

Compressor Rerate Supports New Operating Strategy at Major Processing Complex

Customer:

Industrial Complex, Pennsylvania

Equipment:

Elliott 38M compressor

Challenge:

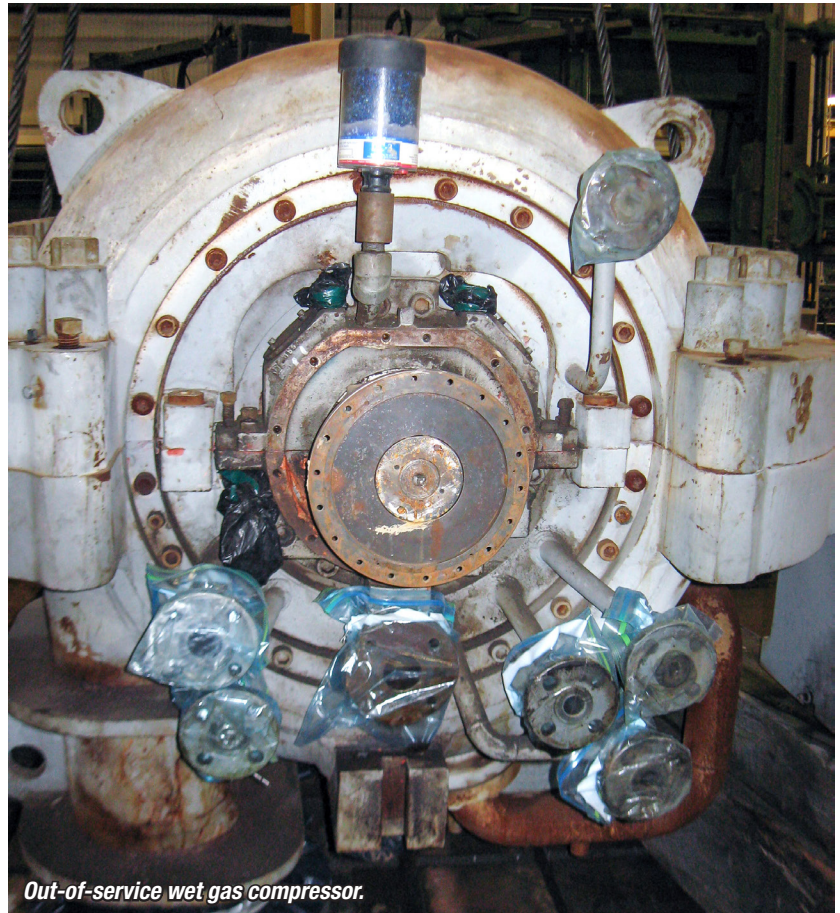
Rerate a multi-stage wet gas compressor for refrigerated propane in only 30 weeks

Solution:

Elliott re-engineered and remanufactured the compressor for a propane application using the existing motor and gear box; it was delivered before the customer's aggressive deadline.

A large industrial complex in eastern Pennsylvania modified its business strategy in 2013 from oil refining to natural gas liquids storage and distribution. The company turned to Elliott to rerate an existing centrifugal compressor for use in a different application with new operating conditions.

Elliott originally designed and built the 38M, multi-stage compressor for the customer in the late 1970s for propane refrigeration. A decade later, as the market demand for propane shifted, Elliott rerated the unit to process wet gas, extending the operational life and value of the compressor. After the compressor had been idle for two years, the customer approached Elliott in 2013 to convert the unit back to propane refrigeration. The company's plan was to process a specific volume of refrigerated propane, and then rerate the compressor for use in a different application.

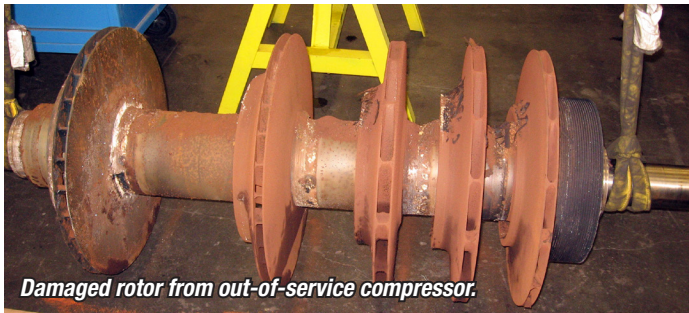


Out-of-service wet gas compressor.

