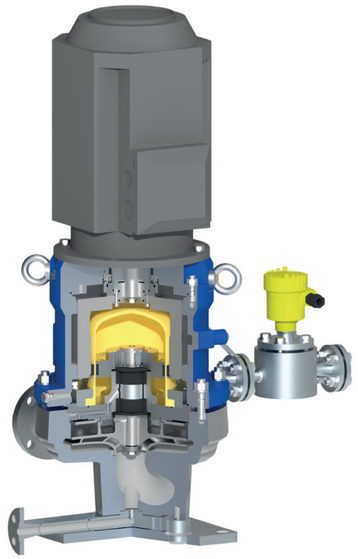
KLAUS UNION

OUR QUALITY IS YOUR SUCCESS

MAGNET DRIVE VERTICAL INLINE CENTRIFUGAL PUMPS

FOLLOWING DIN EN ISO 2858 & 15783, ASME B73.3 OR API 685

MAGNET DRIVE VERTICAL INLINE CENTRIFUGAL PUMPS



Space is at a premium for many users. To provide the highest reliability with the lowest footprint, Klaus Union has a wide range of vertical inline pumps. Utilising over 75 years of Klaus Union experience, these pumps represent best in class magnet drive technology.

The design is based on Klaus Union's range of proven hydraulics to the following standards DIN EN ISO 2858, ASME B73.3 and API 685 2nd Edition respectively, the following vertical inline models are available:

- **Series SLM NVBI (DIN EN ISO)**
- **Series SLM AVBI (ASME)**
- **Series SLM APCI (API)**

Klaus Union's philosophy puts quality and safety first. Pumps are equipped with magnet drive and are leak free in accordance with the TA-Luft specification (German Technical Instruction on Air Quality Control), and require much lower maintenance compared to pumps with dynamic mechanical shaft seals.

Leak-free magnet drive pumps are required for pumping toxic, aggressive, hot, flammable, expensive and other environmentally hazardous liquids in:

→ **Chemical** → **Petrochemical** → **Refineries**

→ **On-/ Offshore** → **Tank Farm**

Their compact design allows these pumps to fit into areas where space is at a premium. Pumps can be retrofitted to replace existing inline pumps including replacing pumps with problematic mechanical seals.

Designed using Klaus Union's modular system for the magnetic coupling, pumps come with a wide range of proven features and options. This array of options enables pumps to be easily tailored to your specific application to ensure maximum safety and reliability.

As standard pumps are rated for 40 bar and come in close-coupled arrangement (OH3-CC).
Other designs including lower/ higher pressure ratings, long coupled designs and designs with magnet drives using non-metallic containment shells are available on request. This increases pump efficiency, reliability and permissible operating range significantly compared to other designs utilizing metallic containment shells or dynamic mechanical shaft seals.

The close-coupled design allows for the use of standard IEC or NEMA motors and eliminates maintenance requirements on standard pump bearing brackets, without adversely affecting the motor bearings, making the pump nearly maintenance free.

Experience
Responsibility
Passion

Performance Range

- **Flow Rate Q:** up to 900 m³/h [3,963 gpm / 135,860 bpd]
- **Delivery Head H:** up to 220 m [722 ft]

Higher flow rates and delivery heads upon request

Temperature Range / Pressure Rating

- **Temperature Range:** -120 °C up to 350 °C [-184 °F up to 662 °F]

upon request up to 450 °C (842 °F)

- **Pressure Rating:** PN 40 at 120 °C [580 psi at 248 °F]

Higher pressure ratings upon request

Materials

Components	S-8l	A-8	D-1	H2
Pump Casing	Carbon Steel	316 Austenite	Duplex	Hastelloy C4
Impeller	316 Austenite	316 Austenite	Duplex	Hastelloy C4
Wetted Parts	316 Austenite	316 Austenite	Duplex	Hastelloy C4
Shaft	316 Austenite	316 Austenite	Duplex	Hastelloy C4
Intermediate Lantern / Bearing Support	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel

Other materials upon request, such as A9, H1, T1 and many more

Quality Assurance

A major component 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 is a DIN EN ISO 9001 certified company

