



PRODUCT RANGE PUMPS

CENTRIFUGAL PUMPS /
SIDE CHANNEL PUMPS /
TWIN SCREW PUMPS

ACC. DIN EN ISO / ASME / API



KLAUS UNION PUMPS & SYSTEMS



Founded in 1946 in Bochum, Germany, today Klaus Union is a market leader for the production and supply of pump systems and valves. Klaus Union keeps numerous patents and offers a comprehensive product portfolio of centrifugal and screw pumps. Since many of the global endusers of Klaus Union Pump Systems & Valves are from the chemical, petrochemical, or oil & gas industry, particularly high requirements are placed on all related products. Pumping or handling aggressive, toxic and/or explosive fluids does not allow any compromise on quality, service life and safety. Klaus Union state of the art products guarantee reliable operation and protection of both, people and environment.

KLAUS UNION INNOVATION FOR YOUR SAFETY

In the early 1950s, Klaus Union had already developed the world's first magnet drive, which was introduced at the AICHE in Frankfurt in 1955. Further trendsetting developments followed, such as the first titanium pump manufactured in Europe or state of the art magnet systems.

In 2012, Klaus Union developed Double Volute Twin Screw Pumps with pre-assembled cartridges for quick and easy maintenance. Due to safety and service reasons, today Klaus Union pumping systems are the focus for numerous industries.

ADVANCED MATERIAL – HIGHEST QUALITY

Klaus Union's product range covers pump systems and valves for a number of industries.

They are used e.g. for pumping corrosive and erosive liquids, in temperature sensitive applications (refrigeration, heat transfer), in power stations, liquid gas plants or in galvanic processes.

Beside steel and stainless steel, corrosion-resistant materials, such as nickel- and titanium-based alloys, are forming today's basis of all Klaus Union products.

A state of the art quality management system guarantees the highest degree of quality. Endusers around the world trust in Klaus Union products. The reliability of our products is supported by comprehensive factory service, provided on-site 24/7.

Klaus Union offers worldwide services by Klaus Union Service GmbH, an affiliate of the Klaus Union Group.

Experience
Responsibility
Passion



QUALITY ASSURANCE

A major element of the Klaus Union ethos is to ensure highest product quality.

Existing quality assurance procedures with Klaus Union suppliers are constantly monitored from order placement to goods receipt and final assembly. This quality assurance system, developed on latest technologies, complies with the requirements of international regulations.

Klaus Union products and processes are certified according to:



In accordance with
TUV NORD CERT
procedures,

KLAUS UNION GmbH & Co. KG
Blumenfeldstraße 18, 44795 Bochum
&
KLAUS UNION Service GmbH & Co. KG
Blumenfeldstraße 18, 44795 Bochum

are certified according to
DIN EN ISO 9001

- ▶ DIN EN ISO 9001
- ▶ DIN EN ISO 50001
- ▶ Pressure Equipment Directive 2014 / 68 / EU
- ▶ Machinery Directive 2006 / 42 / EC
- ▶ Explosion Protection Directive 2014 / 34 / EU
("ATEX Directive", equipment category 2 for use in explosion protection zone 1, II 2G Ex h IIC T1-T4 Gb)
- ▶ EAC Certificate - Certificate of conformity with requirements of technical regulations
CU TR 004/010/012/020/2011, Russia



PRODUCT PORTFOLIO

MAGNET DRIVE PUMPS



DIN
ASME
API



SINGLE-STAGE CENTRIFUGAL PUMP

p. 20/21

According **DIN EN ISO 2858 & DIN EN ISO 15783**

- ▶ Flow Rate: max. 3,500 m³/h
max. 15,410 USGPM
- ▶ Delivery Head: max. 220 m L.C.
max. 722 ft
- ▶ Temperature Range: -200 °C to +450 °C
-328 °F to +842 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



SINGLE-STAGE CENTRIFUGAL PUMP

p. 22/23

According **ASME B73.3**

- ▶ Flow Rate: max. 200 m³/h
max. 881 USGPM
- ▶ Delivery Head: max. 155 m L.C.
max. 509 ft
- ▶ Temperature Range: -200 °C to +450 °C
-328 °F to +842 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



SINGLE-STAGE CENTRIFUGAL PUMP

p. 24/25

According **API 685**

- ▶ Flow Rate: max. 3,500 m³/h
max. 15,410 USGPM
- ▶ Delivery Head: max. 220 m L.C.
max. 722 ft
- ▶ Temperature Range: -200 °C to +450 °C
-328 °F to +842 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi

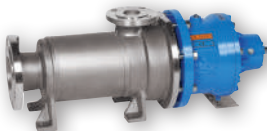


VERTICAL INLINE CENTRIFUGAL PUMP

p. 26/27

Following **DIN EN ISO 2858 & DIN EN ISO 15783 / ASME B73.3 / API 685**

- ▶ Flow Rate: max. 900 m³/h
max. 3,963 USGPM
- ▶ Delivery Head: max. 220 m L.C.
max. 722 ft
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 40
max. 580 psi

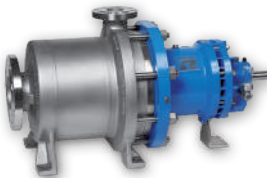


MULTI-STAGE SIDE CHANNEL PUMP

p. 28/29

Following **DIN EN ISO 15783**

- ▶ Flow Rate: max. 42 m³/h
max. 185 USGPM
- ▶ Delivery Head: max. 470 m L.C.
max. 1,542 ft
- ▶ Temperature Range: -120 °C to +250 °C
-184 °F to +482 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



MULTI-STAGE CENTRIFUGAL PUMP

p. 30/31

Ring-Section Design /
Barrel Design

According **DIN EN ISO 15783 / API 685**

- ▶ Flow Rate: max. 300 m³/h
max. 1,321 USGPM
- ▶ Delivery Head: max. 2,200 m L.C.
max. 7,218 ft
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 250
max. 3,626 psi



VERTICALLY SUSPENDED (SUMP) PUMP

p. 32-35

Single- / Multi-Stage

According **DIN EN ISO 2858 & DIN EN ISO 15783 /**
Following **ASME B73.3 / API 685**

- ▶ Flow Rate: max. 900 m³/h
max. 3,963 USGPM
- ▶ Delivery Head: max. 1,200 m L.C.
max. 3,937 ft
- ▶ Temperature Range: -40 °C to +200 °C
-40 °F to +392 °F
- ▶ Pressure Rating: max. PN 63
max. 914 psi



SINGLE VOLUTE TWIN SCREW PUMP

p. 36/37

According **API 676**

- ▶ Flow Rate: max. 1,800 m³/h
max. 7,925 USGPM
- ▶ Diff. Pressure: max. 40 bar
max. 580 psi
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi

Note: All maximum parameters mentioned above are referring to standard designs.
Extension of these parameters is possible subject to detailed technical review.

PRODUCT PORTFOLIO

MECHANICALLY SEALED PUMPS



SINGLE-STAGE CENTRIFUGAL PUMP

p. 38/39

According **DIN EN ISO 2858 & DIN EN ISO 5199**

- ▶ Flow Rate: max. 3,500 m³/h
max. 15,410 USGPM
- ▶ Delivery Head: max. 220 m L.C.
max. 722 ft
- ▶ Temperature Range: -120 °C to +450 °C
-184 °F to +842 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



SINGLE-STAGE CENTRIFUGAL PUMP

p. 40/41

According **API 610 & ISO 13709**

- ▶ Flow Rate: max. 3,500 m³/h
max. 15,410 USGPM
- ▶ Delivery Head: max. 220 m L.C.
max. 722 ft
- ▶ Temperature Range: -120 °C to +450 °C
-184 °F to +842 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



MULTI-STAGE CENTRIFUGAL PUMP

p. 42/43

Ring-Section Design /
Barrel Design

According **DIN EN ISO 5199 /**
Following **API 610 & ISO 13709**

- ▶ Flow Rate: max. 300 m³/h
max. 1,321 USGPM
- ▶ Delivery Head: max. 2,200 m L.C.
max. 7,218 ft
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 250
max. 3,626 psi



VERTICALLY SUSPENDED (SUMP) PUMP

p. 44/45

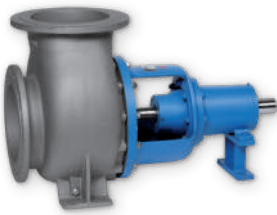
Single- / Multi-Stage

According **DIN EN ISO 2858 & DIN EN ISO 5199 /**
API 610 & ISO 13709

- ▶ Flow Rate: max. 900 m³/h
max. 3,963 USGPM
- ▶ Delivery Head: max. 1,200 m L.C.
max. 3,937 ft
- ▶ Temperature Range: -40 °C to +300 °C
-40 °F to +572 °F
- ▶ Pressure Rating: max. PN 63
max. 914 psi



DIN
ASME
API



SINGLE-STAGE PROPELLER PUMP

p. 46/47

- ▶ Flow Rate: max. 12,000 m³/h
max. 52,835 USGPM
- ▶ Delivery Head: max. 12 m L.C.
max. 39 ft
- ▶ Temperature Range: -120 °C to +250 °C
-184 °F to +482 °F
- ▶ Pressure Rating: max. PN 100
max. 1,450 psi



SINGLE VOLUTE TWIN SCREW PUMP

p. 48/49

According **API 676**

- ▶ Flow Rate: max. 1,800 m³/h
max. 7,925 USGPM
- ▶ Diff. Pressure: max. 40 bar
max. 580 psi
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 400
max. 5,802 psi



DOUBLE VOLUTE TWIN SCREW PUMP

p. 50/51

According **API 676**

- ▶ Flow Rate: max. 5,000 m³/h
max. 22,000 USGPM
- ▶ Diff. Pressure: max. 100 bar
max. 1,450 psi
- ▶ Temperature Range: -120 °C to +350 °C
-184 °F to +662 °F
- ▶ Pressure Rating: max. PN 150
max. 2,176 psi

Note: All maximum parameters mentioned above are referring to standard designs.
Extension of these parameters is possible subject to detailed technical review.

THE MODULAR SYSTEM FOR MAGNET DRIVE PUMPS

THE MODULAR SYSTEM

Klaus Union's modular pump system consists of three different elements:

- ▶ Pump Hydraulic
- ▶ Magnet Coupling
- ▶ Bearing Bracket

The combination of these components allows a large operating envelope with few differing parts. The parts are even interchangeable between the screw pump and centrifugal pump series. Over 100 different pump sizes and magnet drives cover operation parameters up to 3.500 m³/h and 400 bar. Interchangeability, stock size and servicing equipment are simplified for all users.

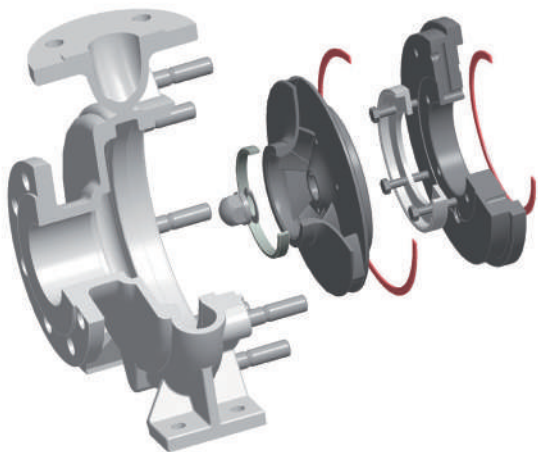


Fig. 1: Pump Hydraulic (Centrifugal Pump), 41 Sizes

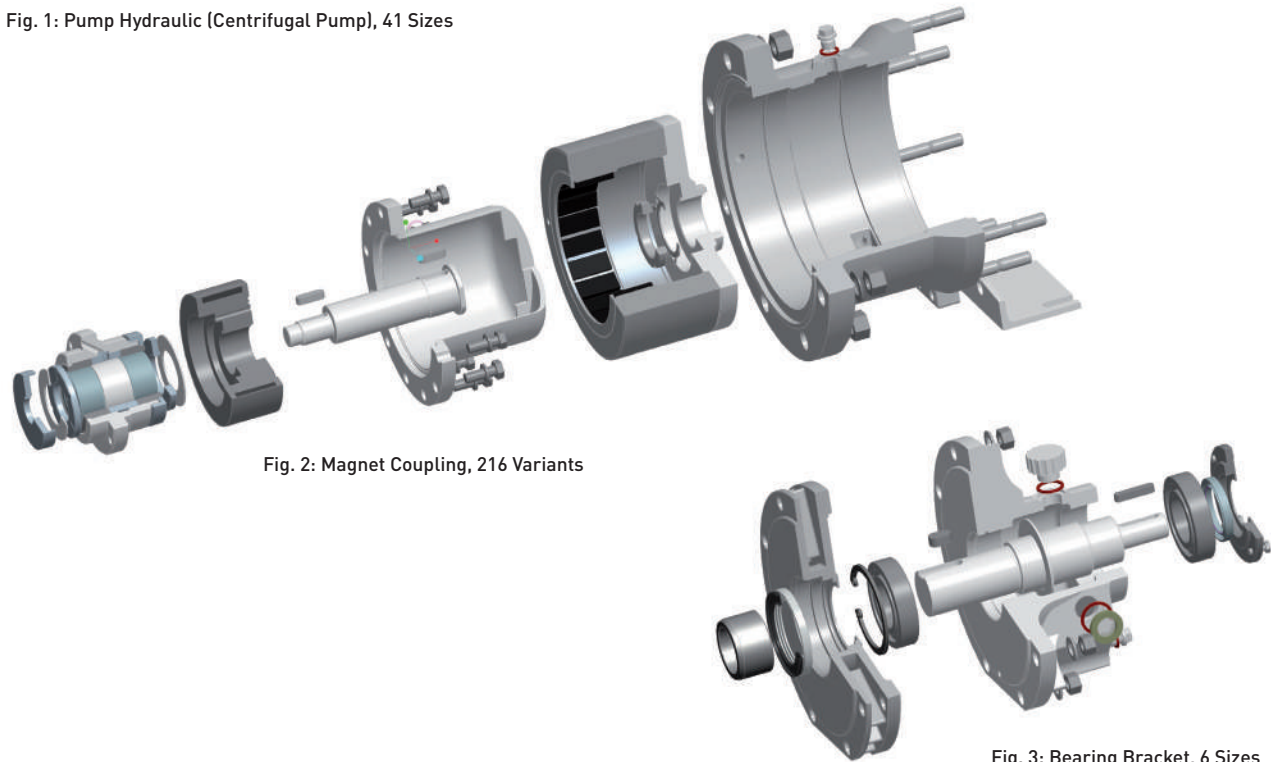


Fig. 2: Magnet Coupling, 216 Variants

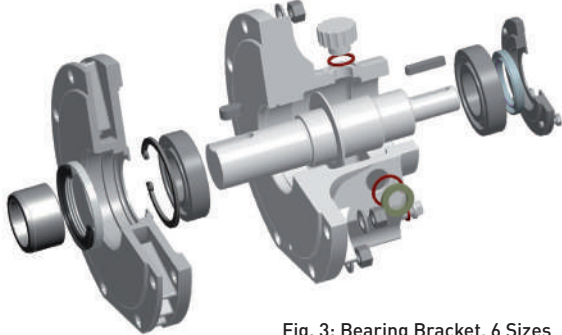


Fig. 3: Bearing Bracket, 6 Sizes



Quality and
Know-How

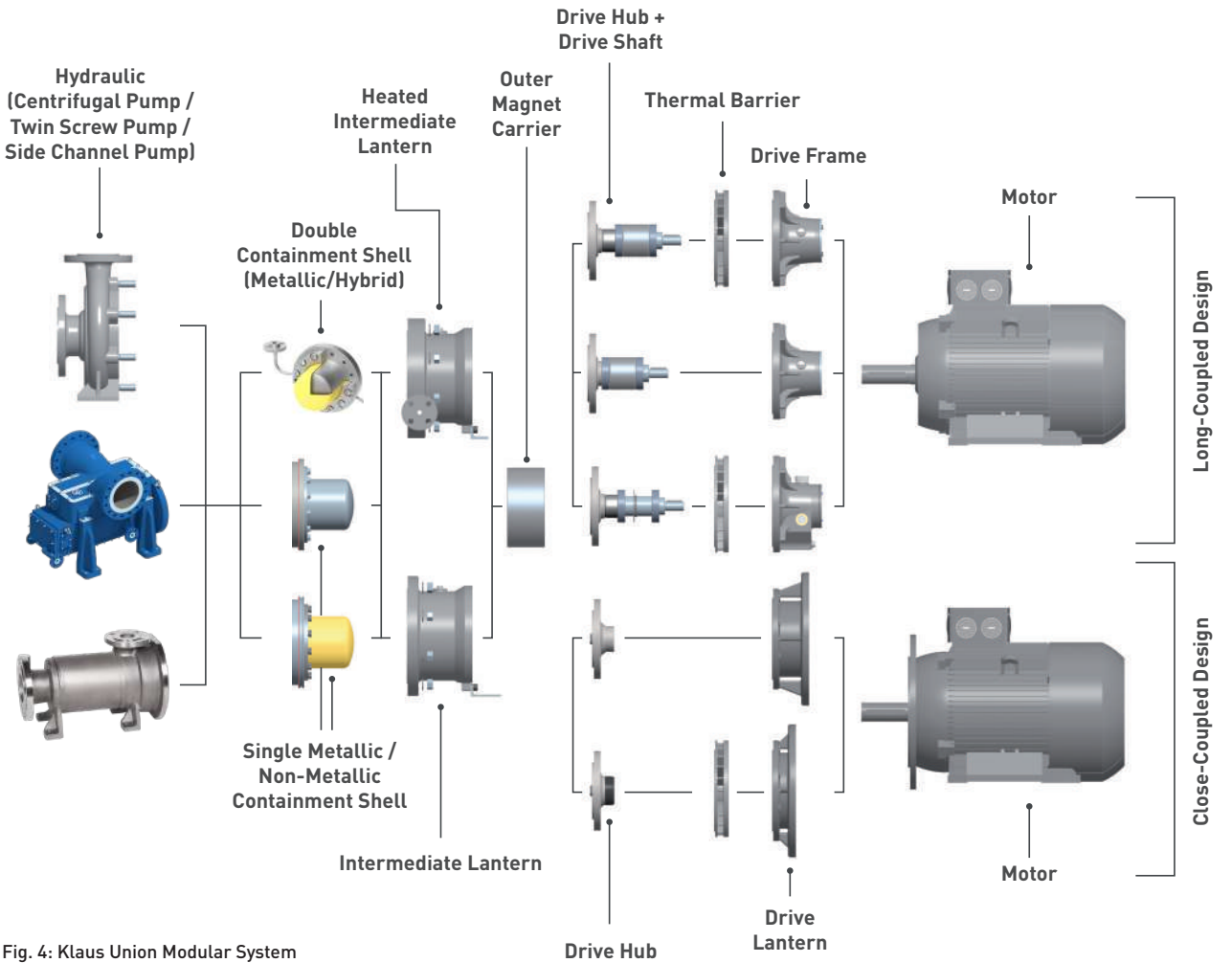


Fig. 4: Klaus Union Modular System

KLAUS UNION MAGNET DRIVE - WHEN LEAKAGE IS NOT AN OPTION

SEALLESS TECHNOLOGY

If pumps are used to handle dangerous products, it is essential to avoid even the smallest leakages into the environment in order to ensure the protection of both people and the atmosphere.

