



Specialist for Pumping Technology

Session 41 – Vertical Pumps (VS4/5, VS6, VS7)

Simon Smith May 2025



Presenter Profile – Simon Smith

Simon graduated with an honours degree in Chemical Engineering from the University of Surrey in 1978 and began a long career in the engineered pump industry spanning 44 years (so far!) with Peerless Pump, BW/IP International / Flowserve, SPP Pumps, Ruhrpumpen and Ebara Cryodynamics.

Over his long career he has filled various roles as Applications Engineer / Manager, Project Manager, Key Account Specialist, Vertical Pump Product Specialist, International Sales Engineer / Manager / Director and he has considerable experience in Training & Mentoring young engineers.



Ruhr*RP*umpen Short Courses

Here is a listing of all the previous courses in the last two years.

- No 21 – BB4 Multistage Pumps for the Power Industry
- No 22 – Coking Process and Hydraulic Decoking Equipment
- No 23 – Pumps for the Desalination Market
- No 24 – Cryogenic Pumps
- No 25 – Magnetic Drive Pumps
- No 26 – Mechanical Seals & Systems
- No 27 – The Importance of System Curves
- No 28 – NPSH & Nss Made Simple
- No 29 – Curve Shape, Head Rise & Allowable Tolerances
- No 30 – Selecting the Right Pump for the Application
- No 31 - Comparison of API610 12th & 11th Editions
- No 32 - Pump Instrumentation
- No 33 - Handling Viscous Fluids with Centrifugal Pumps
- No 34 - Fire Pumps for the Oil & Gas Industries
- No 35 - Vertical Sump Pumps (Type VS4)
- No 36 - Engineered Systems
- No 37 - BB5 Double Case Barrel Pumps
- No 38 - Start-Up, Commissioning & Trouble Shooting
- No 39 – Positive Displacement Pumps
- No 40 – Vertical Pumps Part 1 VS1,2,3

Any you have missed you can get from our website www.ruhrpumpen.com

and follow the menu bar link to [RP Short Courses](#)



Ruh*RP*umpen Short Courses

www.ruhrpumpen.com



More Articles

- Introducing the new Ruhrpumpen Website
- Impeller Lift Procedure
- Newsletter Ruhrpumpen Fire Systems - December 2022
- VTP pumps for major water transfer project in Bolivia
- COVID-19 UPDATE
- Introducing the RP ANSI Process Pump Range
- Ruhrpumpen Resources
- Coolant System Maintenance
- RP delivers API 674 pumps for Gas Dehydration Package in Algeria
- Packing strips and packing gland tightening procedure

All Courses

Don't miss our

short course #25

COMING SOON



Simon Smith

Solutions Expert





Ruh*RP*umpen Short Courses

SHORT COURSE 37

Double Case Pumps (Barrel Pumps – BB5)

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 38

Start-Up, Commissioning & Troubleshooting of Centrifugal Pumps

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 39

An Introduction to Positive Displacement Pumps

- Full Session
- Download presentation
- Q&A Report

SHORT COURSE 40

Vertical Pumps (VS1, VS2, VS3)

- Full Session
- Download presentation
- Q&A Report

Session 40 –

“Vertical Pumps (VS1, VS2, VS3)”

Session 41 –

“Vertical Pumps Part 2 (VS4, VS5, VS6,VS7)”

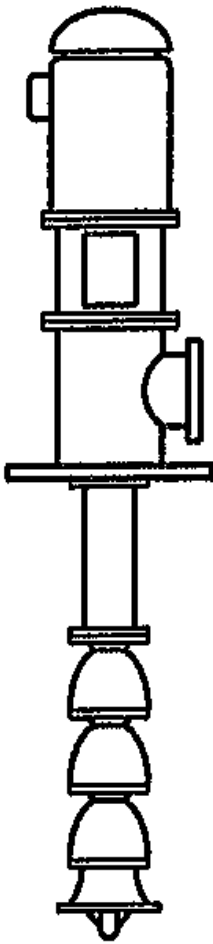
Aimed at Process, Mechanical, and Consultant Engineers who specify pumping equipment for the Water, Wastewater and Oil & Gas Industries as well as Applications & Sales Engineers selecting and quoting them.

While engineers generally have a good understanding of horizontal pumps, their exposure to vertical pumps is more limited and as a result they are frequently misunderstood and under-utilised.

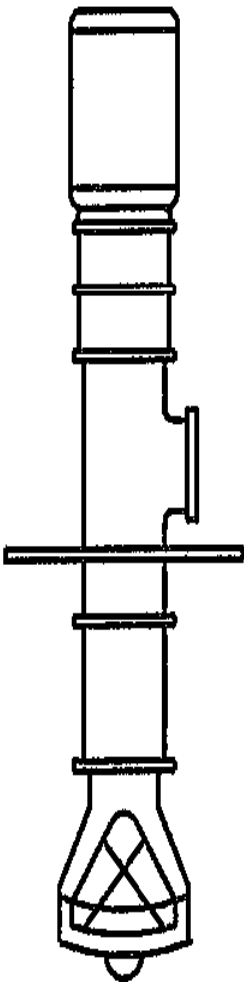
This course will look to put that right and explain the features and benefits of vertical sump pumps and how they can frequently be problem solvers.



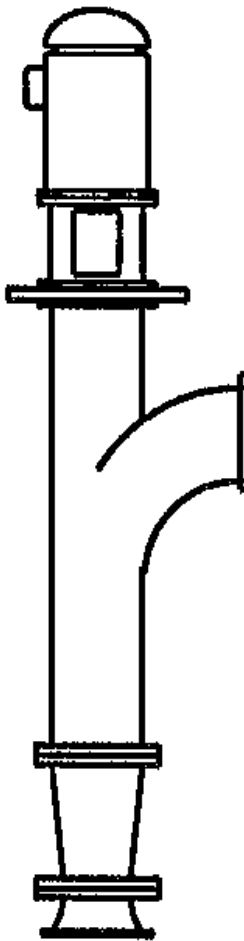
API 610 CONFIGURATIONS



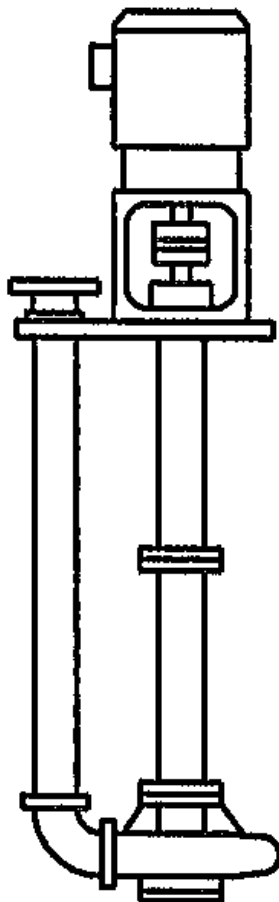
VS1



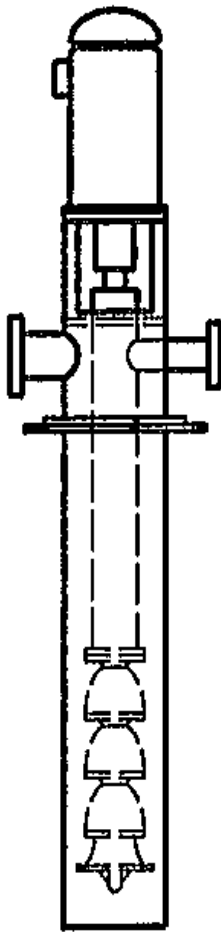
VS2



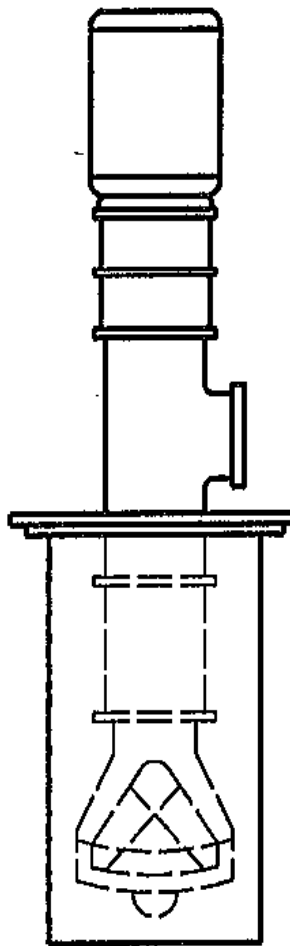
VS3



VS4/5



VS6



VS7

RUHRPUMPEN VERTICAL PRODUCTS

RUHRPUMPEN
Specialist for Pumping Technology



VS1



VS1



VS2



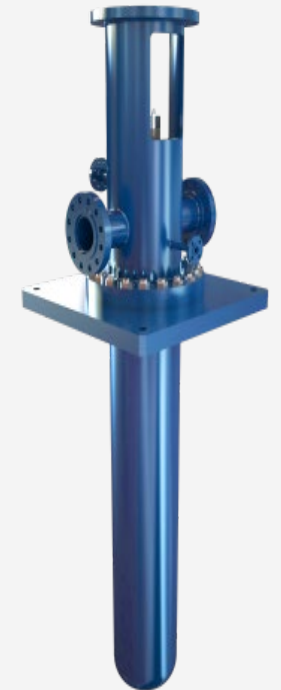
VS3



VS4/5



VS6



VS6



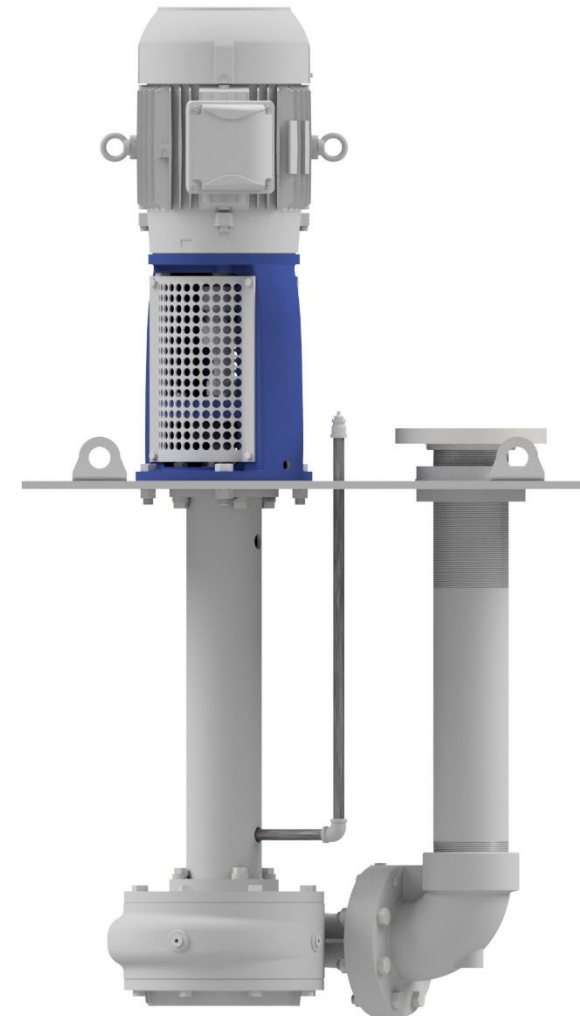
Pump Type VS4 Sump Pumps

General Description

VSP

VSP are vertically suspended single casing pumps with separate discharge, semi open or closed impeller designed for wet pit applications.

VSP Pumps can be built according API 610 latest edition, type VS4.



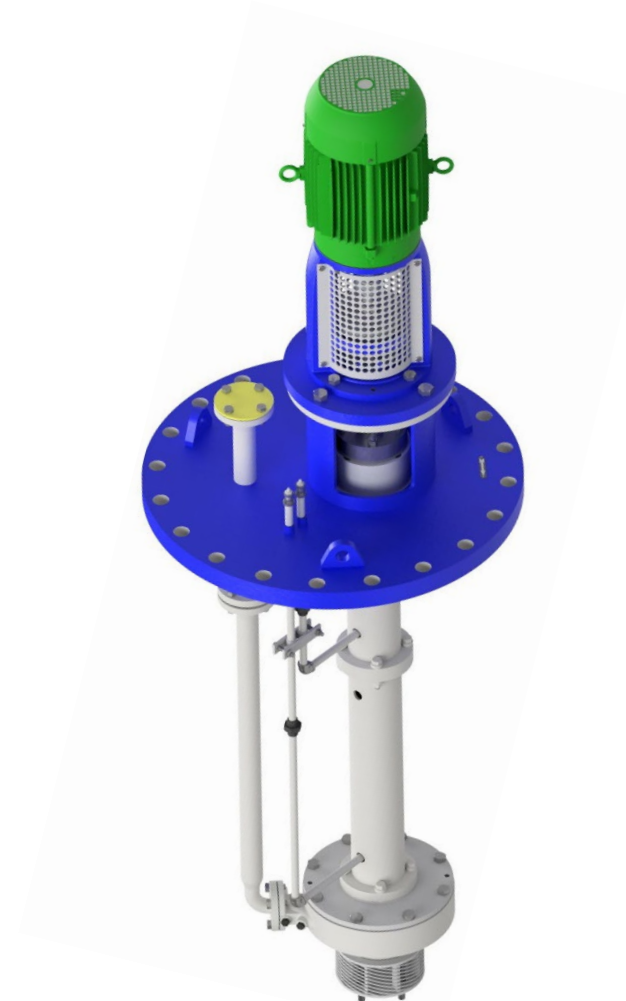


Product Line

VSP



VSP



VSP Chem



- HI design
- Single stage, vertical centrifugal pump
- Horizontal case in vertical configuration
- Clock-wise rotation (viewed from coupling end)
- Solid handling up to 1-5/8" (41mm) diameter
- Semi-open or Closed Impeller
- Standard construction in Cast Iron
- Grease lubrication for line shaft bearings
- Grease lubrication for ball bearings
- Threaded discharge pipe & 150# Rating Flange
- Available in 44 hydraulic sizes
 - 11 Non-Clog (SHD)
 - 33 Standard (GSD)



Product Line

VSP – Non Clog

VSP – NON CLOG - SHD



Description

- Enclosed Non-clog Impeller
- Handling solids up to 6" diameter
- Cast Iron & 316SS construction
- H.I. Design

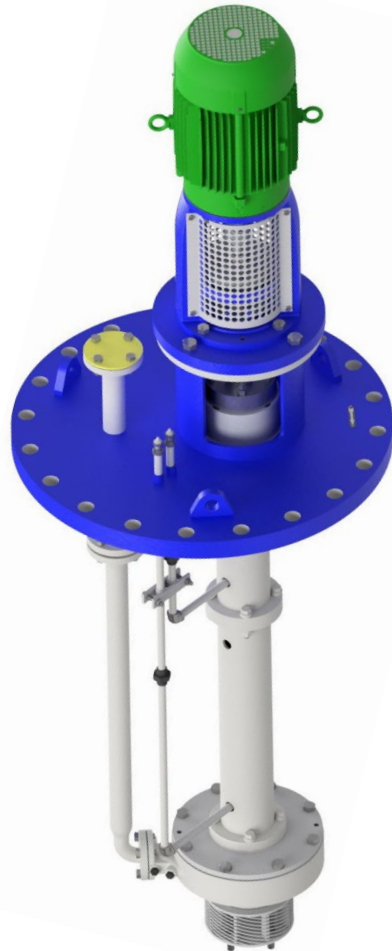
Application

- Sanitary wastes
- Industrial waste
- Waste treatment

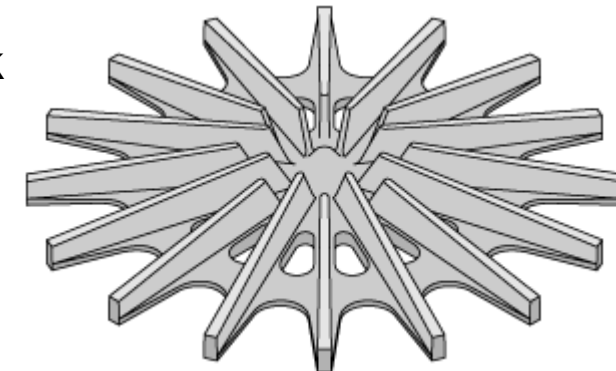
- Sanitary wastes
- Industrial waste
- Waste treatment

Product Line

VSP - Chem



- HI & API Design
- Single stage, vertical centrifugal pump
- Horizontal case in vertical configuration
- Clock-wise rotation (viewed from coupling end)
- Semi Open and Barske Impeller
- Standard materials and API
- Grease or external flush lubrication for line shaft bearings
- Grease or oil lubrication for ball bearings
- Threaded or welded discharge pipe design
- Enabled rating flanges in 150# and 300#
- Available in 27 hydraulic sizes
- Circular mounting flange to suit tank flange mounting



Barske Impeller –
Low Flow High Head

Application Range

VSP / VSP-Chem

Wide range of industrial, chemical process and municipal applications such as:

- Sump drainage
- Flood control
- Air wash systems
- Power plants
- Industrial processes
- Condensation control
- Pollution control
- Dewatering service
- Process plants
- Utility service
- Wet pit
- Water treatment
- Effluent
- Hydrocarbon processing
- General industry
- Automotive Solvents
- Polymers
- Plating and electroplating
- Pharmaceuticals
- Chemical / Petrochemical industry

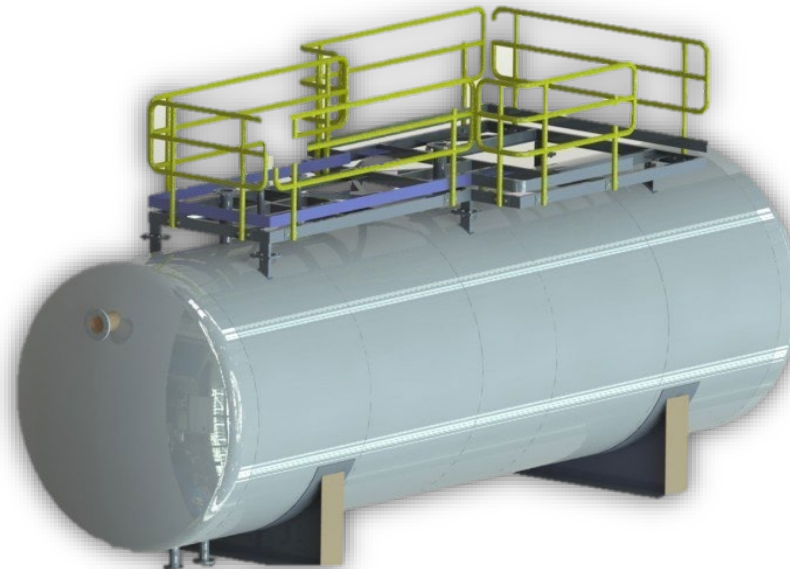


Application Range

VSP-Chem

HYDROCARBON PROCESSING (OIL & GAS)

VSP Chem Pumps are frequently installed in horizontal tanks. Usually these types of applications are for hydrocarbon transfer or for waste from the same processes





Application Range

VSP

FLOOD CONTROL

VSP Pumps are installed in open tanks to avoid water overflow from the collectors



Application Range

VSP

GENERAL INDUSTRY/CHEMICAL INDUSTRY/WASTE WATER /AUTOMOTIVE SOLVENTS

VSP Pumps are used to collect effluent for many processes in general industry



Performance Range

VSP

VSP

Capacity	up to 974 m ³ /h	4288 U.S. gpm
Head	2 to 104 m	5 to 342 feet
Temperature	-30°C to +135°C	-20°F to +275°F

VSP (Non-Clog)

Capacity	up to 864 m ³ /h	3802 U.S. gpm
Head	3 to 76 m	7 to 249 feet
Temperature	-30°C to +135°C	-20°F to +275°F

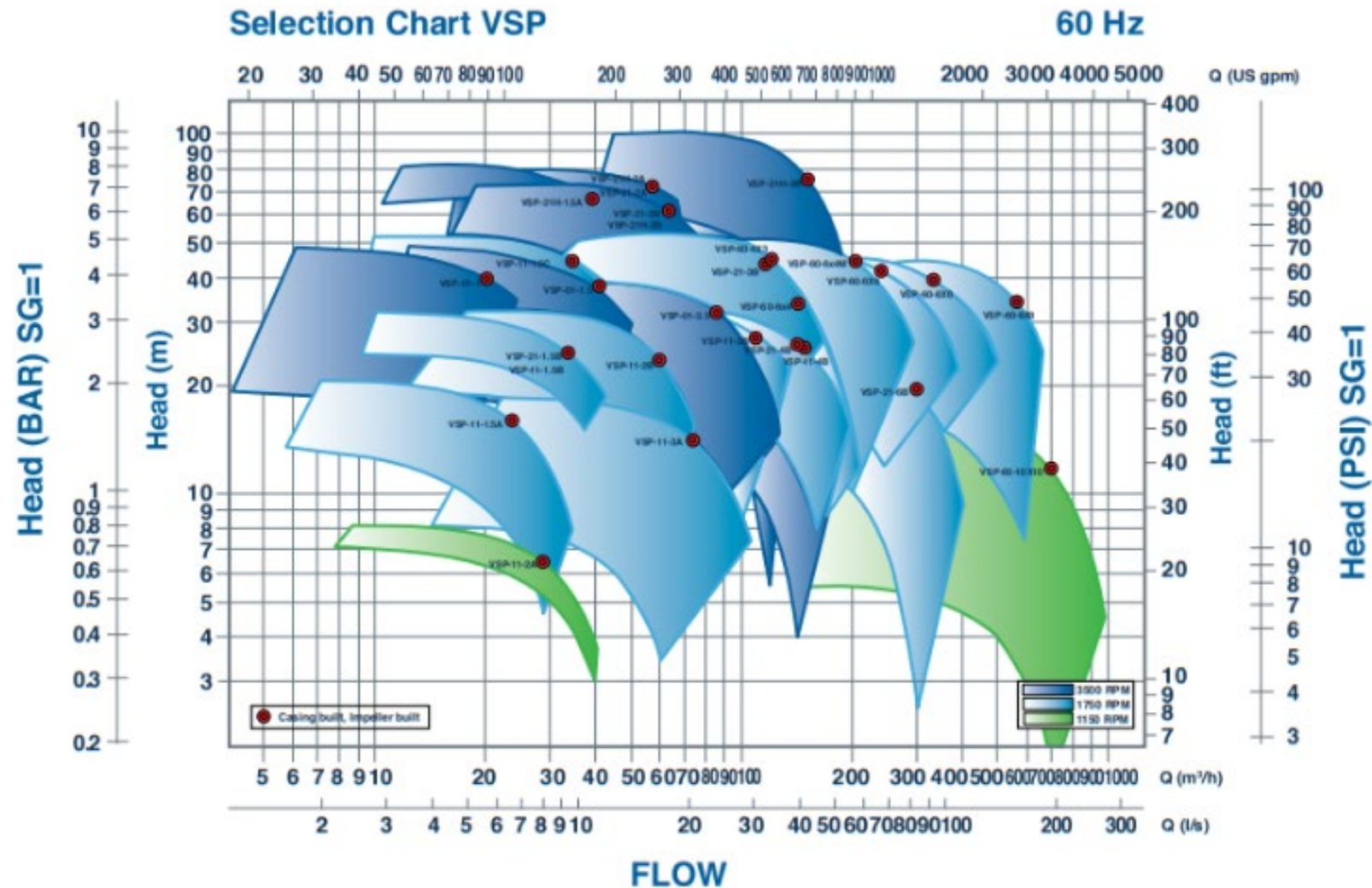
VSP-Chem

Capacity	up to 1908 m ³ /h	8403 U.S. gpm
Head	12 to 262 m	38 to 861 feet
Temperature	-30°C to +135°C	-20°F to +275°F

