RUHRPUMPEN

Specialist for Pumping Technology







Session 19 –

Overhung Process Pumps

Part 2 – Vertical Overhung Pumps Type OH3, 4, 5, 6

Simon Smith November 2022

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 40 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.

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Ruh*RP*umpen Short Courses

Here is a listing of all the previous courses.

- No 1 – API610 12th v 11th editions
- No 2 - Curve Shape
- No 3 – The Importance of System Curves
- No 4 - Selecting the Right Pump for the Application
- No 5 - NPSH & Nss
- No 6 - Mechanical Seals & Systems
- No 7 - Firepumps
- No 8 - BB5 Barrel Pumps
- No 9 - Pump Instrumentation
- No 10 – Non-Destructive Examination
- No 11 - Vertical Pumps (Part 1) Type VS1, VS2, VS3
- No 12 – Vertical Pumps (Part 2) Type VS4, VS5, VS6 & VS7
- No 13 – Performance Testing of Centrifugal Pumps; the What, the Why & the How
- No 14 – Testing & Inspection of API 610 Pumps
- No 15 – Start-Up, Commissioning & Troubleshooting Centrifugal Pumps
- No 16 – Introduction to Positive Displacement (Plunger) Pumps
- No 17 – Refresher Session
- No 18 – Overhung Process Pumps OH1 & OH2
- No 19 – Vertical Overhung Process Pumps OH3-OH6

Any you have missed you can get from our website using this link https://short-courses.ruhrpumpen.com/

Or from www.ruhrpumpen.com and follow the link to RP Short Courses

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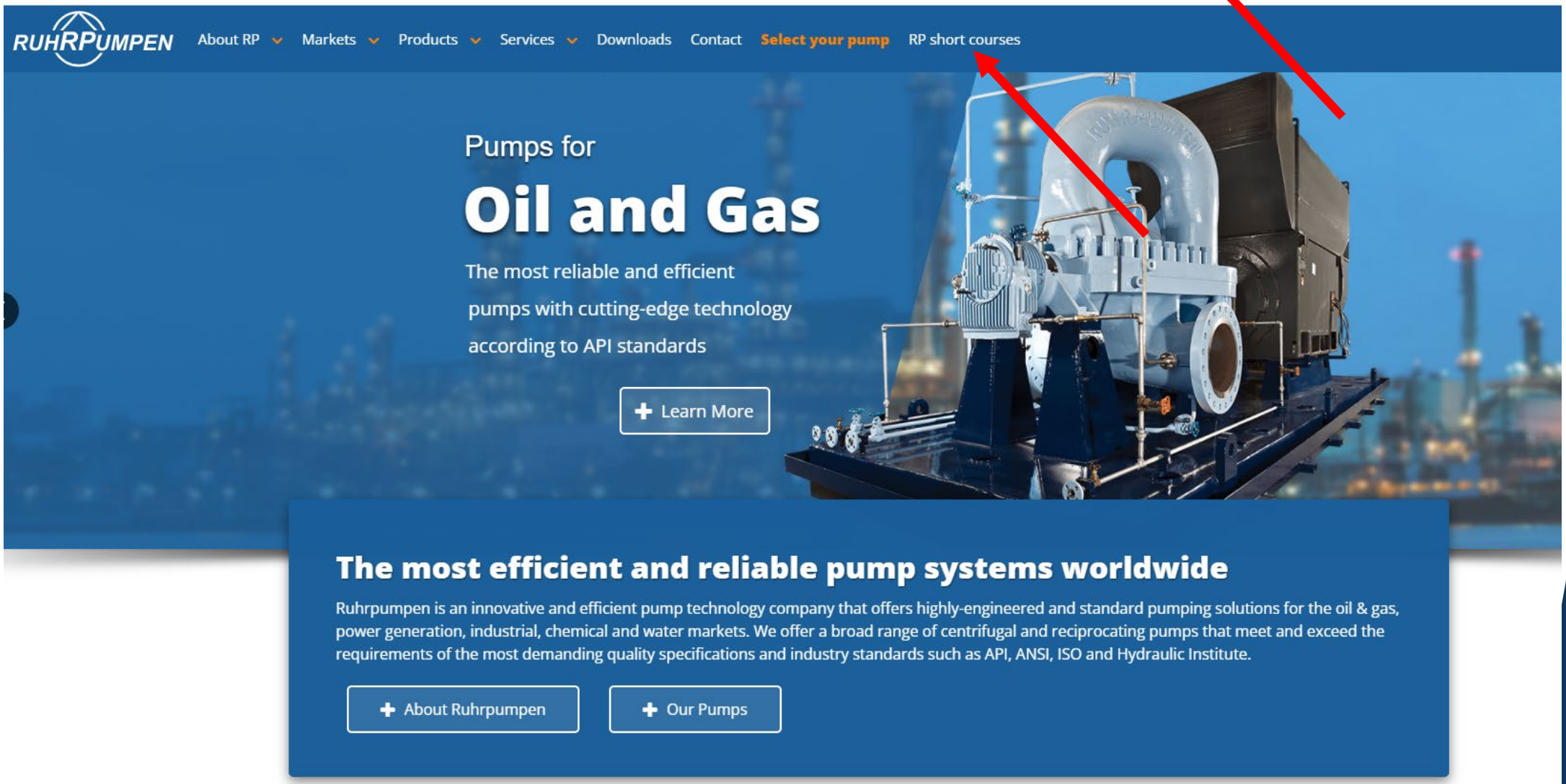