Using sealless pumps with magnet drive is the premier and most ideal solution for such applications. The first of its kind was already introduced by Klaus Union in 1955.

TECHNICAL DESCRIPTION

Figure 5 shows a cross sectional view of a pump with magnet drive. The drive shaft - to transfer the mechanical energy from the drive to the pump hydraulics - is not a single shaft with a gland packing or mechanical seal on it. Instead, the mechanical energy transferred from the drive to the pump shaft is transferred to an outer ring (outer magnet carrier) fitted with permanent magnets. The impeller of the centrifugal pump is firmly connected via the impeller shaft to an inner ring (inner magnet carrier) also fitted with permanent magnets. Due to the rotation of the outer magnet carrier, the inner magnet carrier is rotated synchronously via magnetic forces; the mechanical drive energy is transmitted via the magnetic field.

A containment shell is installed to separate the pumped fluid from its environment. The impeller shaft is supported by fluid-lubricated slide bearings within the pump's hydraulic system. This special design enables hermetic integrity.

There are no dynamic seals between the pumped fluid and the environment from which leaks can escape to the environment. Only two static seals (designed as flat seals or O-rings) are used between pump casing and casing cover and between casing cover and containment shell in the magnetically driven pump. The static seals are maintenance free and therefore the pump is hermetically sealed.

ADVANTAGES VS. MECHANICALLY SEALED PUMPS

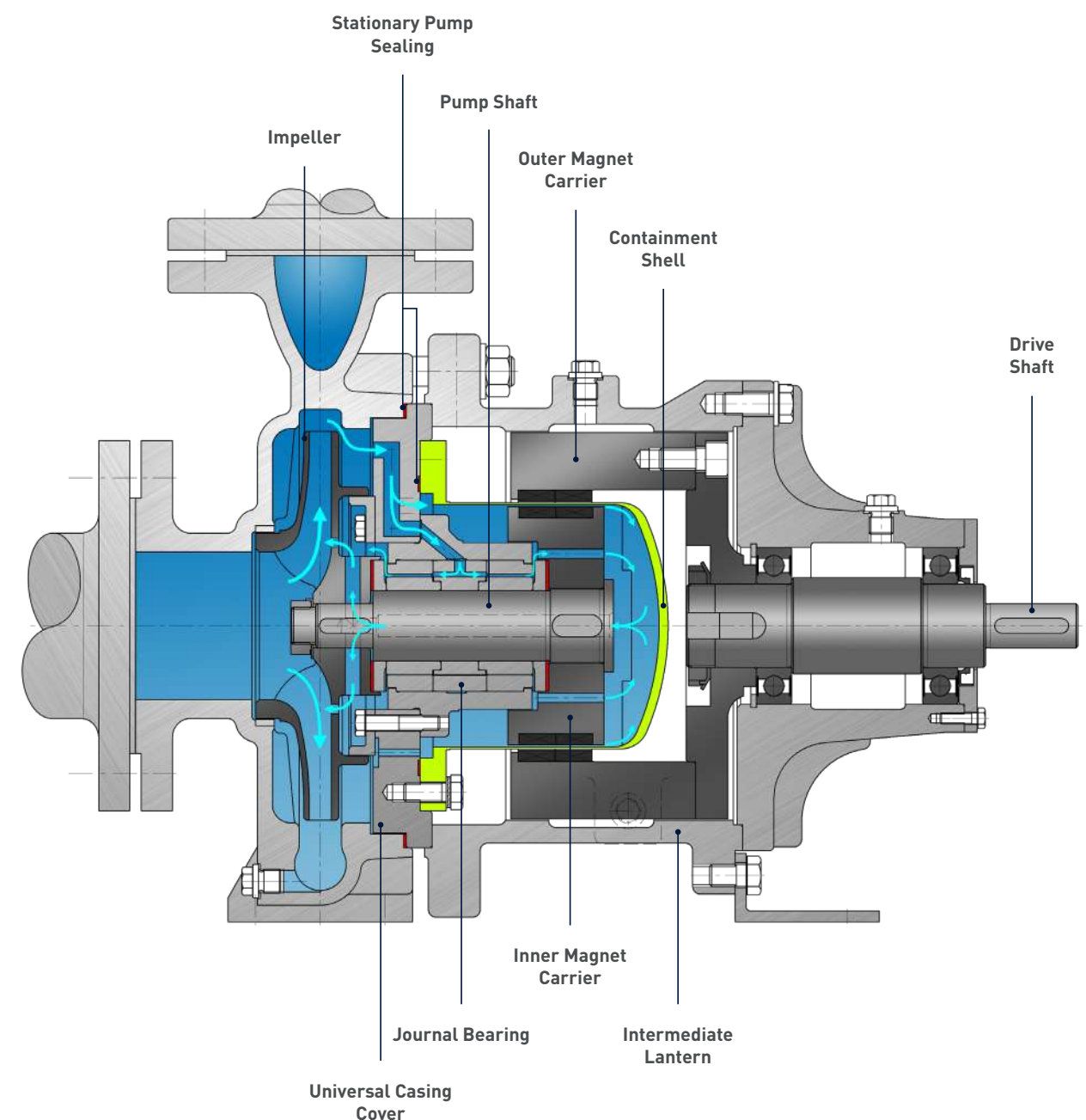
- ▶ Nearly maintenance free
- ▶ Less investment costs and less maintenance costs
- ▶ No instrumentation or special monitoring devices required in standard
- ▶ No utilities required at all, such as nitrogen or cooling water
- ▶ No leakage to the atmosphere at all
- ▶ No loss of sealant liquid at all
- ▶ No wear of the seals at all
- ▶ Low mechanical loads on shaft and bearings
- ▶ High stiffness of the pump shaft

ADVANTAGES VS. CANNED MOTOR PUMPS

- ▶ Standard IEC and NEMA motors can be used
- ▶ Maintenance without disconnecting pump and motor possible
- ▶ Lower investment and repair costs
- ▶ Separate flushing of journal bearing
- ▶ Higher efficiency
- ▶ Use of non-metallic containment shell possible
- ▶ No heat generation of the rotor by electric losses
- ▶ Pumping fluids having higher viscosities possible
- ▶ Higher temperatures possible without cooling
- ▶ No special monitoring devices necessary



Fig. 5: Magnet Drive Pump Cutaway // Main Components & Internal Circulation (internal circulation of the fluid →)



CLOSE-COUPLED DESIGN FOR MAGNET DRIVE PUMPS

KLAUS UNION PUMPS IN CLOSE-COUPLED DESIGN

Close-coupled pumps are the result of the continuous development of the proven Klaus Union pumps with magnet drive and without shaft seal.

Pumps in close-coupled design meet highest technical and economic requirements that chemical, petrochemical, and oil & gas industry expect today from pumps without shaft seals.

The design without shaft seal but with magnet drive guarantees that the pump operates leak free, in accordance with the TA-Luft specification (German Technical Instruction on Air Quality Control). In comparison to pumps with mechanical seal, Klaus Union's sealless magnet drive pumps operate maintenance-free.

Klaus Union's leak-free pumps are particularly suitable for pumping toxic, aggressive, inflammable and other environmentally hazardous liquids particularly in the following industries:



The design covers the complete performance range of centrifugal and twin screw pumps. Multistage centrifugal pumps and pumps designed for high pressure applications are also available as special designs.

The close-coupled design offers significant cost savings because of the following advantages:

- ▶ No alignment between pump and motor necessary
- ▶ No coupling and coupling guard needed
- ▶ No ball bearings
 - Pump does not require scheduled maintenance
 - No oil lubrication necessary
 - Lower noise level
- ▶ High stiffness of the pump shaft because of small overhung compared to pumps with shaft seal
- ▶ Use of standard high efficient IEC and NEMA motors contrary to canned motors
 - Better availability with standard motors
 - Maintenance of motors is standardized and can be done by the customer on site

All Klaus Union magnet drive pumps are available in close-coupled design.

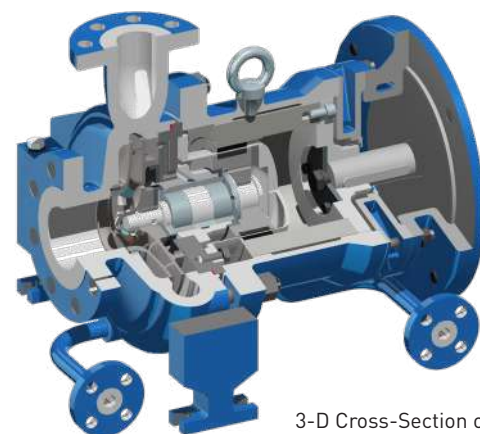


Fig. 6:
3-D Cross-Section of SLM APC
No coupling and coupling guard necessary

Tailor-Made Solutions

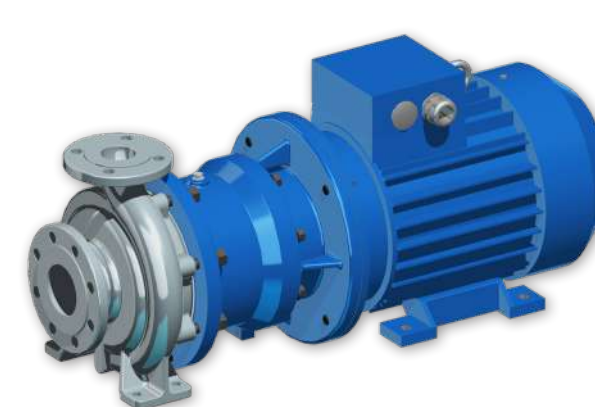


Fig. 7:
Magnet Drive Centrifugal Pump SLM NVB
(Close-Coupled Design)



Fig. 8:
Magnet Drive Centrifugal Pump SLM APC
(Close-Coupled Design)

ENERGY EFFICIENT DESIGN FOR MAGNET DRIVE PUMPS I

ENHANCING PUMP EFFICIENCY WITHOUT COMPROMISING ITS PERFORMANCE

Through the use of non-metallic containment shells instead of the traditionally used metallic containment shells, Klaus Union eliminates eddy current losses and increases the efficiency of magnet drive pumps significantly.

Thanks to the zero-leakage magnet drive concept, pumps with magnet drive have a huge and significantly growing market share in the chemical, petrochemical, and oil & gas industry.

For many years, Klaus Union has used non-metallic containment shells and particularly those made from technical ceramics for various applications due to their high chemical resistance.

So far, the operation range has been limited due to the specific material characteristics. However, pump applications increasingly require higher operating pressures, temperatures and flow rates whilst still offering maximum efficiency.



Klaus Union accepted this challenge and provides the following application envelope:

NOM. PRESSURE RANGE:

UP TO PN 63

UP TO 914 PSI

TEMPERATURE RANGE:

-200 °C to +450 °C

-328 °F to +842 °F

TRANSMITTABLE POWER:

UP TO 1 MW



Fig. 9:
Size Range Zirconium Oxide Containment Shells

Performance,
Technology and
Innovation

MODULAR SYSTEM MAKES THE DIFFERENCE

Klaus Union offers a modular system for all sealless centrifugal and screw pumps.

This system consists of the pump hydraulic, the magnet drive and the bearing bracket. All pump types in this system use an universal casing cover, which easily allows to change the existing containment shells regardless of its material. Within the modular system, containment shells made of technical ceramic are available for every magnet drive size (09-31 E/T/P/U).

Our containment shell design is optimized by the aid of state of the art Finite Element Analysis (FEA). This simulation method allows to detect and analyze accurate approximations of stress and deformations. The result is an optimization of structural parts and its quality as well as the elimination of the risk of failure.

The graphics below show a strain behaviour (Fig. 1) and a stress analysis (Fig. 2) at a hydrotest at 94,5 bar (1370 psi).

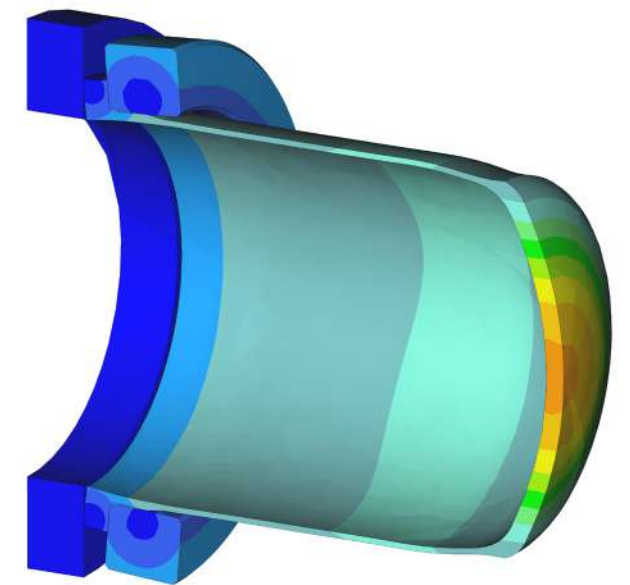


Fig. 10:
Displacement Analysis

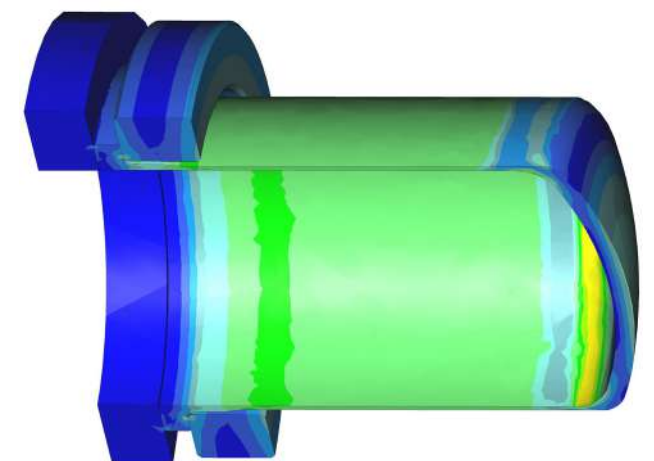


Fig. 11:
Stress Analysis

ENERGY EFFICIENT DESIGN FOR MAGNET DRIVE PUMPS II

ADVANTAGES OF CERAMIC CONTAINMENT SHELLS

Containment Shells made of Zirconium Oxide are not magnetizable. Due to this characteristic there are no eddy current losses impacting the pump performance. In consequence, no heat is added to the pumped liquid. This has the following advantages:

- ▶ Enables for dry run capable executions (RTZ-design) and executions without continuous flush flow (OTZ-design).
- ▶ Enables for applications with high gas content.
- ▶ Pumps can handle fluids close to boiling point, e.g. liquid gas applications.
- ▶ Instrumentation to monitor the isolation shell temperature is not required anymore (since eddy current losses are eliminated).