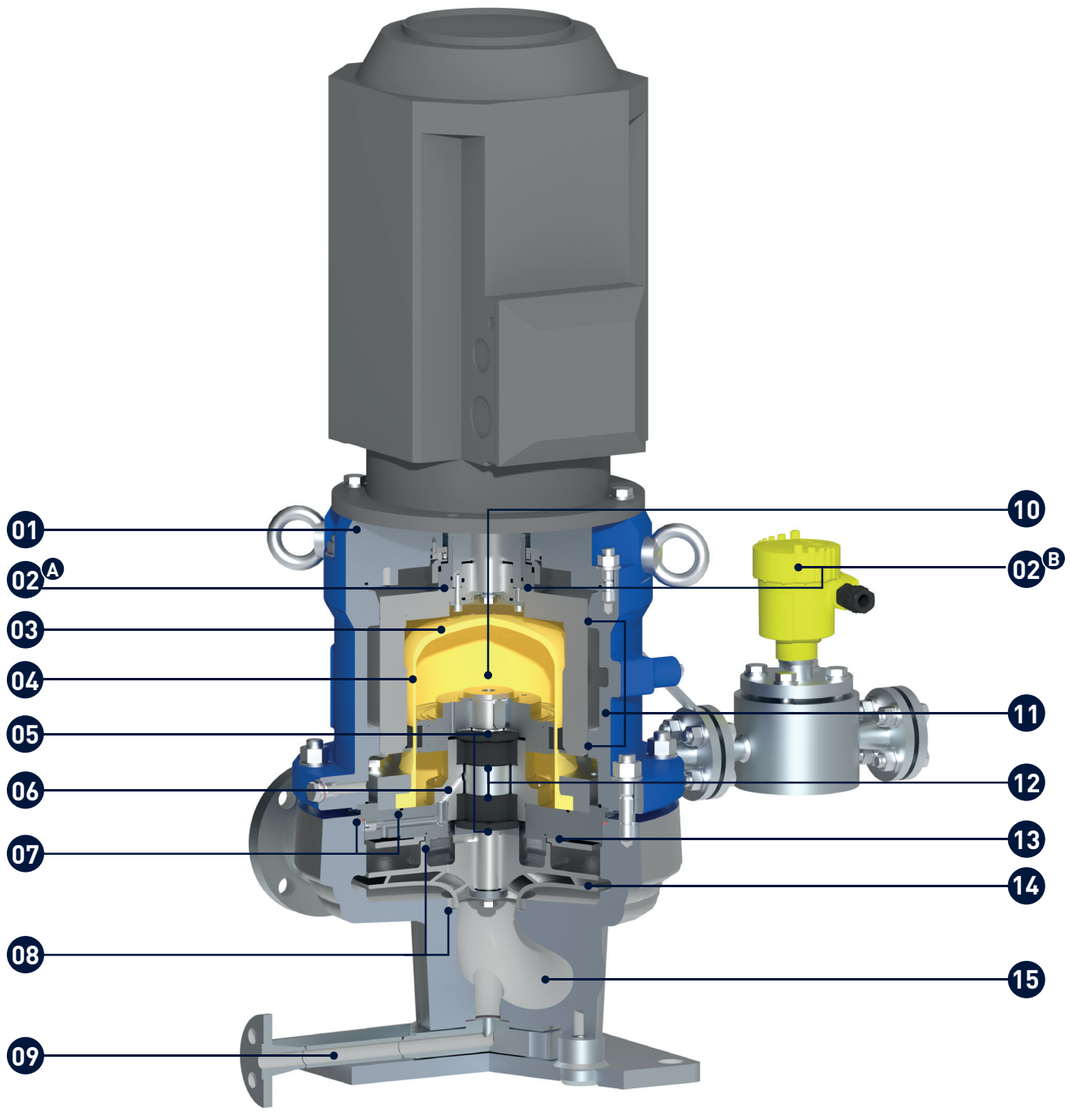
TÜV NORD CERT GmbH ISO 9001

In accordance with TÜV 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

DESIGN DETAILS



Please see
the description
on the following page
→

VERTICAL INLINE DESIGN

01 ▶ **Thermal Barrier (Optional)**
Protects the motor bearing in case of higher operational temperatures.

02 ▶ **Secondary Control (A) / Control System (B) by Standard Backup Seal (Optional)**
Klaus Union backup mechanical seal, acting as a secondary control device, in case of primary containment failure, to provide additional safety acc. API 685 §3.67 or as a complete secondary control system with appropriate instrumentation acc API 685 § 3.68.

