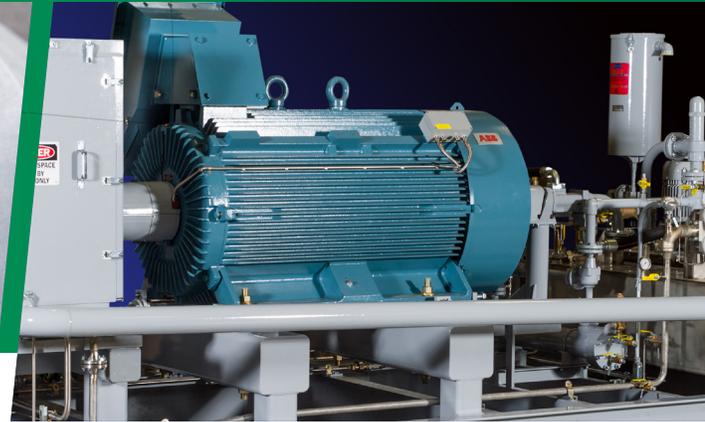


ROTOFLOW TURBOMACHINERY

Dense Fluid Expanders



World-Class Performance

Rotoflow's dense fluid expanders (DFE) deliver significant plant operating power savings in air separation and liquefaction plants by providing refrigeration and electrical power recovery. The DFE expands cryogenic liquid to extract energy from the process that can be converted into electricity or can be dissipated. Operability and maintainability have been optimized in our equipment design. Power recovery is achieved by directly mounting the expander on a gearbox and loading it with an electric generator. The DFE is also available in an oil-loaded dissipative configuration for a lower cost alternative.

Design/build expertise, operational insight, and unrivaled experience work together to create Rotoflow's comprehensive line of turboexpanders, serving the full spectrum of turbomachinery markets and applications.

Typical Design Capabilities

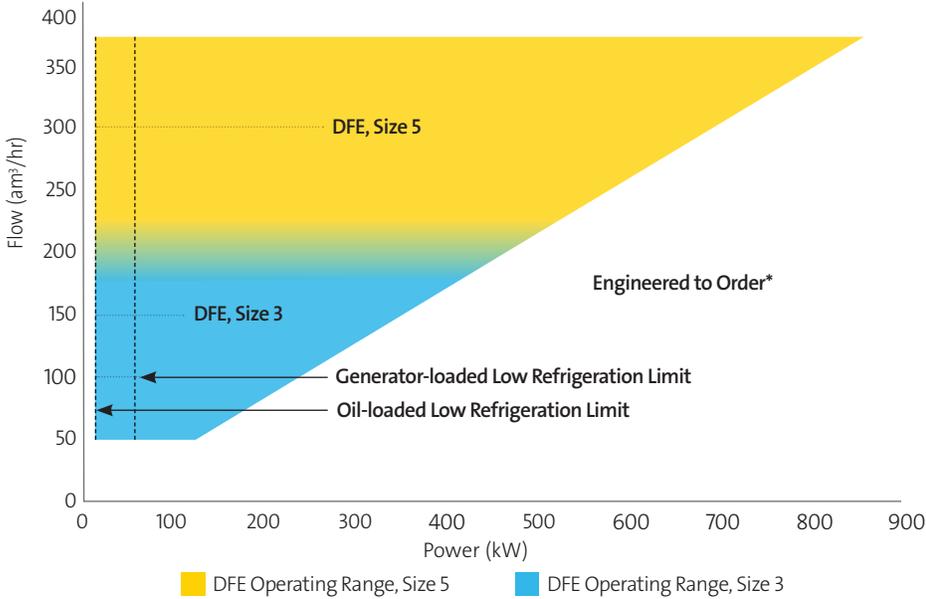
Nominal Unit Capacity	50 to 450 am ³ /hr
Pressure	53 to 84 barg
Inlet Expander Temperature	Down to -185°C
Refrigeration Power	Up to 800 kW
Expander Efficiency	Up to 88%
Expander Pressure Ratio	Up to 16:1
Speed	Up to 28,000 rpm
Fluids	Air Oxygen Nitrogen Hydrocarbons
Hazardous Area Design	Comply with NEC & IEC

Benefits

- Broad equipment operating ranges
- Equipment performance is consistently among the leaders in our industry
- Helical gearing design provides a long service life, with low vibration and low noise levels
- Expander/gearbox mounting configuration eliminates the need for high speed couplings and additional high speed bearings
- Adjustable guide vanes result in accurate flow and high efficiency
- Split gearbox design provides easy access to gears and bearings
- Equipment aerodynamically optimized to the customer's process
- Simplified motor mode startup and shutdown sequence allows for smooth machine operation
- Fully skidded packages can be supplied for customer-specific conditions
- ISO 9001 certified since 1997 (currently ISO 9001:2015)

Dense Fluid Expanders

Product Operating Range



Engineered to order for customer-specific applications. Represented is an overview of our turbomachinery capabilities. Please contact us to discuss your specific needs.

Options

- Low cost energy-dissipating dense fluid expander option available
- Expander and gearbox spare assembly
- International code compliance
- Inlet strainers
- Inlet trip valve
- Safe area or hazardous area location
- 50Hz or 60Hz
- Medium/low voltage motor options
- Package control system
- Purged enclosure
- API compliant on request

Technical Highlights

- High efficiency turbo expander directly mounted to an integral gearbox
- Custom designed precision helical gearing manufactured to AGMA Q12 / DIN Class 5 standards
- Horizontally split gearbox
- Adjustable zero clearance inlet guide vanes
- Proven high speed and high load tilt pad bearings handle steady state and transient thrust loads
- Electric actuator provides precision control of inlet guide vanes over a wide operating range
- Wear resistant material and coatings
- Flexible disk low speed coupling for long life
- Robust impeller attachment and torque transmission design for high reliability
- Motor mode start to eliminate potential for over-speed
- No lengthy pre-operational cool down procedures required

Experience more. Together.

Rotoflow, an Air Products business, combines one of the industry's most trusted names in turbomachinery with world-leading industrial gas expertise. We're transforming the hydrocarbon, LNG, petrochemical, and industrial gas markets with superior equipment performance and unrivaled reliability, safety, and value. Our combined capabilities are the key to this new level of quality. Technological innovations expertly integrated with decades of know-how are the foundation for Rotoflow's valued products, proven performance, and world-class service. This synergy helps customers around the world reach their unique technology and operational targets more efficiently than ever before.

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