FURTHER ADVANTAGES:

- ▶ High mechanical strength; Extension of the application through higher pump speed.
- ▶ Vacuum-tight up to 0 bar absolute.
- ▶ High corrosion and erosion resistance; zirconium oxide has a nearly unlimited application range, especially related to lyes and acids.
- ▶ Excellent thermal shock resistance
- ▶ Enhanced energy efficiency

RETROFIT OF PUMPS WITH SHAFT SEAL

- ▶ As there are no eddy current losses, efficiencies comparable to pumps with shaft seals can be achieved.

For quality control purposes, all Klaus Union containment shells are equipped with an individual, engraved serial number. Furthermore, Klaus Union provides material certificates on request.

COST SAVINGS THROUGH THE APPLICATION OF ZIRCONIUM OXIDE

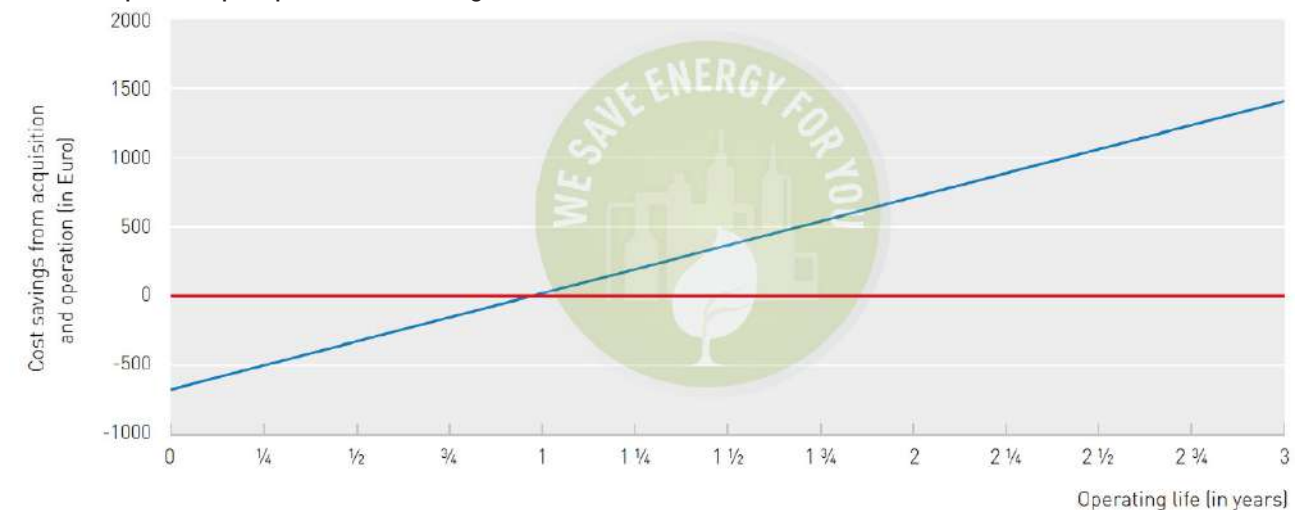
- ▶ Ceramic containment shells are a fundamental part of Klaus Union's modular pump system. Due to the universal casing cover containment shells can be easily and safely mounted or replaced. The operator saves stock capacities and service costs.
- ▶ There is no heat input into the pumped liquid; this significantly increases the process reliability. In consequence, no temperature monitoring is required at the containment shell.
- ▶ Energy consumption can be lowered as there are no performance-impairing eddy currents. In fact, the consumed power can be reduced by 10 to 15 %, compared to metallic isolation shells.
- ▶ Due to reduced shaft power demand, smaller electric motors can be installed.

Klaus Union
**Our Quality
is your Success**

ENERGY-SAVING POTENTIAL BY ELIMINATING EDDY CURRENT POWER LOSSES

Case study during 8800 operating hours illustrating the energy saving potential

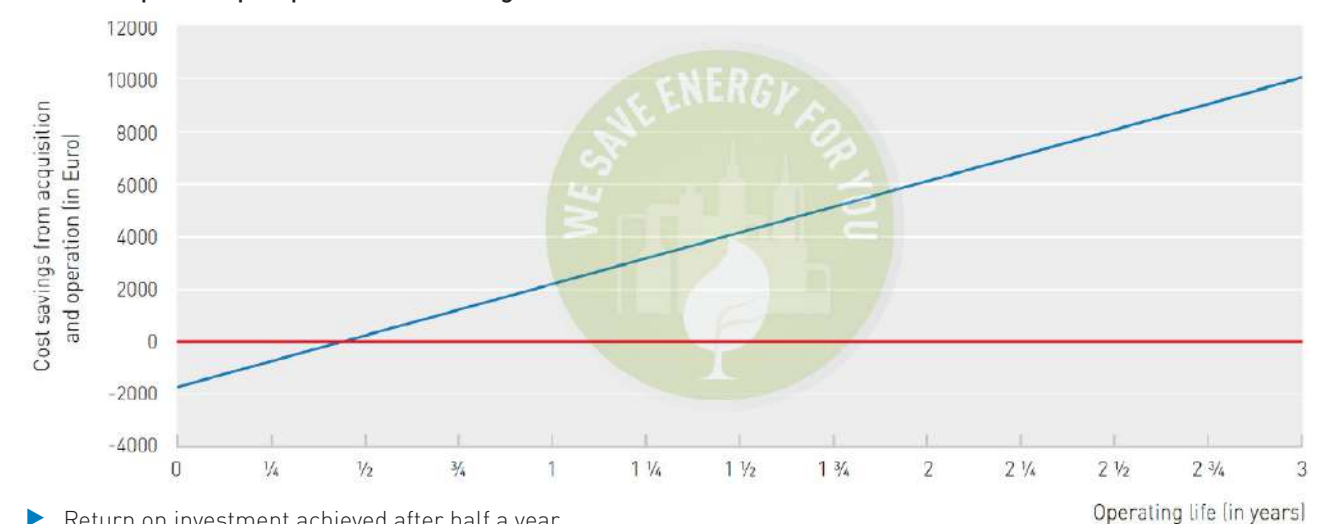
Cost-comparison pump with 10 kW magnet drive



- ▶ Return on investment achieved after one year

Centrifugal pump with magnet drive ▶ Energy-efficient design ▶ Standard design

Cost-comparison pump with 100 kW magnet drive



- ▶ Return on investment achieved after half a year.

Centrifugal pump with magnet drive ▶ Energy-efficient design ▶ Standard design

HYBRID DOUBLE CONTAINMENT SHELL

HYBRID DOUBLE CONTAINMENT SHELL

Pumping aggressive, explosive and highly toxic liquids requires the highest level of process safety. To protect people and the environment, leakage of the pumped liquid must be avoided - including in the event of a pump failure. For these most critical applications a magnetic drive pump equipped with a monitored, double containment shell still remains the safest solution.

To reduce the heat generated by a purely metallic, double containment shell and at the same time to improve the overall efficiency of the pump, Klaus Union has developed and patented a new hybrid double containment shell.



ADVANTAGES

- ▶ Reduced heat input into the pumped process liquid
- ▶ Increased reliability when pumping liquids close to their boiling point
- ▶ High corrosion resistance
- ▶ Higher efficiency leading to power savings
- ▶ Wider application range than full metal, double containment shells
- ▶ Fully compliant with requirements for secondary containment system as defined by API 685, 3rd Edition, § 3.1.71
- ▶ Primary and secondary containment integrity is constantly verified by the pressure transmitter
- ▶ Easy and reliable detection of containment breach through a standard pressure transmitter
- ▶ High spare parts availability by using of standard Klaus Union components
- ▶ Ability to flush the area between shells (according API 685, 3rd Edition, § 6.7.9)
- ▶ Available across entire Klaus Union mag-drive pump range
- ▶ Reliable and maintenance friendly construction

MAX. PRESSURE RATING:

63 BAR at 120 °C

914 PSI AT 248 °F

TEMPERATURE RANGE:

-60 °C to +400 °C

-76 °F to +752 °F

(HIGHER ON REQUEST)

MAX. PUMP SPEED:

3.600 RPM

Quality and Know-How

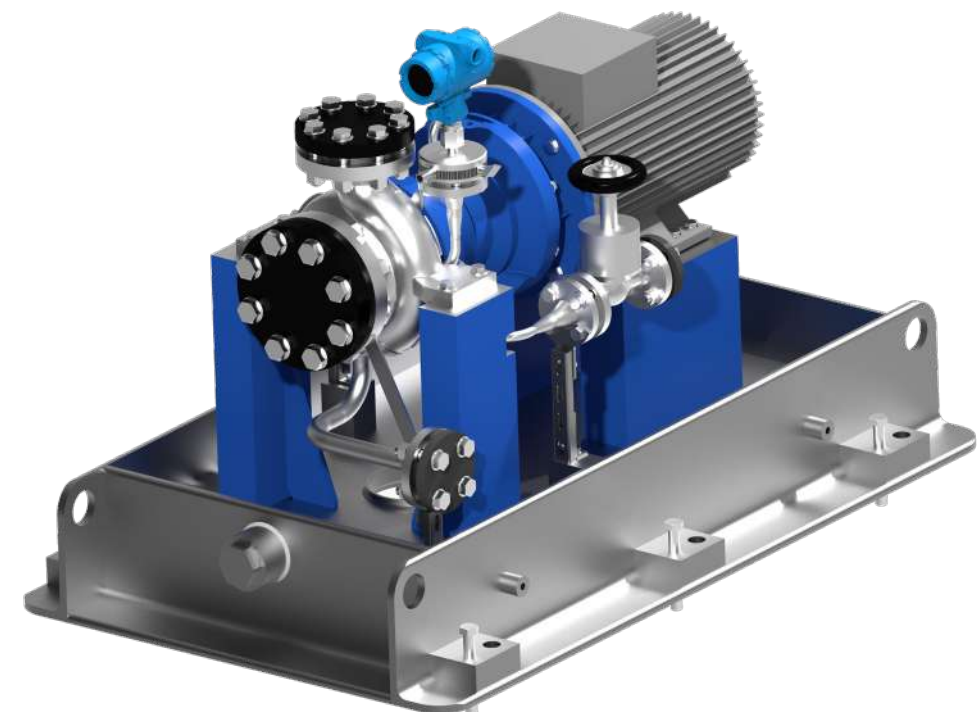


WORKING PRINCIPLE

The hybrid double containment shell combines two separate shells. The inner shell is a highly corrosion resistant metallic containment shell while the outer, secondary shell is a non-metallic containment shell made from heavy duty technical ceramics. The increased electrical resistance of the materials used in this hybrid design reduces the eddy current losses. It improves the efficiency of the pump putting it about on par to traditional metallic, single containment shells. Moreover the risk of vaporization, especially when pumping media close to the boiling point or under other critical operating conditions, is significantly reduced.

The gap between both shells is provided with a vacuum and can be monitored with a standard pressure sensor; typically a pressure transmitter following customer instrumentation standards. In the event of damage to either containment shell the sensor immediately detects the change in pressure and alerts the operator, identifying which shell has been breached. This immediate and detailed information allows the operator to take any necessary steps to avoid any leakage of the dangerous pumped liquid to the atmosphere.

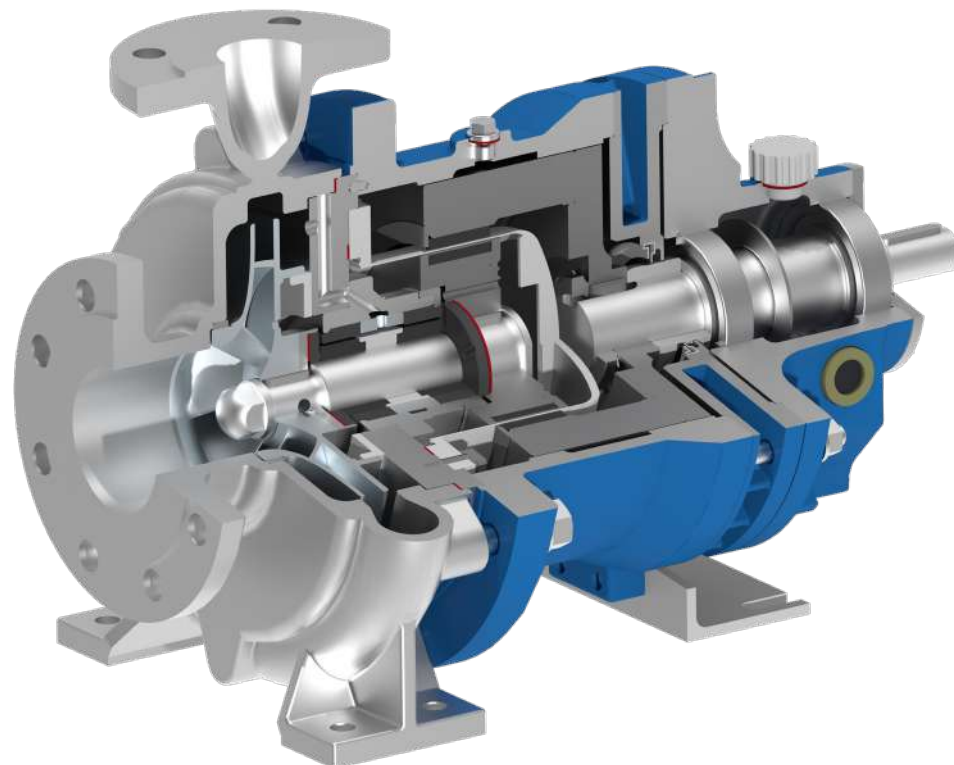
The patented hybrid double containment shell design substantially increases safety and reliability for operators in all kinds of industries reducing operation costs for the most critical applications where leakage is not an option - ever.



SINGLE STAGE CENTRIFUGAL PUMP WITH MAGNET DRIVE

SERIES SLM NV

ACCORDING DIN EN ISO 2858 & DIN EN ISO 15783



DIN EN ISO

MAX. FLOW RATE:

3.500 M³/H

15,410 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-200 °C to +450 °C

-328 °F to +842 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Hydraulic performance and dimensions according to DIN EN ISO 2858
- ▶ Design based on DIN EN ISO 15783
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with anti-friction bearings; oil-lubricated or greased-for-life
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

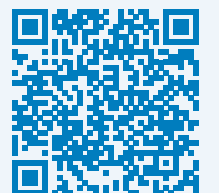
OPTIONS

- ▶ Double volute casing design in case of larger sizes
- ▶ Centerline mounting (OH2)
- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Semi-open and open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Back pull out-unit
- ▶ Magnet drive acc. API 685
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM NVB)
- ▶ Vertical dry mounted arrangement
- ▶ Retrofit

PUMPING OF

- | | |
|--|-----------------------------|
| ▶ Acids | ▶ Liquids containing solids |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Lyes |
| ▶ Coolants | ▶ Molten sulfur |
| ▶ Dyes and paints | ▶ Refrigerants |
| ▶ Heat transfer liquids | ▶ Salt solutions |
| ▶ Hot water | ▶ Sea water |
| ▶ Hydrocarbons | ▶ Solvents |
| ▶ Liquid gases | ▶ Valuable liquids |
| | ▶ And many more |

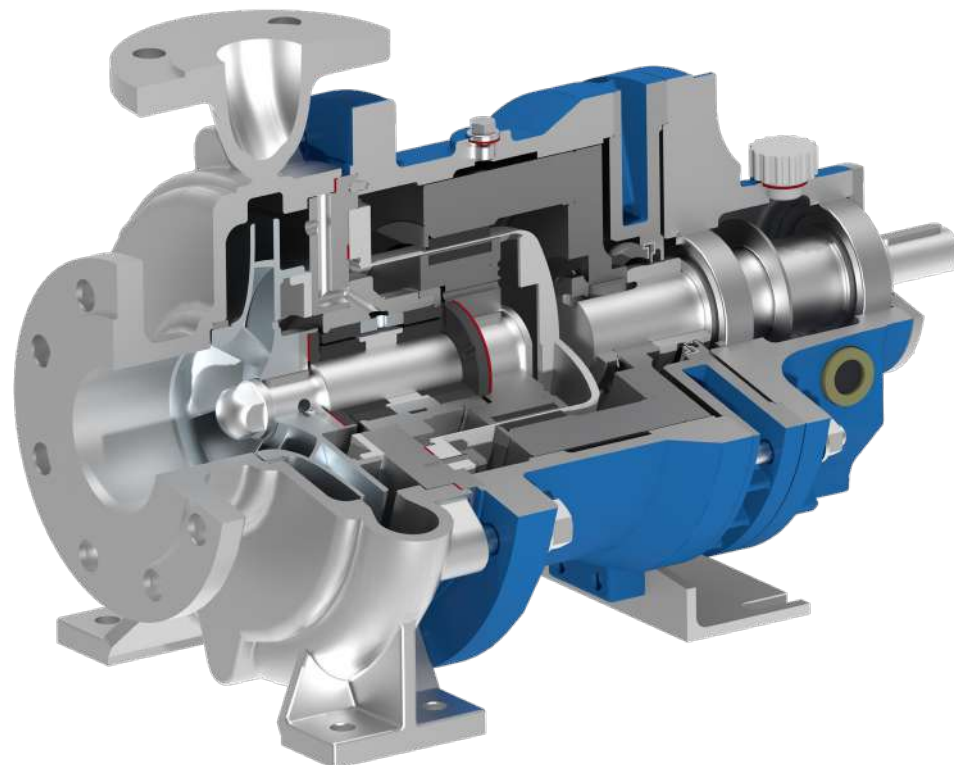
BROCHURE:



