

CRYOGENIC PRODUCTS



AEROSPACE • INVESTMENT CASTING • CRYOGENICS • SURFACE TREATMENT

35 YEARS IN CRYOGENICS

PBS has been in the cryogenic business for more than 35 years. Since the late '80s, PBS has been developing and supplying cryogenic turbines for the liquefaction of helium. Helium applications must meet extremely demanding technical requirements not only in the design and construction phase but also in terms of production processes, final assembly and testing.

The internal Research & Development activities are

currently focused especially on the perfection of custom-made turboexpanders for gas liquefaction and air separation. PBS R&D is on the way to successfully complete the development of the more powerful and efficient turbine expander CTE 300.

Our cryogenic product lines utilize the unique PBS technology and know-how of dynamic gas bearings which benefit the customers in terms of reduced maintenance costs.



WHY PBS

Extremely demanding cryogenic product development has been part of the PBS R&D since the mid-1980s.

Due to the high technical level and quality, PBS products are widely used in healthcare, science and research, hydrogen storage and logistics, air separation, CO₂ capture and the aerospace industry. We deal with each customer's project individually, allowing flexible adaptation to individual customer requirements.



CRYOGENIC PRODUCTS

PBS cryogenic products are mainly used in helium and hydrogen liquefiers and refrigerators operating at low gas or liquid temperatures ranging from 1.8 K to 150 K.



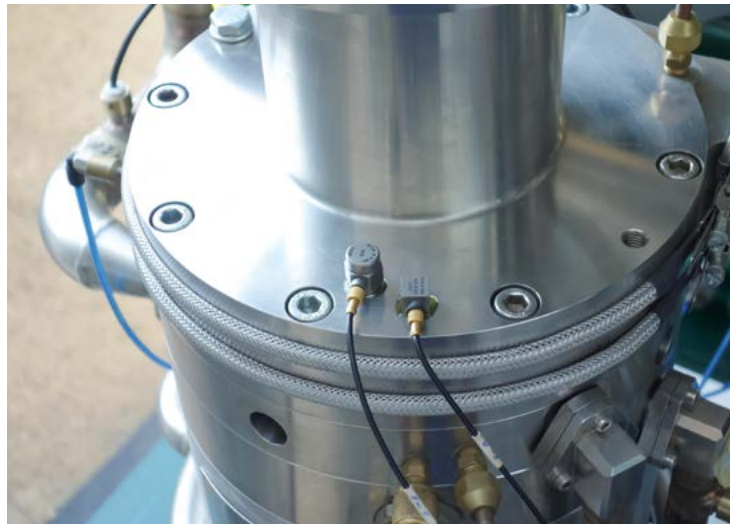
TURBOEXPANDERS

compact and modular design



COMPRESSORS

single or multi-stage



PUMPS

centrifugal pumps for liquefied gases



TURBOEXPANDERS

Our turboexpanders have a compact modular design, allowing modifications for different inlet and outlet parameters of the expanded gas. The key advantage of our turboexpanders is speed control by means of an eddy current brake and their maintenance-free operation due to dynamic

gas bearings. PBS turboexpanders are primarily designed to expand gases such as helium, nitrogen, argon, air, and other media in gas liquefiers. The development of a more powerful and more efficient turbine expander CTE 300 is well underway.



MAIN PARAMETERS	HEXT/CTE 100	HEXT/CTE 200	HEXT/CTE 300
Cooling power	0.1 – 3 kW	2 – 8 kW (up to 16 kW*)	10 – 100 kW
Mass flow*	0.009 - 0.331 lbm/s	0.331 - 1.323 lbm/s	0.661 + lbm/s
Max RPM	360,000	180,000	100,000
Max. inlet pressure	261.1 Psi	406.1 Psi	725.2 Psi
Inlet temperature	6 – 150 K	6 – 150 K	6 – 150 K
Impeller diameter	0.35 - 0.79 in	0.79 - 1.97 in	1.18 - 3.94 in
Bearing types	Dynamic gas bearings	Dynamic gas bearings	Dynamic gas bearings
Turboexpander configuration	Eddy current brake	Eddy current brake/Generator**	Generator**/Compressor**

*Presented data are for helium
**Under development



COMPRESSORS

Our cryogenic compressors are used for compressing gases such as helium, nitrogen, argon, air, and other mediums.

We deal with each project for each customer individually, which enables us to flexibly respond to requirements in the process of optimising the particular system in which the compressor is in-

corporated, as well as to adapt the system to different working media.

The compressor design is modular. There are four standard lines from which our customers are able to select their products according to the parameters and impeller sizes.



COMPRESSORS

- › **Compact design**
- › **Possibility of an intercooler connection**
- › **High efficiency**
- › **High reliability and high MTBF**

MAIN PARAMETERS

Mass flow*	0.022 - 0.254 lbm/s
Impeller diameter	1.58 - 11.02 in
Min. inlet pressure	0.2 Psi
Min. inlet temperature	4 K
Max. RPM	90,000

*Presented data are for helium

DRIVE UNIT

- › **Compact design**
- › **Possibility of an intercooler connection**
- › **High efficiency**
- › **High reliability and high MTBF**

We have developed a cryogenic drive unit for compressors. The use of dynamic gas bearings ensures many years of maintenance-free operation and very low levels of heat transfer.

MAIN PARAMETERS

Power output	7 kW @ 70,000 RPM
Max. RPM	70,000

PUMPS

Our centrifugal pumps are primarily designed for transporting liquefied inert gas (helium, nitrogen, argon, air, and other gases) to a cryogenic device. The pumps are designed modularly with two lines of standardised casings for different working media parameters and impeller sizes.



Our cryopumps work in tandem with our cryogenic compressors and cryogenic turboexpanders, performing a vital role in the entire cryogenic process of compressing, trapping, delivering, and extracting energy as gases expand.

PUMPS

- › **Compact design**
- › **Possibility of an intercooler connection**
- › **High efficiency**
- › **High reliability and high MTBF**

MAIN PARAMETERS

Mass flow*	0.110 - 1.102 lbm/s
Impeller diameter	1.58 - 4.33 in
Min. inlet pressure	14.5 Psi
Min. inlet temperature	1.8 K
Max. RPM	45,000

*Presented data are for helium

DRIVE UNIT

- › **Compact design**
- › **Possibility of an intercooler connection**
- › **High efficiency**
- › **High reliability and long services**

We have developed a cryogenic drive unit for compressors. The use of dynamic gas bearings ensures many years of maintenance-free operation and very low levels of heat transfer.

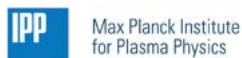
MAIN PARAMETERS

Power output	7 kW @ 70,000 RPM
Max. RPM	70,000

OUR CUSTOMERS

The cryogenic technology has been part of our business since the mid-1980's.

We supply our turboexpanders, compressors and cryogenic pumps to major customers, incl. prestigious research institutes such as Linde Kryotechnik, CERN, Rosendorf Research Centre and the Max Planck Institute.

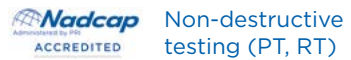
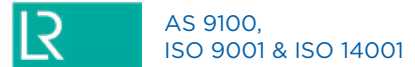


ABOUT US

PBS is a globally recognized engineering brand with a history of over two hundred years.

The company specializes in the R&D and manufacturing of turbine engines, APUs, and ECS systems designed for unmanned aerial vehicles, medium helicopters, and airplanes.

PBS also develops and produces cryogenic equipment for the world's largest manufacturers of gas liquefaction systems. PBS Foundry is one of the leading suppliers of nickel and cobalt-based superalloy castings in Europe.



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