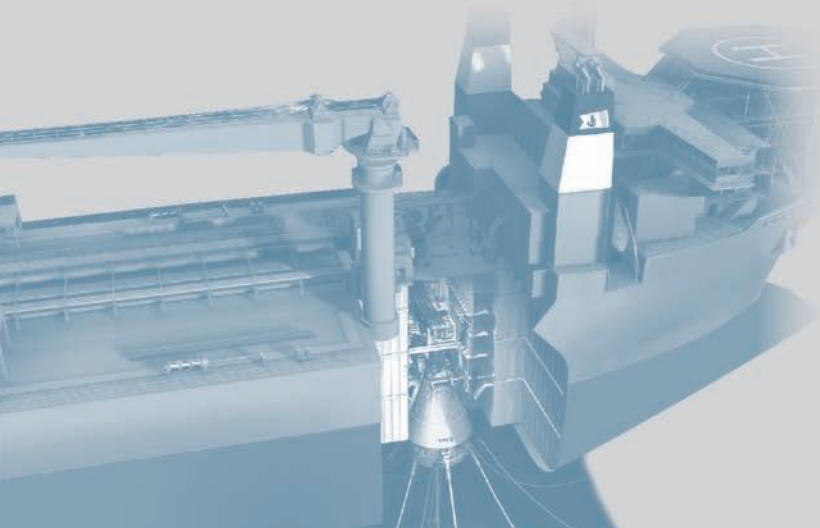
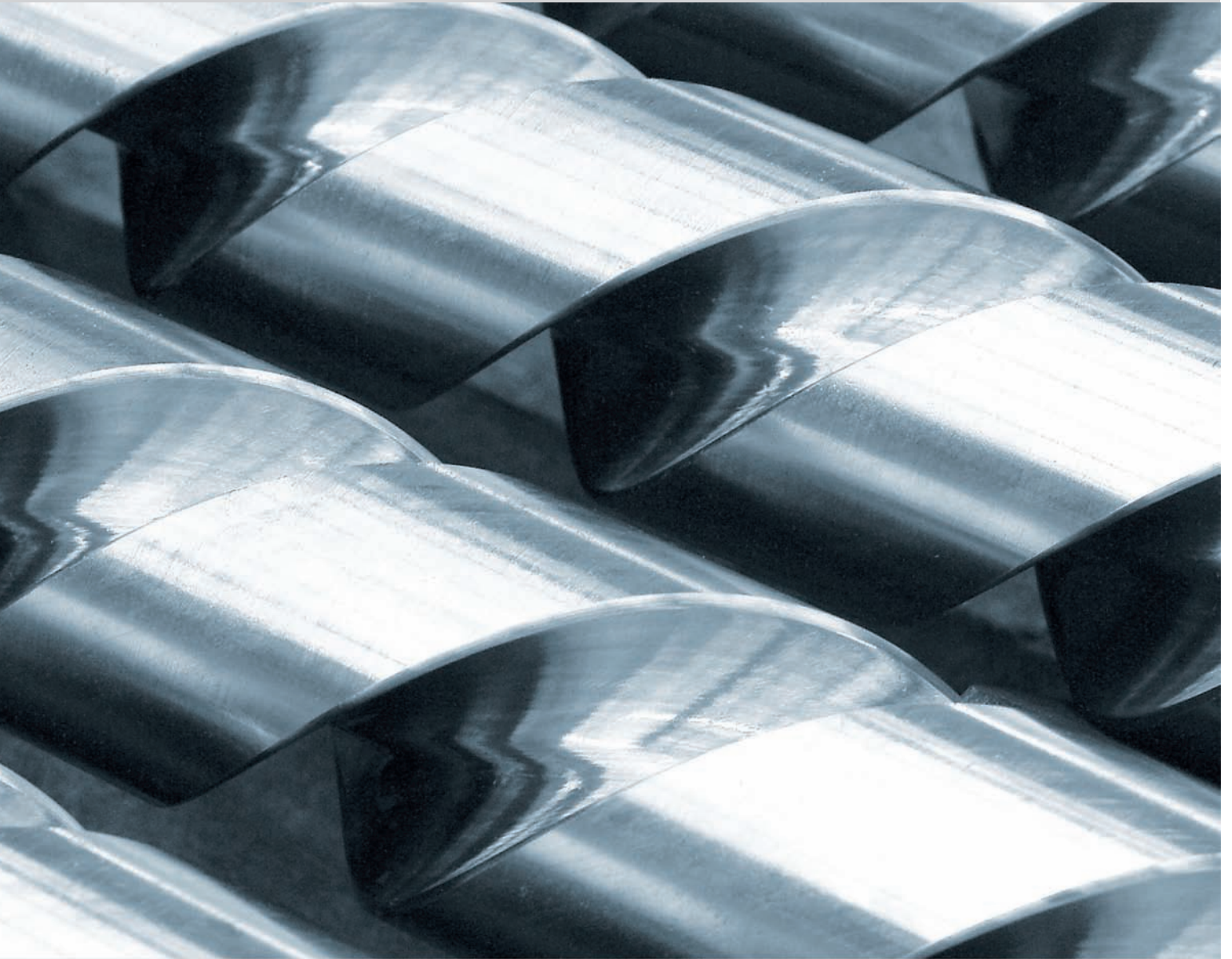


