DDHF pump for CO_2 applications

The optimized solution for CCS and EOR re-injection, transportation and storage

Proven experience & value-adding technologies

GE Oil & Gas has extensive experience in liquefied gas pumping, and provides customers with all the technological resources needed for the challenges of CO_2 re-injection, transportation and storage.

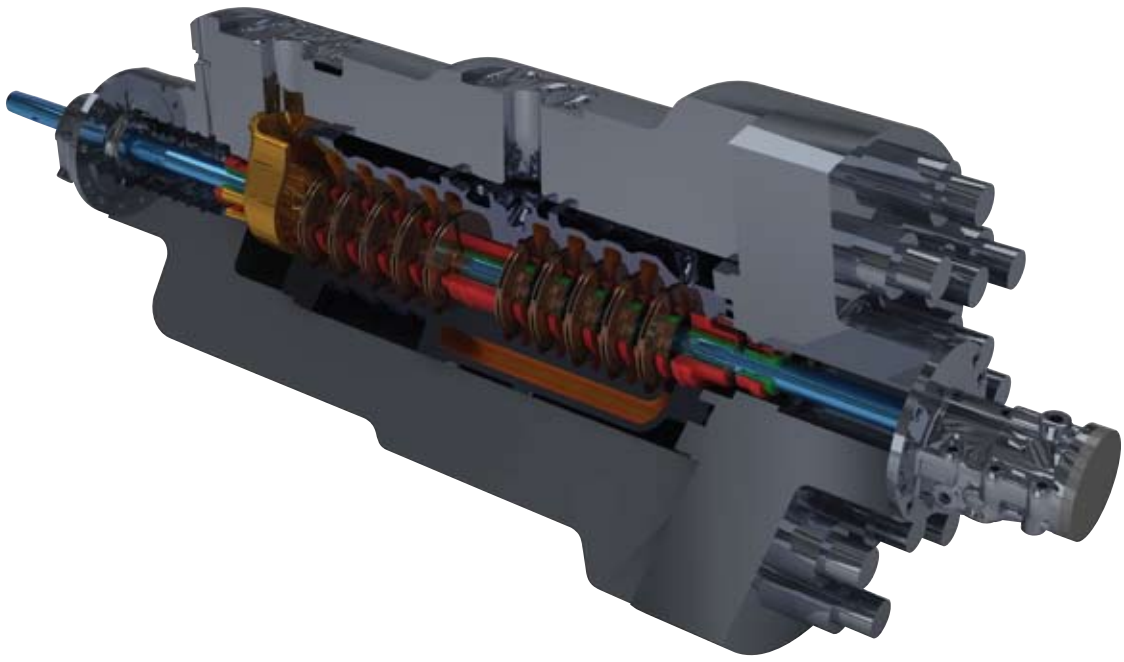
Our domain knowledge in turbomachinery enables a unique centrifugal compressor plus pump solution for carbon capture and sequestration (CCS) and enhanced oil recovery (EOR) applications. It gives customers the opportunity to realize significant power savings as well as highly flexible performance upgrades.

With a high molecular weight, CO_2 reaches the liquid phase at high pressure (> 90 bar) and water-cooled temperature without the need for any additional power installation.

The enhanced DDHF is a multistage centrifugal pump with double casing and barrel-type, back-to-back arrangement. It is based on our proven hydraulic design, but specially re-engineered for CO_2 pumping and EOR. It delivers 540 bar discharge pressure – the highest ever provided by a centrifugal pump.

