Reduction of Boiler Hum

Th.B.J. Campmans
LBPSIGHT, Nieuwegein, Netherlands,
t.campmans@lbpsight.nl

Introduction: A 220 ton/hr steam boiler installation suffered from a severe hum (low frequency noise), between 66 and 80% of the load. The dominant frequency was 30 Hz. The objective was to reduce the hum.

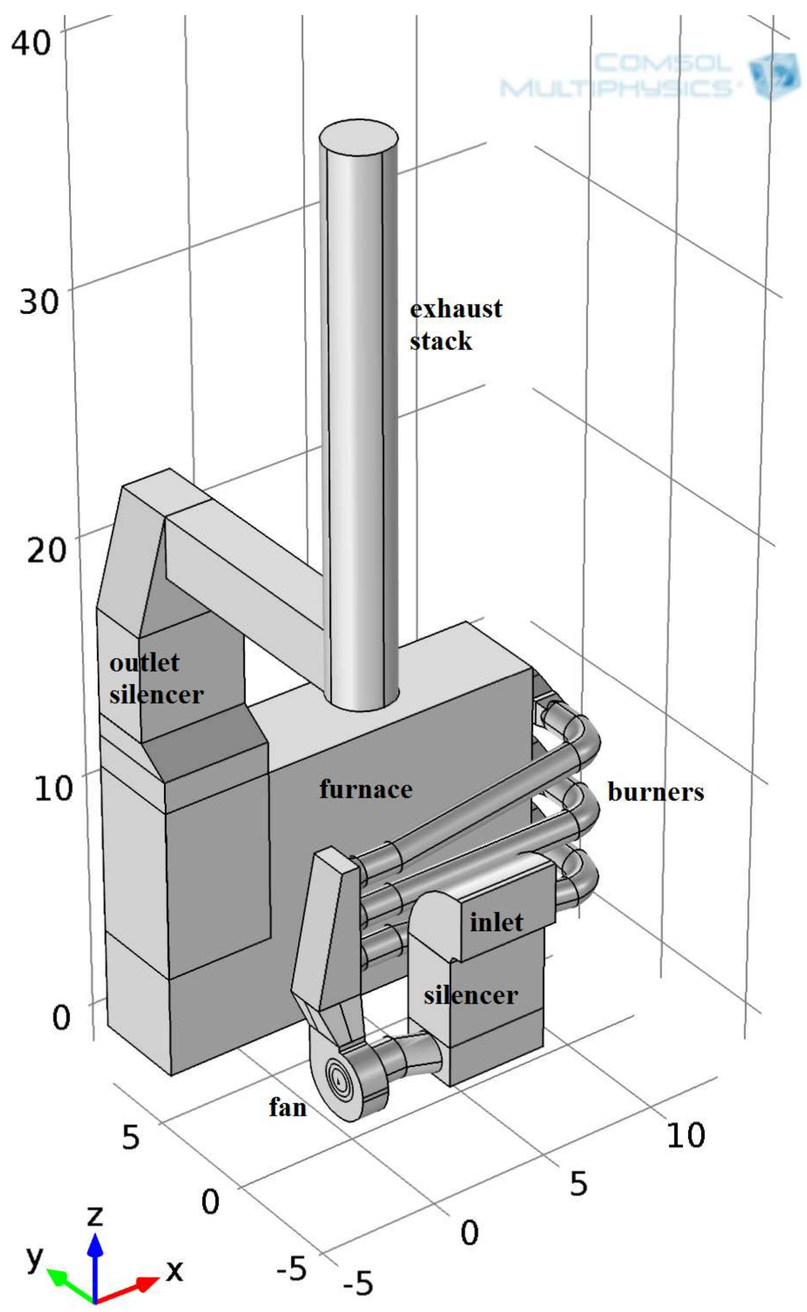

Figure 1. Geometry of boiler

Flow study: The flow at the inlet and outlet of the fan was studied with a RANS turbulence k-ε model, as part of a non isothermal flow (Kays-Crawford). Although thermal effects were not studied, this gave good convergence. The flow in the original situation proved to be unstable containing vortices. Improvements were designed: a changed duct shape and flow guiding vanes.

