

Vibration

Introduction

Vibration readings are utilized to determine the mechanical condition of machinery.

In addition, they can identify piping and structural vibration sources.

Vibration amplitude and frequency are two important factors when conducting vibration analysis. Overall vibration is a summation of vibration (at all frequencies) throughout the frequency range. An overall vibration reading is made up of several components that occur at different frequencies. The overall vibration amplitude is larger than any single component.

In reciprocating compressors, mechanical vibration is generated by unbalanced forces and couples that are produced by two masses: rotating and reciprocating.

Rotating masses consist of crankpin, crankpin web, and 2/3 the connecting rod weight. These masses generate forces at one times the running speed (1X RPM). Reciprocating masses consist of the pistons, piston rods, cross-heads, cross-head pins, and 1/3 the connecting rod weights. These masses generate horizontal forces at 2X RPM.

Piping and skid vibration analysis can identify the source of troublesome excitations. Common excitation sources are: compressor rotating unbalanced forces (1X RPM), compressor reciprocating unbalanced forces (2X RPM), compressor gas pulsation (2X RPM) and acoustical resonance (varied).

The following are typical "expected vibration levels" and Tech Transfer's "trouble shooting (T.S.) vibration guidelines" for high speed reciprocating compressors with similar package configuration, equipment, speed and power ratings. These are velocity levels in inches per second.

	Expected Vibration	T.S. Guidelines
Motor Frame (End Wall & Brg Housings)	0.08 - 0.15 IPS	0.20 IPS
Compressor Frame (Top of Frame)	0.30 - 0.40 IPS	0.50 IPS
Compressor Cylinders (Outer End)	0.30 - 0.60 IPS	0.65 IPS
FPSO Pallets & Package Skids	0.06 - 0.12 IPS	0.20 IPS
Piping & Vessels	0.20 - 0.80 IPS	1.00 IPS

Some compressor and driver manufacturers allow vibration levels that are higher than the above values. These overall amplitudes have been established from TTI's past field experience. These vibration levels have been achieved on many compressor packages that have been properly designed, fabricated and installed. Readings above TTI's limits indicate that further investigation is required and do not necessarily mean that fatigue failures will occur. Excessive vibration levels requiring corrective action will be noted in the test vibration analysis report.