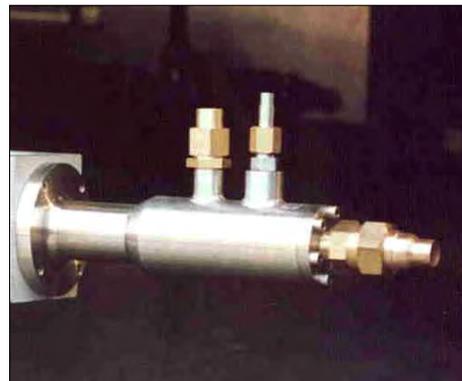
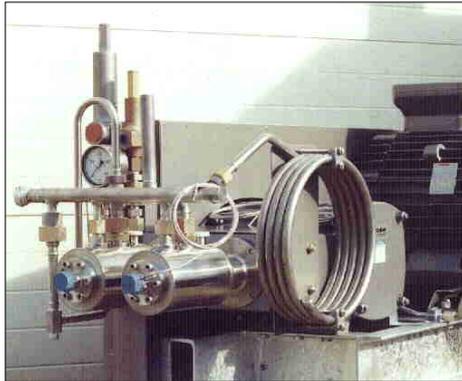
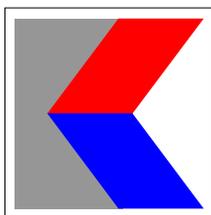


Low-Temperature Reciprocating Pumps



KRYTEM



Krytem piston pumps for low-temperature fluids

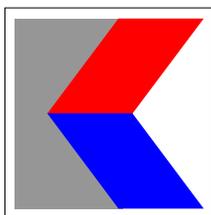
Krytem low-temperature piston pumps have been designed especially to meet the physical demands expected during the discharge of low-boiling point liquids and have been used in numerous industrial gas-supply and bottling plants for nearly two decades.

Huge investment and maintenance costs are associated with the production of medium to high ultimate pressures when using industrial gases. The production of high operating pressures by gas compression requires an excessive amount of energy. In contrast to this, pressure production by displacing the low-temperature liquid phase of the gas to be delivered has significant technical and economic advantages. This, in any case, applies especially where the supply is taken from liquid-storage tanks for logistical reasons or for the purpose of guaranteeing the required gas purity. Using Krytem pumps helps to reduce the expense involved in setting up and operating industrial-gas delivery plants.

In addition to supplying reliable and mature products, Krytem also offers detailed advice on the shaping and planning of pumping plants as well as an extensive servicing and maintenance service.

Krytem pumps benefits:

- + High efficiency and low energy costs
- + High investment security due to a long service life and availability of spare parts for many years to come
- + Extensive guarantee for product and wearing parts
- + Low costs due to wear-and-tear:
main cold end service intervals of 1,500 hrs (intermittent)
or 4,000 hrs (continuous operation),
main crank drive service interval \geq 15,000 hrs.
- + Close-proximity-to-customer service:
 - Full project consultation
 - Staff training
 - Plant installation and commissioning
 - Servicing and maintenance service
 - Fast repairs and/or spare-part supplies



Krytem pump technology

Pump head

Low-boiling point liquids tend to form gas bubbles due to local evaporation caused by small differences in temperature and pressure. When conditions on the suction side are unfavourable, therefore, gas can enter the displacement chamber along with the liquid and reduce the degree of admission into the cylinder. This reduces also the effective discharge rate of the pump in comparison to geometric discharge volume. The collapse of the bubbles during the push stroke causes considerable noise and wear to the valves, piston and seals.