Leistritz

LEISTRITZ PUMPEN GMBH

Leistritz Screw Pumps & Systems



**Cargo and
Liquid
Handling**



Leistriz Screw Pumps and Systems

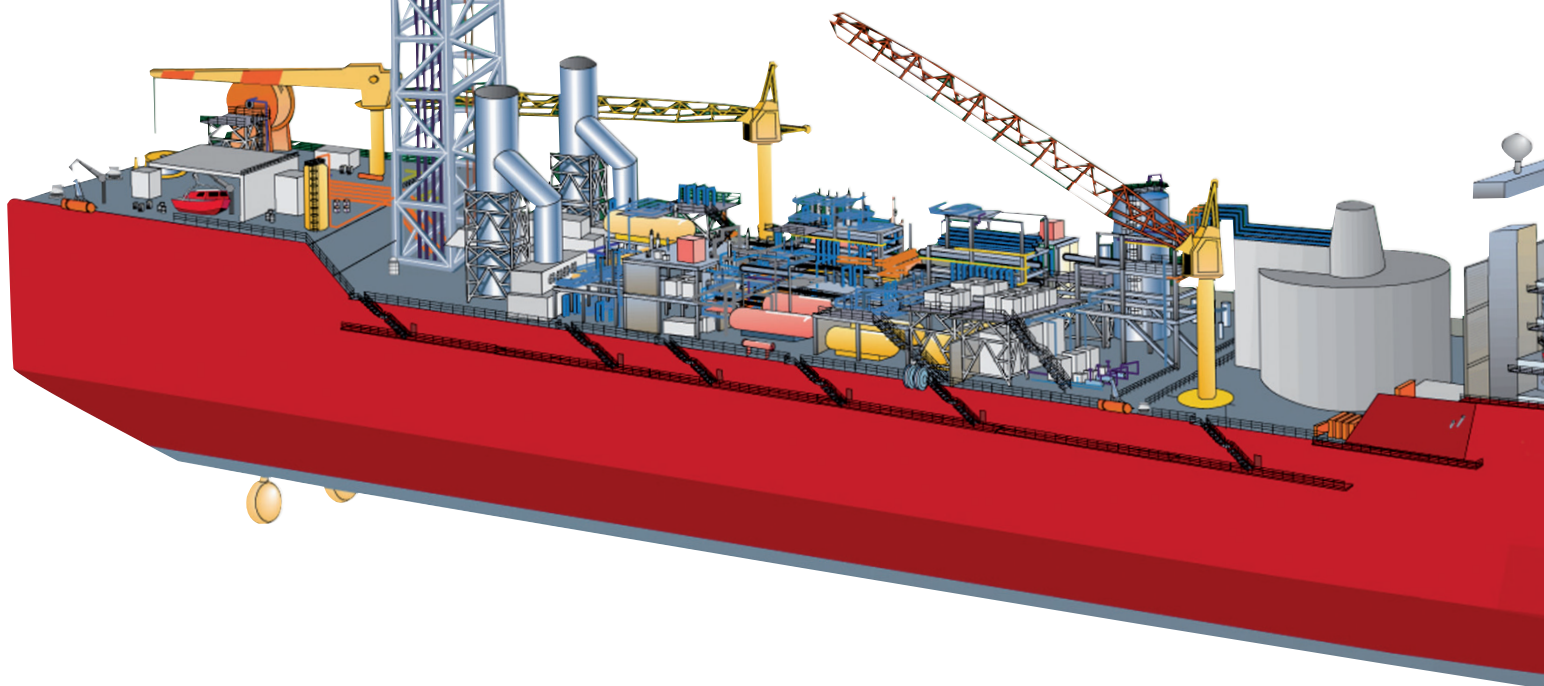
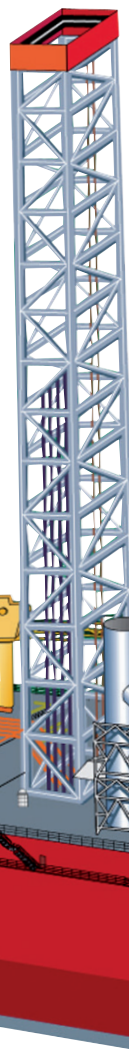
Leistriz Pumpen GmbH

Leistriz Pumpen GmbH with its headquarters in Nuremberg/Germany has been producing Screw Pumps since 1924. The first Leistriz Screw Pump was developed by Paul Leistriz as Main Lube Oil Pump for bearings of Steam Turbine Generator Sets.

With the worldwide largest product range of Twin, Triple and Five Screw Pumps, Leistriz offers today complete pump packages for a variety of applications.

Latest technology in combination with strictly controlled quality is the basis for the globally recognized efficiency and reliability of Leistriz Screw Pumps.

The testing of the pumps through all well known classification societies as ABS, BV, DNV, GL, LRS, RINA and others is made on Leistriz test fields to generate contribution to international shipping safety and maritime regulation.



Cargo and Liquid Handling

FPSO Dehydrating System



Page 8

FPSO Produced Water



Page 9

Leistritz Cargo Control



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Tankers for Oil, Refined Products, Chemicals and Asphalt

The transport of liquid cargos at sea is done by different types of tankers depending on the nature of the cargo and how it can be transferred and off-loaded safely and efficiently. The pumps required have to be selected for most efficient operations taking into account pumping rate at different viscosities, stripping of tanks and flow lines and offering the best environmental together with safe service.

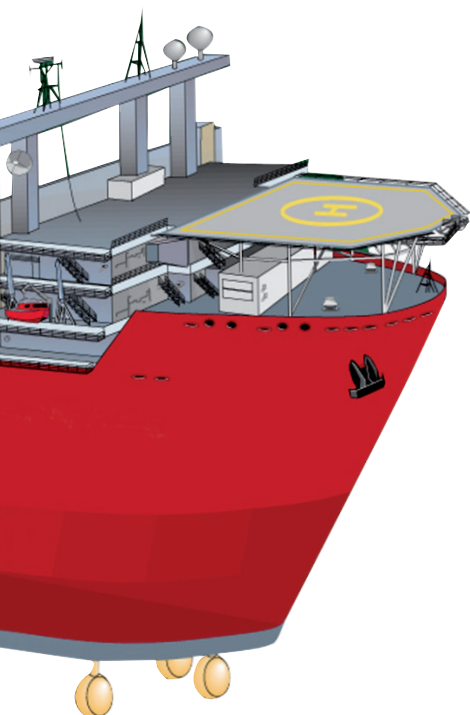
The reliability of Leistritz Screw Pumps provides the optimum pumping solution for most types of liquid cargo.

