

Experience more. *Together.*



**ROTOFLOW**  
An Air Products Business

# 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.

## *A Powerful New Synergy*

### EXPERIENCE

Rotoflow has been designing, building, and operating centrifugal turbomachinery for over 125 combined years. We listen, we understand, and we are responsive to your needs.

### RELIABILITY

Rotoflow has more than 20 years MTBF\* as a result of experience gained by operating and maintaining a current fleet of over 3,200 expanders worldwide.

### PERFORMANCE

Our measured efficiencies are up to 92%, and all Rotoflow® equipment is aerodynamically optimized to your cycle.

### RESPONSIVENESS

As an owner/operator, we understand the value of your processes. Scheduled and emergency support is always only a phone call away.

### COMMITMENT

From conceptual process engineering through manufacturing, startup, and operation, Rotoflow is dedicated to your application.

### SAFETY

All Rotoflow turbomachinery is designed and manufactured to stringent safety requirements. Our commitment to total safety is a commitment to doing things right.

\*Air Products heritage turbomachinery—tracked since 2002.




# PROVEN PERFORMANCE

*Exceptional Reliability, Safety & Value*

Rotoflow brings a new level of expertise to the design, build, and support of mission-critical turbomachinery. As one of the world's only OEMs both manufacturing and operating turbomachinery, we know the equipment and the processes. This unique access to operation data and results enables us to continuously incorporate this feedback and knowledge into our machinery design to deliver ongoing reliability, safety, and value.

Backed by 125 years of combined experience, Rotoflow has collectively built over 4,000 expanders and offers world-class mean time between failures measured at over 20 years.\* Our proven designs have millions of successful hours of operation, and we have more than 3,200 units currently operating worldwide—machinery that is simple to operate and maintain and has a long record of delivering proven performance and high value.

For Rotoflow customers, this translates into continuous operation with minimum maintenance and downtime for efficient, productive operation.

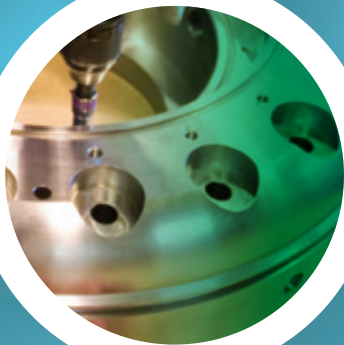


*Rotoflow is both a pioneer and leader in turboexpander technology in natural gas applications. In 1958, Dr. Judson S. Swearingen, founder of the original Rotoflow Corporation, initiated the program for building and operating the world's first hydrocarbon turboexpander.*



# PRODUCTS & SOLUTIONS

*The Rotoflow Legacy, Serving Today's Markets*



Merging expert design/build and operational insight into a single resource is the ultimate efficiency. This has always been the Rotoflow foundation. We deliver superior design and manufacturing, experienced engineering and production, and on-target custom solutions. We serve a range of markets and applications where precision and reliability are key. Who we are is why we're always one step ahead in a fast-paced market.

## COMPRESSOR-LOADED EXPANDERS

Our compressor-loaded turboexpanders (companders) deliver high value by providing refrigeration for the most efficient hydrocarbon, air separation, and liquefaction facilities around the world.

## GENERATOR-LOADED EXPANDERS

Our generator-loaded turboexpanders offer the best match of efficiency and long-term capital investment, providing refrigeration and economic power recovery in hydrocarbon, air separation, and liquefaction facilities.

- Direct-drive
- Integral Gear
- External Gear
- Multi-stage

## ENERGY-DISSIPATIVE EXPANDERS

Available in three types, energy-dissipative expanders are commonly found providing low-cost refrigeration options for efficient hydrocarbon, air separation, and liquefaction operations.