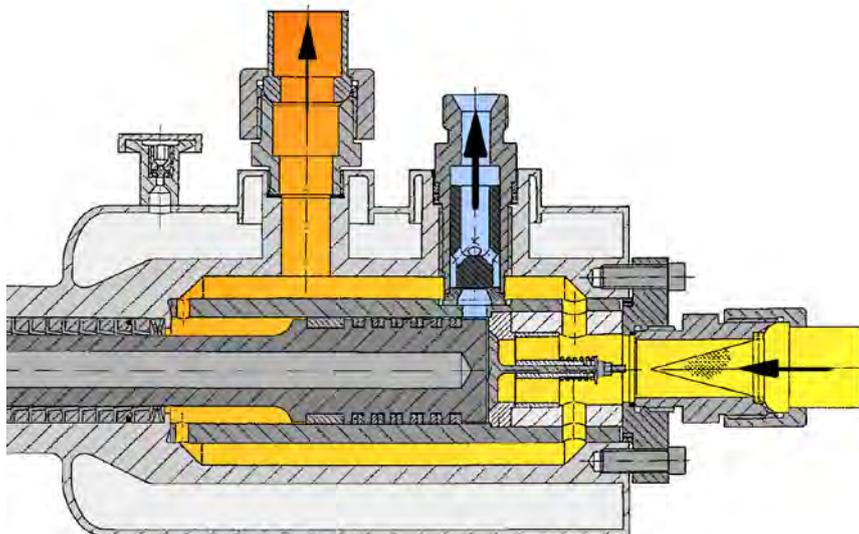
The Krytem pump head design minimises heat absorption and pressure loss of the medium flowing into the cylinder. Heated or evaporated medium is fed out of the pump head without entering the displacement chamber.

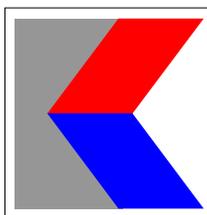
A vacuum mantle effectively isolates the cold pump components from the warmth of the environment. The cylinder is surrounded by the discharge medium to conduct away heat generated inside the pump by friction. The movement of the piston displaces the medium in the direction of discharge through the pressure valve and circulates the surrounding fluid at the same time.

Warmed medium can expand in the gas return feed and, in the case of a suitable tank installation, reach the tank under natural convection.

The piston rod seals consist of an active spring-loaded rod packing, which utilises the pressure of the gas-producing medium to increase its tightness. Heating the end of the packing on the side of the transmission makes it possible

for the pump to remain primed even for long periods of non-operation without leaks occurring due to ice forming on the piston rod or seals. The bright-chrome plated piston rod reduces friction and increases the working life of rod packing seal. An elastic gaiter made from PTFE protects the exposed end of the piston rod against contamination and moisture from the atmosphere.

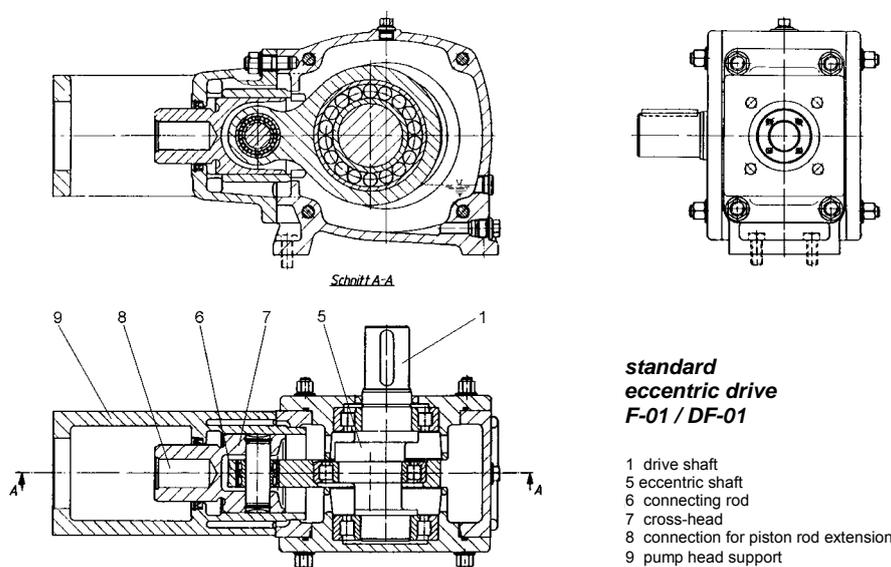




Drives

Eccentric transmissions, F and DF

Krytem pumps for high pressures and/or high discharge rates are driven by 45 mm stroke Type F or 60 mm stroke Type DF eccentric drive units via a V-belt or toothed-belt transmission and an electric motor. Pumps with 2 or 3 pump heads connected to coupled Type DF drive units are available for large discharge volumes.