**Twice the flow range of Flowserve,
Sulzer or Goulds**

Selection Chart

VSP



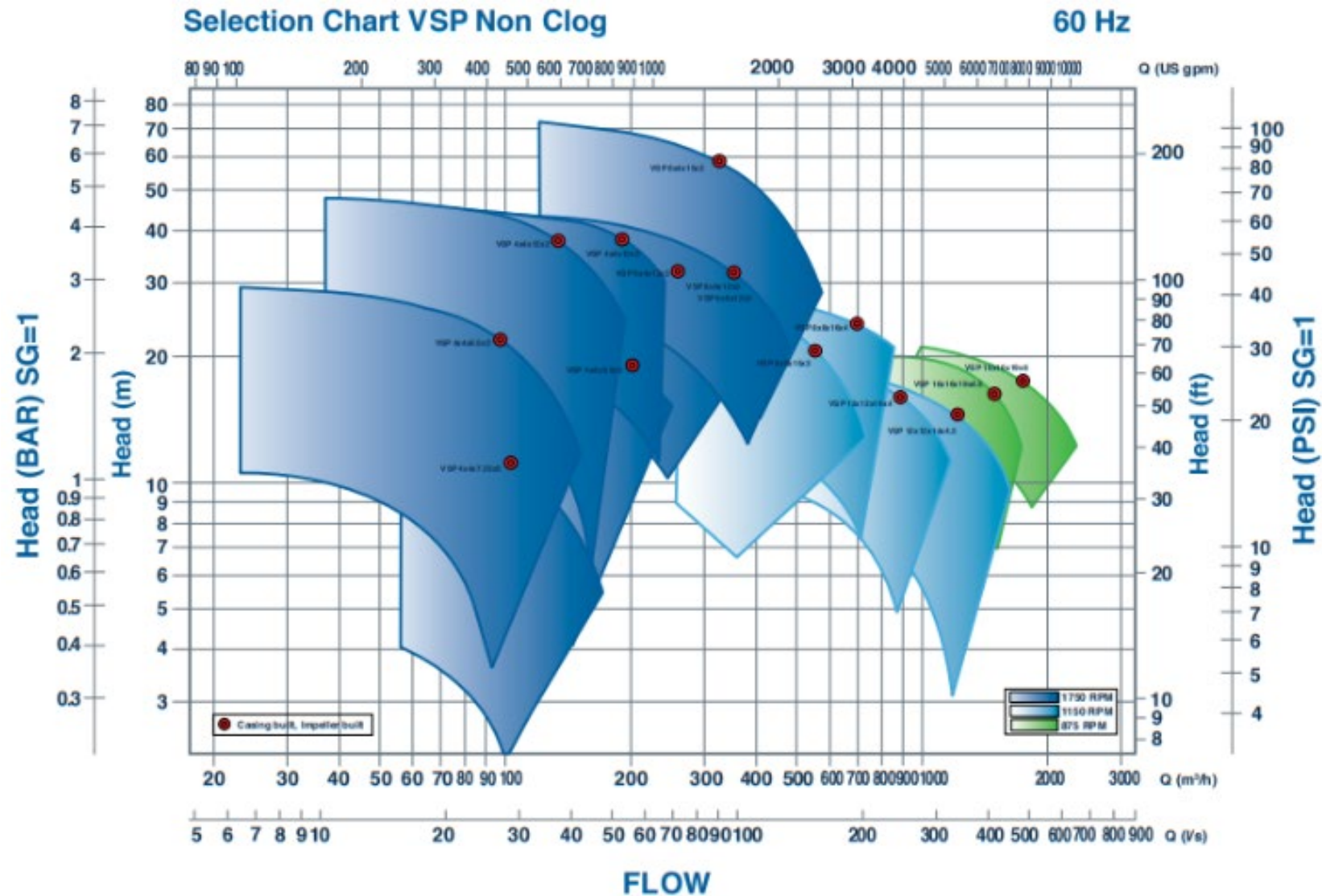
VSP





Selection Chart

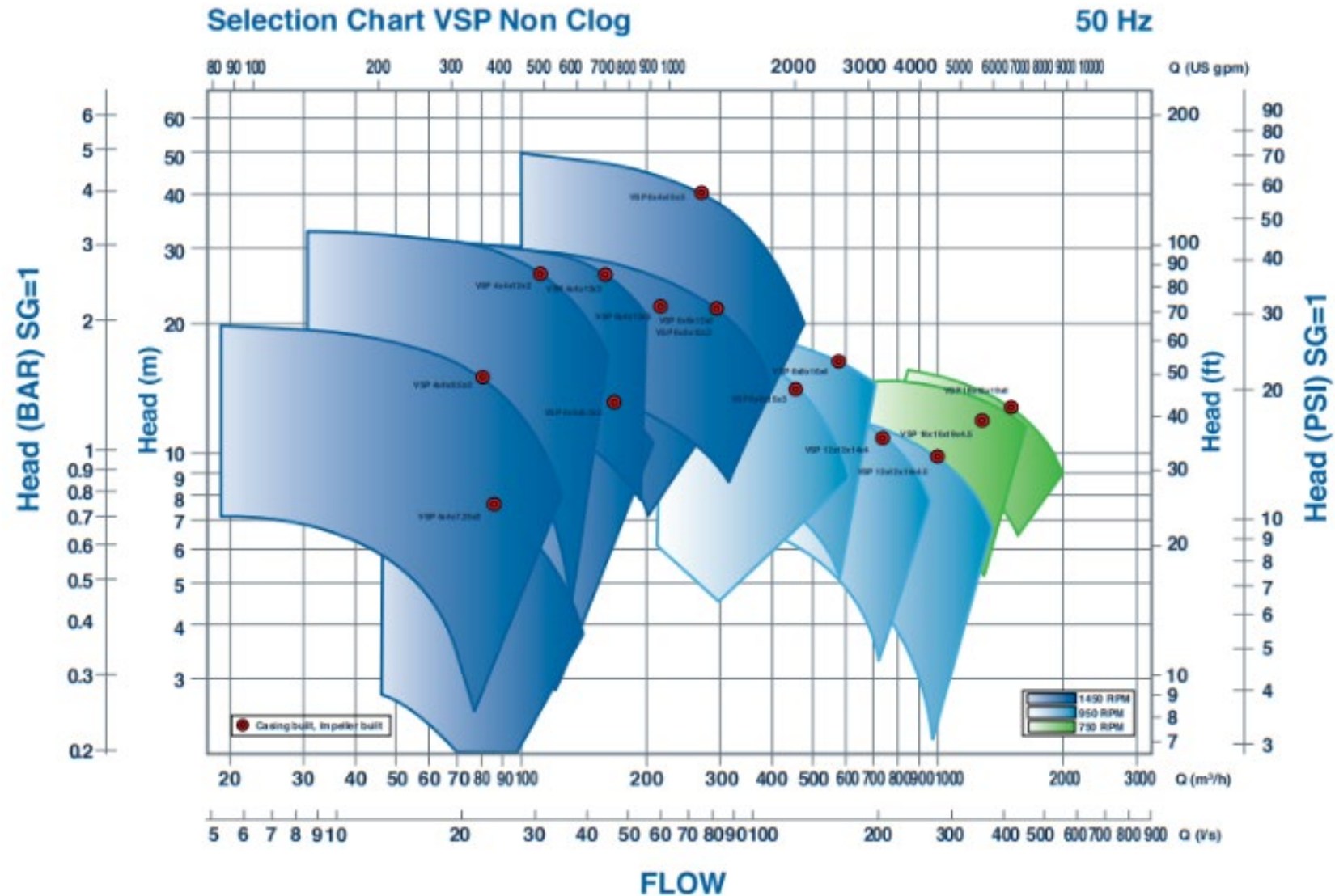
VSP Non Clog





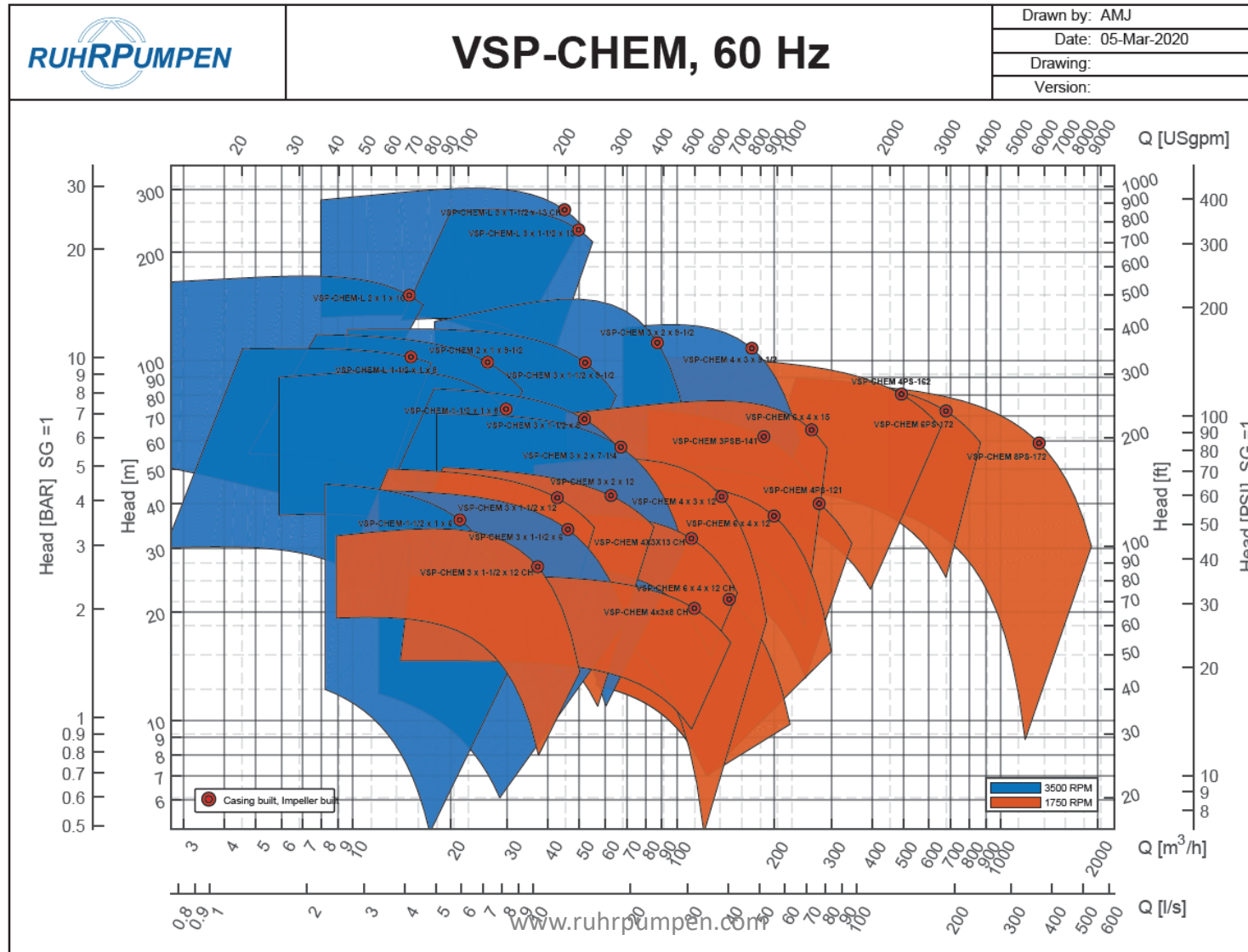
Selection Chart

VSP Non-Clog



Selection Chart

VSP Chem



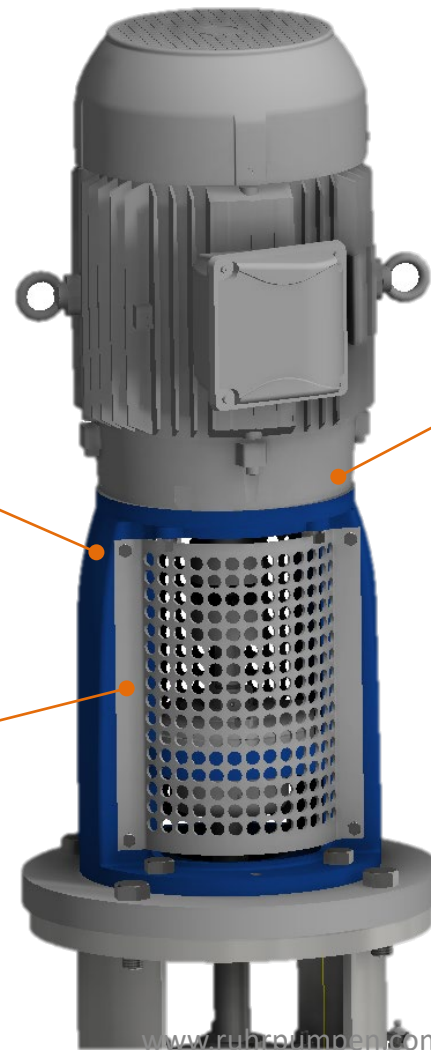
Features

VSP & VSP Chem

MOTOR SUPPORT
Designed to withstand the down axial thrust. With this advantage we can to use a horizontal motor without thrust capacity.

COUPLING GUARD
Fabricated in Aluminum or any other material required

ELECTRICAL MOTORS
Designed for "C", NEMA and "D" (IEC) Flange



Features

VSP & VSP Chem

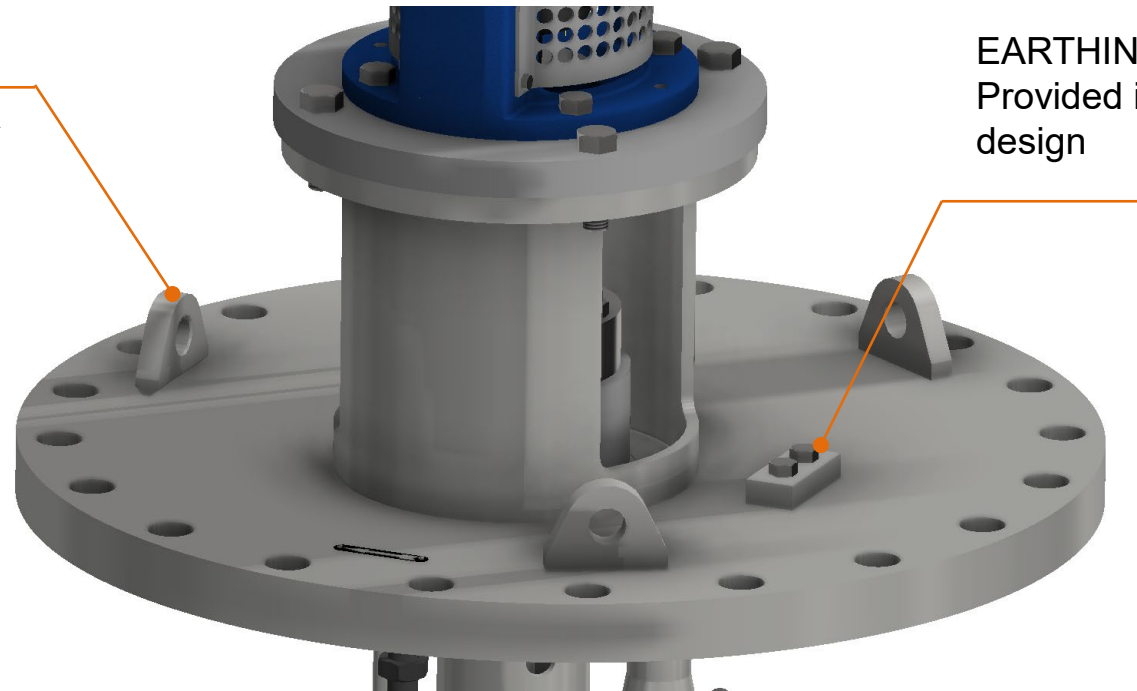
LIFTING LUGS

Included in our two versions

3 for round plates &
4 for square plates

EARTHING LUGS

Provided in API and HI design



Features:

VSP & VSP Chem

PETROCOKE TAPE FOR
VSP CHEM

Major durability and
resistance to abrasion and
wear

CASE & IMPELLERS FROM
HORIZONTALS PUMPS

To reduce models inventory

BEARINGS FOR
VSP

Bronze as
standard design

MINIMUM
SUBMERGENCE

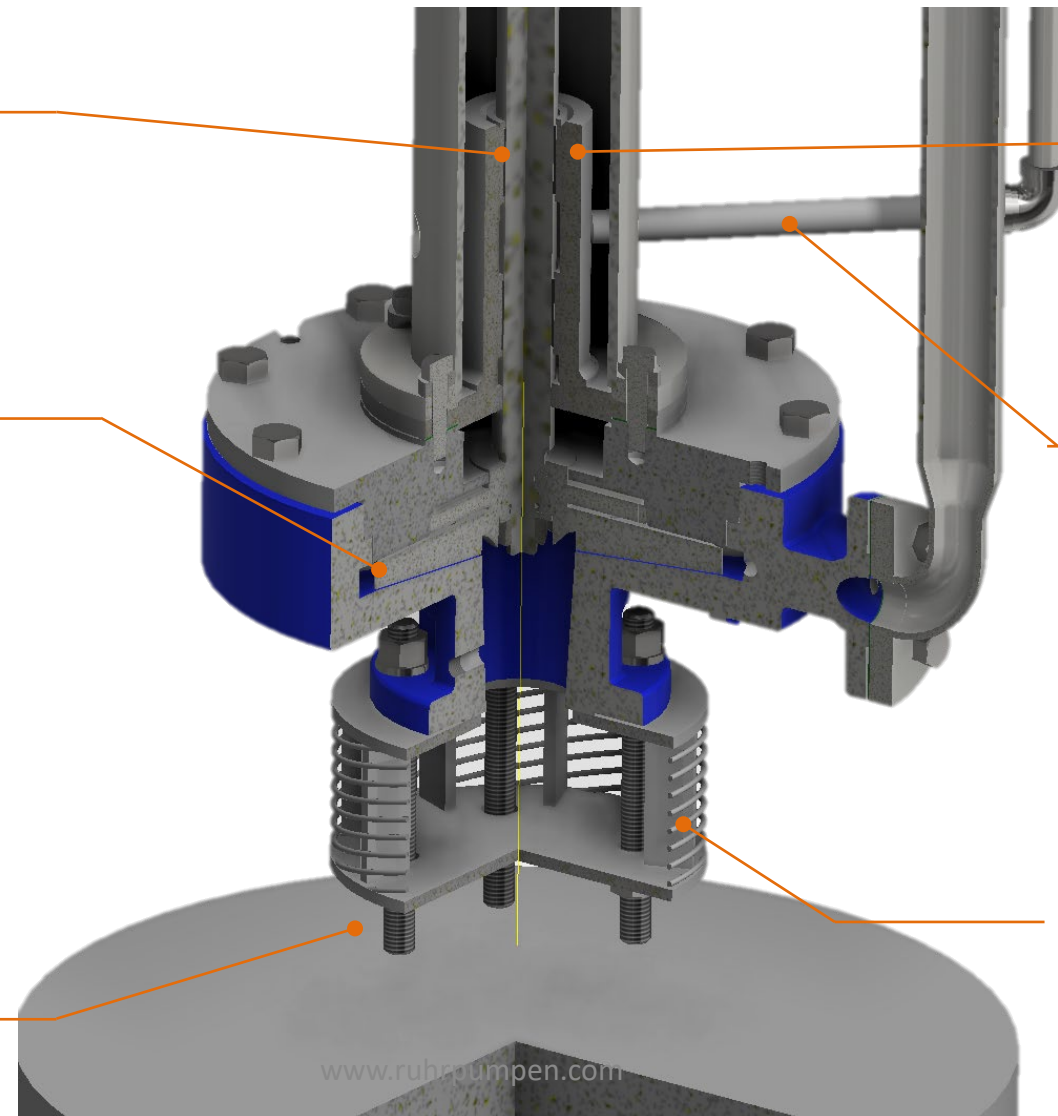
Very low levels
compared with other
brands

GAP

Small gap to reduce even
more the minimum
submergence

BASKET STRAINER

Carbon steel or
galvanized (Optional in
any other material)