FPSO and Produced Water

The offshore oil and gas industry uses Floating Production, Storage and Off-loading (FPSO) vessels in order to process and store gas or oil until it can be unloaded onto tankers or forwarded through a pipeline. FPSOs are very flexible and cost effective since they can also be used in deepwater locations without installing long-distance seabed pipelines.

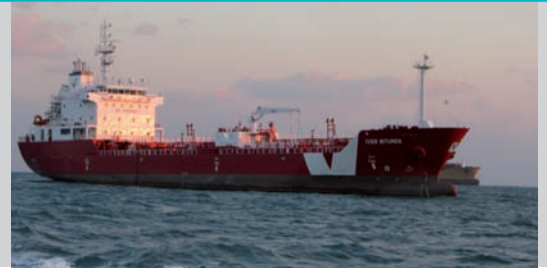
During oil production not only crude oil is pumped but also produced water. The main elements of produced water are dispersed oil, chemicals resulting from treatment, salts and radioactive elements from minerals and heavy metals. For that reason all medium wetted parts of the Leistritz Screw Pumps are built of special materials in order to prevent pitting corrosion.

Leistritz Screw Pumps are responsible for boosting the produced water into a hydro cyclone where the remaining oil and sand will be extracted.



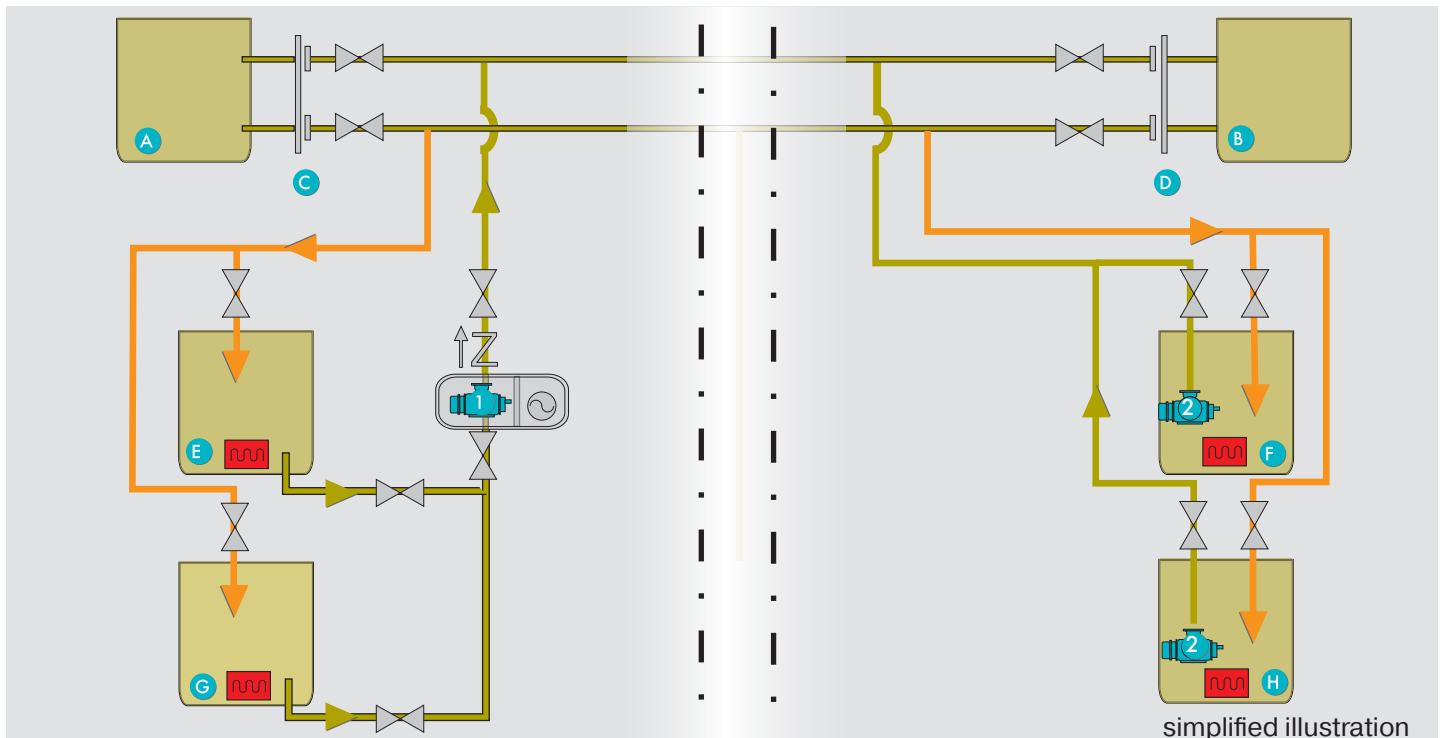


Asphalt Carrier



Dry Installation

Submerged Installation



simplified illustration

- Asphalt
- Filling Line
- Discharge Pipe Line
- Suction Pipe Line
- Valve
- Check Valve
- Heat Exchanger
- Leistriz Sealing System
- Leistriz Variable Frequency Converter
- Leistriz Cargohandling Pump**
- 1 Dry Installation
- 2 Submerged Installation
- A Slop Tank (installed at port side)
- B Slop Tank (installed at port side)
- C Connecting Manifold
- D Connecting Manifold
- E Cargo Tank
- F Cargo Tank
- G Cargo Tank
- H Cargo Tank

Dry Installation

1.1 Leistriz Screw Pumps as Cargo Pumps for Asphalt Carrier

The cargo (asphalt) had been loaded into the tanks of the asphalt carrier at the tank terminal before transport. Leistriz Screw Pumps are used mainly for unloading the cargo from the asphalt carrier at the arrival port. Control of the trim and list of the ship can be done by transferring the cargo from tank to tank on board. The Leistriz Screw Pumps (cargo pumps) will also be utilized as circulation pumps to keep the cargo temperature or property under control during transportation of the highly viscous cargo. Arrangement with gas tight bulkhead additionally available.

