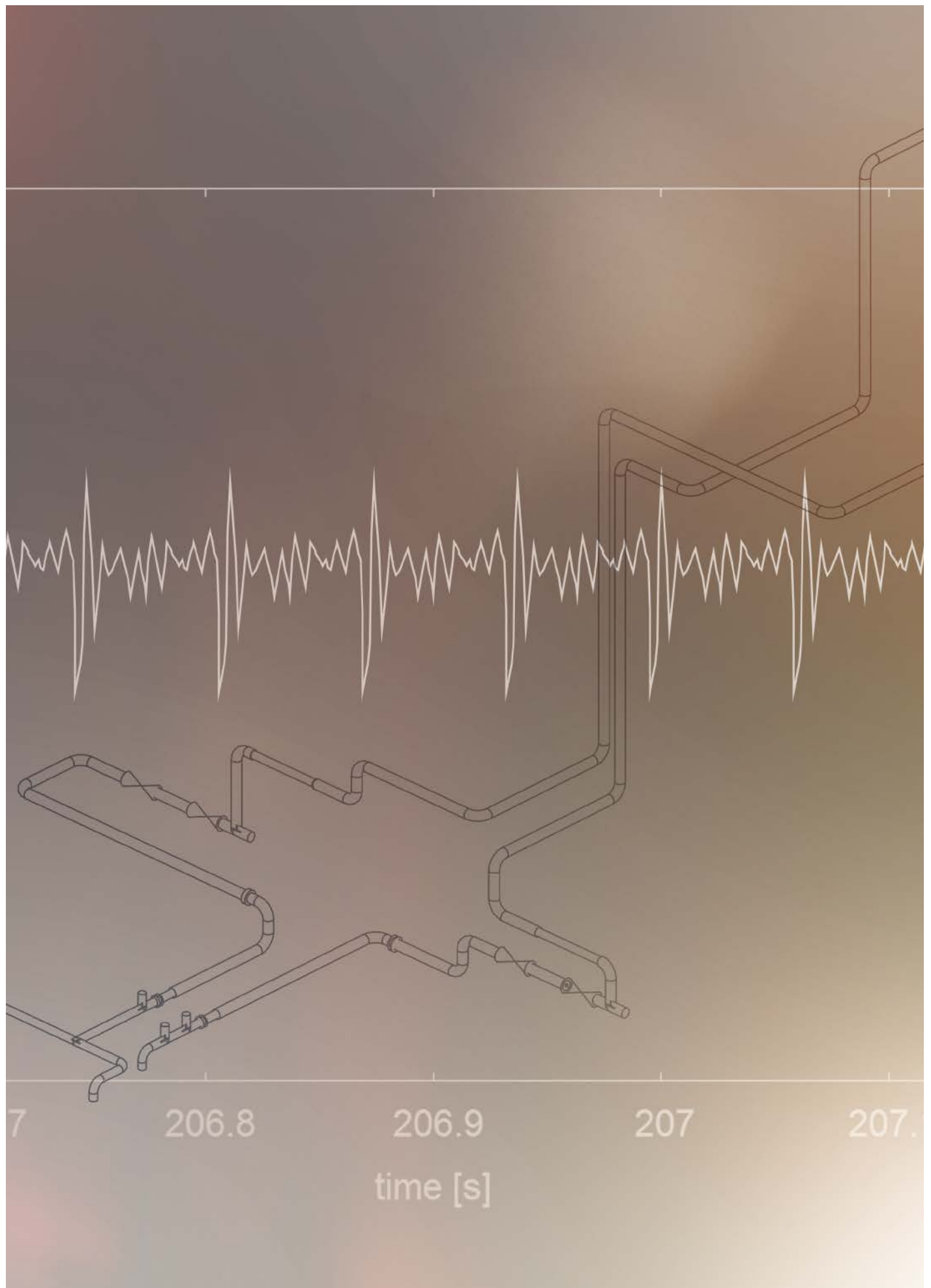



LEWA pulsation studies

For analyzing pipeline systems.