Elliott's scope of work included:

- ♦ Rerating the existing, out-of-service, wet gas compressor to meet three new operating points for a propane refrigeration application
- ♦ Using the existing motor and gear box, and re-machining existing parts to save money and time
- ♦ Replacing aerodynamic parts, including the rotor, diaphragms, and couplings, to improve efficiency and reliability
- ♦ Blanking off two sideloads, making the compressor a "straight-through" unit

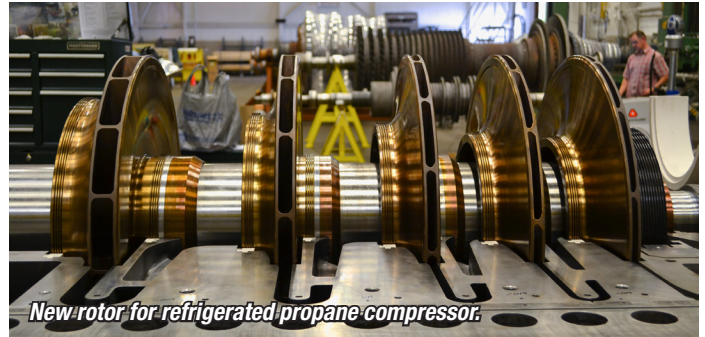
A rerate with this scope of work would typically take 46 weeks to complete. The project began in December 2013. With start-up scheduled for July 1, 2014, Elliott had only 30 weeks to complete the project.



Improved Efficiency, Reliability and Productivity

Elliott visited the customer's site and thoroughly reviewed the process requirements. This enabled Elliott to determine the most cost-effective rerate of the compressor that would also improve the machine's efficiency, reliability, and productivity.

Elliott proposed the replacement of all aerodynamic parts with new components manufactured from material specifically designed for use in propane applications. Other existing parts would be re-machined and re-used to save time and money.