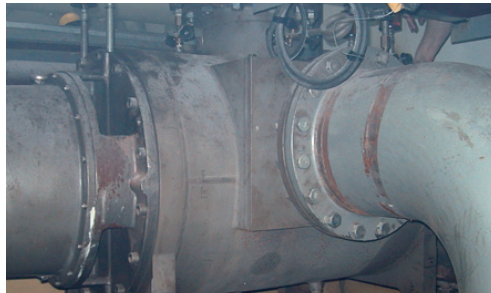
1.2 Stripping Pump

There is no separate stripping pump installed on the asphalt carrier. The work of cargo and line stripping will be done through the cargo pump as well.

1.3 Slop Tanks

The slop tanks are designed to collect any cargo rests after tank cleaning from the connecting manifolds or pipes on the deck and spills.

Cargo Pumps in Dry Installation or Vertical Submerged as Deep Well Asphalt Cargo Pump



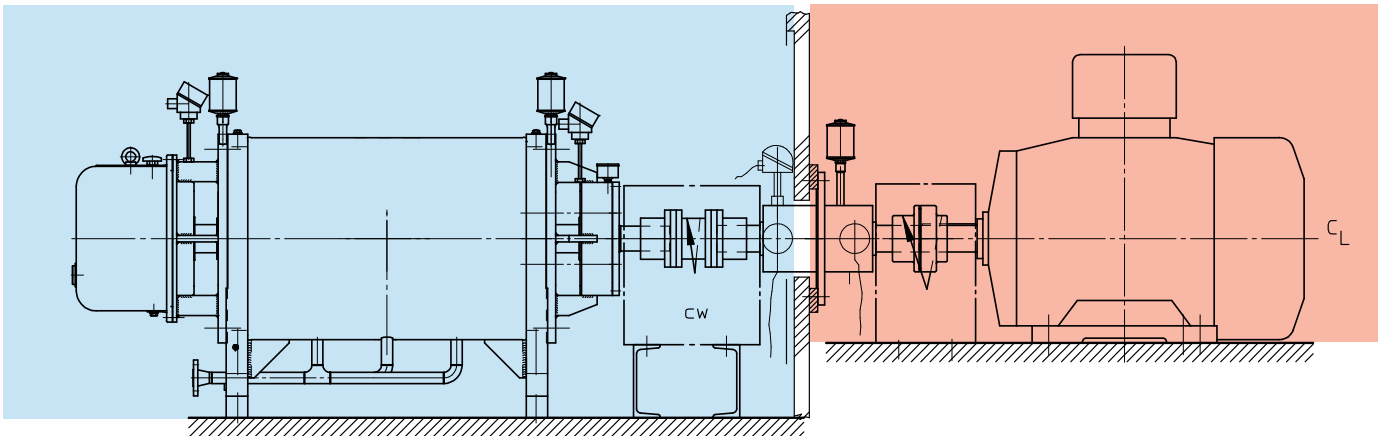
Cargo Loading and Unloading Pump L4



Side view with safety valve

Ex-Zone

Non-Ex-Zone



Submerged Installation

2 Leistritz Screw Pumps as Deep Well Asphalt Cargo Pump

For unloading of the cargo products, Leistritz Screw Pumps can also be arranged as vertical submerged pump inside the tank of the asphalt carrier. Cargo of all viscosities – from kerosene to asphalt – can be unloaded and effectively stripped from tanks and suction lines. The pumps are designed as five-screw (or two-screw), single flow pumps for high-capacity unloading and stripping. Drives are suitable as electrical- or hydraulic motor.

