



## KRAL Z Series.

The screw pump for demanding liquids.

# KRAL Z Series Screw Pumps.

Proven KRAL pump quality suitable even for aggressive and contaminated media.

## Data at a glance.

Delivery rate:	330 to 17,660 l/min or 20 to 1,060 m <sup>3</sup> /h.
Max. differential pressure:	25 bar.
Temperature range in the pumped media:	-40 °C to +300 °C.
Housing:	Nodular cast iron or welded carbon steel.
Screws:	Solid or engineered.
Approvals:	ABS, BV, DNV-GL, LRS, RINA. Others on request.
Heating:	Electrical, media or steam.
API:	Manufacturing according to API 676 possible.

ATEX designation (2014/34/EU):

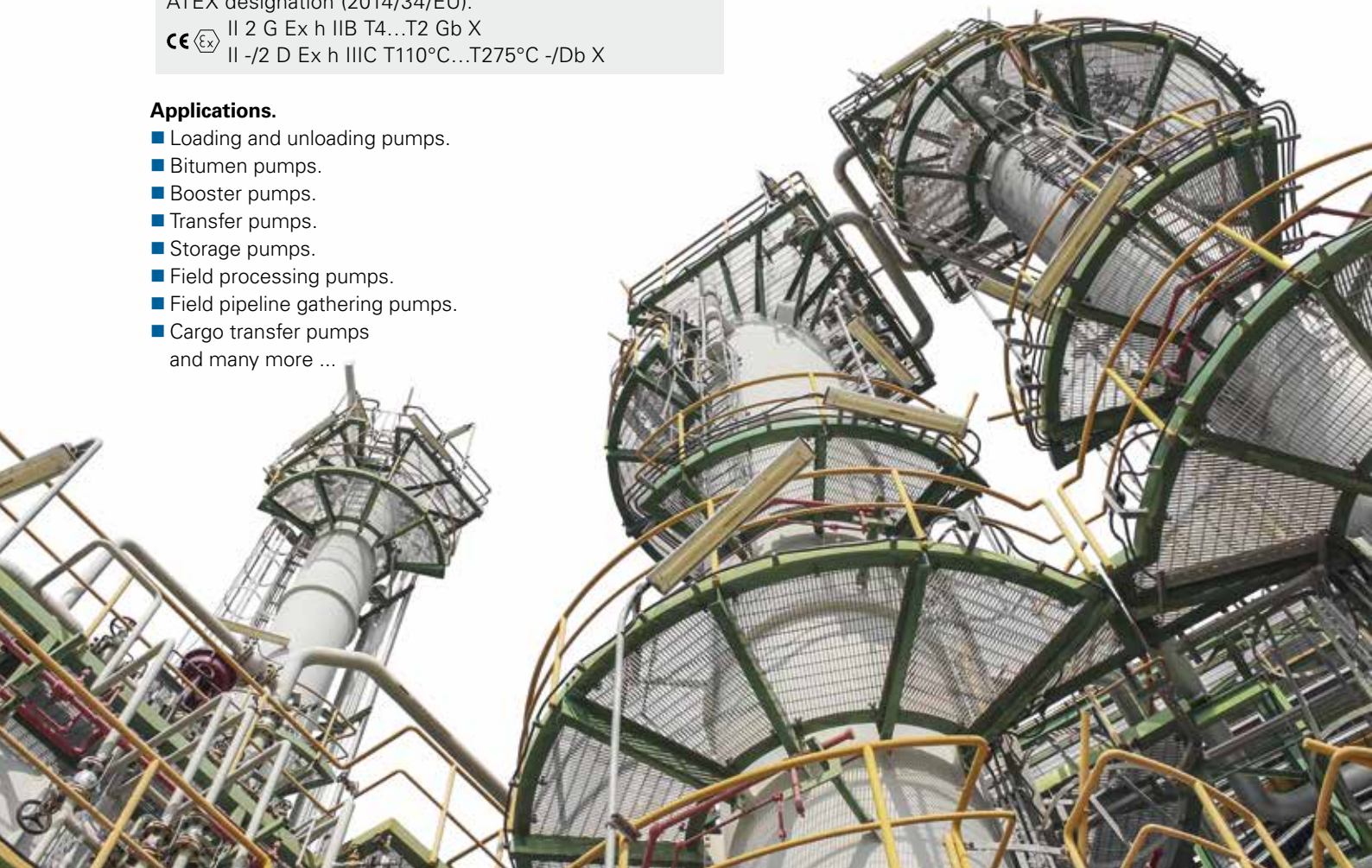
II 2 G Ex h IIB T4...T2 Gb X  
II -/2 D Ex h IIIC T110°C...T275°C -/Db X

In the new Z series, KRAL applies its expertise in pump design and technology to two screw pumps. As a result, the KRAL Z series is capable of delivering aggressive, low- or non-lubricating, and contaminated media with the reliability and quality that KRAL products are valued for by customers worldwide. In keeping with its commitment to constant innovation, KRAL has integrated an important new feature. The ability to arrange the inlet / outlet connections in any desired way (see page 10-11). This is a new feature for pumps of this type, and there is nothing like it on the market.

The KRAL Z series features synchronized, two-spindle screw pumps with a double-suction design. Because the screws are synchronized and hence contact-free, they can deliver even contaminated and non-lubricating media reliably and without pulsation. Dry running is possible, too. The double-fluted design facilitates very high delivery rates and axial pressure equalization in the pump housing, which ensures that the pump has a long lifetime.

## Applications.

- Loading and unloading pumps.
- Bitumen pumps.
- Booster pumps.
- Transfer pumps.
- Storage pumps.
- Field processing pumps.
- Field pipeline gathering pumps.
- Cargo transfer pumps and many more ...