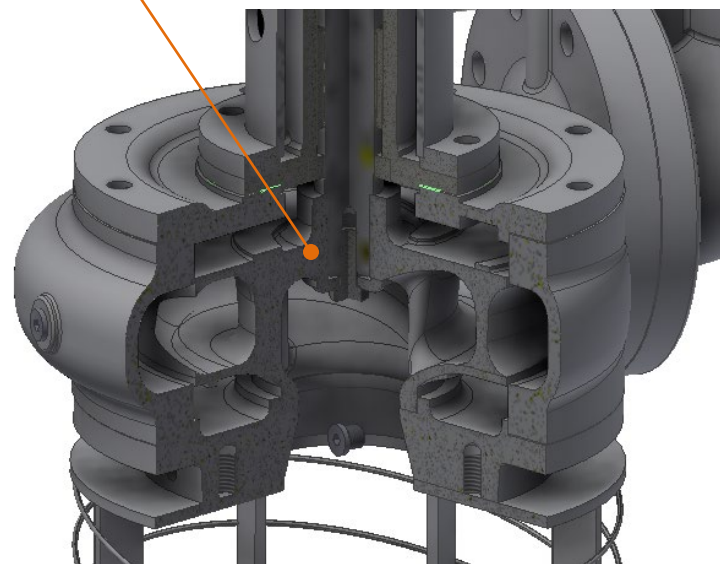


Features

VSP

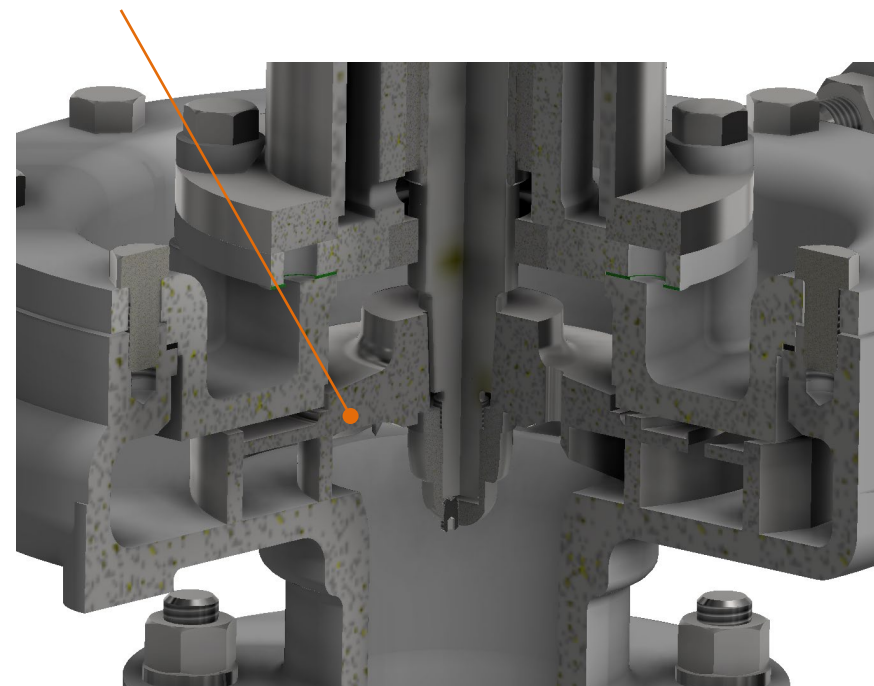
IMPELLER
Non-clogging
impeller

VSP-SHD



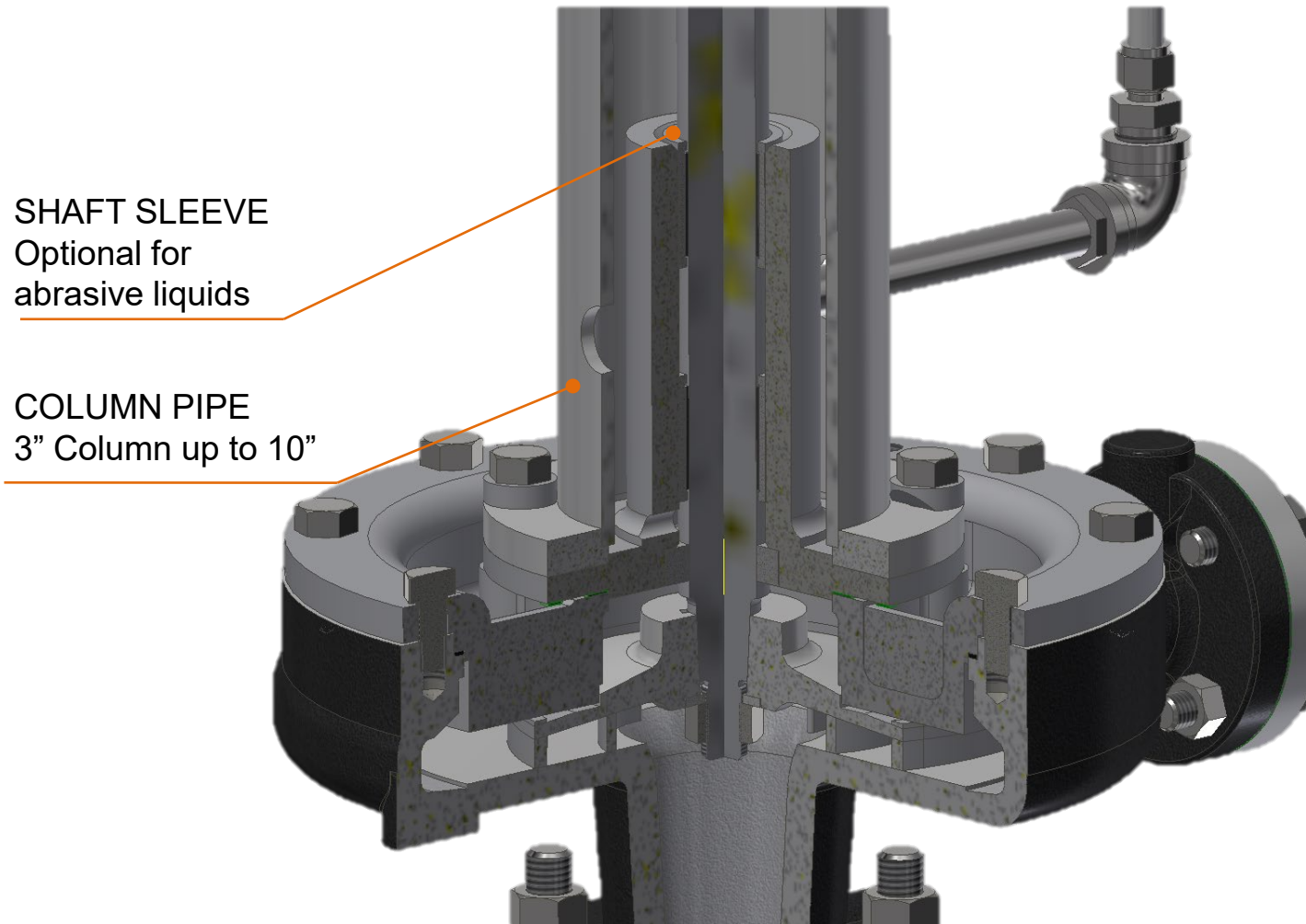
IMPELLER
Keyed, Semi
Open, Radial

VSP



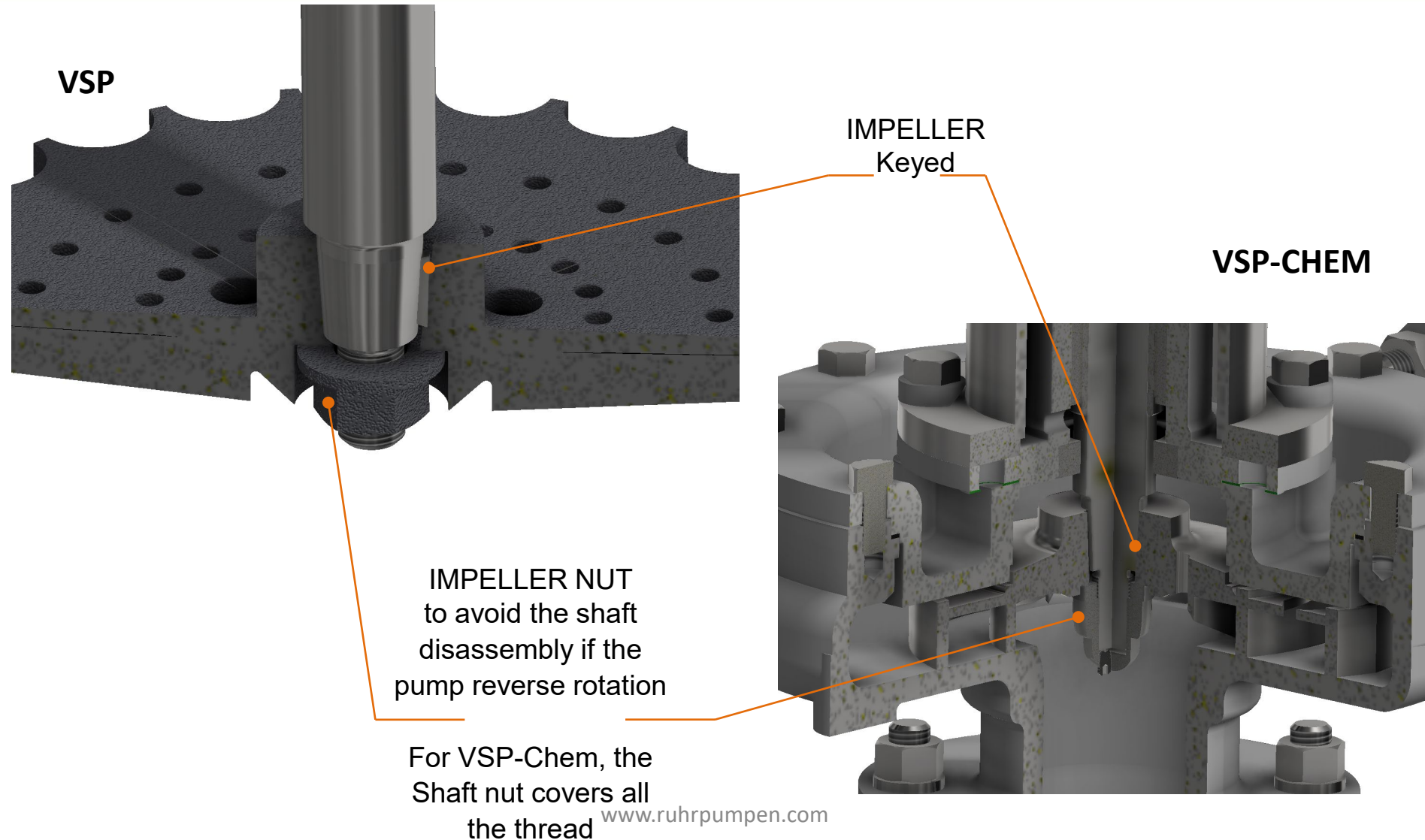
Features: Intermediate bearings

VSP & VSP Chem



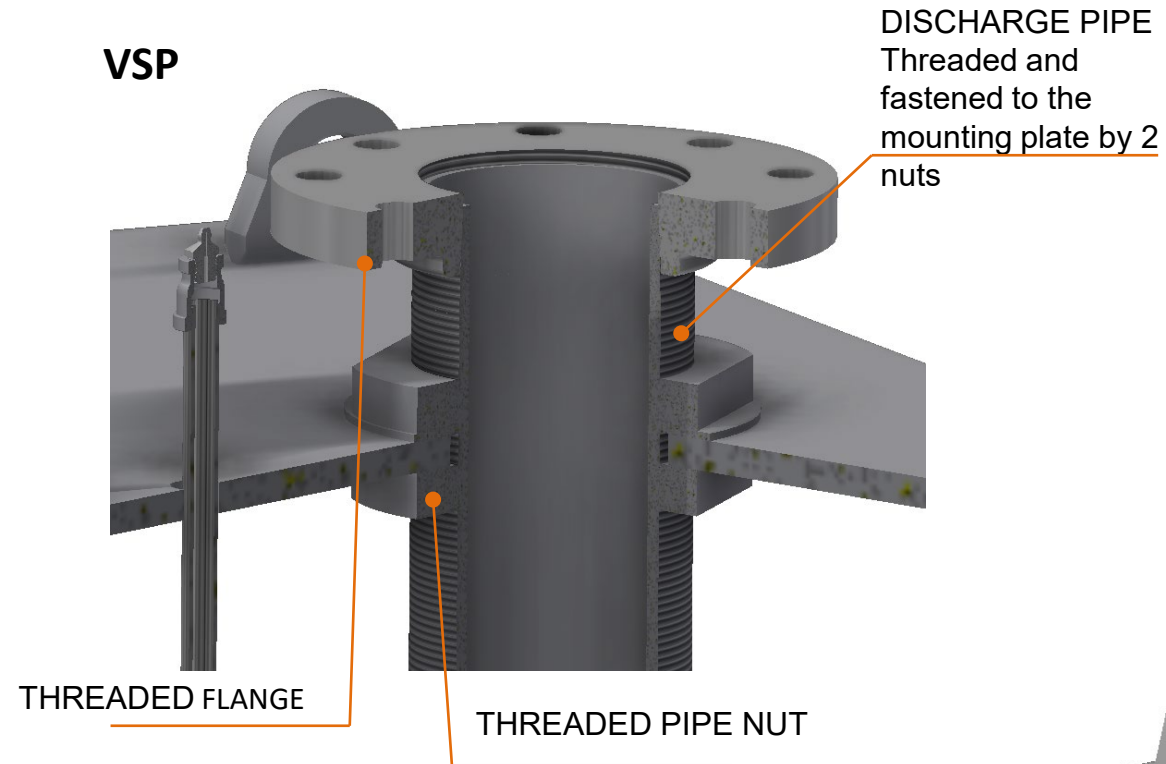
Features & Benefits: Impeller

VSP & VSP Chem



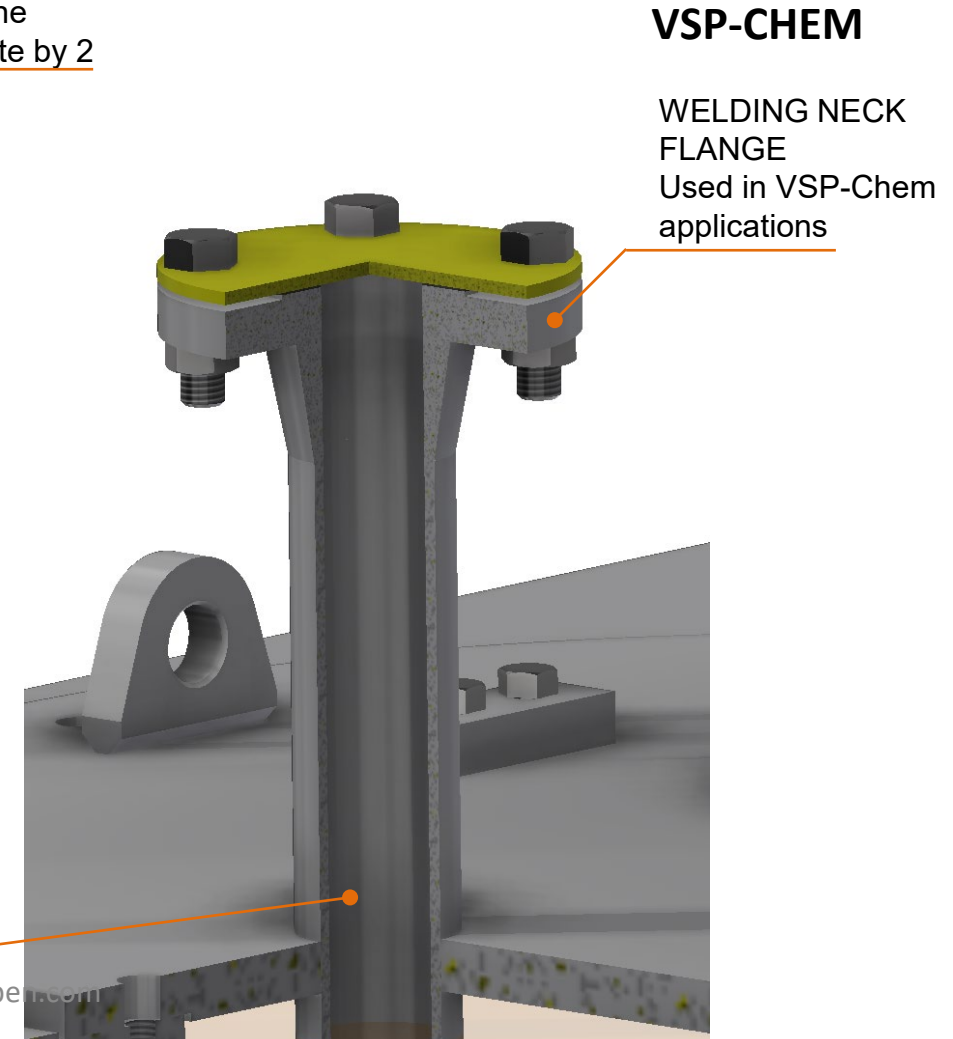
Features: Discharge

VSP & VSP Chem



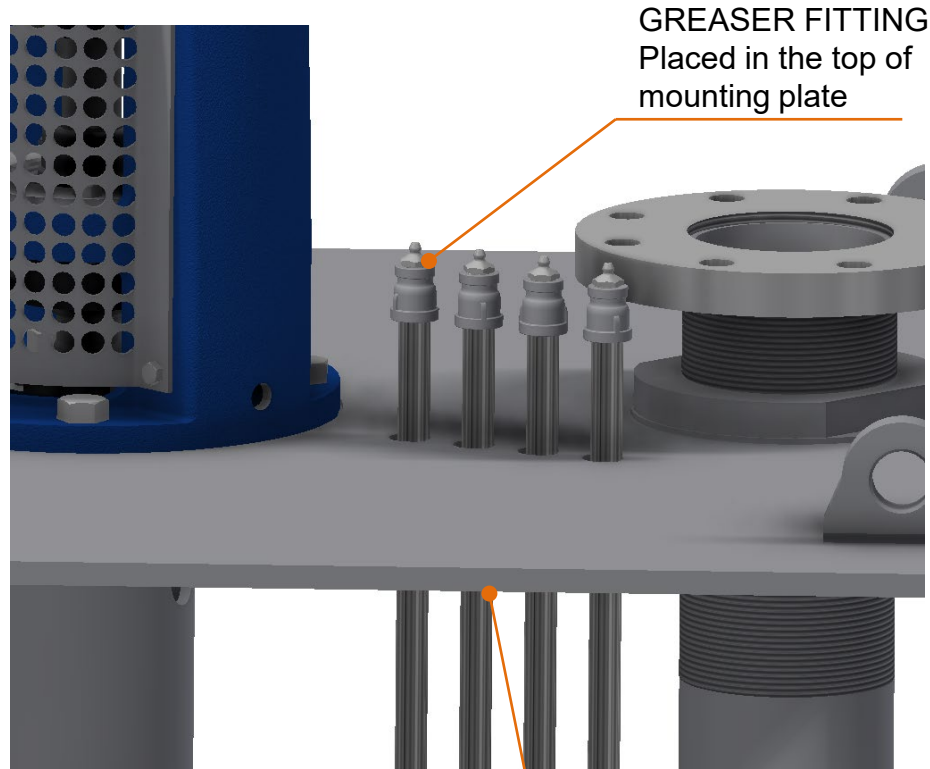
WELDED DISCHARGE PIPE
In API design

www.ruhrpumpen.com



Features: Lubrication

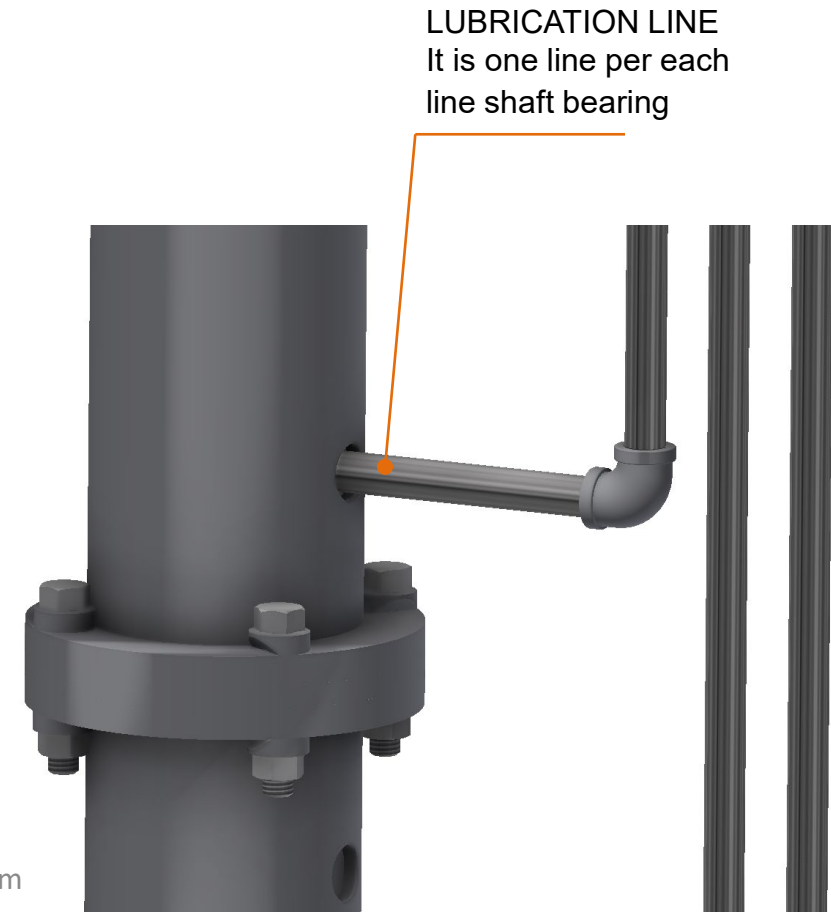
VSP & VSP Chem



GREASER FITTING
Placed in the top of
mounting plate

LUBRICATION
LINE
The connections
pass through the
sole plate

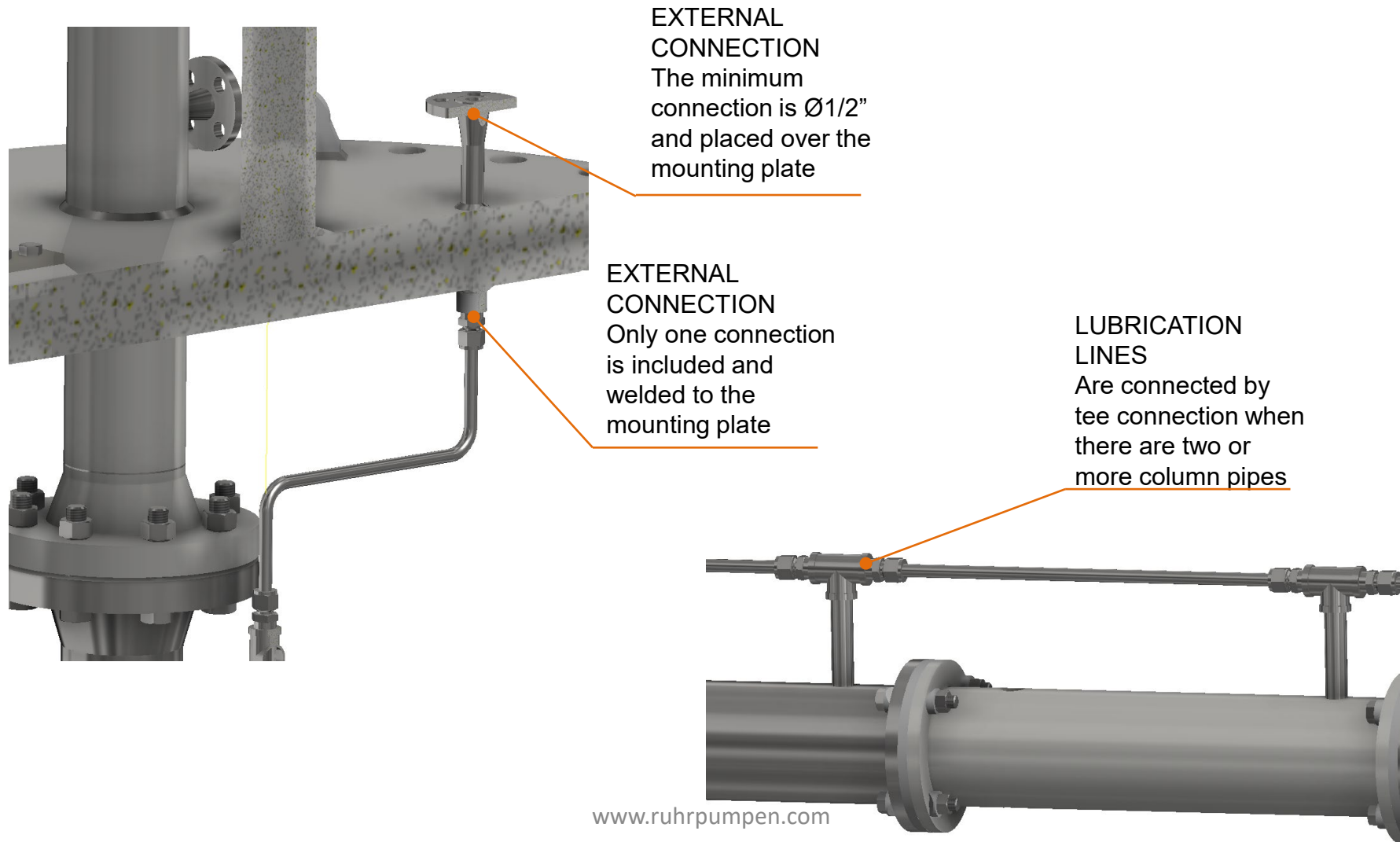
www.ruhrpumpen.com



LUBRICATION LINE
It is one line per each
line shaft bearing

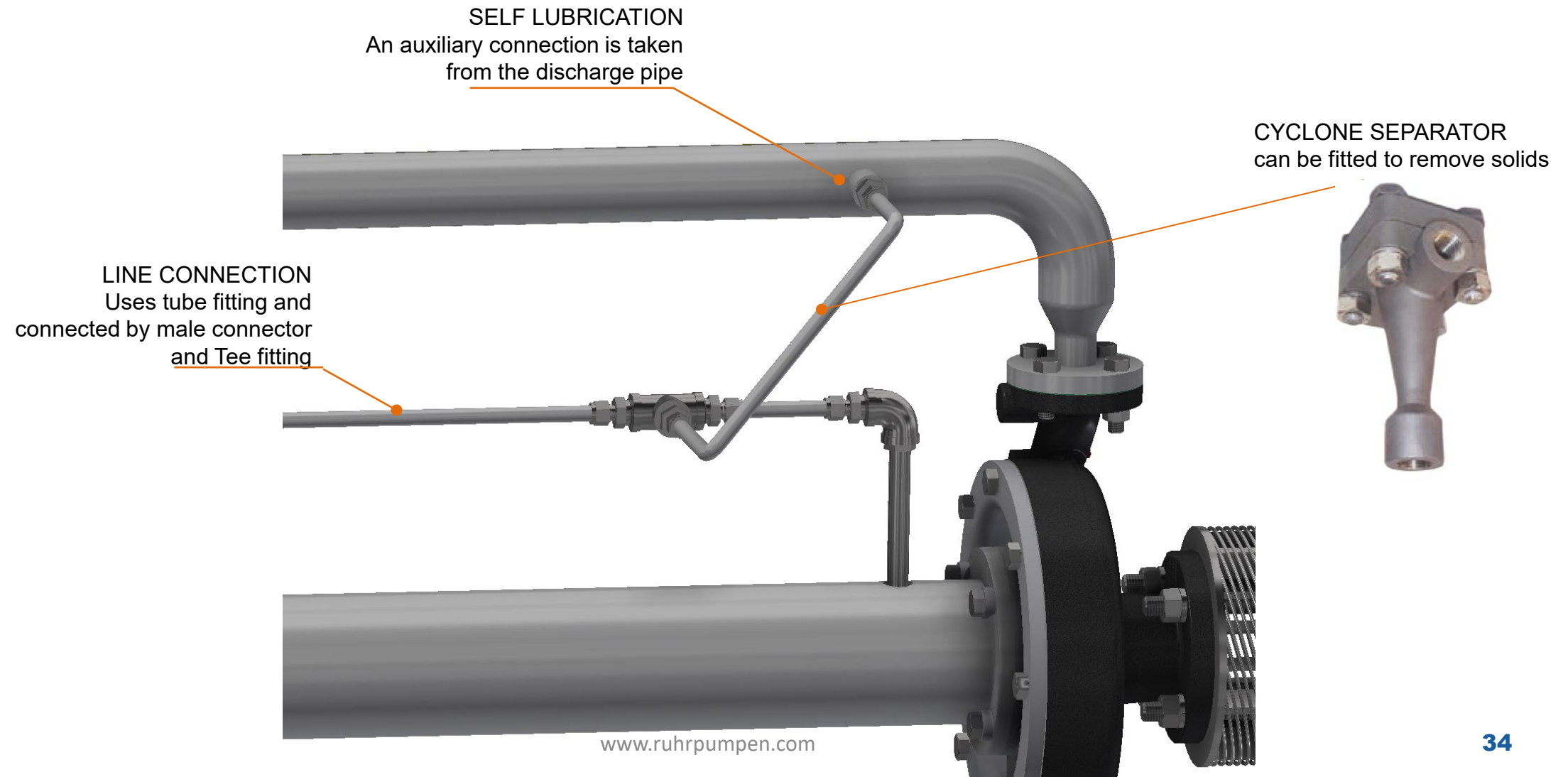
Features & Benefits: Lubrication

VSP & VSP Chem



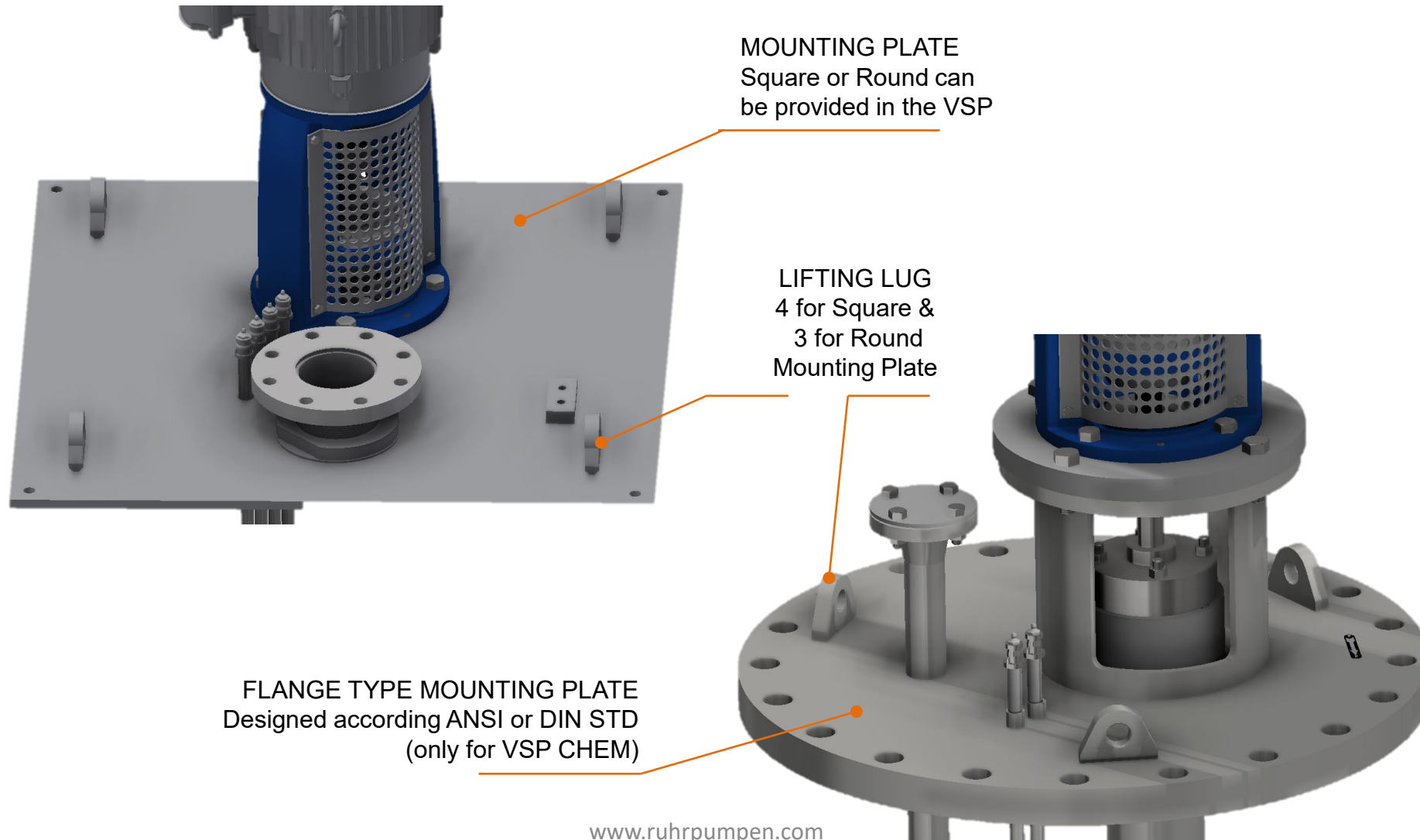
Features: Lubrication

VSP & VSP Chem



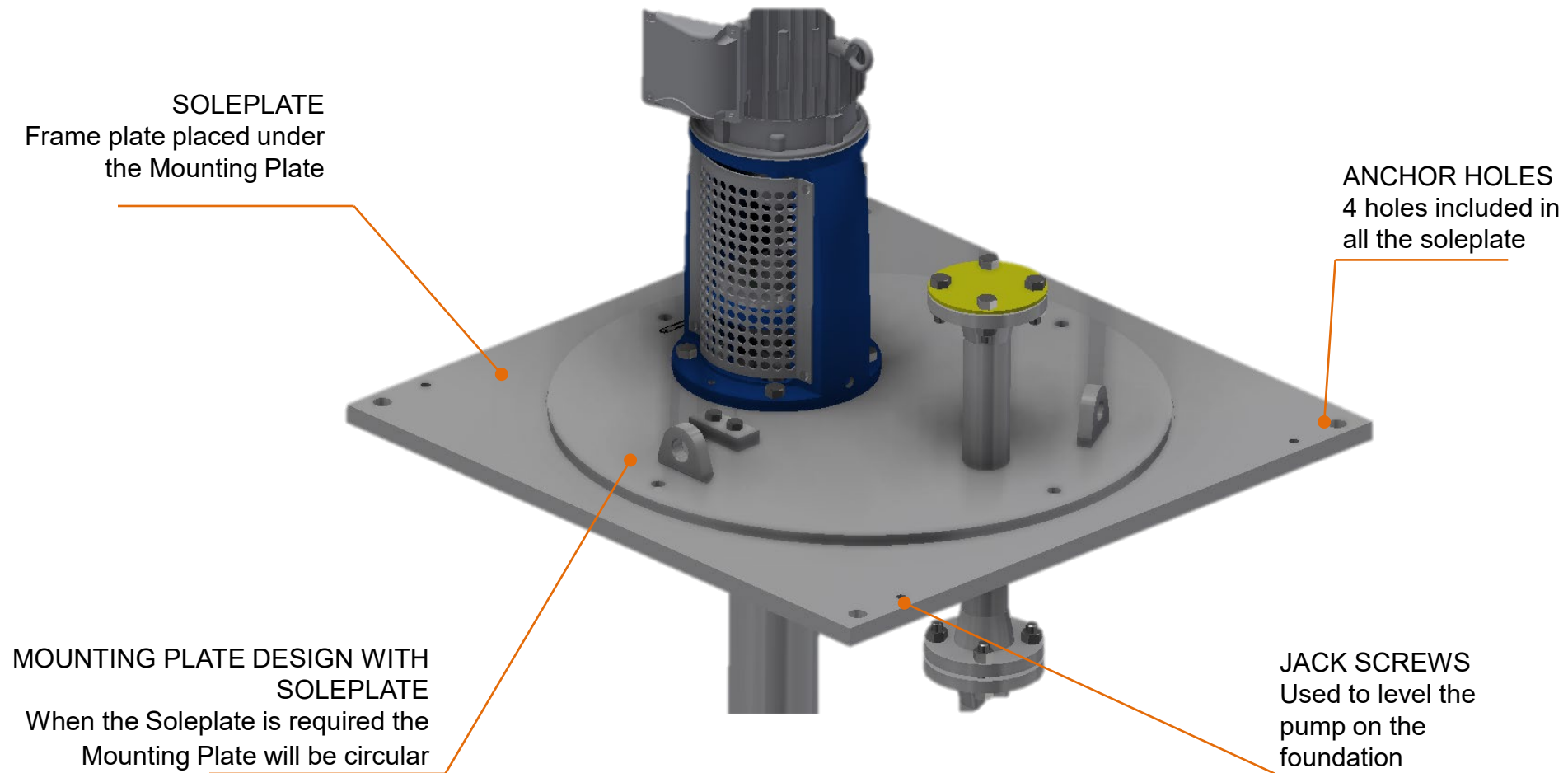
Features: Mounting plates

VSP & VSP Chem



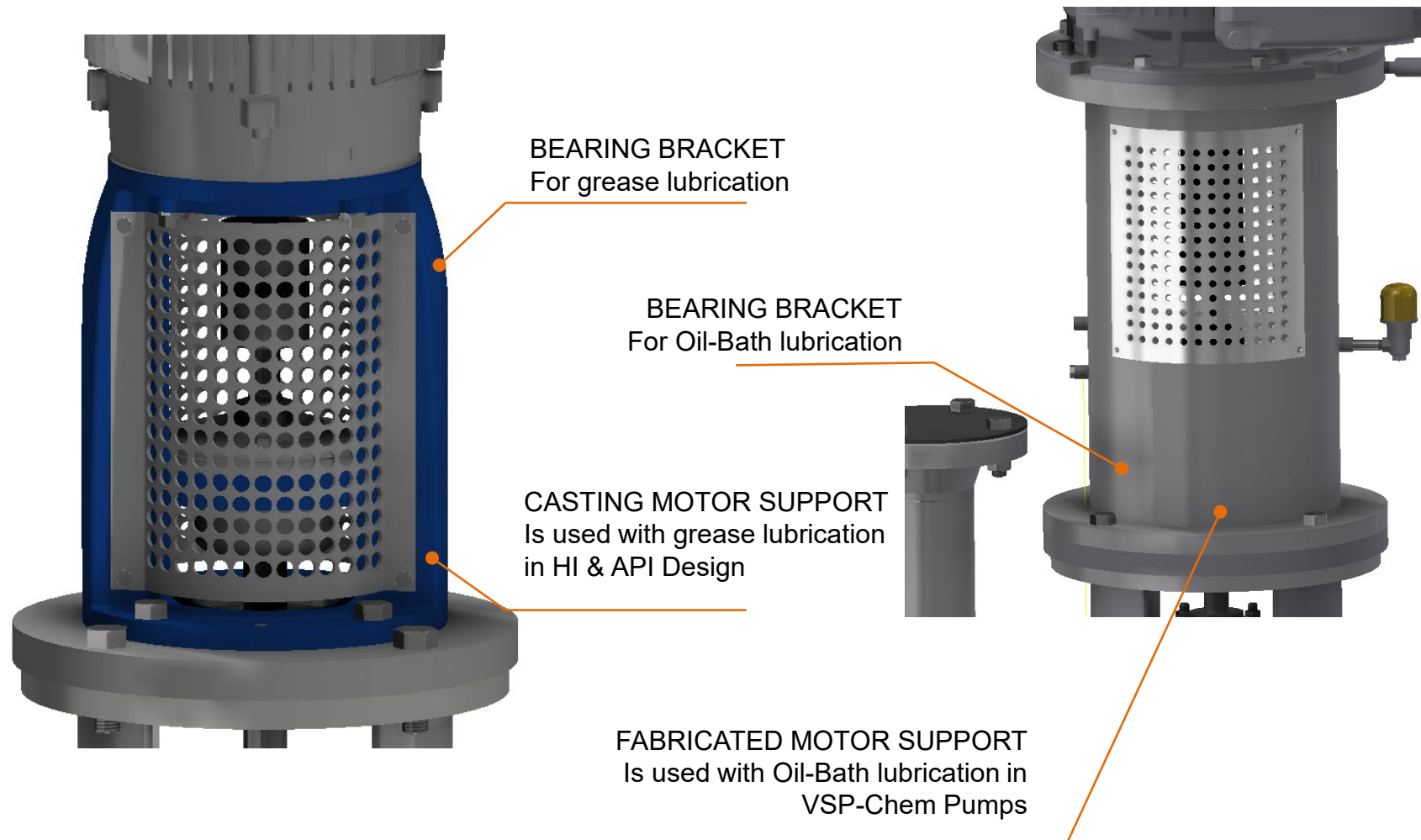
Features: Soleplate

VSP & VSP Chem



Features: Bearing Bracket

VSP & VSP Chem





Features: Bearing lubrication

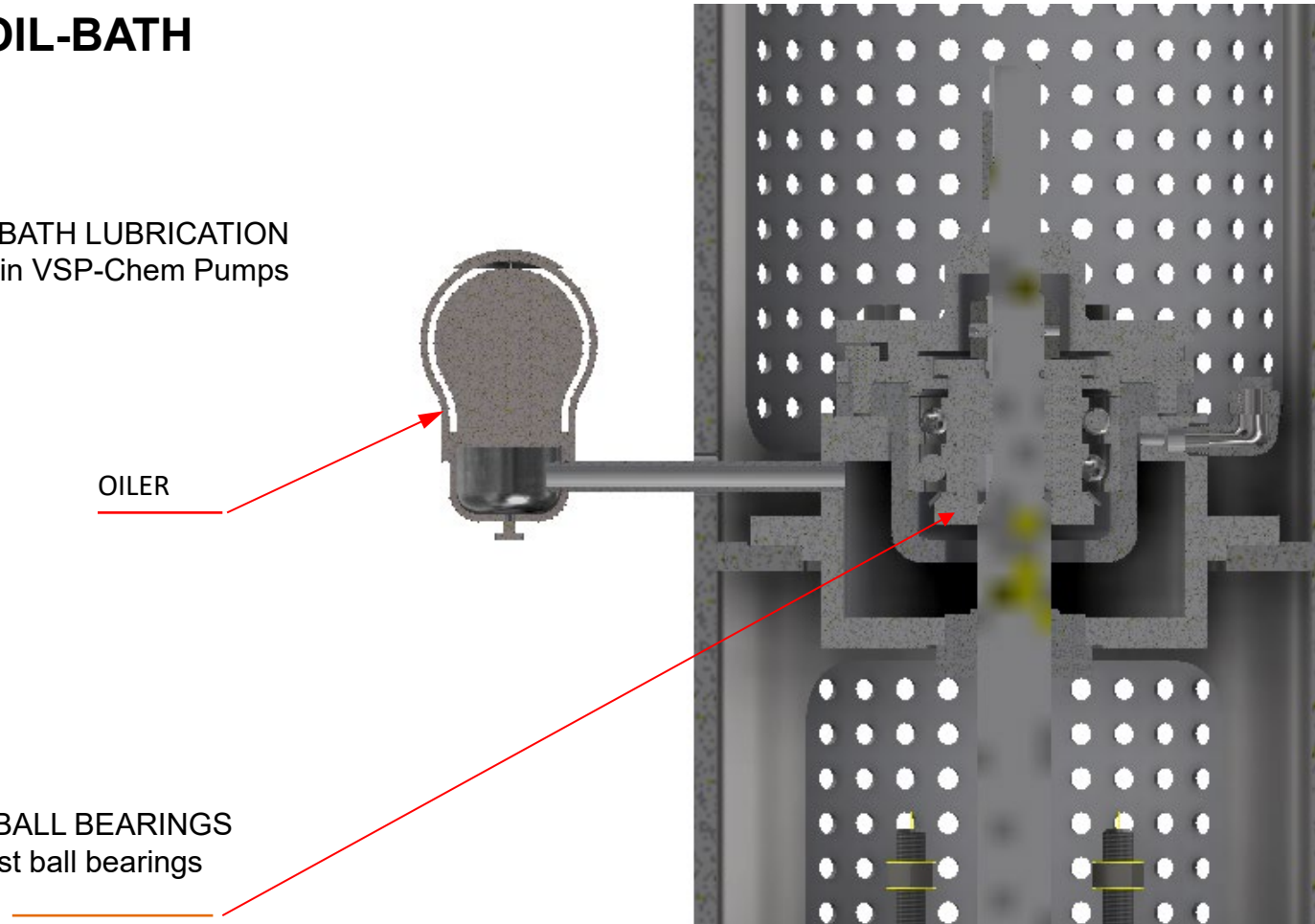
VSP Chem

OIL-BATH

OIL-BATH LUBRICATION
Is used in VSP-Chem Pumps

OILER

THRUST BALL BEARINGS
Axial Thrust ball bearings

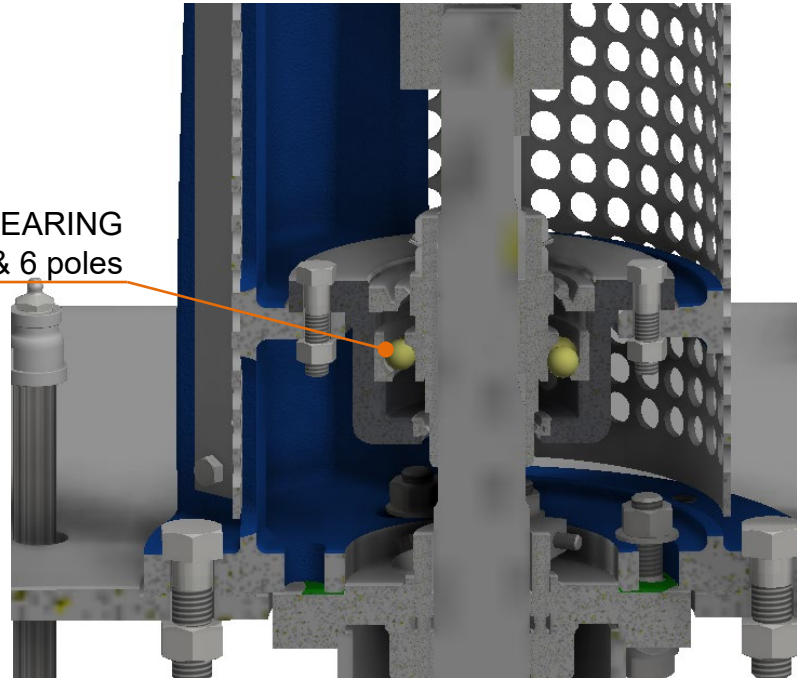


Features: Bearing lubrication

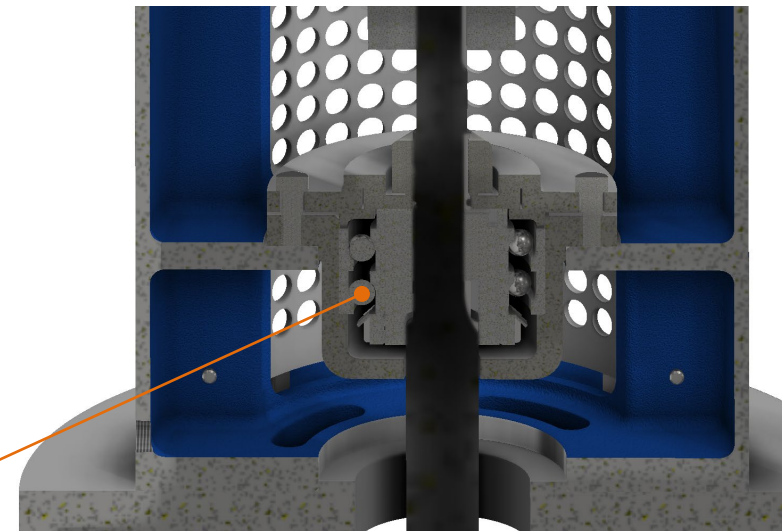
VSP

GREASE

BALL BEARING
1 ball bearing included for 4 & 6 poles

