PULSATION DAMPENERS

Introduction
Compressors form an important item in many production processes, for example, in the gas & oil industry, in the offshore world (ships, FPSO's and production platforms) and in pneumatic transport systems and vacuum systems.
Whether reciprocating compressors, pumps, roots-type blowers, sliding vane type or screw compressors, they all displace gas (or liquid) pulse-wise and are thus a possible source of dynamic problems in the connected pipe system and equipment. Unless the generated pulsations are dampened to acceptable levels before entering the process system…

Problems are not always limited to the pipe system, for some machine types excessive noise levels can occur, well exceeding limits set by environmental or human protection regulation. Roots-type rotary piston blowers and screw compressors for instance generate high noise levels that, undampened, may exceed 160 dB(A)!

The compressor performance or reliability may also be affected by pulsations. Even the process control system can be affected by pulsations, due to, for instance, misreading of flow metering devices.

Technology
Frequently, plain empty vessels are used as a dampening device for pulsations, often in conjunction with restriction orifices at inlet and outlet. Using 'volume' is indeed the first step in tackling pulsations. However, there are more sophisticated ways to reduce pulsations, also from energy point of view. With acoustical filter techniques (based on the Helmholtz principle) a more efficient reduction can be achieved. In addition asymmetrical cones instead of regular shell heads can diminish the chance on internal resonances.
The acoustical design can be further fine-tuned with the use of acoustically optimized diffuser parts or multiple hole orifices for example.

A custom acoustical diffuser

For reduction of radiated sound several alternatives can be provided, one of them being a custom made sand jacket.

To support the best design of the pulsation dampeners not only a large number of sophisticated calculation tools have been developed in-house (based on experimental testing and experience) but also state-of-the-art software has been acquired. Examples are ANSYS and FEMAP/NX NASTRAN for Finite Element modelling, TNO PULSIM for pulsation simulation and Intergraph CAESAR II for static analysis.

Extended Experience
Q.E. International B.V. has built, over several decades, an outstanding reputation for supplying high quality pulsation dampeners. Dampeners that have been successfully installed throughout the world. Several compressor producers have employed QE standard designs. In addition to these, QE has a long-standing tradition in custom-built

equipment that is designed for incorporation into specific compressor/piping configurations to the complete satisfaction of the plant user. Irrespective of installation complexity, QE has demonstrated reliable, tailor-made, high quality, guaranteed solutions. By fabricating the dampeners in the most economic locations, pricing is extremely competitive.

Standard versus Custom Design
Q.E. International B.V. offers a series of standardized dampeners at very attractive prices. These are complete, internally and externally in pressure vessel quality carbon steel.

Standard design pulsation dampener

Because of the extreme loadings, the demands upon the construction of the pulsation dampeners can be very high. In many cases a standardized design no longer meets the requirement. QE is unrivalled in the supply of custom-built dampeners, the design of which is often determined by following complex studies.

Custom design pulsation dampener with sand jacket

Design Calculation
Because the loadings upon the dampeners are high, the pressure containing components are designed and constructed to comply with a ruling Pressure Vessel Code. Examples of such codes are ASME VIII division 1 and 2, European EN13445 or any other international standard (AD 2000, BS5500, CODAP, GB150 etc).

One can design and fabricate a near perfect pulsation dampener, but when installed it may come clear that its operation can not be seen independent from other components connected. Gas composition or operating conditions may differ from the specified design cases. Also, the pipe system connected to the compressor-dampener will not be free of acoustical resonances.
This may all contribute into higher than expected levels of vibration and pulsation in the up- and downstream piping. As a standard we check our designs in a so-called sensitivity analysis. This will reveal how the dampener performs under conditions slightly off nominal design condition.

Additionally we strongly recommend to include the pipe system in these analysis as well (for some of our customers this service is included per default).

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