KRAL Pump Stations.
Series DKC/DMC. The New Generation.

KRAL

KRAL pump stations have been tried and tested for 40 years. We have now upgraded them, resulting in a completely new generation of dual stations.

Maximum operational reliability with a standby pump.

There are critical applications in which a second pump is prescribed for security. Typical examples are booster modules of ocean-going ships, and burner stations in marine and industrial applications.

Maximum reliability is required. The most common operating mode is therefore, that one pump is running and the other is switched off (standby). In the case of a ship, the failure of the fuel pump in the booster module means that the engine comes to a standstill. If the flame goes out in a burner, a production process will be interrupted or a heating system will fail. Such applications require security. For maintenance, the primary pump can be switched to the standby pump, without interruption.

Cost reduction through many functions in compact space.

If a second pump is necessary, it soon becomes clear that the cost of design, pipework and control is considerable. The space requirement for a structure involving individual components is also very large.

A significantly more economical solution is represented by the completely newly developed DKC and DMC dual stations by KRAL. Two pumps of the KFT series (up to 16 bar) or MF series (up to 40 bar) are fitted to one block. The block integrates all functions within minimum space, and is available with many further options.

Operation, materials, accessories.

Flow rate DKC:	5 to 284 l/min.
Flow rate DMC:	5 to 137 l/min.
Max. discharge pressure	DKC: 16 bar.
Max. discharge pressure	DMC: 40 bar.
Temperature range:	-20 °C to 180 °C. Magnetic coupling to 250 °C.
Casing:	EN-GJS-400-15.
Accepted by:	ABS, BV, CCS, DNV, GL, LRS, RS, NK, RINA.
ATEX:	Group II, category 2 Ex II 2 GD b/c.
Heating:	Electrical or fluid heating system.

Light and heavy fuel oil operation.

For alternate operation with two liquids, the operator does not need to do expensive pipework.

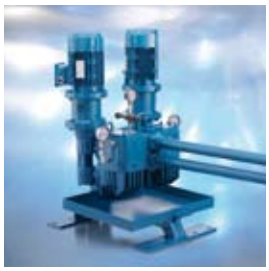
As an option, a liquid changeover switch can be fitted. In this way, KRAL dual stations are connected to two pipeline systems with different liquids.

Switching between the liquids is manual, electrical or pneumatic. For remote monitoring of the lever position, limit switches are available.

Service without stopping the pump.

Reliability through a standby pump which is always available, is the basic idea of the dual station. In this way, maximum reliability is ensured.

After the changeover, the switched-off port of the station block is depressurized and the pump can easily be removed. The ship's engine continues to run, the production process is not interrupted, the heating system continues to operate.



Extremely easy installation.

KRAL dual stations are quickly set up and fixed. In the simplest case, the suction and pressure lines have to be connected. Done! In the case of systems with two different liquids, there are two pipelines. The connections for the suction and pressure sides are at the front, so they are easy to reach.

In contrast to the traditional structure involving two individual pumps, apart from connecting the suction and pressure lines, no development, design or pipework is required. That saves a lot of time and money.

Compact, space-saving design.

The design of the new dual stations reduces the space requirement for all applications with two pumps considerably. Nothing remains as it was in the previous model. Implementing new ideas and new technological possibilities, KRAL has completely redesigned the station block and the components. Its compactness has reached the limit of what is technically feasible.

Highest flow rates on demand.

The dual stations of the DKC and DMC series are eminently suitable for simultaneous operation of two KRAL pumps of the MF or KFT series. By parallel operation of both pumps, the flow rate can be doubled.

From the Single Pump to the KRAL Dual Station

With two pumps, more than twice the benefits.

Tried and tested single pumps.

Compared with other pump types, KRAL screw pumps provide high pumping capacity while needing little space. This applies in particular in the case of high differential pressure. The pumps are self-priming, pump with low pulsation, and can be well controlled.

The KRAL screw pump series K is universally functional. It is also eminently suitable for heavy fuel oil. The KRAL medium pressure pump of the M series is a pump which has been tried and tested for many years in industrial applications, in particular as a burner pump.

From the single pump to the dual station.