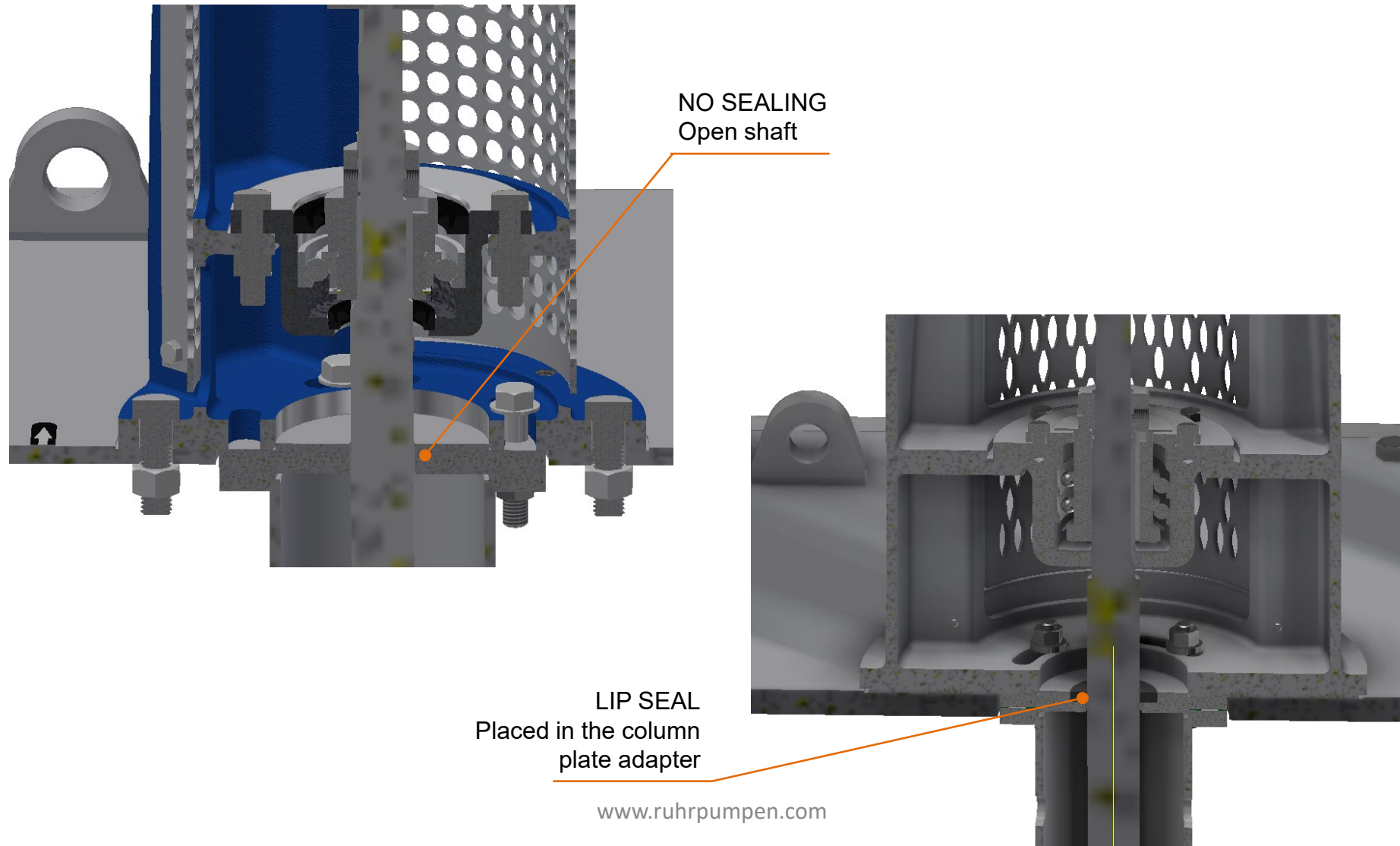


BALL BEARINGS
2 ball bearings when the
pump runs at 2 poles



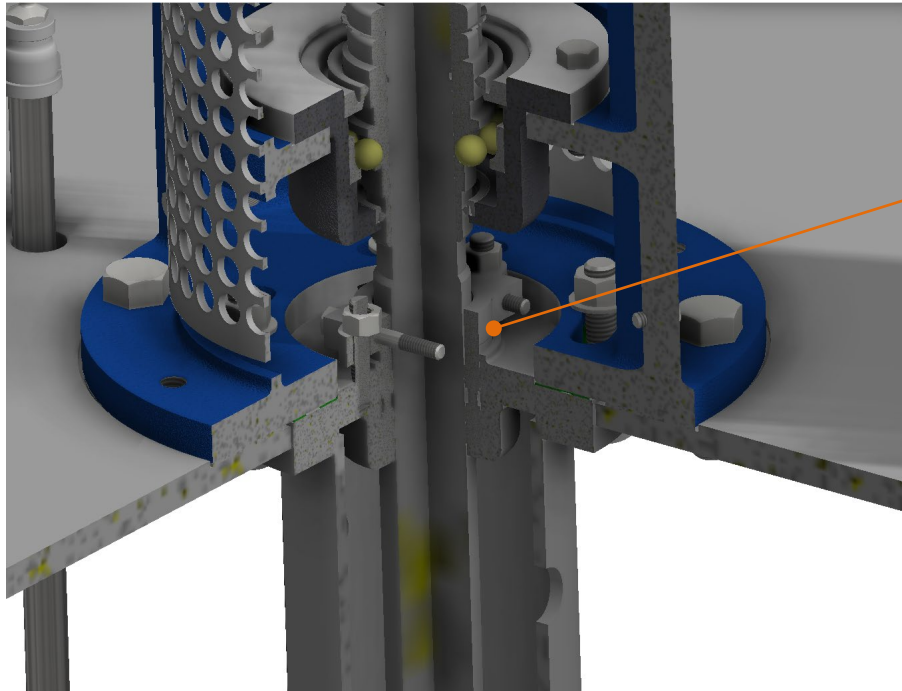
Features: Sealing

VSP



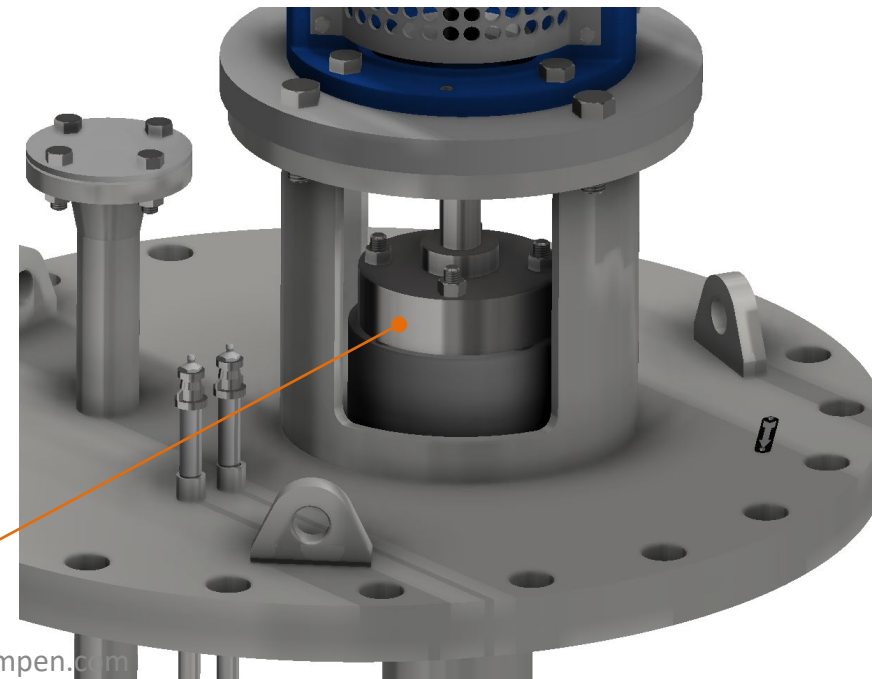
Features: Sealing

VSP Chem



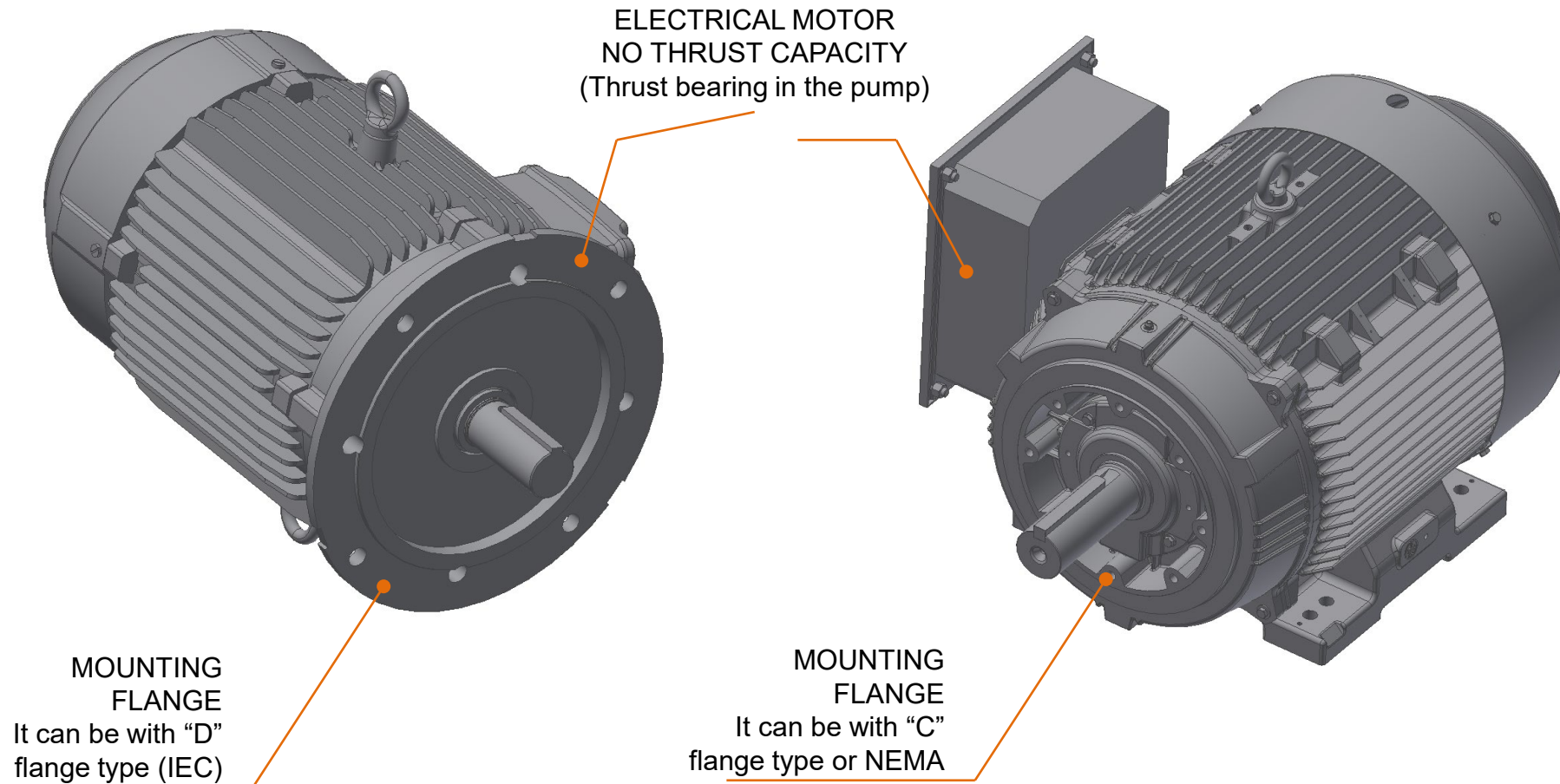
PACKING
Used to avoid leaking of vapors

MECHANICAL SEAL
Used in chemicals applications and placed over the mounting plate. It can be single dry or dual seal



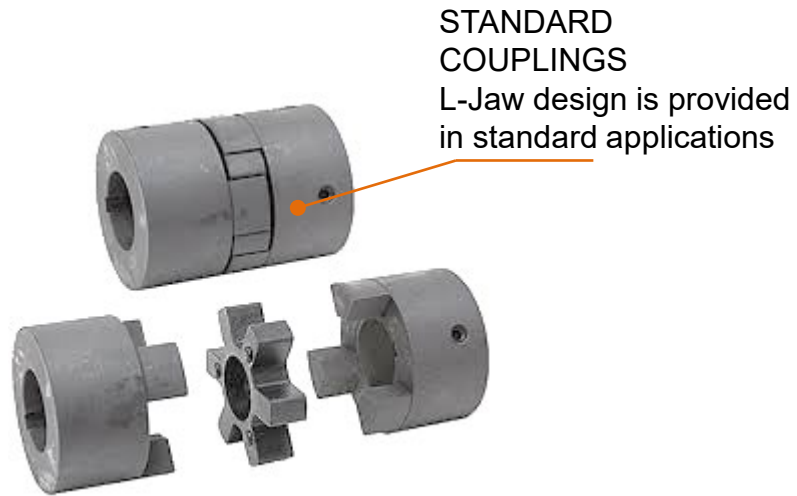
Features & Benefits: Electrical Motors

VSP & VSP Chem



Features & Benefits: Couplings

VSP & VSP Chem



FLEXIBLE
COUPLING
FOR VSP-CHEM
Without spacer



COUPLING WITH
SPACER
Upon customer request,
however these are not
required in our pumps



Features

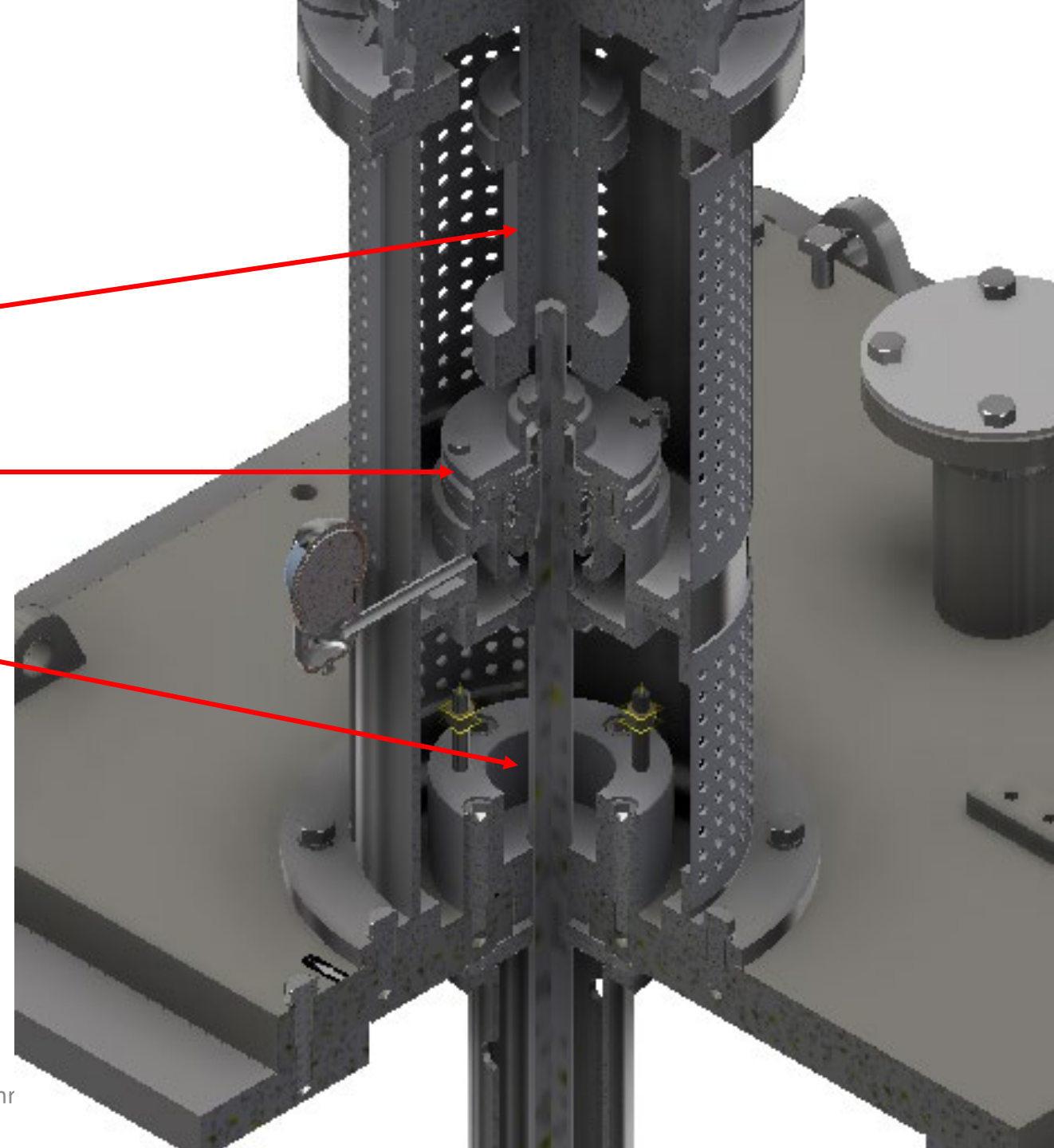
Spacer or Non-Spacer Coupling?

API 610 would require a spacer coupling

to allow you to remove the thrust bearing

And any mechanical seal without removing the motor.

But on smaller pumps it is generally easier to remove the motor to access these than to access them through the coupling spacer



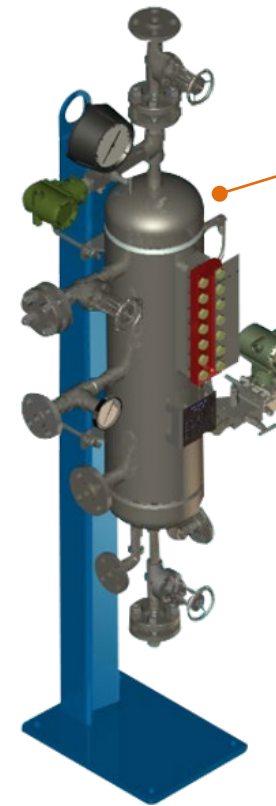
Features: Seal Lubrication Plans

VSP Chem

PLAN 74



PLAN 52, 53 & 53B



Features & Benefits: accesories

VSP Chem

LEVEL INDICATORS
Float or Ultrasonic



TEMPERATUE INDICATOR
RTD



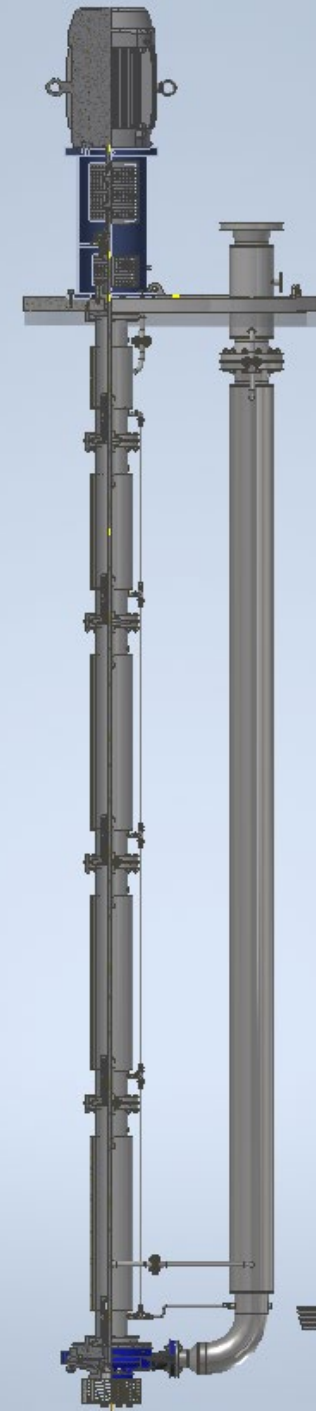
VIBRATION INDICATORS
Accelerometer



Extra Features – Jacketed Pumps

Some fluids, such as molten Sulphur, need to maintain a certain temperature in the pump. This is possible with a steam jacket. The steam flows through the whole pump heating the fluid avoiding crystallization or any change in the operation conditions.