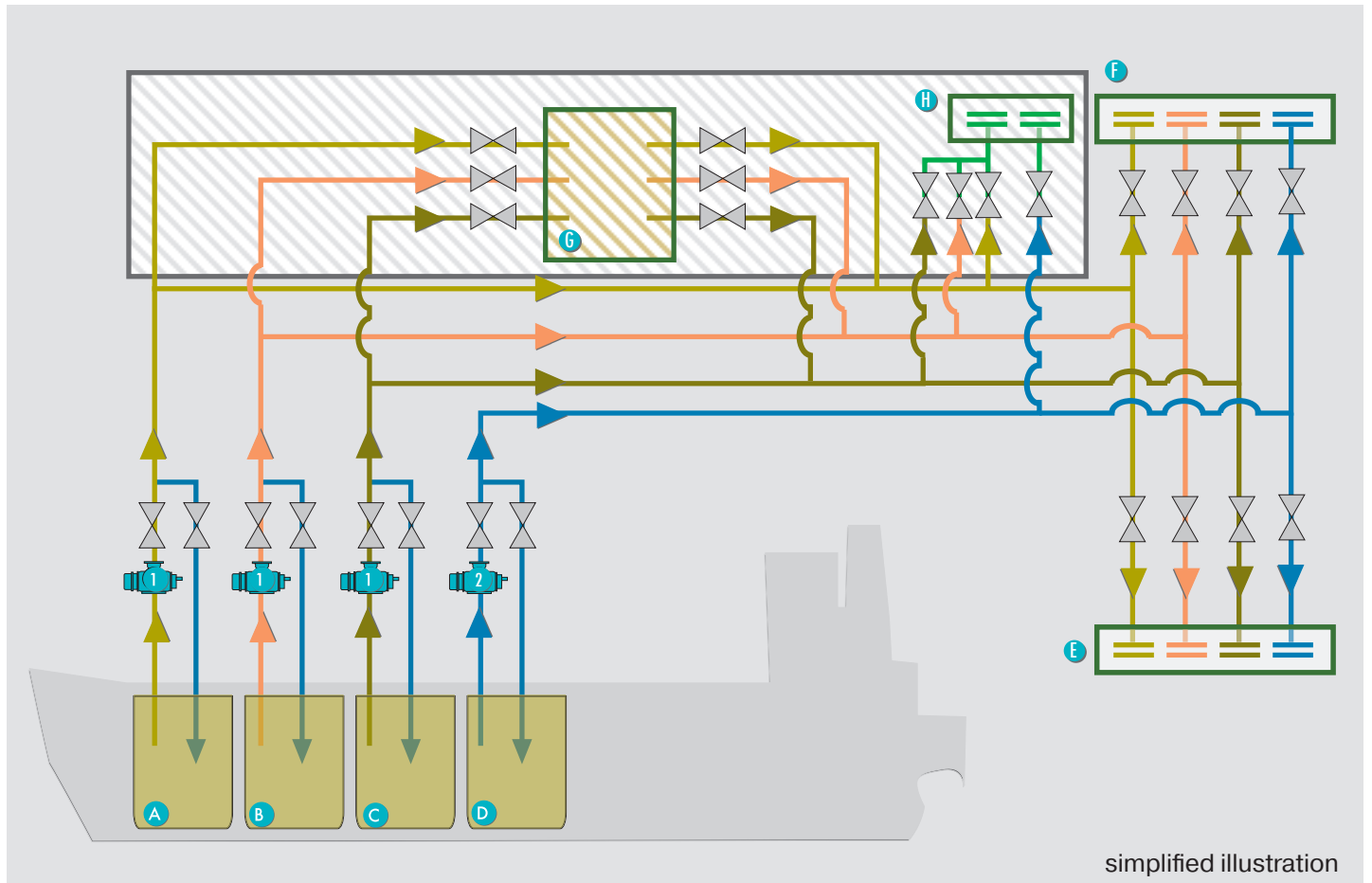


Top picture: Vertical "in-tank installation" of L5NT-Pumps
Right picture: Pump and assembly





Chemical and Oil Tanker



- Unloading Pipe Line
- Unloading Pipe Line
- Unloading Pipe Line
- Unloading Pipe Line
- Valve

- Cargo Pump
- Stripping Pump

- Cargo Tank
- Cargo Tank
- Cargo Tank
- Cargo Tanker & Slop Tank
- Manifold
- Manifold

- Blending station
- Blender
- Hose Crane

Crude Oil, Fuel Oil (Diesel, HFO, Gasoil etc.) Product Oil, Chemical and Molasses Pumping System Additions

1 Cargo Pump

All different fluids from low viscosity diesel oil to high viscosity crude oil or molasses are handled with Leistritz Screw Pumps. The design principle and operation of these pumps ensure a very low noise level and almost pulsation free discharge.



1 Cargo Pump L4N

2 Stripping Pump

All different fluids from diesel oil to crude oil or molasses are handled with Leistritz Screw Pumps. Good suction ability and capability to empty the tank, manifolds and lines.



2 Stripping Pump L4N

Special Applications: Bunkering Tanker

Leistritz Screw Pumps can handle the wide changes of the viscosity in bunkering refueller tanker equipped with blending station.

Viscosity ranges from 1 to 2000 cSt are possible without additional heating system.



Frequency Converter Cabinet

Pumping System adders available

With the use of frequency controlled motors and nearly linear relation of speed and flow rate can be adjusted easily by changing the speed of the pump. Frequency converter with air cooling or water cooling are available.

For changes of the viscosity and temperature, Leistritz offers a PLC to automatically adjust the speed of the pump.

As alternative, Leistritz Screw Pumps can be driven by hydraulic motors. For pump room installation Leistritz offers a gastight bulkhead penetration seal (with type approval) allowing the motor to be installed in a non-hazardous area.

Available materials for pump casings are cast iron, nodular cast iron, cast steel, bronze and stainless steel for handling all different kind of fluids.



Gastight Bulkhead Seal



Control apparatus mounted in Cargo room



FPSO - Dehydrating



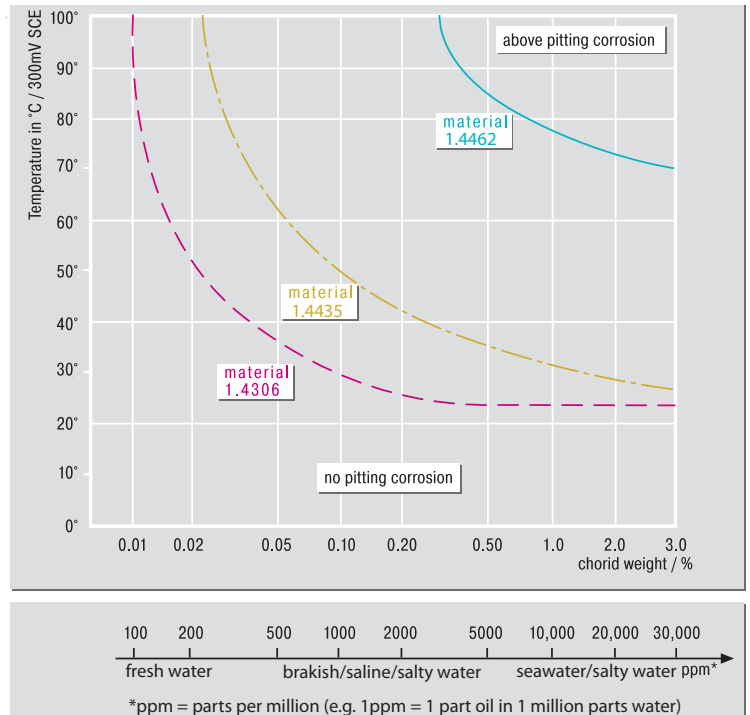
Selection of material for wetted parts of Leistritz Screw Pumps for Produced Water Treatments

