

Vibration problems at a 7 MW piston compressor

On a new 2-stage compressor excessive vibrations appeared at the main pipelines (DN 250, 200 bar) between the discharge pulsation dampers. As the guideline values were significantly exceeded and first measures taken by the customer were not successful, KCE carried out a comprehensive cause analysis. Therefore, the pressure in the cylinder chambers, the pressure pulsation in the pipelines and the vibration velocities were measured simultaneously at different measuring points.

The results show that heavy pressure pulsations in the cylinder chambers of the compressor and at the connecting pieces to the pulsation dampers caused the pipeline vibrations. They depended on the excitation of acoustic natural frequencies of the gas column. Each time the compressed gas was pressed out, this "standing wave" was excited. Near the double-acting cylinders, a direct correlation between the pressure fluctuations and the mechanic vibration was detected.

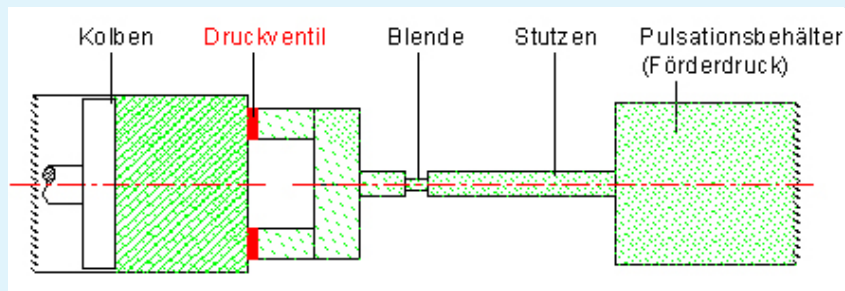
To reduce the pressure pulsations, pulsation-damping-plates at the discharge side of the cylinder have been mounted. For the design of the pulsation-damping-plates the unsteady compression process in the cylinder chamber was modelled in a first step (figure 2). Afterwards, the effect of the special pulsation-damping-plate instead of the installed baffle was calculated.

The customer's control measurement approved the success of this modification (figure 3). The pipeline vibrations could be reduced by 90 % without affecting the performance of the construction. Thus, a safe long-term operation of the compressor was ensured.

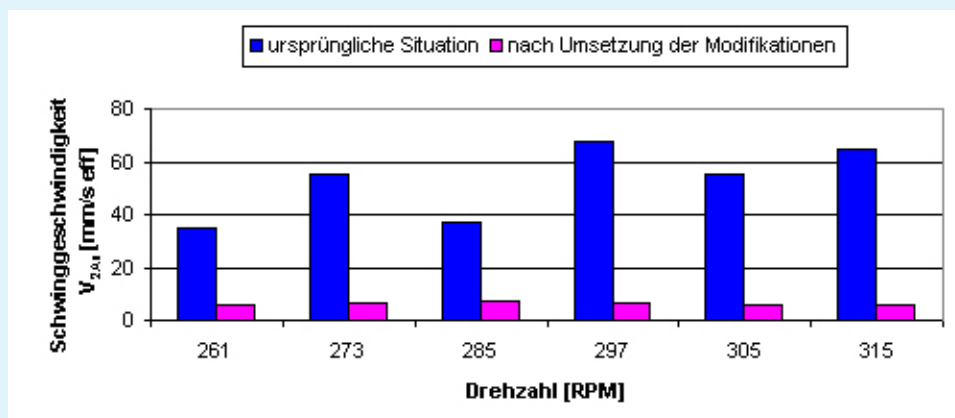


KÖTTER pulsation-damping-plate

MACHINE DYNAMICS



One-dimensional acoustic model of the gas column



Measured vibrations before and after implementation of the proposed measures



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