KRAL dual station blocks accommodate tried and proven KRAL pumps of the KFT and MF series with top flange. With just few steps, a pump is quickly and easily fitted to or removed from the station block.

Changeover - The basic idea of the dual station.

The primary purpose of the dual station is that whenever a pump fails, it is possible to switch immediately to a reserve pump.

Non-return valves ensure that the stopped pump does not turn in reverse.

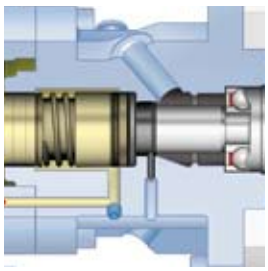
The switched-off pump is disconnected from the operating part of the station block. In the switched-off part of the station block, no liquid is conveyed and no pressure is built up. It is therefore possible to work on the switched-off part of the station and on the switched-off pump, without any risk.

Many functions within minimum space.

The new KRAL dual stations have been designed to be highly modular. Many useful options are available:

- ☐ Heating variants for heating highly viscous liquids.
- ☐ Two-way valve for switching between liquids.
- ☐ Pressure-retaining valve for constant feed pressure.
- ☐ Pressure switch for monitoring pressure.
- ☐ Differential pressure display for monitoring the loading of the strainer.
- ☐ Temperature measurement of the liquid.
- ☐ Monitoring leaked oil.
- ☐ Strainer cover protection to prevent accidents caused by oil being sprayed out.

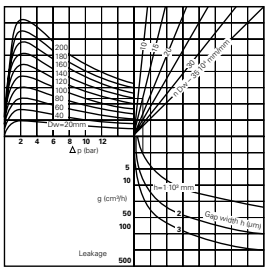
The new KRAL pump stations, now with magnetic coupling.



Mechanical seal for heavy fuel oil.

KRAL stations of the DKC and DMC series provide many sealing options.

In heavy fuel oil operation, KRAL uses hard material mechanical seals made of SiC. These seals have been used successfully for many years. However, despite optimum quality, with mechanical seals there is always the risk of increased leakage.



Specified, functional leakage in mechanical seals.

The surfaces of the mechanical seal's stationary and rotating rings must be lubricated. This is done by the pumped liquid.

Manufacturers of mechanical seals prescribe the liquid flow and thus the specified leakage for functionally appropriate operation of the mechanical seal. Proper design of the pump includes specifying this specified leakage correctly. In normal operation, specified leakage is only a few cm^3/h. This amount usually evaporates without residues, and is hardly noticeable.

Heavy fuel oil residues.

In the refining process, residues of the crude oil always remain. HFO is obtained from these residues. The price of HFO is lower than the crude oil price. The refinery process is therefore optimized for distillates. The higher the requirement for expensive distillates, the worse is the quality of cheap HFO.

Low-quality HFO usually has a high proportion of abrasive components. This may damage the mechanical seal, causing leakage far above the specified leakage. The residues which collect also damage other components such as the ball bearing and the coupling. The result is total failure of the fuel pump.

A mechanical seal of the best materials remains a critical element.

Hermetically sealed magnetic couplings.

The possibilities for improving a mechanical seal are limited. The only possibility for radical improvement of HFO-compatibility is a complete replacement of the mechanical seal by a different technology. As an alternative which has been tried and tested in practice, KRAL provides pumps with magnetic coupling. KRAL pumps with magnetic coupling are hermetically sealed and suitable for temperatures well above 250 °C.

On the new generation of KRAL dual stations, KRAL pumps with magnetic coupling can be fitted without additional cost. In this way, all the benefits of KRAL's magnetic coupling can be used in the dual stations.

Innovative, Compact Pump Stations

Heating system.

Electrical or fluid heating system for preheating highly viscous liquids.

Reversing valve.

Is used to switch to the reserve pump.

Safety valves.

To prevent unacceptably high internal pressure being caused by thermal expansion when the pump is heated, there are two small safety valves in the cylinder of the changeover valve.

Constant feed pressure.

The pressure-retaining valve ensures constant feed pressure even if the demand for liquid varies.

Different liquids.

The two-way valve is used to switch between two liquids.

