

RERATING A CENTRIFUGAL COMPRESSOR FOR HYDROGEN RECYCLE WORK

By Steven Kaulius

Project Description

As part of an upgrade to the catalytic reformer unit, a refinery needed to significantly change the operating parameters of the hydrogen recycle compressor in the unit. Even though the inlet pressure was decreased by 33%, the discharge pressure only decreased by 24% and the volume flow increased by 48%. This resulted in the head required being more than double the original design.

RMS did a study of the machine and determined that the new conditions could be accomplished with a speed increase alone. The new conditions did require more horsepower so a new motor and a change of the gears and the couplings would be required.

Since the entire reformer was being upgraded, the client determined it was worth the investment to upgrade the compressor and support systems and improve the operational flexibility of the unit. The first big upgrade was the decision to use a VFD with the new motor. This opened up the ability to operate the compressor more efficiently over the range of operation from Start-of-Run to End-of-Run and Catalyst Regen. Also included was an upgrade of the oil seals to a modular design that is easier to install and also low leakage as well as a new combined lube & seal oil system. The decision was also made to install a new gearbox since changing the gear set in the old one was marginal and a new gearbox allowed more robust monitoring.

Engineering scope included:

- Aerodynamic measurement, back calculation & performance prediction
- Stress Analysis for higher operating speed
- Lateral rotordynamic analysis
- Torsional rotordynamic analysis
- Seal retrofit design

- Coupling specification & purchase
- Coupling guard design
- Baseplate design
- Lube & seal oil system specification & purchase
- Gearbox specification & purchase

Below is the elevation drawing of the rerated train.

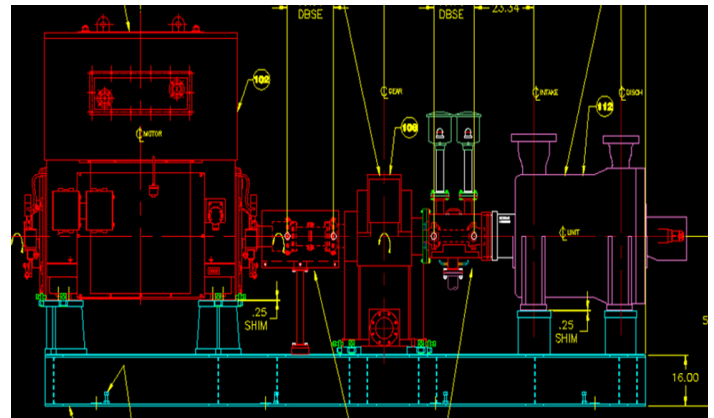


Figure 1

Below is a photo of the compressor after turnaround in the RMS shop.



Below is an isometric and photos of the new lube & seal oil system.

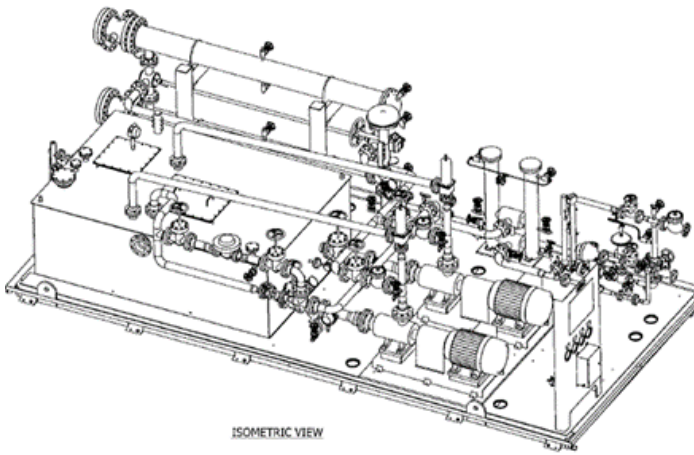


Figure 3



Figure 5



Figure 4

The rerate was installed and commissioned in 2018 and has been operating successfully since then.

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