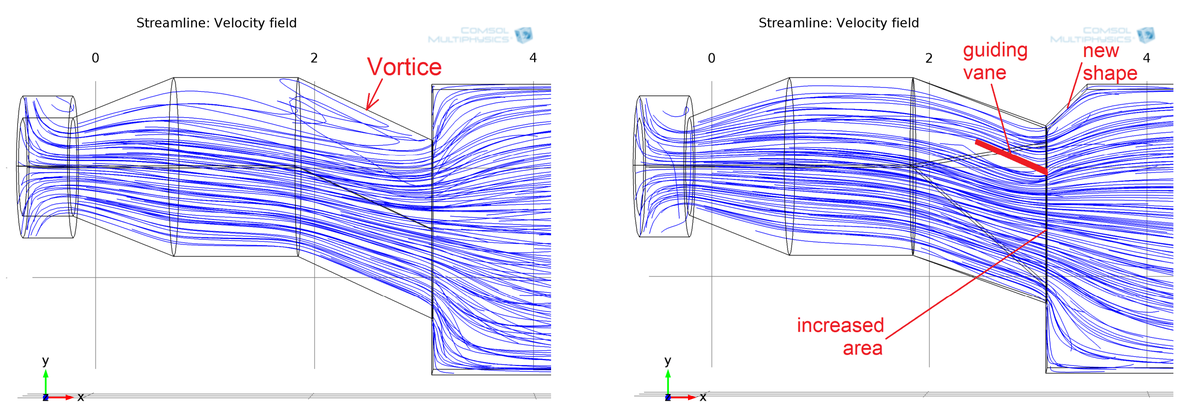

Figure 2. Streamlines in original and improved situation

Acoustic study: Additional to the flow optimisation, noise reduction was desired. The system was modelled with pressure acoustics. The acoustic response on a given excitation of the fan was determined in the original and the adapted design with an absorbing package of mineral wool.