Extremely easy connection.

Via the suction connection and pressure flange, which are easily accessible, the pipelines are connected to the front.

Temperature measurement.

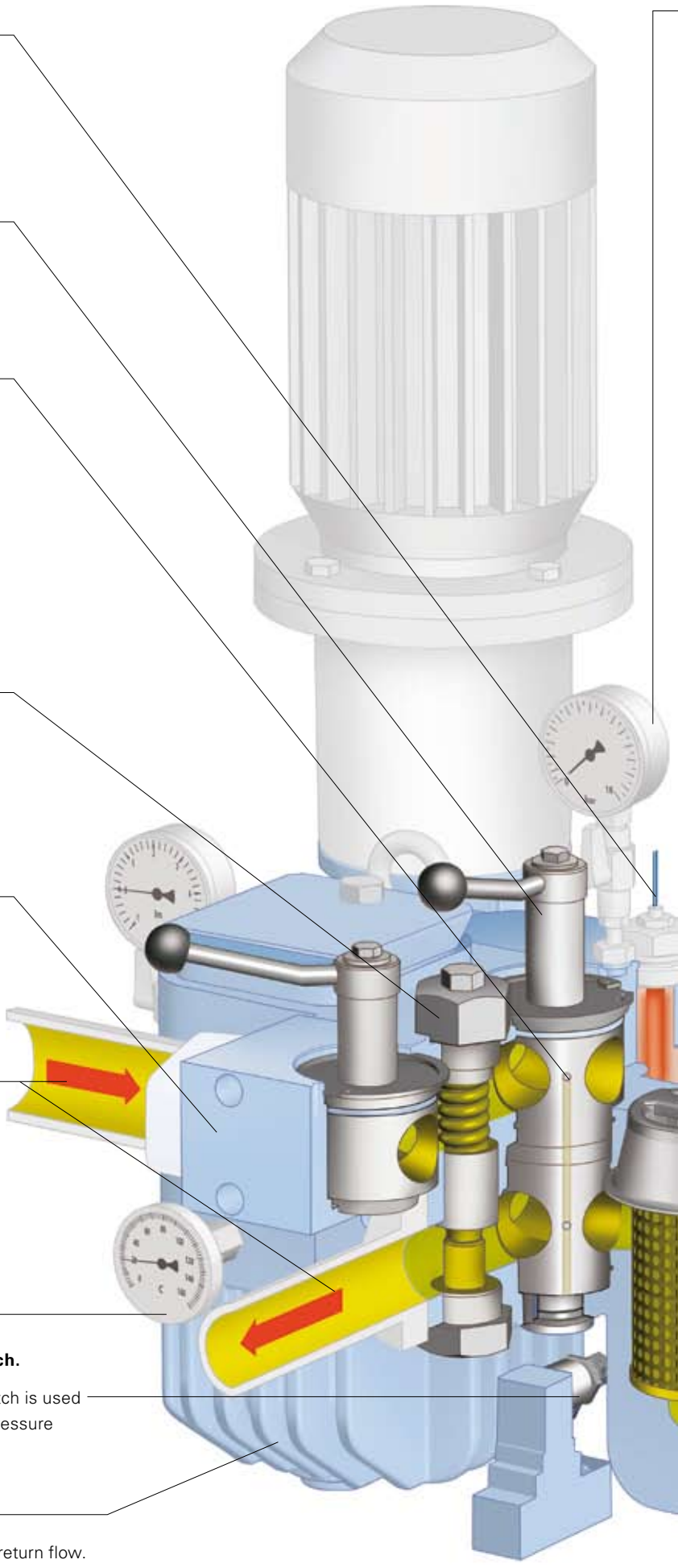
For monitoring the temperature of the pumped medium, two thermometers are optionally supplied.