## How it works.

The KRAL Z series pump is the product of over 65 years of experience on the screw pump market. This series optimizes all the accustomed advantages in an innovative way in order to cover a broad range of delivery rates, pressures, temperatures, and viscosities in keeping with reliable KRAL quality. Short dry running possible, and gas proportions of up to 80 % are supported.

costs, and costs over the life-cycle of the pump. To inspect its pumps, KRAL built its own large-scale test stand, where endurance tests can be conducted to measure the performance limits of the series. All pump inspections can be conducted by classification authorities that are known on the market. Special inspections are also possible upon request.



The KRAL Z series pumps are positive displacement pumps that draw the liquid through the suction connection and continually feed it in two partial streams to the two screws. As a result, the pump is pressure-equalized axially. The pressure builds up linearly along the length of the screw. The housing design ensures that the gap between the screws and the housing remains sealed. This ensures that the pump can be primed very effectively, even when the suction line is empty. An absolute pressure of up to 0.2 bar is therefore possible. The pump works against the system pressure. The pump can be operated reversible too.

The KRAL Z series can be implemented as a customized solution for any required application. For example, depending on the application, the screws can be designed solid or engineered. This results in substantial benefits for important aspects such as fatigue strength, media resistance, maintenance

## Your benefits.

- Very broad range of applications.
- Flexible connection arrangement.
- Excellent suction characteristics.
- Low-pulsation delivery.
- Adjustable screw design.
- Little space required.
- Dry running protection.
- Support for different delivery heights without booster pump.
- Optional delivery direction can be changed easily for a short time.
- No need for a separate stripping system with control unit.

# Sophisticated Design and Ultra-precise Manufacturing.

Many important details give the KRAL Z series an edge.



## Screws.

Unlike many other products on the market, the KRAL Z series offers adjustable screw design. This enables the pumps to be used in a very broad range of applications. The KRAL Z series can be designed with one-piece or multi-piece screws. Thanks to their homogeneous material structure, one-piece screws offer considerable cost benefits, whereas multi-piece screws have the advantage that combinations of different metals can be used.

The high fatigue strength of the screws and the shortened bearing distance of the KRAL Z series are another major advantage, especially for high-load applications. Thanks to the screws' innovative fastening method, the pumps are even more reliable to operate. The high precision with which torque is transmitted to the pair of synchronization gears further increase the efficiency of the pumps.

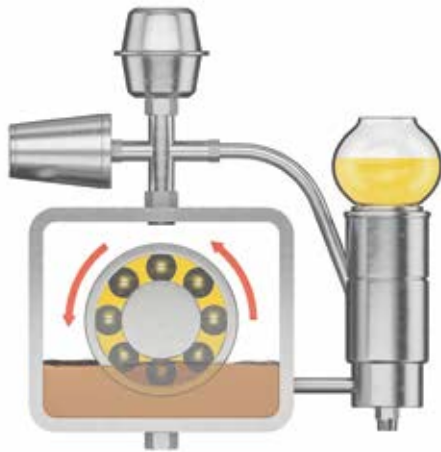
- Adjustable designs.
- Broad range of applications.
- High fatigue strength.
- Optimal pump efficiency.

## Bearings.

A high radial load can misalign the pump bearings, increasing the amount of wear they're subjected to.

KRAL Z series features an optimized bearing concept that offers high tolerance to bearing misalignment, compared with standard concepts on the market. This increases the lifetime considerably. It reduces bearing play. The differential pressure was also increased significantly in the KRAL Z series, thanks to the use of reinforced screws, shorter distances between bearings, and highly precise manufacturing.

- Long-lasting bearings.
- High delivery capacity.
- Compact housing.
- High differential pressure.



### Lubrication.

Poorly chosen lubricants and inadequately thought-out design can lead to high maintenance and secondary costs in many applications. That's why the KRAL Z series is equipped with a special lubrication system. What's more, the KRAL Z series uses a lubricant especially suited to the design of the bearings, and optionally the lubricating oil is hermetically sealed from the surrounding air, so that the oil hardly ages at all. Thanks to an ingenious internal lubrication system, all the bearing positions are given just the right amount of lubricant at just the right temperature at all times. External cooling is also available.

- Reduced maintenance and costs.
- Optimal lubrication at all times.
- Minimal lubricant aging.
- Additional cooling as an efficient option.



### Pump housing.

System design is often complicated by the fact that there are limited options for arranging the pump. That's why KRAL is committed to maximum flexibility for connections. The ability to organize them flexibly is one of the unique advantages of KRAL Z series pump design, every aspect of which has been carefully considered. Thanks to this feature, the customer can freely choose how to arrange both suction and pressure flanges on a high-resolution grid. All the connections can be arranged either horizontally (inline) or at several angles (see page 10-11).

The design of the pump housing prevents dry running in both horizontal and vertical positions. The pump therefore maintains its outstanding suction performance even when the suction line is empty. Furthermore, the special geometry of the housing enables a multi-phase capability for gas proportions of up to 80 %. Thanks to the integrated heating jacket, which covers the entire lower half of the housing, high-viscosity media can be pumped as well.