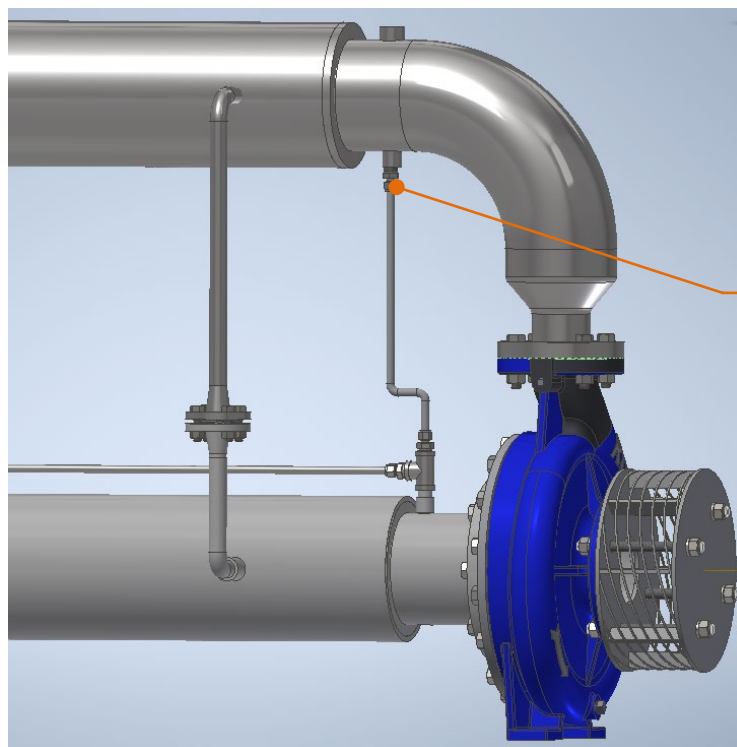
- Pressure of jacket: Up to 14 bar (200 psi)
- Materials: Available in all principal alloys according to API



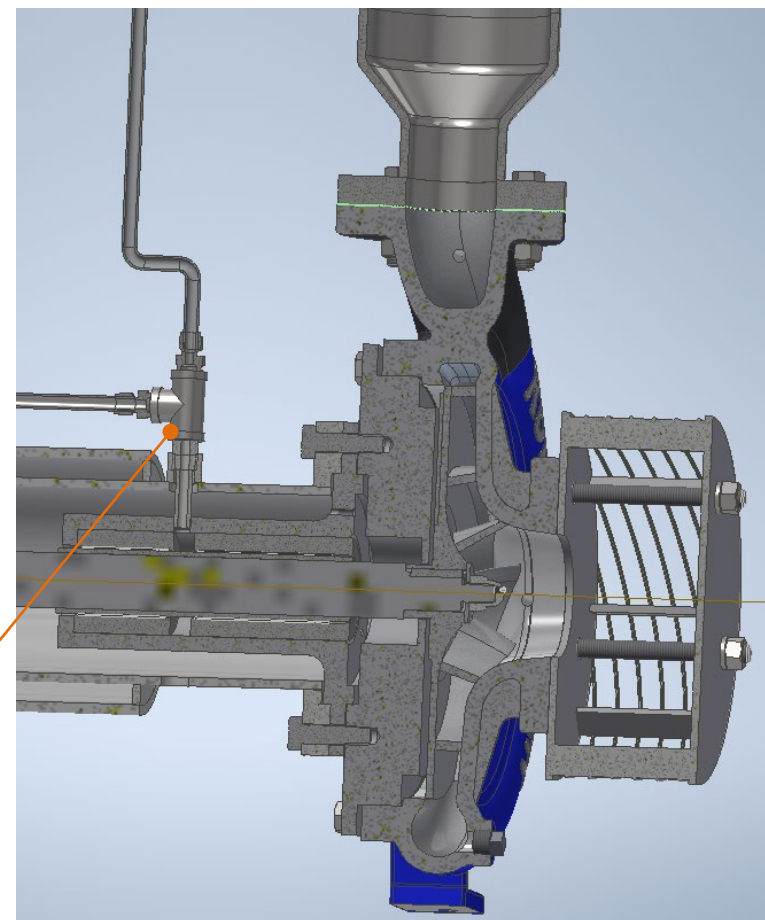


Jacketed Pumps

VSP-Chem



LUBRICATION LINE
The fluid past through an auxiliary connection taken from the discharge pipe



LUBRICATION LINE
Bearings are lubricated by product

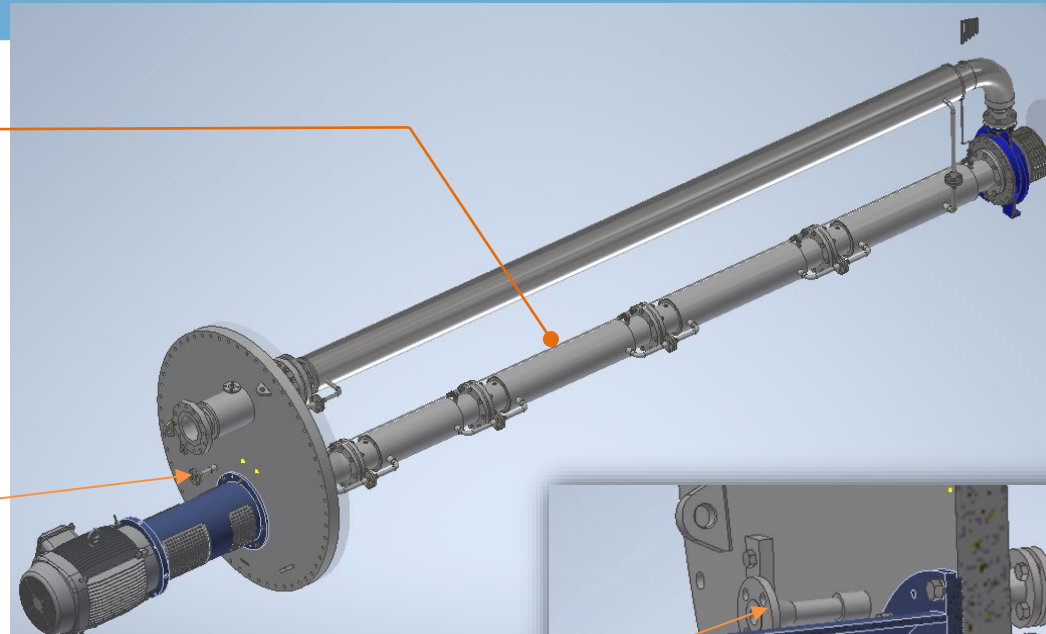


Jacketed Pumps

VSP-Chem

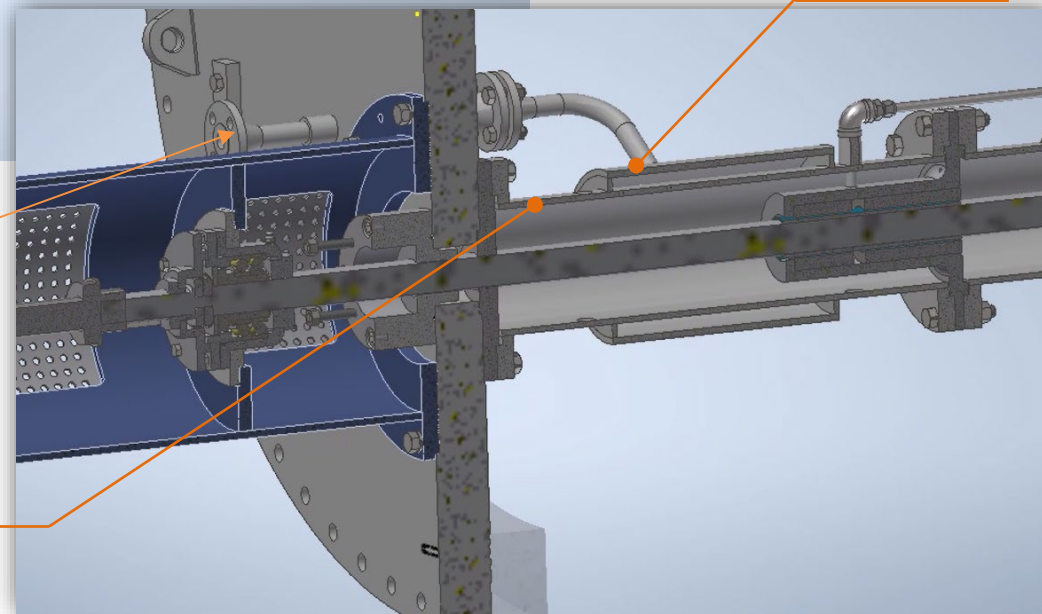
COLUMN JACKET
The column pipe is jacketed to maintain the temperature of the fluid

Steam In



Steam In

COLUMN PIPES

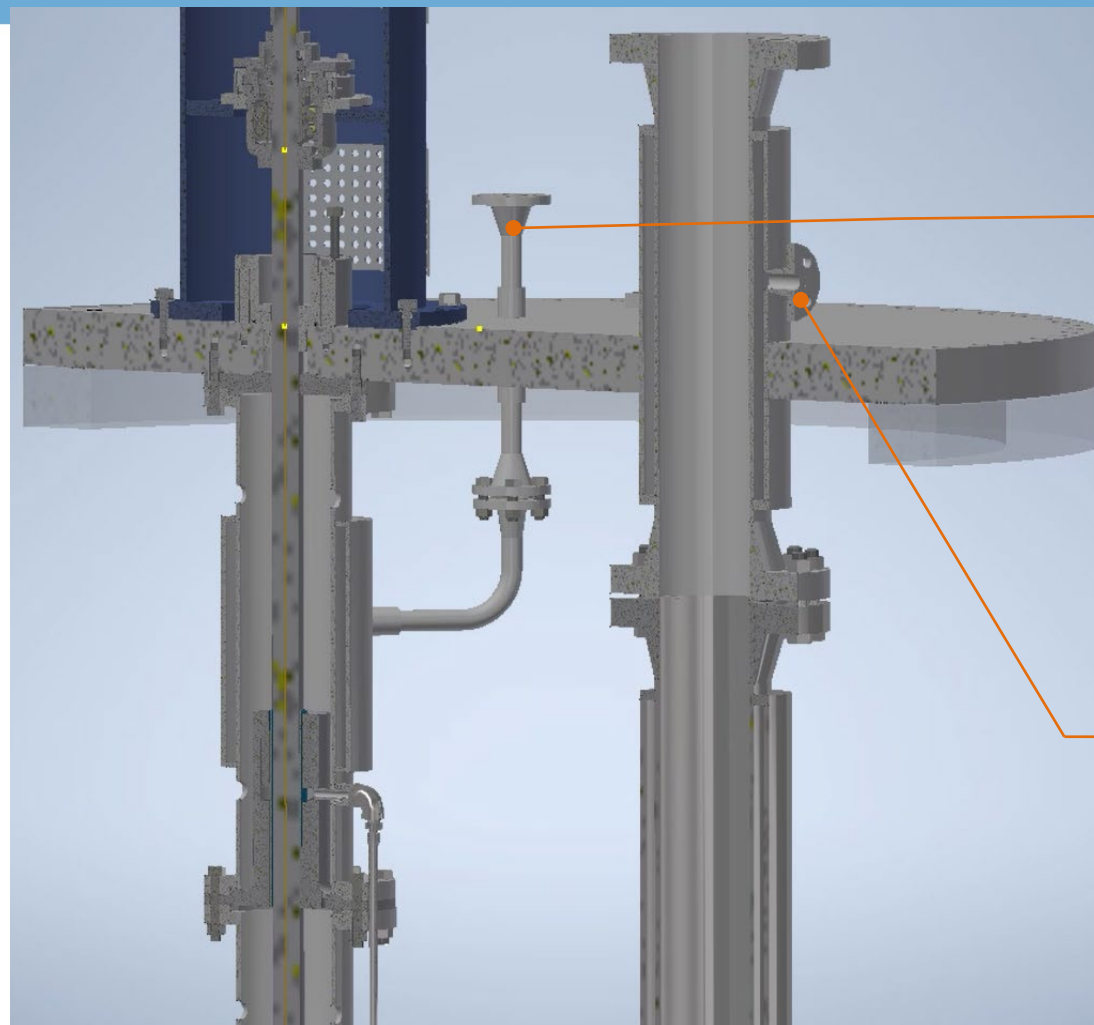


COLUMN JACKET



Jacketed Pumps

VSP-Chem



VAPOR OR STEAM INLET

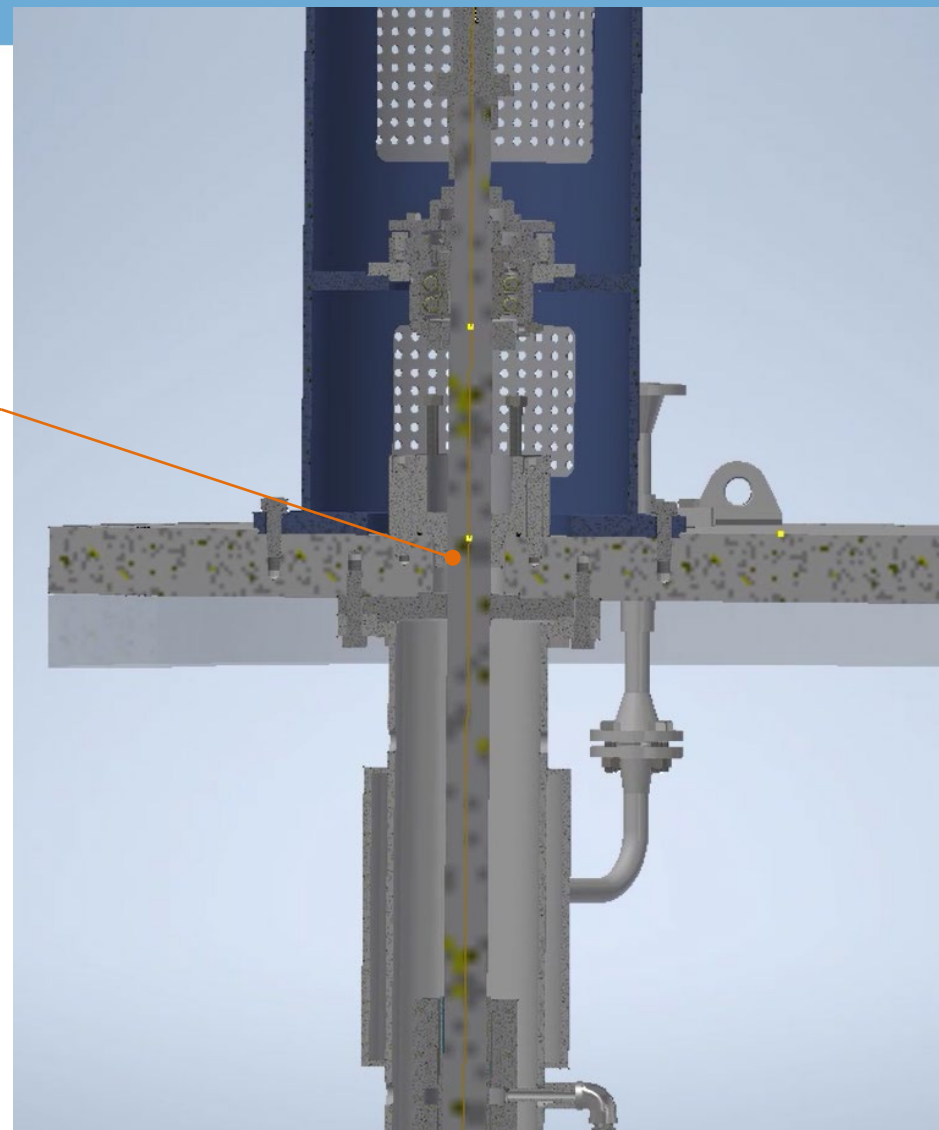
VAPOR OR STEAM
EXIT



Jacketed Pumps

VSP-Chem

SEALING METHOD
Mechanical seal is used in
almost all the case
(Packing is possible with a
pressurized plan 74)



Competitors – ITT Goulds

Product Description

API 610 11th edition, compliant VS4 sump pump

The Model 3171 is the Veteran vertical sump and process pump. Thousands of installations in industrial process, sump drainage, corrosive liquids, pollution control, molten salts attest to the 3171's remarkable performance. Simple mounting.



Specifications

- Capacities to 3180 GPM (722 m³/h)
- Heads to 344 Feet (105 m)
- Temperatures to 450° F (232° C)
- Pit Depths to 20 Feet (6 m)

Design Features

- Self-Priming
- Rugged Double Row Thrust Bearing
- Heavy Duty One-piece Shaft
- External Impeller Adjustment
- Available in a Wide Range of Alloys
- Open Impeller Design
- Vapor Proof Option: Choice of packing, mechanical or fluid sealing methods to seal sump vapors

Sump Pumps - CPXV

The Flowserve CPXV is a vertical sump pump incorporating state-of-the-art hydraulic design for efficient and reliable service. The CPXV can be customized to meet a wide range of needs. Compliant with ISO 5199, the CPXV is available in more than 40 hydraulic wet-ends and numerous materials of construction. It is also available with multiple mechanical seal options and sump depths. Also, for oil and gas installations, the CPXV is available with many ISO 13709/API 610 compliant features.





Competitors – **Flowserve**

Operating Parameters

- Flows to 1400 m³/h (6160 gpm)
- Heads to 250 m (820 ft)
- Pressures to 25 bar (365 psi)
- Temperatures from -40°C (-40°F) to 400°C (752°F)

Features and Benefits

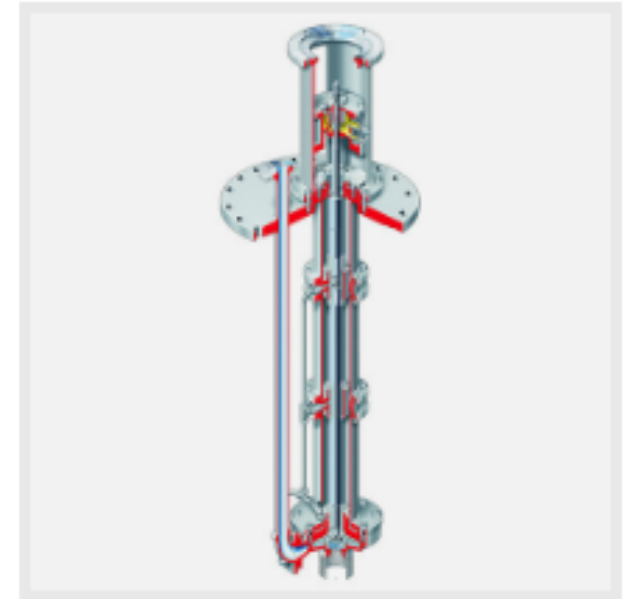
- Heavy-duty casing with integral foot and multi-ribbed discharge flange provides superior resistance to pipe loads
- Standard front vane open-style impeller design delivers high-efficiency performance
- Reverse vane impeller available
- Additional column lengths are provided up to a maximum of 10 m (32 ft)
- Heavy-duty thrust bearings with axial adjustment made above soleplate level
- Recessed impeller version is available for enhanced solids handling capability
- Suction strainer is optional
- Fully jacketed version available for molten sulfur applications
- ATEX Category 1 (Zone 0) build for high risk explosive environments

Competitors – Flowserve

Sump Pumps - ECPJ

The ECPJ single-stage, vertical lineshaft sump pump is designed to perform tough jobs reliably, under a variety of difficult conditions. Based on a modular design system, this rugged pump is fully compliant with the latest ISO 13709/API 610 (VS4) standards and may be custom engineered for the specific application in which it will be used.

Brand: Worthington





Competitors – **Flowserve**

Operating Parameters

- Flows to 1000 m³/h (4400 gpm)
- Heads to 150 m (500 ft)
- Temperatures from -46°C (-51°F) to 350°C (660°F)
- Pressures to 20 bar (285 psi)

Design Range

Size Range:

- 45 sizes
- Setting length up to 8 m (26 ft)

Features and Benefits

- ECPJ vertical sump pumps are proven performers in chemical and hydrocarbon processing, delivering reliable performance in a wide range of applications
- The ECPJ is available in three ISO 13709/API 610 compliant hydraulic designs: closed, open and free-flow impeller
- A steam jacketed version for applications where it is critical to maintain a high temperature is available (such as liquid sulfur service)
- For low NPSHa service the ECPJ can be equipped with inducers
- A broad range of materials, including ISO 13709/API 610, NACE MR0175 and NACE MR0103 compliant alloys and specialty materials such as titanium are available
- ECPJ pumps can be provided in compliance with ATEX Zone 0 / Category 1.



Competitors – Sulzer

CVT vertically suspended sump pump

Vertical pumping expertise in ANSI markets

The CVT can be applied to any sump application with moderate solid content.



Competitors – Sulzer

✓ Main benefits

- Interchangeable casing and impeller with CPT ANSI B73.1 chemical pump
- Ductile iron or Duplex SS casing with Duplex SS impeller for long life
- Heavy duty shaft in variety of materials for improved corrosion resistance and high torque capacity
- Variety of level switches, level transducers and other instrumentation available

✓ Main applications

- Drainage Sumps
- Oily Water Sumps
- Lube Oil Supply
- Tank Transfer

Capacities	Up to 750 m ³ /h / 3,200 US gpm
Heads	Up to 120 m / 550 ft
Pressures	Up to 26 bar / 375 psi
Temperatures	-45 to 205°C / -40 to 400°F
Discharge sizes	50 to 200 mm / 2 to 8 inches

- Bearing spacing follows API 610 to assure first critical speed of shaft system is above operating speed
- Epoxy coated carbon steel mounting plate standard
- Grease lubricated 7300 series BECBM thrust bearing with machined brass cages



Pump Type VS5 Cantilever Pumps



VS5 Cantilever Pumps



- Cantilever design
- Heavy duty shaft
- No support bearings for the shaft
- Typical use high solids content , slurries, strong acids (sulfuric acid)
- API or ANSI hydraulics.

Pump Type VS6
“Double Casing, **Diffuser** Type,
Vertical Suspended” Pumps
“Canned Suction” Pumps
“Vertical Barrel” Pumps

VS6 Pumps – Zero NPSH_R

The Spacesaver and Costsaver

Works on the basis that if you have 0m NPSHA at Grade, then 3m down you have 3m NPSHA
So we make the pump long enough, by putting in spool pieces as necessary to position the first impeller low enough to give you sufficient NPSH margin.

- Not just an NPSH saver but a space saver too. Around 20% of the floorspace of the equivalent BB2
- And a cost saver too. Less expensive than the equivalent BB2
- One seal, one sealing system
- Once you can persuade your civil engineers to dig a hole you are saving all the way.

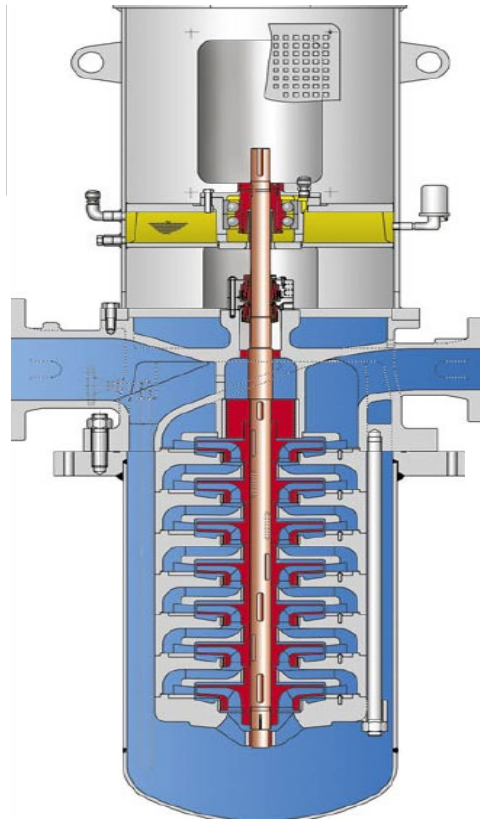
0 m NPSH_A

3 m NPSH_A

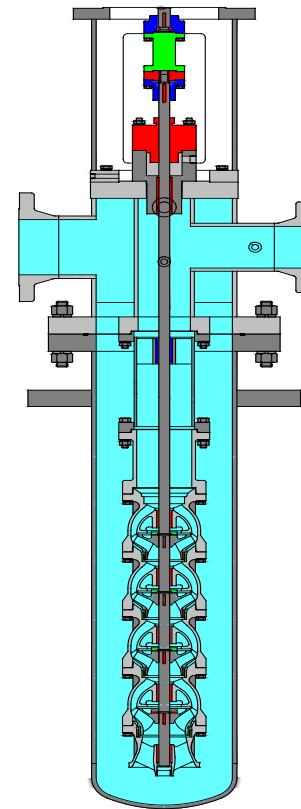


SECTIONAL OF RADIAL VS FRANCIS VANE

Note the difference between 'flat' appearance of radial design "VLT-Radial" model (low flow, high head)