Especially for reciprocating positive displacement pumps, interactions with connected pipelines and system parts must be taken into consideration.

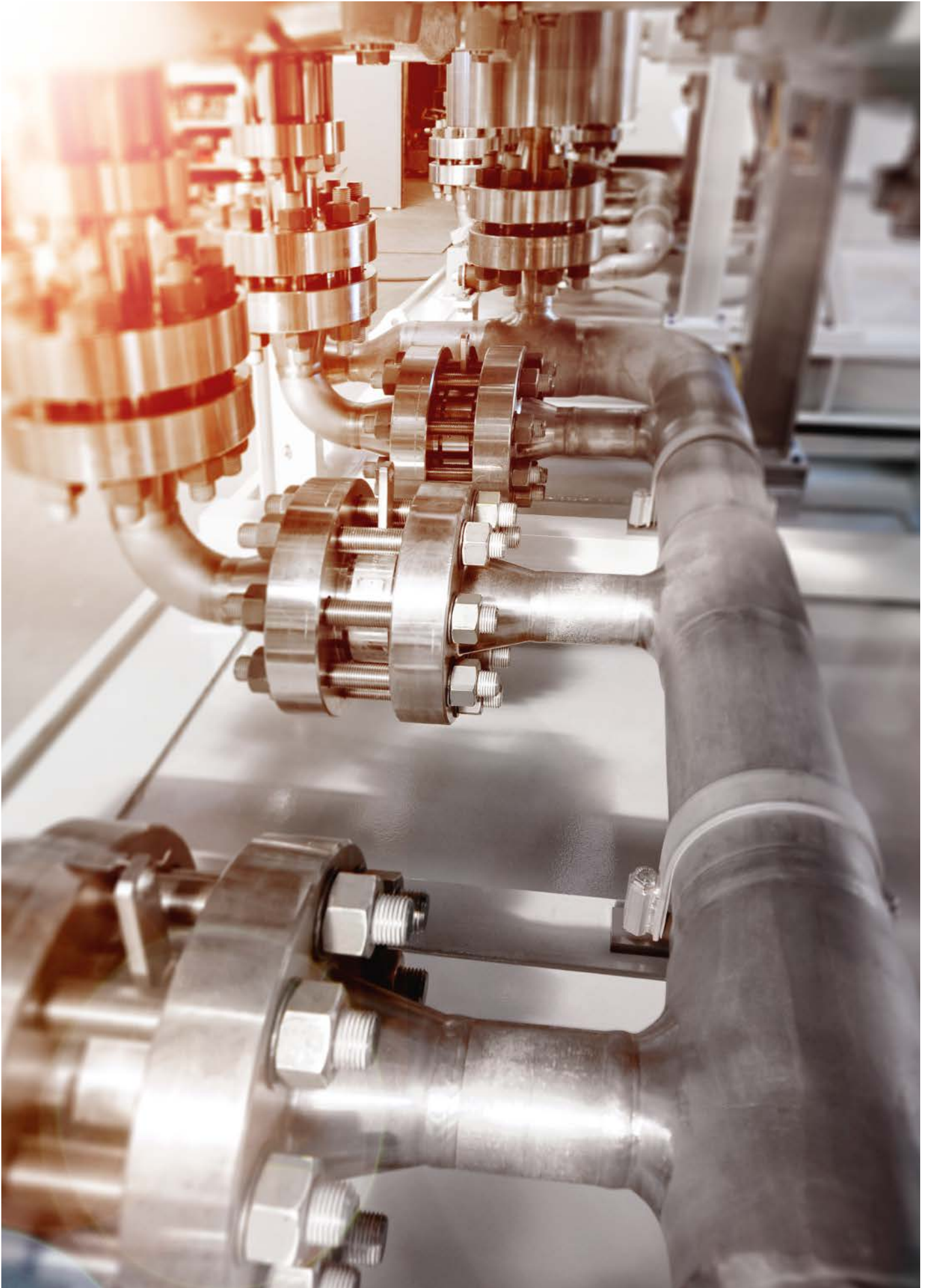
An installation check can ensure right from the planning stages that the overall system (both pump and pipeline) will work reliably, using precise calculation to avoid typical operational problems such as: cavitation, excessive pressure pulsations, fatigue damage to pipelines and components.