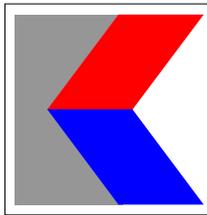


The standard V-belt transmission unit damps the hydraulic shock and pulsation pulses due to its elasticity thus protecting the electrical drive unit and - if applicable - the electronic control devices at the same time.

With high operating pressures large forces must be transmitted by the eccentric drive unit. Effective lubrication is necessary to achieve a reasonable service life. The spatial separation between the pump head and the oil-proof drive housing, due to an open space and the gaiter seal on the end of the rod packing, also facilitates the safe use of efficient standard hydrocarbon-based lubricants when delivering oxygen or other oxidising media.

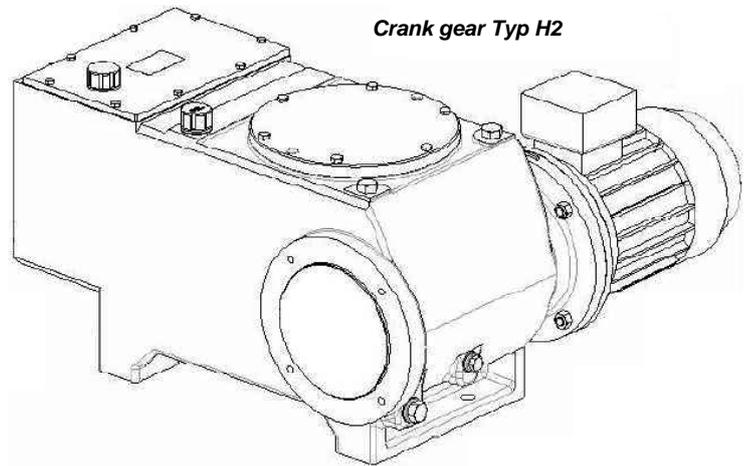
A shear coupling (fracture ring) protects the transmission from unacceptable loading due to situations such as those caused by the maximum pressure being exceeded or the pump head being blocked mechanically by foreign objects or ice

When using F or DF Type drives, the whole pump unit, including the motor, transmission, belt safety cover, eccentric drive, pump head and connection accessories is mounted on a weather-resistant galvanised steel frame.

