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The Development, of a Longer Life and Superior Performance Compressor Plate Valve

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THE DEVELOPMENT OF A LONGER LIFE AND SUPERIOR PERFORMANCE COMPRESSOR PLATE VALVE

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ABSTRACT

The constant desire to minimize machine downtime while obtaining peak performance of the equipment is the objective of every manufacturer and end user. One component of reciprocating compressors which has a definite affect on both of these is the compressor valve. The author reviews the development program of a reciprocating compressor valve that delivers a longer average life ratio along with an increase in the valves' flow coefficient.

The first subject area will be that of the valve life. Included will be:

1. The evaluation of materials and hardness levels used in the manufacturing of valve plates. This consisted of placing a cyclic load on samples of identical dimensions with varying material and material hardness. The process was also used to evaluate several manufacturing processes, such as laser cutting, water jet cutting, milling, and die cutting of the valve plate ports.

2. The results of valve plate motion tests which utilized proximity probes to monitor valve plate motion and also indicated the plates' impact velocity.

3. The results of valve plate stress tests which consisted of attaching strain gauges to the valve plate.

4. The utilization of the valve endurance tester that Ingersoll Rand designed to dynamically test valve designs at an accelerated rate.

Results of altering valve plate design, material, and hardness, along with varying valve seat configuration will be discussed.

The second area will address the valves' flow performance. The apparati used for flow measurement and port configuration evaluation will be described. Results from these tests using a plate type valve will be presented.

The conclusion will tie these two subjects together and indicate the design criteria Ingergoll Rand has chosen to incorporate in future valve configurations along with the benefits on compressor performance.

AN EXPERIMENTAL TEST DEVICE FOR ACCELERATED ENDURANCE EVALUATION OF COMPRESSOR VALVE ASSEMBLIES

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ABSTRACT

Valve and compressor manufacturers have often sought a means by which the time required to conduct compressor valve fatigue evaluations could be significantly reduced. Screening new concepts and improvements in design, processing and manufacture in a manner which properly simulates the compressor and produces realistic valve failure modes has often been a concern in initiating development activities. A technology improvement program has addressed the need to rapidly establish the endurance characteristics of complete valve assemblies; such as plate, ring and channel configurations, in such a way that reasonably realistic valve cycle dynamics and failure modes are achieved.

A valve endurance test device is described which permits the accelerated fatigue evaluation of valve elements as part of their complete seat and stop assemblies. The test device is a multi-chamber machine with a rotating ported plate which defines passages to and from each of three valve port openings. As the ported plate rotates it sequentially exposes inlet and exhaust ports to rapidly open and close the valve twice per port-plate revolution. Three valve port openings allow experimental assemblies to be run in direct comparison with baseline valves at the same time and under the same operating conditions. The basic design of the device, its control features and the instrumentation used to monitor valve motion and pressure differential are discussed.