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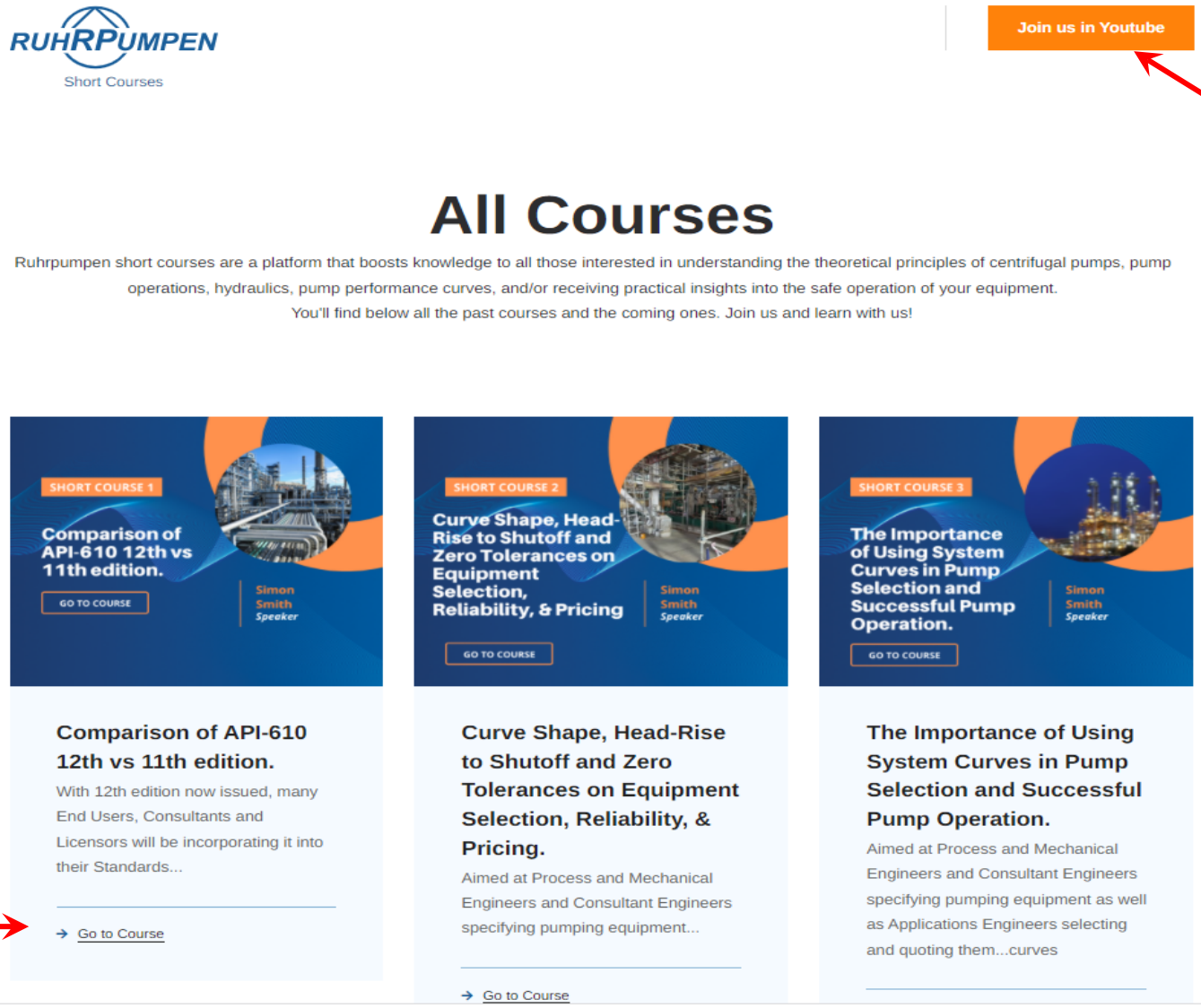


Session 18 –
Overhung Process Pumps
– Part 2 – Vertical API Types OH3, 4, 5, 6

Describing, comparing and contrasting the features and benefits of the various vertical overhung process pump configurations, OH3, 4, 5 & 6. Discussing when they are a suitable choice compared with the more conventional horizontal type OH2
Aimed at Process and Mechanical Engineers, and Consultant Engineers who specify pumping equipment as well as Applications & Sales Engineers selecting and quoting them.

“What’s the Difference?”

OH3, 4, 5 & 6 Pumps

What's the Difference? - API 610 definition

4.2.2.4 Pump Type OH3

Vertical, in-line, single-stage overhung pumps with separate bearing brackets shall be designated pump type OH3 (Figure 3). They have a bearing housing integral with the pump to absorb all pump loads. The driver is usually mounted on a support integral to the pump. The pumps and their drivers are flexibly coupled.

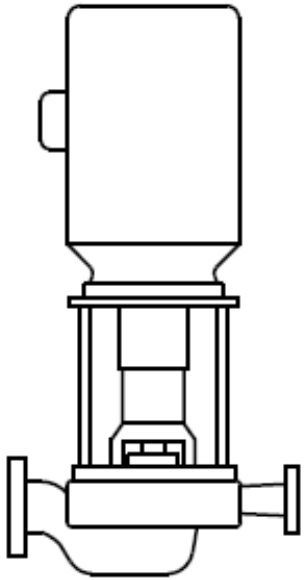


Figure 3—Pump Type OH3

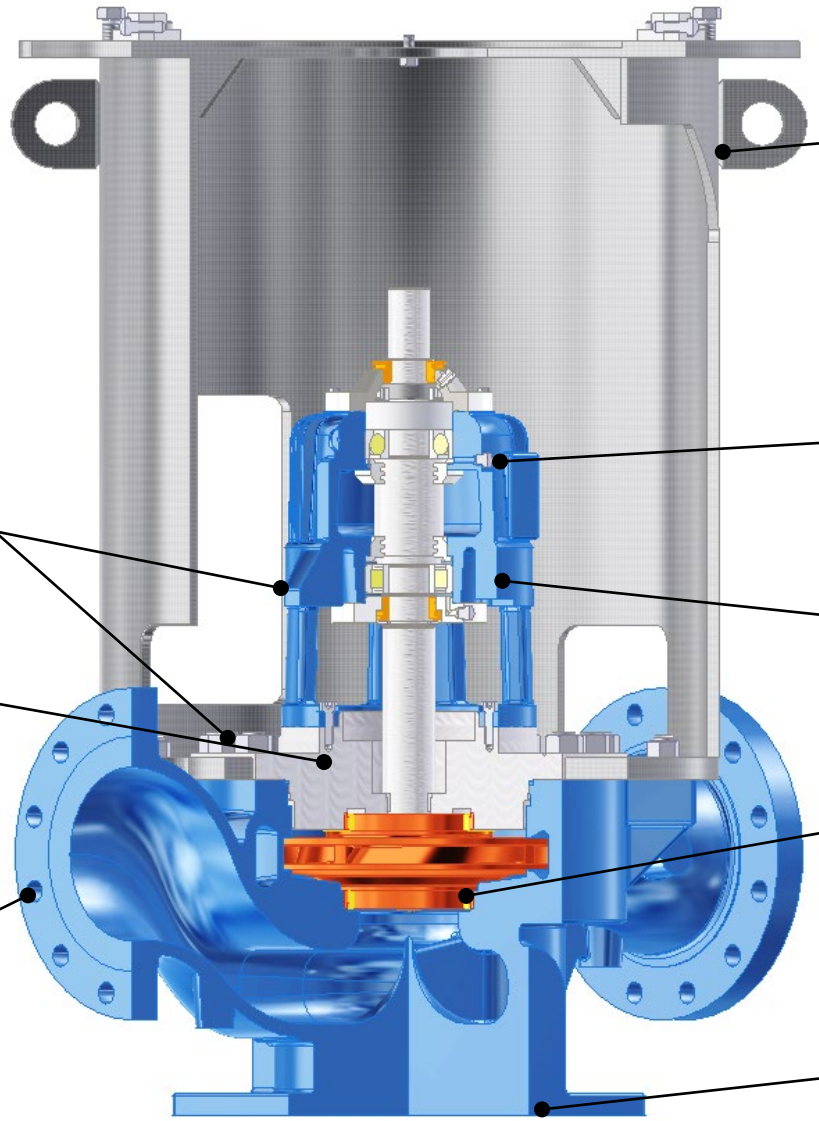
OH3 Pumps

MOTOR STOOL INSTALLED DIRECT TO THE PUMP VOLUTE
The motor stool mounts directly to the pump volute.