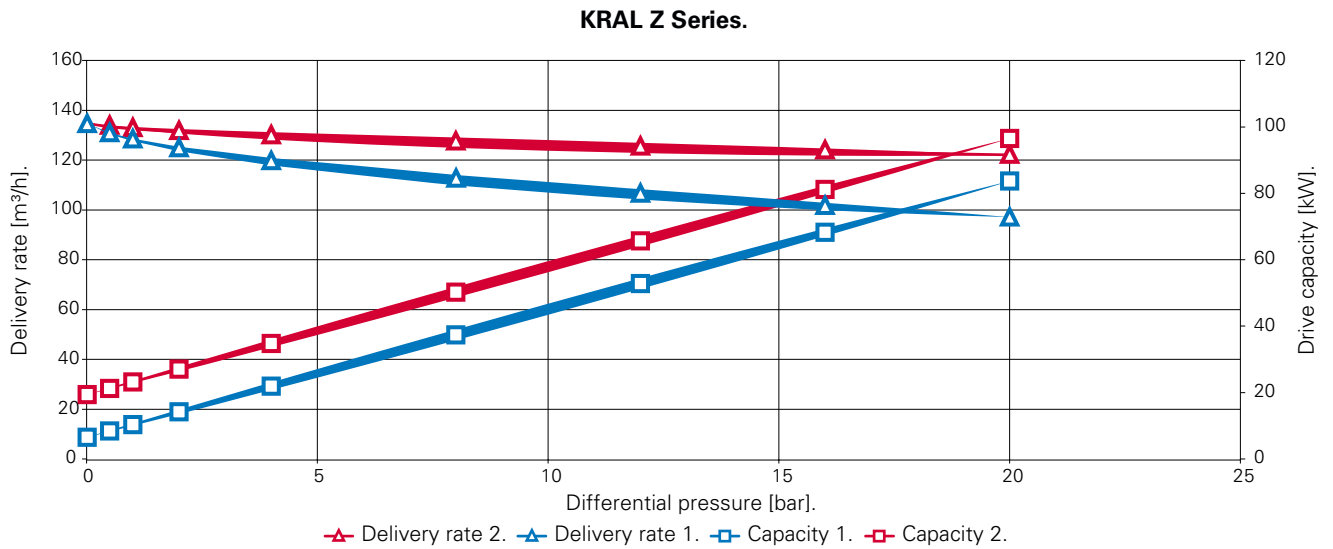
- Maximum connection flexibility.
- Dry running protection.
- Excellent suction characteristic.
- Multi-phase capability.
- Innovative heating jacket design.

# Technical Data.

Precise control of delivery rate characteristics.

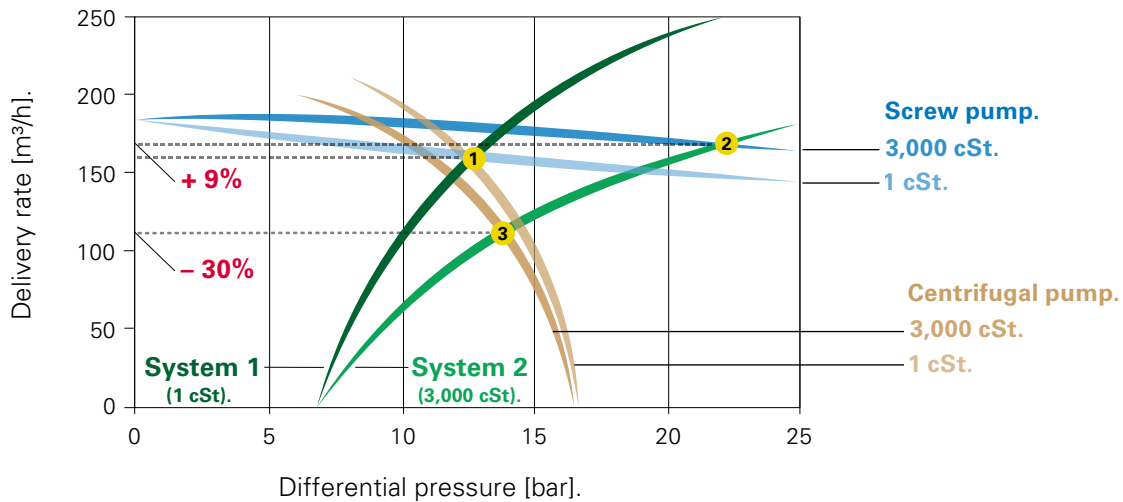
## Constant pressure, even for high viscosity media.

Viscosities of 0.7 to 100,000 cSt are possible at constant pressure. The delivery rate is proportional to the speed.



## Advantages over centrifugal pumps.

Unlike centrifugal pumps, screw pumps from KRAL cover a broad range of delivery rates, pressures, temperatures, and viscosities for almost all conveyable media. The KRAL Z series offers maximum flexibility even under changing operating conditions.

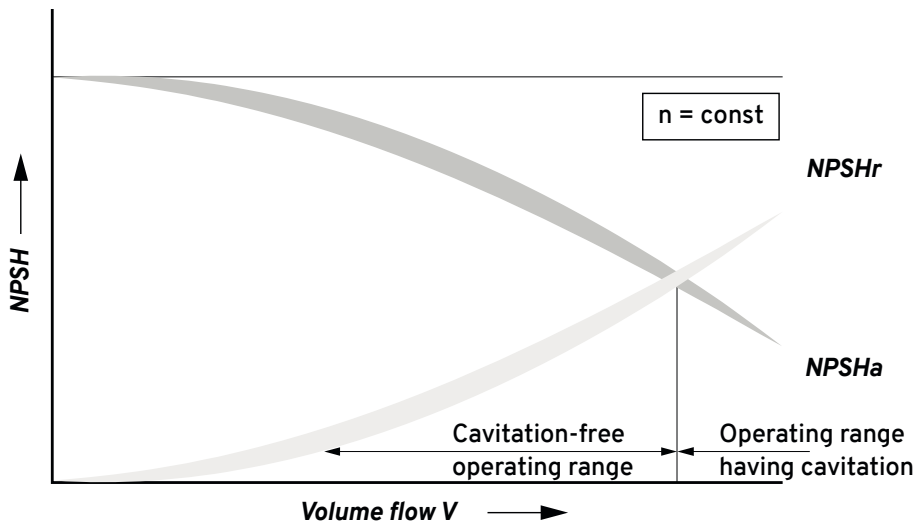


Based on water as a reference (with viscosity 1 cSt) ①, operation with viscous liquids (e.g. with viscosity 3,000 cSt) reduces the delivery rate of centrifugal pumps by up to 30% ③. The delivery rate of a screw pump increases in such a case by 9% ②.