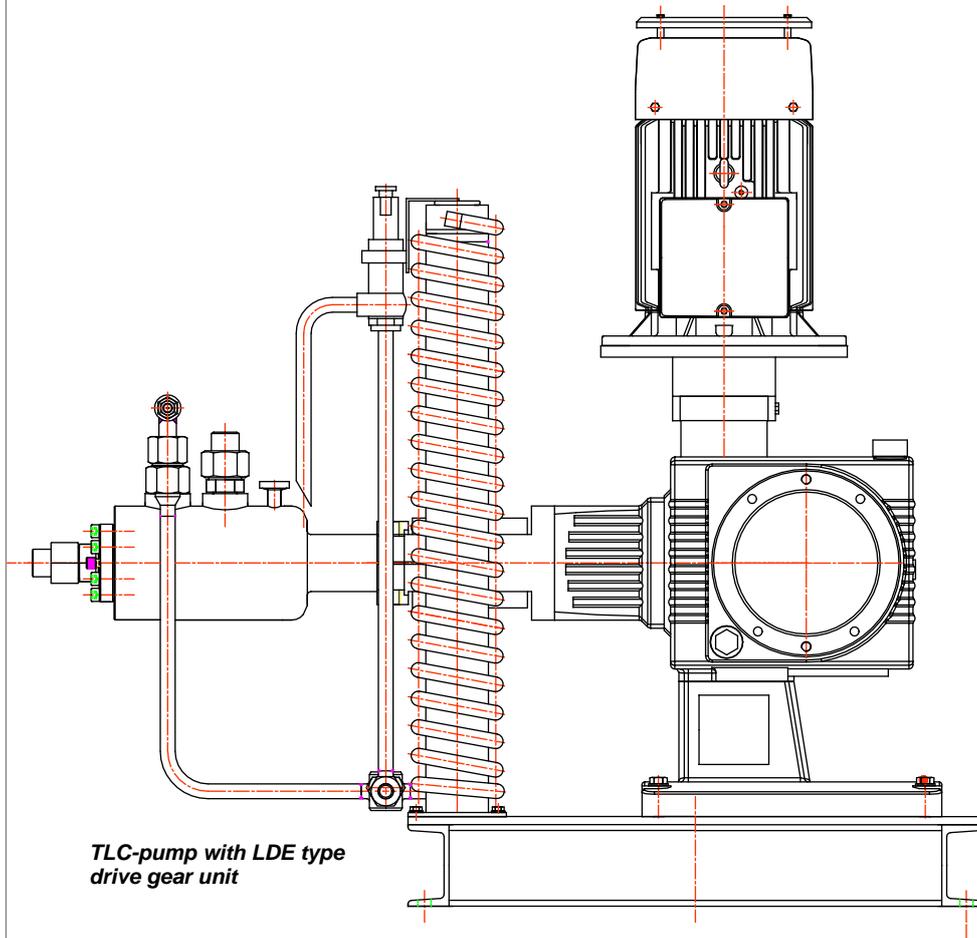


Short-stroke drive units H and LDE

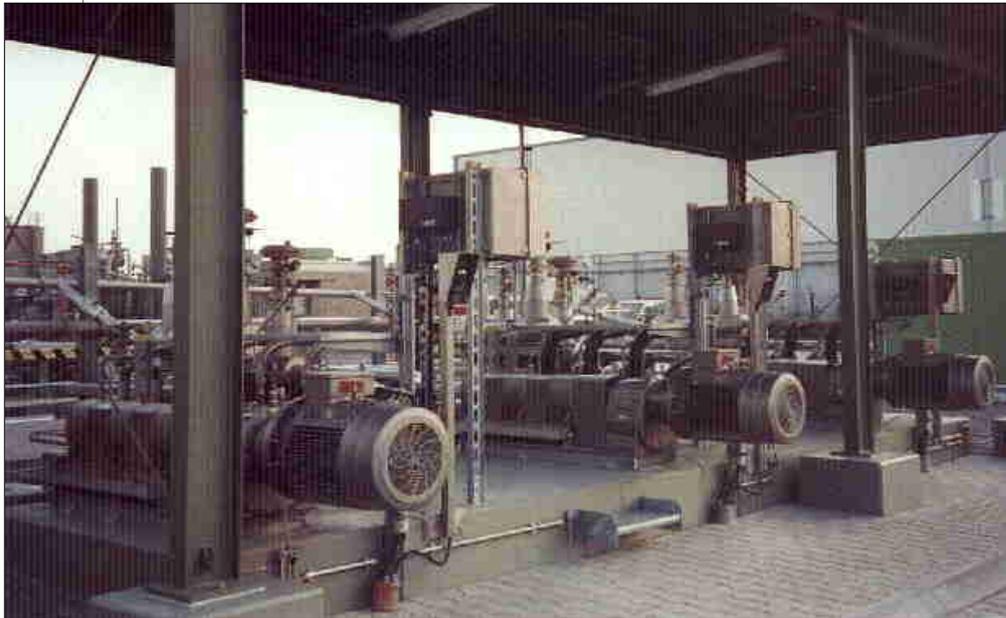
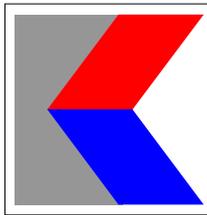
Types H and LDE 30 mm stroke eccentric drive units with integrated reduction gears are available for smaller discharge volumes and/or lower operating pressures. H2 transmissions are available with stroke adjustment 0 to 30 mm.



