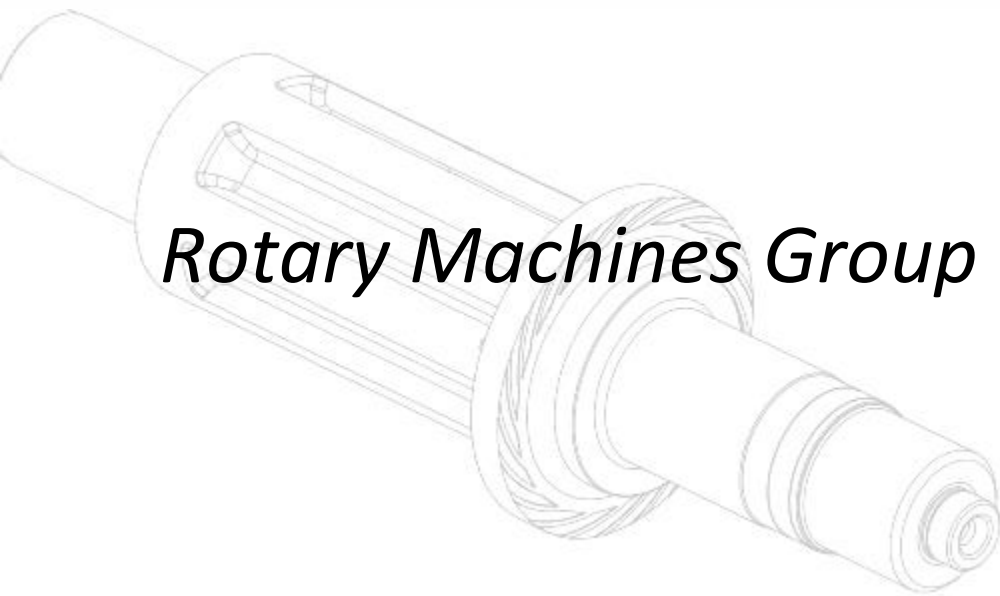
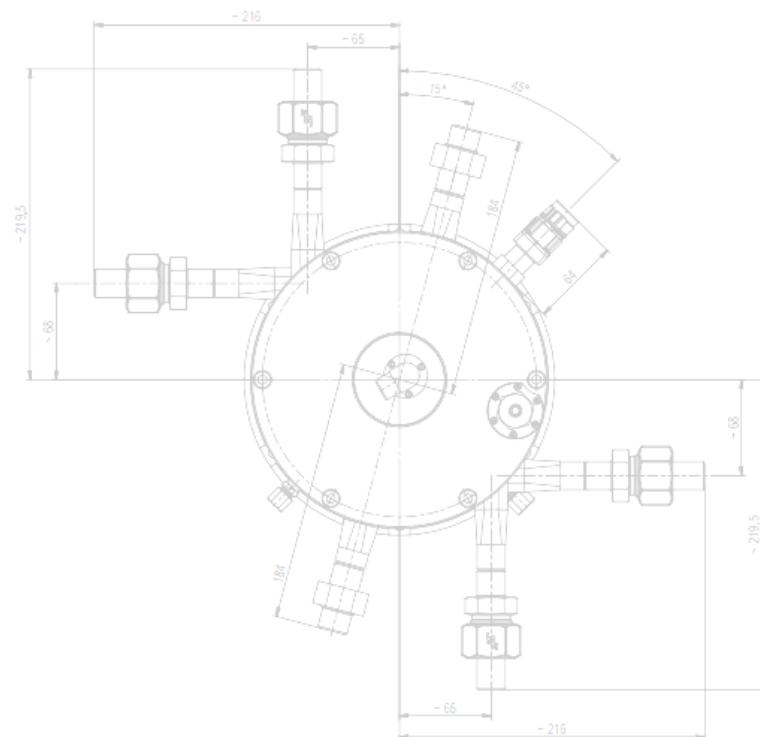


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Helium Expansion Turbines (HET)

- A single shaft high-speed cryogenic machine braked by eddy current brake
- Designed as a one stage expansion of He or other gases (N_2 , Ar, CO_2 , CH_4 etc.)
- Up to 300 000 rpm
- HET 2 – 10 kW, HEXT 0.1 – 2 kW
- Inlet temperature: from approx. 5 K (or by customer requirements)
- Pressure: up to 25 bar,a (or by customer requirements)



Rotary Machines Group

Turbo-Circulators (TC)