Excellent suction characteristics of the KRAL Z series ensure reliable system operation.

**Suction characteristics – NPSH.**

Cavitation-free operation is only possible if the pump is precisely matched to the system. The excellent suction characteristics of the self-priming, screw pump facilitate reliable system operation, even under difficult and changing operating conditions.



The acceleration of the media at the pump inlet provides for a pressure drop, known as the NPSH value of the pump ( $NPSH_r$ ). This value must be available at the suction flange as a pressure reserve from the system ( $NPSH_a$ ) to avoid cavitation.

# KRAL Z Series.

The technical highlights at a glance.

## ■ Pump housing.

The unique delta design reduces internal flow losses and facilitates optimal suction performance. High viscosity media and brief phases with high gas content are no problem.

## ■ Variable screws.

Optimized for fatigue strength. Application-specific protection against wear is also possible. Screws can be inserted as one-piece or multi-piece components.

## ■ Mechanical seals.

Single- and double-acting mechanical seals depending on design and application. Can also be used with leakage monitoring and supply systems (API plans).

## ■ Optional leakage monitoring of mechanical seals.

Leakage is conducted via a drain to a monitored reservoir.

## ■ Oil level check.

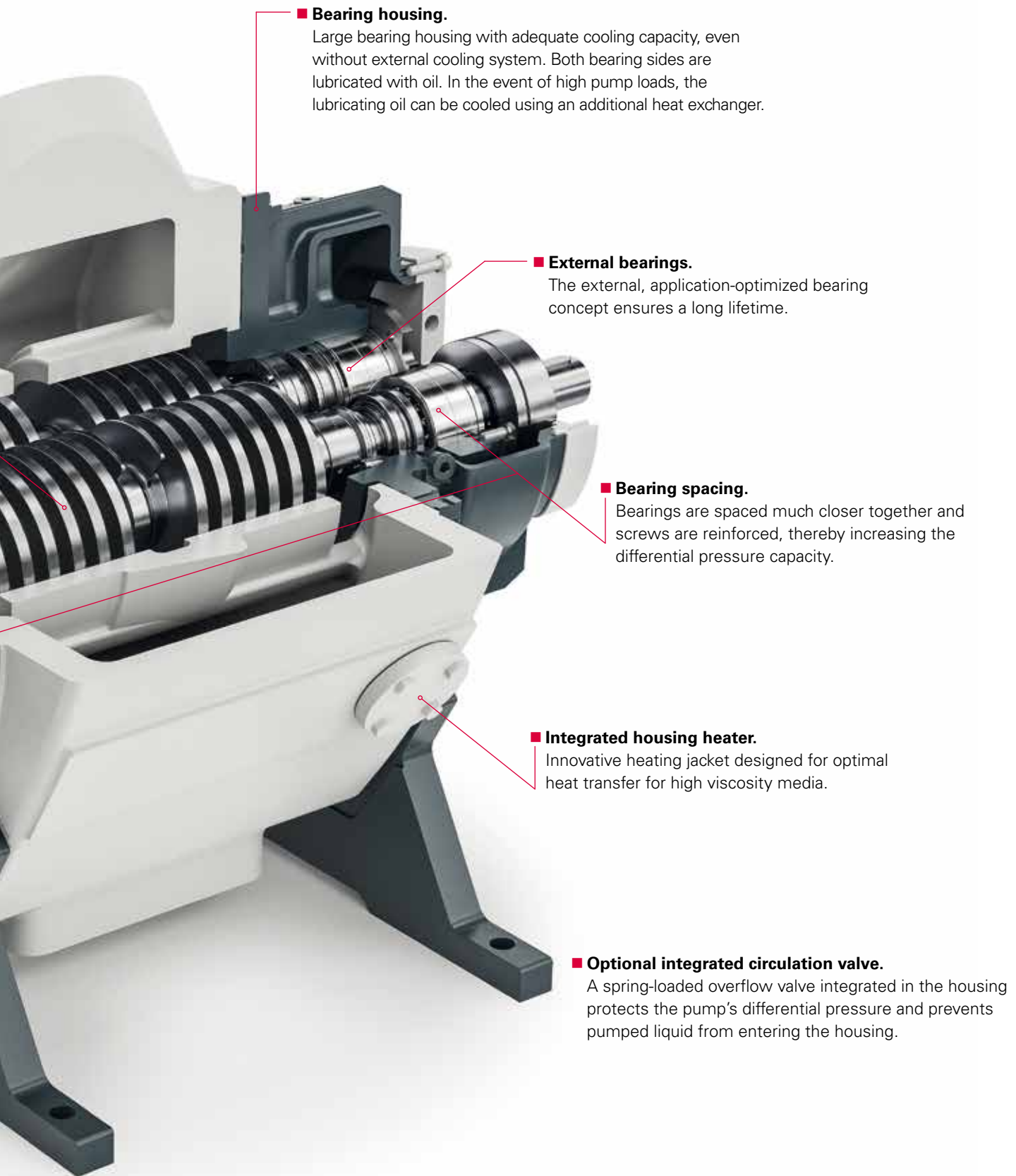
Long intervals between oil changes and low service costs, thanks to external monitoring and replenishment of hermetically sealed oil chamber.

## ■ Precision gears.

Hardened and tempered precision gears can be positioned exactly for reduced backlash and increased efficiency.







■ **Bearing housing.**

Large bearing housing with adequate cooling capacity, even without external cooling system. Both bearing sides are lubricated with oil. In the event of high pump loads, the lubricating oil can be cooled using an additional heat exchanger.