03 ▶ **Secondary Containment System (Optional)**
Klaus Union hybrid double containment shell with standard pressure transmitter acc. API 685, 2nd Edition, § 3.66 (page 10).

04 ▶ **Non Metallic Containment Shell (Optional)**
Increases pump efficiency and reliability, extending the permissible operating range.

05 ▶ **Thrust Bearing**
Hydraulic balancing minimizes axial thrust across the pump operating range. Thrust bearings take startup loads and pump weight.

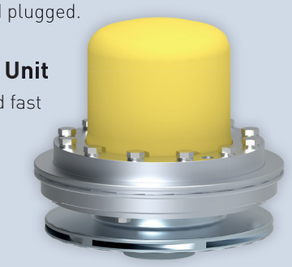
06 ▶ **Internal Bearing Flush Circuits**
As per Klaus Union's proven design, the pressurized flush circuits lubricate and cool the internal bearings properly. Proper self-venting in place.

07 ▶ **Gasket (Static)**
Acc. to TA-Luft with minimized number (two) of static seals.

08 ▶ **Wear Rings**
Renewable casing wear ring. Additional renewable wear ring on impeller/ impeller rear optional.

09 ▶ **Casing Drain (Optional)**
Flanged or drilled and plugged.

10 ▶ **Wetted Cartridge Unit**
To provide an easy and fast maintenance.



11 ▶ **Intermediate Lantern**
With rub zone to prevent contact of containment shell by outer rotor. Assembly and disassembly guides for easy maintenance. Replaceable rub zone available on request.

12 ▶ **Journal Bearing**
Heavy duty design with many material combinations available depending on operating parameters. Compensation for relative thermal extension provided acc. API 685 §6.9.4.

13 ▶ **RTZ Design with Reduced Partial Flow (Optional)**
The RTZ Design with reduced flush flow provides an additional safety feature against dry run conditions and acts as an internal filter of the flush flow to prevent solids from entering the bearing and magnet drive area.

14 ▶ **Standard Impeller and Internals**
Impeller and internals are part of the standard series. They are easily interchangeable and allow fast delivery times.

15 ▶ **Optimized Inlet Geometry**
Providing superior $NPSH_R$ and efficiency characteristics.

ADVANTAGES OF SEALLESS CENTRIFUGAL PUMPS

Advantages of the Magnet Drive

- No dynamic seals and no ancillary seal supply systems
  - Highest process safety
  - Longer MTBM & MTBF
  - Lower CAPEX & OPEX
- High efficiency due to non-metallic containment shells as per standard eliminating eddy current losses
- Easy to maintain, no special tools necessary
- Complete self-draining / self-venting
- Standard motors used or alternate drives on demand
- Cost effective installation due to small footprint
- Various designs available when pumping critical liquids (e.g. liquids containing solids, low boiling liquids)
  - Product Information

Handling Liquids Containing Solids

Products (amongst others)

- Acids
- Lyes
- Hydrocarbons
- Heat Transfer Liquids
- Coolants
- Liquid Gases
- Aggressive, Explosive, Toxic and Expensive Liquids
- Liquids Containing Solids

Industries (amongst others)

- Chemical Industry
- Petrochemical Industries
- Refrigeration and Heat Treatment
- Oil & Gas
- Power
- Tank Farms

Increased safety can be provided with the following options
(compliant with API 685 2nd Edition, Annex B, Figure B.1 - Logic Diagram): *

Basic Monitoring

- Containment shell temperature monitoring optional **
- Pump power monitoring

Secondary Control as per API 685 § 3.67 ***

- Single containment shell
- Pump power monitoring
- Welded drain connection on intermediate lantern with flange
- Backup mechanical seal on drive shaft
- Monitoring device, liquid detector

Secondary Control System as per API 685 § 3.68 *** (with Liquid Sensor)

- Single containment shell
- Containment shell temperature monitoring optional **
- Pump power monitoring
- Welded drain connection on intermediate lantern with flange
- Backup mechanical seal on drive shaft
- Monitoring device, liquid detector

* Liquid detection in vertical section of discharge piping (on request)
** Only required when using a metallic containment shell
*** Numbering according API 685 2nd Edition, page 10

Secondary Control System as per API 685 § 3.68 *** (with Pressure Sensor)