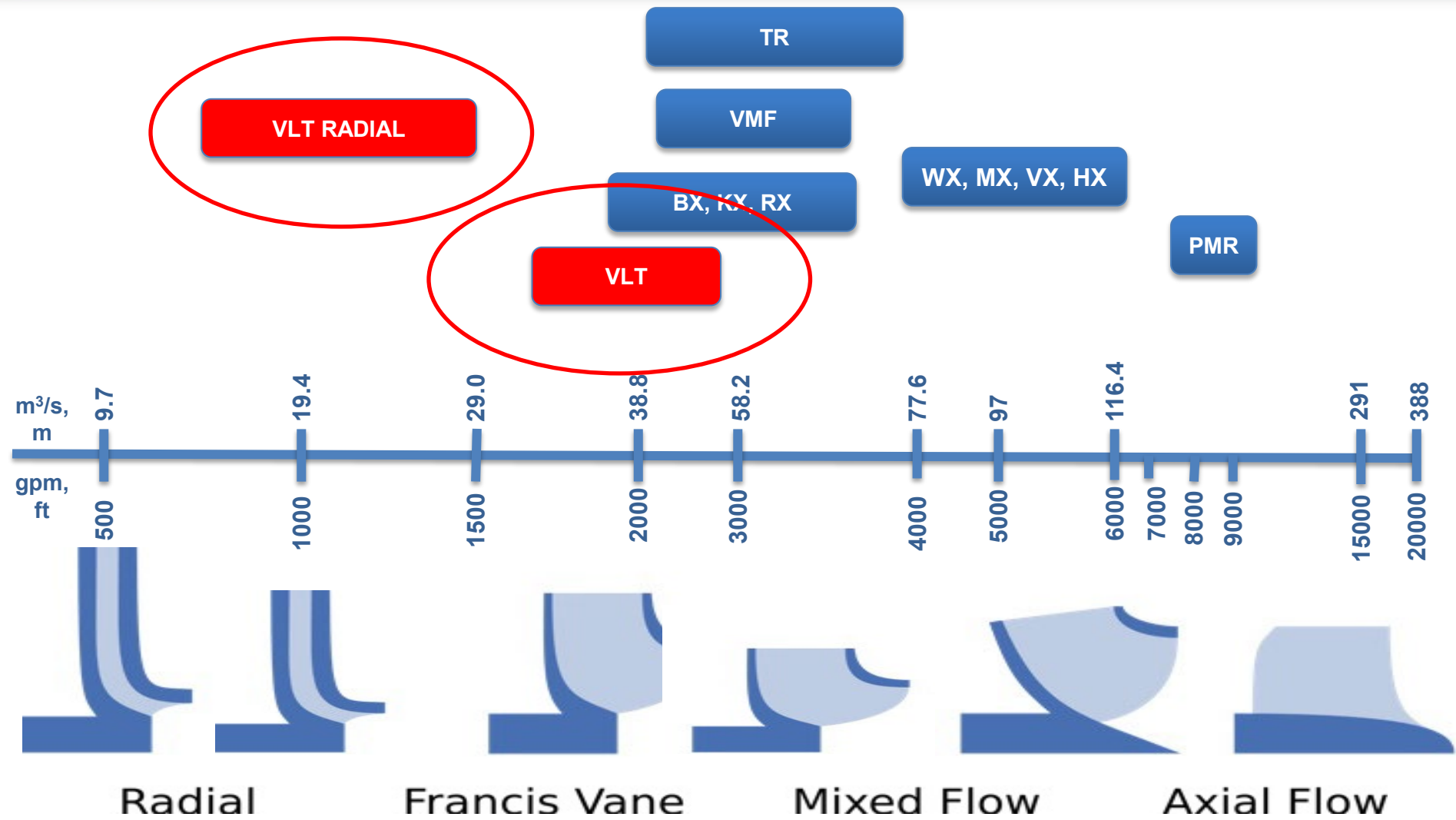


... compared with curved Francis Vane design of "VLT" model



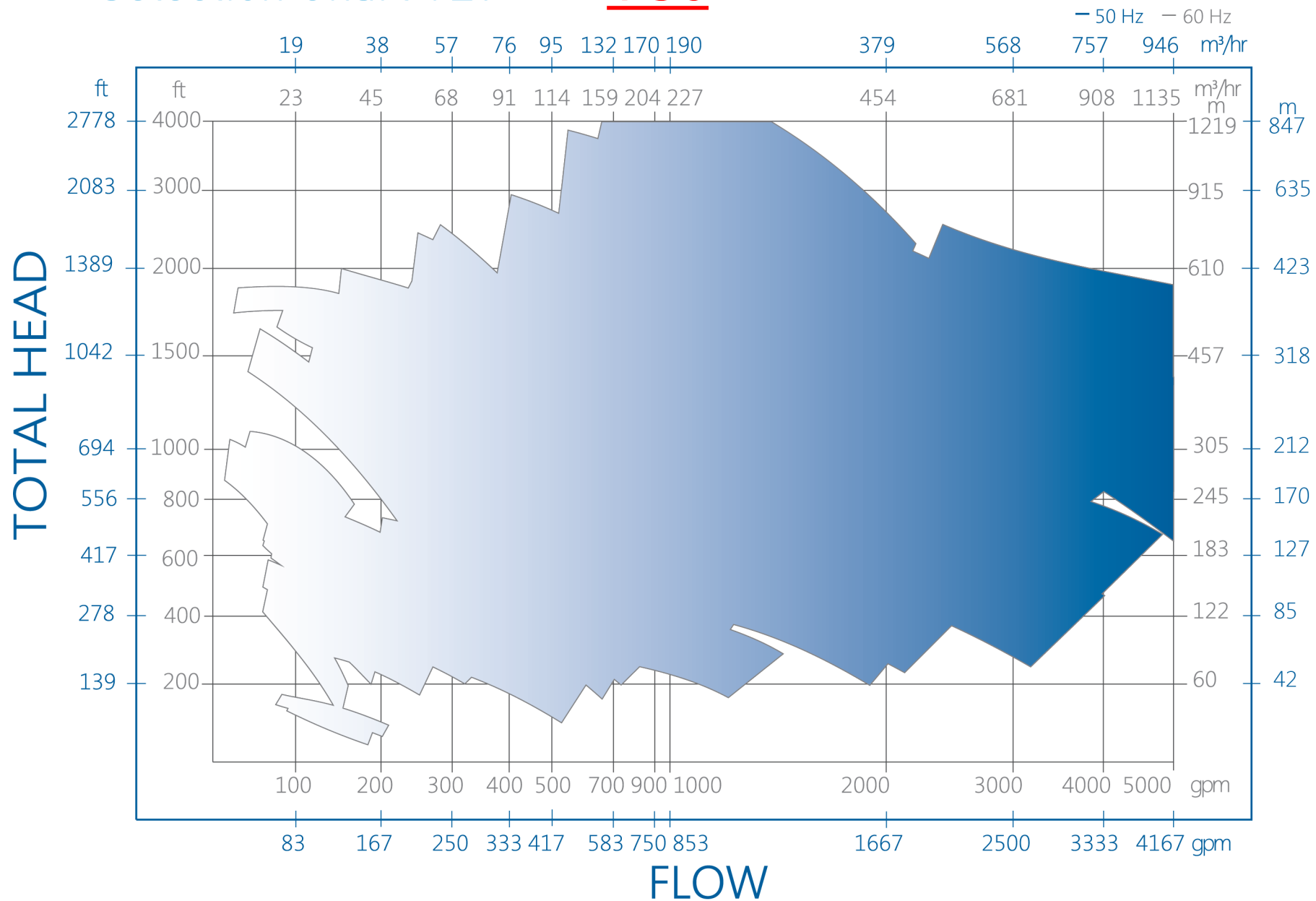


SPECIFIC SPEED, N_s



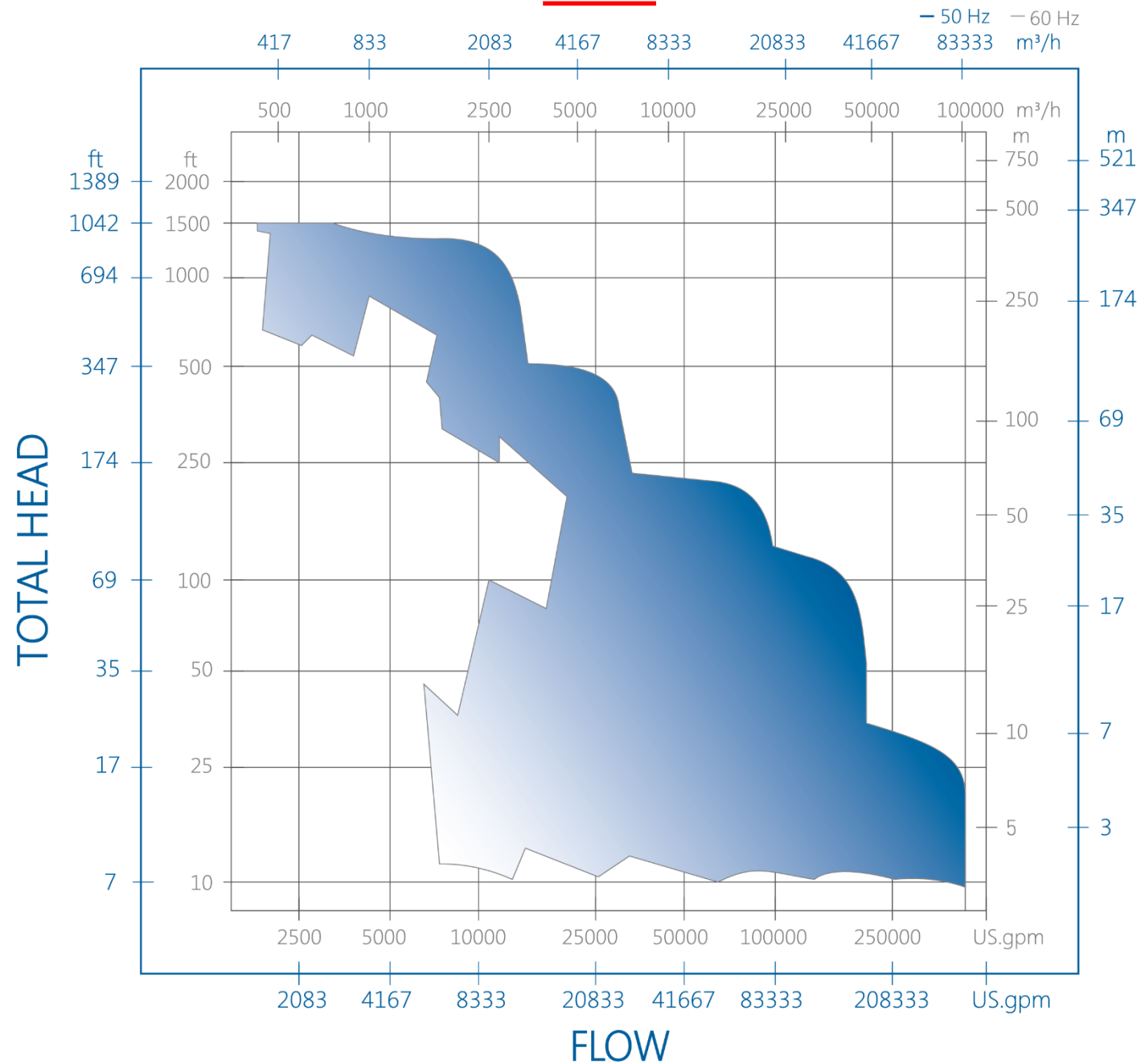


Selection Chart VLT VS6





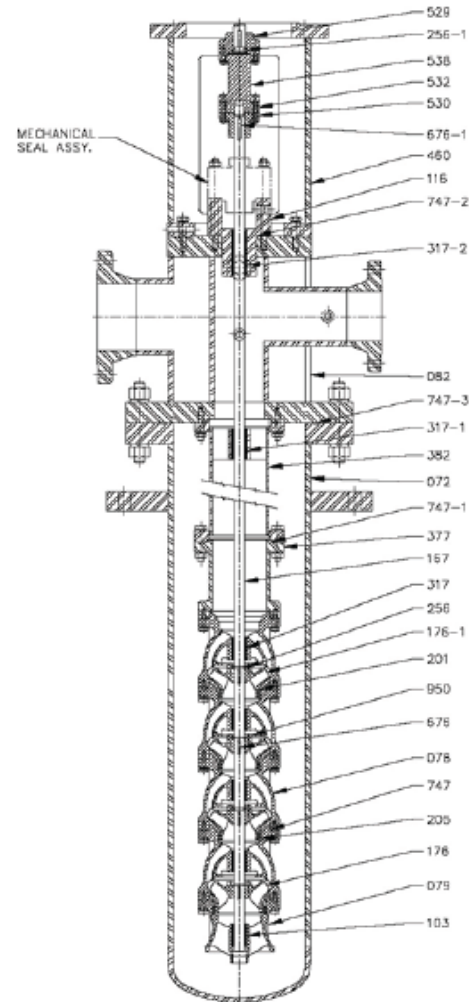
Selection Chart VMT VS6





CONFIGURATION AND MOUNTING OPTIONS

SH (SUCTION IN HEAD)

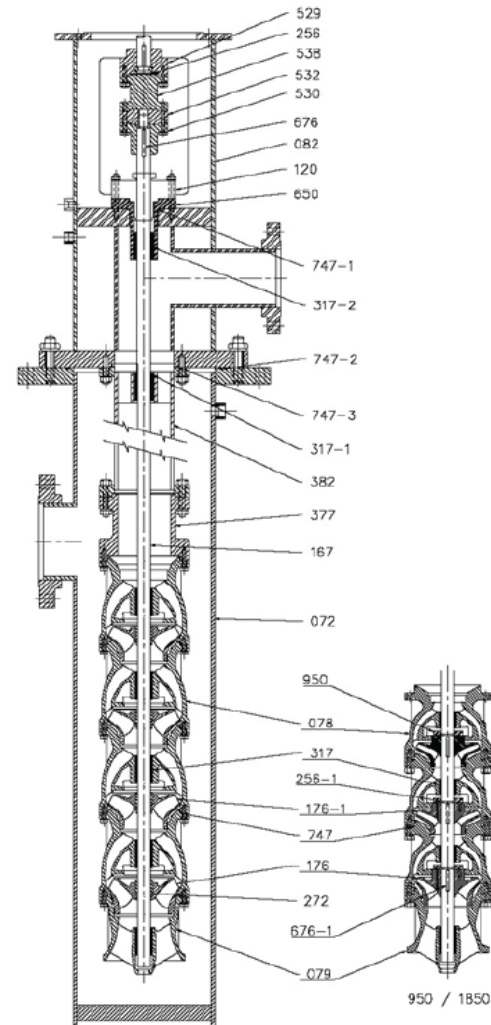


REFERENCE NUMBER	PART DESCRIPTION
072	CAN
078	CASE, SERIES
079	CASE, BOTTOM
082	NOZZLE HEAD
103	BEARING, CASE, BOTTOM
116	SEAL CHAMBER
167	SHAFT, PUMP
176	IMPELLER, 1ST STAGE
176-1	IMPELLER, SERIES
201	WEAR RING, IMPELLER
205	WEAR RING, CASE
256	RING, SPLIT, IMPELLER
256-1	RING, SPLIT, COUPLING
317	BEARING, CASE, SERIES
317-1	BEARING, COLUMN
317-2	BEARING, SEAL CHAMBER
377	FLANGE, CASE, TOP
382	COLUMN, SPOOL
460	SUPPORT, DRIVER
529	COUPLING, DRIVER
530	COUPLING, PUMP
532	PLATE, ADJUSTING
538	COUPLING, SPACER
676	KEY, IMPELLER
676-1	KEY, COUPLING
747	O-RING, CASE
747-1	O-RING, COLUMN
747-2	O-RING, SEAL CHAMBER
747-3	O-RING, BARREL
950	GUARD, RING, RETAINING

NOTE: S-1 Bowls have integrally cast impeller wear rings as Standard.



SB (SUCTION IN CAN)



REFERENCE NUMBER	PART DESCRIPTION
072	CAN
078*	CASE, SERIES
079	CASE, BOTTOM
082	NOZZLE HEAD
120*	SEAL, CRTG
167*	SHAFT, PUMP
176*	IMPELLER, 1ST STAGE
176-1*	IMPELLER, SERIES
256	RING, SPLIT, COUPLING
256-1	RING, SPLIT, IMPELLER
272	COLLER, LOCK
317*	BEARING, CASE
317-1*	BEARING, COLUMN
317-2*	BEARING, STUFFING BOX
377	FLANGE, CASE, TOP
382	COLUMN, SPOOL
529	COUPLING, DRIVER
530	COUPLING, PUMP
532	PLATE, ADJUSTING
538	COUPLING, SPACER
650	HOUSING, BEARING
676	KEY, COUPLING
676-1	KEY, IMPELLER
747*	O-RING, CASE
747-1*	O-RING STUFFING BOX
747-2*	O-RING, BARREL
747-3*	O-RING, COLUMN
950	GUARD, RING, RTNG

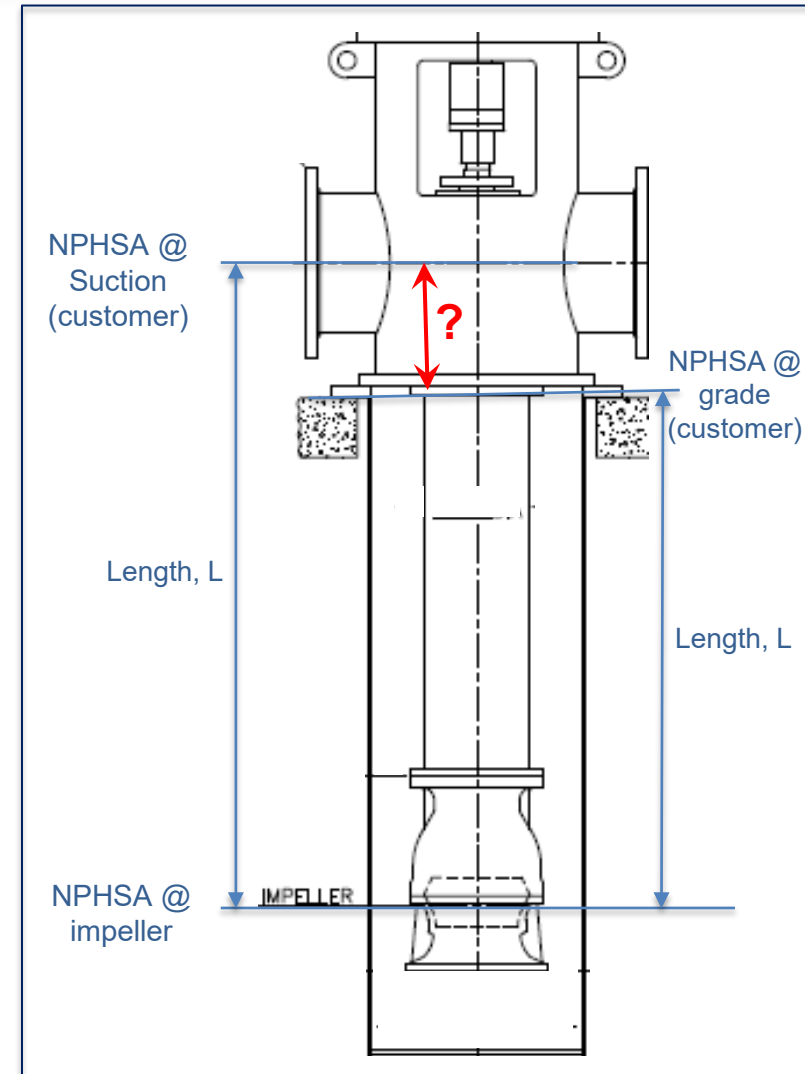
* Recommended Spare Parts

1. IMPACT OF NPSH (SUCTION IN HEAD)

- NPSH Available must be stated by the customer
- We can assume head/can is always full of fluid
- Vendor should ensure that it's clear what is the reference level of customer NPSHA. Often stated @ pump suction flange or @ grade. When stated @ suction flange vendor should check with customer what is the assumed height of pump suction from grade. This ensure we are 100% clear on the actual submergence over the impeller

$$NPSHA @ \text{Impeller} = NPSHA \text{ customer} + L$$

- If NPSHA @ Impeller is still not sufficient - lengthen the pump with column pipe to increase L
- NPSHR of pump defined by 1st stage only
- Once 'L' is known then total can length can be calculated

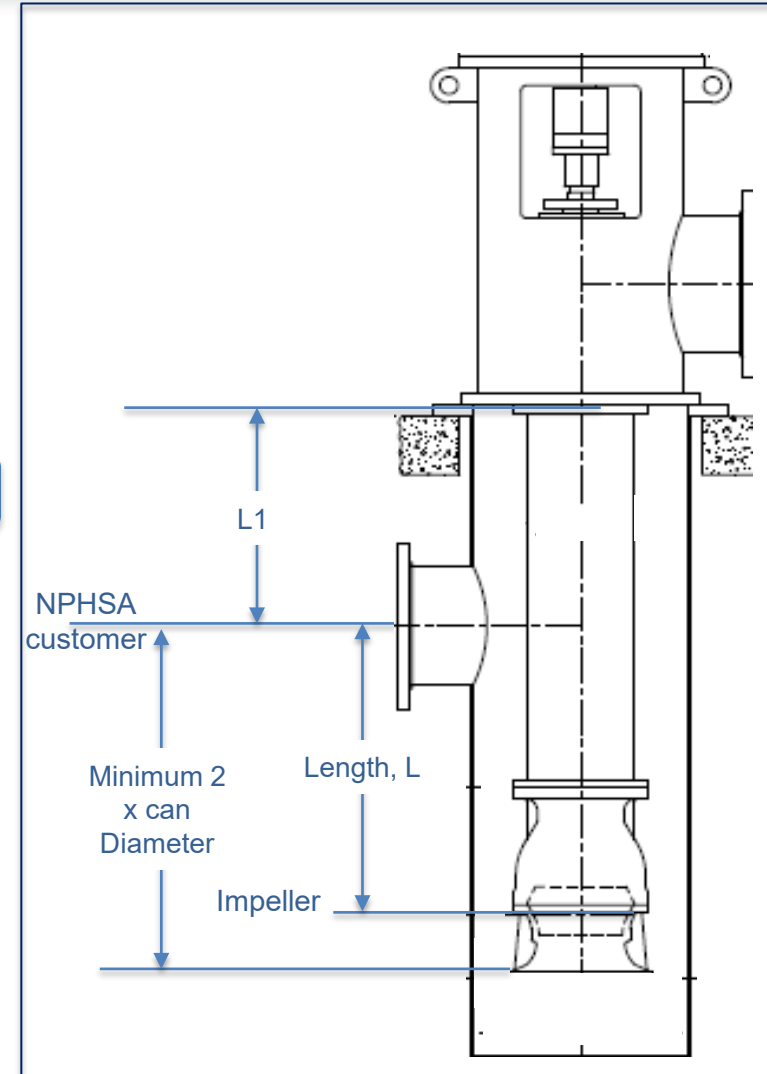


1. IMPACT OF NPSH (SUCTION IN CAN)

- With suction-in-can the situation is different
- Minimum distance of 2 can diameters must be considered for distance from CL of suction-in-can to inlet of pump
- Vendor shall ensure that it's clear what is the reference level of customer NPSHA and correct to CL suction if necessary

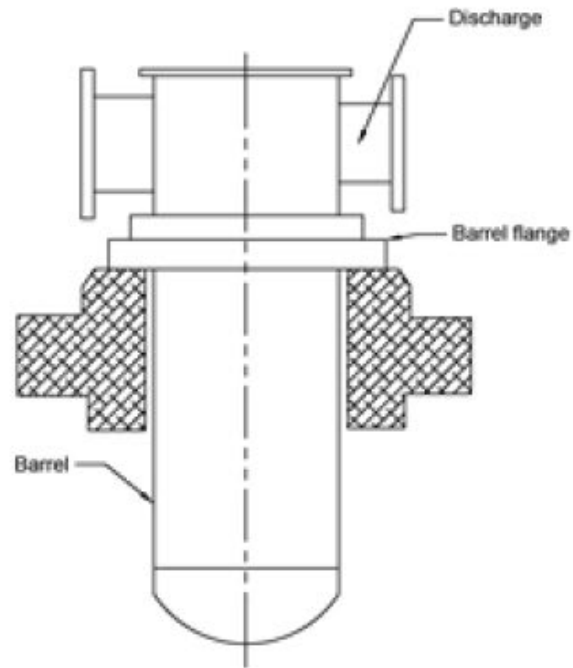
$$NPSHA @ \text{Impeller} = NPSHA \text{ customer} @ \text{CL Suction} + L$$

- If NPSHA @ Impeller is still not sufficient then lengthen the pump with column pipe to increase L. Suction flange remains on same elevation
- Can is likely to be full above CL suction during operation, but we do not assume it. Also there is usually some turbulence on the open surface of the fluid so we do not consider L1 for NPSH purposes
- Once 'L' is known then total can length can be calculated



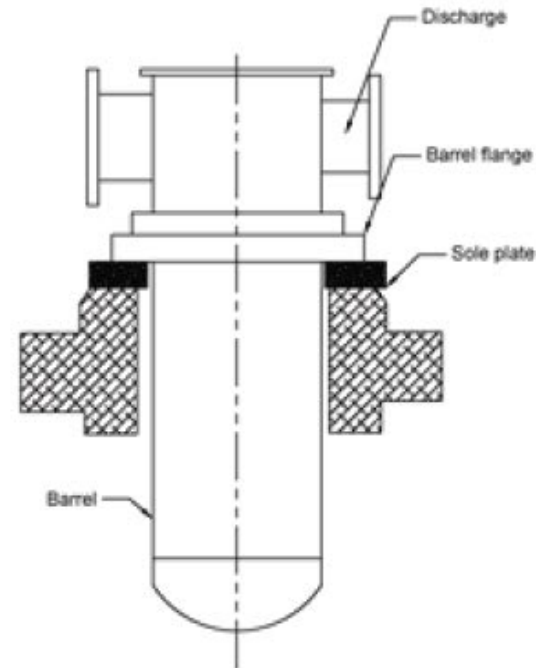


MOUNTING OPTIONS



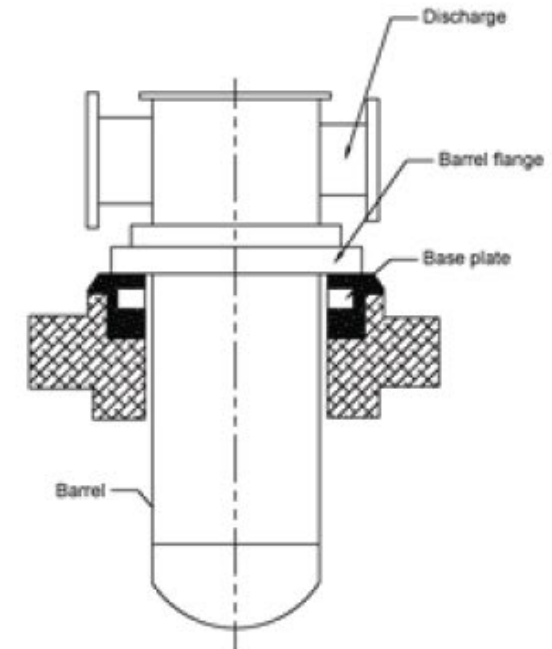
Standard Design

One flange at the barrel
Barrel directly mounted on the foundation



Standard Design with Sole Plate

One flange at the barrel
Barrel mounted on the sole plate
Sole plate mounted and adjusted on the foundation

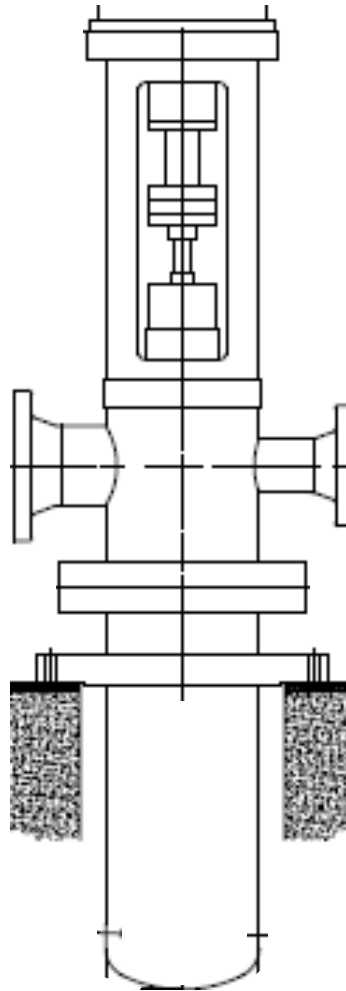


Standard Design with Base Plate

One flange on the barrel
Barrel mounted on the base plate
Base plate mounted and adjusted in the foundation Grouted with concrete



MOUNTING OPTIONS



- Separate mounting flange on can was required for API 610 8th edition
- No longer required by API, but is available as an option if required by the customer



BARREL INSTALLATION



Source – Robert Burnstad – ITT Goulds





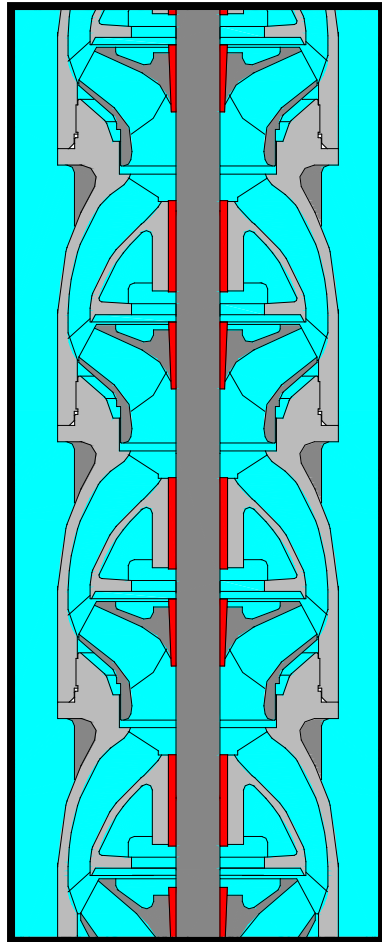
PUMP INSTALLATION



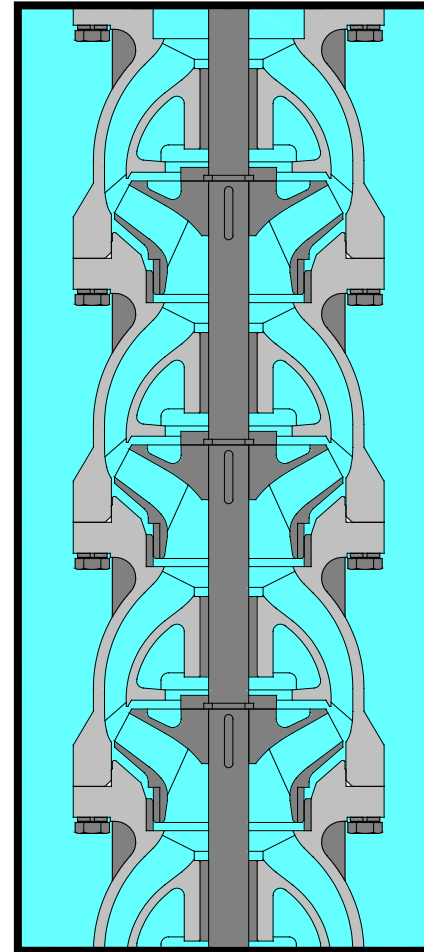


FLANGED VS THREADED BOWLS

Threaded Bowls (Non API)



Flanged Bowls (API)



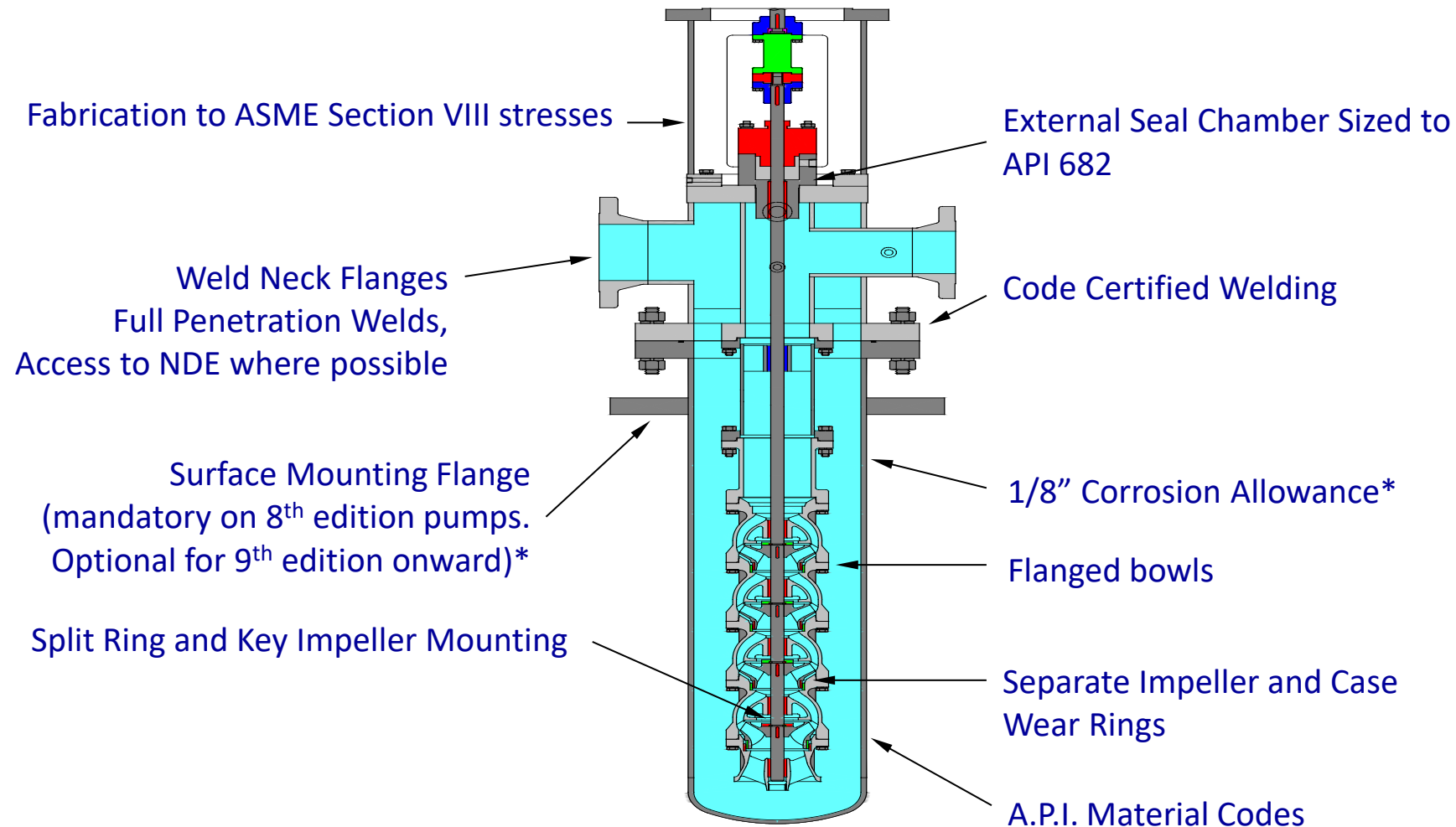


LOW NPSH FIRST STAGE

- Low NPSH First Stage (13,000 Nss) with wide operating range (15-120% BEP)
- Some (non RP) designs use an inducer.
- Inducers historically had a limited operating range (U shaped NPSH curve)
- More recent designs have a broader range