PADS IN BRACKET
To lift the bracket for maintenance

STUFFING BOX
For API Mechanical Seals

DIRECT CONNECTION TO THE PIPELINES
The In-Line pump design allows direct connection to the pipelines which reduces installation costs and minimizes the footprint.



MOTOR STOOL
Fabricated motor stool

BEARING FRAME SIZE 35, 55 & 75
Carries pump loads, standard option grease lubricated, Oil mist also available.

BACK PULL-OUT
For easy maintenance.

WEAR RINGS
Impeller and casing

FLAT CONTACT SURFACE
To make the pump stable if freestanding on a pad or foundation

General Description

SPI In-Line Vertical Pumps

- Vertical In-line pump
- Flexible Coupling
- Driver is usually mounted on support integral to the pump.
- Fully enclosed, balanced, one-piece design impeller
- Back pull-out design, without lifting the motor or suction and discharge pipework
- Flanged suction and discharge on common centerline casing
- Bearing housing (3 sizes)integral with the pump to absorb all pump loads
- D and C Motors

Capacity	450 m^3/h	2,000 US GPM
Head	200 m	656 ft
Temperature	-50°C to 450 °C	-58°F to 842 °F
Pressure	80 bar	1160 psi

OH3, 4, 5 & 6 Pumps

What's the Difference? - API 610 definition

4.2.2.5 Pump Type OH4

Rigidly coupled, vertical, in-line, single-stage overhung pumps shall be designated pump type OH4 (Figure 4). Rigidly coupled pumps have their shaft rigidly coupled to the driver shaft. (This type does not meet all the requirements of this standard; see Table 3.)

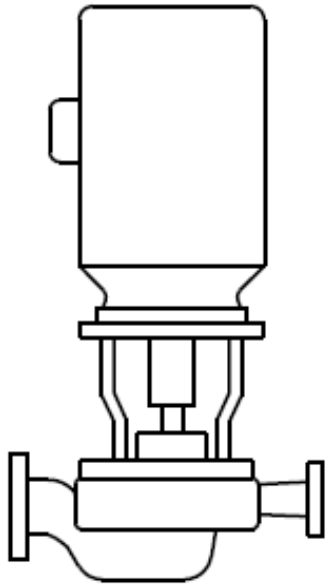
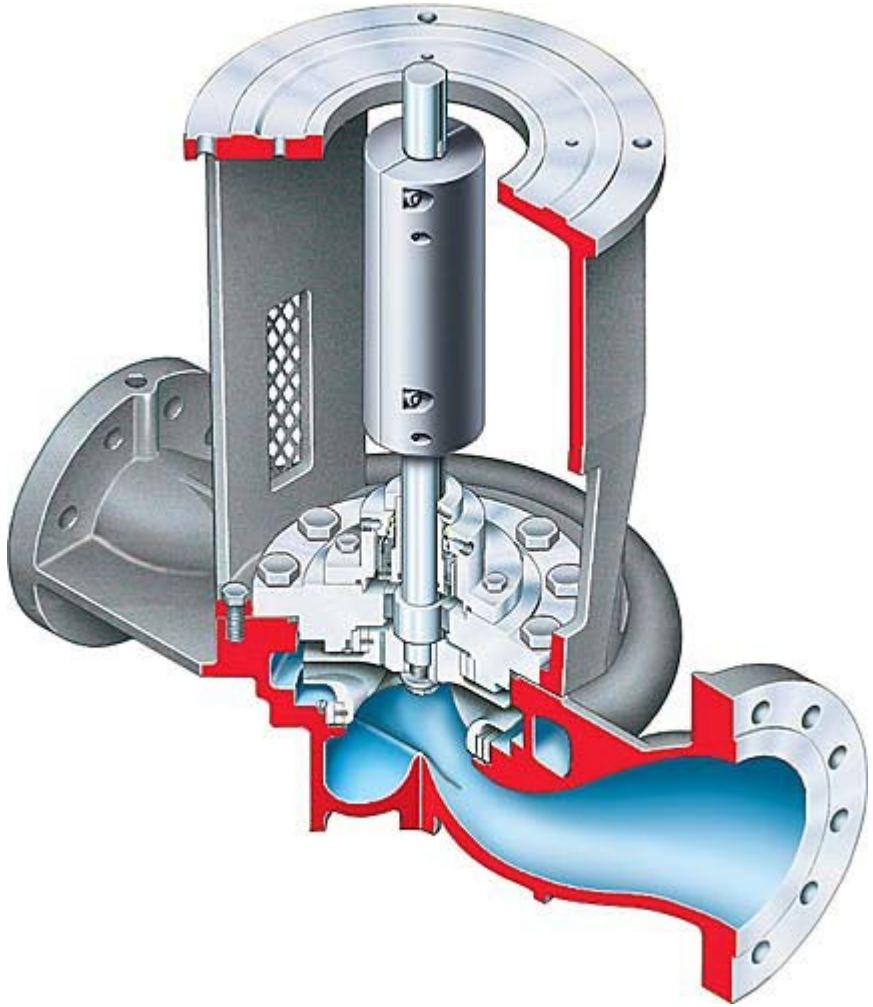


Figure 4—Pump Type OH4

OH4 Pumps



OH3, 4, 5 & 6 Pumps

What's the Difference? - API 610 definition

4.2.2.6 Pump Type OH5

Close-coupled, vertical, in-line, single-stage overhung pumps shall be designated pump type OH5 (Figure 5). Close-coupled pumps have their impellers mounted directly on the driver shaft. (This type does not meet all the requirements of this standard; see Table 3.)

