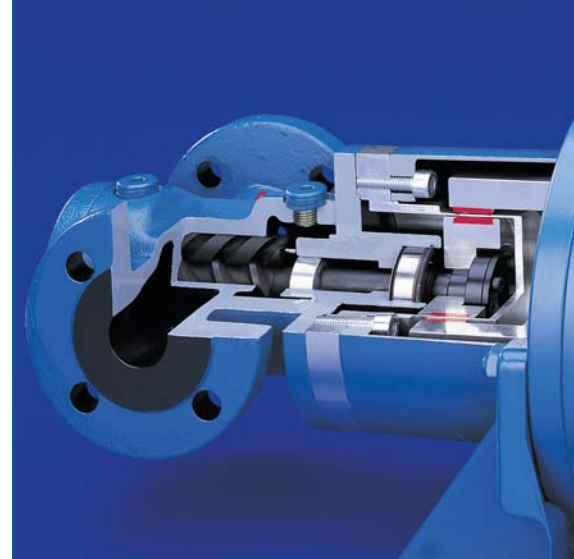
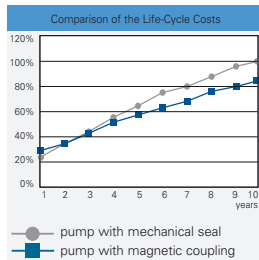


KRAL Pumps with Magnetic Coupling  
for Marine Applications



## No more problems with mechanical seals



### Reduced lifecycle costs

Spare parts and maintenance costs of mechanical seals increase lifecycle costs.

The use of high quality mechanical seals in KRAL screw pumps is the standard. Even when properly applied, mechanical seals are subject to wear. Spare parts and maintenance costs arise.

KRAL magnetic couplings are maintenance free. The cost premium of a pump with a magnetic coupling will be typically amortized after only three years of operation.

### Prevent pump failure

The residue of heavy fuel oil can cause a pump to fail.

To reduce friction, the faces of the mechanical seal rely upon the pumped fluid for lubrication. The pumped fluid comes in contact with the atmosphere as it moves across the sealing faces. When the pumped fluid is heavy fuel oil, it reacts with the oxygen in the atmosphere to form carbon deposits. These residual deposits build up in the connecting frame causing additional damages to the bearing. The damaged bearings run hot, and the elastomeric coupling may also melt. The pump then fails.

KRAL magnetic couplings are hermetically sealed. The fuel does not come into contact with the atmosphere and there is no build-up of residue.

## Comparing a magnetic coupling with a mechanical seal

	Magnetic coupling	Mechanical seal
Maintenance interval:	40,000 hours	10,000 hours
Temperature:	480 °F	265 °F
Easy to convert:	It is quick and easy to convert to KRAL pumps with magnetic couplings. In virtually all cases, the dimensions for the pipework and for installation are the same.	
Costs:	It takes a maximum of three years to amortize the additional costs for magnetic coupling.	



### Prevent pump damage due to incorrect startup

Running the pump dry will damage the mechanical seal and result in leakage.

Each mechanical seal needs positive lubrication. Venting and filling are an essential part of startup. If the system is not vented, the mechanical seal will quickly run dry and may start to leak.

KRAL magnetic couplings provide additional security if the pump is not started properly and help to avoid expensive lay-off periods.

### Greenship technology

Heavy fuel oil leakage increases the risk for accidents.

KRAL screw pumps with magnetic couplings are hermetically sealed. The magnetic couplings never leak. The site stays clean and safe.

KRAL pumps with magnetic couplings are an innovative contribution for companies going into 'Greenship technology'.



### Engine failure

If the booster module pumps fail, the diesel engines can cut out and the ship will be unable to maneuver.

Up until now, tanks have contained heavy fuel oil of 380 cSt, but a trend towards 500 cSt fuel is now common. These residual oils must be preheated to 360 °F instead of the previous 265 °F. The higher temperature is required to achieve the proper injection viscosity. These high temperatures will damage mechanical seals resulting in pump failure.

Magnetically coupled KRAL pumps can be used at temperatures of up to 480 °F.



### Guarantee on-board safety

SOLAS requires the piping to be jacketed. This sealing is compromised on pumps that have a mechanical seal.

The International Maritime Organization (IMO) published SOLAS, the International Convention for the Safety of Life at Sea. This specifies measures for fire and explosion protection. Jacketing is required for fuel lines.

