MACHINE DYNAMICS

Buzzing noise of a heat exchanger.

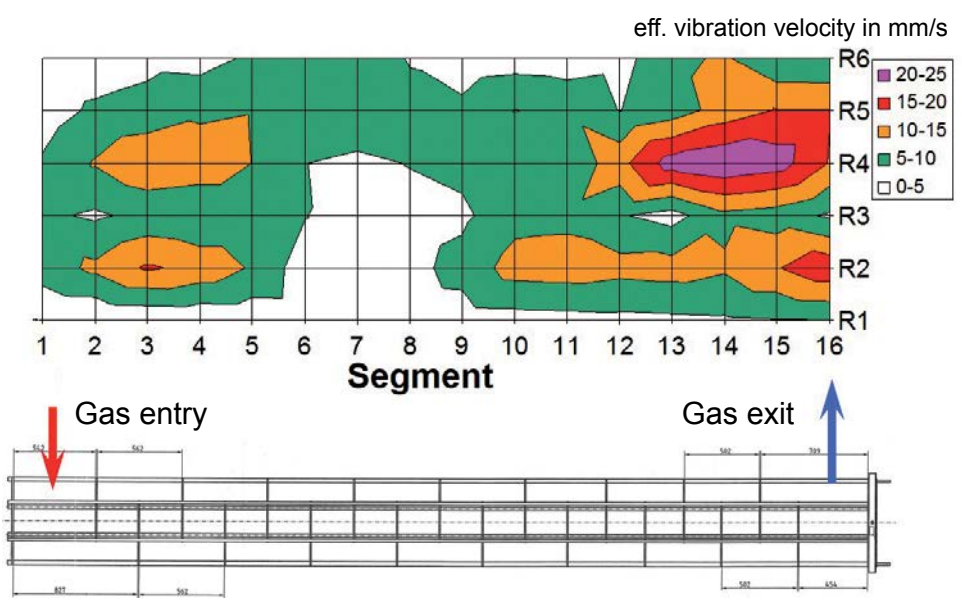
Sometimes, unusual sounds such as individual sounds or humming in certain operating conditions occur in tube bundle heat exchangers even after years of operation without problems. This is often due to a combination of different phenomena, such as vortex shedding, acoustic transverse or longitudinal modes, fluid-dynamic instabilities, thermo-acoustic effects or turbulence excitations that are particularly relevant in fluids.

Additionally, the influence of possible structure resonances may take effect, which then leads to noise as well as recurring damage such as cracking of tubes or other leaks. Detailed analysis is needed in order to specifically find the „cause". This is the case in the following project example as well:

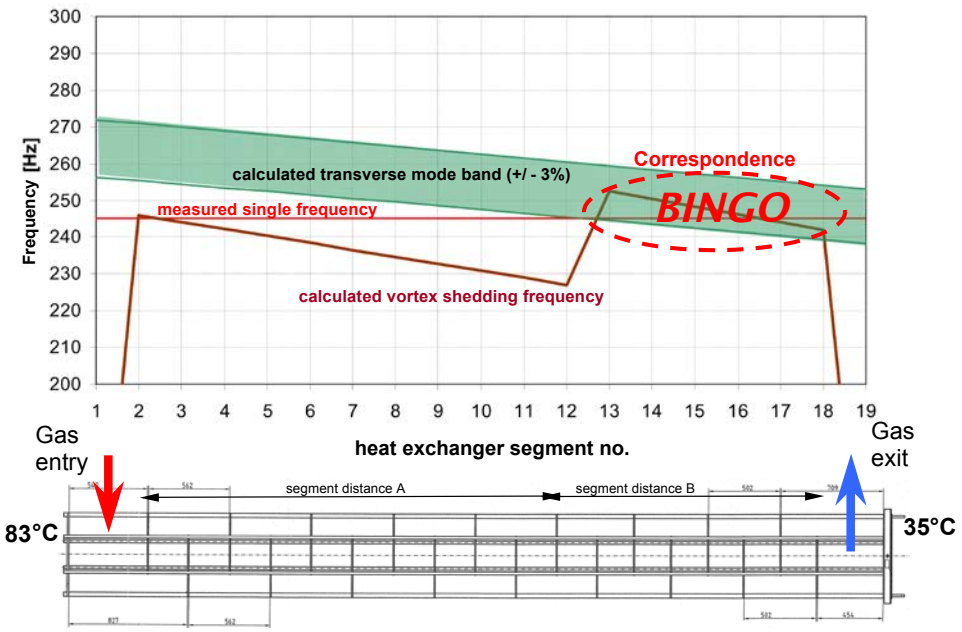
After conversion, an intense hum at a frequency of 245 Hz occurred on a lying heat exchanger. After the frequency had been found both in the air-borne sound and the jacket space downstream of the heat exchanger, a structure-born sound measurement of the jacket surface in operating condition subject to complaint was performed (see fig. 1).

Increased vibrations in the segments just before and at the gas outlet became evident. Comparison of the calculations to the vortex shedding frequency and the acoustic cross-modes that arise to the measuring results brought the decisive information regarding the cause-and-effect chain. The excitation takes place via vortex shedding at the tubes, which occurs in the area of the rear segments with an acoustic transverse mode and the natural structure frequency correlate (see fig. 2). Since the effective mechanisms are now known, targeted measures can be designed. In this case, by modification of intermediate plates the flow speed was reduced so that the "coincidence" between the excitation frequency and the acoustic natural frequencies no longer occurs and the system can be operated without the annoying single sound.

Contact:
Dipl.-Ing. Franz-Josef Düttmann
Telephone: +49 5971 9710-26
fj.duettmann@koetter-consulting.com



Measured vibration speed on the jacket surface of the heat exchanger



Comparison of calculation and measurement