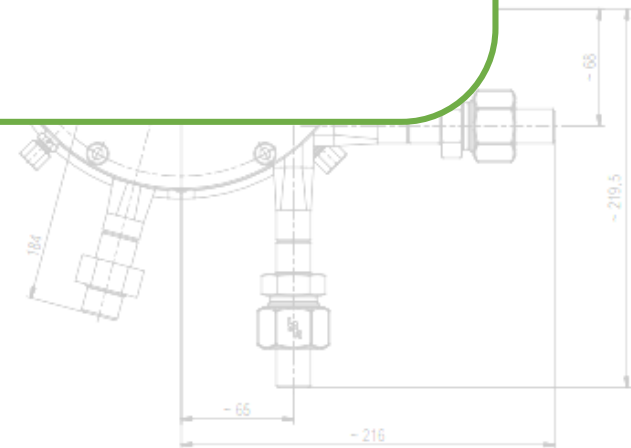
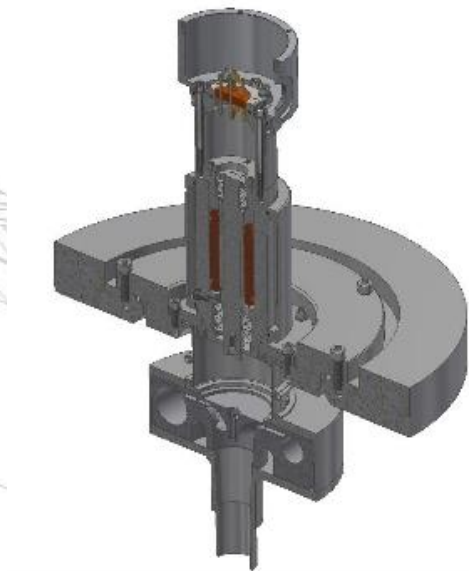
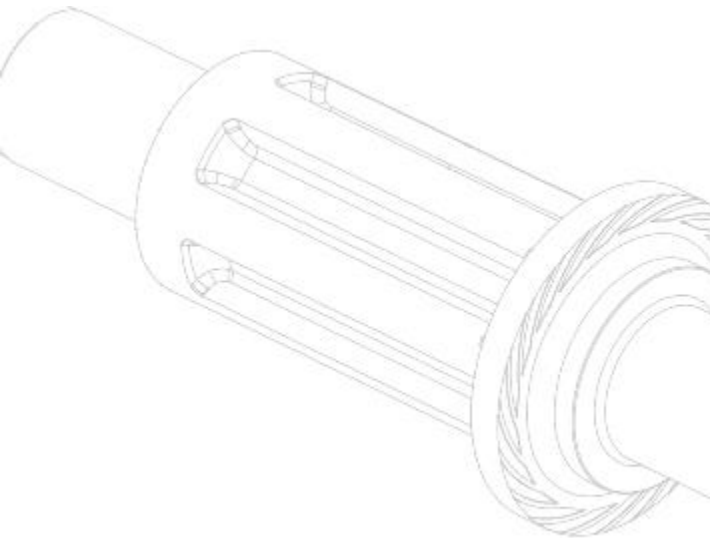
- A single shaft high-speed machine with one or two-stage compression of He or other gases (N_2 , Ar, CO_2 , CH_4 , LFG, air, radioactive gases etc.)
- Up to 250 000 rpm
- 0.5 kW – 400 kW
- Temperature: up to approx. 800 K
- Pressure: up to 150 bar (or by customer requirements)



Rotary Machines Group

Cold Compressors (CC)

- A single shaft high-speed machine
- Designed as a one stage compression of cryogenic Helium
- Up to 54 000 rpm (or higher according operating param. and customer requirements)
- 0.1 - 10 kW
- Temperature from approx 2.5 K
- Pressure from: 3 kPa (or lower or higher)



Rotary Machines Group

Turbo-Expander Circulator (TEC) – Cryogenic Cooling System Brayton (CSB)

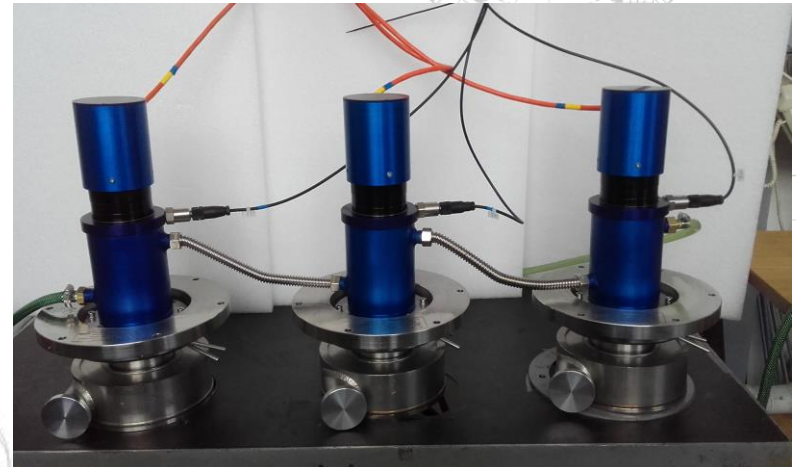
- A cryogenic cooling system Brayton
- 250 000 rpm
- Cooling power: 0.1 - 20 kW
- Temperature: 170 - 5 K
- Pressure: 25 bar,a (or higher according to customer requirements)