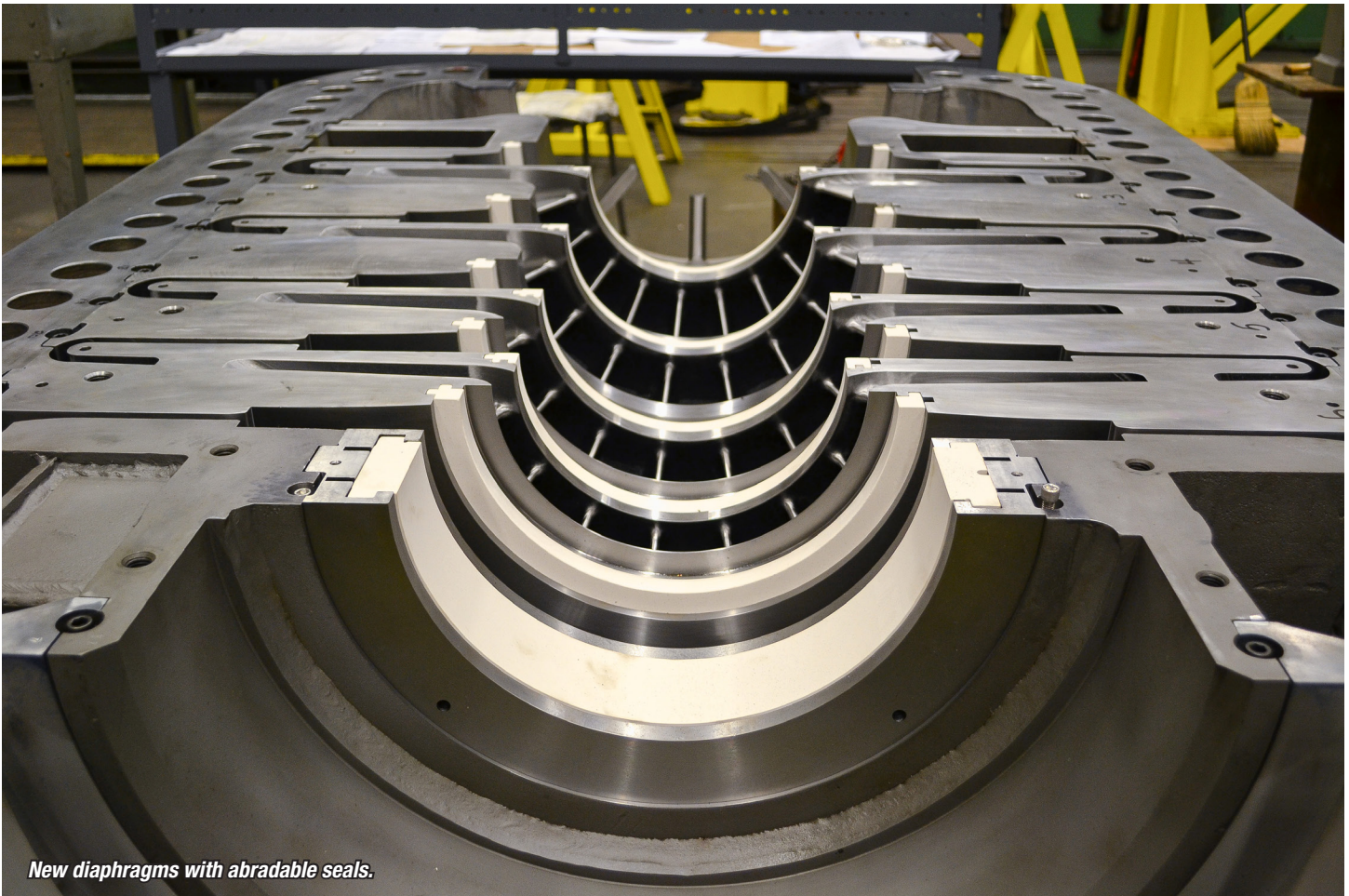
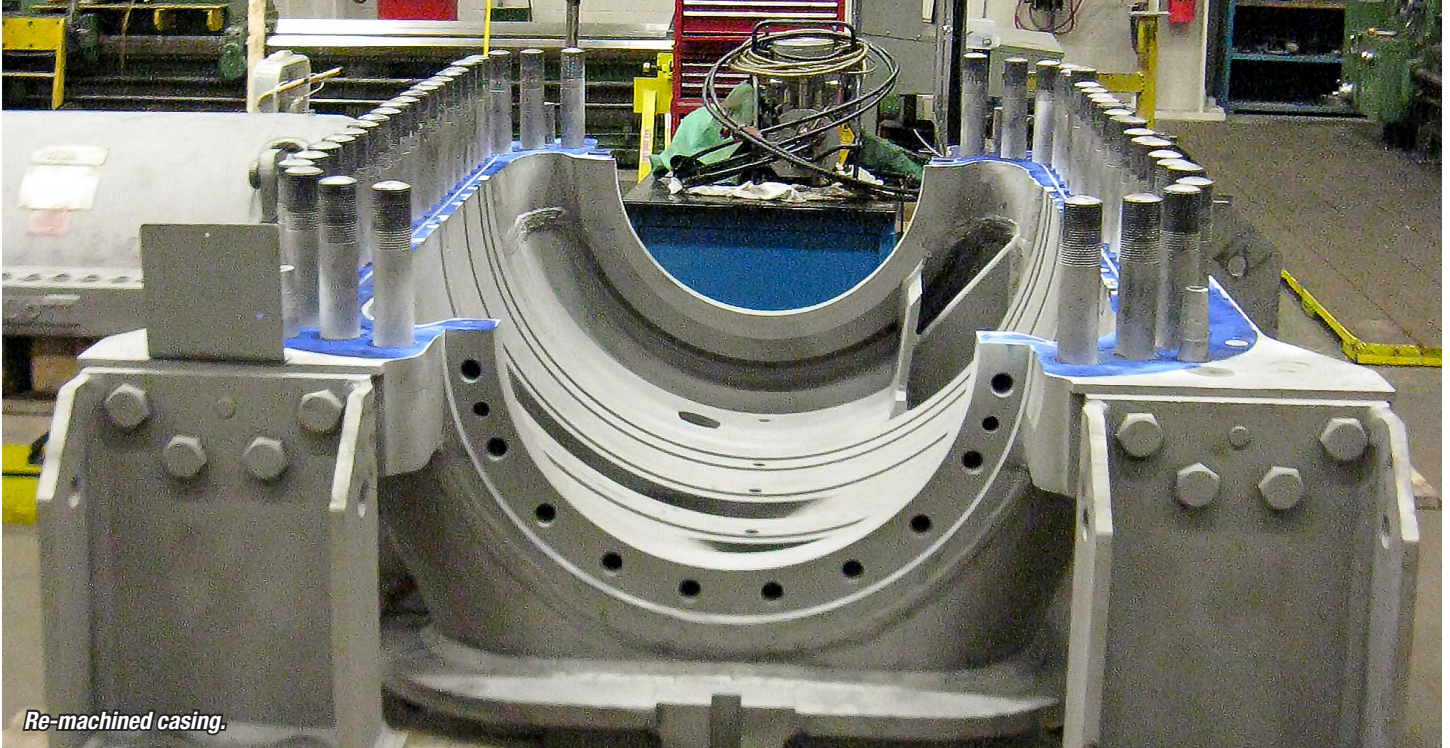
- ♦ New rotor and diaphragms were made of high quality materials to support the new operating conditions
- ♦ New seals made of abradable materials replaced the existing aluminum seals to reduce the recirculation of gas and minimize the potential for leaks
- ♦ Modern, flexible-disc couplings were installed to handle the increased torque requirements of the propane refrigeration application
- ♦ The casing assembly, bearings, bearing housings, and discharge volute were re-machined rather than replaced, reducing the overall cost of the rerate
- ♦ The fixed-speed motor and gear box from the wet gas compressor string were re-used at the customer's request

The compressor's operating conditions were changed significantly for the propane refrigeration process. Inlet weight flow, inlet volume flow, inlet pressure, inlet temperature, total head, and required power were increased. Molecular weight, discharge pressure, and the overall pressure ratio were decreased, while the speed remained constant. The customer's process required three operating conditions with different gas flows, temperatures, and molecular weight. Processes with multiple operating points typically use a variable speed driver, however the existing fixed-speed motor was being re-used. Elliott employed "suction throttling" to adjust the suction pressure for each specific operating condition and ensure that the required discharge pressure was maintained at all times.