- Single containment shell
- Pump power monitoring
- Welded drain connection on intermediate lantern with flange
- Backup mechanical seal on drive shaft
- Monitoring device, pressure transmitter

Secondary Containment System as per API 685 § 3.66 ***

- Hybrid double containment shell
  (Combination of 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.)
  - 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
- Secondary containment integrity is constantly verified by the pressure transmitter
- Easy and reliable detection of containment breach through a standard pressure transmitter
- Ability to flush the area between shells (according API 685, 2nd Edition, § 6.7.9)
- Containment shell temperature monitoring optional **
- Pump power monitoring

CASE STUDY

INDUSTRY: REFINERY
PROCESS: STYRENE UNIT
PRODUCT: BENZENE
APPLICATION: BENZENE DRYING COLUMN OVERHEAD PUMP
SOLUTION: VERTICAL INLINE CENTRIFUGAL PUMP (OH3-CC)
LOCATION: FRANCE

The Job:

A large petrochemical plant had trouble with a "bad actor" pump. The bad actor in question was a vertical inline pump with a mechanical seal, rigid coupling and no bearing bracket (API 610 OH4). The OH4 design imparted significant loads on the driver. The original motor handled these demands fine. But after 25 years it had to be replaced with a new driver compliant with up to date standards. This new standard motor could not handle these loads and required unacceptable high maintenance efforts. As a result, continuous production was no longer guaranteed. In addition, high leakage rates of the mechanical seal worsened the service life even more.
Klaus Union supplied a sealless vertical inline centrifugal pump in close-coupled design as a refit (OH3-CC).

In this design the hydraulic loads are absorbed by the robust, heavy duty journal bearing combination, while magnet drive acts as a coupling and protects the motor from any non-standard loads. These journal bearings together with an axial thrust optimized hydraulic allow a considerable extension of the allowable operating range, compared to the original pump, to between 10% and 120% of BEP. All this while keeping vibrations at around 0,5 mm/s peak velocity when in installed condition.

Operating Data:

- Fluid: Benzene
- Flow Rate: 10,5 m³/h (46,2 gpm)
- Temperature: 110 °C (230 °F)
- Delivery Head: 63 m (206,7 ft)
- $NPSH_R$: 0,9 m (2,95 ft)

The Solution:

SLM APCI 03.0x02.0x10A-16E02 RTZG

- SLM: Sealless magnet drive
- APCI: Vertical inline centrifugal pump in close-coupled design following API 685 (OH3-CC)
- 03.0: Nominal pipe size of suction flange; 3"
- 02.0: Nominal pipe size of discharge flange; 2"
- 10: Nominal size of impeller; 10"
- A: Type of hydraulic
- 16: Magnet drive size
- E: Type of magnet
- 02: Length of magnet drive
- RTZ: Dry run capable design
- G: Backup mechanical seal as a secondary control device acc. API 685

Klaus Union
Magnet Drive
When Leackage
is not an Option

The Thought Process:

The existing benzene pumps in the refinery were all mechanically sealed. Due to high leakage rates of carcinogenic fluid and especially because of the poor performance of the replaced motor, all pumps were classified as obsolete. Based on this existing experience with magnet drive pumps Klaus Union has been contacted by the refinery to make a proposal for a replacement.

Klaus Union proposed the following feature set:

- Magnet drive pumps acc. API 685 to achieve leak free, maintenance free operating capability.
- Utilizing a non-metallic containment shell to avoid any eddy current losses and maximize pump efficiency.
- Dry run capable "RTZ" design to protect the pump from accidental dry running.
- Using of a secondary control system with liquid detector acc. API 685 with backup mechanical seal rated for full design pressure (40 bar / 580 psi).

The Result:

Two pumps were installed, successfully commissioned and have been in operation without any downtime for maintenance since more than one year. The satisfied customer has started a project to replace all his existing old pumps with Klaus Union sealless vertical inline centrifugal pumps.

The Benefits:

- Eliminating „bad actor" No. 1: mechanical seal.
- Maintenance and leak-free magnet drive, eliminating costs for maintenance.
- Robust API 685 compliant pump type OH3-CC.
- As Secondary Control System was specified by the customer, the leackage detector was provided for pump monitoring.
  Please note: As per standard, no pump monitoring is required to fulfill ATEX regulations.
- No fluid contamination by buffer liquids.
- No utility consumption for cooling, lubrication or seal supply.
- Utilizing standard Klaus Union components for hydraulic and magnetic coupling. The high standardization ensures fast availability of spares, many available directly from stock and interchangeability with spares for pumps already installed on site (horizontal or vertical type).

