

# Case study 3

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## Auxiliary boiler preheater overheating

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Date: 20.12.14.

Boiler technical data:

Project No.: 100295-01-1 / -02-1, 052218-01-1 / -02-1  
Boiler type: Small oil fired boiler  
Model: MISSION OS  
Burner type: Pressure atomizing  
Burner regulation: Modulating  
Model: KBO-R50M-E  
Primary fuel: Heavy fuel oil (HFO)  
Secondary fuel: Diesel oil (DO)

Description of the problem:

Shutdown of aux. boiler due to high fuel oil temperature in preheater. Controller will not switch off heaters(solid state relays). Problem occurs only on HFO mode. Analogue temperature indication is 180C. Often preheater temperature switch also trips.

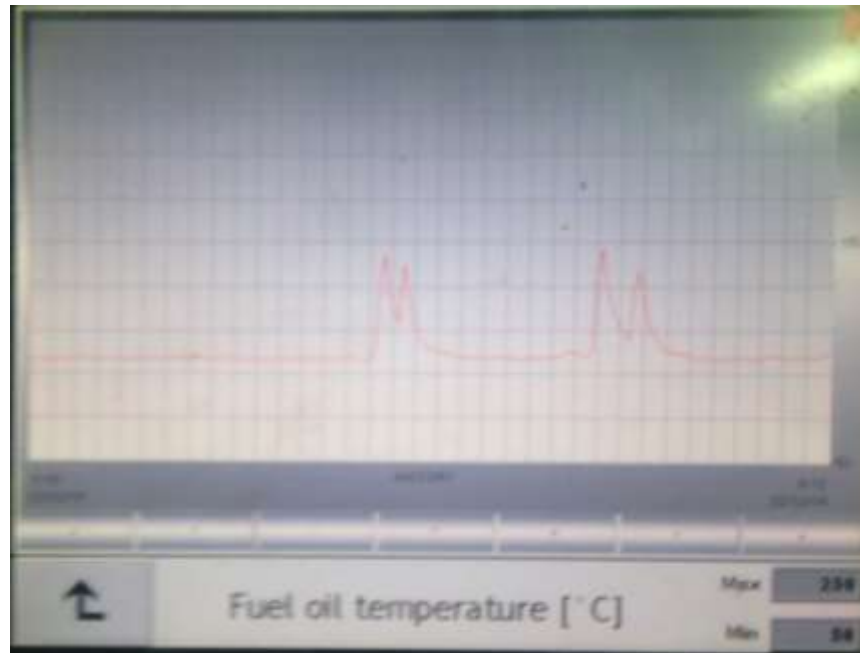
Measures taken:

1. Second engineer raised LSHFO settling tank to 110C ensuring good viscosity in burner and indication of HFO was bypassed so that it shows DO mode.
2. Replaced preheater PT100 sensor with new one. Problem still occurs. Preheater sensor for regulation doesn't have a range in the manual, it only defines as PT100.
3. Checked wiring of preheater system and checked heater elements.(Solid state relays, Heater circuit breaker, Heaters, Connections) All working good.
4. Measured with laser thermometer inside the heater and temperature is 180C after overheating.
5. Tested all sensors by manual eg. Disconnecting sensors one by one and getting alarm. Sensors are eliminated as source of the problems. If they were then we would get the same alarms during DO operation.
6. Lowered F.O. setpoint of the regulator from 135C to 120C. Same overheating problem occurs. Setpoints entered in control touch interface. By manual we should have two setpoints, one for standby, one for firing. We have only for standby and we changed that to 120C but still overheating.
7. Transferred control to LP1 panel inside the cabinet and found discrepancies on Actual setpoint which was 145C same as the High F.O. temperature that is used for firing. Set High F.O. temperature setpoint to 130C. Auxiliary boiler started working on HFO and started heating but in the first 20 seconds the F.O. temperature in preheater reached 159C and did not trip the boiler. It then steadied at 130C and worked for 6 hours when it tripped again due to high temperature of F.O. in preheater.
8. Switched to HFO from LSHFO. Same problem occurs. Auxiliary boiler working no more than 12h and then it trips sometimes even after 30 min.
9. Replaced relay for preheater solid state relay from EXH. Gas Boiler control panel which is not used. Same problem occurs. Auxiliary boiler working no more than 12h and then it trips sometimes even after 30 min.

10. Observed Solid state relay function on the circuit board and found that controller excites the relay normally for a while but after some time it gives continuous signal to engage heating eg. Solid state relays causing overheating in preheater. Controller board defective.

11. Boiler works normally if the Abnormal alarm is not reseted on the control touch panel.

P.S. Trouble before this problem was that for unknown reason 2/3 solid state relays have burned out. One day before overheating problems another solid state relay burned out.



Auxiliary boiler setpoints in the controller

Boiler load – Manual (60%)

F.O. standby Setpoint – 120 C

High shutdown alarm limit – 165C

Low alarm limit – 30C

Low shutdown alarm limit – 30C

Actual SP – 130C

Setpoint – 120C

Setpoint high – 130C

F.O. pressure – 21 bar

Oil regulator parameters (PID regulator):

Neutral zone – 2 C

Gain – 1.6

Sampling time – 0.5 sec

Integral time – 160 sec

Derivative time – 0 sec

Min pulse – 1 sec

Run Time – 25 sec