- Oil-loaded
- Blower-loaded
- Resistor-loaded

## RECIPROCATING CRYOGENIC PUMPS

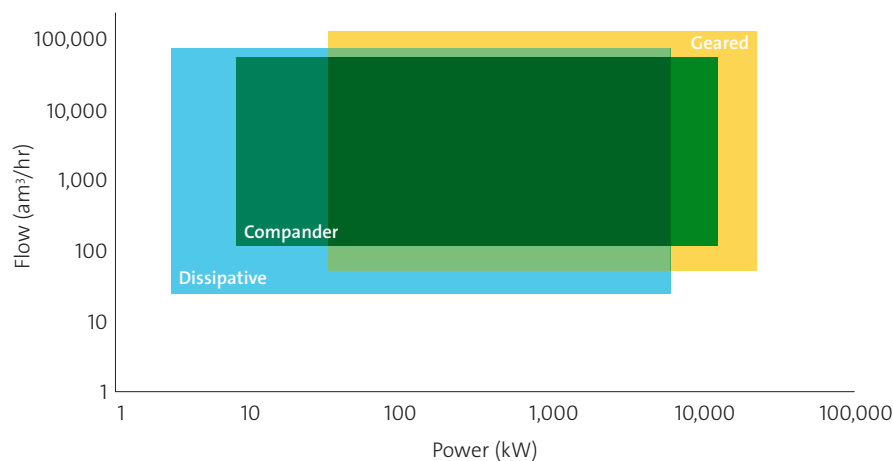
Now key components within the industrial gas industry handling primarily liquid oxygen, argon, and nitrogen, our reciprocating cryogenic pumps are designed to reduce cryogenic tank losses and deliver increased refrigeration while reducing cryogenic storage and pumping costs.

## CUSTOMIZED SOLUTIONS

Depending on your needs, Rotoflow can customize our equipment to meet your requirements. Since we are both a manufacturer and an operator, we understand your applications and can provide a total solution—simple or complex.

*Rotoflow is one of the world's only OEMs in both the manufacturing and operation of turbomachinery.*

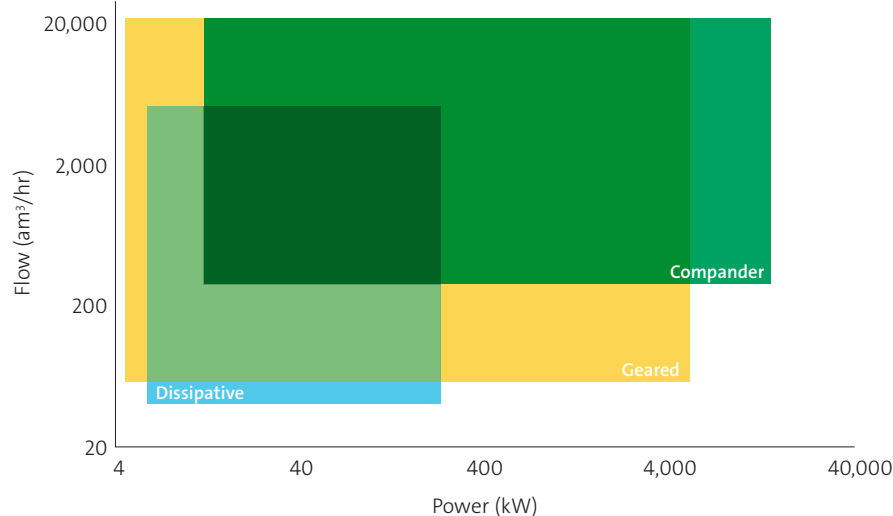
## Hydrocarbon Product Operating Range



## Typical design capabilities

|                |  |
|----------------|--|
| Power          | 3 to 22,569 kW<br>(4 to 30,265 hp)                           |
| Speed          | Up to 105,000 rpm  |
| Inlet pressure | 1.7 to 210 barg<br>(25 to 3,045 psig)                        |
| Temperature    | -270°C to +340°C<br>(-454°F to +644°F)                       |
| Outlet flow    | 24 to 163,173 $\text{am}^3/\text{hr}$<br>(14 to 96,040 ACFM) |
| Impellers      | 17 to 1,270mm<br>(0.65 to 50 in.)                            |