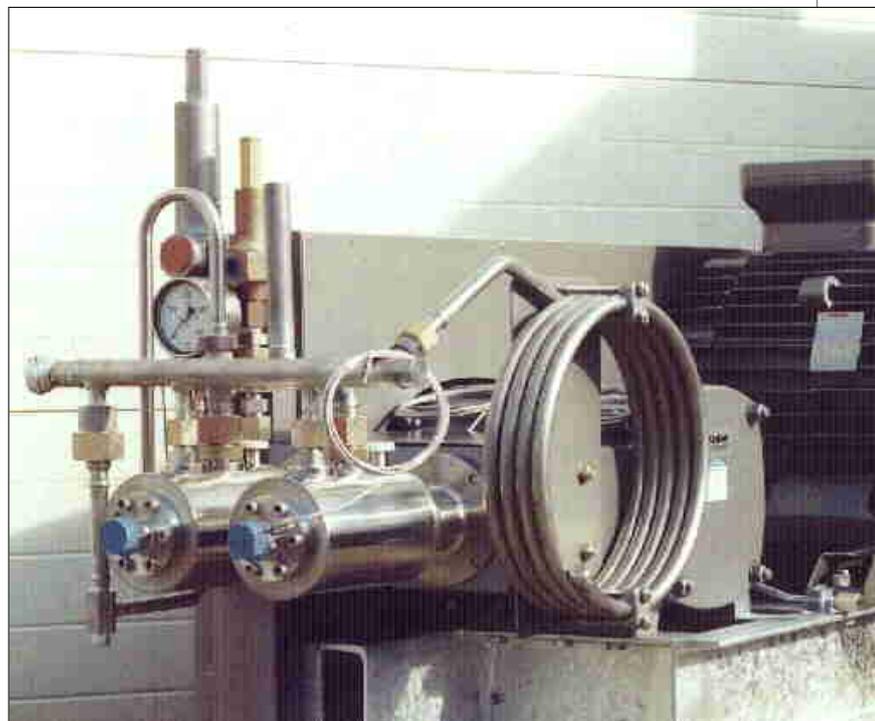
Crank gear Typ H2



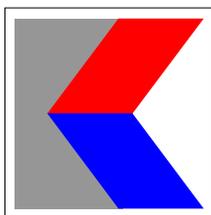
TLC-pump with LDE type drive gear unit



***Krytem high pressure pump plant;
capacity 250 l/min liquid nitrogen against 200 bar***



***Twin head TLC-pump, explosion proof construction for LNG;
capacity 3 to 25 l/min at 400 bar with frequency control***

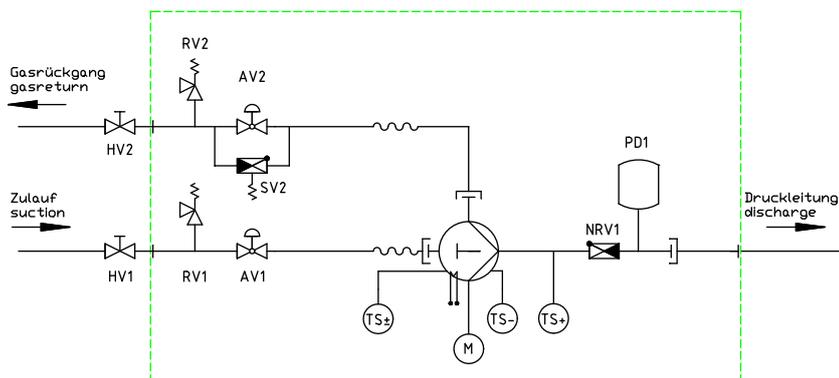


Pump control technology

The standard control unit includes an automatic starter for cold-running regulation via a temperature probe integrated in the pump head. This prevents the pump from starting above the permissible operating temperature. The pump-head temperature in the area of the packing is constantly monitored as a protection against the dispersion of cold resulting from unacceptable gaps and leaks. The medium discharge rate can be monitored by means of a flow sensor which must be installed on the pressure side.