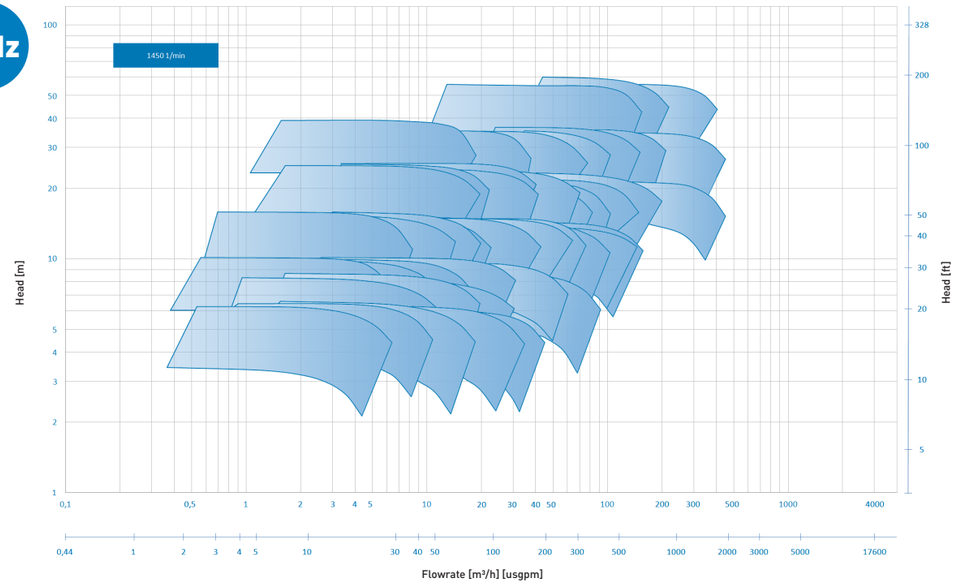
Old „bad actor" Pump

New Pump by Klaus Union

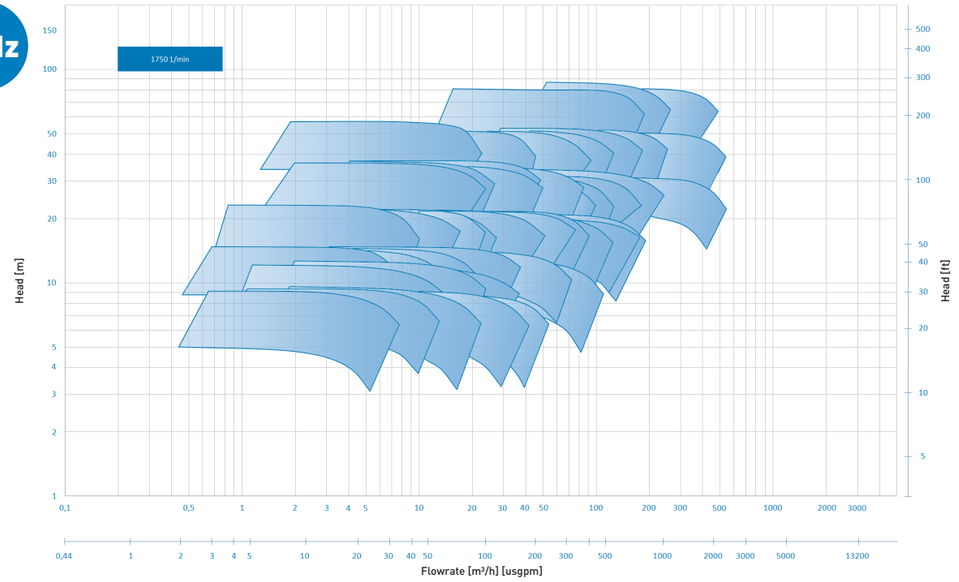
PERFORMANCE CURVES VERTICAL INLINE PUMPS

(OTHER DATA AVAILABLE ON REQUEST)