We recommend carrying out an acoustic analysis for:

Optimum design: Analysis of the interaction between the pump and pipeline early on, during the planning phase. The objectives are:

- Reliable long-term operation: Complying with defined limit values for pressure pulsation and extending the service life of the overall system
- Increasing availability: Improving operating reliability and lowering maintenance costs

Individual system optimization: Systematic cause analysis for critical operating states for existing systems



LEWA pulsation studies.

The advantages at a glance.

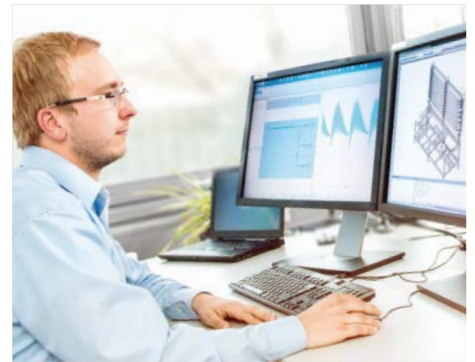
1



Efficient

LEWA creates acoustic analyses (pulsation studies) in-house. This saves you the detour of dealing with an external service provider and makes carrying out the studies extremely efficient.

2



Expert

Our decades of experience as a pump and system manufacturer flow directly into the analysis

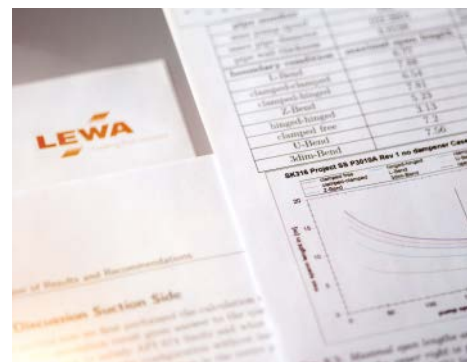
3



One-of-a-kind

We are the world's only pump manufacturer who can carry out numerical simulations and check them against API 674/675 criteria

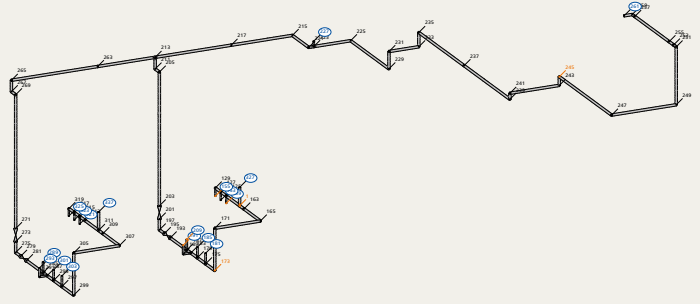
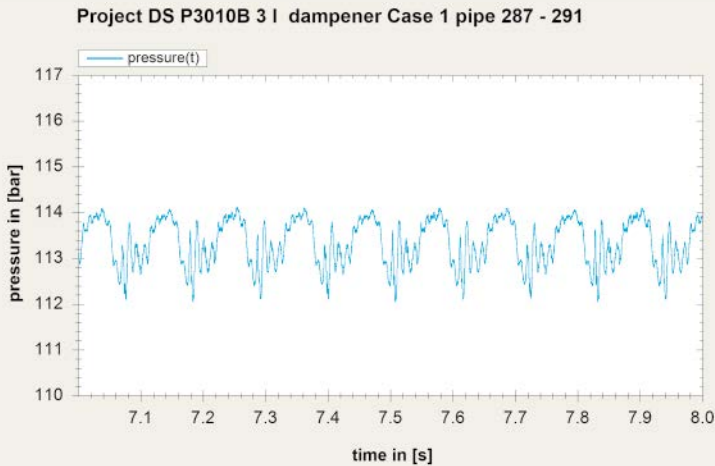
4



Detailed

At the end, we provide you with a final report including a detailed discussion of the results, along with a graphic presentation of all simulation results and specific recommendations for optimizing the system.