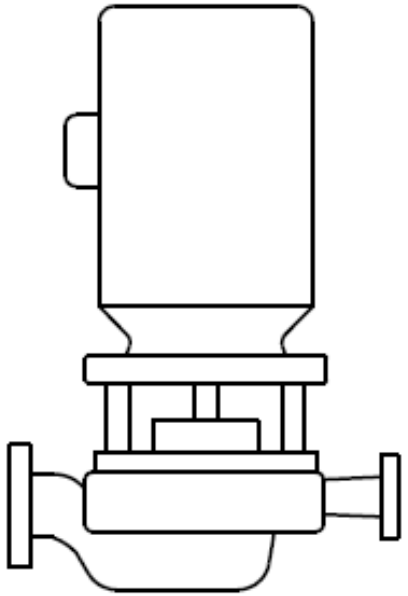
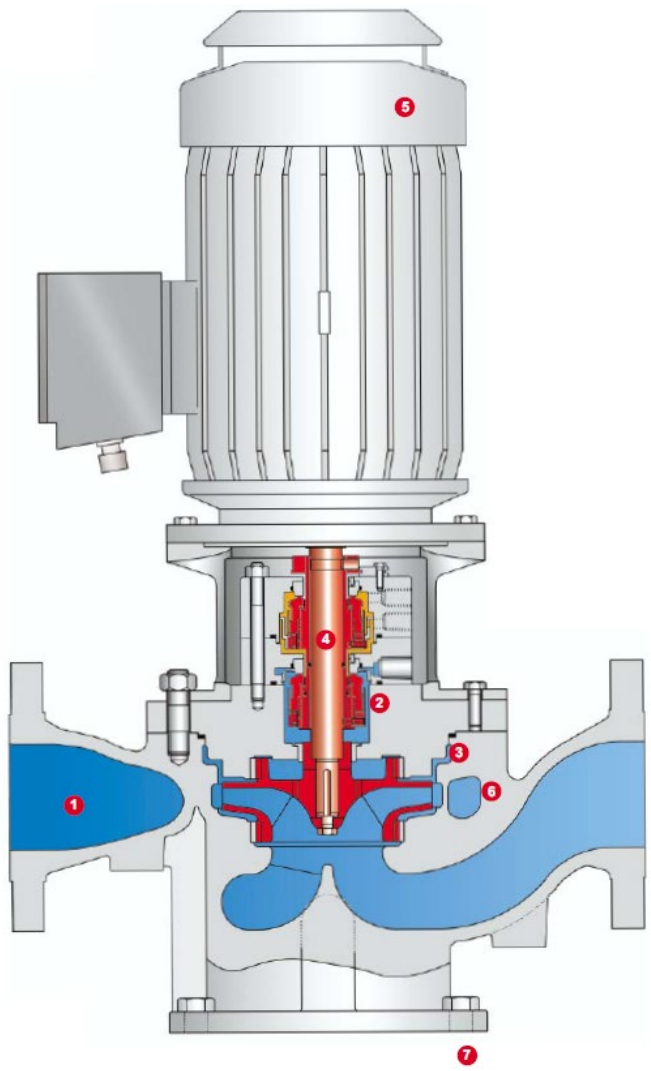


Figure 5—Pump Type OH5

OH5 Pumps



OH3, 4, 5 & 6 Pumps

What's the Difference? - API 610 definition

4.2.2.7 Pump Type OH6

High-speed, integral, gear-driven, single-stage overhung pumps shall be designated pump type OH6 (Figure 6). These pumps have a speed-increasing gearbox integral with the pump. The impeller is mounted directly to the gearbox output shaft. There is no coupling between the gearbox and pump; however, the gearbox is flexibly coupled to its driver. The pumps can be oriented vertically or horizontally.

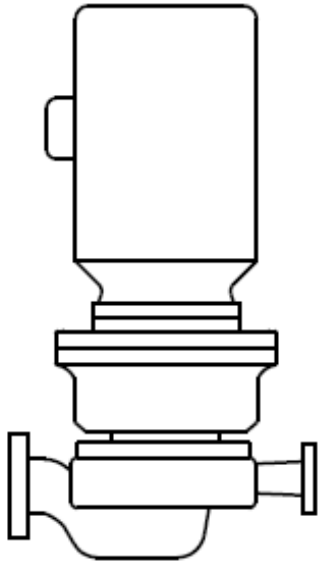
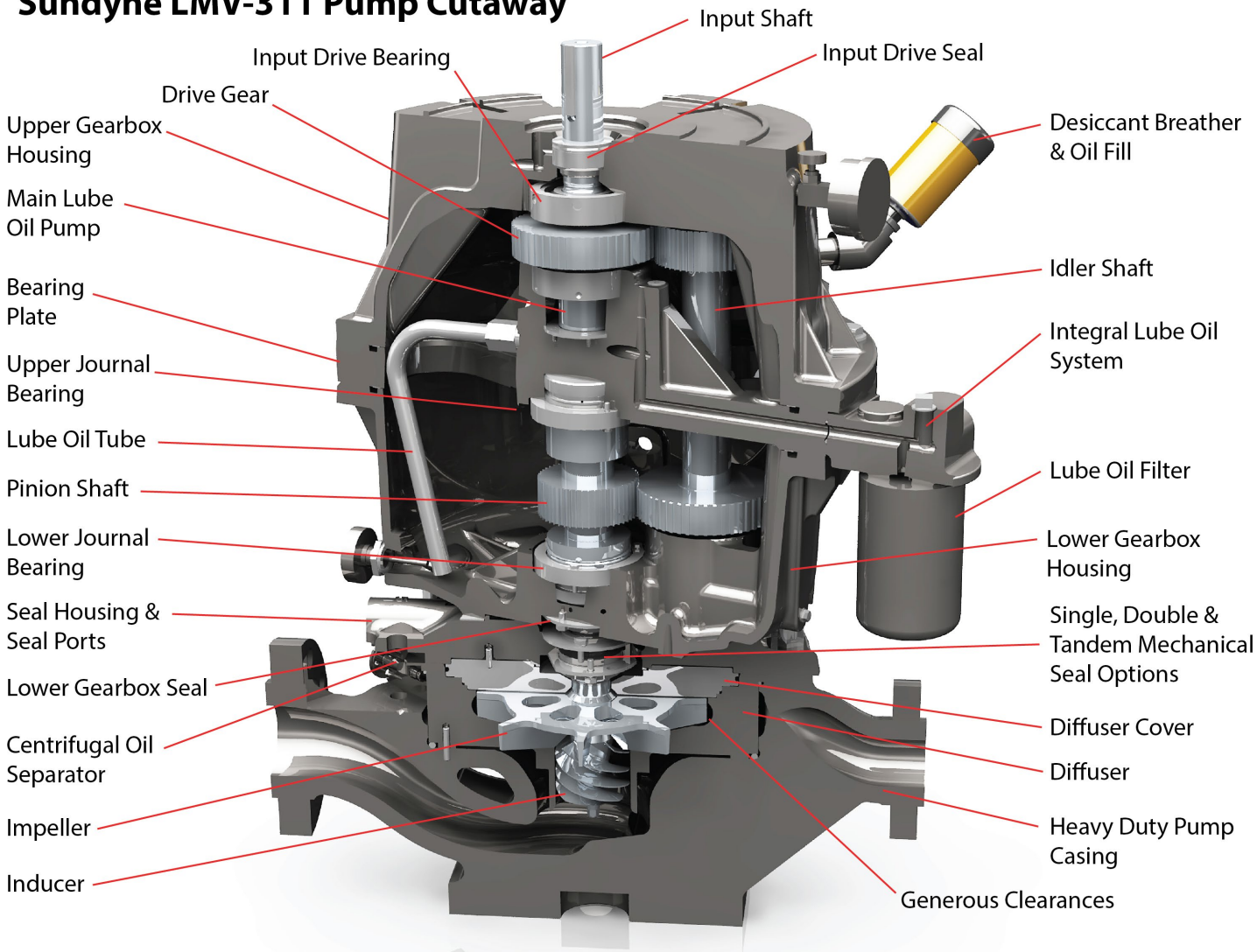


Figure 6—Pump Type OH6

Sundyne

OH6 Pumps

Sundyne LMV-311 Pump Cutaway



OH3, 4, 5 & 6 Pumps

What's the Difference? - API 610 definition

6.2 Pump types

The pump types listed in Table 3 have special design features and shall be furnished only if specified by the purchaser and if the manufacturer has proven experience for the specific application. Table 3 lists the features requiring special consideration for these pump types, and gives in parentheses the relevant subclause(s) of this International Standard.