Chloride Content of Water

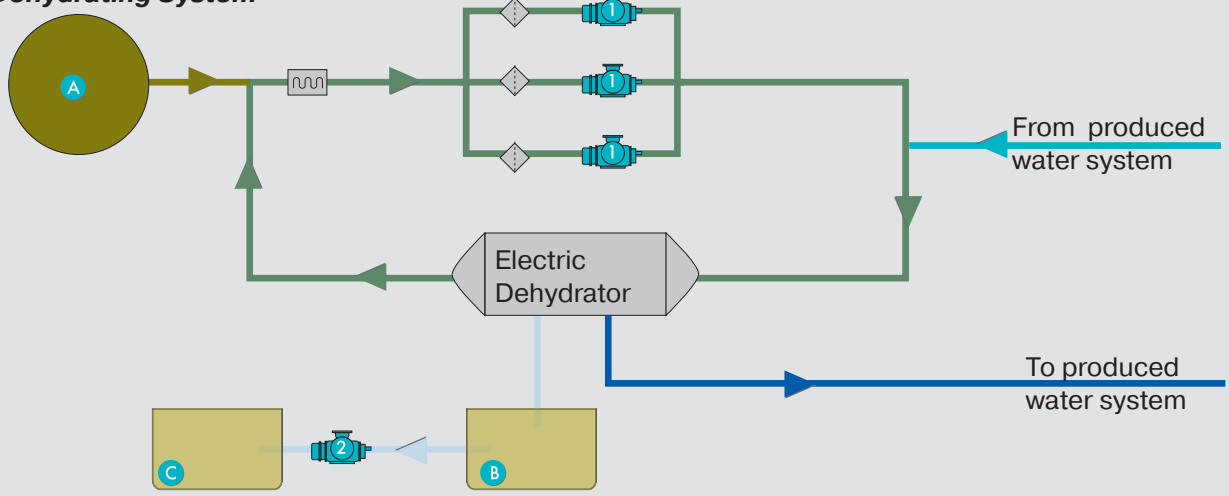
description	chloride content (PPM x 1000)
freshwater	+/- 1
saline water	1-25
seawater	25-50
salty water	<50

In order to select the optimal pump material, it is necessary to know the chloride content of the produced water.

The influence on critical temperature for initiation of pitting (CTP) for different rust-resistant steels in chloride solutions is mentioned in the adjoining diagram.



Electric Dehydrating System

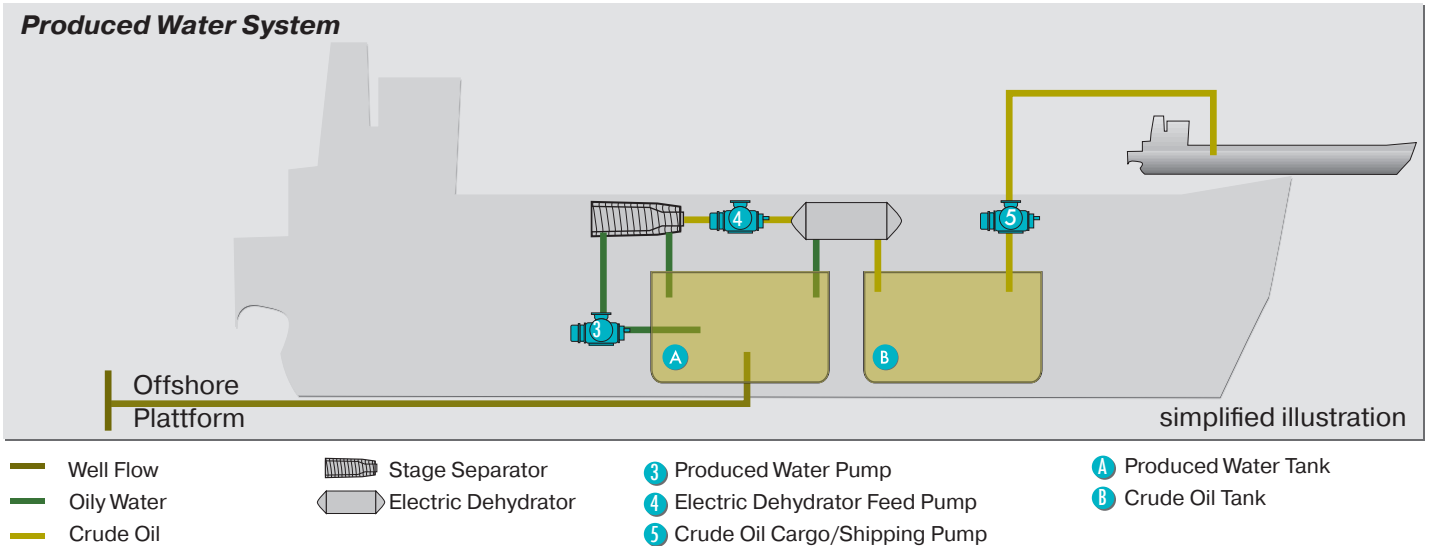


simplified illustration

- Crude Oil
- Mixture of Water & Oil
- Water (Oil more than 2000 ppm)
- Water (Oil less than 2000 ppm)
- Oil (Water less than 0,5 % by volume)
- Heat Exchanger
- Filter
- ① Leistritz Dehydrating Pump
- ② Leistritz Forwarding Pump
- A Oil Well
- B Settling Tank
- C Storage Tank



FPSO - Produced Water



1 Leistritz Dehydrating Pump

One method used to separate water from oil in offshore oil fields is the principle of electrostatic separation. Leistritz Dehydrating Pumps, series L4, are used for the supply of the electrostatic separator.

