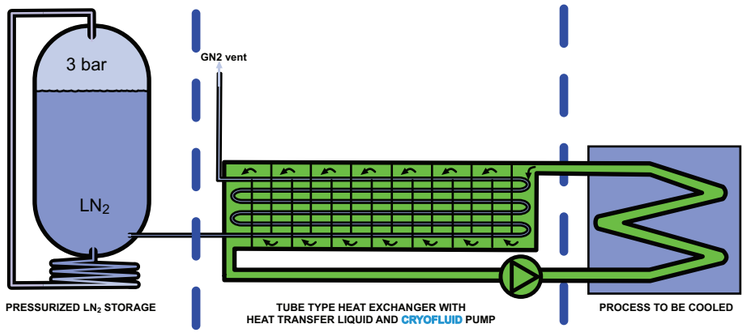
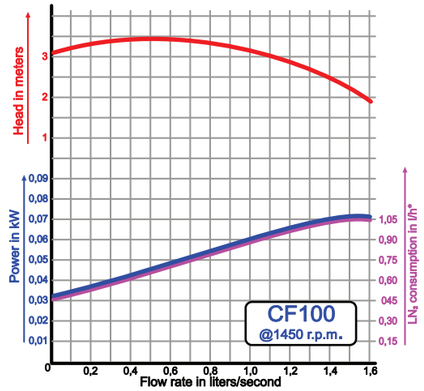
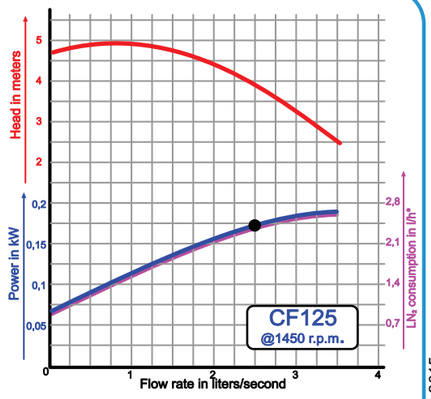
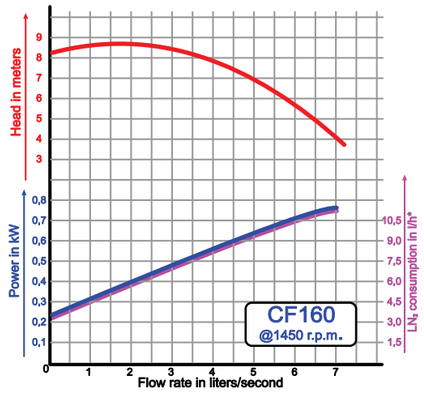


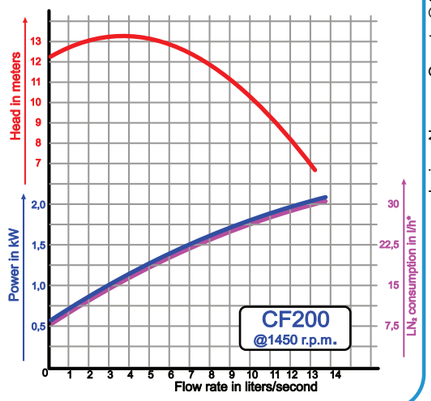
As opposed to commonly available designs (without modification or customization,) the CRYOFLUID concept is fully tailor-made and governed by the objective to reduce the total energy absorbed by the cryogenic fluid through the pumping process.

Consequently we express the energy consumption of the CRYOFLUID pump in liters per working hour of the fluid. This is by far the most expensive utility in cryogenic pumping. Should this value be missing in information supplied by manufacturers of the classic pump models a clear cost estimation for daily operation cannot be calculated . It is however obvious that this value is required to correctly offset initial investment against long time operational cost.