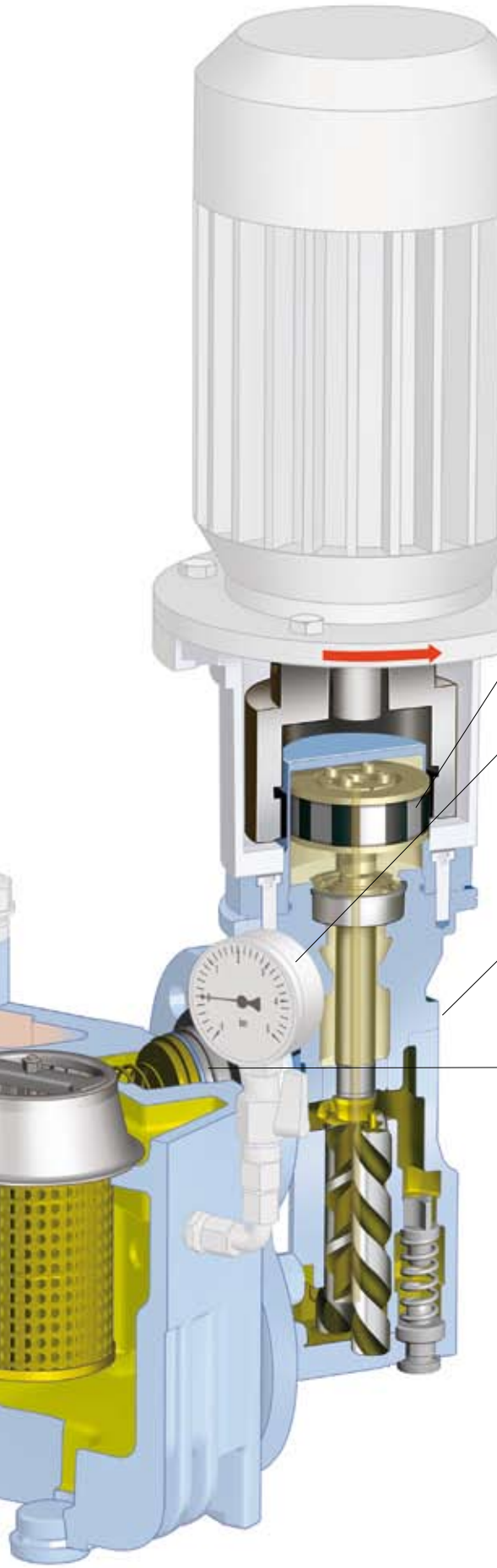
Pressure switch.

A pressure switch is used for additional pressure monitoring.

Cooling fins.

For cooling the return flow.





Permanent pressure monitoring.

For monitoring the feed pressure, a manometer is fitted centrally in the station.

Sealing variants.

For the shaft seal, many seal options are available. The hermetically sealed magnetic coupling provides particularly high reliability.

Monitoring the loading of the filter.

The suction-side manometer is used for monitoring the build up on the filter.

Pump variants.

The dual stations can be fitted with KRAL screw pumps of the KFT series (up to 16 bar) or MF series (up to 40 bar).

Non-return valve.

When the pump has been switched off, no liquid flows back into the pump.

Monitoring leaked oil.

A leaked oil monitoring device can be supplied for fitting in an oil sump.

Precise flow measurement.

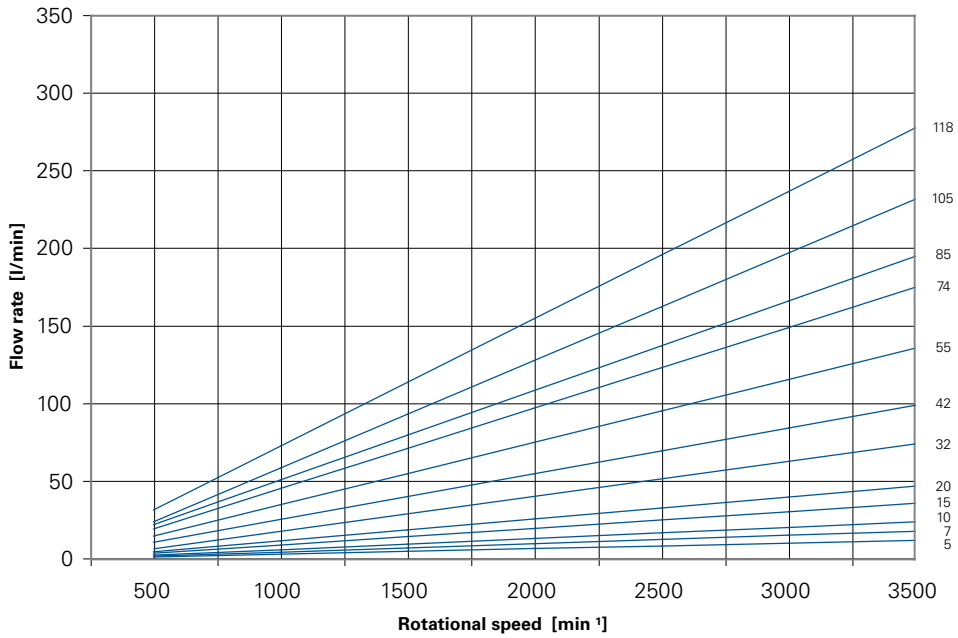
A flow meter can be optionally fitted. KRAL Volumeter make precise measurement of the flow rate possible.