SINGLE STAGE CENTRIFUGAL PUMP WITH MAGNET DRIVE

SERIES SLM AV

ACCORDING ASME B73.3



ASME



MAX. FLOW RATE:

200 M³/H

881 USGPM

MAX. DELIVERY HEAD:

155 M L.C.

509 FT

TEMPERATURE RANGE:

-200 °C to +450 °C

-328 °F to +842 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Hydraulic performance and dimensions according to ASME B73.3
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with anti-friction bearings, oil-lubricated or greased-for-life
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

OPTIONS

- ▶ Centerline mounting (OH2)
- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Semi-open and open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Back pull out-unit
- ▶ Magnet drive acc. API 685
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM AVB)
- ▶ Vertical dry mounted arrangement
- ▶ Retrofit

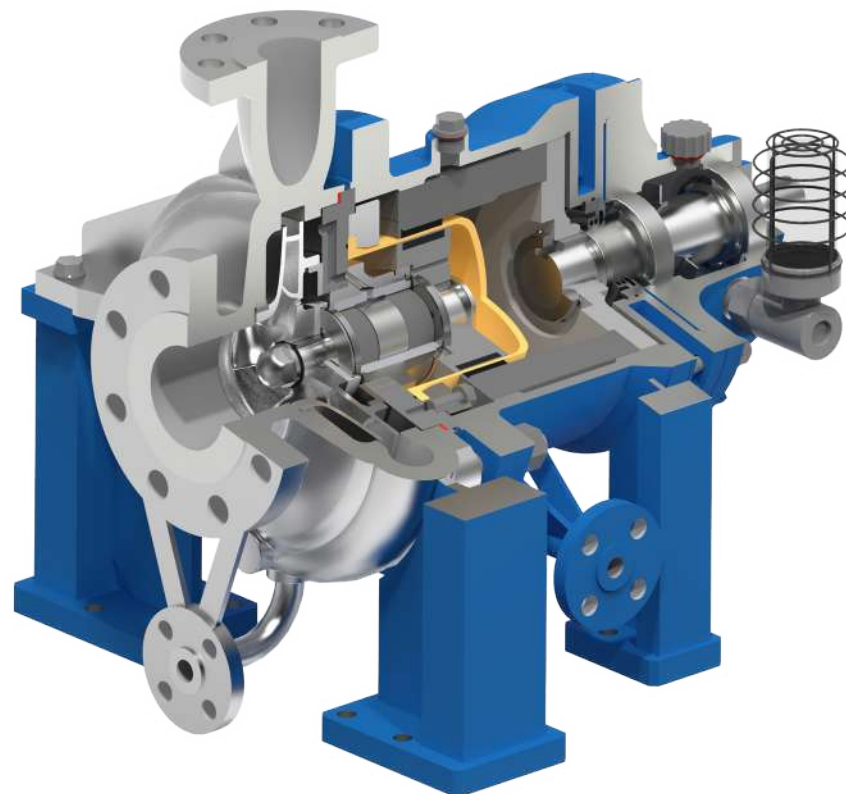
PUMPING OF

- | | |
|--|-----------------------------|
| ▶ Acids | ▶ Liquids containing solids |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Lyes |
| ▶ Coolants | ▶ Molten sulfur |
| ▶ Dyes and paints | ▶ Refrigerants |
| ▶ Heat transfer liquids | ▶ Salt solutions |
| ▶ Hot water | ▶ Sea water |
| ▶ Hydrocarbons | ▶ Solvents |
| ▶ Liquid gases | ▶ Valuable liquids |
| | ▶ And many more |

SINGLE STAGE CENTRIFUGAL PUMP WITH MAGNET DRIVE

SERIES SLM AP

ACCORDING API 685



API



MAX. FLOW RATE:

3.500 M³/H

15,410 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-200 °C to +450 °C

-328 °F to +842 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Technical design according to API 685
- ▶ Flanges according to ANSI/ASME B16.5, class 150, class 300
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil-lubricated anti-friction bearings
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

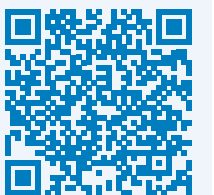
OPTIONS

- ▶ Double volute casing design in case of larger sizes
- ▶ Centerline mounting (OH2)
 - (required as per API 685 for temperatures above 175 °C, especially for impellers larger than 200 mm / 8")
- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Semi-open and open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Back pull out-unit
- ▶ Bearing bracket with greased-for-life, regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM APC)
- ▶ Vertical dry mounted arrangement
- ▶ Retrofit

PUMPING OF

- | | |
|--|-----------------------------|
| ▶ Acids | ▶ Liquid gases |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Liquids containing solids |
| ▶ Coolants | ▶ Lyes |
| ▶ Dyes and paints | ▶ Molten sulfur |
| ▶ Heat transfer liquids | ▶ Salt solutions |
| ▶ Hot water | ▶ Sea water |
| ▶ Hydrocarbons | ▶ Solvents |
| | ▶ Valuable liquids |
| | ▶ And many more |

BROCHURE:



VERTICAL INLINE CENTRIFUGAL PUMP WITH MAGNET DRIVE

SERIES SLM NVBI

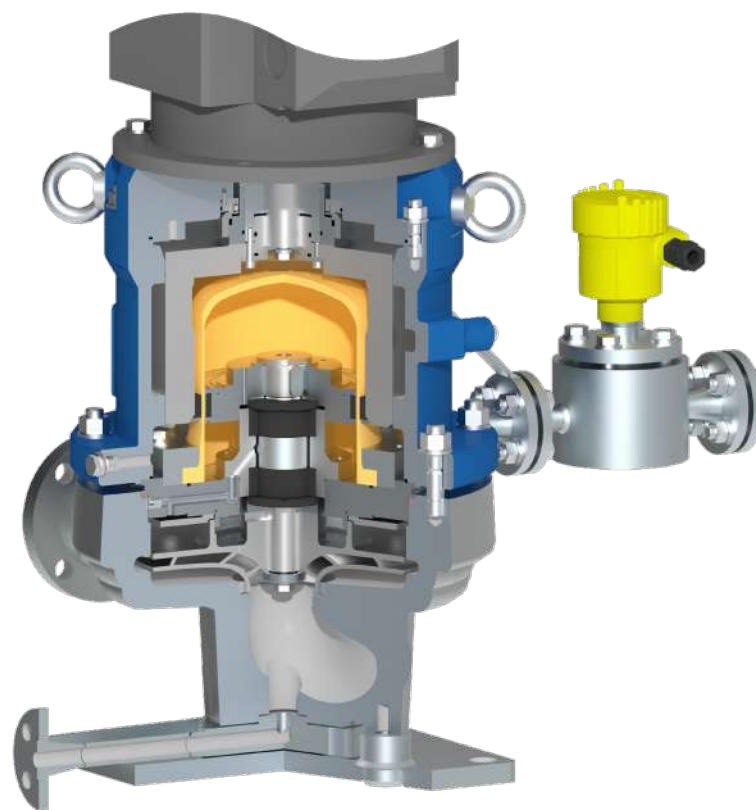
FOLLOWING DIN EN ISO 2858 & 15783

SERIES SLM AVBI

FOLLOWING ASME B73.3

SERIES SLM APCI

FOLLOWING API 685



DIN EN ISO
ASME
API



MAX. FLOW RATE:

900 M³/H

3,963 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. PRESSURE RATING:

PN 40

580 PSI

DESIGN

- ▶ Vertical inline centrifugal pump, close-coupled design (OH3-CC)
- ▶ Hydraulic performance and dimensions following DIN EN ISO 2858 & 15783 / ASME B73.3
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Rub zones as per standard for increased safety

OPTIONS

- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Semi-open and open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Back pull out-unit
- ▶ Magnet drive acc. API 685
- ▶ Retrofit

PUMPING OF

- | | |
|--|-----------------------------|
| ▶ Acids | ▶ Liquid gases |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Liquids containing solids |
| ▶ Coolants | ▶ Lyes |
| ▶ Dyes and paints | ▶ Sea water |
| ▶ Heat transfer liquids | ▶ Solvents |
| ▶ Hydrocarbons | ▶ Valuable liquids |
| | ▶ And many more |

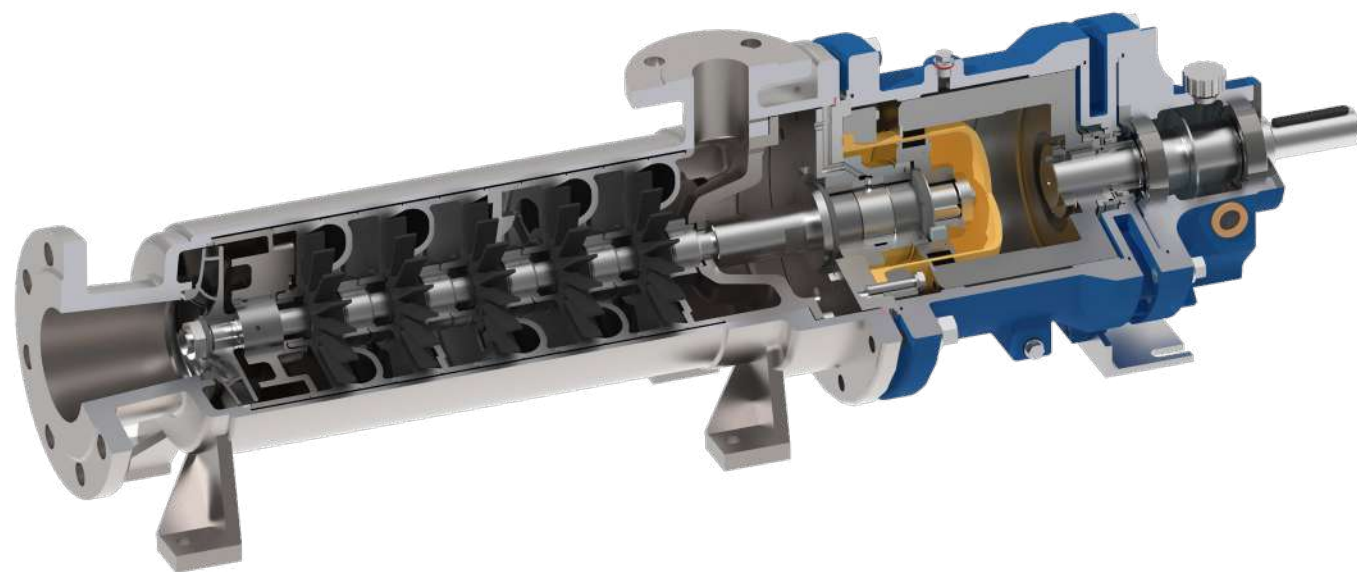
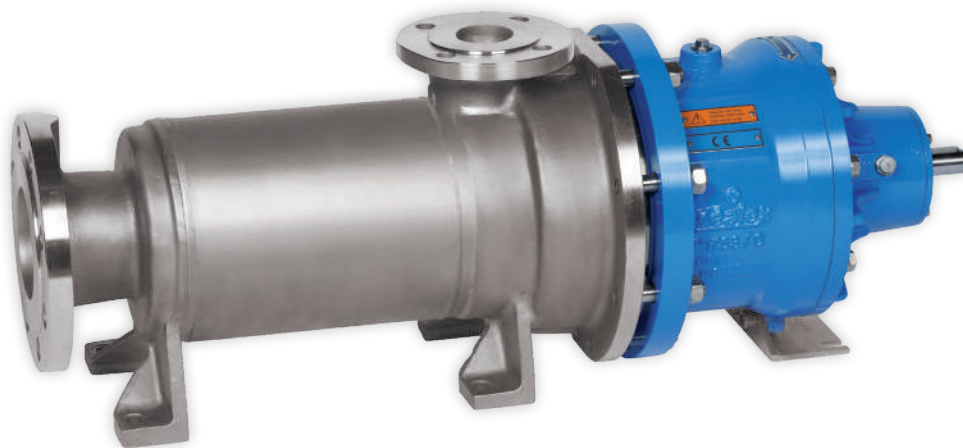
BROCHURE:



MULTI-STAGE SIDE CHANNEL PUMP WITH MAGNET DRIVE

SERIES SLM SV

FOLLOWING DIN EN ISO 15783



DIN EN ISO



MAX. FLOW RATE:

42 M³/H

185 USGPM

MAX. DELIVERY HEAD:

470 M L.C.

1,542 FT

TEMPERATURE RANGE:

-120 °C to +250 °C

-184 °F to +482 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal side channel pump, process design
- ▶ Magnet drive based on DIN EN ISO 15783
- ▶ Maximum number of stages: 8
- ▶ Vanes made of duplex, with DLC coating
- ▶ Self-priming
- ▶ Barrel casing (just only two gaskets for sealing)
- ▶ For handling of gas loaded liquids
- ▶ Low-NPSH first stage for improved suction performance
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials
- ▶ Bearing bracket with anti-friction bearings, oil-lubricated or greased-for-life
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

OPTIONS

- ▶ Centerline mounting (OH2)
- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ Heavy duty design for improved solid resistance
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Magnet drive acc. API 685
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM SVB)
- ▶ Retrofit

PUMPING OF

- | | |
|--|--------------------|
| ▶ Acids | ▶ Lyes |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Refrigerants |
| ▶ Coolants | ▶ Sea water |
| ▶ Hydrocarbons | ▶ Solvents |
| ▶ Liquid gases | ▶ Valuable liquids |
| | ▶ And many more |

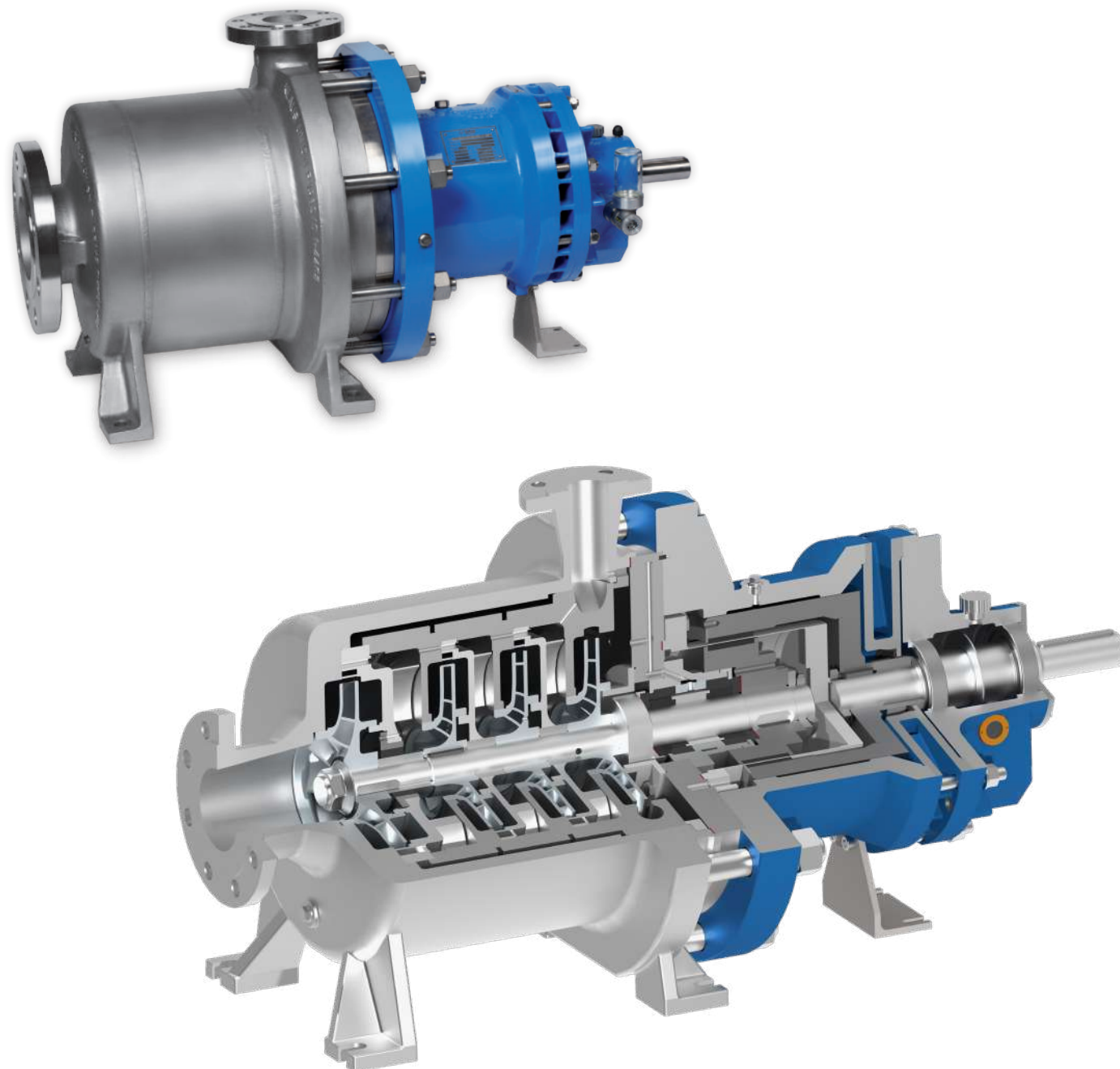
MULTI-STAGE CENTRIFUGAL PUMP WITH MAGNET DRIVE

SERIES SLM GV / GVxT

ACCORDING DIN EN ISO 15783

SERIES SLM APG

ACCORDING API 685



DIN EN ISO API



MAX. FLOW RATE:

300 M³/H

1,321 USGPM

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. DELIVERY HEAD:

2.200 M L.C.

7,218 FT

MAX. PRESSURE RATING:

PN 250

3,626 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Magnet drive based on DIN EN ISO 15783
- ▶ Maximum number of stages: 15
- ▶ Low-NPSH first stage for improved suction performance
- ▶ Barrel housing (SLM GVxT / SLM APG) or ring-section design (SLM GV)
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with anti-friction bearings, oil-lubricated or greased-for-life
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

OPTIONS

- ▶ Centerline mounting (OH2)
- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Magnet drive acc. API 685
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM GVB / GVBT / APGC)
- ▶ Vertical dry mounted arrangement
- ▶ Retrofit

PUMPING OF

- | | |
|--|-----------------------------|
| ▶ Acids | ▶ Liquid gases |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Liquids containing solids |
| ▶ Coolants | ▶ Lyes |
| ▶ Heat transfer liquids | ▶ Sea water |
| ▶ Hot water | ▶ Solvents |
| ▶ Hydrocarbons | ▶ Valuable liquids |
| | ▶ And many more |

BROCHURE:



VERTICALLY SUSPENDED (SUMP) PUMP WITH MAGNET DRIVE

SERIES SLM NVT

ACCORDING DIN EN ISO 2858 & DIN EN ISO 15783

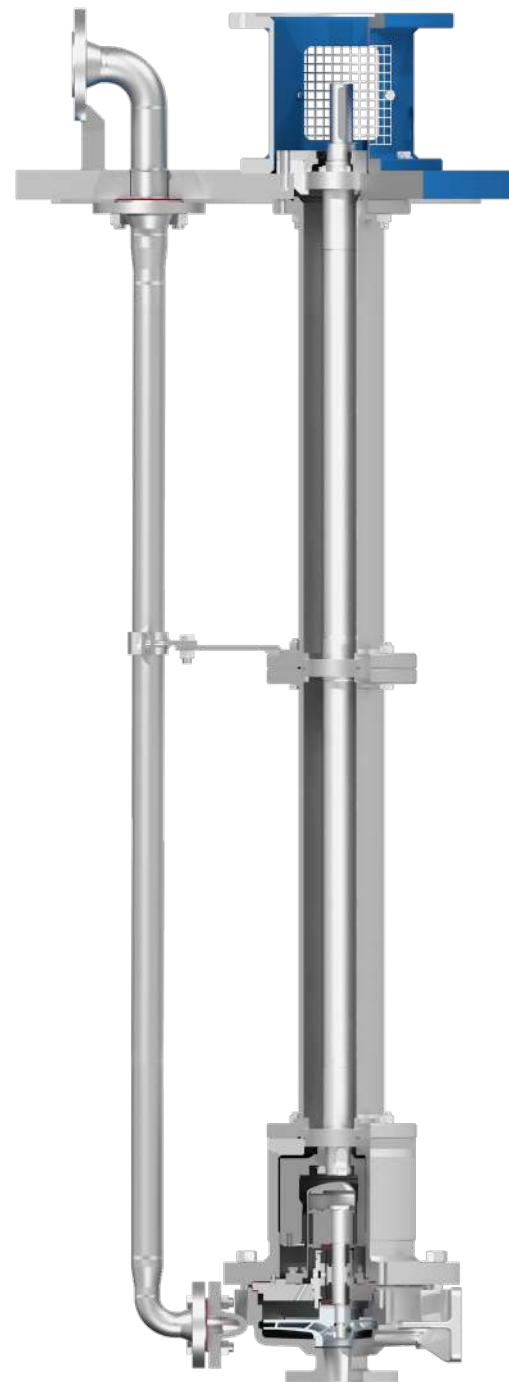
SERIES SLM AVT

FOLLOWING ASME B73.3

SERIES SLM APT

FOLLOWING API 685

SINGLE- &
MULTI-STAGE
DESIGN



DIN EN ISO
ASME
API

MAX. FLOW RATE:

900 M³/H

3,963 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-40 °C to +200 °C

-40 °F to +392 °F

MAX. PRESSURE RATING:

PN 63

914 PSI

DESIGN

- ▶ Vertically suspended, single-stage (sump) pump (VS4/VS6)
- ▶ Submerging Depth: max. 6.000 mm
- ▶ Hydraulic performance and dimensions according to DIN EN ISO 2858 / ASME B73.3
- ▶ Design based on DIN EN ISO 15783 and / or API 685
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with greased-for-life anti-friction bearings
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety

OPTIONS

- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ High viscosity optimized design
- ▶ Semi-open and open impeller
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Pull out-unit
- ▶ Magnet drive acc. API 685
- ▶ Multi-stage design (page 34)
- ▶ Retrofit

PUMPING OF

- | | |
|--|--------------------|
| ▶ Acids | ▶ Lyes |
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Molten sulfur |
| ▶ Heat transfer liquids | ▶ Sea water |
| ▶ Hydrocarbons | ▶ Solvents |
| ▶ Liquids containing solids | ▶ Valuable liquids |
| | ▶ And many more |

MULTI-STAGE DESIGN FOR VERTICALLY SUSPENDED (SUMP) PUMPS

SERIES SLM GVT / GVTT

ACCORDING DIN EN ISO 15783

SERIES SLM APST / APGT

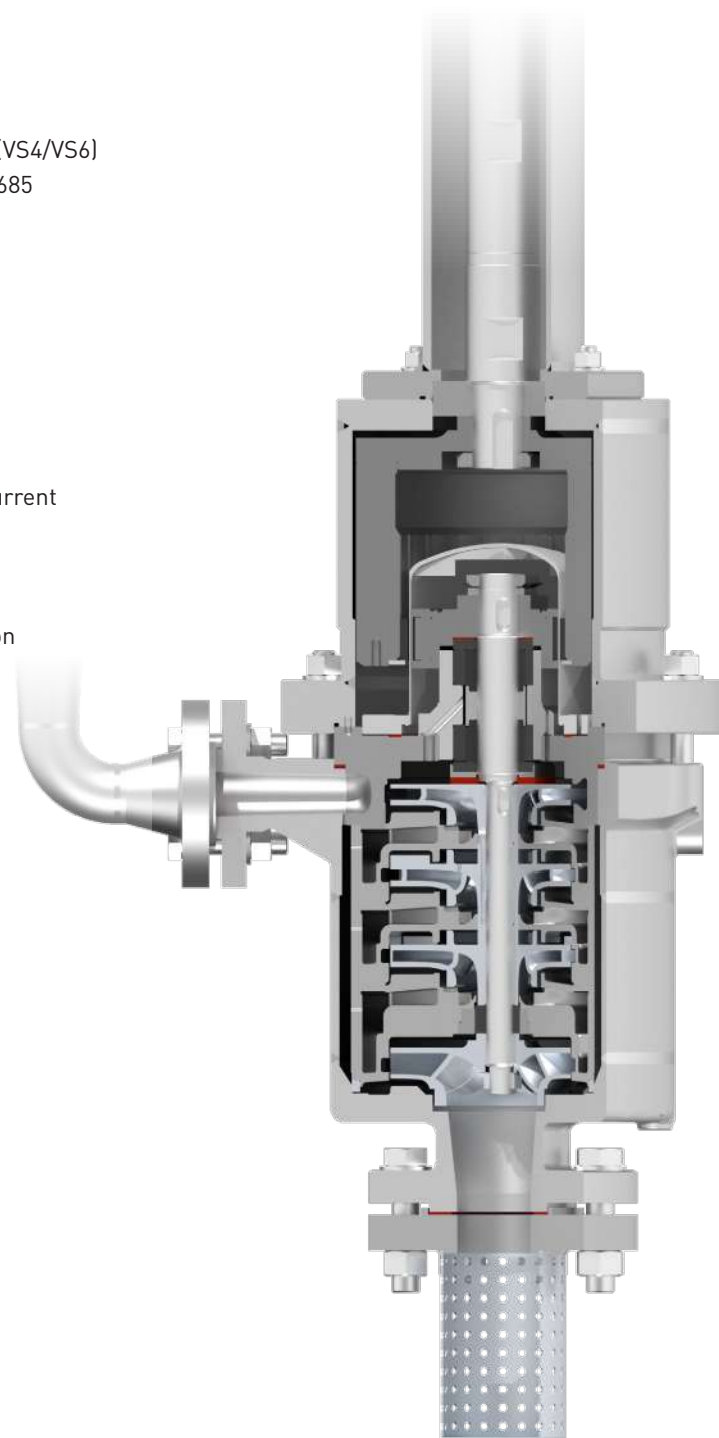
ACCORDING API 685

DESIGN

- ▶ Vertically suspended, multi-stage (sump) pump (VS4/VS6)
- ▶ Design based on DIN EN ISO 15783 and / or API 685
- ▶ Maximum number of stages: 8
- ▶ Submerging Depth: max. 6.000 mm
- ▶ Barrel housing (SLM GVTT / SLM APGT) or ring-section design (SLM GVT / SLM APST)
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses / lubrication of journal bearings)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with greased-for-life anti-friction bearings
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Rub zones as per standard for increased safety
- ▶ Options and liquids as for single-stage design

PERFORMANCE DATA

- ▶ MAX. FLOW RATE:
300 M³/H | 1,321 USGPM
- ▶ MAX. DELIVERY HEAD:
1.200 M L.C. | 3,937 FT
- ▶ TEMPERATURE RANGE:
-40 °C to +200 °C | -40 °F to +392 °F
- ▶ MAX. PRESSURE RATING:
PN 63 | 914 PSI



PULL-OUT DESIGN FOR VERTICALLY SUSPENDED (SUMP) PUMPS WITH MAGNET DRIVE

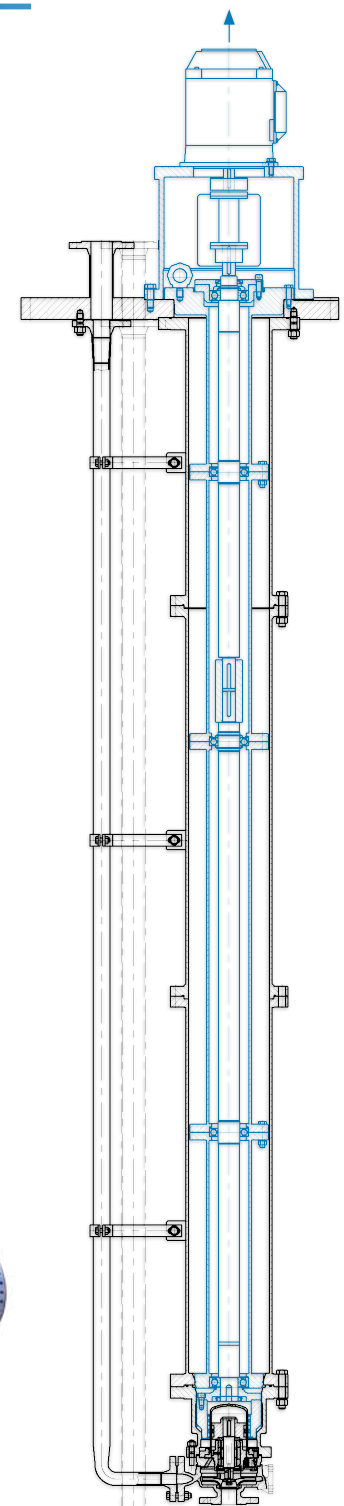
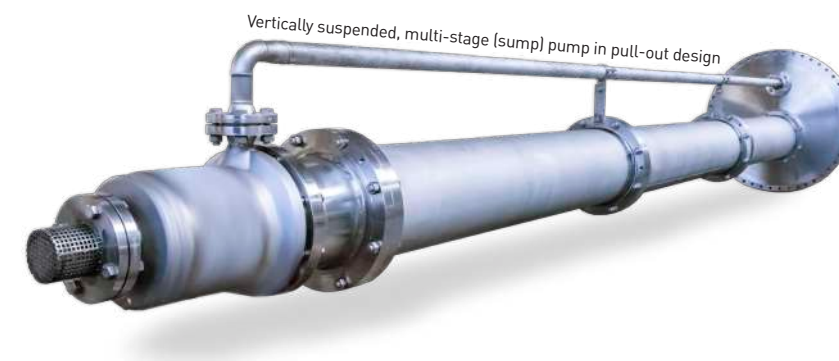
CLEAN AND SAFE MAINTENANCE OF VERTICALLY SUSPENDED (SUMP) PUMPS

Maintenance of vertically suspended (sump) pumps is often a dirty and dangerous business, as the pump operates directly in the medium. If the pumps are equipped with a magnetic coupling and operated properly, at least the hydraulics are almost maintenance-free. However, if the bearings in the stand pipe are maintained, the entire system must always be pulled out of the medium.

KLAUS UNION's pull-out design for magnetically coupled vertically suspended (sump) pumps, though, offers a clean and safe solution: While the pump casing inclusive the hydraulics and containment shell remains in the medium, the pull-out unit (blue) can easily be lifted out. This consists of the outer magnet carrier, the bearings and the drive shaft along with the coupling. Even in the event of maintenance, the containment shell ensures hermetic separation between the medium and the atmosphere, so that neither liquid nor vapors can escape to the outside.

ADVANTAGES

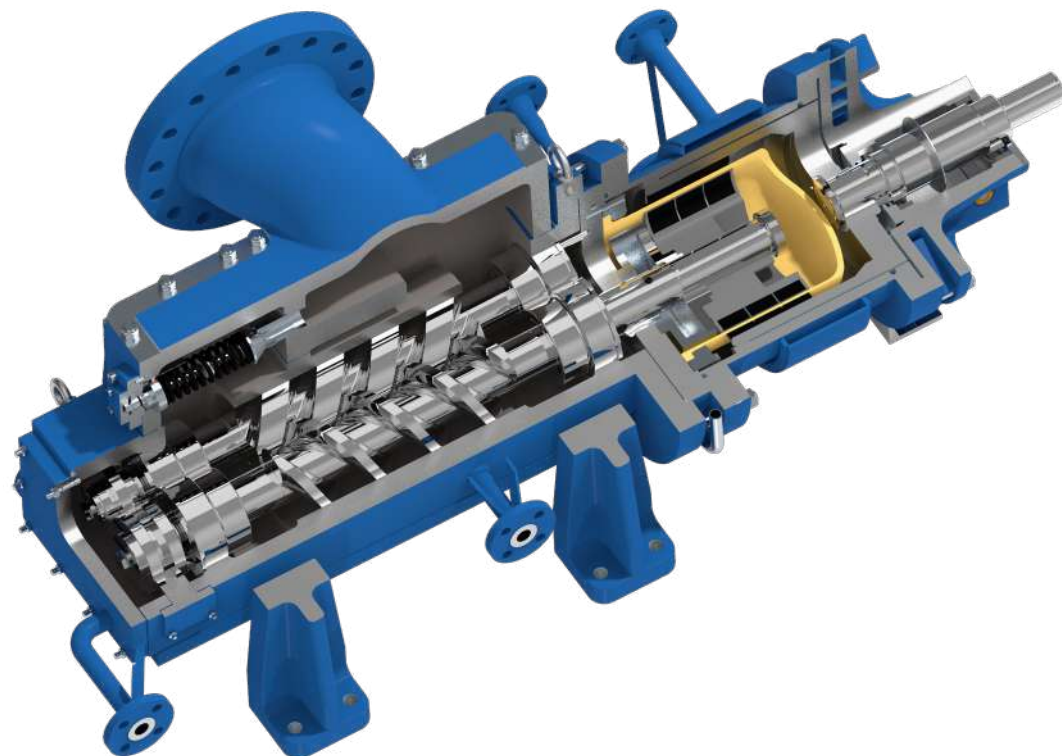
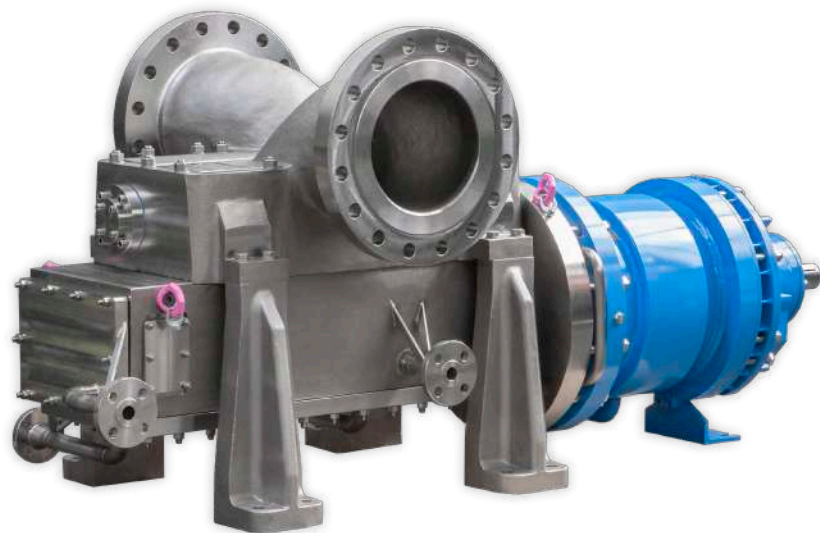
- ▶ Clean and safe maintenance regardless of the medium; protecting people and the environment
- ▶ In the event of maintenance, the containment shell ensures hermetic separation between the medium and the atmosphere
- ▶ Reduction of OPEX through optimized maintenance
- ▶ Available for all Klaus Union vertically suspended (sump) pumps with magnet drive (single- & multi-stage)