Reduced life cycle costs through optimal design.



Calculation methods

Two modeling variants are available, which are called Approach I and Approach II based on the API 674/675 standard. Both methods use a state-of-the-art numerical calculation method.

Approach I

Based on a greatly simplified model of the network, which is suitable in most cases for pipeline systems with pumps with small to medium hydraulic power. In this method, the main pipeline section and the area surrounding the pump are studied. The acoustic influence of branches and fittings is not taken into account. The model is generated in accordance with a simple schematic diagram made available by the client. No extensive isometries are required. This method provides a good quantitative overview of the basic pressure pulsation behavior in the pipeline.

Approach II

This uses a complete, detailed model of the pipeline network, which is drafted based on the original isometries. The acoustic properties of all components in the system such as bends, valves, branches etc. are incorporated into the calculation. Statements can be made about pressure-time curves in each area of the pipeline system. Particularly for complex pipeline systems or pumps with high output, it is urgently recommended to use this calculation method.

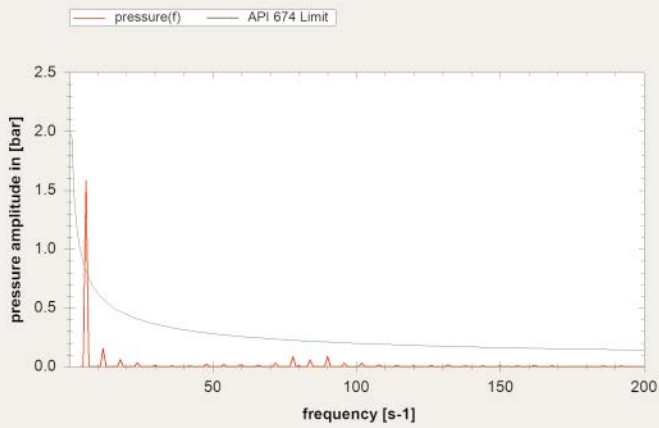
Recommendations

We recommend carrying out a study in accordance with Approach II if at least one of the following points is fulfilled:

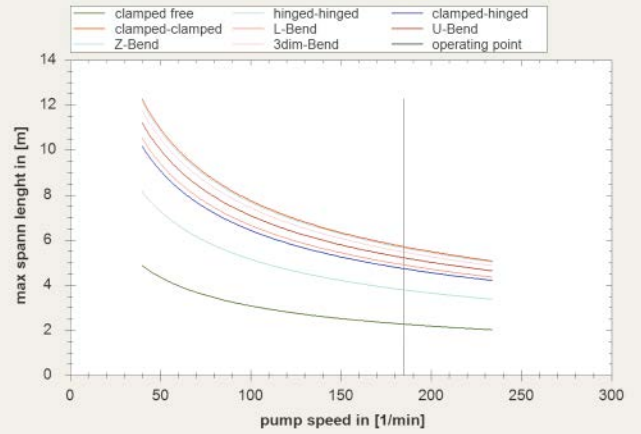
- More than 50 kW of hydraulic power
- Stroke frequency greater than 200 rpm
- Complex pipeline network
- Critical process
- Critical fluid

If the pipeline systems are very short and simple, it is usually sufficient to inspect the system in accordance with the Approach I standard. This has to be decided on a case-by-case basis.