Differential pressure monitoring.

For monitoring, an optical scale or an electrical differential pressure monitoring with signal can be used.

Finely graduated sizes and a linear flow rate characteristic which can be finely regulated.

Size of KFT from 5 to 118.
(0 bar, 75 mm²/s)



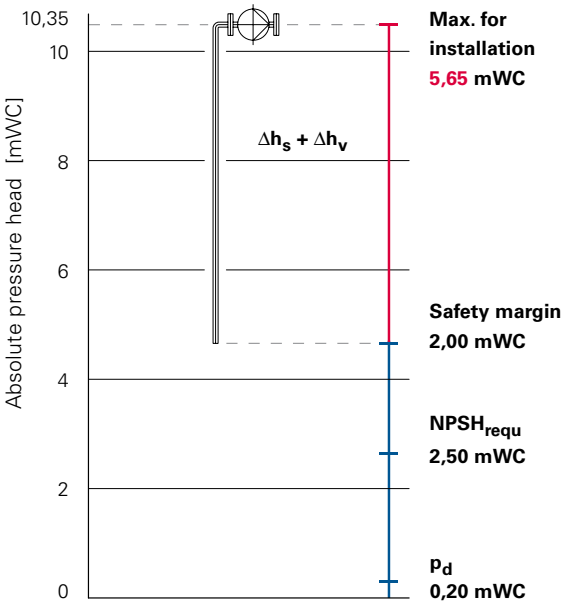
KRAL screw pumps are self-priming.

The NPSH (net positive suction head) value indicates by how much the total pressure head at the pump inlet must be above the vapor pressure head p_d of the liquid to avoid cavitation. The available absolute pressure head is reduced by the suction height Δh_s, the pipe loss Δh_v and a safety margin of 2 mWC.

Example: On a ship, how far above the tank can the HFO 380 heavy fuel oil pump KFT55 be installed?

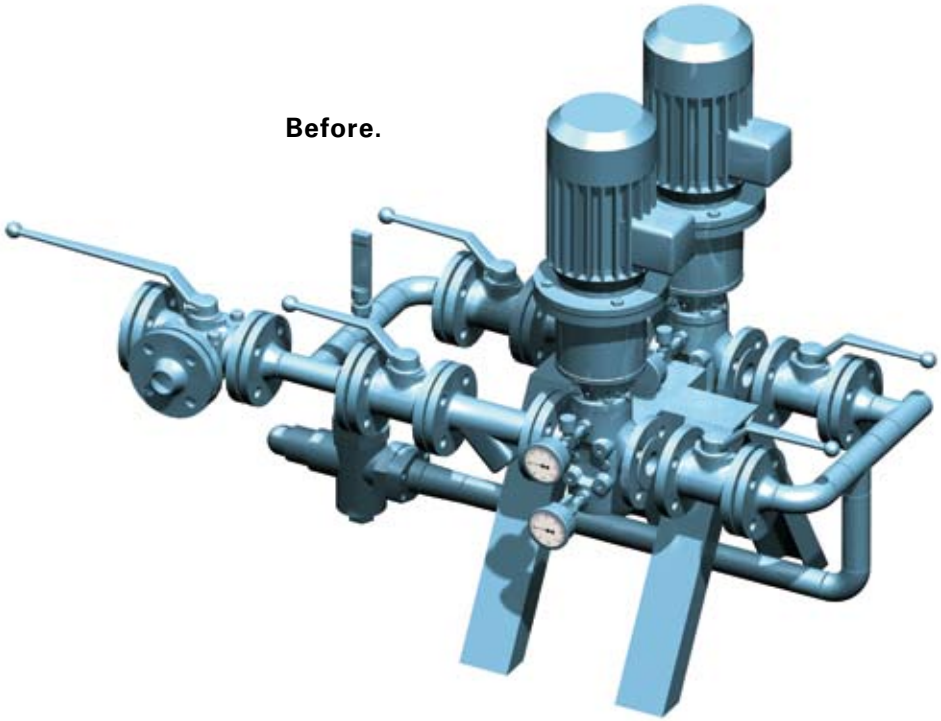
Solution: At the rated rotational speed of 1.450 min^{-1}, the KFT55 at 380 mm²/s has an $NPSH_{requ}$ value of 2,5 mWC.