Table 3—Special Design Features of Particular Pump Types

Pump Type	Features Requiring Special Consideration
Rigidly coupled vertical in-line, OH4	a) Motor construction (7.1.8, 7.1.9) b) Rotor stiffness (6.9.1.3) c) Product-lubricated guide bearing (6.10.1.1) d) Shaft runout at seal (6.6.9, 6.8.5)
Close-coupled (impeller mounted on motor shaft), OH5	a) Motor construction (7.1.8, 7.1.9) b) Motor bearing and winding temperature at high pumping temperatures c) Seal removal (6.8.2)

“Who Makes Them?”

OH3, 4, 5 & 6 Pumps

Who Makes Them?

API 610 Pump Models of the Key Global Manufacturers

	API Pump Type	Description	Sundyne	FLOWSERVE	SULZER	GOULDS PUMPS	KSB	EBARA	RUHRPUMPEN	Baker Hughes	CELEROS / CLYDEUNION PUMPS
Over Hung / Single Stage	OH1	Foot Mounted	Not Applicable								
	OH2	Centreline Mounted	SMK	HPXPHL	OHH/PRE	3700	RPH	UCW/UCS	SCE	TC	CUPOH2
	OH3	Vertical Inline Flexibly Coupled, Bearing bracket	LMV 801 CS	HPX-V	OHV	3910			SPI	VP	CUPOH3
	OH4	Vertical Inline Rigidly Coupling		MSP/DSVP				LPWM			CUPOH4
	OH5	Vertical Inline Close Coupled	LMV 80X	PVML		3900		LPW	SPN		
	OH6	High Speed Integrally Geared	LMV 3XX HMP/BMP								

Source – Kirit Domadiya - Sundyne

OH3 Pumps

RP Model SPI

Applicable Standards

The SPI corresponds to the following standards:

- API 610 11TH/12th Edition
- API 682 3RD Edition for mechanical seals
- ATEX (Explosion Protection Directive 94/9/EC)

  The pump line is designed to meet group II, category 2 G (intended use in zone 1). This includes category 3 (intended use in zone 2).

  The required risk analysis for the pumps has been performed at Ruhrpumpen.

  Basis for the analysis are the standards EN 13463-1, EN 13463-5 and EN 1127. Ex II 2G c X

  The final documentation is retained at the notified body.

General Description

SPI In-Line Vertical Pumps

- Vertical In-line pump
- Flexible Coupling
- Driver is usually mounted on support integral to the pump.
- Fully enclosed, balanced, one-piece design impeller
- Back pull-out design, without lifting the motor or suction and discharge pipework
- Flanged suction and discharge on common centerline casing
- Bearing housing (3 sizes)integral with the pump to absorb all pump loads
- D and C Motors

SPI
1.5 X 1.5 X 8
2 X 2 X 7
2 X 2 X 10
2 X 2 X 12
3 X 3 X 7
3 X 3 X 9 A
3 X 3 X 9 B
4 X 4 X 8
4 X 4 X 9
3 X 3 X 12
3 X 3 X 15
4 X 4 X 12
4 X 4 X 15
6 X 6 X 10
6 X 6 X 12
6 X 6 X 15
8 X 8 X 10
8 X 8 X 12
8 X 8 X 15
12 X 10 X 20
6 X 26

Capacity	450 m^3/h	2,000 US GPM
Head	200 m	656 ft
Temperature	-50°C to 450 °C	-58°F to 842 °F
Pressure	80 bar	1160 psi

Applications

- The Ruhrpumpen In-Line Pumps OH3 are designed for continuous duty, pumping various fluids, with a combination of mechanical and installation features for applications in petroleum, petrochemical, and industrial product service.

  - Refinery Process Services
  - Off-site hydrocarbon
  - Tank Transfer
  - Tank Farm Booster
  - Fuel Oil
  - Gasoline
  - Crude Oil
  - LPG
  - Water
  - Naptha
  - Kerosene

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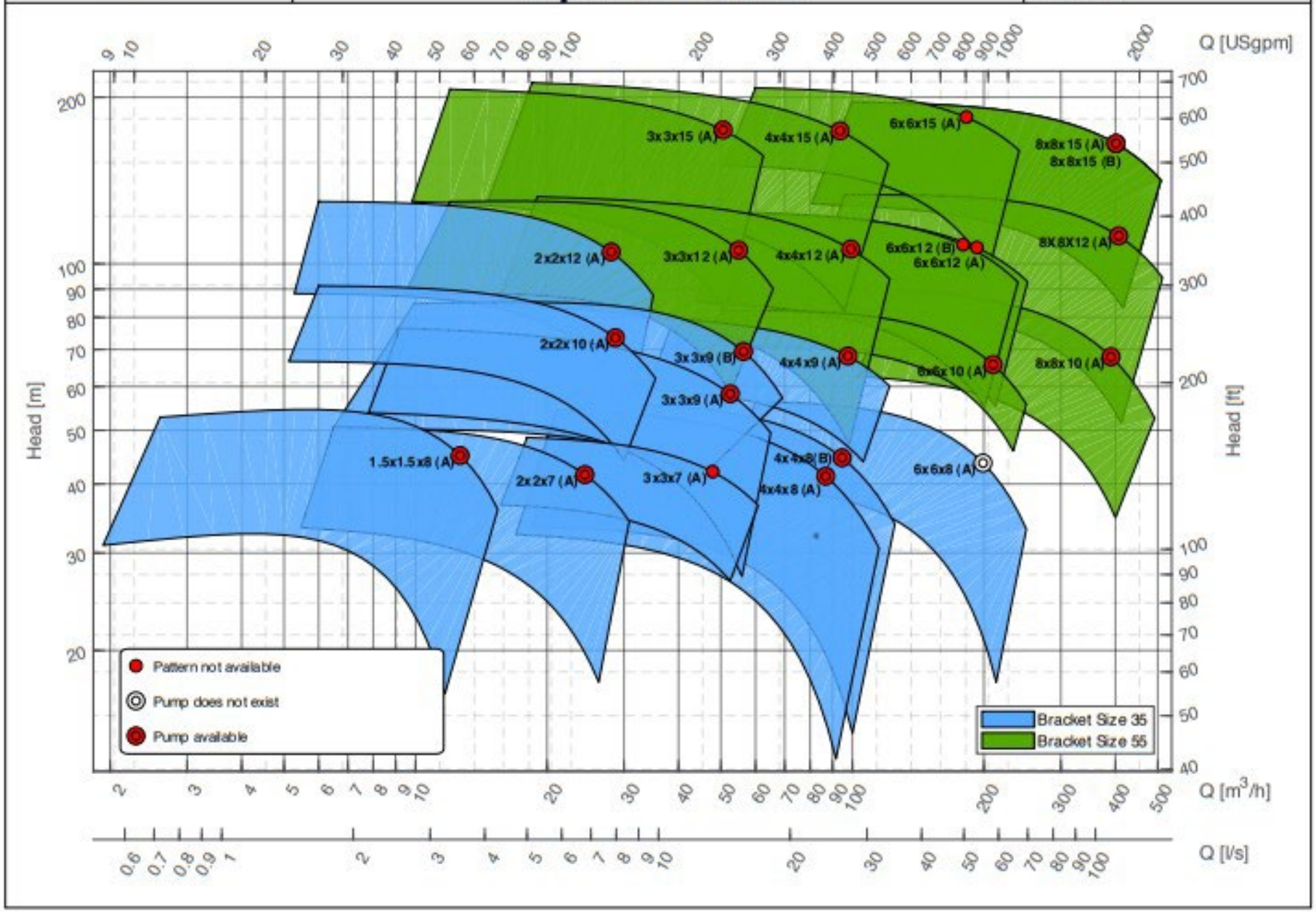
SPI Selection Chart
2 poles - 50Hz