RMG References – 2018

TIPC, China

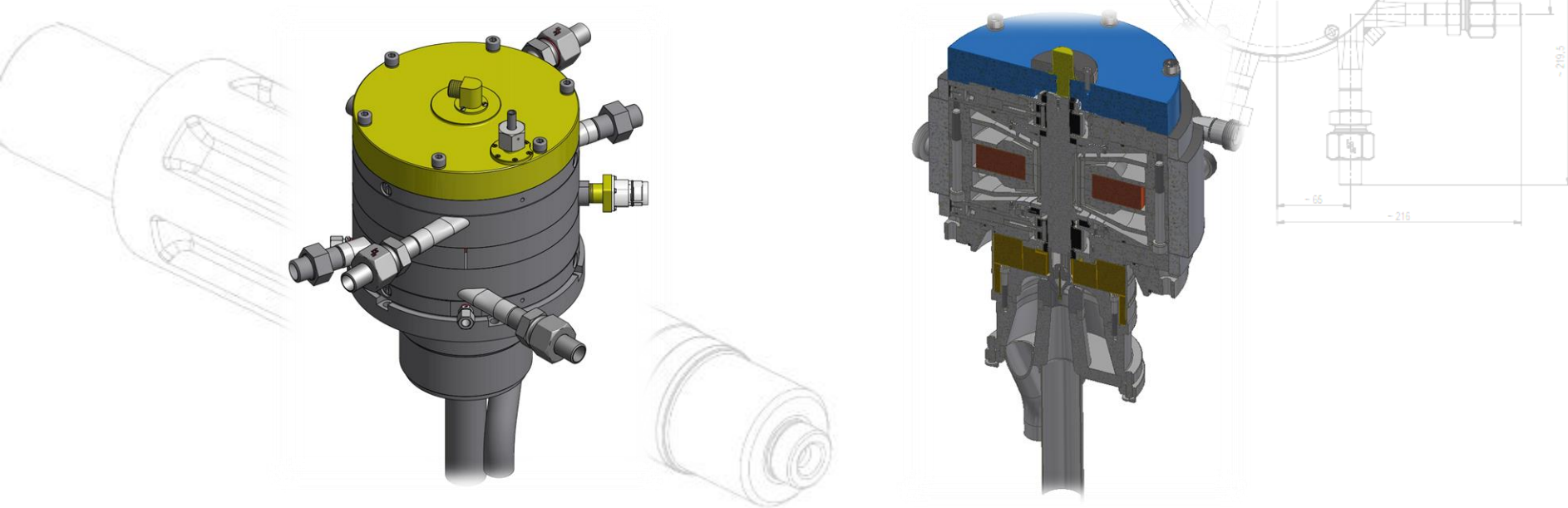
- 3 pcs.
- Cold compressors
- Including control system
- Delivered and on-site tested
- Inlet pressure 3 – 25 kPa,a
- Max. 43 000 rpm



RMG References – 2016

ASIPP, China

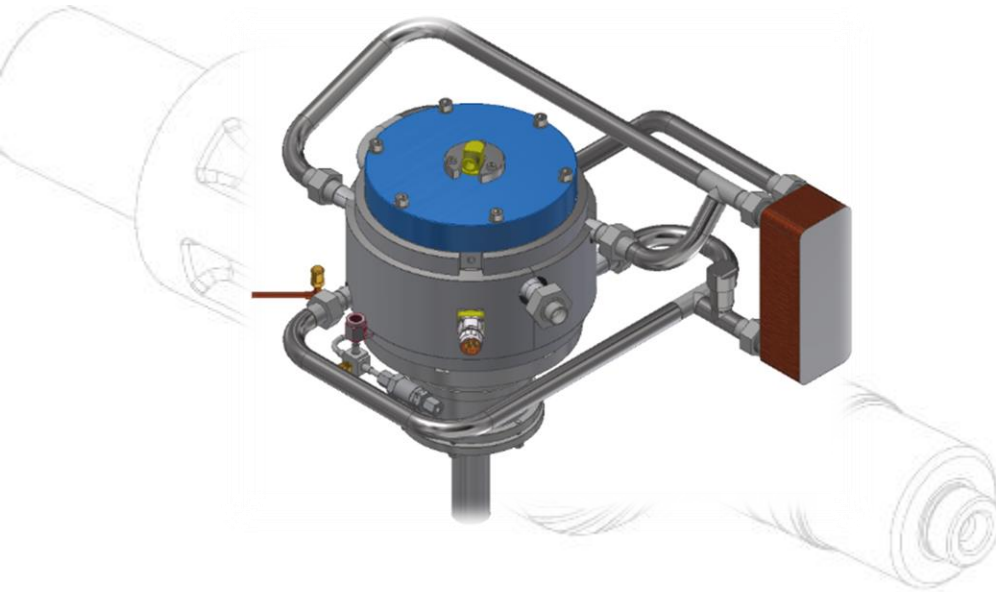
- Helium turbo-expanders
- Cooling power: 500 - 10 000 W
- Inlet temperature 14 K – 80 K
- Inlet pressure 0.5 – 2.0 Mpa,a
- Max. 250 000 rpm
- 2 types (HET and HEXT)
- 12 pieces – 7x HET, 5x HEXT



