By: B. Howes et. al.
Beta Machinery Analysis

API 618 Forced Response Studies

API 618, 4th Edition, Design Approach 3, requires that the vibration and stress levels in compressor manifolds and piping be calculated. Studies M.6 and M.7 are described. However, many would insist that this type of analysis is impractical or ineffective.

In fact, there are uncertainties associated with the behaviour of the final system versus the modelled system. Most of these uncertainties are related to construction and installation variations.

This paper attempts to demonstrate that mechanical modelling is valuable in the design of compressor installations. Good design, however, must be combined with attention to detail in the implementation stage. At best, all vibration problems can be avoided at start-up. At worst, tuning the system, after start-up, to reduce vibrations can be achieved with minimal impact. This efficient tuning of the system is achieved through an understanding of the sensitivity of the system to added mass, and by the strategic provision of places for stiffening braces and supports.

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Brian graduated from the University of Calgary with a Master of Science in Solid Mechanics. His thesis was entitled *Acoustical Pulsations in Reciprocating Compressor Systems*.

Brian has worked with Beta Machinery Analysis since 1972. In his present position as Chief Engineer for Beta, he has traveled all over the world, troubleshooting as far abroad as India, China and Venezuela.

Brian has many technical papers to his credit. The range of machinery problems they cover includes all manner of reciprocating and rotating machinery and piping systems, balancing and alignment of machines, finite element analysis, modelling of pressure pulsation torsional vibration testing and modelling, flow induced pulsation troubleshooting and design, pulp and paper equipment such as pulp refiners, etc. He has worked on hundreds of reciprocating compressor installations.

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Kelly Eberle is a Senior Project Engineer for Beta Machinery Analysis Ltd., Calgary. His experience includes 14 years of troubleshooting problems and design for a wide range of equipment, with a primary focus on reciprocating compressor installations. He has a Bachelor of Science in Mechanical Engineering from the University of Saskatchewan.

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Derrick graduated from the University of Saskatchewan with a Master of Science in Mechanical Engineering in 1993. His thesis was entitled *The Effect of Wind on the Air Intake of Cooling Towers*.

Previous employment with Atomic Energy of Canada Limited and contract work with the University of Saskatchewan has developed his experience in experimental measurement, dimensional analysis, fluid dynamics, flow-induced vibration, acoustics, and finite element modelling.

Derrick has worked with Beta Machinery Analysis since 1997. In his present position as Project Engineer for Beta, he works on digital acoustic simulation, thermal analysis, and dynamic finite element analysis of reciprocating compressor packages. Developing analysis techniques and practical application of technology are an integral part of his daily duties.