

CASE STUDY: SOLVING A CHRONIC E-520 NITRIC ACID EXPANDER VIBRATION PROBLEM

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One of our customers has been experiencing chronic vibration on the thrust bearing (inlet) end of their Ingersoll-Rand E-520 tail gas expander. Inspection of the bearing housing area during a recent shutdown revealed severe coking of the bearing housing end seal, as shown in the Figure 1. It is not unusual for this area to run extremely hot, as it is adjacent to the high pressure (HP) casing seal, which can be prone to wear and excessive leakage. The HP seal is a long stepped honeycomb style with extremely tight design clearances, and tends to rub and wear over time. As the seal wears, 1200 degF inlet gas will leak past the seal and impinge directly on the end of the thrust bearing housing. The honeycomb seal can be seen in the figure.

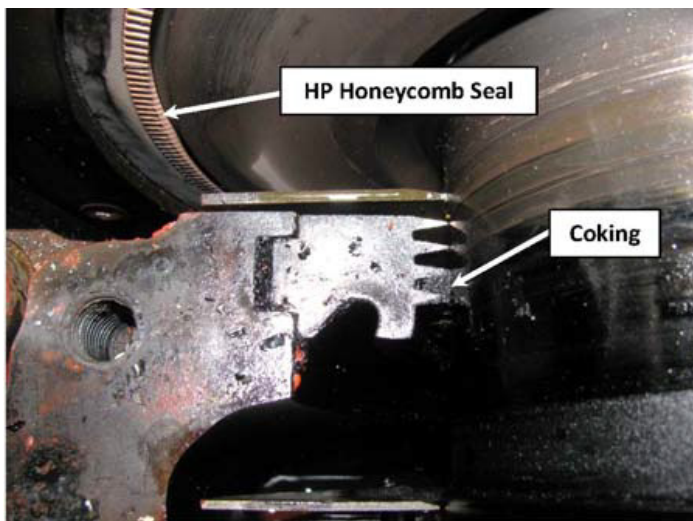


Figure 1

It was suspected that the heavy coke deposits, while not causing significant damage, were acting as a third bearing, inducing unwanted forces into the rotor. To combat this problem, RMS recommended that a purge be added to the bearing housing seal, a modification reasonably performed in the field during the shutdown. As with many modifications, success depends upon properly designed and executed details:

- Add a sufficient quantity of purge air feed holes through the seal (a minimum of six per half), and

make them as large as seal tooth spacing allows.

- Use a large enough purge air feed line to the bearing housing to avoid unwanted pressure drops.
- Key: Drill a pressure tap directly into the annulus around the seal to insure proper purge pressure at the seal location.

The modification was a success and reduced rotor vibration to a level suitable for long-term operation. However, the flow of purge air into the bearing housing resulted in an unwanted increase in misting from the lube oil console at higher purge pressures. After some trial and error it was found that operating the seal at 1.0 to 1.5 psig was effective in limiting vibration with only a minor increase in misting.

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