The water content of crude oil is a very important parameter that characterizes the grade or quality of the crude oil. In general a water content (BSW) of 0,2 % to 0,5 % by volume is considered as acceptable.

The small water drops in crude oil are getting separated in a strong electric field. Cathods and anods attract small water drops in order to form bigger ones. This procedure enables an easily water separation from crude oil.

2 Leistritz Forwarding Pump

After the electrostatic separation Leistritz Triple Screw Pumps, series L3, are used for transferring oil from the settling tank to the storage tank in the FPSO vessel.

3 Leistritz Produced Water Booster Pump

Formation water or produced water are usually produced along with oil and gas from a well or well cluster. The produced water is separated and treated to minimize the oil and solids content. Leistritz L4 Pumps are used to boost high pressure produced water injection pumps for pressure maintenance of the reservoirs.



3 Produced Water Pump L4NG

4 Leistritz Electric Dehydrator Feed Pump

As boosting equipment, Leistritz L4 Pumps will transfer oil from the first stage separator to the electrostatic Dehydrator. Two Pumps shall run in parallel, one standby. Leistritz L4 Pumps will be part of the process treatment module (FPSO deck).



4 Electric Dehydrator Feed Pump L4

5 Leistritz Crude Oil Cargo/Shipping Pump

Leistritz L4 Pumps will transfer the crude oil from the crude oil tank to the Oil Tanker. Low NPSH requirements and reliable flow, free of turbulence are the major advantage for Leistritz L4 Pumps.



5 Leistritz Crude Oil Cargo/Shipping Pump L4NG



Leistritz Cargo Control



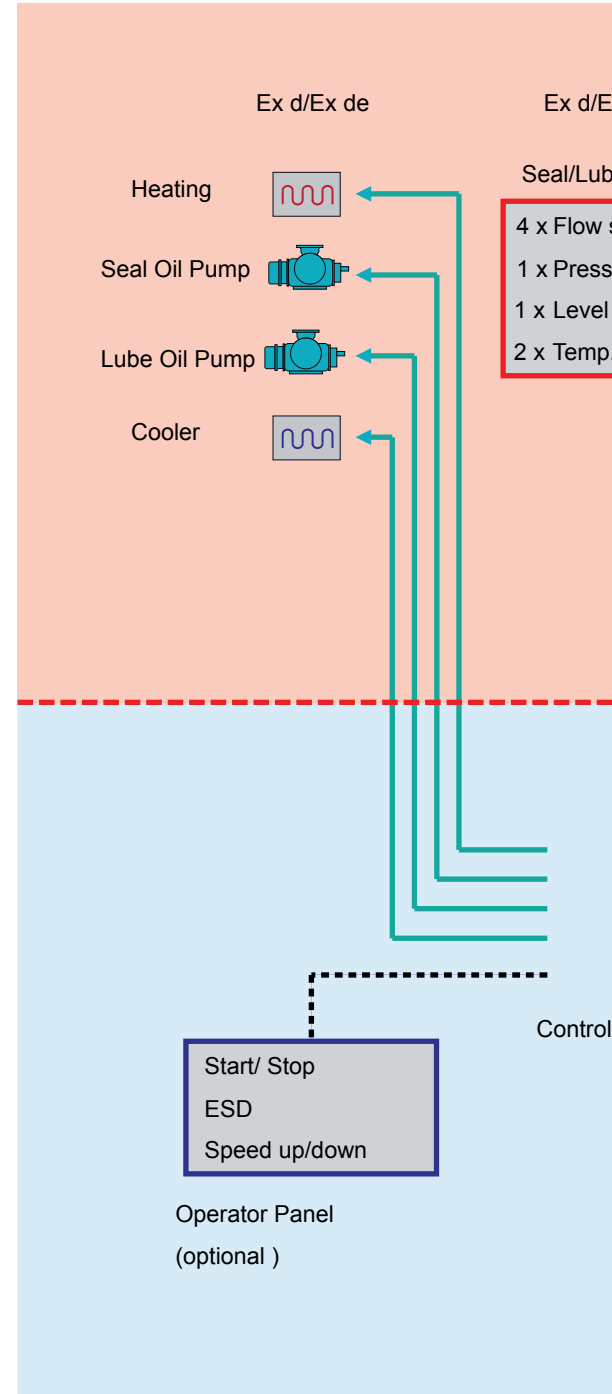
Electro-hydraulic Control System

The Independent load control of cargo pumps and side thruster connected to main close loop hydraulic system is generally arranged both remotely and locally.