■ **External bearings.**

The external, application-optimized bearing concept ensures a long lifetime.

■ **Bearing spacing.**

Bearings are spaced much closer together and screws are reinforced, thereby increasing the differential pressure capacity.

■ **Integrated housing heater.**

Innovative heating jacket designed for optimal heat transfer for high viscosity media.

■ **Optional integrated circulation valve.**

A spring-loaded overflow valve integrated in the housing protects the pump's differential pressure and prevents pumped liquid from entering the housing.

## Installation Variations.

Maximum flexibility by unlimited options for connection arrangements.

Pumps are often built into existing systems, where predetermined installation conditions can easily become a problem. The KRAL Z series offers the solution with a unique innovation for screw pumps. The connections can be flexibly arranged both horizontally and vertically. The installation options are therefore unlimited. Both installation variations are →



### **Horizontal installation.**

Horizontal installation makes the pump very easy to service without separating the pump from the pipe system. This installation has a positive effect on thermal performance.

Examples of connection arrangements for horizontal installation.



The diagrams only show a few examples of connection arrangements. The design possibilities are extremely variable. All the connections can be arranged horizontally (inline) and at several angles.

→ designed with external bearings so that the bearings don't come into contact with the liquid. This significantly increases their lifetime. The mechanical seals are located on the suction side of the pump flow and are cooled and lubricated by the pumped liquid. Both single- and double-acting mechanical seals can be used in combination with an extremely broad range of seal supply systems.

Different materials can be used in the design, depending on the pumped liquid. The use of variable-speed drives enables the delivery rate to be controlled very easily, since it's proportionate to the speed. Hydraulic motors can also be used as an alternative to electrical drives. Thanks to the sophisticated flow control inside the housing, suction loss is reduced in both horizontal and vertical installation. This reduces the NPSHr value. Furthermore, once the pump has been primed for the first time, it is always capable of self-priming, even when the suction line is empty.

### Vertical installation.

The benefit of this design is its very compact layout, which makes it ideal for systems with limited space. It is installed via a pedestal, and the motor is mounted over the pump with a motor support.



Examples of connection arrangements for vertical installation.

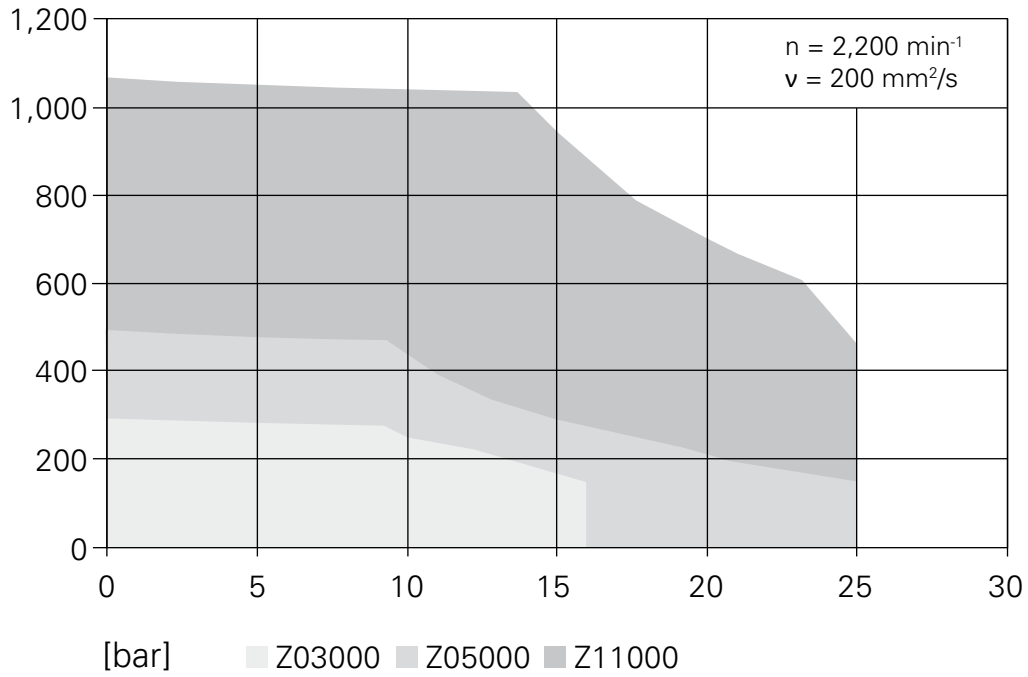


The diagrams only show a few examples of connection arrangements. The design possibilities are extremely variable. All the connections can be arranged vertically (inline) and at several angles.

# All Sizes at a Glance.

Z03000 | Z05000 | Z11000.

## Capacity diagram.



Z03000.