SINGLE VOLUTE TWIN SCREW PUMP WITH MAGNET DRIVE

SERIES SLM DSP-2C

ACCORDING API 676



DIN EN ISO API



MAX. FLOW RATE:

1.800 M³/H

7,925 USGPM

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. DIFFERENTIAL PRESSURE:

40 BAR

580 PSI

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Single volute twin screw pump, process or tank farm design
- ▶ Design based on API 676 and DIN EN ISO 14847
- ▶ Axial split modular casing (larger sizes with radial split casings)
- ▶ Centerline mounting (OH2)
- ▶ Permanent & synchronous magnet drive
 - Maintenance-free
 - Separation of liquid chamber and atmosphere by means of containment shell
- ▶ Pressurized partial flush flow (cooling of eddy current losses)
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with anti-friction bearings, oil-lubricated or greased-for-life
- ▶ Spare parts of magnetic coupling and bearing brackets are interchangeable with centrifugal pump series

OPTIONS

- ▶ Various containment shell executions (metallic / non-metallic, single / double shell)
- ▶ Energy efficient design
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids) and for interrupted suction flow (dry run)
- ▶ Low & high viscosity optimized design
- ▶ Thermal barrier
- ▶ Various heating designs
- ▶ Secondary control / secondary control system / secondary containment system acc. API 685
- ▶ Temperature protection system
- ▶ Differential pressure limiting valve using Klaus Union Valve Series Internals
- ▶ Back pull out-unit
- ▶ Magnet drive acc. API 685
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Close-coupled design (SLM DSP-2CB)
- ▶ Vertically suspended design (SLM DSP-2CT)
- ▶ Vertical dry mounted arrangement (SLM DSP-2CBI)
- ▶ Retrofit

PUMPING OF

- | | |
|--|----------------------------|
| ▶ Aggressive, explosive, toxic, hot and malodorous liquids | ▶ Hydrocarbons |
| ▶ Bitumen | ▶ Lube, crude or fuel oils |
| ▶ Bitumen / asphalt | ▶ Molten sulfur |
| ▶ Dyes and paints | ▶ Polymers |
| ▶ Fuel oils | ▶ Residues |
| ▶ Heat transfer liquids | ▶ Resins |
| ▶ High-viscosity liquids | ▶ Solvents |
| | ▶ Valuable liquids |
| | ▶ And many more |

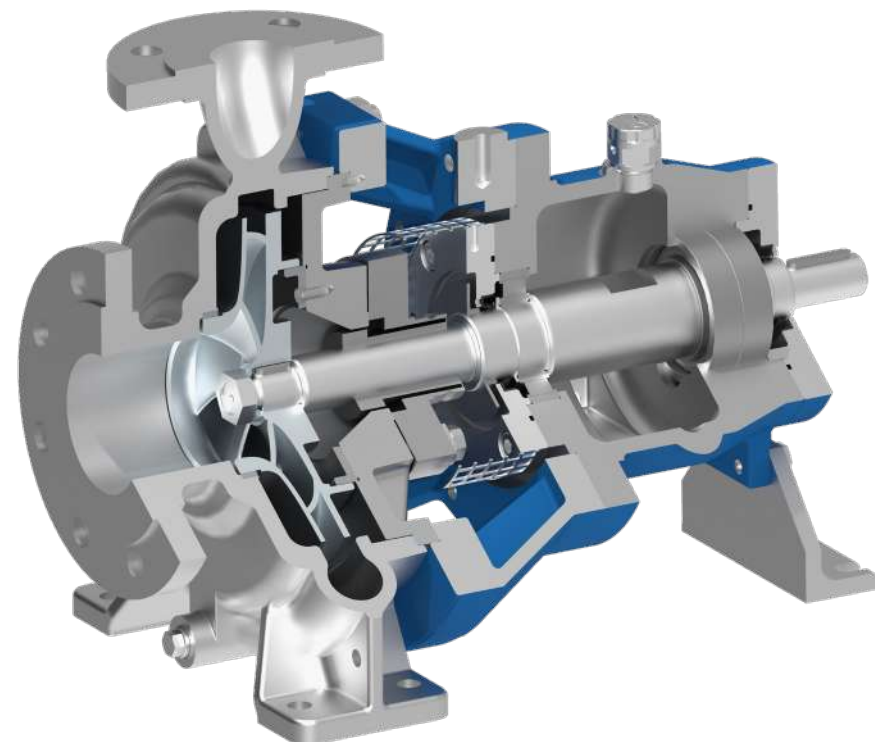
BROCHURE:



SINGLE-STAGE CENTRIFUGAL PUMP WITH MECHANICAL SEAL

SERIES NOV

ACCORDING DIN EN ISO 2858 & DIN EN ISO 5199



DIN EN ISO



MAX. FLOW RATE:

3.500 M³/H

15,410 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-120 °C to +450 °C

-184 °F to +842 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Hydraulic performance and dimensions according to DIN EN ISO 2858
- ▶ Design according to DIN EN ISO 5199
- ▶ Shaft sealing space for installation of mechanical seals according to DIN EN 12756
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil-lubricated anti-friction bearings

OPTIONS

- ▶ Double volute casing design in case of larger sizes
- ▶ Centerline mounting
- ▶ Open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Various heating / cooling facilities
- ▶ Shaft sealing space for installation of mechanical seals according to API 682
- ▶ Gland packing instead of DIN EN / API mechanical seal
- ▶ Bearing bracket with oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Retrofit

PUMPING OF

- ▶ Coolants
- ▶ Dyes and paints
- ▶ Fresh- / cooling water
- ▶ Fuel oils
- ▶ Heat transfer liquids
- ▶ Hydrocarbons
- ▶ Molten sulfur
- ▶ Pulp, paper and cellulose mash
- ▶ Salt solutions
- ▶ Sea water
- ▶ Sewage
- ▶ And many more

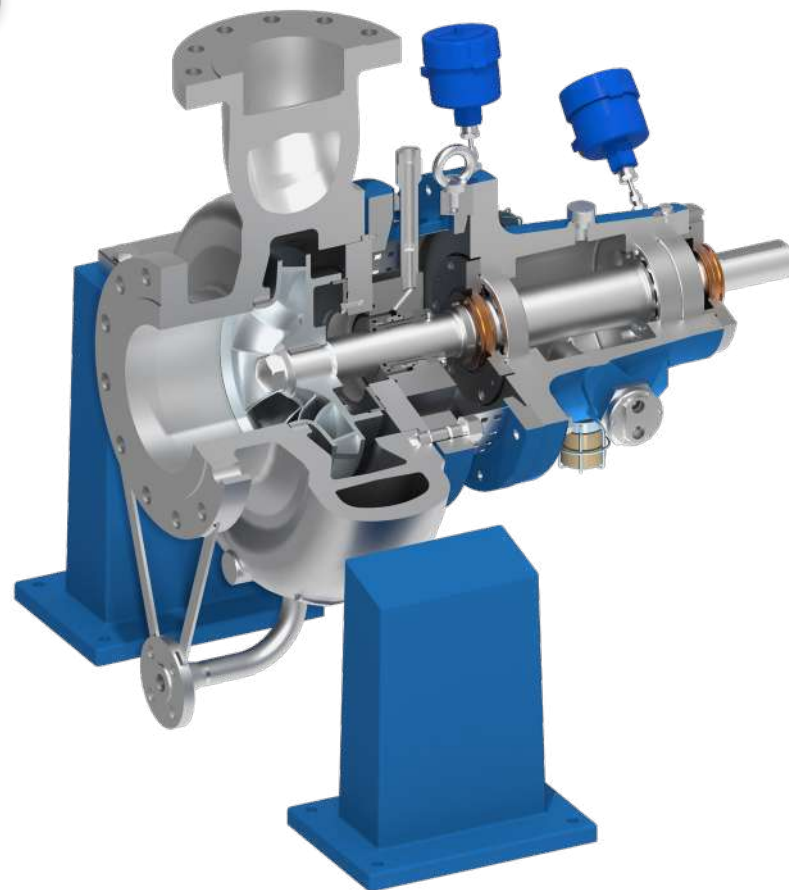
BROCHURE:



SINGLE-STAGE CENTRIFUGAL PUMP WITH MECHANICAL SEAL

SERIES APL

ACCORDING API 610 & ISO 13709



API



MAX. FLOW RATE:

3.500 M³/H

15,410 USGPM

MAX. DELIVERY HEAD:

220 M L.C.

722 FT

TEMPERATURE RANGE:

-120 °C to +450 °C

-184 °F to +842 °F

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Design according to API 610 & ISO 13709
- ▶ Centerline mounting (OH2) for heavy duty service
- ▶ Back pull-out execution as per standard for easy maintenance
- ▶ Shaft sealing space for installation of mechanical seals according to API 682
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil-lubricated anti-friction bearings, in a carbon steel housing, designed to provide L10 bearing life exceeding API 610 requirements
- ▶ Standard casing design for double API 610 nozzle load requirements
- ▶ Protection of bearing housing by bearing isolators on both sides

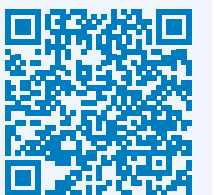
OPTIONS

- ▶ Double volute casing design in case of larger sizes
- ▶ Non-metallic wear rings for abrasive service
- ▶ Renewable wear ring on impeller rear
- ▶ Semi-open and open impeller
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Various heating / cooling facilities
- ▶ Additional cooling provision for bearing housing (air or water cooled) for high ambient / product temperatures
- ▶ Gland packing instead of API 682 mechanical seal
- ▶ Bearing bracket with oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Casing design for higher pressure ratings
- ▶ Retrofit

PUMPING OF

- ▶ Coolants
- ▶ Dyes and paints
- ▶ Fuel oils
- ▶ Heat transfer liquids
- ▶ Hydrocarbons
- ▶ Liquid gases
- ▶ Pulp, paper and cellulose mash
- ▶ Salt solutions
- ▶ Sea water
- ▶ Sewage
- ▶ And many more

BROCHURE:



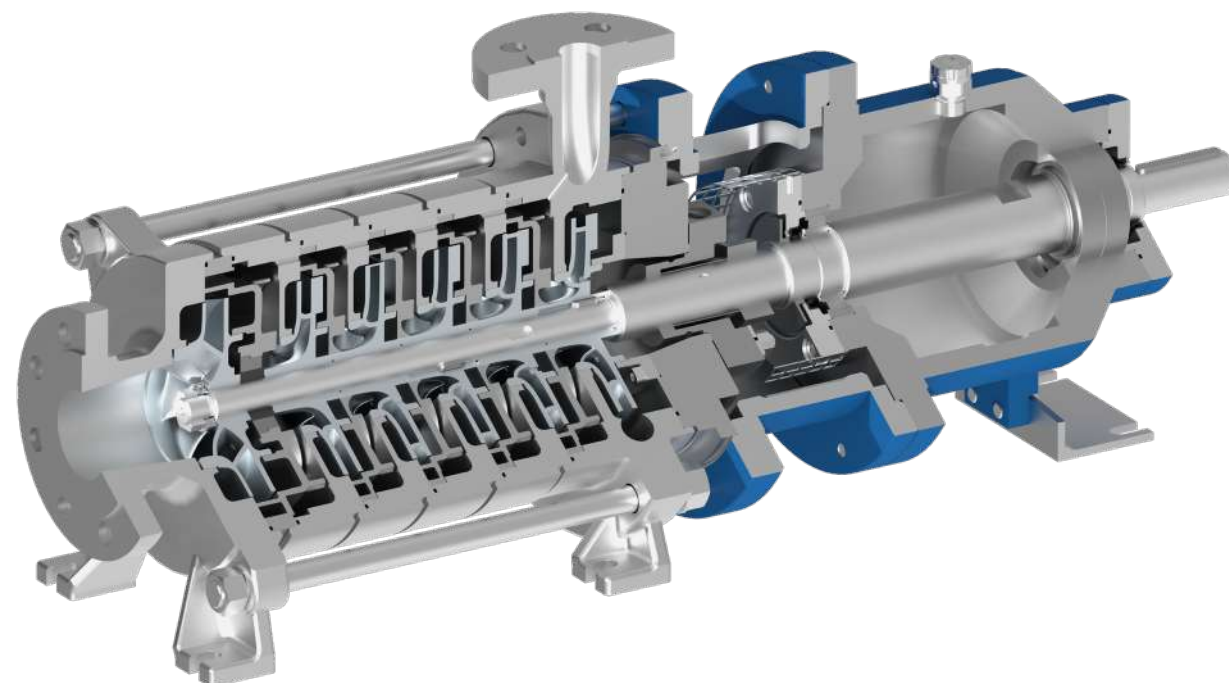
MULTI-STAGE CENTRIFUGAL PUMP WITH MECHANICAL SEAL

SERIES GOV / GOVT

ACCORDING DIN EN ISO 5199

SERIES APG

FOLLOWING API 610 & ISO 13709



DIN EN ISO API

MAX. FLOW RATE:

300 M³/H

1,321 USGPM

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. DELIVERY HEAD:

2.200 M L.C.

7,218 FT

MAX. PRESSURE RATING:

PN 250

3,626 PSI

DESIGN

- ▶ Horizontal centrifugal pump, process design
- ▶ Technical design based on DIN EN ISO 5199 or acc. API 610 & ISO 13709
- ▶ Impeller arrangement in series, maximum number of stages: 15
- ▶ Barrel housing (GOVT / APG) or ring-section design (GOV)
- ▶ First low-NPSH stage for improved suction performance
- ▶ Shaft sealing space for installation of mechanical seals according to DIN EN 12756
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil-lubricated anti-friction bearings

OPTIONS

- ▶ Centerline mounting
- ▶ Inducer to significantly improve pump's NPSH
- ▶ Various heating designs
- ▶ Shaft sealing space for installation of mechanical seals according to API 682
- ▶ Gland packing instead of DIN EN / API mechanical seal
- ▶ Shaft seal only exposed to partial pressure
- ▶ Bearing bracket with oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Retrofit

PUMPING OF

- ▶ Coolants
- ▶ Fuel oils
- ▶ Fresh- / cooling water
- ▶ Heat transfer liquids
- ▶ Hot water
- ▶ Hydrocarbons
- ▶ Liquid gases
- ▶ Sea water
- ▶ And many more

VERTICALLY SUSPENDED (SUMP) PUMP WITH MECHANICAL SEAL

SERIES TP NO

ACCORDING DIN EN ISO 2858 & DIN EN ISO 5199

SERIES APT

ACCORDING API 610 & ISO 13709

SINGLE- &
MULTI-STAGE
DESIGN



DIN EN ISO API



MAX. FLOW RATE (SINGLE-STAGE):

900 M³/H

3,963 USGPM

MAX. DELIVERY HEAD (SINGLE-STAGE):

220 M L.C.

722 FT

TEMPERATURE RANGE:

-40 °C to +300 °C

-40 °F to +572 °F

MAX. PRESSURE RATING:

PN 63

914 PSI

DESIGN

- ▶ Vertically suspended (sump) pump (VS4/VS6)
- ▶ Single-stage / multi-stage
- ▶ Submerging depth: max. 6.000 mm
- ▶ Hydraulic performance according to DIN EN ISO 2858
- ▶ Design based on DIN EN ISO 5199 or acc. API 610 & ISO 13709
- ▶ Shaft sealing space for installation of mechanical seals according to DIN EN 12756
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Product-lubricated journal bearings; made of silicon carbide (SSiC) or customized materials
- ▶ Bearing bracket with greased-for-life anti-friction bearings