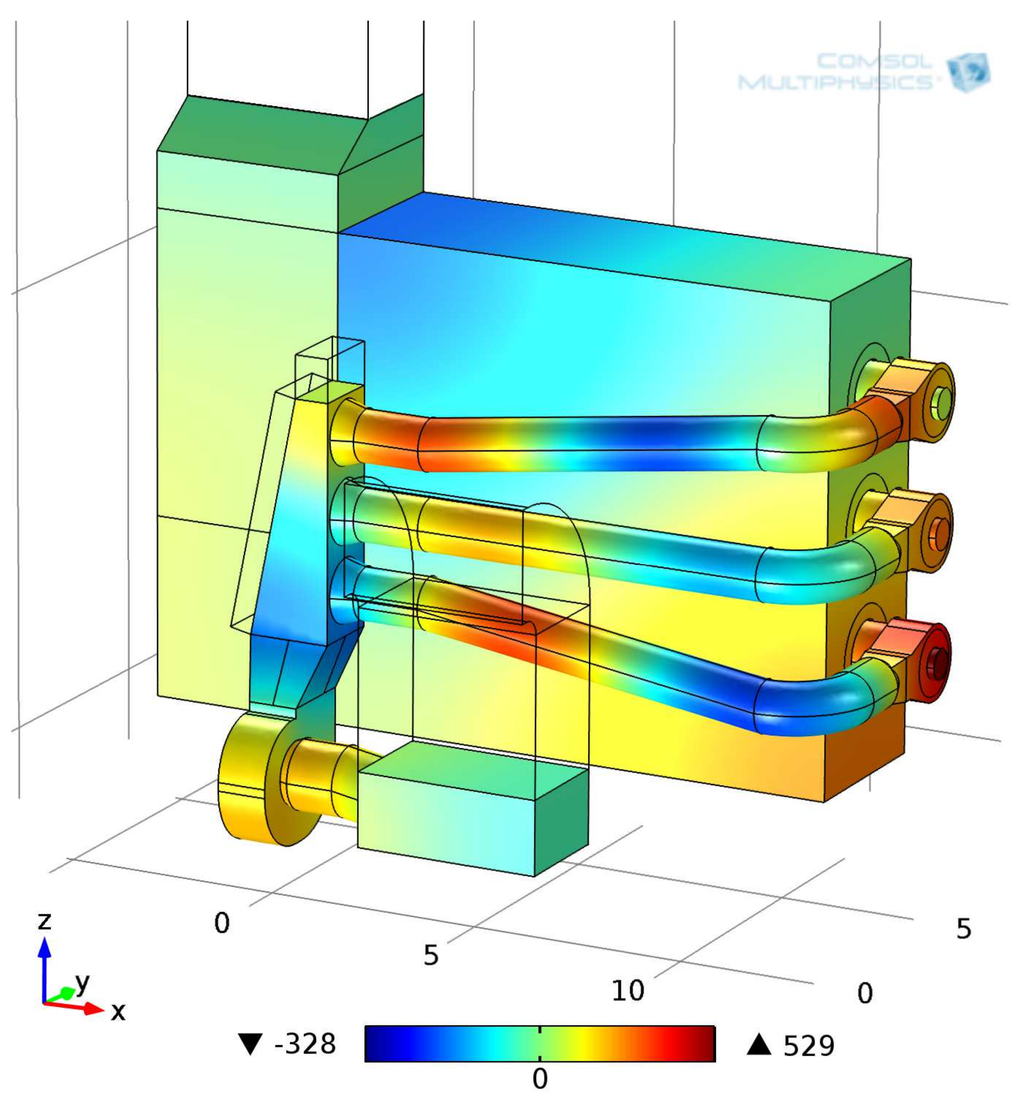

Figure 3. Acoustic pressure mode at 30 Hz (no absorption)

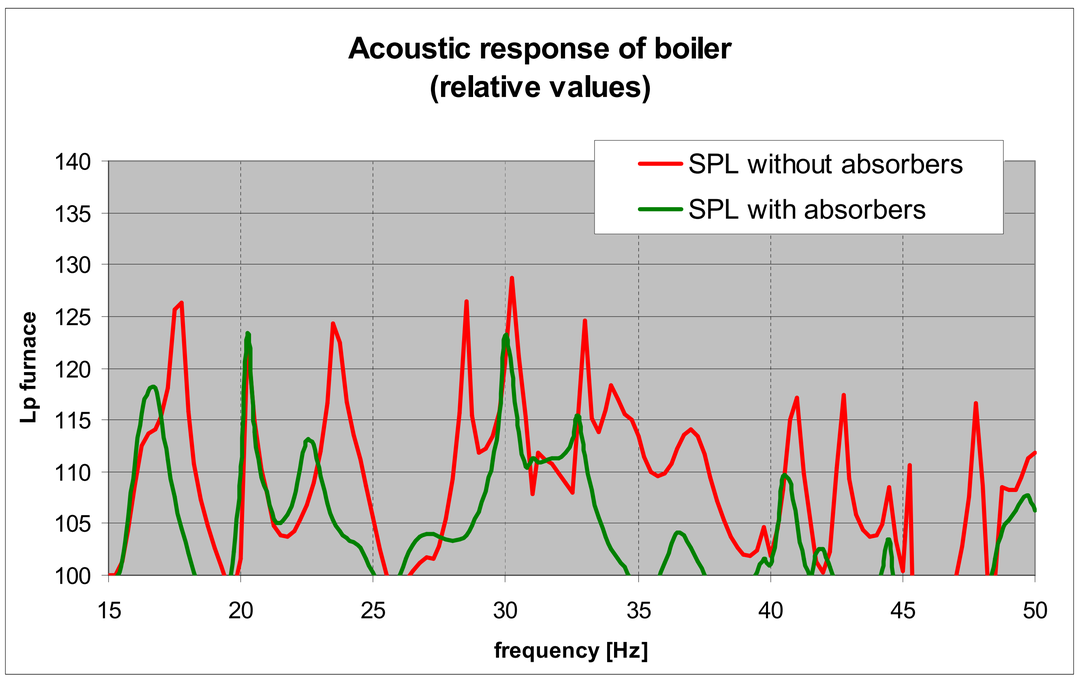

Figure 4. Acoustic response without/with absorption

Conclusions: The flow and acoustic analysis was used succesfully to design reduction measures for the boiler hum. After the changes were made, the reduction proved to be 7 dB at the problem frequency. This reduces annoyance for neighbours significantly.

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