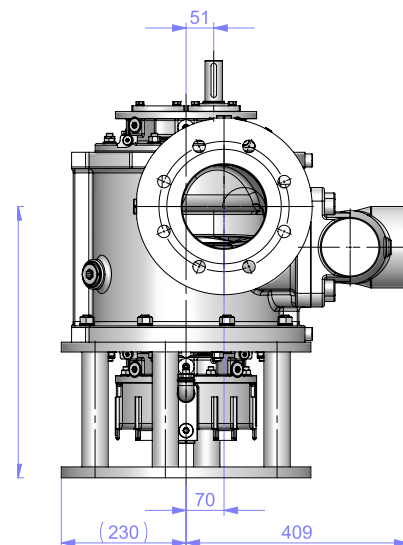
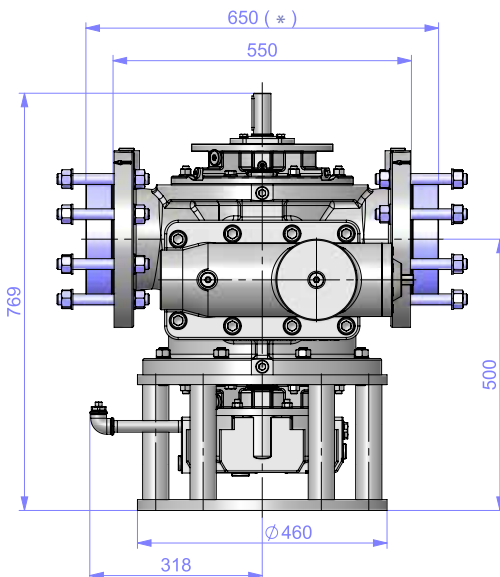
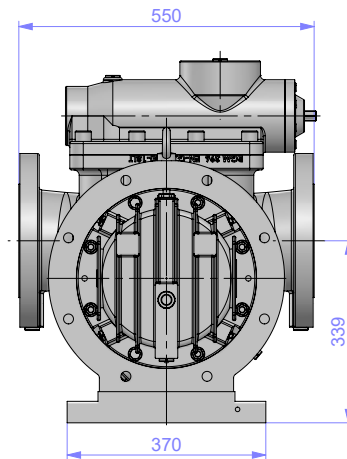
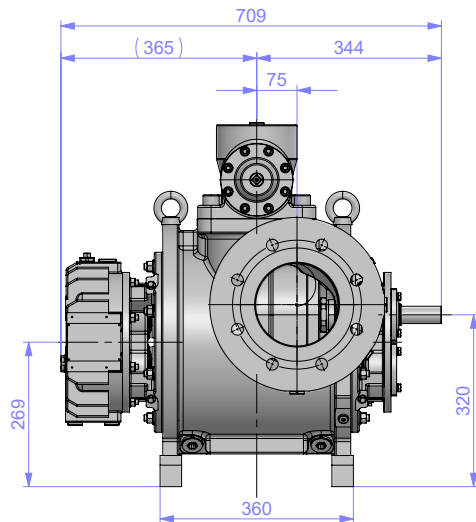
Z05000.



Z11000.

## Z03000 – the Compact one.

Capacity up to 270 m<sup>3</sup>/h.



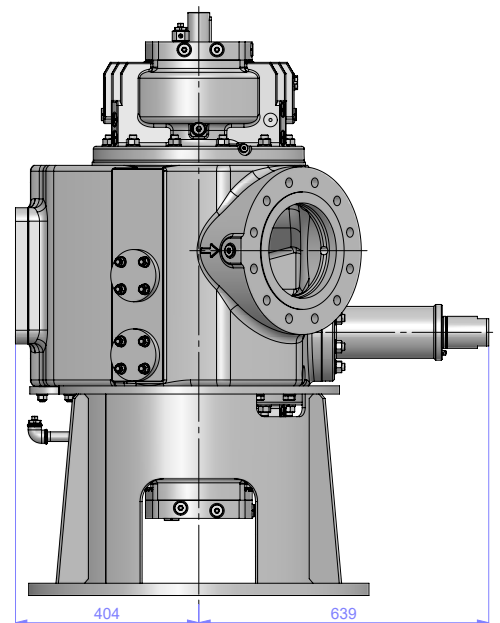
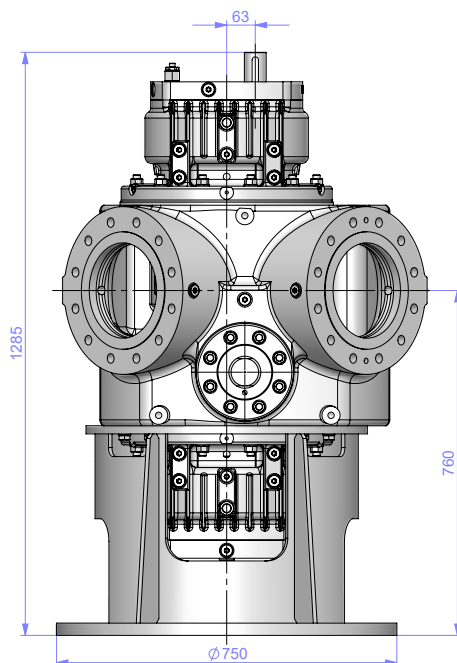
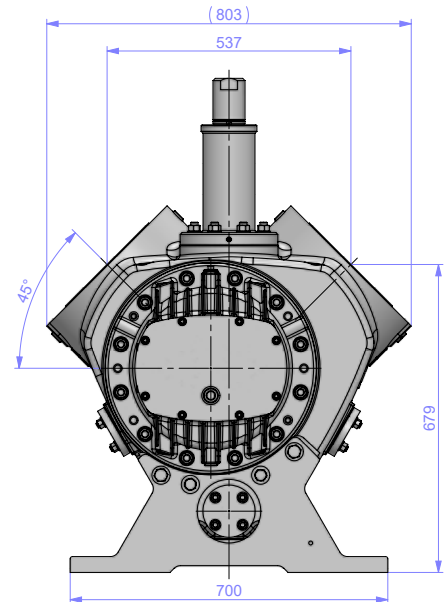
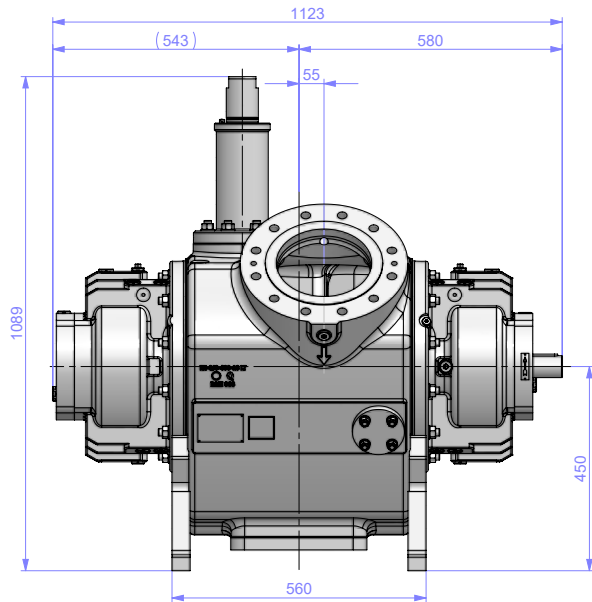
\* 1:1 exchange of commonly used marine pumps with adapters due to compactness.