OPTIONS

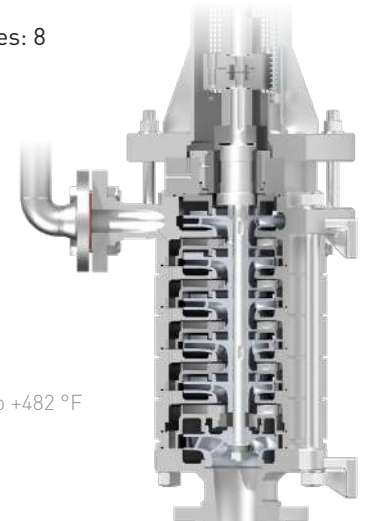
- ▶ Open impeller
- ▶ Various heating designs
- ▶ Shaft sealing space for installation of mechanical seals according to API 682
- ▶ Gland packing instead of DIN EN / API mechanical seal
- ▶ Bearing bracket with regreaseable, oil or oil mist lubricated anti-friction bearings
- ▶ Retrofit

MULTI-STAGE DESIGN

- ▶ TP GO (ring-section design) / TP GOT (barrel housing) acc. DIN EN ISO 5199
- ▶ APST (ring-section design) / APGT (barrel housing) acc. API 610 & ISO 13709
- ▶ Maximum number of stages: 8

PERFORMANCE DATA

- ▶ MAX. FLOW RATE:
300 M³/H | 1,321 USGPM
- ▶ MAX. DELIVERY HEAD:
1.200 M L.C. | 3,937 FT
- ▶ TEMPERATURE RANGE:
-40 °C to +250 °C | -40 °F to +482 °F
- ▶ MAX. PRESSURE RATING:
PN 63 | 914 PSI

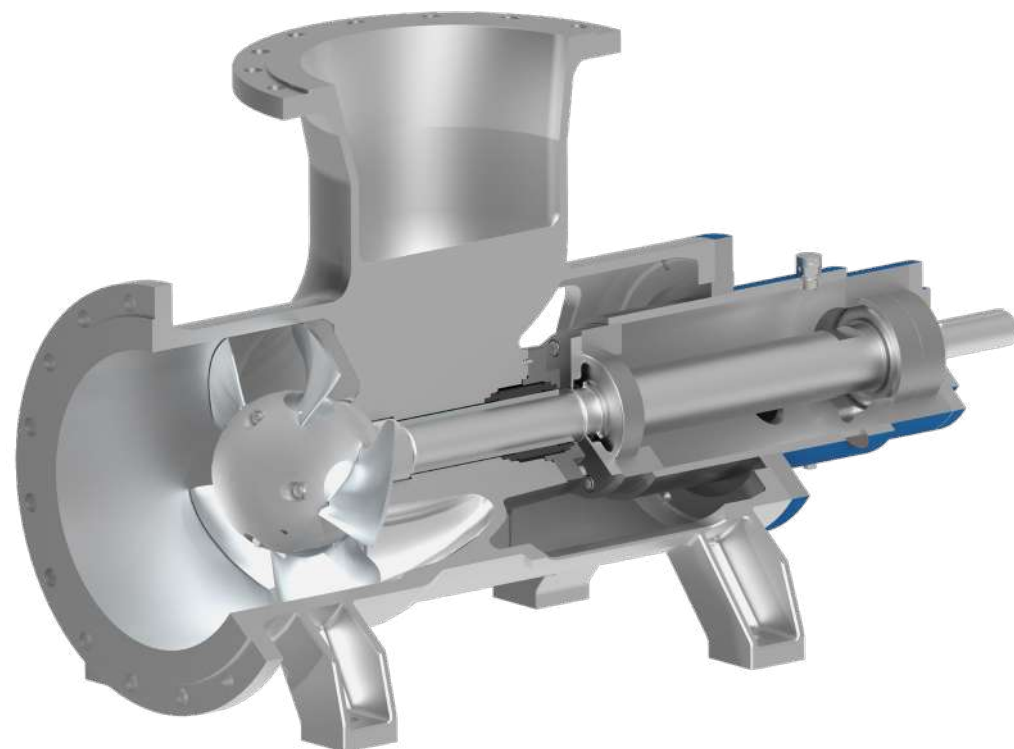
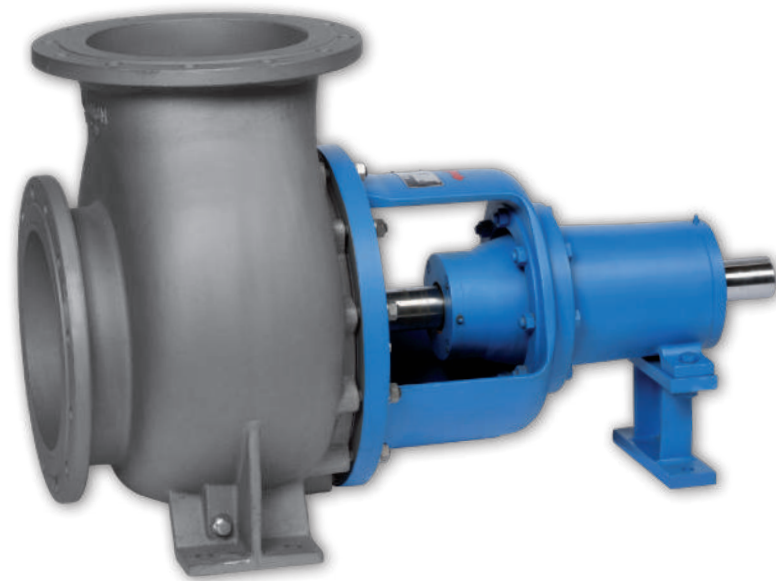


PUMPING OF

- ▶ Crude oils
- ▶ Fuel oils
- ▶ Heat transfer liquids
- ▶ Hydrocarbons
- ▶ Molten sulfur
- ▶ Sea water
- ▶ Sewage
- ▶ Slop / residues
- ▶ And many more

HORIZONTAL AXIAL FLOW PROPELLER PUMP WITH MECHANICAL SEAL

SERIES P



DIN EN ISO



MAX. FLOW RATE:

12.000 M³/H

52,835 USGPM

TEMPERATURE RANGE:

-120 °C to +250 °C

-184 °F to +482 °F

MAX. DELIVERY HEAD:

12 M L.C.

39 FT

MAX. PRESSURE RATING:

PN 100

1,450 PSI

DESIGN

- ▶ Horizontal axial flow pump
- ▶ Pump casing in cast or welded construction
- ▶ Shaft sealing space for installation of mechanical seals according to DIN EN 12756
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil- or grease-lubricated anti-friction bearings
- ▶ Pumping direction freely selectable
- ▶ Modification of performance possible by means of adjusting propeller blades

OPTIONS

- ▶ Special execution with magnet drive
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids)
- ▶ Various heating designs
- ▶ Shaft sealing space for installation of mechanical seals according to API 682
- ▶ Gland packing instead of DIN EN / API mechanical seal
- ▶ Back pull out-unit
- ▶ Bearing bracket with oil mist lubricated anti-friction bearings
- ▶ Oil sump bottle for bearing housing
- ▶ Retrofit

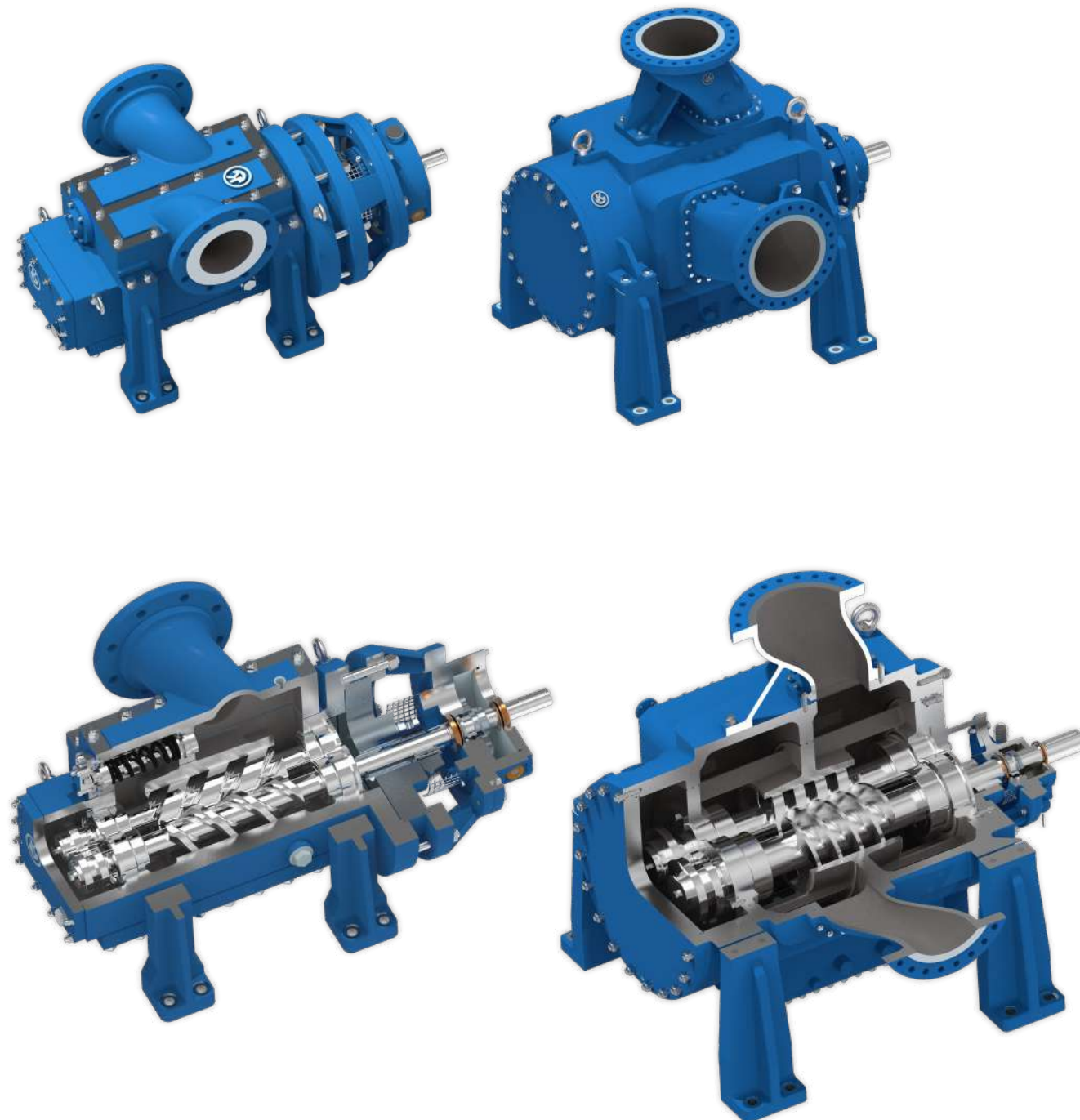
PUMPING OF

- | | |
|------------------------------|----------------------------------|
| ▶ Acids | ▶ Mineral fertilisers (liquid) |
| ▶ Brine (evaporation plants) | ▶ Mother liquor |
| ▶ Coolants | ▶ Pulp, paper and cellulose mash |
| ▶ Dyes and paints | ▶ Sea water |
| ▶ Fresh- / cooling water | ▶ Sewage |
| ▶ Hydrocarbons | ▶ And many more |
| ▶ Lyes | |

SINGLE VOLUTE TWIN SCREW PUMP WITH MECHANICAL SEAL

SERIES DSP-2C

ACCORDING API 676



API

MAX. FLOW RATE:

1.800 M³/H

7,925 USGPM

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. DIFFERENTIAL PRESSURE:

40 BAR

580 PSI

MAX. PRESSURE RATING:

PN 400

5,802 PSI

DESIGN

- ▶ Single volute twin screw pump, process or tank farm design
- ▶ Design based on API 676 and DIN EN ISO 14847
- ▶ Axial split modular casing (Larger sizes with radial split casings)
- ▶ Centerline mounting (OH2)
- ▶ Shaft sealing space for installation of mechanical seals according to DIN EN 12756 / API 682
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Bearing bracket with oil-lubricated or greased-for-life anti-friction bearings

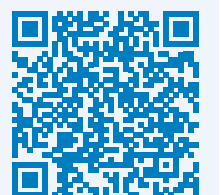
OPTIONS

- ▶ Low & high viscosity optimized design
- ▶ Various heating designs
- ▶ Other shaft sealing possibilities such as lip seals or gland packings
- ▶ Back pull out-unit
- ▶ Differential pressure limiting valve Klaus Union valve Series internals
- ▶ Bearing bracket with regreaseable or oil mist lubricated anti-friction bearings
- ▶ Vertically suspended design (DSP-2CT)
- ▶ Retrofit

PUMPING OF

- ▶ Bitumen
- ▶ Bitumen / asphalt
- ▶ Dyes and paints
- ▶ Fuel oils
- ▶ Heat transfer liquids
- ▶ High-viscosity liquids
- ▶ Hydrocarbons
- ▶ Lube, crude or fuel oils
- ▶ Molten sulfur
- ▶ Polymers
- ▶ Residues
- ▶ Resins
- ▶ Solvents
- ▶ And many more

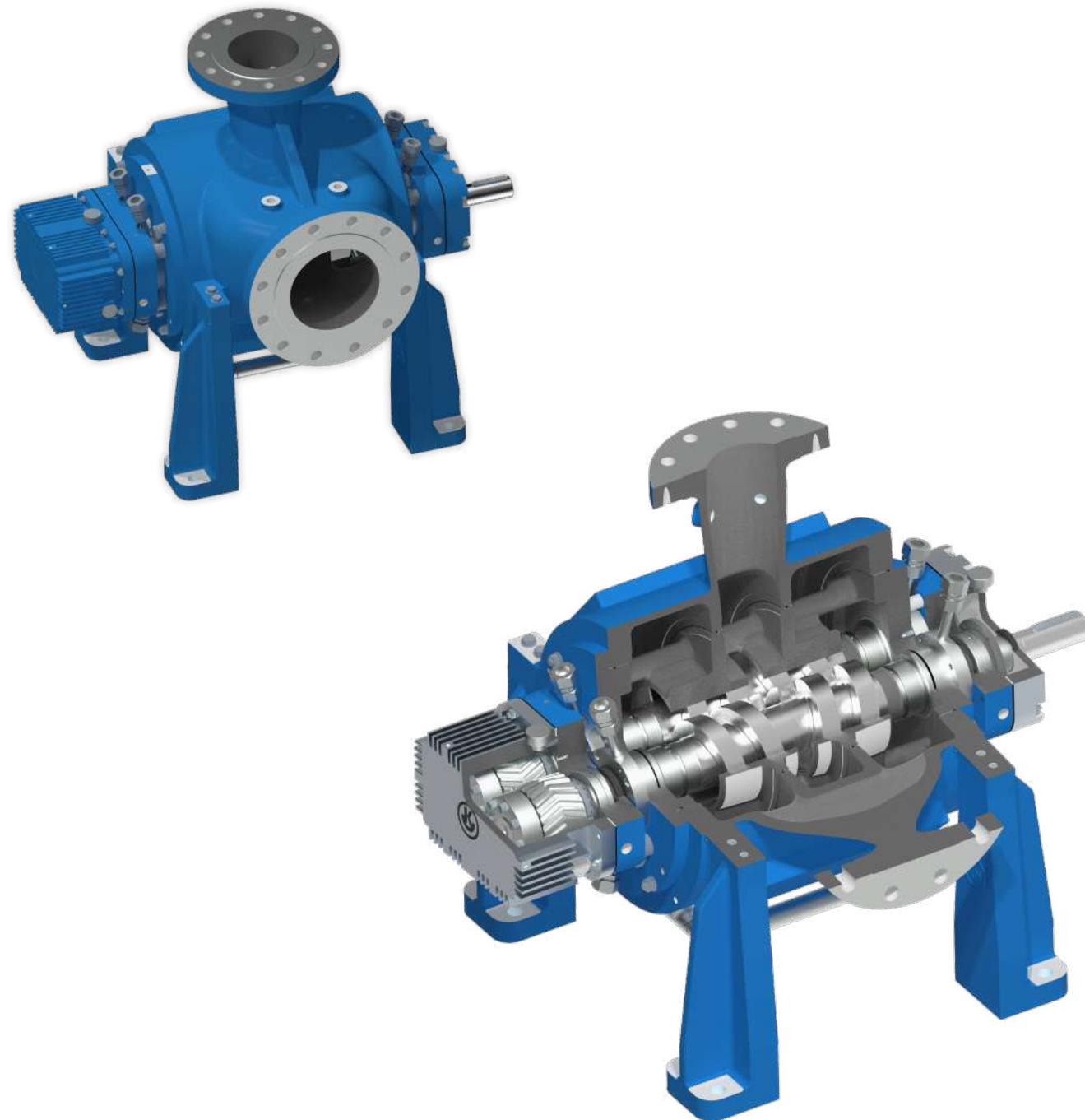
BROCHURE:



DOUBLE VOLUTE TWIN SCREW PUMP WITH MECHANICAL SEAL

SERIES DSP-4U / 4C

ACCORDING API 676



API

MAX. FLOW RATE:

5.000 M³/H

22,000 USGPM

MAX. DIFFERENTIAL PRESSURE:

100 BAR

1,450 PSI

TEMPERATURE RANGE:

-120 °C to +350 °C

-184 °F to +662 °F

MAX. PRESSURE RATING:

PN 150

2,176PSI

DESIGN

- ▶ Horizontal, double volute twin screw pump
- ▶ Drive torque transfer by herringbone timing gears located outside of pumping chamber
- ▶ Materials: steel, stainless steel, duplex steel, nickel-based materials, titanium
- ▶ Rotors manufactured from single piece bar stock
- ▶ Bearings located outside of pumping chamber
- ▶ Inline or side in / top out
- ▶ Improved NPSH / NPIP
- ▶ Casted design

OPTIONS

- ▶ Centerline mounting
- ▶ Various design options when pumping critical liquids (e.g. liquids containing solids)
- ▶ Various heating designs
- ▶ Cartridge unit (DSP-4C)
- ▶ Differential pressure limiting valve
- ▶ Hardcoating of liner and / or rotors
- ▶ Retrofit

PUMPING OF

- | | |
|--|--|
| ▶ Bitumen | ▶ Polymers |
| ▶ Bitumen / asphalt | ▶ Residues |
| ▶ High-viscosity liquids | ▶ Resins |
| ▶ Hydrocarbons | ▶ Sea water |
| ▶ Liquids containing solids | ▶ Viscous liquids containing considerable amount of solids |
| ▶ Lube, crude or fuel oils | ▶ And many more |
| ▶ Multiphase products containing liquids, gas and solids | |

CUSTOM MATERIALS OF CONSTRUCTION

Steel			
Castings DIN/EN	[AISI / ASTM]	Rolled Material DIN/EN	[AISI / ASTM]
1.0619 / GP240GH	[A216 WCB]	1.0038 / S235JR	[A283M]
1.6220 / G20Mn5	[A352]	1.0460 / P250GH	[A105]
		1.7225 / 42CrMo4	[A331, A505, A519, A646]
		1.7227 / 42CrMoS4	[A331, A505, A519, A646]
		1.8550 / 34CrAlNi7-10	[A355-89]
Stainless Steel			
Castings DIN/EN	[AISI / ASTM]	Rolled Material DIN/EN	[AISI / ASTM]
1.4308 / GX5CrNi 19-10	[304L]	1.4122 / X39CrMo 17-1	[-]
1.4408 / GX5CrNiMo 19-11-2	[A351 CF8M]	1.4404 / X2CrNiMo 17-12-2	[316L]
1.4409 / GX2CrNiMo 19-11-2	[CF3M]	1.4462 / X2CrNiMoN 22-5-3	[S31803]
1.4469 / GX2CrNiMoN 26-7-4	[J93404]	1.4501 / X2CrNiMoCuWN 25-7-4	[S32750]
1.4470 / GX2CrNiMoN 22-5-3	[J92205]	1.4541 / X6CrNiTi 18-10	[321]
		1.4571 / X6CrNiMoTi 17-12-2	[316Ti]
Nickel-Based Materials			
Castings DIN/EN	[AISI / ASTM]	Rolled Material DIN/EN	[AISI / ASTM]
9.4170 / G-Ni95	[CZ100]	1.4539 / X1NiCrMoCu 25 20 5	[904L]
9.4365 / G-NiCu30Nb	[A494 M35-1]	2.4068 / Ni99	[N02201]
9.4539 / GX2NiCrMoCu 25-20-5	[A743 CN3M]	2.4360 / NiCu30Fe	[N04400]
9.4600 / G-NiMo29Cr	[N3M, N7M]	2.4600 / NiMo29Cr	[B564, B335]
9.4610 / G-NiMo16Cr16	[CW2M]	2.4610 / NiMo16Cr16Ti	[N06455]
9.4660 / GX1NiCrMoCuN 35-20	[A743 CN7M]	2.4660 / NiCr20CuMo	[B473, N08020]
Titanium			
Castings DIN/EN	[AISI / ASTM]	Rolled Material DIN/EN	[AISI / ASTM]
3.7031 / G-Ti2 [Ti Grade 2]	[-]	3.7035 / Ti2	[B348, B338, B861, B265]
3.7032 G-Ti2Pd [TiPd Grade 7]	[-]	3.7165 / Ti6Al4V	[B348, B265]

Further materials upon request



RETROFIT OF CENTRIFUGAL AND TWIN SCREW PUMPS PUMPS W/O MODIFICATION OF INSTALLATION

- ▶ Record & evaluation of existing pump parameters & dimensions
- ▶ 3D-laser scan for precise pump & installation measurements
- ▶ Entire pump engineering within the boundaries of an existing installation
- ▶ Conversion of old pumps to latest state-of-the-art high efficient pumps
- ▶ Certification of pump compliance acc. to Machinery Directive 2006/42/EG and ATEX 94/9/EG



USER ADVANTAGES

- ▶ Significant reduction of facility emissions by employing enhanced sealing technologies
- ▶ Alteration of non-compliant pump systems into latest state-of-the-art installations and conformity to the relevant and current EU-directives (Machinery and ATEX)
- ▶ Updated pump installations to most recent standards
- ▶ No change of existing piping, baseplates or drives
- ▶ Reduction of OPEX due to significant energy savings through the use of highly efficient hydraulics
- ▶ Considerable increase of MTBF



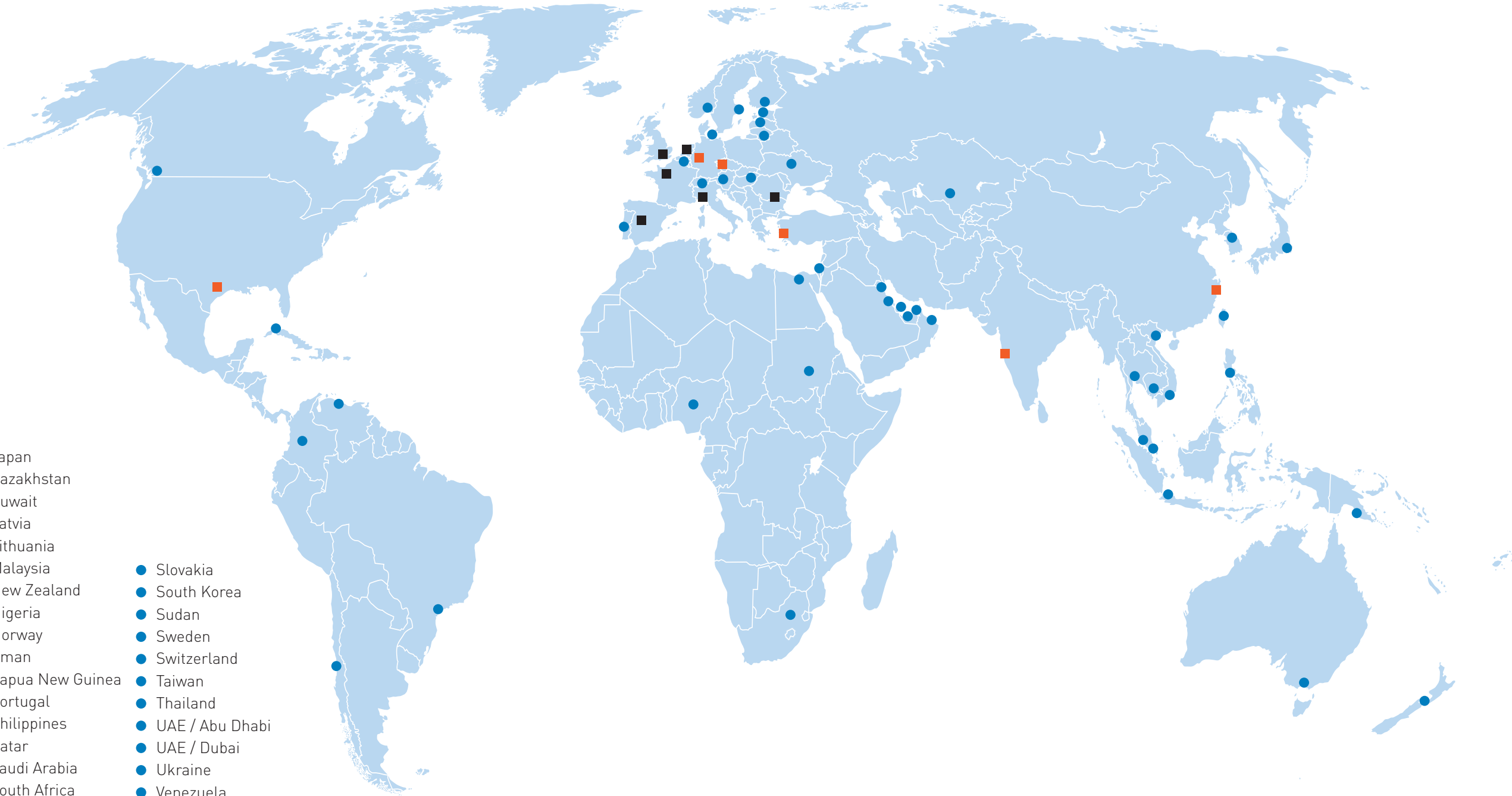
KLAUS UNION GLOBAL PRESENCE



- Klaus Union Center of Competence
- Klaus Union Subsidiary
- Klaus Union Sales Office

- Germany/ Bochum
- China/ Ningbo
- Czech Republic/ Krnov
- India/ Pune
- Turkey/ Izmir
- USA/ Houston
- England
- France
- Italy
- The Netherlands
- Romania
- Spain

- | | |
|-------------|--------------------|
| ● Australia | ● Japan |
| ● Austria | ● Kazakhstan |
| ● Belgium | ● Kuwait |
| ● Brazil | ● Latvia |
| ● Cambodia | ● Lithuania |
| ● Canada | ● Malaysia |
| ● Chile | ● New Zealand |
| ● Colombia | ● Nigeria |
| ● Cuba | ● Norway |
| ● Denmark | ● Oman |
| ● Egypt | ● Papua New Guinea |
| ● Estonia | ● Portugal |
| ● Finland | ● Philippines |
| ● Hungary | ● Qatar |
| ● Indonesia | ● Saudi Arabia |
| ● Iraq | ● South Africa |
| ● Israel | ● Singapore |
- | |
|-------------------|
| ● Slovakia |
| ● South Korea |
| ● Sudan |
| ● Sweden |
| ● Switzerland |
| ● Taiwan |
| ● Thailand |
| ● UAE / Abu Dhabi |
| ● UAE / Dubai |
| ● Ukraine |
| ● Venezuela |
| ● Vietnam |



KLAUS UNION SERVICE

KLAUS UNION WORLDWIDE SERVICE

Following our service philosophy „your worldwide partner“, Klaus Union works with subsidiaries, approved representatives and service partners worldwide.

Since the founding of Klaus Union Service GmbH in 2006 our efforts focus on providing service and support for our customers quickly and comprehensively. As an independent service company with exceptionally strong customer focus, we provide full service, using state of the art technologies and experience. Klaus Union Service draws on 75 years of process engineering with pumps, valves and agitator drives.

We provide service and planning advice, clearly arranged documentation and other required services, including the delivery of spare parts on short lead times.

Our individual service and maintenance contracts provide safety and certainty with your specific needs and location in mind. Through our worldwide network of partners we have highly trained maintenance staff worldwide along with fully equipped workshops to provide service, training and onsite services.

Quality is at the centre of all we do. Quality assurance measures certified to international standards are implemented across our company and sub suppliers providing the best product and service possible.



Worldwide
**Close to the
Customer**



OUR RANGE OF SERVICES

We will analyse your technical problem and provide a technically inspired solution to solve the issue and get you back in service. Areas that we can look at is equipment reliability and availability, maintenance planning, risk management, equipment upgrades and other operational reviews.

We work with our customers by engaging with all stakeholders to provide the best solutions that benefit your business.

As part of the Klaus Union family Klaus Union Service GmbH has access to all Klaus Union knowledge and state of the art technology.

Providing expertise in logistics worldwide we are provide high availability and fast delivery of all key spare parts. We are always working on improving our systems to keep them best in class and provide you with fast service to keep your equipment online.

SERVICE PERFORMANCE

- ▶ Workshop Repairs
- ▶ On-Site Repairs
- ▶ Genuine Spare Part Delivery Worldwide
- ▶ Spare Parts Storage
- ▶ Customized Spare Parts Management
- ▶ On-Site Maintenance
- ▶ Installation
- ▶ Retrofitting
- ▶ On-Site Testing
- ▶ Customer Advisory Service
- ▶ Laser Alignment
- ▶ Start Up & Commissioning
- ▶ Individual 24/7-Service
- ▶ Trouble-Shooting
- ▶ In-House & On-Site Training
- ▶ On-Site Assembly and Disassembly
- ▶ Long-Term Maintenance Contracts
- ▶ On-Site Monitoring
- ▶ Maintenance Planning and Consulting
- ▶ Diagnostics

KLAUS UNION SERVICE

TESTING FACILITIES

In our modern testing facility, pumps are tested up to DN 1200. Testing of the repaired pumps with appropriate test reports gives you optimum plant safety and availability.

- ▶ Testing range:
 - Q = 0,1 m³/h up to 5.000 m³/h
 - H = 2 m L.C. up to 1.000 m L.C.
 - ΔP = up to 100 bar
 - Motor power: up to 2 MW
 - n = up to max. 3.600 rpm
- ▶ NPSH-measurements
- ▶ Axial thrust measurements
- ▶ Vibration measurements
- ▶ Noise measurements
- ▶ Test run according to HI 14.6 / DIN EN ISO 9906 and API 610, 676 and / or 685

COMMISSIONING

Klaus Union Service GmbH accompanies you from the offer complying with the specifications, via the commissioning of complete plants, to the assurance of plant availability with scheduled maintenance intervals and process optimisation.



WORKSHOP REPAIRS

Klaus Union Service uses state of the art manufacturing machinery for the production and repair of pumps and valves. The following different types of welding processes can be carried out:

- ▶ TIG
- ▶ MIG/MAG
- ▶ E
- ▶ Plasma

Plant-specific modifications and changes of pumps are accompanied, executed and documented by the design department of Klaus Union.



Worldwide
**Close to the
Customer**



HOW TO FIND US ...

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 Blumenfeldstr. 18 P.O. Box 10 13 49
 44795 Bochum 44713 Bochum
 Germany Germany

Phone +49 (0) 234 45 95-0
 Fax +49 (0) 234 45 95 7016

E-Mail service@klaus-union.com
 Service Helpdesk +49 700 55 28 77 37



Product Range Pumps:

Magnet Drive Pumps

- ▶ Centrifugal Pumps according to DIN EN ISO 2858 & DIN EN ISO 15783
- ▶ Centrifugal Pumps according to ASME B73.3
- ▶ Centrifugal Pumps according to API 685
- ▶ Multi-Stage Centrifugal Pumps (Barrel/Ring-Section Design)
- ▶ Side Channel Pumps following DIN EN ISO 15783
- ▶ Twin Screw Pumps, Single Volute, according to API 676 and DIN EN ISO 14847
- ▶ Pumps in Close-Coupled Design
- ▶ Pumps for High Pressure Applications
- ▶ Pumps for High Temperature Applications
- ▶ Self-Priming Pumps
- ▶ Vertically Suspended (Sump) Pumps, Single- / Multi-Stage and Twin Screw Design
- ▶ Vertical Inline Pumps

Mechanically Sealed Pumps

- ▶ Centrifugal Pumps according to DIN EN ISO 2858 & DIN EN ISO 5199
- ▶ Centrifugal Pumps following API 610 & ISO 13709
- ▶ Multi-Stage Centrifugal Pumps (Barrel/Ring-Section Design)
- ▶ Propeller Pumps, Horizontal / Vertical / Bottom-Flange
- ▶ Side Channel Pumps
- ▶ Twin Screw Pumps, Single / Double Volute, according to API 676 and DIN EN ISO 14847
- ▶ Pumps for High Pressure Applications
- ▶ Pumps for High Temperature Applications
- ▶ Self-Priming Pumps
- ▶ Vertically Suspended (Sump) Pumps, Single- / Multi-Stage and Twin Screw Design
- ▶ Vertical Inline Pumps

Product Range Valves:

- ▶ Globe Valves, T-Pattern
- ▶ Globe Valves, Y-Pattern
- ▶ Control Valves
- ▶ Gate Valves, Isomorphous Construction Series
- ▶ Gate Valves, Wedge or Wedge Plates
- ▶ Check Valves
- ▶ Butterfly Valves, Metal Seated
- ▶ Control Butterfly Valves, Metal Seated

Klaus Union Service Performance:

- ▶ Workshop / On-Site Repairs
- ▶ Genuine Spare Part Delivery Worldwide
- ▶ Spare Parts Storage
- ▶ Customized Spare Parts Management
- ▶ On-Site Maintenance
- ▶ Installation
- ▶ Retrofitting
- ▶ On-Site Testing / Monitoring
- ▶ Customer Advisory Service
- ▶ Start Up & Commissioning
- ▶ Individual 24 / 7 Service
- ▶ Trouble-Shooting
- ▶ In-House & On-Site Training
- ▶ On-Site Assembly and Disassembly
- ▶ Long-Term Maintenance Contracts
- ▶ Maintenance Planning and Consulting
- ▶ Diagnostics

Klaus Union GmbH & Co. KG

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www.klaus-union.com