With KRAL magnetic couplings, this additional sealing safety can also be transferred to the pumps. The sealing surface of the jacket round the pipes is fully enclosed between the pump flanges by the pump casing and the containment can of the magnetic coupling.



### Overload protection

If the operating limits are exceeded, the pump may become damaged.

Solid matter in the fuel can cause blockage in the pump. In many cases it is not worth repairing and the pump must be replaced. Damage to the pump is also possible if there is excessive overpressure. This is why pumps must have a relief valve. If the overpressure situation is not recognized, the relief valve and the pump may become damaged due to excessive heat.

The magnetic coupling can prevent subsequent damage. When the limits are exceeded, the motor decouples from driving the pump. The cause can then be eliminated and the pump restarted.



### KRAL – The marine specialists

KRAL provides a variety of solutions for marine applications:

- Magnetically coupled pumps for transfer and circulation pumps in the booster module.
- Pumps with mechanical seals as fuel and lubricating oil pumps in ships packages.
- Magnetically coupled pumps in KRAL stations for marine burners that also run on heavy fuel oil. In the burner, the magnetic coupling again has advantages with regard to temperature stability and the prevention of heavy fuel oil residues.
- Pumps for hydraulic applications, as for winches, for example.

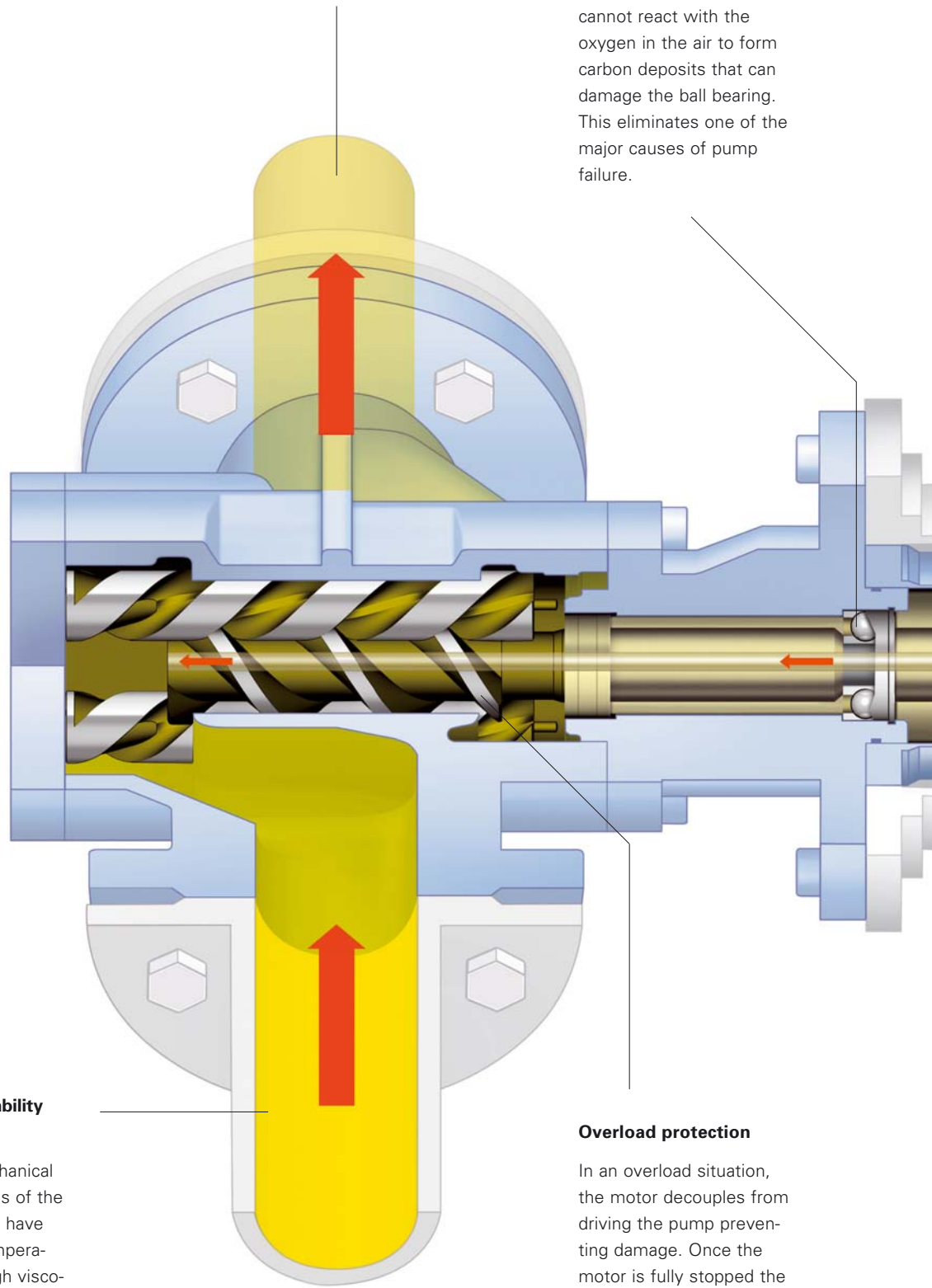
**Optimum safety and significantly reduced operating costs**