### Technical data.

- Delivery rate: Up to 4,500 l/min | 270 m<sup>3</sup>/h.
- Max. differential pressure: 16 bar.
- Temperature range in the pumped media: -40 °C to +120 °C.
- Shaft seal options: Single component mechanical seal, single component mechanical seal with quench.
- Heating: Electrical, media or steam.
- Housing: Nodular cast iron.

# Z05000 – the Allrounder.

Capacity up to 490 m<sup>3</sup>/h.

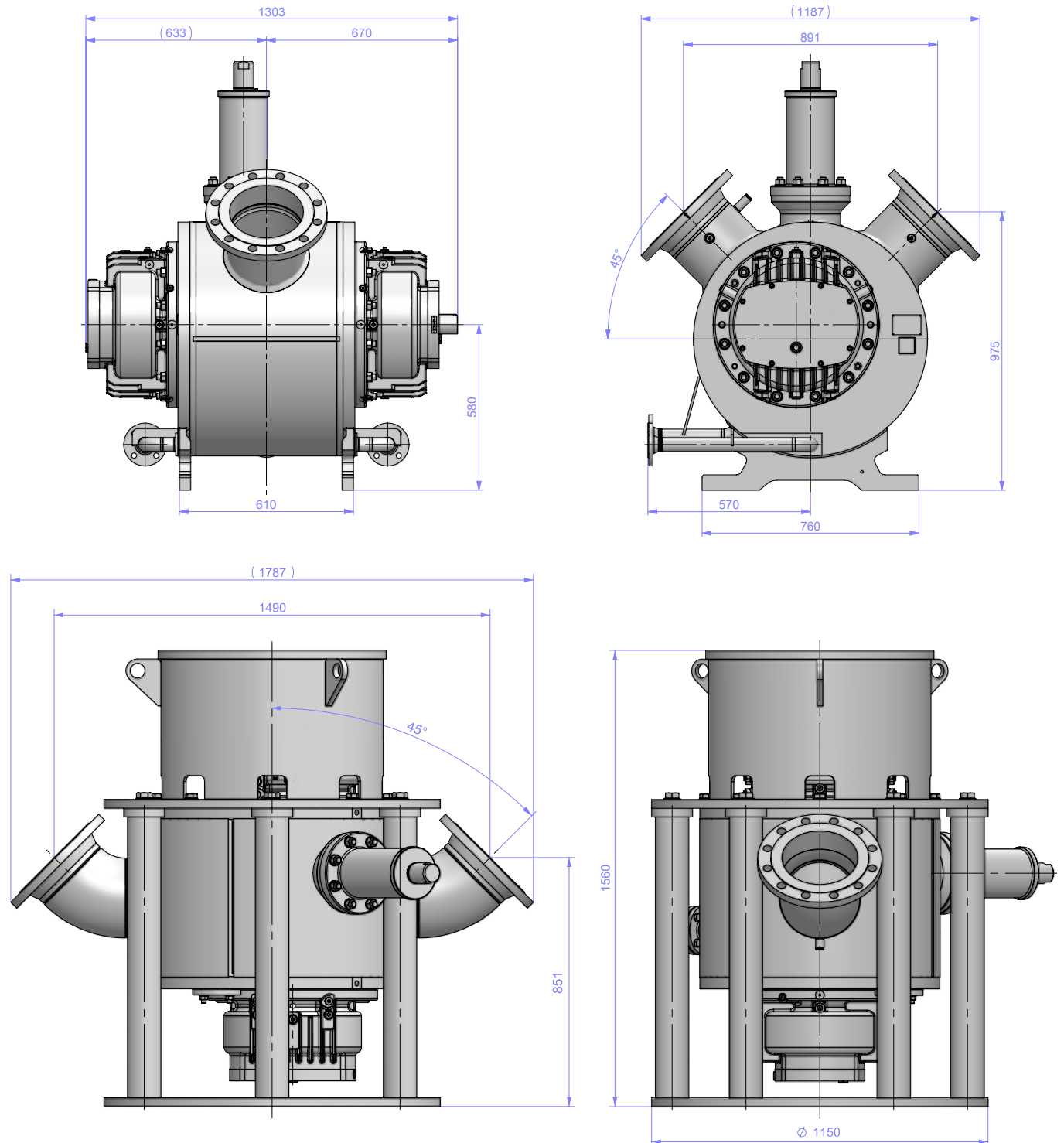


## Technical data.

- Delivery rate: Up to 8,170 l/min | 490 m<sup>3</sup>/h.
- Max. differential pressure: 25 bar.
- Temperature range in the pumped media: -40 °C to +300 °C.
- Shaft seal options: Single component mechanical seal with quench, single & double component mechanical seal, cartridge single & double mechanical seal.
- Heating: Media or steam.
- Housing: Nodular cast iron or welded carbon steel.

## Z11000 – the one for Large Quantities.

Capacity up to 1.060 m<sup>3</sup>/h.



