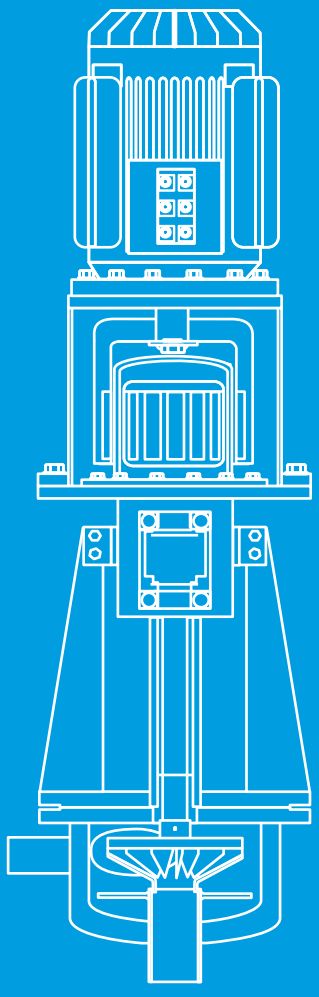
RLD

COP21 CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

LINOXAR

A new cryogenic pump



ECONOMICAL SOLUTIONS
LN2
RLD

-196°C -30°C

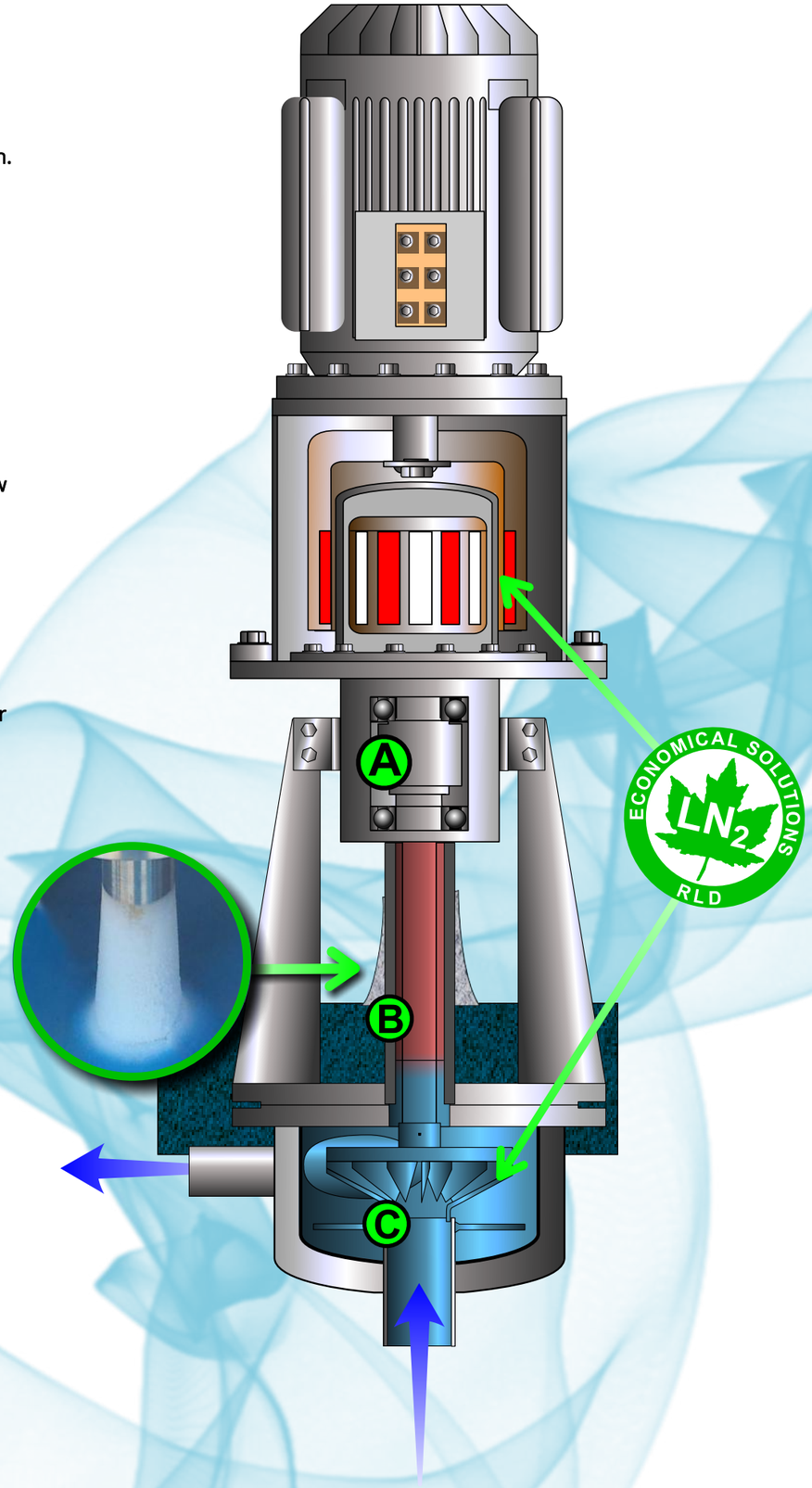
LINOXAR
The economical cryogenic pump on the market.