Drawn by:	AMJ
Date:	21-Aug-2018
Drawing:	51046200001
Version:	01



RUHRPUMPEN

SPI Selection Chart
2 poles - 60Hz

Drawn by:	AMJ
Date:	21-Aug-2018
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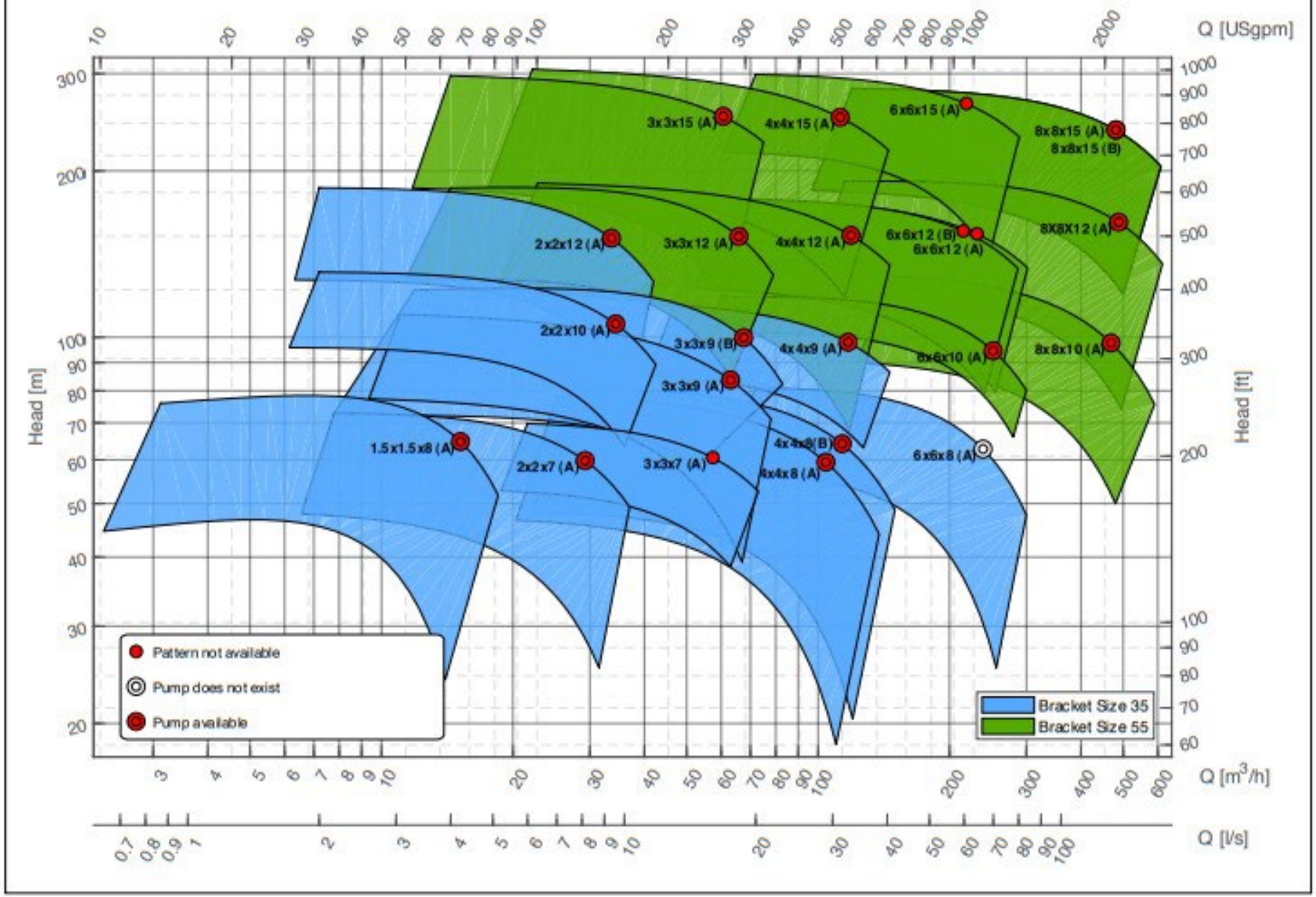
Version:	01



Advantage of OH3 SPI line over OH2

Vertical Inline Pump Design eliminates the need for an expensive base-plate and saves valuable floor space.

- Reduces footprint
- Saves in platform, FPSO deck cost
- Reduces installed weight vs OH2 systems
- Do not require grouting