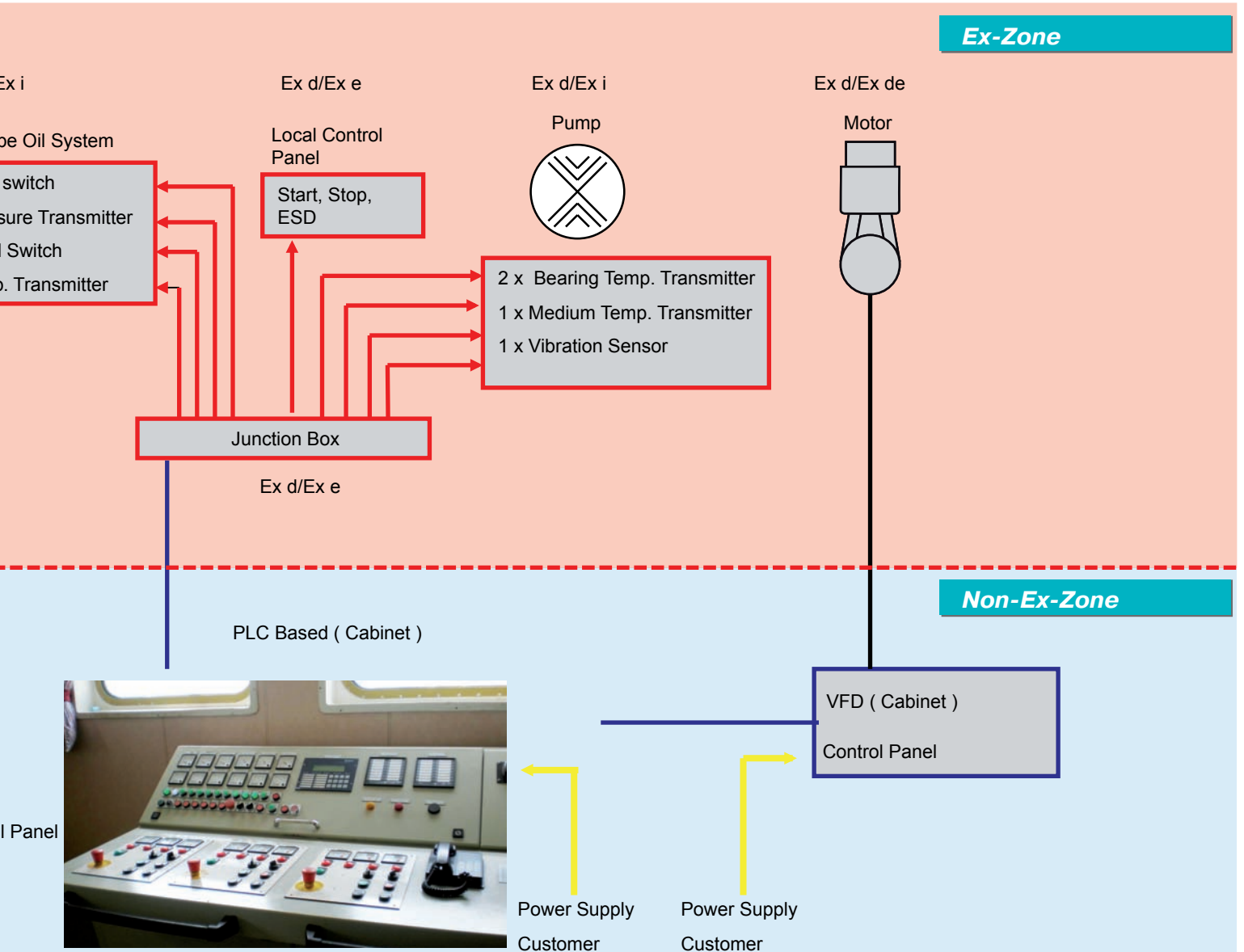
The Cargo Pumping System is controlled by a Programmable Logic Controller (PLC) installed inside the control panel. The PLC is programmed by HHI and provides the logic for safe operation and easy maintenance of the control system

The control panel contains a potentiometer and pressure gauge for each pump, for stepless independent load control. Electrical connections run between the control panel and a proportional valve/amplifier located in a safe area, where the electronic control signals are transformed into hydraulic signals.

Only hydraulic pilot lines run between the proportional valve/amplifier and the individual pumps. This control system can be interfaced to any central ship computerizing system.



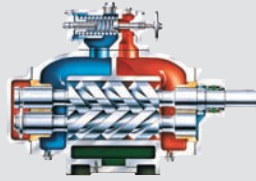
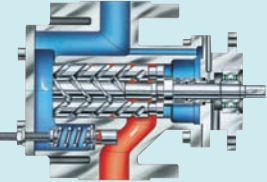
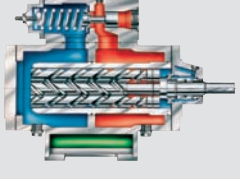
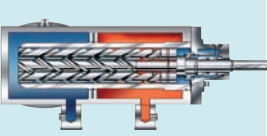
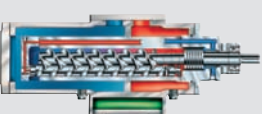
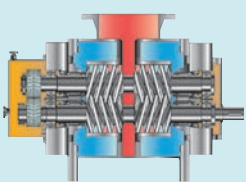
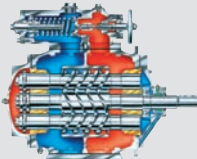
Leistritz Cargo Control



simplified illustration



Leistritz Screw Pump Programm

Series	Use for	Leistritz Screw Pump	Maximal Performance Data			
			Capacity	Differential Pressure	Viscosity	Pumping Temperature
L2	Low pressure duty, suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		900 m ³ /h [3,960 gpm]	16 bar [232 psi]	100,000 cSt	280°C [536°F]
L3N	Low pressure duty, suitable for transport of non abrasive lubricating fluids.		700 m ³ /h [3,100 gpm]	16 bar [232 psi]	15,000 cSt	180°C [356°F]
L3M	Medium pressure duty, suitable for transport of non abrasive lubricating fluids.		300 m ³ /h [1,320 gpm]	80 bar [1,160 psi]	10,000 cSt	280°C [536°F]
L3H	High pressure duty, suitable for transport of non abrasive lubricating fluids.		200 m ³ /h [880 gpm]	160 bar [2,320 psi]	10,000 cSt	280°C [536°F]
L3V/U	Ultra high pressure duty suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		180 m ³ /h [792 gpm]	280 bar [4,060 psi]	1,000 cSt	280°C [536°F]
L4	Low, medium and high pressure duty, suitable for transport of abrasive/non abrasive, corrosive/non corrosive, lubricating/non lubricating, high or low viscous fluids.		5,000 m ³ /h [22,000 gpm]	150 bar [2,175 psi]	150,000 cSt	350°C [662°F]
L5	Low pressure duty, suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		1,700 m ³ /h [7,500 gpm]	10 bar [145 psi]	100,000 cSt	280°C [536°F]

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