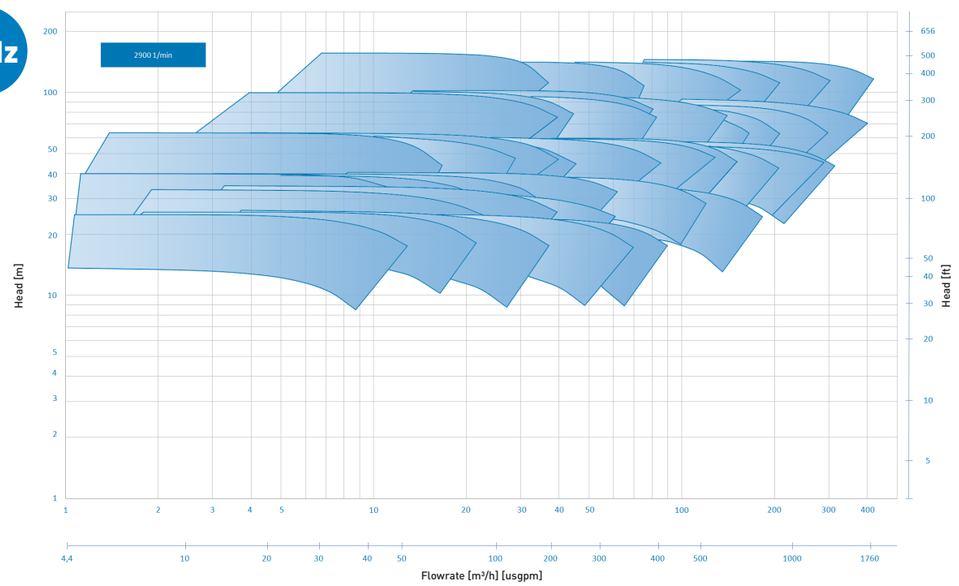
50 Hz



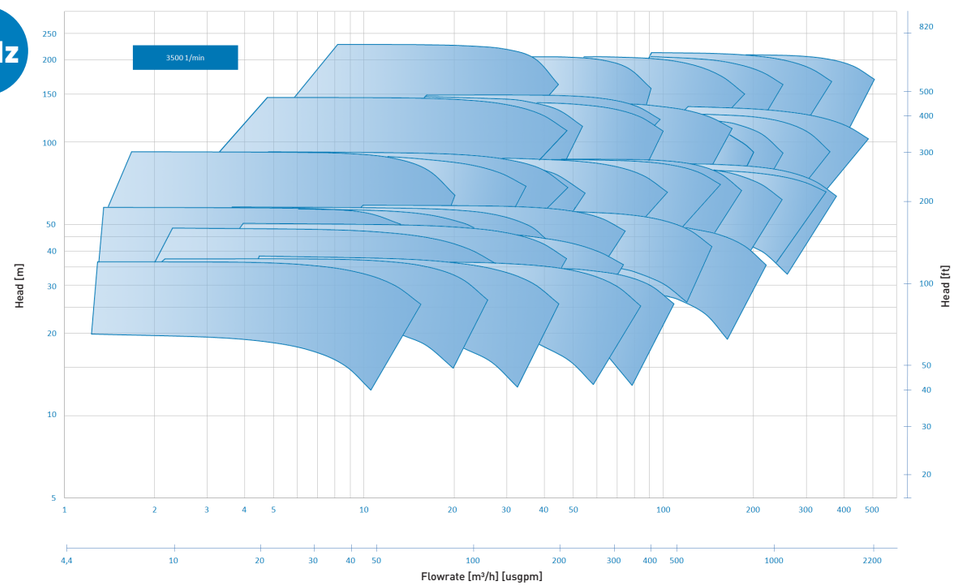
60 Hz



50 Hz



60 Hz



Product Range Pumps:

Magnet Drive Pumps

- Centrifugal Pumps according to DIN EN ISO 2858 & DIN EN ISO 15783
- Centrifugal Pumps according to ASME B73.3-2015
- Centrifugal Pumps according to API 685 2nd Edition
- Multi-Stage Centrifugal Pumps (Barrel-Type Design available)
- Side Channel Pumps following DIN EN ISO 15783
- Twin Screw Pumps, Single Volute, according to API 676 4th Edition
- 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 12th Edition & ISO 13709 2010
- Multi-Stage Centrifugal Pumps (Barrel-Type Design available)
- Propeller Pumps, Horizontal / Vertical / Bottom-Flange
- Side Channel Pumps
- Twin Screw Pumps, Single / Double Volute, according API 676 4th Edition
- 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

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