### Technical data.

- Delivery rate: Up to 17,660 l/min | 1,060 m<sup>3</sup>/h.
- Max. differential pressure: 25 bar.
- Temperature range in the pumped media: -40 °C to +300 °C.
- Shaft seal options: Single component mechanical seal with quench, single or double component mechanical seal, cartridge single or double mechanical seal.
- Heating: Media or steam.
- Housing: Nodular cast iron or welded carbon steel.

# Examples of Applications for the KRAL Z Series.

Can be used in many different industries while offering excellent control behavior at different pressures and viscosities. The pump is dry-running-capable at all levels and offers optimal performance.



## Cargo / tanker / bunker.

- Pumped liquids: Light chemicals.
- Delivery rate: 500 m<sup>3</sup>/h.
- Pressure: 16 bar.
- Viscosity: 0.7 – 1,000 cSt.
- Rotation speed: 2,000 min<sup>-1</sup>.
- Housing: Nodular cast iron.
- Screws: Nodular cast iron, stainless steel.
- Shaft seal: Single-acting mechanical seal.



## Stripping.

- Pumped liquids: Light chemicals.
- Delivery rate: 300 m<sup>3</sup>/h.
- Pressure: 14 bar.
- Viscosity: 0.7 – 1,000 cSt.
- Rotation speed: 2,200 min<sup>-1</sup>.
- Housing: Nodular cast iron.
- Screws: Nodular cast iron, stainless steel.
- Shaft seal: Single-acting mechanical seal.



## Bitumen.

- Pumped liquids: Bitumen, asphalt.
- Delivery rate: 600 m<sup>3</sup>/h.
- Pressure: 12 bar.
- Viscosity: 1 – 5,000 cSt.
- Rotation speed: 2,200 min<sup>-1</sup>.
- Housing: Welded steel.
- Screws: Stainless steel.
- Shaft seal: Double-acting mechanical seal.



## Transfer.

- Pumped liquids: HFO.
- Delivery rate: 200 m<sup>3</sup>/h.
- Pressure: 10 bar.
- Viscosity: 1 – 700 cSt.
- Rotation speed: 2,200 min<sup>-1</sup>.
- Housing: Nodular cast iron.
- Screws: Nodular cast iron, stainless steel.
- Shaft seal: Single-acting mechanical seal.





### Oil terminals / tank farms.

- Pumped liquids: HFO, crude oil, gas oil, gasoline, additives, base oil, naphtha, kerosene, slops etc.
- Delivery rate: 700 m<sup>3</sup>/h.
- Pressure: 16 bar.
- Viscosity: 0.7 – 2,000 cSt.
- Rotation speed: 2,400 min<sup>-1</sup>.
- Housing: Nodular cast iron.
- Screws: Nodular cast iron, stainless steel.
- Shaft seal: Single-acting mechanical seal.



### Crude oil.

- Pumped liquids: Crude oil.
- Delivery rate: 700 m<sup>3</sup>/h.
- Pressure: 25 bar.
- Viscosity: 1 – 2,000 cSt.
- Rotation speed: 2,400 min<sup>-1</sup>.
- Housing: Cast steel / welded steel.
- Screws: Stainless steel.
- Shaft seal: Single-acting / double-acting mechanical seal.



### Refineries.

- Pumped liquids: HFO, crude oil, gas oil, gasoline, additives, base oil, naphtha, kerosene, slops.
- Delivery rate: Up to 400 m<sup>3</sup>/h.
- Pressure: 16 bar.
- Viscosity: 0.7 – 2,000 cSt.
- Rotation speed: 1,800 min<sup>-1</sup>.
- Housing: Cast steel / welded steel.
- Screws: Stainless steel.
- Shaft seal: Single-acting / double-acting mechanical seal.
- With integrated heat jacket for optimal heat transfer.



### Power plants.

- Pumped liquids: HFO, crude oil.
- Delivery rate: 250 m<sup>3</sup>/h.
- Pressure: 12 bar.
- Viscosity: 1 – 2,000 cSt.
- Rotation speed: 2,400 min<sup>-1</sup>.
- Housing: Nodular cast iron.
- Screws: Nodular cast iron, stainless steel.
- Shaft seal: Single-acting mechanical seal.

# Service From a Single Source.

Short reaction times. Fast and competent.



## **Installation and commissioning.**

We can help you install and commission your KRAL products upon request. Professional installation and optimal deployment of the pumps are prerequisites for error-free operation. Our technicians not only know our products; they also know how the system affects the pump and can configure the latter accordingly for optimal performance. As a customer, you benefit from our wealth of experience, because we've commissioned large numbers of KRAL pumps at our customers' premises.

## **Training.**

KRAL training provides you with in-depth knowledge on installing, commissioning, and maintaining your KRAL product. You receive expert information from the manufacturer on how to install and commission your KRAL product properly, and you learn about various applications and utilization limits. You also learn to identify and rectify faults based on actual damage profiles. We lead you through a professional maintenance routine and show how you can reduce your product's operating costs. The training can be held either at our headquarters in Lustenau or at your premises, upon request.



### **Maintenance and repair.**

Downtime can generate substantial costs. Increase the operational safety and minimize the life-cycle costs of your KRAL product through the preventative maintenance services provided by our competent service team. When a breakdown occurs, our service technicians react quickly and arrive at your premises in no time. When you make a repair shipment, confirmation of receipt is sent to you as soon as the shipment arrives. Each time a repair is made, we send you a comprehensive technical report together with detailed images. We perform maintenance work and repairs at our headquarters in Lustenau or at your premises, upon request. And the genuine KRAL parts we use guarantee the highest standards of quality.

### **Spare parts.**

KRAL pumps meet the highest quality standards. To ensure those standards are maintained, you should only use genuine KRAL parts as spare parts. They guarantee that your pumps maintain a high level of quality, continue to operate smoothly, and last a long time.



#### Headquarters.

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