## ASU Product Operating Range



## Typical design capabilities

|                |   |
|----------------|---|
| Power          | 4 to 14,000 kW<br>(16 to 18,774 hp)                         |
| Speed          | Up to 105,000 rpm   |
| Inlet pressure | 1.5 to 100 barg<br>(22 to 1,450 psig)                       |
| Temperature    | -200°C to +150°C<br>(-320°F to +300°F)                      |
| Outlet flow    | 40 to 20,883 $\text{am}^3/\text{hr}$<br>(24 to 12,292 ACFM) |
| Impellers      | 89 to 483mm<br>(3.5 to 19 in.)                              |

Engineered to order for higher flows and powers. This represents an overview of Rotoflow's turbomachinery capabilities. If your needs fall outside of these application ranges, please call for additional information.



# DESIGN & MANUFACTURE

*Committed to Safety & Reliability*

Rotoflow designs were achieved with more than 120 turboexpander-related patents and the advantage of shared research and development. Fast forward to today, and Rotoflow quality still dominates the industry through the innovation of leading-edge R&D. Our turbomachinery is built for a long and relatively maintenance-free operational life. We engineer components and conduct analyses that enhance safety, reliability, and efficiency—for every application requirement.



## ENGINEERING SOLUTIONS

- Rotordynamics
- Bearing Analysis & Design
- Pressure-Containing Housing Design
- Gear & Gearbox Analysis
- Impeller Design
- Static, Dynamic & Thermal FEA (Finite Element Analysis)
- Computational Fluid Dynamics
- Advanced Material & Coating Application
- Lube System & Seal Gas Systems Design
- PLC Control System Design
- Reverse Engineering
- API & Customer Specification Compliance

## PRODUCTION

The production of high-performance turbomachinery is the cornerstone of the Rotoflow organization. As both a manufacturer and an operator, we are able to provide cost-effective solutions for a variety of applications while ensuring exceptional reliability and value.

Safety is paramount at Rotoflow. All turbomachinery is designed and manufactured to stringent safety requirements, and every one of our technicians has undergone extensive safety training and adheres to global safety policies.

Quality standards are essential to the Rotoflow production process. Quality control measures include inspection, balancing, ambient and cryogenic spin testing, and pressure testing, all performed at cutting-edge inspection and testing facilities. Rotoflow is ISO 9001:2015 certified.

*The leading expert in turbomachinery technology, equipment, and system design, Rotoflow seamlessly serves customers around the world, no matter what their conditions or demands.*





# SERVICE & SUPPORT

*Responsive & Resourceful*

Service and follow-up are critical to making the best technology truly great. Rotoflow provides complete support for our turbomachinery equipment and systems, backed by the same knowledge that's innate in our engineering and manufacturing divisions. We are also the world's only authorized Rotoflow parts dealer, so we can provide customers with what they need, when they need it.

Our skilled service technicians have years of experience with a wide range of rotating and reciprocating equipment, and have completed work in more than 24 countries. We mobilize quickly to complete a job safely and efficiently. Whether customers need field service, parts, repairs, upgrades, or rerates, we're focused on being both responsive and resourceful.

## GLOBAL AFTERMARKET SERVICE


- Shop & Field Repairs
- Spare Parts
- Field Service
- Upgrades & Rerates
- Inventory Management
- Fleet Optimization
- Performance Assessments
- Reliability Assessments
- Root Cause Analysis
- Reverse Engineering
- Data Monitoring
- Training
- Plant Assessments & Upgrades
- Online Maintenance History
- Operational Optimization
- Troubleshooting



# 24/7/365 GLOBAL SUPPORT

*Keeping Operations Running at Their Best*

Rotoflow is available around the clock and around the world to tackle production obstacles. The Rotoflow objective is meeting project demands in the fastest, most efficient, most cost-effective way possible. That's a promise we make to every customer.



*Rotoflow is now closer than ever to our customers, with new sales and service teams and new locations.*



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