With the vapor pressure head p_d and the security margin at an atmospheric pressure of 1.013 mbar (10,35 mWC), the diagram on the right gives the installation height of 5,65 mWC.



Less space required. More functions. Lower costs.

Before.



New!

Conventional structure.

Our customers are innovative companies, which are constantly improving their systems. The benefit to customers and the functions of the systems are always growing. Historically, the result is a complex module structure involving individual components. Modules of individual components take up at lot of space and are expensive.

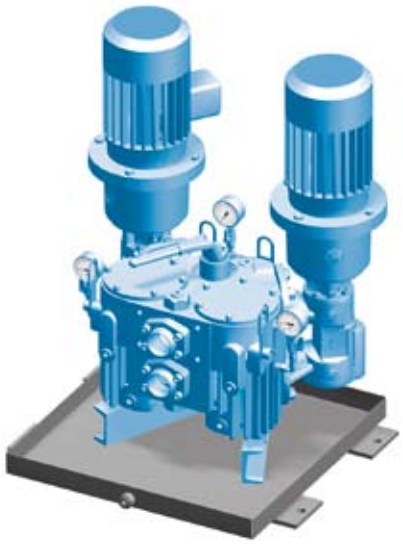
After years of development in small steps, the time will come when it is advisable to redesign the module. With its skills in building modules and systems, KRAL can make vital contributions here. KRAL AG develops and builds compact modules. Customer-specific modules are among KRAL's strengths.

The new dual station compared for size.

The new DKC und DMC dual stations are an impressive example of KRAL's competence in building modules. The illustrations above show the situation of a structure involving individual components, compared with the new compact station. All the functions and pipework are now implemented in one compact station block. More than 50% of space is saved. There are more functions, and the total cost is significantly lower.

Various forms of KRAL pump stations make numerous styles of installation possible.

Mounting foot with oil sump.
The small DKC 4 to 42 and DMC 5 to 54 blocks are mounted at the rear of the oil sump on a support. Being suspended eases the draining of the station and the cleaning of the oil sump.



Mounting foot with oil sump.
The large DKC block with pump sizes 55 to 118 is mounted on the oil sump. This form of mounting ensures the necessary stability for the higher weight.

Heating integrated.
For high viscous media, an electrical or fluid heating system is used to preheat the block.

Thermometers and differential pressure display.
The temperature of the pumped medium is monitored using two thermometers. The differential pressure display is used for monitoring the loading on the strainer.

Manual liquid changeover.
Changeover between two liquids, usually light and heavy fuel oil (MDO, HFO) is via a 3/2-way valve. In the standard form, changeover is done manually.

Electrical or pneumatic liquid changeover.
Optionally, liquid changeover is done electrically or pneumatically. The lever position can be monitored. Note: the illustration shows electrical changeover as an example.

Strainer cover protection.
The vent screws prevent liquids being sprayed out when the strainer covers are opened, and help to avoid accidents.

KRAL Volumeter®.
A KRAL precision flowmeter is fitted for highly precise flow measurement. KRAL Volumeter, like KRAL pumps, are another product by KRAL AG.