*LN_2 consumption in 4 graphs is in l/h,
- LN_2 storage pressure: 2 barg
- density of heat transfer liquid: 1
- working temperature: -50°C

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

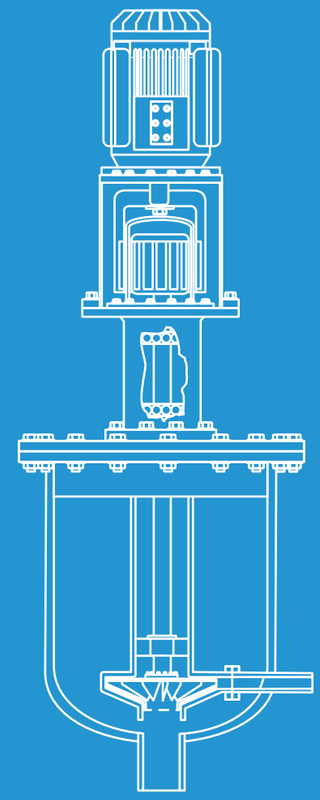

Factory cold test without thermal insulation prior to delivery to the customer, .

RLD

ravanat

CRYOFLUID

A new pump for heat transfer



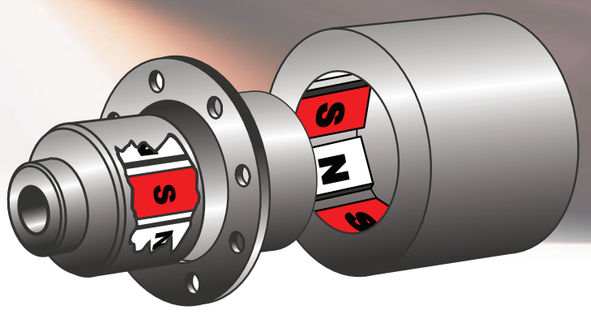
-120°C +150°C

CRYOFLUID

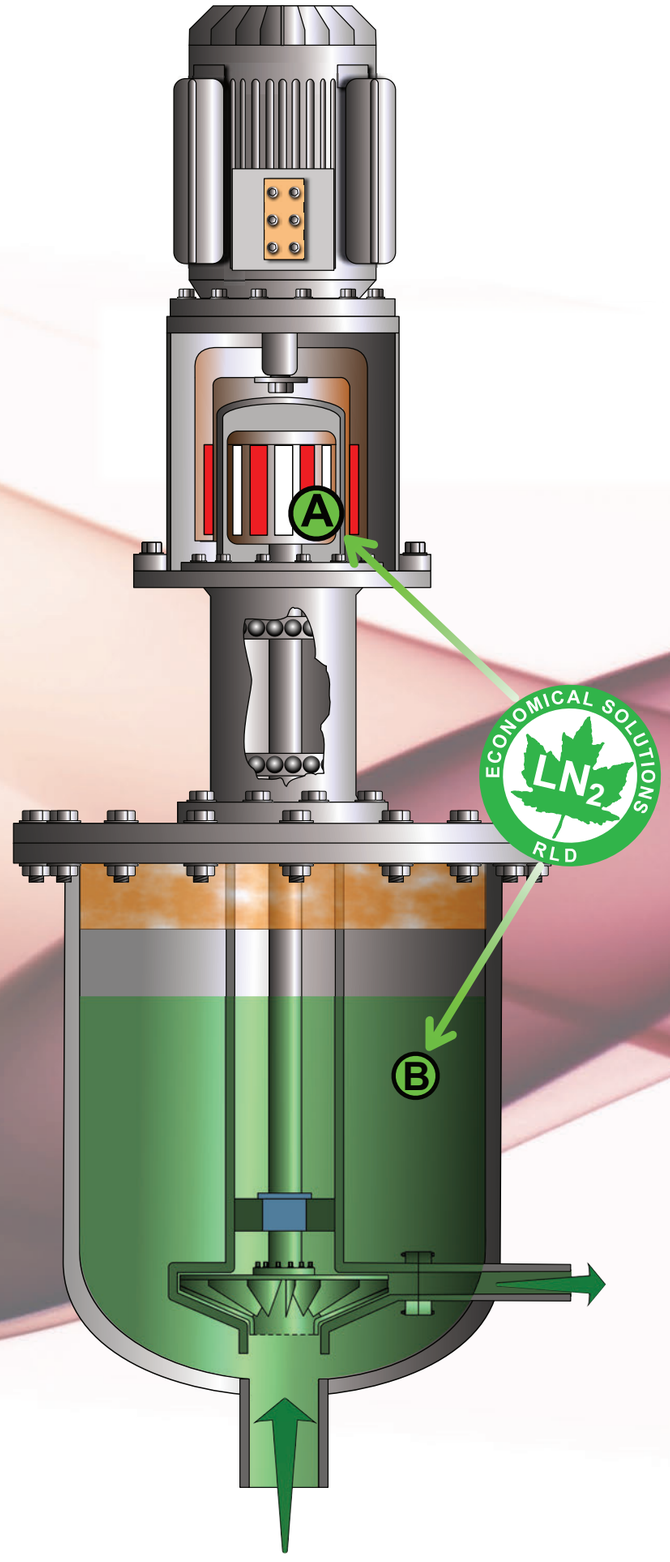
The economical cryogenic fluid pump on the market.