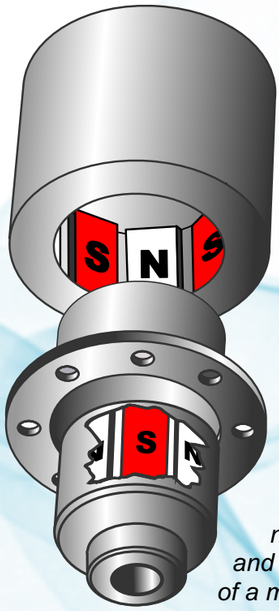
World-wide importance is given to energy efficiency and cost reduction. In cryogenics this means: to concentrate on the possible savings in processes where cryogenic fluids are used.

A number of processes demand closed loop circulation of pressurized sub-cooled cryogenic fluids, using centrifugal pumps. Ideally such a pump would only convey hydraulic circulation energy to the liquid.

In the vertical **LINOXAR** design, the only mechanical connection between warm drive Ⓐ and cold centrifugal pump Ⓒ, consists of a magnetic coupling to a double jacketed stainless steel shaft Ⓑ with low thermal conductivity.
The gas/liquid frontier is stabilized in the lower part of Ⓑ, with a heat input of 5-20 watts into the cryogenic fluid, depending of the model.

The above mentioned design characteristics make the **LINOXAR** perfectly suited for la large number of cryogenic fluids, in particular for liquid oxygen applications.

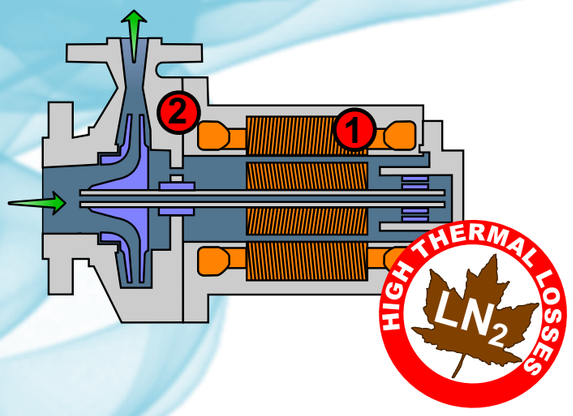




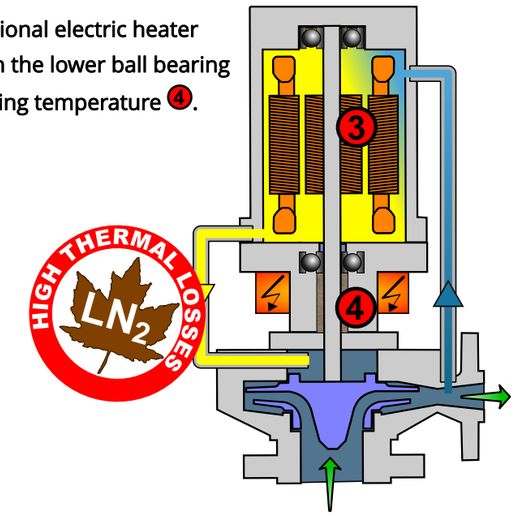
Inner magnets, non-magnetic bell and exterior magnets of a magnetic coupling

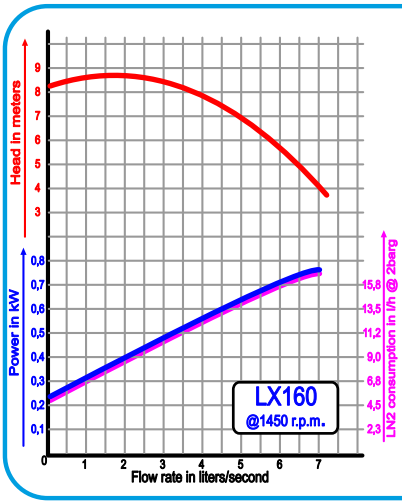
Up till now most pump manufacturers offer hermetically sealed centrifugal pumps for circulation of cryogenic liquids.
The range covers canned motor pumps and encapsulated motor pumps. Obvious disadvantages of these designs is the fact that part of the cryogenic liquid is used for the cooling of the drive motor. This results in excessive liquid nitrogen consumption and thus higher operational cost.

In the canned version the rotor is immersed in the cryogenic fluid. The fluid is heated by the eddy currents between rotor and stator ❶. The direct mounting of the motor onto the pump body results in an additional ambient heat leak into the cryogenic fluid ❷.