Technical Data, Dimensions and Weights

Technical data DKC. At 0 bar, 75 mm²/s.		**240 - 2400 (KFT 5 - KFT 20)**	**1600 - 5000 (KFT 32 -KFT 42)**	**3000 - 9000 (KFT 55 - KFT 85)**	**5500 - 13000 (KFT 105 - KFT 118)**
Q_{th} (1.450 min^{-1}, 50 Hz)	l/min	5 - 20	32 - 42	58 - 83	100 - 118
Q_{th} (1.750 min^{-1}, 60 Hz)	l/min	6 - 25	38 - 52	70 - 101	121 - 144
Q_{th} (2.900 min^{-1}, 50 Hz)	l/min	10 - 41	64 - 86	117 - 167	200 - 238
Q_{th} (3.460 min^{-1}, 60 Hz)	l/min	12 - 49	76 - 102	139 - 199	240 - 284
Max. press. pressure flange	bar	16	16	16	16
Temperature	°C				
with NBR radial sealing ring		80	80	80	80
with FKM radial sealing ring		150	150	150	150
with standard mechanical seal		150	150	150	150
with hard material mechanical seal		180	180	180	180
with magnetic coupling		250	250	250	250
Viscosity	mm²/s				
min.		2	2	2	2
max.		100.000	100.000	100.000	100.000
Max. pressure suction flange	bar				
with radial sealing ring		6	6	6	6
with standard mechanical seal		6	6	6	6
with hard material mechanical seal		6	6	6	6
with magnetic coupling		16	16	16	16

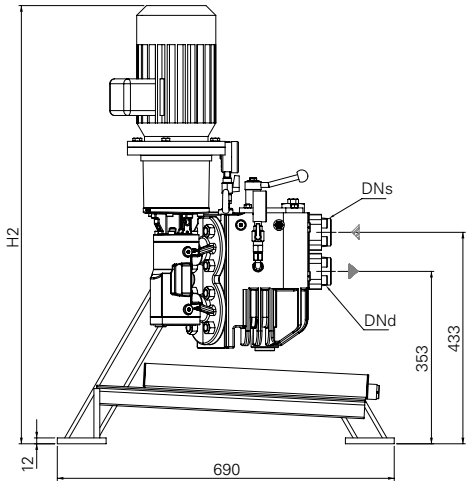
Capacities are valid for the operation of one pump.

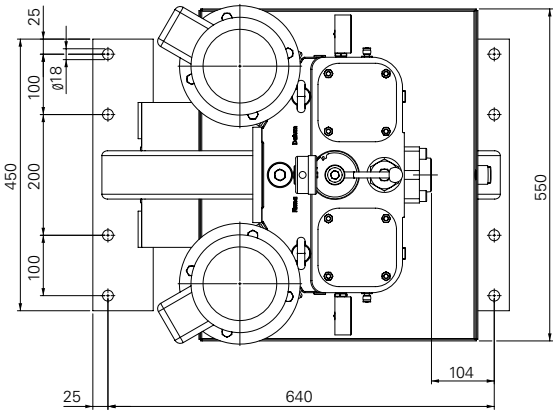
Dimensions and weights DKC.	**DNs / DNd**	**H2**	**kg**
Size			
240 - 2400	SAE 1 1/2" 3.000 PSI	906	170
1600 - 5000		965	215
3000 - 9000	SAE 2" 3.000 PSI	1.182	475
5500 - 13000		1.182	475

Technical data DMC. At 0 bar, 75 mm²/s.		**240 - 1200 (M 5 - M 10)**	**800 - 6500 (M 15 - M 54)**
Q_{th} (1.450 min^{-1}, 50 Hz)	l/min	5 - 10	15 - 57
Q_{th} (1.750 min^{-1}, 60 Hz)	l/min	6 - 13	18 - 69
Q_{th} (2.900 min^{-1}, 50 Hz)	l/min	10 - 21	31 - 115
Q_{th} (3.460 min^{-1}, 60 Hz)	l/min	12 - 25	37 - 137
Max. press. pressure flange	bar	40	40
Temperature	°C		
with NBR radial sealing ring		80	80
with FKM radial sealing ring		150	150
with standard mechanical seal		150	150
with hard material mechanical seal		180	180
with magnetic coupling		250	250
Viscosity	mm²/s		
min.		2	2
max.		100.000	100.000
Max. pressure suction flange	bar		
with radial sealing ring		6	6
with standard mechanical seal		6	6
with hard material mechanical seal		6	6
with magnetic coupling		6	6

Capacities are valid for the operation of one pump.