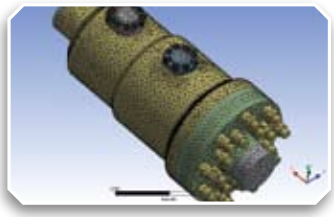
Key features

- API 10,000 barrel design
- Onshore and offshore application (ABS certified for FPSO)
- Mechanical seals dynamically qualified up to 550 bar
- Dry gas seals available
- Can be fully integrated with our high-pressure centrifugal compressors
- Detailed thermodynamic and rotor dynamic assessment as a result of proprietary centrifugal compressor technology
- Standard performance tested at API 610, latest edition
- Advanced CO_2 full-load test to simulate operating conditions



Mechanical design

The DDHF pump design was developed using finite element analysis (FEA) to avoid resonance in structural and foundation natural frequencies. Additional FEA with ANSYS codes has ensured sizing accuracy (to ASME VIII Div. II Appendix 4) of the pump's outer barrel as the main pressure retaining part.

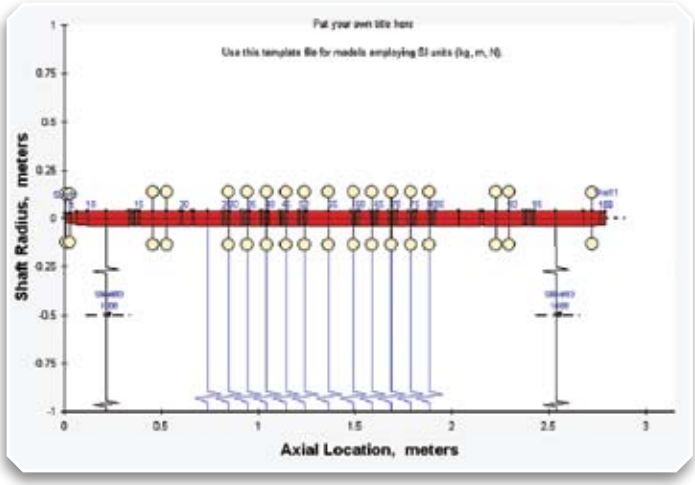


Stress analysis

Support resonance analysis

Rotordynamics

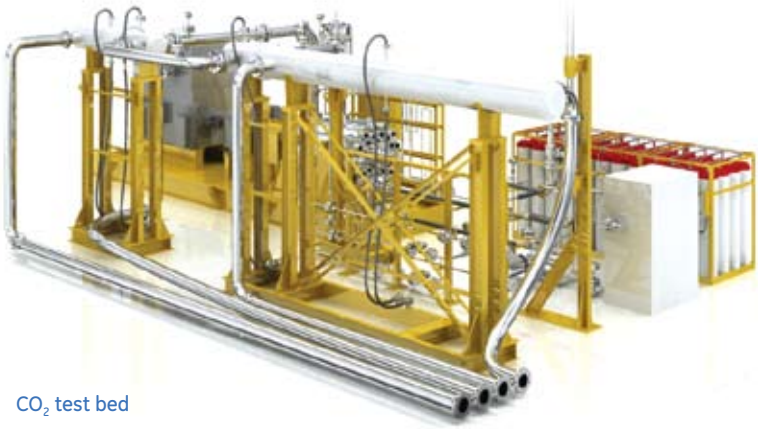
Dry and wet analyses have been carried out with acceptance criteria as stated in API 617. Drawing on the strengths of our centrifugal compressor design, the wet analysis was performed with annular seal stiffness and damping coefficients based on process fluid properties slightly variable versus pressure and temperature. Rotordynamic and thermodynamic tools has been implemented, and hydraulic forces have been calculated by CFD code, taking into account the cross-coupled aerodynamic coefficients for impeller-stator interaction.



Rotordynamics

Testing performance & discovering opportunities

Like every product GE designs for the oil and gas industry, our pumps undergo stringent testing at every stage of the design and manufacturing process. With the most advanced techniques and seasoned professionals, our goal is not simply to confirm specifications (API610) and deliver reliable machines, but to find new opportunities to improve performance. The GE Oil & Gas Center of Excellence for pumps in Bari, Italy, includes advanced testing facilities for liquefied CO_2 pumps, including a CO_2-filled closed loop for performance assessment under the specified in-field conditions.



CO_2 test bed

GE imagination at work

ge.com/oilandgas

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