The use of LN_2 cooled heat transfer liquids down to -80°C / -100°C for chemical reactor cooling began in the seventies in the chemical synthesis and pharmaceutical plants. The result was of paramount importance for the the development of cost effective processes. The heat transfer liquids then in use, were inexpensive - solvents, alcohols and hydrocarbons - and the pumps were of the centrifugal type with mechanical seals. In those days, thanks to their configuration, the cold liquid was thermally well separated from the heat in-leak of the electric driving motor.
International standards and regulation for this type of fluids became more and more stringent and required leak proof units. The formerly used fluids were no longer accepted and the newly formulated liquids (such as eg. silicon oils and HFEs) appeared at higher prices. Correct choice of the appropriate fluid for the temperature range as well as economic use of these fluids is therefore of utmost importance.

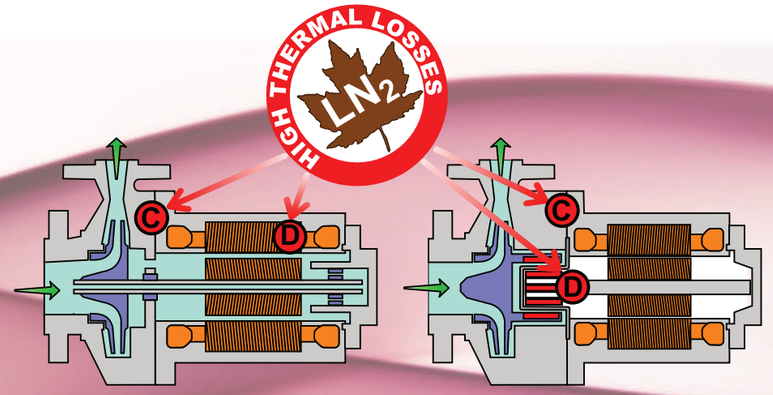
The CRYOFLUID is a recently developed pump for heat transfer fluids where the drive system is totally insulated from the cold transfer fluid. Emphasis during its design was on maximum energy economy during operation. The magnetically coupled drive system of the CRYOFLUID is designed to operate comfortably at ambient temperature allowing for years of maintenance free continuous operation. Also the motor is fully insulated from the cold fluid circuit and hence it does not inject any energy from (A) into the fluid (B).
Additionally, the temperature gradient in the CRYOFLUID unit guarantees longevity and makes the unit virtually maintenance free .



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



Up till now most pump manufacturers offer hermetically sealed centrifugal pumps for circulation of cold liquids.
The range covers canned motor pumps and magnetic drive pumps. Obvious disadvantages of this design are the direct contact of the fluid with the warm mounting casing or flange (C) and the heating of the same fluid by eddy currents (D) generated by the driving motor or magnetic coupling. This heat in-leak results in excessive liquid nitrogen consumption and thus higher operational cost.



All energy (mechanical or thermal) transmitted to the liquid must be compensated by an equal amount of refrigeration in order to maintain a stable cooling temperature.

Some consumption figures for LN_2 as refrigeration fluid (@ 2barg):

Working Temperature	Absorbed Energy	LN2 consumption
0°C	1 kWh	12,4 liters/h.
-50°C	1 kWh	14,4 liters/h.
-100°C	1 kWh	17 liters/h.

After factory testing each CRYOFLUID will function for years with impressive efficiency resulting in economical low LN_2 consumption and operational cost.