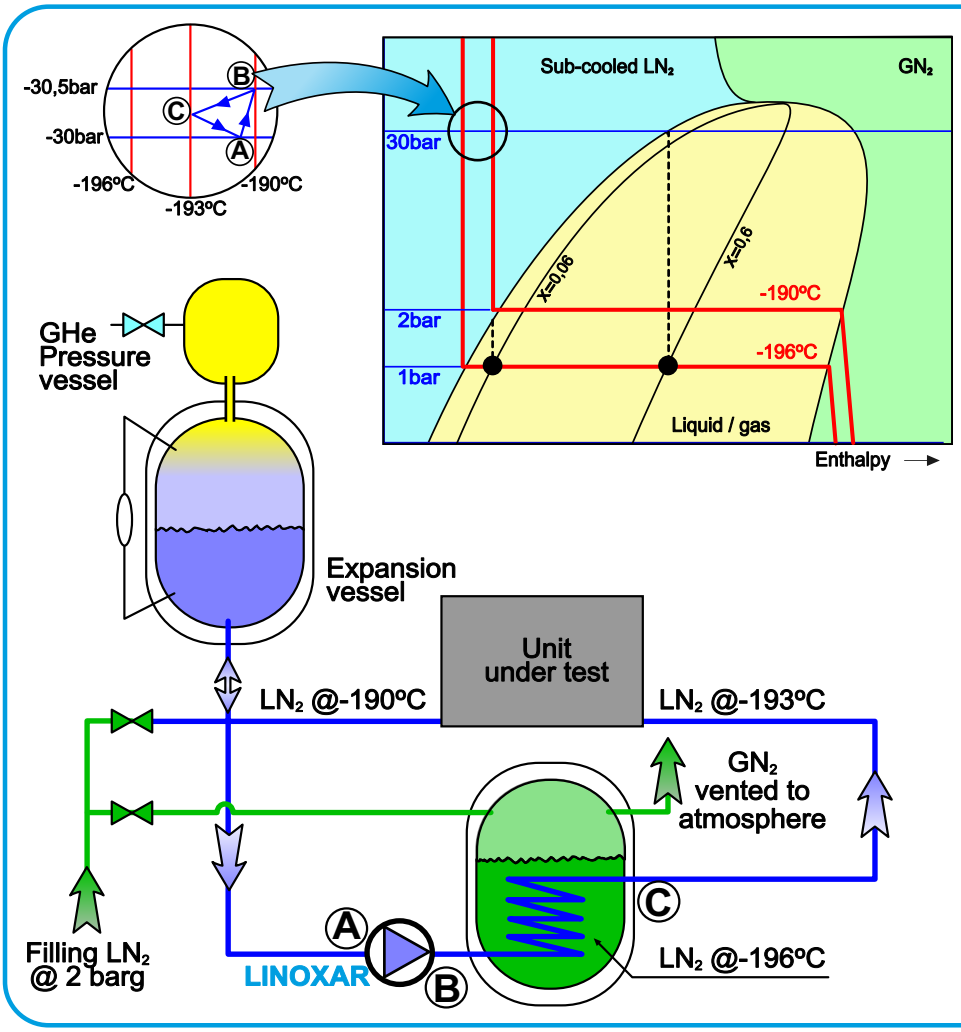


The same remarks are valid for the encapsulated motor version where the fluid is heated by the eddy currents between rotor and stator ❸.
Moreover an additional electric heater is used to maintain the lower ball bearing at its warm operating temperature ❹.





In contrast with commonly available designs without modification or customization, the **LINOXAR** concept is fully tailor-made and governed by the objective to reduce the total energy absorbed by the cryogenic fluid through the pumping process.
The energy consumption of the **LINOXAR** pump is expressed in liters per working hour of the fluid. This is by far the most expensive utility in cryogenic pumping. This value is missing in information supplied by manufacturers of the classic pump models but is of utmost importance in order to calculate a clear cost estimation for daily operation. It is obvious that this value is required to offset initial investment against long time operational cost.
Additionally, the temperature gradient in the **LINOXAR** unit guarantees longevity and makes the unit virtually maintenance free.



Typical application: testing of large equipment with sub-cooled LN_2

The reason for using sub-cooled nitrogen is that in case of a blow-out of the tested unit, the resulting Boiling Liquid Expanding Vapor Explosion (BLEVE) can safely be contained.

For this purpose the circulated nitrogen circuit is pressurized by helium. As can be seen in the enthalpy diagram the temperatre of the liquid nitrogen inside the circuit will descend to temperatures as low as -193ºC .
The **LINOXAR** maintains the circulation through the unit being tested while being cooled down to -193ºC inside a special sub-cooler. In case of a blow out under this condition, the total mass of LN2 will depressurize and only 6% of the mass is converted into gas.
This compared to a situation with saturated LN2, where 60% would be converted into gas.

The green sign for Economical Solutions for equipment using LN2 indicates products developed by RLD Thermique - Ingénierie from Grenoble France.

Grenoble is known worldwide for high technology and innovative solutions. In addition to the local high manufacturing quality of industrial and scientific products the company RLD Thermique - Ingénierie has made it their trademark to optimize their designs for low LN2 consumption combining efficiency, reliability, low maintenance and longevity.

Over 40 years experience in designing and manufacturing key elements for major international projects guarantees high quality units optimized for their intended tasks.

For additional information see:

www.thermique-ingenierie.fr