1: Interference in flue gas velocity

Installing a scrubber after an exhaust gas boiler may result in back pressure, thus causing a possible reduction in the exhaust gas velocity. Such a reduction may in turn cause soot deposits to increase on the boiler's smoke side.

When soot accumulation is exposed to a sufficient amount of oxygen and a high enough temperature, it has the potential to ignite and cause a soot fire. Although the ignition temperature of the soot layer itself is around 300–400°C, the presence of unburnt oil can lower it to as little as 150°C. Slow steaming, manoeuvring or insufficient engine maintenance could all lead to poor combustion and oil residue.



Water-tube exhaust gas boilers with extended heat transfer areas are more susceptible to dangerous soot fires. This is because water-tube boilers have more surface on which the soot can potentially accumulate. In addition, the extremities of the extended surface areas normally have a higher metal temperature that can be an ignition source. For this reason, water-tube boilers are usually installed with soot blowers to remove any soot deposits.

Smoke-tube exhaust gas boilers with straight tubes are not normally installed with soot blowers. These boilers are intended to be self-cleaning and depend on higher exhaust gas velocities to blow the soot away.

Regardless of the tube type, it is essential to prevent excessive fouling of the boiler surface as a general rule. Alfa Laval has the following recommendations in this regard.

Recommendations

- Make differential pressure and temperature curves* using measurements for every 10% increase in ME load **with the scrubber in use** (up to full load). The boiler must be clean during this procedure.
- Constantly (at least daily) compare the actual pressure and temperature conditions with the curve.
- If a soot blower is installed, perform soot blowing 2–3 times per day as a minimum, or **more frequently if the differential pressure reveals soot build-up**. Soot blowing should be done with at least 75% engine load, as high gas velocity will help carry the soot out.
- Perform a visual inspection of the heating surface (minimum scope) every three months.
- Adjust the frequency of soot blowing to obtain a reasonably clean boiler condition and/or perform water washing** as necessary.***

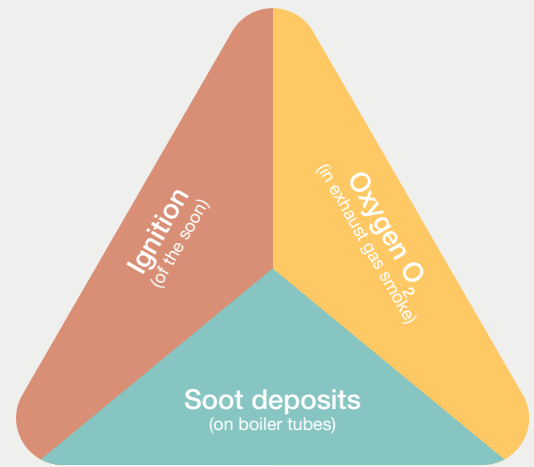
* Differential pressure and temperature curves show the drop in pressure and temperature over the exhaust gas boiler:

$$DP = P_{inlet} - P_{outlet}, DT = T_{inlet} - T_{outlet}$$

* When performing water washing, it is important to ensure that the washing is complete. The soot should not simply be flushed from the upper part of the boiler into a lower part.

* Because water washing corrodes the boiler slightly each time, it should never be performed unless deemed necessary.

Alfa Laval can also supply a pressure and temperature monitoring system for exhaust gas boilers that can provide an early warning of boiler fouling. For more information, please contact your local Alfa Laval office.



Scenario 2: SOx scrubber non-compliance during soot blowing

When an exhaust gas boiler is equipped with a soot blower, the soot blowing can potentially send an excessive amount of soot into the scrubber for a short time. This means the scrubber periodically risks non-compliance, as the scrubber's wash water flow is based on the engine load.

Alfa Laval has the following recommendations to prevent a non-compliance situation.

Recommendations

- Consider changing the soot blowing pattern as needed to reduce the amount of soot build-up between soot blowings.
- Establish a feedback loop between the exhaust gas boiler and the scrubber. This will signal the scrubber to ramp up the water flow during soot blowing, so that it remains in compliance.

Alfa Laval can provide the upgrade and interface needed to establish a feedback loop between the exhaust gas boiler and scrubber. For more information, please contact your local Alfa Laval office.

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