**High capacity rates**

KRAL pumps with magnetic couplings are available for flow rates up to 175 gpm.

**No fuel residue**

Because the magnetic coupling is sealed, the fuel does not come into contact with the atmosphere. The heavy fuel oil cannot react with the oxygen in the air to form carbon deposits that can damage the ball bearing. This eliminates one of the major causes of pump failure.



**Temperature capability to 480 °F**

Compared to mechanical seals, the materials of the magnetic coupling have far better high temperature capability. High viscosity heavy fuel oils that must be preheated to 360 °F can be pumped without risk.

**Overload protection**

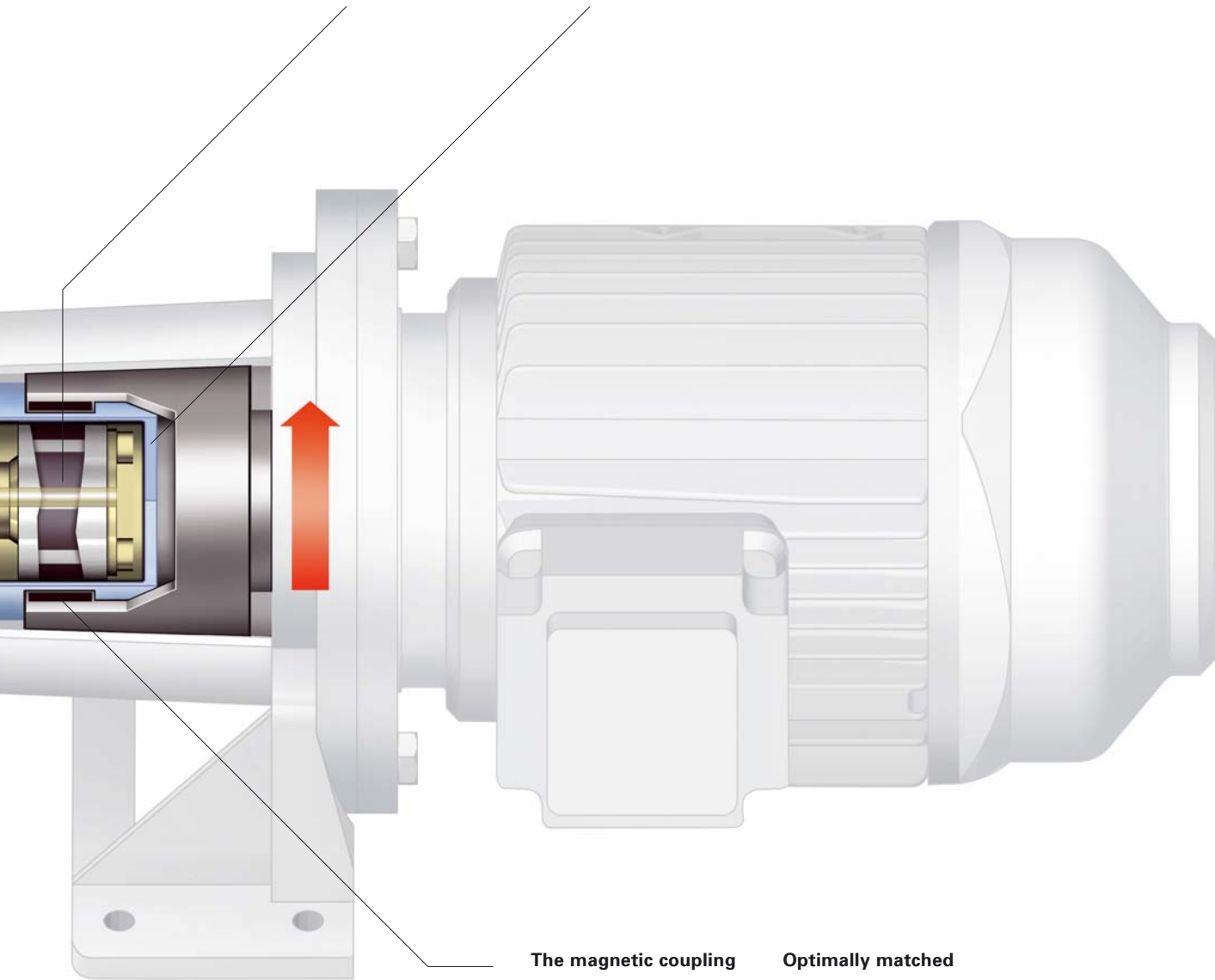
In an overload situation, the motor decouples from driving the pump preventing damage. Once the motor is fully stopped the magnetic coupling will synchronize and the pump can be restarted.