Compressor Assembly

The rerate was conducted at Elliott's Pittsburgh Service Center in Donora, PA, and the manufacturing and high speed balancing facilities located in Jeanette, PA. The compressor was inspected and disassembled at the service center, and the parts to be re-used were machined to meet

the new specifications. The aerodynamic components and new rotor were made at the manufacturing facility, and the new rotor was also balanced in Elliott's state-of-the-art high-speed balance facility. The compressor was reassembled using new and re-machined parts and was returned to the customer's site in June 2014, comfortably in advance of the July 1st start-up.

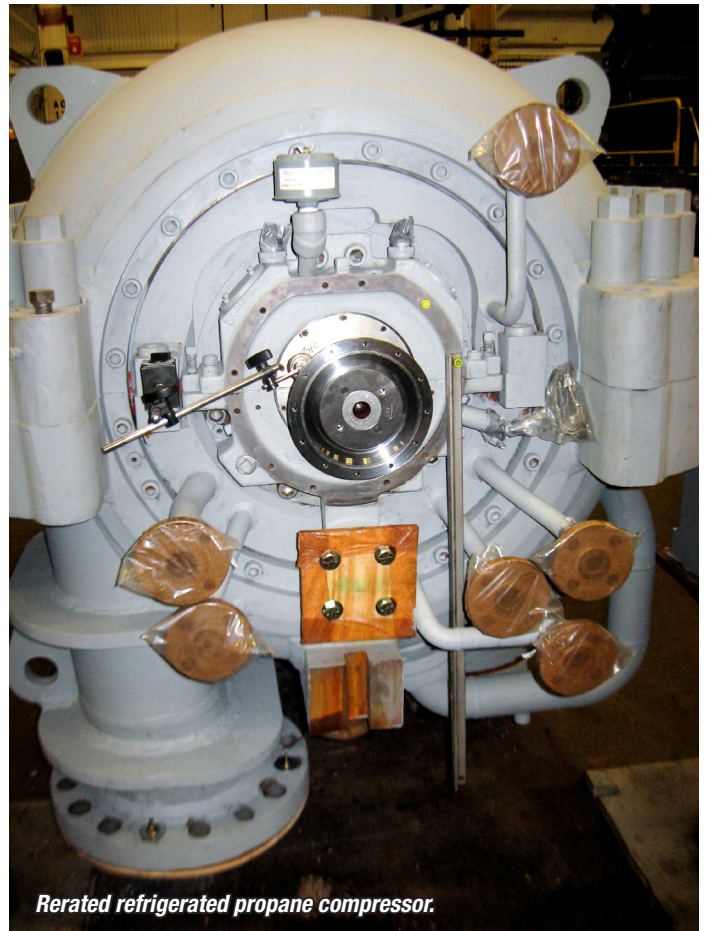


Results

Elliott's rerate of the customer's out-of-service compressor extended the operational life and value of this critical process machinery. The unit was delivered on time, met all of the required operating conditions, and was able to process nearly 50% more refrigerated propane than when originally manufactured.

In consideration of the customer's plan for future rerates, Elliott converted the compressor into a "straight-through" machine by blanking off two sideloads. This modification resulted in less size restrictions inside the casing, simplifying maintenance and streamlining future rerates.

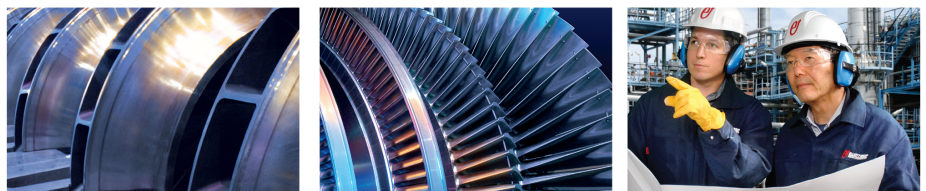
For more than 100 years, customers have been turning to Elliott for technical expertise, precision engineering, and an unwavering commitment to customer satisfaction. From replacing and repairing parts to building new machinery, Elliott is dedicated to providing unique, reliable, and cost-effective solutions to meet each customer's specific needs and requirements.



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