LESS SPACE REQUIREMENT

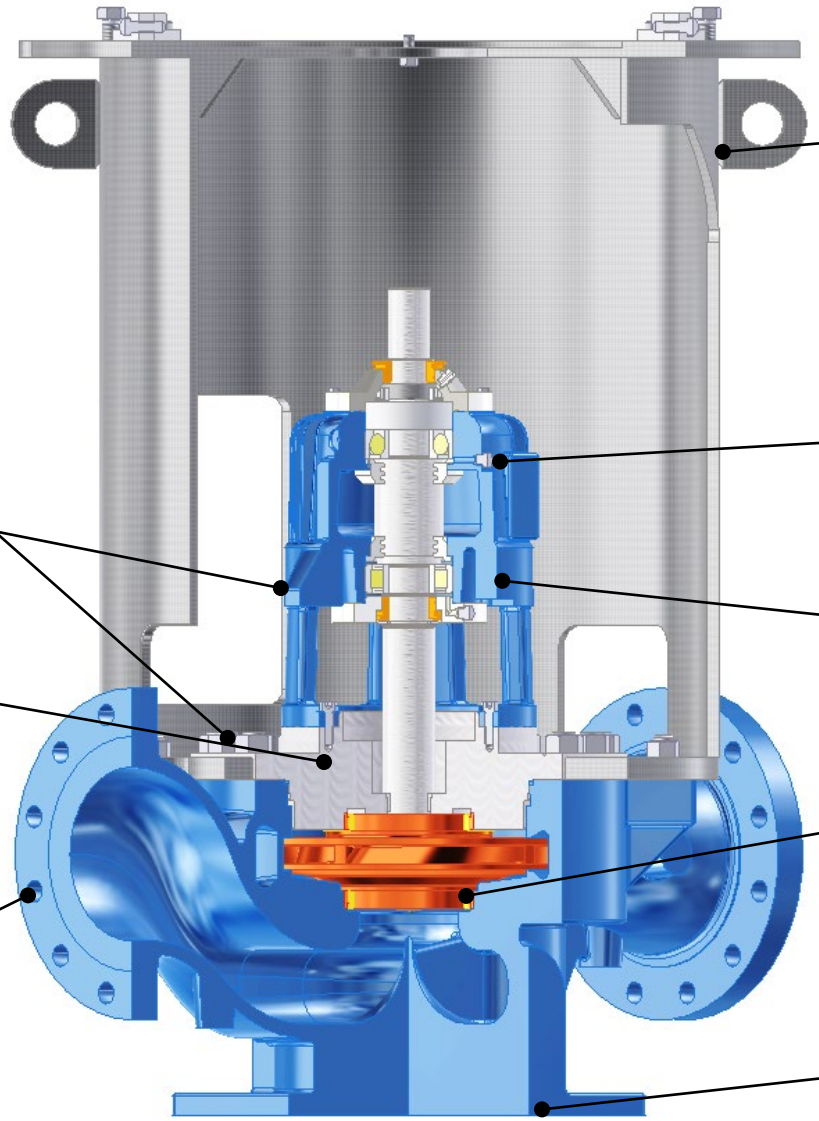
OH3 (SPI) - Characteristics

MOTOR STOOL INSTALLED DIRECT TO THE PUMP VOLUTE
The motor stool mounts directly to the pump volute.

PADS IN BRACKET
To lift the bracket for maintenance

STUFFING BOX
For API Mechanical Seals

DIRECT CONNECTION TO THE PIPELINES
The In-Line pump design allows direct connection to the pipelines which reduces installation costs and minimizes the footprint.



MOTOR STOOL
Fabricated motor stool

BEARING FRAME SIZE 35, 55 & 75
Carries pump loads, standard option grease lubricated, Oil mist also available.

BACK PULL-OUT
For easy maintenance.

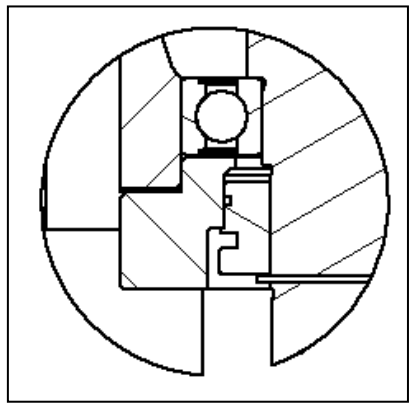
WEAR RINGS
Impeller and casing

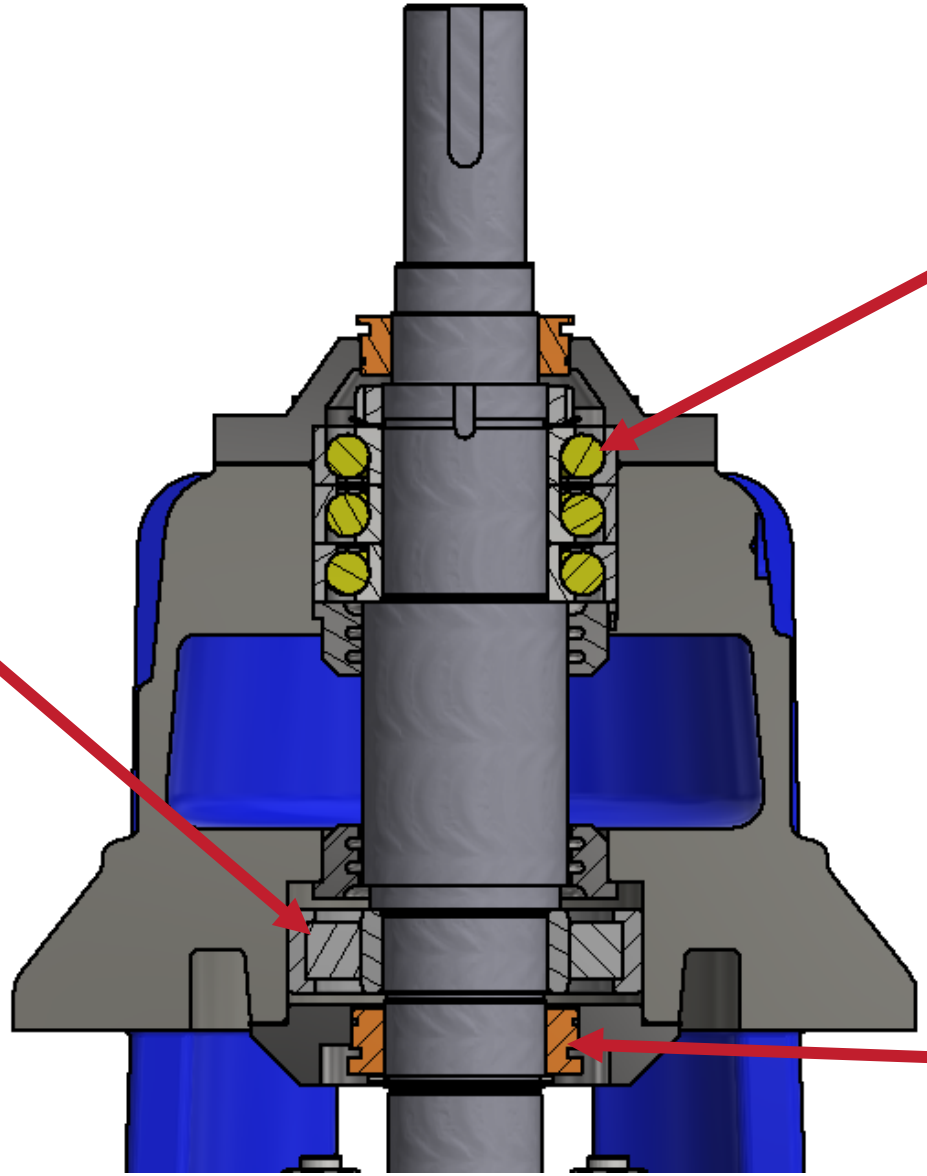
FLAT CONTACT SURFACE
To make the pump stable if freestanding on a pad or foundation

OH3 (SPI) - Characteristics

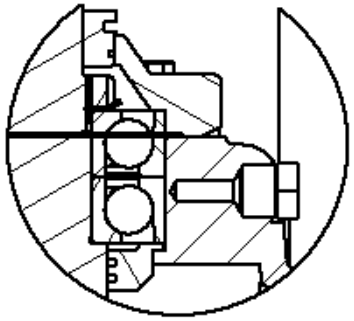
Bracket specification

- Deep groove ball bearings used for radial bearings for bearing bracket 35
- Cylindrical roller bearings are used for the rest of the bearing brackets