Project DS P3010B 3 I dampener Case 1 pipe 307 - 309



Project SS_ P3010A Rev 1 5 I dampener Case 2 Pipe 19 - 15

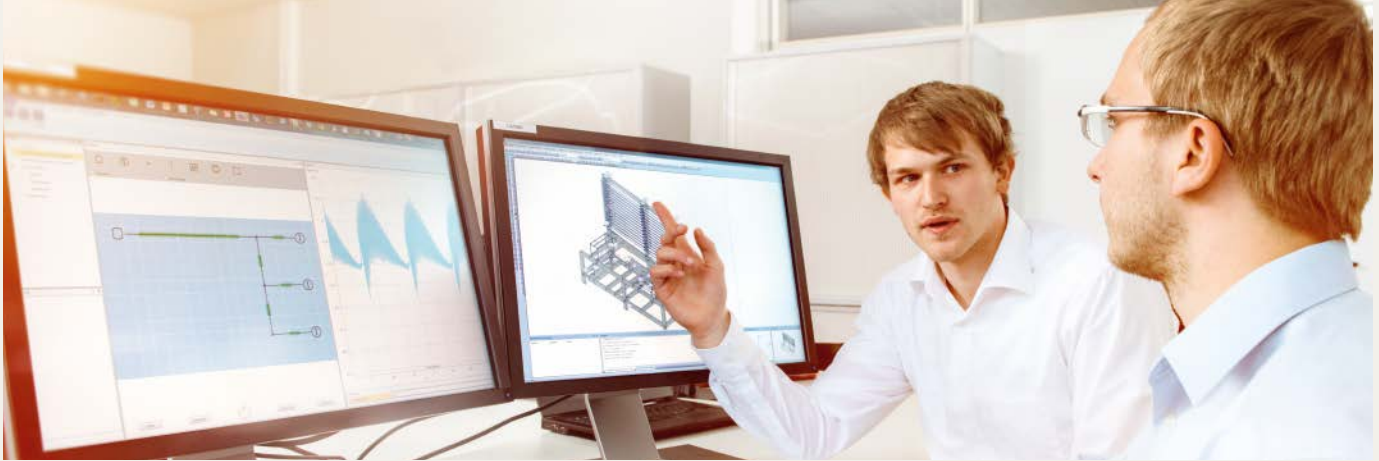


Assessment in accordance with API 674/675

We are the only pump manufacturer in the world to offer this service. Without having to spend time consulting external institutions, you receive detailed information. In this case, the pipeline system is inspected in accordance with the following criteria:

- Comparison of the expected pressure amplitudes with the max. permitted values in accordance with API 674/675
- Inspection of the minimum pressure in the system to prevent cavitation
- Calculating the margin between the maximum pressure in the system and the setting pressure of the safety valve
- Adequate distance of the pump excitation frequency from the mechanical natural frequencies of the pipeline system. These result in shaft length recommendations.

We inspect your installation, considering the complexities of the system, the kinematics of the number of cylinders and the control range of the pump as well as the properties of the fluid.



Required information

To carry out an acoustic study, we need the following data from you:

- Fluid data: Density, viscosity, sound velocity, vapor pressure
- Detailed description of the operating states:
 - Which pump is running (if multiple pumps are running simultaneously: at what offset to each other are they running?)
 - Stroke frequency
 - Valve configuration (which are open/closed?)
 - Which fluid is pumped?
 - Information about the pressures on the intake and discharge side
- Schematic sketch (including length specification/pipeline classes of the main line as well as safety valve line) of the pipeline network (Approach I)
- Final isometries and P&ID flow diagram (Approach II)

Result of an acoustic analysis

Customized solutions recommended for minimizing the pressure pulsations and the resulting mechanical load of the system

Optimum pump/dampener/resonator configuration

Recommendation for the maximum distance between the pipe supports (span length)

Determining critical operating states

Assessment of the system in accordance with various criteria (e.g. API 674/675)

Prediction of the pressure amplitudes in all sections of the considered pipeline system



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