

## Surveyor's Guidelines:

### Boiler Damage

This note serves as a guideline to Surveyors attending a Boiler Damage on behalf of The Swedish Club. The purpose is not to limit the extent of the survey. If deemed necessary, the scope may very well be extended to cover areas not addressed below, as found necessary.

The survey report issued by the attending surveyor should include the following information, as available:

#### Feed water treatment:

- Report on feed water temperatures maintained. Ideally the temperature in the hot well shall be kept at minimum 85-95 degrees for an effective deoxygenizing of the feed water. If the system is fitted with a deaerator, report on the condition and the settings of the same.
- Report on type of system in use for chemical treatment of the feed water, chemicals used and dosage of the same. Include records for PH levels and conductivity as available.
- Report on blow down procedures as carried out by the vessels crew.
- Rupture/structural damage may be the result of contaminations with sea water or oil due to the increased heat transfer factor. Check the hot well for traces of oil contamination. Sources of contamination include fuel tank coils, fuel oil heaters, oil tanks and lube oil heaters. Sea water may enter the system from leaking heat exchangers and condensers. Check the boiler water sight glasses for any signs of oil contamination. Some boiler systems are fitted with an oil detecting device which monitors whether any oil is present in the condensate, if so, include records for the same.
- Check the condition and report on the testing of alarms as fitted, such as salinity alarms/shut down, low water level, shut down of boiler etc.

#### Recommended boiler water characteristics (Boilers up to 20 Bar working pressure):

Appearance	Clear and free of mud
Chloride content	<100 ppm Cl
"P" alkalinity	100-150 ppm CaCO <sub>3</sub>
Total alkalinity	<2x"P" alkalinity
pH at 25°C	10.5-11.5
Hydrazine excess	0.2-0.5 ppm N <sub>2</sub> H <sub>4</sub>
Phosphate excess	20-50 ppm PO <sub>4</sub>
Specific gravity (20°C)	<1.003 kg/m <sup>3</sup>
Conductivity	<2000 micromhos
Oil content	Nil

**Recommended feed water characteristics:**

Appearance	Clear and free of mud
Hardness	0-0.5 ppm CaCO <sub>3</sub>
Chloride content	<15 ppm
pH at 25°C	8.5-9.5
Oil content	Nil

**Cracks in boilers**

Cracks may be caused by:

- Bursting due to short term overheating.

Bursting of boiler tubes could be caused by partial dry running of the boiler or by blocked tubes.

- Creep cracks due to long term overheating.

This type of cracks typically manifests itself as cracks at the intersection between the boiler tube plate and the tube.

- Corrosion fatigue cracks and stress corrosion.

Corrosion fatigue cracks are normally caused by a combination of corrosion and mechanical stresses in the boiler. Corrosion attacks may be the consequence if the boiler water contains too much oxygen. Mechanical stresses are introduced during start-up of the boiler and are also caused by fluctuating temperature loads on the boiler.

Cracks may occur in way of leakages or crevices where evaporation increases the salt concentrations.

Expanding of boiler tubes in way of the boiler tube plate is important in order to avoid high stress levels. If not carried out or executed in a poor or in an unsuitable manner it may cause cracks to form. Fitting of the boiler tubes by means of only welding may be considered as insufficient. Proper stress relieving is equally important in order to decrease the risk for cracks in both boiler tubes and in the boiler shell.

**Important factors to consider include:**

- Firing up procedures as described in the boiler manual.
- Vibrations transferred from the hull.
- Condition of securing and fastenings as well as boiler foundation.
- Condition and adjustment of the boiler burner plant.
- Type of fuel used.
- Waste burning, as applicable.

### **Corrosion on the flue gas side**

The likeliness of corrosion on the flue gas side will increase if cleaning instructions for the boiler is not properly adhered too. Soot deposits in combination with a humid environment may cause corrosion attack, in particular in way of the boiler tube plate and the lower end of the boiler tubes. Check onboard records for cleaning as carried out.

### **Sludge deposits**

In order to avoid sludge deposits in the boiler which may lead to crevice corrosion as well as increased thermal load on the boiler it is important that blow down procedures and feed water treatment as described in the boiler manual is adhered to.

### **Soot fires**

Low grade fuels commonly used today, increases the risk for soot fires in the exhaust gas boiler as more soot is produced in the exhaust gases, hence more deposits will be formed. If the exhaust gas boiler is not cleaned in accordance with the manufacturer's recommendation, the risk for soot fires will increase.

#### **In connection with a soot fire check:**

- Manufacturer's recommendation for method and cleaning frequency. Review onboard records how the cleaning was executed.
- If temperature and pressure sensors are fitted across the economiser, include records for the same.

#### **General documentation (include as available):**

- Boiler drawings
- Maintenance records
- Damage reports
- Feed water analysis
- Blow down and cleaning procedures
- Burner maintenance instructions
- Class records
- Service reports
- Chemical invoice/purchase receipt
- C/E report
- Logbook extracts