### Function

The rotation of the electric motor is transferred through the magnetic coupling to the pump spindles without contact. The electric motor and the pump shaft each have a rotor with several magnets. During operation, the two rotors run in synchronized rotation.

### Hermetically sealed

The containment can is the sealing element of the KRAL pump. It encapsulates the pump shaft and inner magnet hub. If, in the illustration, you cover the outer rotor on the shaft of the electric motor, the fully-encapsulated nature of the pump becomes apparent.



### The magnetic coupling has no wear

The magnetic coupling is a contact free component. The pump spindles are driven without contact by the magnets on the outer and inner rotor. As there is no friction, there is no wear.

### Optimally matched design

KRAL has been making magnetically coupled pumps for many years. We manufacture the components to our design standards. This means that the magnetic coupling perfectly matches the requirements of the KRAL screw pump.

### Advantages

Compared to other types of pump, KRAL screw spindle pumps provide fast delivery rates in restricted spaces. Delivery is low in pulsation and quiet.



## Protect life on-board ship – eliminate the risk of fire

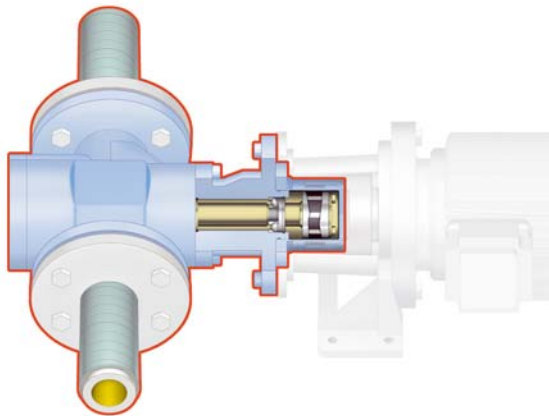
To comply with the provisions of SOLAS, fuel lines must be jacketed. This precaution prevents the escape of flammable and combustible liquids.

Pumps are not required to be jacketed. Despite compliance with the SOLAS safety regulations, there still exists a fire risk.

### Magnetic couplings provide optimum safety

To close the safety gap, KRAL recommends pumps with magnetic couplings. The containment can of the magnetic coupling is a totally secure barrier:

- Fuel cannot escape, as the pump is leak free.
- The fire risk is effectively reduced.



### Advantage:

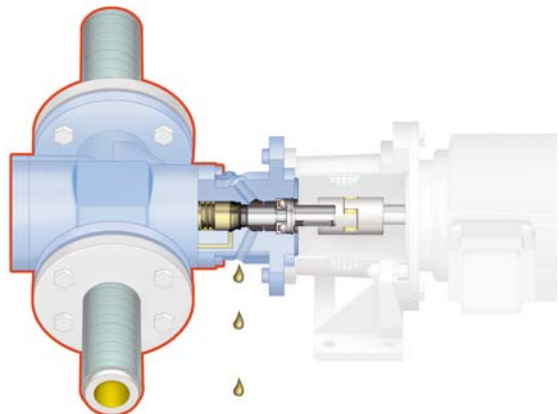
The containment can of the magnetic coupling effectively closes the sealing line between the pipelines.