RMG References – 2015

TIPC, China

- Helium turbo-expanders
- Cooling power: 500 - 10 000 W
- Inlet temperature 14 K – 45 K
- Inlet pressure 0.5 – 1.8 Mpa,a
- max. 250 000 rpm
- 7 pieces



RMG References – 2015

ELI Beamlines

- AV CR, 2014 - 2015, Czech Republic
- Cooling System Brayton
- 1x Helium turbo-expander-circulator, 1x Turbo-circulator
- Cooling power: 300 W
- Cooling temperature 150 K
- Design pressure 1.2 MPa,a
- 120 000 rpm



RMG References – ITER Project 1

EFDA, KATHELO

- 2011 - 2013, KIT, Karlsruhe, Germany
- 2x TC 1x TC
- $P = 232 \text{ kW}$ $P = 22 \text{ kW}$
- $n = 40\,000 \text{ rpm}$ $n = 76\,000 \text{ rpm}$
- $\Theta_n = 50^\circ\text{C}$ $\Theta_n = 50^\circ\text{C}$
- $p_n = 80 \text{ bar,g}$ $p_n = 80 \text{ bar,g}$
- Active magnetic and Aerodynamic gas bearings



EFDA

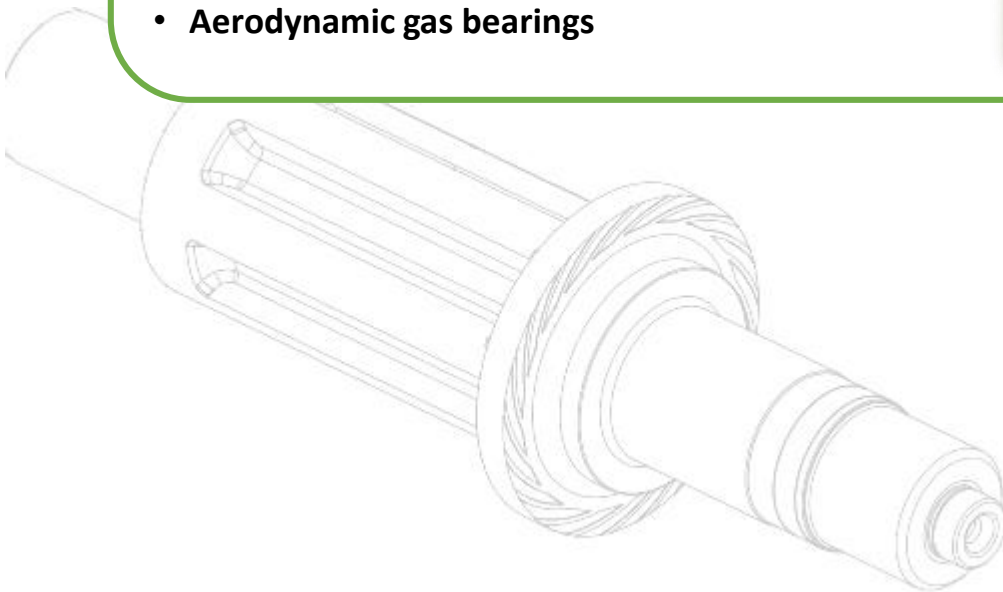
- 2009, ENEA, Brasimone, Italy
- TC
- $P = 232 \text{ kW}$
- $n = 40\,000 \text{ rpm}$
- $\Theta_n = 50^\circ\text{C}$
- $p_n = 80 \text{ bar,g}$
- Active magnetic bearings



RMG References – ITER Project 2

IPR

- 2016, India
- 2x TC
- $P = 18 \text{ kW}$
- $n = 75\,000 \text{ rpm}$
- $\Theta_n = 60^\circ\text{C}$
- $p_n = 78 \text{ bar,g}$
- Aerodynamic gas bearings



Thank you for your attention

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