ROTORDYNAMIC STABILITY MEASUREMENT DURING FULL-LOAD, FULL-PRESSURE TESTING OF A 6000 PSI RE-INJECTION CENTRIFUGAL COMPRESSOR

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ABSTRACT

Full load, full pressure rotordynamic stability measurements were conducted on a seven stage, back-to-back centrifugal compressor. To validate rotor dynamic predictions, the rotor was excited while operating at full load and full pressure during factory testing. This was accomplished through means of a magnetic bearing, which was attached to the free end of the rotor. This device injected an asynchronous force into the rotor system to excite the first forward whirling mode. This technique measures the rotor's logarithmic decrement (log dec), which indicates the level of stability, or damping, in the rotor. The device is designed to be non-intrusive to the original dynamics of the rotor and may be easily installed/removed on the test stand. This paper discusses the techniques used to measure the rotordynamic stability from a full-load, full-pressure test of a 6000 psi re-injection compressor. The results demonstrate the effectiveness of swirl brakes and damper seals in producing a compressor that becomes more stable as discharge pressure increases. This approach to compressor design is in stark contrast to traditional designs in which the stability degrades with increasing pressure, ultimately leading to rotordynamic instability. This technology ensures trouble-free start-up and operation of these compressors in the field, minimizing risk for the end-user.