

PROBLEMS WITH CE VU20 BOILER AT GLENDALE

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Abstract

Glendale operates a VU20 boiler, designed for 3300 kpa – 23 t/h at the mill range of 2100 kpa, at 330–360°C, at a peak loading of 30 t/h, averaging 26 t/h. During the 1994 season sudden serious temperature drops were experienced, without loss of pressure. These periods of low temperature did not always coincide with peak loads. Only by reducing the loading, through stopping the milling operation was the temperature restored. This paper describes the detailed efforts made to locate the problem and how the problem was eventually solved.

Introduction

The boiler was built by CE in 1966 as a coalfired unit for a rubber factory and installed by Techserve, as a secondhand unit in 1978 at Glendale and converted to fire bagasse and coal. During the 1992/93 season the boiler in question was virtually completely retubed. The only old parts were the furnace side and front walls. No problems occurred during the short crushing season other than during the last crushing week of 1993 when on two occasions the final steam temperature of this boiler dropped from its normal 335°C level to approximately 240°C. The mill was stopped, the temperature restored itself, and the mill started again. It was noted as a strange occurrence.

During the offcrop nothing was detected or noted as being unusual and at the beginning of the 1994 season everything worked normally. During the first seven weeks of the crop loads of 30 t/h were regularly encountered, temperatures fluctuated between 320° and 370°C. During the eighth week, at the end of July 1994, sudden temperature drops occurred, down to 230°C and possibly even further if the mill was not stopped. Carryover was noted due to overloading of the boiler. Some load reduction was achieved by using some Eskom power, instead of mill generated power.

Even with reduced load the temperature dips occurred. The unexplainable point was the irregularity of the temperature dips. It happened on all shifts, irrespective of the operators, time of the day or week. It happened four times in an hour, hour after hour recovering in minutes after the mill was stopped, and sometimes there were six shifts without any problem!

Observations

The feedwater temperature and flow were checked, nothing being out of standard. The pH was brought down from the 11,7–12 range to between 10,5 and 11,2 to prevent possible priming. The total dissolved solids (TDS) was extremely low at 300–500 ppm. Eventually a long weekend stop was scheduled for an internal inspection. Nothing appeared to be wrong, but upon pressure testing a series of weeping leaks was found on the gusset position between the roof and rear wall tubes (Figure 1). Why the gussets were fitted during the 1992/93 offcrop is outside the scope of this paper. The problem of cracks around the welds, next to the superheater tubes was assumed to have been the reason of the temperature drops. The gussets were removed, the cracks repaired, the boiler steamed up and the same problems occurred again, just as before!

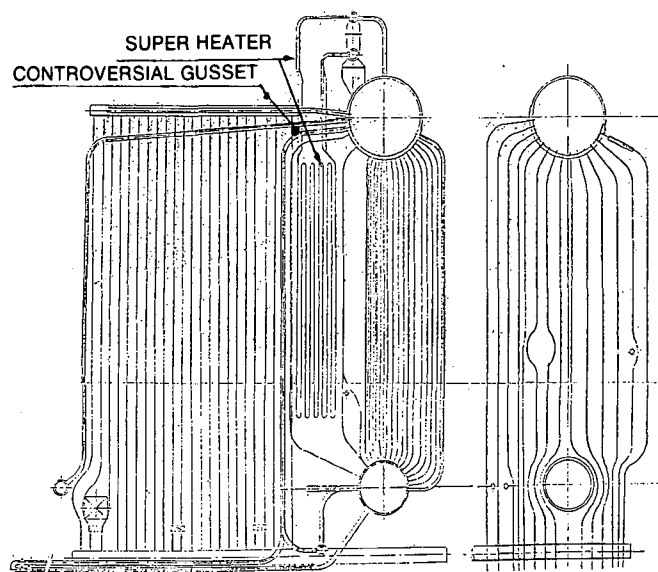


FIGURE 1 Layout of the boiler.

Nearly all authorities on boilers were consulted. No one had come across similar problems. The boiler was observed for 24 h/day by outside consultants for three days. The boiler loading was reduced to ± 22 tons/h, to no avail.

A typical observation by the author:

The temperature dropped from 320°C over a period of three minutes to 270°C (danger warning – signalled the mill to stop at 250°C). The mill was stopped at 245°C, after which the temperature immediately stopped dropping and rose rapidly to 290°C, slowly climbing to 305°C, stopping and dropping again to 270°C, the mill still being stopped! The temperature then started rising to 320°C, when the mill starting sign was given. When the load went up, the temperature still rose to 350°C. There were no problems for the next six hours!