API 610 - MANDATORY REQUIREMENTS

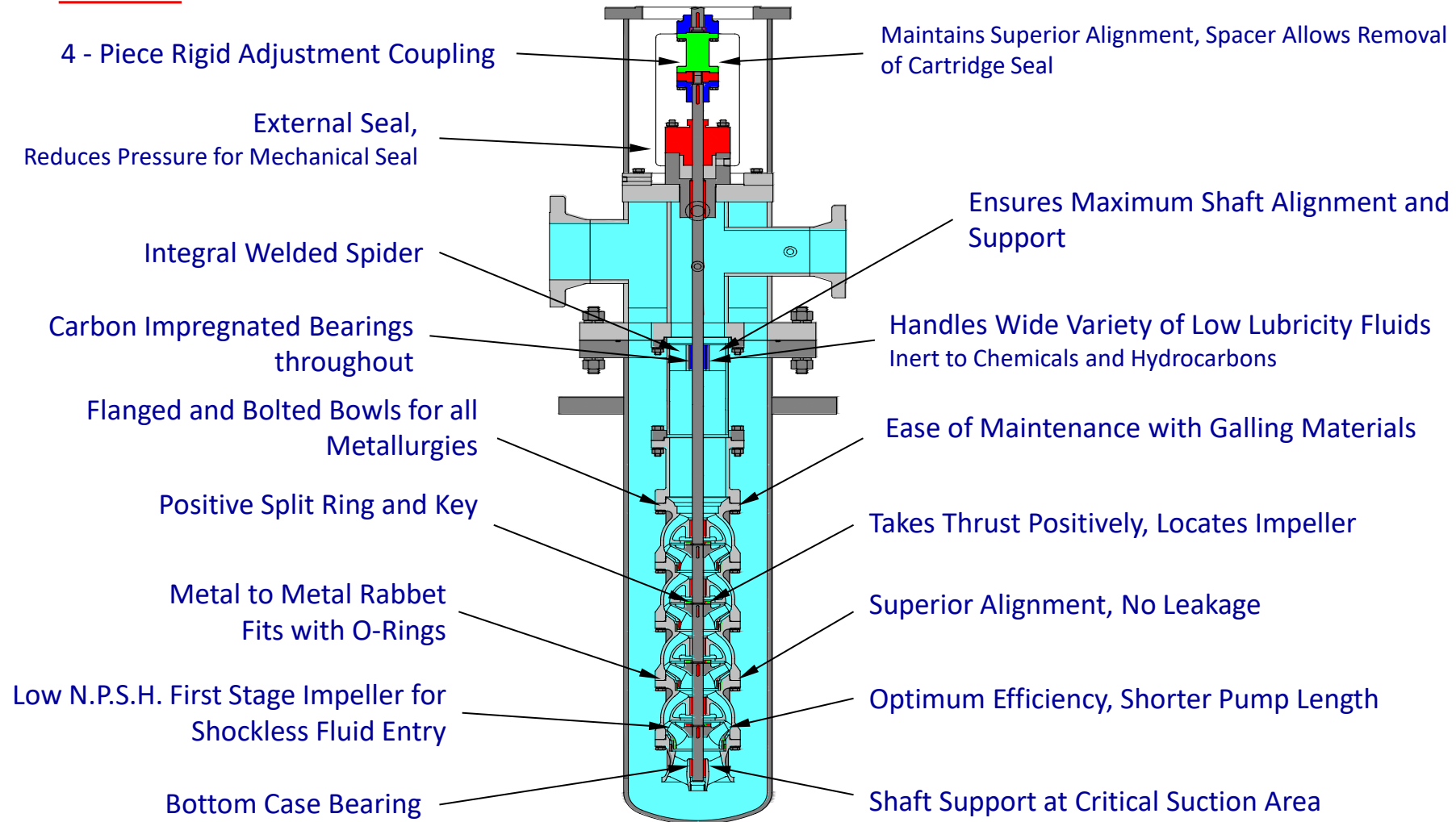


FEATURES AND BENEFITS

API 610 VLT

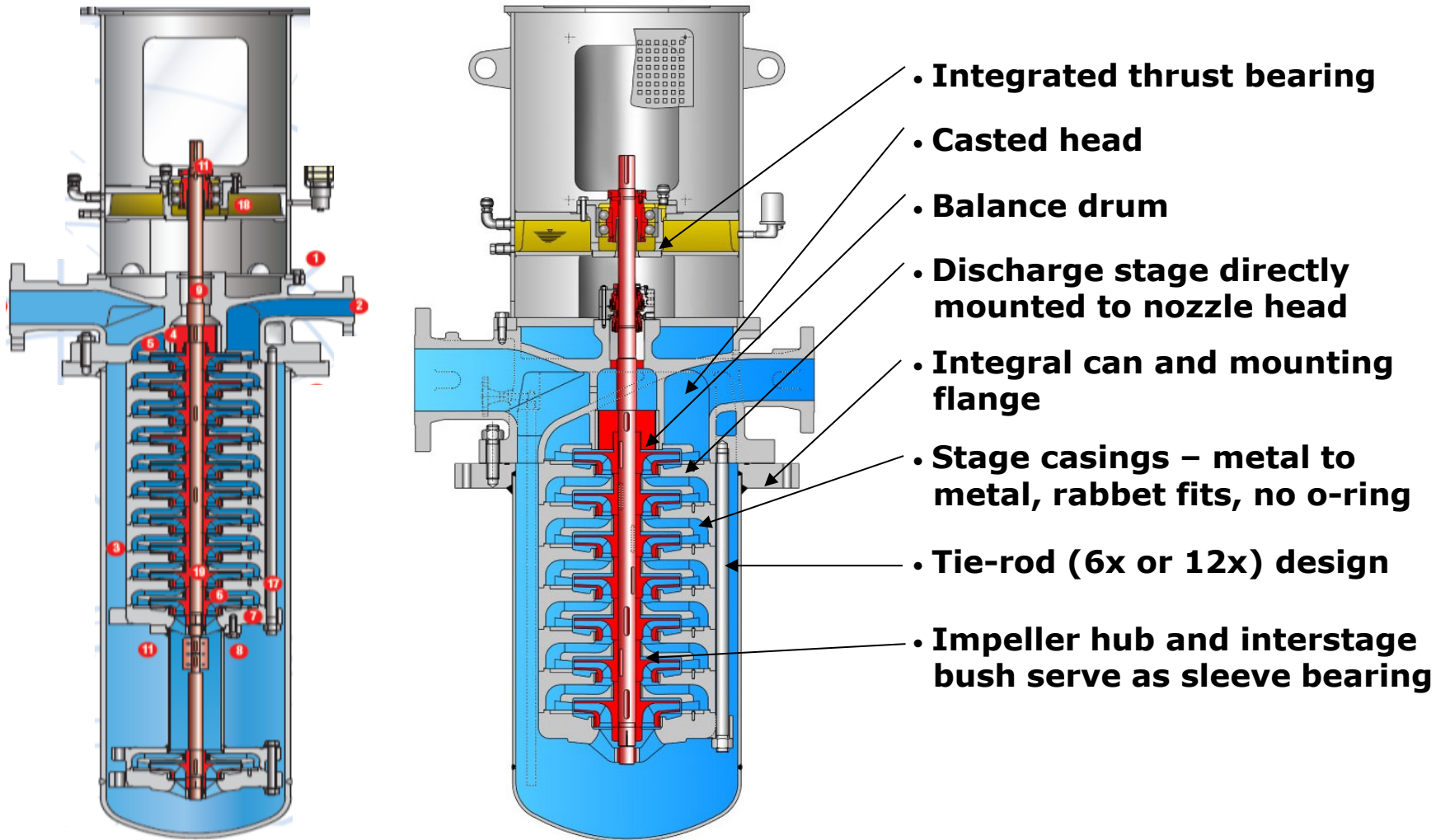
Feature

Benefit

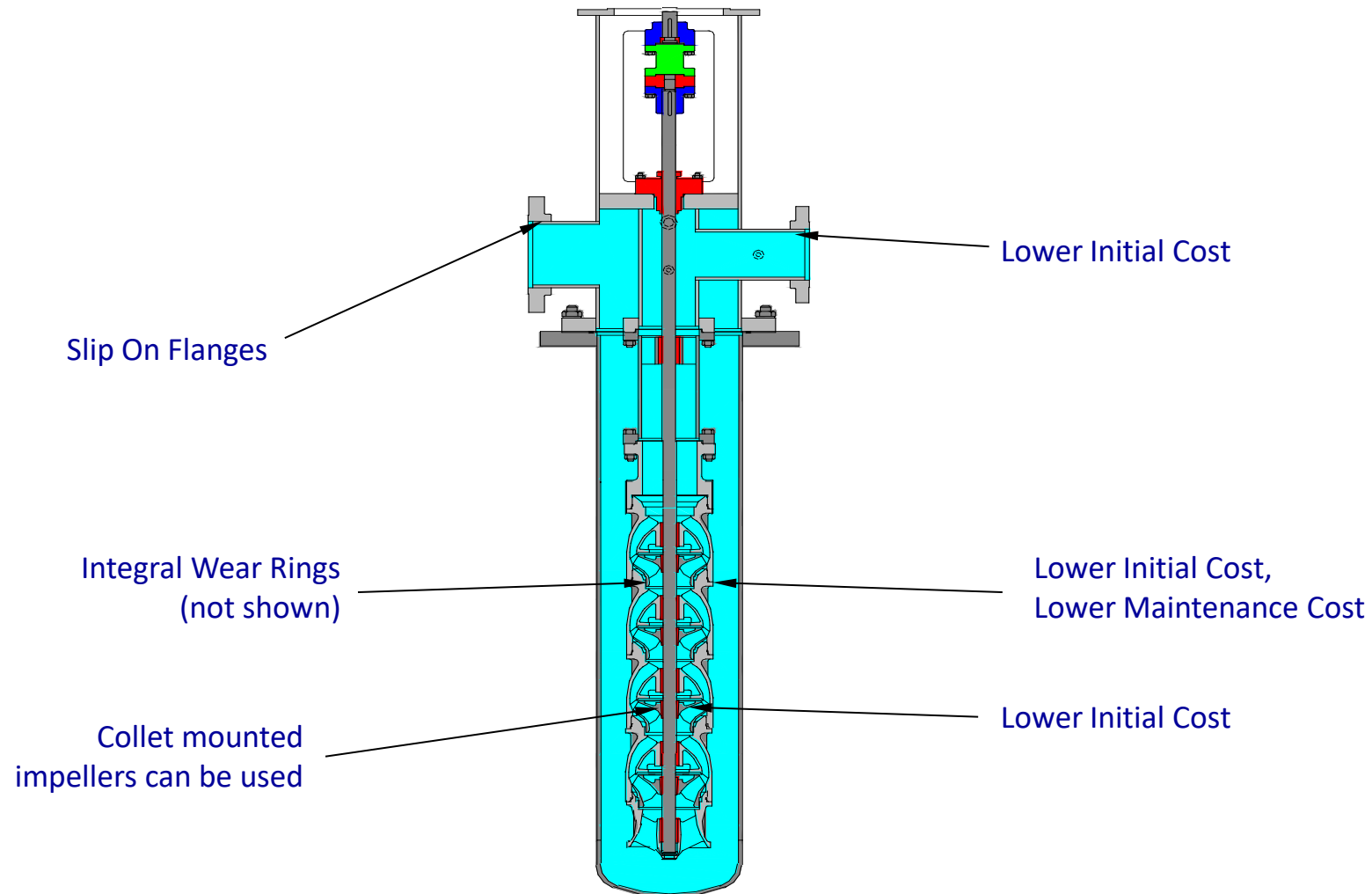


FEATURES AND BENEFITS

VLT RADIAL FLOW

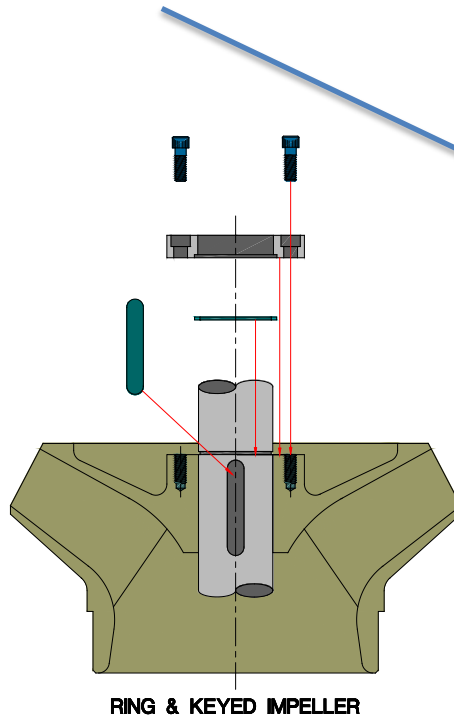


FEATURES AND BENEFITS COMMERCIAL VLT – DIFFERENT FROM API



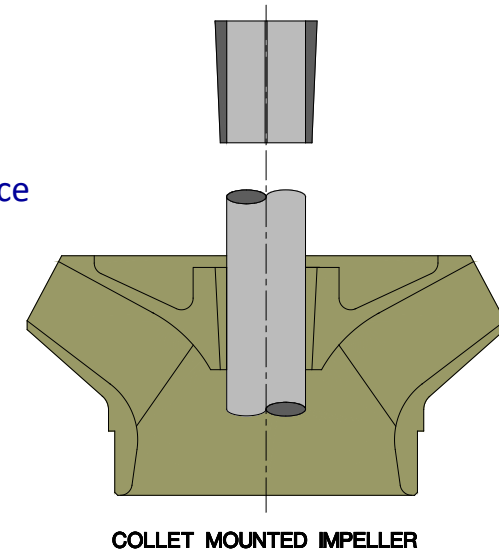
FEATURES AND BENEFITS DESIGN CHARACTERISTICS

API



- Collet mounted Impellers
 - Ease of assembly and disassembly
 - Ensures positioning of impeller
 - Lower cost and easier for maintenance

Non API

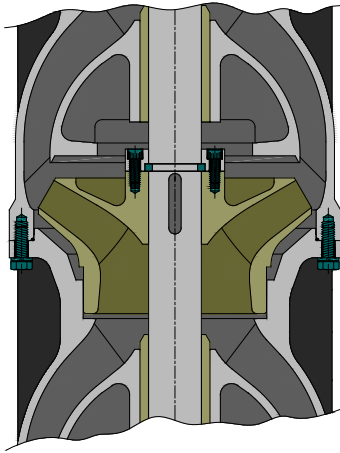


- Locked and keyed Impellers.
 - Positive retention.
 - Important when pumping hot/cold liquids.
 - Less susceptible to loosening when subject to shock load

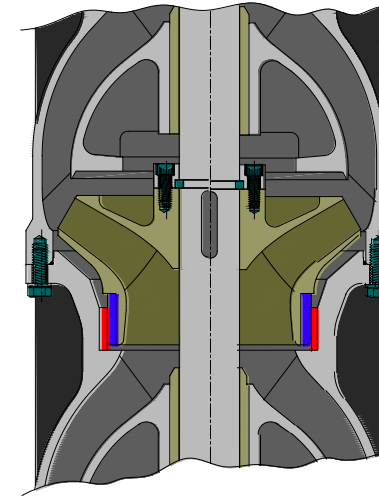
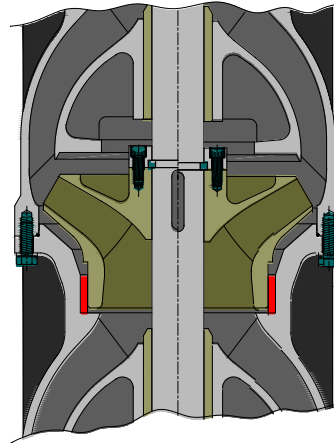
The use of locked and keyed impellers is mandatory for hot services above 230 deg F and below -20 deg F. The reason for this is the tendency for collets to loosen.

We also like to use locked and keyed impellers for high suction pressures and also series pump operation

FEATURES AND BENEFITS WEAR RINGS



Integral Wear Rings (Non API)



Renewable Wear Rings (API)

- The choice of wear rings is available
- Integral wear rings is a cost saving

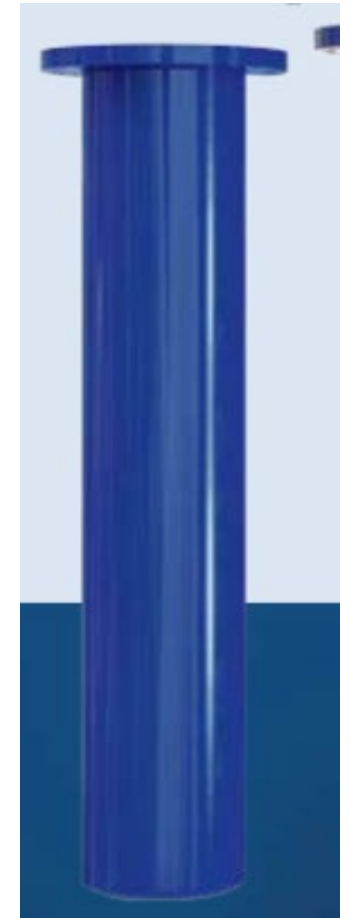
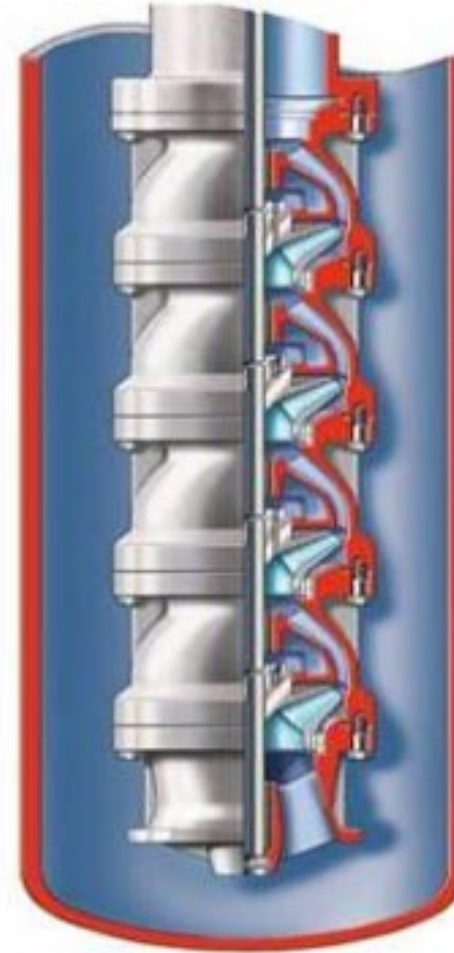
FEATURES AND BENEFITS NOZZLE HEAD

- Fabricated Steel Discharge Heads
- Pre-Engineered standard designs for the 100 to the 2000 VLT size
- Meets API 610 nozzle load requirements (Only API model)
- 300# flanges standard for API VLT. 150#, 600# & 900# optional
- All pipe, vent & gauge connections are ANSI Class 300
- 150# flanges are standard for Commercial VLT
- 300# and above optional
- Top flange has rabbet / register fit for motor - no field doweling or fit-up
- Lifting Lugs
- OSHA coupling guards
- Standard motor mating flanges to NEMA standards for Vertical Solid Shaft Motor



FEATURES AND BENEFITS SUCTION CAN AND SHAFTING

- Fabricated Steel Barrel (or “Can”)
- O-ring gasket seal to the head
- Sized to meet allowable velocities
- Elliptical bottom is standard on API VLT
- Flat bottom standard on Commercial VLT
- 416ss shafting as standard



DESIGN CHARACTERISTICS COLUMN AND LINE SHAFT

- For API design bearing holder / 'spider' is welded into the top of each column piece and machined concentric with mating flanges
- For Commercial design spiders can be drop—in type. But there is an option for welded
- Better radial loading capability
- Rabbet /Register fit and o-ring sealing between column and head, and column and bowl assembly
- Carbon Impregnated bearings as standard (usually graphalloy)
 - Suitable for wide range of services and can tolerate upset conditions
 - These bearings give excellent life when pumping dry liquids like propane, butane, ethane and also condensate
- Bronze, Cast Iron, Nitronics are also available depending on the service



- Seal chambers suitable for API 682 mechanical seals
- Choice of arrangements to suit process
- Seal systems normally mounted away from the pump, but engineering will look at mounting on pump head on case to case basis if required (photo)



THRUST HANDLING IN PUMP IN-HEAD THRUST POTS

REFERENCE NUMBER	PART DESCRIPTION	MATERIAL
120	SEAL, CARTRIDGE	ASSY
167	SHAFT, PUMP	A582 TP 416
252	NUT, SHAFT, DRIVER	A582 TP 416
346	SLEEVE, BEARING, BALL, THRUST	STL 1213
486	RING, SEALING-V	NITRILE
486-1	RING, SEALING-V	NITRILE
508	THRUST POT	A48, CL 30
510	COVER, THRUST POT	A36
655	BEARING, BALL, RADIAL	ASSY
673	WASHER, LK, BBRG	A36
678	KEY, GIB	AISI 302-316
747-4	O-RING	NITRILE
878	NUT, LK, BBRG	A36

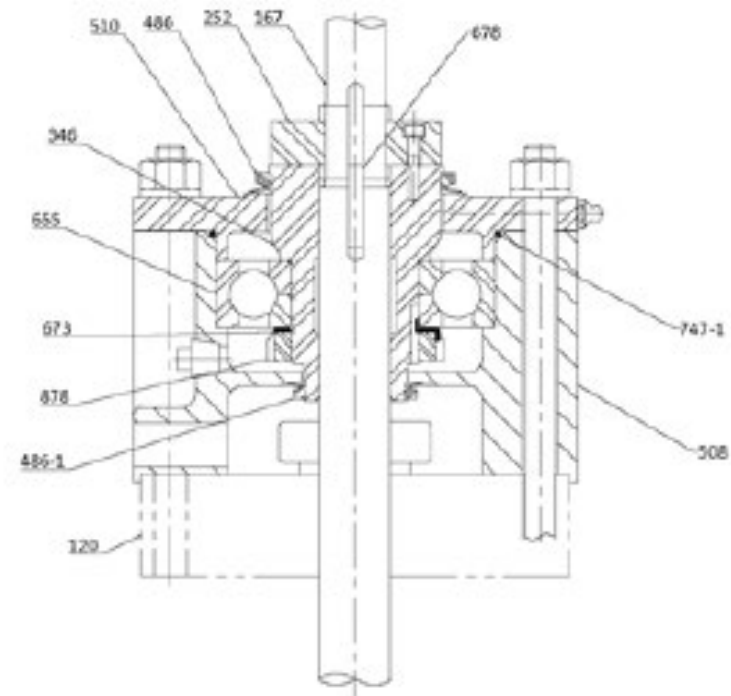
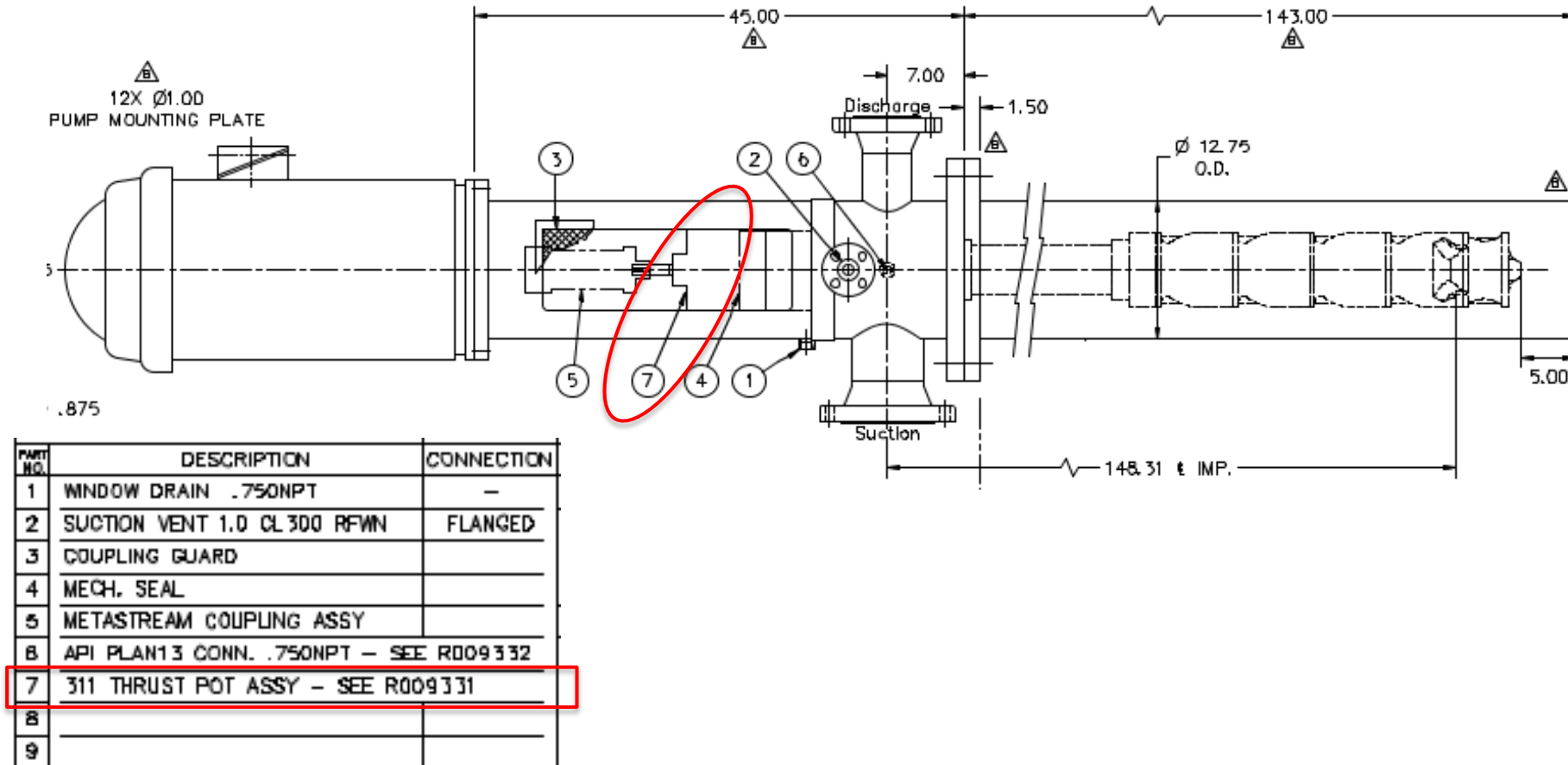


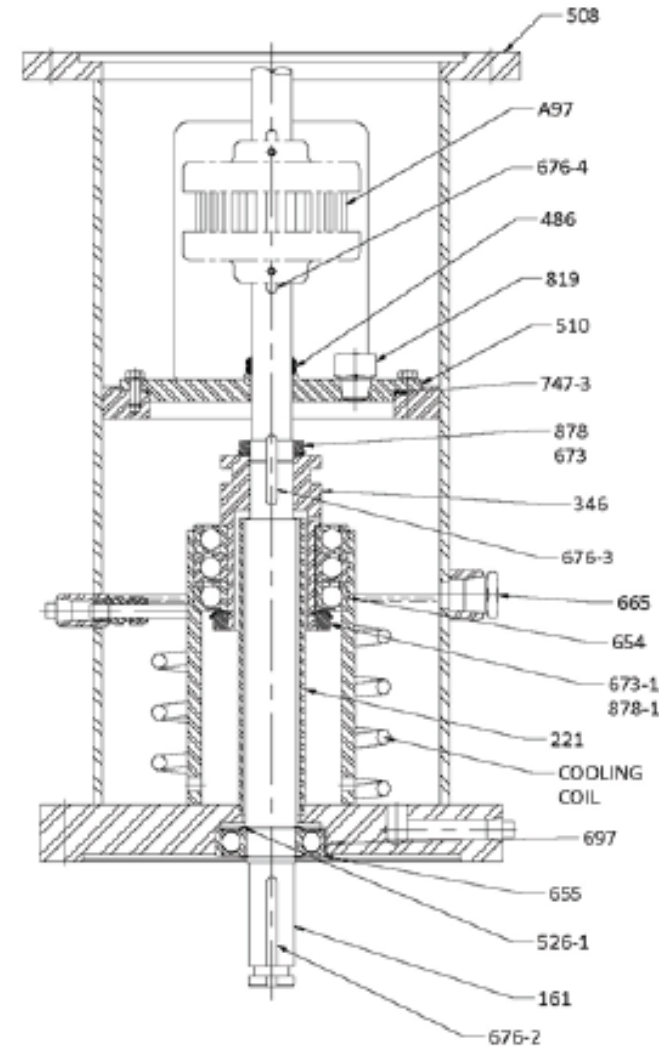
Figure 6.1 Thrust Pot Model 311 / 311 QJ Sectional Drawing