### SOLAS, Part A, Regulation 15

The International Convention for the Safety of Life at Sea, known as SOLAS, describes the precautionary measures to be required to prevent fire and explosion. The important points for the pump environment are Nos. 9 and 10.

**9.** "All external high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A jacketed pipe incorporates an outer pipe into which the high-pressure fuel line is placed, forming a permanent assembly. The jacketed piping system shall include a means for collection of leakages and arrangements shall be provided for an alarm to be given of a fuel line failure."

**10.** "All surfaces with temperatures above 430 °F which may be impinged as a result of a fuel system failure shall be properly insulated."



### Disadvantage:

The nominal leakage of the mechanical seal interrupts the sealing line.

## Easy conversion to magnetically coupled pumps

To assure ease in the conversion from KRAL pumps with a mechanical seal to KRAL pumps with a magnetic coupling, KRAL provides conversion kits that maintain the dimension of the pedestal mounting and piping connection. There are however 2 factors that could require mounting modification for magnetically coupled pumps:

- A new KRAL flange to take a VDMA connecting frame.
- A larger electric motor to compensate for the power dissipation of the magnetic coupling may be required.

All KRAL conversion kits are supplied pre-assembled. The variations are shown in the illustrations on the right.

### All inclusive

#### Mounting of pump unit

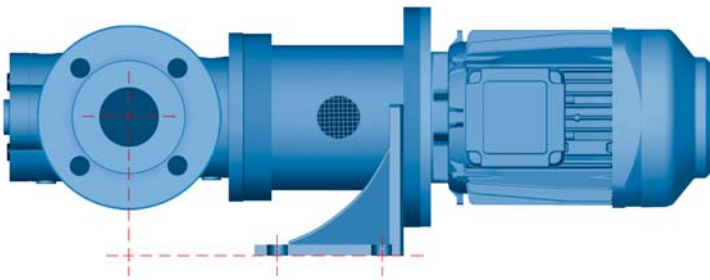
The appropriate pedestal is fitted to the pump.

#### Dimension specification tables

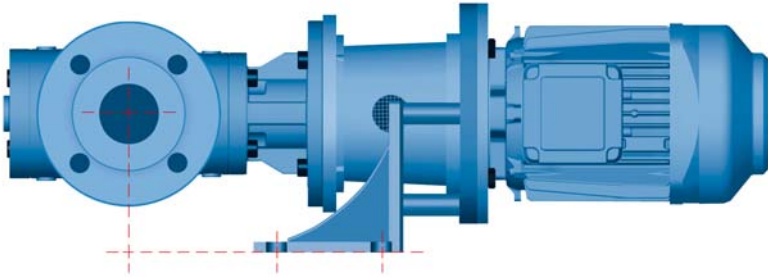
Are included in the conversion package.

#### 2-D and 3-D CAD data

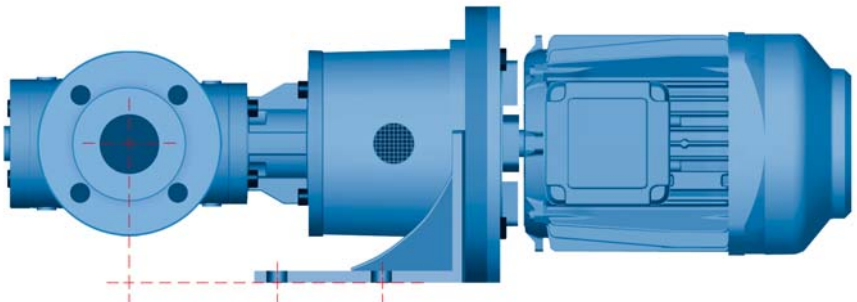
Integrate the new pump unit into your system drawing. This is available on CD at your request.



**Initial situation:** Current KRAL pump with mechanical seal.



**Conversion situation 1:** The electric motor is unchanged: the same output and size. The KRAL flange to take the VDMA connecting frame makes the unit a bit longer. The pump pedestal is the same as it was for the pump with a mechanical seal. The pipe connection dimension is the same. The change in length is compensated for by adapter sleeves, so that the pedestal mounting dimension is retained.