Dimensions and weights DMC.	**DNs / DNd**	**H2**	**kg**
Size			
240 - 1200	SAE 1 1/2" 3.000 PSI	900	165
800 - 6500		1.026	240





References from practical applications.

Photo: GEA Group AG.

Booster modules in the ship's engine room.

Pump stations:
DKC 240 to 13000.
Medium: HFO.
Flow rate: up to 7.500 l/h.
Pressure: 5 bar.
Temperature: 70 to 85 °C.
Viscosity: 2 to 1.000 mm²/s.
Volumeter installed:
OMA 32.
Seal: hard material mechanical seal or magnetic coupling.

Our customer is a leading manufacturer of high-quality separators and booster modules. These systems are part of the fuel treatment system in large diesel engines for ship propulsion or for power generation.

Separators remove water and solid components from the heavy fuel oil. Booster modules heat highly viscous HFO to about 150 °C, to set the low injection viscosity of about 12 mm²/s. The HFO is made available to the injection pumps of the diesel engine with an individually adjustable pressure.

Ship owners with high quality standards order DKC stations with hermetically sealed, magnetically coupled pumps from our customer. For these ship owners, a clean engine room, reduced danger of fire, no Port State Detention supervision, fewer replacement parts and greatly reduced maintenance costs are important.

Compact DKC pump stations by KRAL make a vital contribution, so that our customer can offer extremely compact booster modules with many integrated functions, and further extend its position as a market leader in quality.

Photo: Aalborg Industries A/S.

Marine boilers from the market leader.

Boiler sizes: 8 t/h to 55 t/h.
Pressure: 20 to 25 bar.
Medium: HFO.
Temperature: 130 to 140 °C.
Flow rate: 11 to 132 l/min.
Pump stations:
DMC 600 to 6500.

Our customer's marine boilers are outstanding for their high efficiency, modular design, low weight, long life and low maintenance costs. The boilers are supplied as complete units, including burners and burner controls. As burners, pressure atomizers, rotating atomizers and steam atomizers are provided.

In this application, KRAL DMC pump stations work as circular pipeline pumps. They pump the fuel from the tank to the burners. Pump stations are fitted for reliability, because process steam is used for operationally important functions on board a ship.

Hot steam is used to preheat the fuel, which in the case of ocean-going ships is almost exclusively heavy fuel oil. Heavy fuel oil must be preheated to reach the low injection viscosity required for the injection pumps of the diesel engines. Hot steam is also used to keep the temperature of the cargo constant.

Our customer uses both products: KRAL pump stations and KRAL Volumeter.

Manufacture of components from polyurethane.

Pump stations:
up to DKC 13000.
Medium: polyol, isocyanate.
Flow rate: up to 7.500 l/h.
Pressure: up to 15 bar.
Temperature: 50 °C.
Viscosity:
300 to 5.000 mm²/s.
Seal: mechanical seal or magnetic coupling.

The automotive supplier industry is subject to strict auditing by the automobile manufacturers, conforming to relevant standards. Verification of production processes of maximum availability is simple and obvious with redundant systems.

KRAL dual stations, with their two pumps, ensure during service of a pump, that other pump keeps the production process going.

Integrated systems according to customer's wishes.

Pump stations are an example of integrated systems by KRAL. Their development requires a very high degree of technical competence.

Integrated systems combine multiple functions in one compact housing.

KRAL AG specializes in the implementation of customer-specific integrated systems.

Joint projects.

Our business partners particularly value working in cooperation with KRAL AG. From the best possible support to successful completion of the project, friendly business relationships result again and again. We offer our customers dialog and close technical support. They can rely on us.

KRAL

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