THRUST HANDLING IN PUMP IN-HEAD THRUST POTS

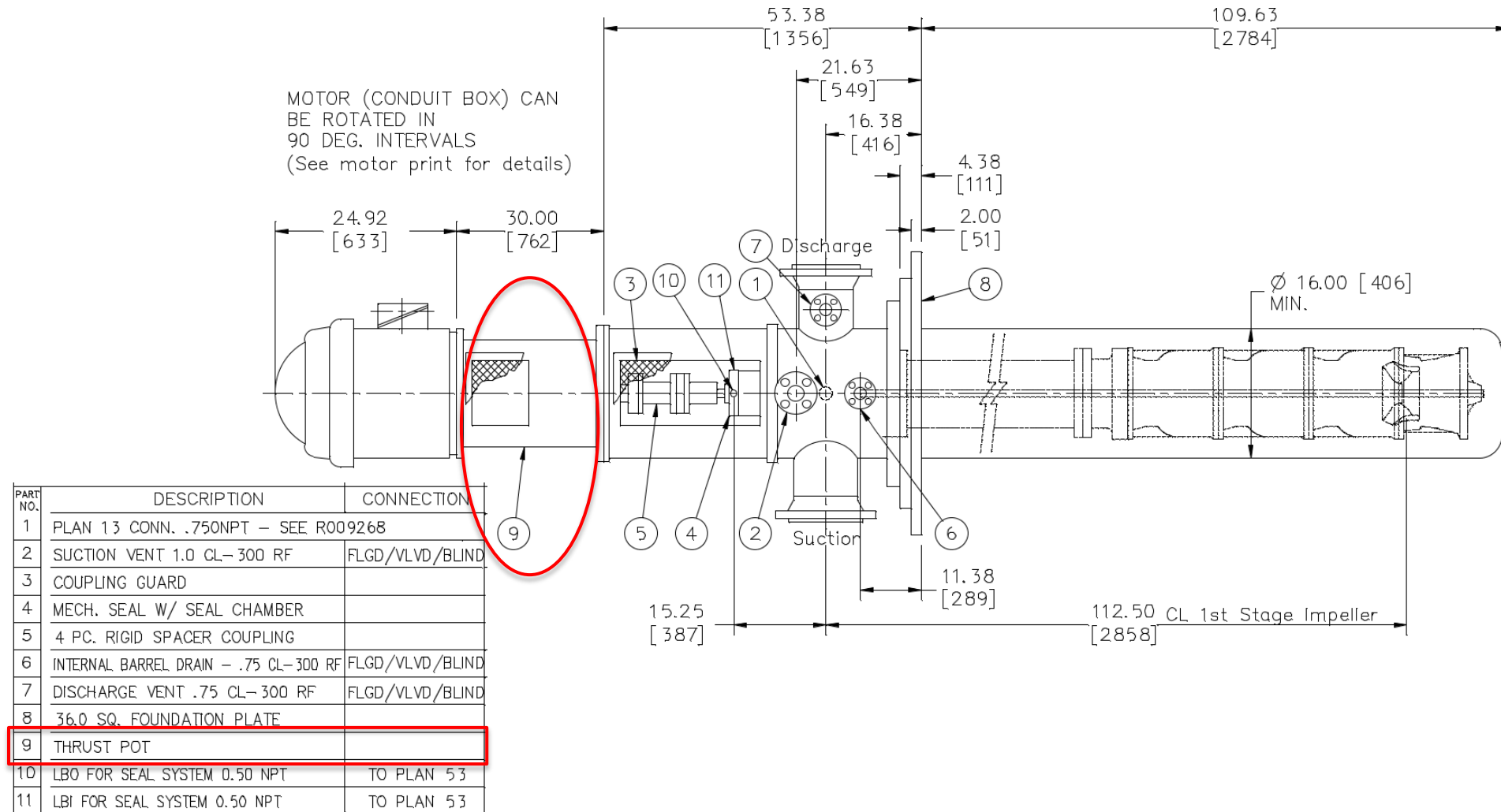


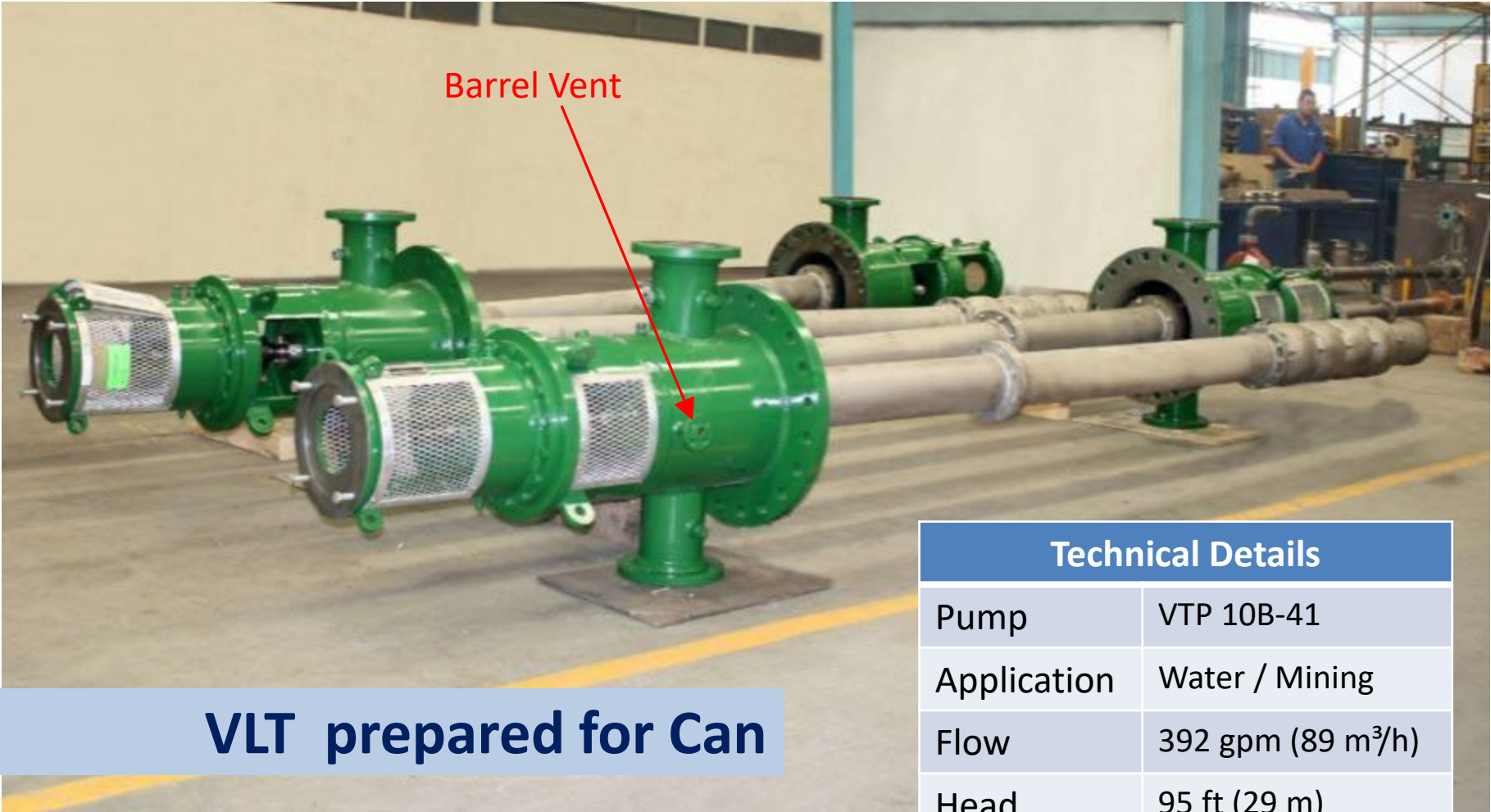
THRUST HANDLING IN PUMP SEPARATE THRUST POTS

REF. NO.	PART DESCRIPTION	MATERIAL
161	SHAFT, THRUST POT	A528 TP 416
221	SLEEVE, OIL	A36 - STL LC
346	SLEEVE, BEARING, BALL	A36 - STL LC
486	RING, SEALING-V	NITRILE
508	THRUST POT	FABRICATION NOTE
510	COVER, THRUST POT	A36 - STL LC
523-1	RING, RETAINING	AISI 302
654	BEARING, BALL, THRUST (QTY: 3)	SKF # 7216-BG
655	BEARING, BALL, RADIAL (QTY: 1)	SKF # 6309-2RSNR
665	GAUGE, LEVEL	BW20 GITS # 04054
673	WASHER, LOCKNUT 40 W-80	STL SKF W08
673-1	WASHER, LOCKNUT 80 W-16	STL SKF W16
676-3	KEY, PRL (QTY: 1)	AISI 302-316
676-4	KEY, PRL (QTY: 2)	AISI 302-316
697	PIN, ANTI-ROTATION	AISI 302
747-3	O-RING	NITRILE
819	FITTING, VENT, BREATHER	M-841 TEDECO
878	NUT, BEARING, THRUST 40 N-08	STL SKF N-08
878-1	NUT, BEARING, THRUST 80 AN-16	STL SKF AN-16
A97	COUPLING METASTREAM TSKS 0135	



THRUST HANDLING IN PUMP SEPARATE THRUST POTS

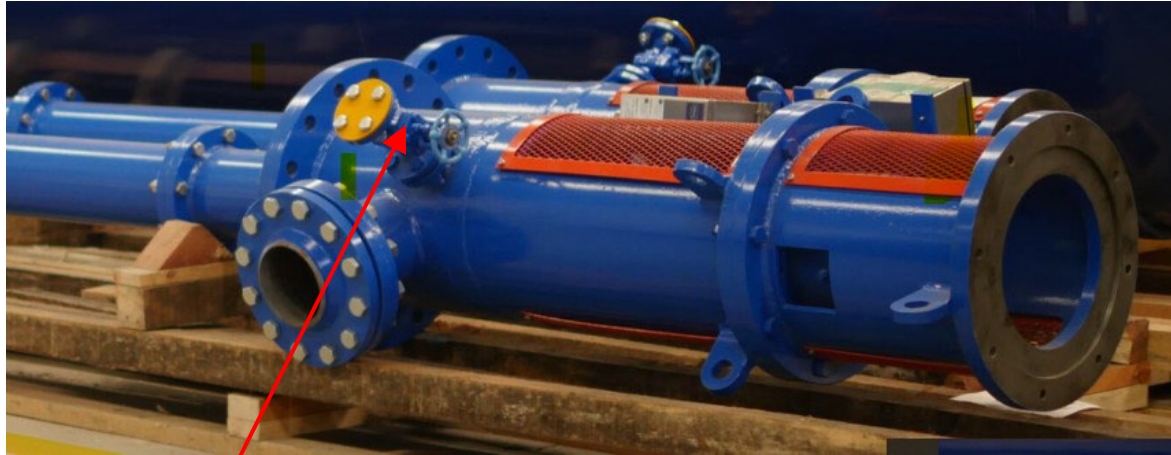




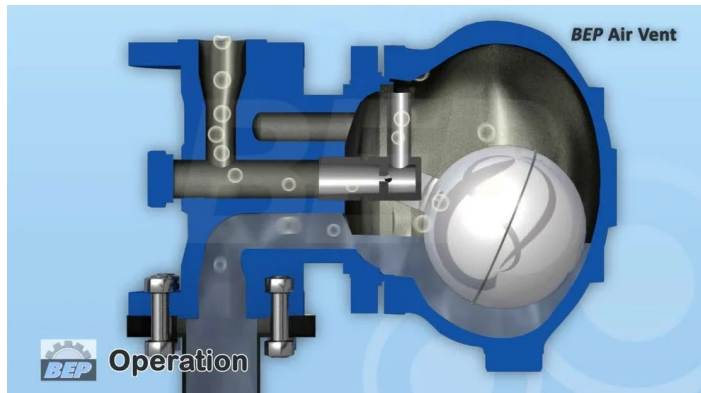
VLT prepared for Can

Technical Details	
Pump	VTP 10B-41
Application	Water / Mining
Flow	392 gpm (89 m³/h)
Head	95 ft (29 m)
Motor	15 Hp (11 kW)

VLT Venting

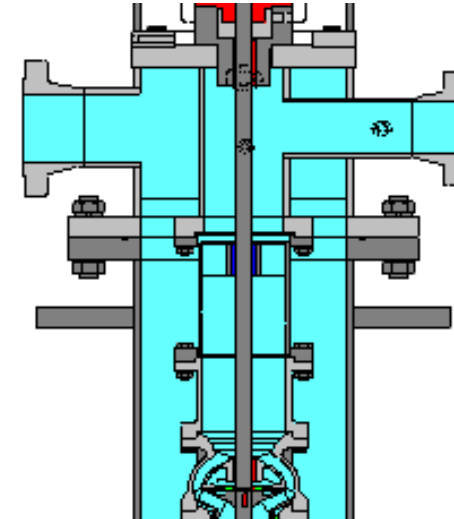


Barrel Vent



The suction can of a VS6 pump should have a vent connection permanently connected back to the suction vessel or to the flare system.

It need not continuously pass fluid, you can fit float type interceptors that will open to pass vapours but not liquids (for example).



But the key point is that you must never let vapours build up in the pump suction can. If you do you have lost your NPSHA advantage. Your NPSHA will now only be the level of liquid in the can with no contribution from suction pressure. You will probably cavitate.

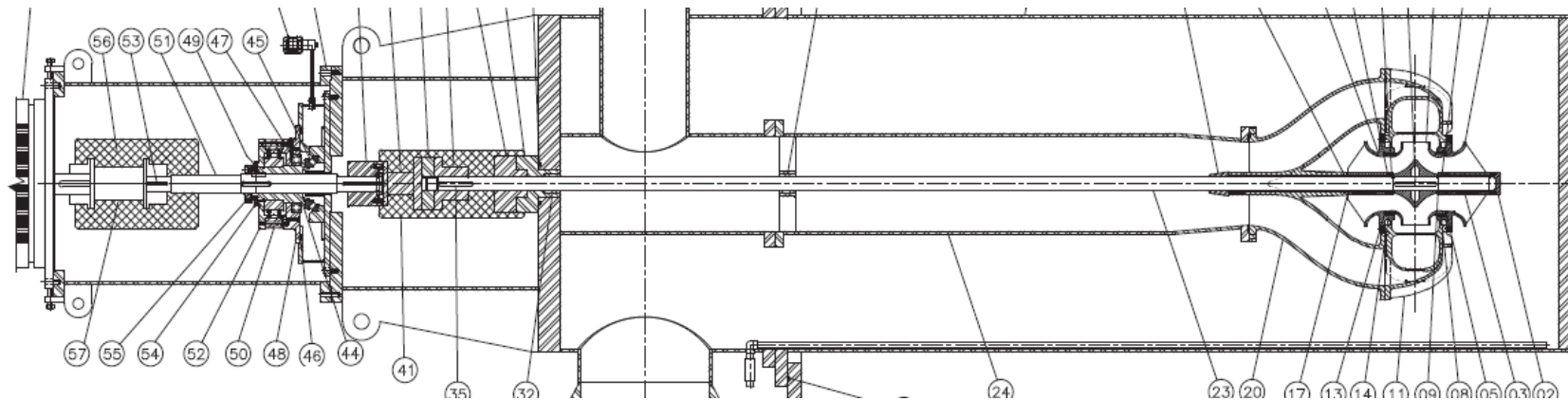
Pump Type VS7

“Double Casing, **Volute** Type Vertical Suspended” Pumps



FEATURES AND BENEFITS

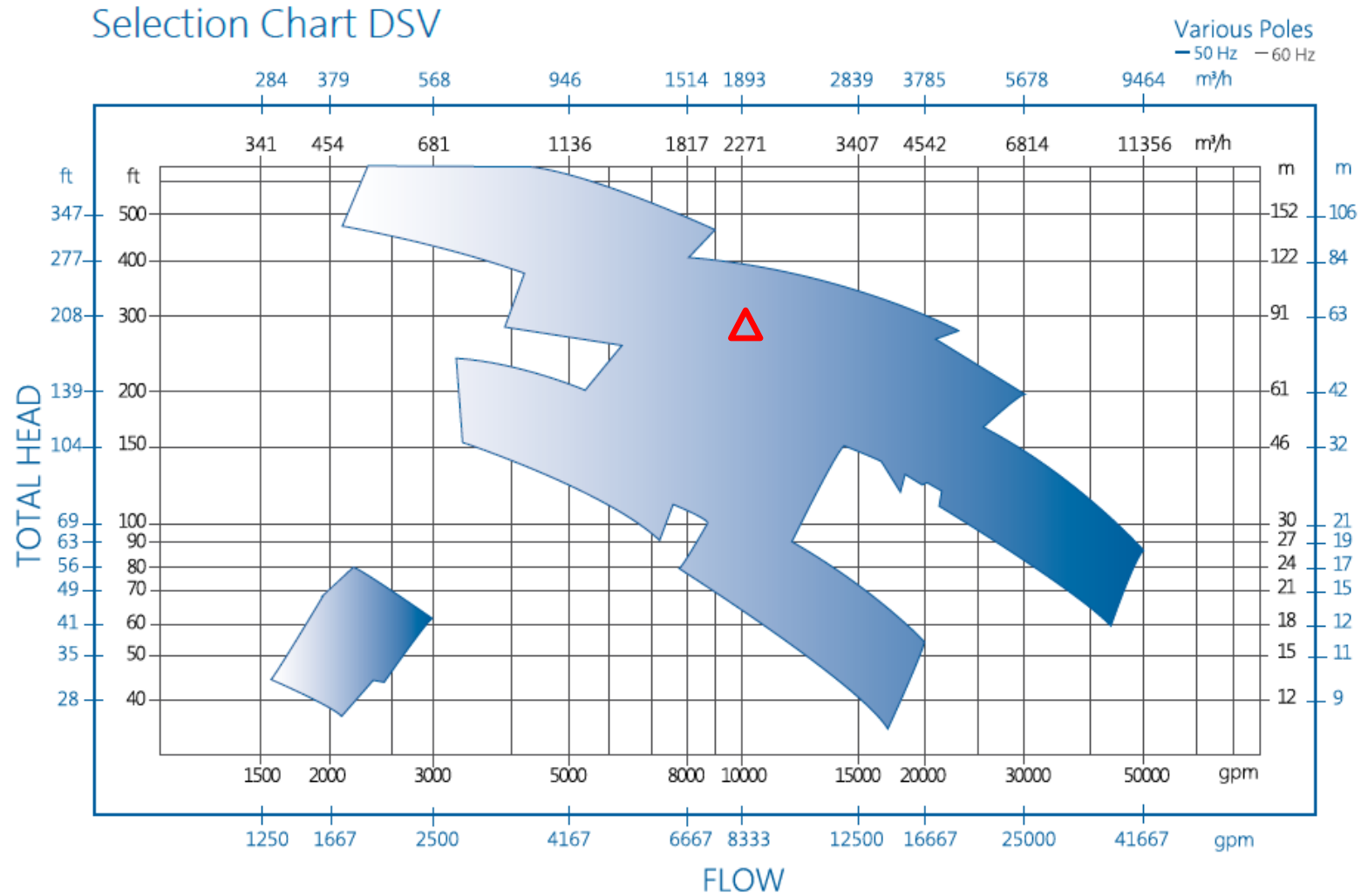
- DSV is a heavy-duty, vertical double-suction, twin volute, single-stage, centrifugal design.
- The single impeller develops the higher heads and capacities without the need for additional stages. This minimizes the number of wearing parts, resulting in easier maintenance and positive alignment. Unlike the vertical turbine pump, this completely eliminates the use of intermediate bowl bearings, which are vulnerable when handling abrasive liquids.





FEATURES AND BENEFITS

DSV



VERTICALS BUSINESS UNIT



Features and Benefits - Double Suction



Double suction enclosed impeller as a first stage can be manufactured in VCT pumps

DX First Stage

VERTICALS BUSINESS UNIT



Features and Benefits - Double Suction



DX First Stage

Coming Attractions ☺

“Performance Testing & Inspection of API 610 Pumps”

Provisionally Thurs 11th September – 08.00 (UK GMT) (Eastern Hemisphere) &
17.00 (UK GMT) (Western Hemisphere)

Aimed at Process and Mechanical Engineers, and Consultant Engineers who specify pumping equipment as well as Applications & Sales Engineers selecting and quoting them.

This session will look at the What, the Why and the How of Pump Performance Testing and also look at the various Inspections & Tests that are frequently specified on the Data Sheets.

Future Subjects

Pumping CO₂, Dense Fluids and Compressible Flow



Specialist for Pumping Technology

Q & A

ssmith@ruhrpumpen.com

www.ruhrpumpen.com

marketing@ruhrpumpen.com

RUHRPUMPEN AT A GLANCE

**VERTICAL
INTEGRATION**

**SALES
OFFICES IN
+35 COUNTRIES**

**MANUFACTURING
FACILITIES
IN 10 COUNTRIES**

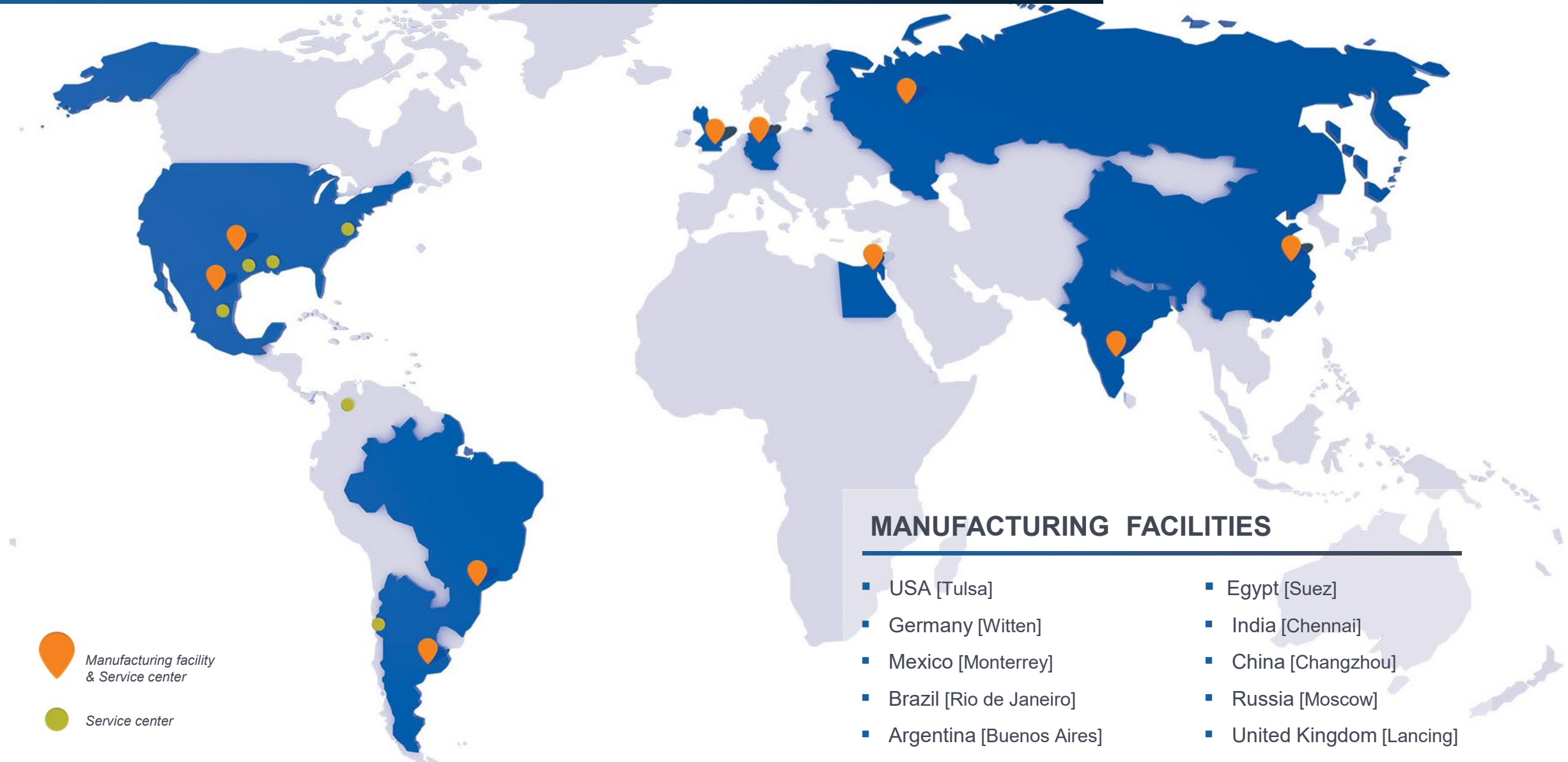
**+70 YEARS
OF EXPERIENCE**

**+2,000
EMPLOYEES**

**15 SERVICE
CENTERS**

+70,000 PUMPING SOLUTIONS INSTALLED WORLDWIDE

A GLOBAL COMPANY



MARKETS WE SERVE

Our commitment to create innovations that offer reliable solutions to our customers allow us to provide a complete range of pump systems to support **core markets** as:





OUR PUMP LINES

Ruhrpumpen offers a broad range of highly engineered and standard pumping products that meet and exceed the requirements of the most demanding quality specifications and industry standards.

Our pumps can handle head requirements as high as 13,000 ft (4,000 m) and capacities up to 300,000 gpm (68,000 m³/hr). Moreover, our pump designs cover temperatures from cryogenic temperatures of -310 °F (-196 °C) up to 752 °F (400 °C).

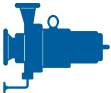
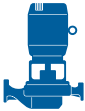
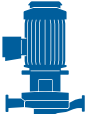


Products include:

- Single Stage Overhung Pumps
- Between Bearings Pumps
- Horizontal Multi-Stage Pumps
- Vertical Multi-Stage Pumps
- Vertical Mixed Flow & Axial Flow Pumps
- Positive Displacement Pumps
- Full Range of Industrial Pumps
- Submersible Pumps
- Magnetic Drive Pumps
- Decoking Systems
- Packaged Systems
- Fire Systems



OVERHUNG PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Sealless Magnetic Drive Pumps	CRP-M / CRP-M-CC	ISO 2858 & 15783 HI design (OH11)	
	SCE-M	API 685	
Foot Mounted OH1 and General End Suction Pumps	IPP	HI design (OH1)	
	CPP / CPP-L	HI design (OH1) ANSI B73.1	
	CPO / CPO-L	HI design (OH1) ANSI B73.1	
	CRP	HI design (OH1) ISO 2858 & 5199	
	GSD	HI design (OH0)	
	SHD / ESK / SK / SKO SKV / ST / STV	HI design (OH1)	
	SWP	HI design (OH3A)	
Centerline Mounted	SCE	API 610 (OH2)	
Vertical In-Line Pumps	SPI	API 610 (OH3)	
	IVP / IVP-CC	HI design (OH4 / OH5)	
	IIL	HI design (OH5) Dimensionally compliant with ANSI B73.2	
	SPN	API 610 (OH5)	





BETWEEN BEARING PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
1 and 2 stage	Axially split	HSC / HSD / HSL HSR / ZW	HI design (BB1)	
		HSM	HI design (BB3)	
		ZM / ZMS ZLM / ZME	API design (BB1)	
	Radially split	HVN / J	API design (BB2)	
		RON / RON-D	API design (BB2)	
Multi-stage	Axially split	SM / SM-I	API design (BB3)	
		JTN	API design (BB3)	
	Radially split <i>single casing</i>	GP	API design (BB4)	
	Radially split <i>double casing</i>	A LINE	API design (BB5)	





VERTICAL PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
Single casing	Diffuser	VTP	HI & API 610 (VS1)	
		VCT	HI & API 610 (VS1)	
		HQ	HI & API 610 (VS1)	
		VLT	HI & API 610 (VS1)	
	Volute	DSV / DX	HI & API 610 (VS2)	
	Discharge through column – Axial flow	VAF	HI & API 610 (VS3)	
Double casing	Separate discharge line	VSP / VSP-Chem	HI & API 610 (VS4)	
	Diffuser	VLT / VMT	HI & API 610 (VS6)	
	Volute	DSV / DX	HI & API 610 (VS7)	
Submersible pumps		SMF	HI design (OH8A)	
		VLT-Sub / VTP-Sub	HI design (VS0)	





SPECIAL SERVICE PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Pitot tube pumps	COMBITUBE	HI design	
Reciprocating pumps	RDP	API 674 ISO 13710	
Vertical turbine generator	VTG	HI design (VS6)	
Barge	LS BARGE	HI design	
Floating dock pumps	ZVZ	HI design	
	LVZ	HI design	
Cryogenic pumps	SVNV	-	
	VTG Cryogenic	-	
	VLT Cryogenic VLTV	-	
Pre-packaged fire pump systems	Fire systems incorporate pumps, drivers, control systems and pipework in a single container. They can be skid mounted, with or without enclosure and supplied with electric motor or diesel engine.		 NFPA-20-850 UL and FM approved components