**Conversion situation 2:** The next larger size electric motor is required. KRAL makes and fits a special pedestal to allow the pedestal mounting dimension and the piping connection dimension to be retained. Adapter sleeves are not required for this situation.

## KRAL pumps with magnetic couplings for marine applications



Technical data	Delivery rate	Pressure	Temperature
Series			
<b>K</b>	175 gpm	230 psi	480 °F
<b>M</b>	106 gpm	580 psi	480 °F
<b>C</b>	175 gpm	1450 psi	480 °F

Application	Transfer pumps	Circulation pumps	Marine burners
<b>K</b>	•	•	•
<b>M</b>		•	•
<b>C</b>		•	•

Product brochures available upon request.



## KRAL pumps with magnetic couplings in practical use

### Manufacturers of booster modules



Medium: heavy fuel oil (HFO).  
Delivery rate: Up to 175 gpm.  
Pressure: Up to 230 psi.  
Temperature: Up to 360 °F.  
Viscosity: 3 to 760 cSt.

HFO must be preheated to 265 °F for combustion. Current pumps are therefore specified for 300 °F. Manufacturers of booster modules are now requiring higher temperatures. The reason for this is the higher-viscosity HFO made from residual oils, which also contain abrasive silicates that may damage the mechanical seals.

KRAL pumps with magnetic couplings work at temperatures of up to 480 °F without difficulty and are not sensitive to the abrasive materials.

### Ship-owners



When the fuel supply fails, ships can be rendered incapable of maneuvering. This situation can threaten the ship-owners' image and potentially threaten their very existence. This is the reason why a major European ship-owner has begun a replacement program. Pumps with mechanical seals have been replaced with KRAL pumps with magnetic couplings.

KRAL pumps with magnetic couplings are now the standard for any new constructions: Greater reliability and reduced maintenance costs are the result. Ship-owners who are particular in demanding high quality and economic efficiency, do not leave the choice of pump to the shipyard. They set the standards themselves.

### Ship suppliers



Screw pumps for the in-board package:

- Feed pumps
- Circulation pumps
- Booster pumps

KRAL has excellent partnership relationships with the most important ship suppliers in Germany and Norway.

Complete pump programs, price/performance ratios, quality, application know-how and in particular meeting deadlines are important criteria for ship suppliers. If a supplier is late with a delivery, the package supplier must provide preliminary finance for the component suppliers. KRAL customers are always writing to confirm that compared to their rivals, KRAL is astonishingly good at keeping to on time deliveries.

### Joint projects



Our business partners are particularly appreciative of their cooperative collaboration with KRAL. From best-possible support to the successful conclusion of the project, friendly business relations are always the order of the day. We take the time to talk to our customers and collaborate closely with them on technical matters. You can rely on KRAL.



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You cannot afford  
to miss this!



Guaranteed Leak Tight for Life\*, and  
one Test Pump for Free\*\*.



Clean and safe, thanks to KRAL pumps with magnetic couplings.

**The magnetic coupling stays leak tight, for life.**

Unlike mechanical seals, magnetic couplings are hermetically sealed. In our pump upgrade project for magnetically coupled pumps, we guarantee leak free operation for life. \*Full details are outlined in our warranty certificate.

**Pump upgrade.**

No matter who manufactured your pumps – replace them by KRAL pumps with magnetic couplings. With KRAL magnetic coupling pumps, fuel leakage and fuel pump failures are a thing of the past. \*\*As a special incentive, for a limited time period

we offer you – without obligation – the use of a KRAL pump with a magnetic coupling for 12-months FREE to install in your booster module.

After the 12-month test, you can either return the pump to us or purchase it at our special trial offer rate. Conditions do apply.

This offer is not to be missed!

**Contact - see back side or visit [www.kral.at](http://www.kral.at) or [www.kral-usa.com](http://www.kral-usa.com)**





## You Wish to use all Advantages of the KRAL Pump Upgrade Project?

Contact us.

Tel.: (704) 814 - 6164

[www.kral-usa.com](http://www.kral-usa.com)

Or use this **contact form**.

You will be contacted by our staff soon.

Company:	
Prefix:	Herr <input type="checkbox"/> Frau <input type="checkbox"/>
Title:	
First / last name:	
Address:	
ZIP, City:	
Country:	
Tel:	
Fax:	
e-mail:	

When can we reach you best?

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**Fax to: (704) 814 - 6165**