Instruments and equipment

All instruments, control valves, pumps, fans etc. were checked for accuracy and proper working. No significant abnormalities were found. The water level was closely observed at the sight glass. This appeared to be steady within 20 mm. All the refractory was carefully checked and possible leaks of gasses or air were investigated.

Possible consequences

During temperature drops the likelihood of carryover (water droplets being carried by the steam) is very high. This may result in very serious damage at the end of the line in the turbines. Blading can be stripped of the rotors. Besides the actual droplets in the high pressure steam, too low a superheat can cause droplets forming in the turbines due to the energy loss whilst the steam expands in the stages. These problems would cause the mill to stop for a long time.

Final approach

As no apparent external technical/operational reason existed the problem had to be found inside the boiler.

Possible causes

- Dirty superheater: unlikely because very dirty superheater tubes would overheat, and result in a bunch of spaghetti.
- Blocked steam separating screen: unlikely as it would cause a serious pressure drop.
- Mechanical problem in the drum with screens/feedwater pipe (Figure 2): unlikely as no water level problem was apparent.
- Contaminated boiler water *i.e.* presence of oil, hence causing foaming/priming: no traces of oil were found.

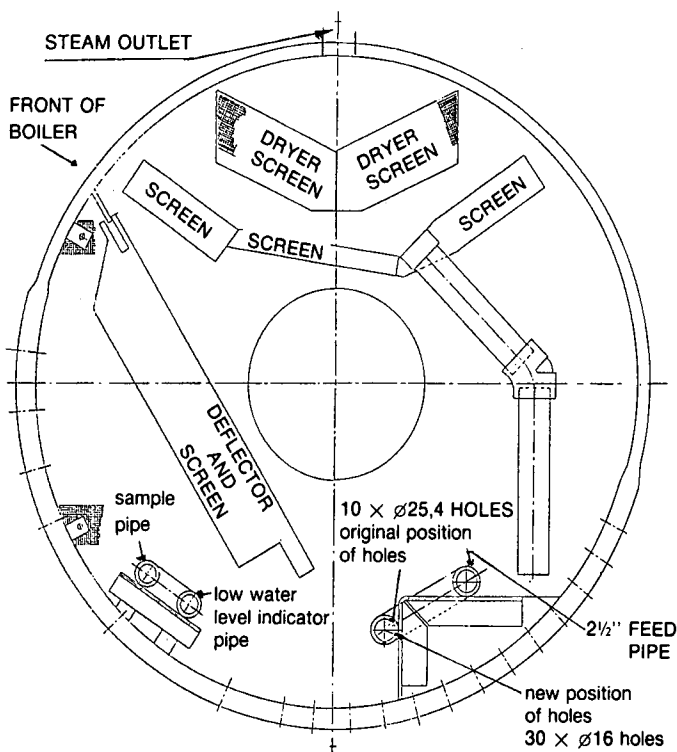


FIGURE 2 Details of the steam drums.

Action

Notwithstanding the above it was decided to:

- clean the superheater chemically.
- clean all the screens.
- check and modify the feedwater pipe not to spray 10° up, but $\pm 10^\circ$ down.
- drain and refill the boiler with fresh soft feedwater.

The above action was commenced on 27 September 1994.

Findings

- The superheater tubes had a slight deposit, not of any significance but a residue was removed.
- The steam screens had more than a normal coating and had carbon residue from a slug of sugar on 25 August 1994. Far dirtier screens have in the past been removed at the end of crushing seasons.
- The feedwater pipe was fitted exactly according to the drawings. Two holes, however, impinged their water onto support brackets, which could possibly have created a fountain effect on the surface. This pipe has been there since 1978. A new pipe was fitted with many more, slightly smaller holes directed 10° down from the horizontal, not impinging on brackets.
- The bottom drum was completely clear of any loose deposit and only slightly scaled.

On 2 October 1994 the boiler was relit and on Tuesday evening 4 October 1994 the boiler was put back on range. The load initially was kept low, and gradually put back to 27/28 t/h. No further problems were experienced. The steam temperature was maintained from 325–370°C.

Conclusions

The apparent problem was cured but we still have no idea what the actual cause was. Each of the causes stated above under 1, 2, 3 and 4 would have had other effects, and these did not manifest themselves. It is, however, felt that some carryover may have caused the initial problems.

Acknowledgements

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