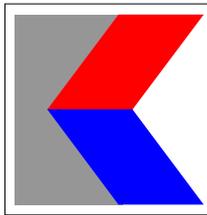
In addition to this, an ultimate pressure monitor, operation of an automatic valve in the suction pipe and gas-return feed and, if necessary, the control of a electric evaporator can all be integrated in the control unit.

Krytem pump units can be integrated into higher level automatic control circuits of large scale plants (e.g. automated process supplies of N₂ or O₂). However, part automation is usually the case via a Krytem control cabinet. Designs using dual speed motors (2 fixed discharge volumes) or stepless discharge-volume adjustment via speed control using a frequency converter are also available.



Pump accessories

- **Pulsation dampers** for all pressures (for reducing the feedback of pressure- and discharge-flow-pulsation to the pump unit)
- **Flexible connection hoses** for the gas return and feed line in non-insulated or vacuum insulated forms
- **High-pressure links** to take a flow meter and connect a pulsation damper
- **Flow monitors** for protection against dry running
- **End-pressure switches** for automated pressure-controlled pump operation
- **Automatic valves** in feed and gas return line
- **Safety, excess flow and high-pressure check valves**



Krytem supply conditions

Guarantee

The guarantee period for the pump unit - excluding items subject to wear - is 24 months from the date of despatch, at the max. 6000 operating hours.

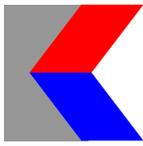
Service: Training - Servicing - Maintenance - Spares

For all pumps, Krytem offers a comprehensive Maintenance service. Beside servicing the pump head and overhaul based on individual orders, a service contract can be arranged for KRYTEM pumps requiring the pump head to be exchanged on site at regular intervals to be overhauled at our works. This will reduce down-times and maintenance to a minimum. Depending on load and application conditions the normal service interval is settled between 1,200 and 4,000 operating hours without further service requirements in the meantime.

Krytem offers comprehensive **personnel training** on pump maintenance and servicing for the customer's technical staff. In addition to this, the pump documentation contains detailed instructions on installation, commissioning, maintenance and servicing. All maintenance work can be carried out **without special tools**.

Layout and installation of low-temperature pumps

The operating and discharge problems of low-temperature piston-pump facilities can generally be avoided by thorough designing. For this reason, Krytem offers consultation with regard to specific **questions relating to the layout**. A **code of practice sheet** on the installation and layout of the pump plant can be obtained from our office.



Pump Data Sheet

Layout Questionnaire

Project ID

Customer / Project

(address, phone / fax)

responsible technician

project ID customer

project description:

deployment, site,

environmental conditions

Medium / Operation

capacity

min.

l/min

max.

l/min

high purity

discontinuous

capacity control

2-step (on / off)

3 step (step 1 / step 2 / off)

continuous (with frequency converter)

max. discharge pressure

bar(g)

test pressure

bar(g)

Tank (manufacturer / type)

design

vertical

horizontal

with thermosiphon

operation pressure

bar(g)

max. admissible pressure

bar(g)

minimal height of inner vessel above pump foundation

m

vertical distance between tank and pump (min. feed line length)

m

mean tank filling interval

days

Electrical supply

V -

Hz

Miscellaneous / Specialities

explosion protection zone

Accessories

control cabinet

high pressure connection with flow guard

pulsation damper

flexible connection hoses (feed / gas return line)

high pressure non return valve

automatic feed and gas return shut-off control (automated valves)

end pressure switch

high pressure safety valve

low pressure safety valve

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erstellt am / durch
12-11-12

bearbeitet am / durch
28-08-2018 / mi - R04

Dateiname
KRYTEM Cryogenic Recip Pumps R04