- Dual Row Thrust Bearings in back-to-back – and tandem arrangement
- Heavy duty thrust bearings allow higher suction pressure as standard by bracket 55
- Bracket 35 use the same bearing arrangement as SCE



- Labyrinth seal for bearing housing sealing
- Designed with internal taper to prevent oil flow to mechanical seal during disassembly

OH3 (SPI), S-6 Standard MOC

ITEM DESCRIPTION	ASTM DESCRIPTION
VOLUTE CASING	A 216 Gr. WCC + QT 300 (Casting)
CASING COVER	A 216 Gr. WCC + QT 300 (Casting) or A 516 Gr. 70 (Plate)
IMPELLER	A 487 Gr. CA6NM Class A (Casting)
WEAR RINGS	A 743 Gr. CA6NM (340-375HB) - UNS J91540 (Casting) or A 240 Type 410 (340-375HB) - UNS S41000 (Wrought) or A 276 Type 420 (340-375HB) - UNS S42000 (Bar)
CASING COVER WEAR RING	A 743 Gr. CA6NM (340-375HB) - UNS J91540 (Casting) or A 240 Type 410 (340-375HB) - UNS S41000 (Wrought) or A 276 Type 420 (340-375HB) - UNS S42000 (Bar)
PUMP SHAFT	A 434 Gr. 4140 Cl BC (Bar) or A 322 Gr. 4140 - UNS G414000 (Bar)
STUFFING BOX BUSHING	A 743 Gr. CA6NM (340-375HB) - UNS J91540 (Casting) or A 240 Type 410 (340-375HB) - UNS S41000 (Wrought) or A 276 Type 420 (340-375HB) - UNS S42000 (Bar)
CONTINUOUS STUD - VOLUTE CASING	A 193 Gr. B7 (Zinc Plated)
HEX NUT - VOLUTE CASING	A 194 Gr. 2H (Zinc Plated)
ANTI-FRICTION BEARING	BECBM (Machined Brass Cage Ring)
RADIAL BALL BEARING	6211 or 6211-Z (Steel Stamped Cage Ring)
RADIAL ROLLER BEARING	ECJ (Steel Stamped Cage Ring)
BEARING BRACKET	A 216 Gr. WCB - UNS J03002 (Casting)
MOTOR STOOL	A 36 (Plate) and A 53 Gr. B (Structural Pipe)
GREASE RETAINERS	A 36 (Plate)
BEARING COVER DE	A 216 Gr. WCB - UNS J03002 (Casting) or A 36 (Plate)*
BEARING COVER NDE	A 36 (Plate)

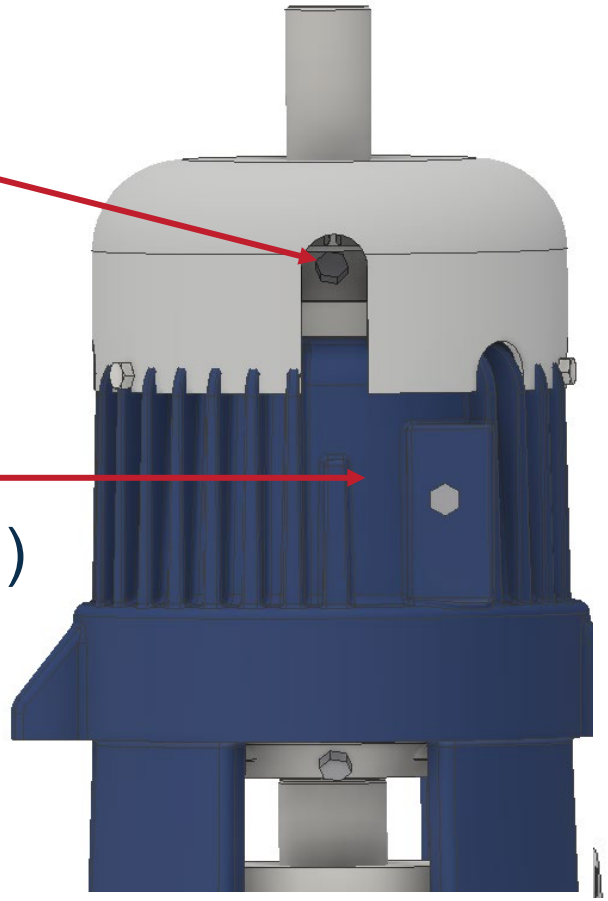
Also…	
Description	**API Option**
Carbon Steel	S-1, S-4, S-5, S-6, S-8
12 % CR	C-6
316 AUS	A-8
Duplex	D-1
Super Duplex	D-2

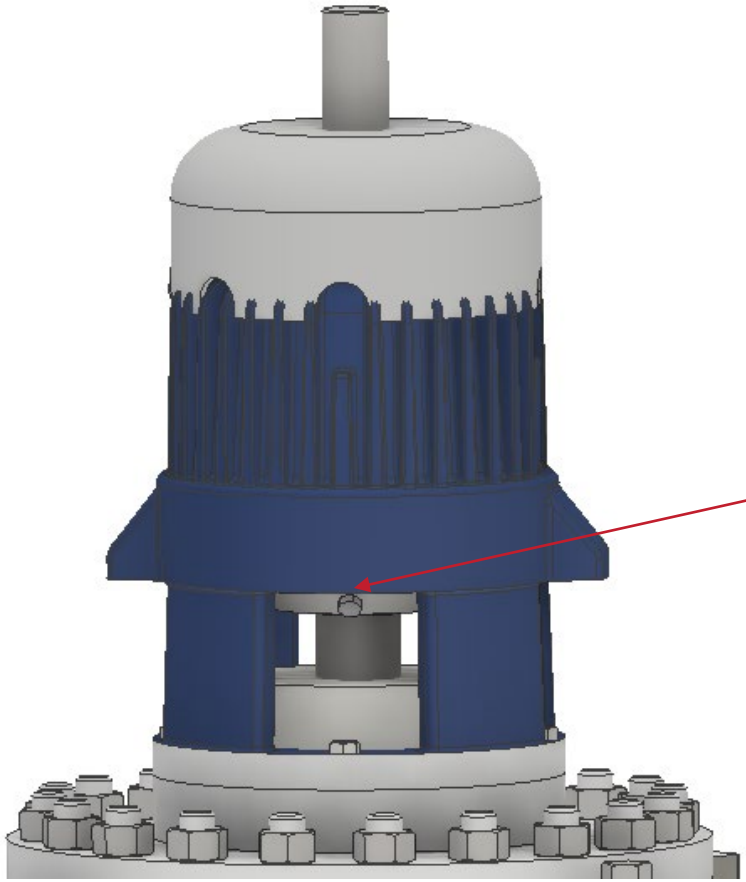
Lubrication

- **Oil mist**

Oil mist inlet
¼ NPT (Axial)

Oil mist inlet
¼ NPT (Radial)

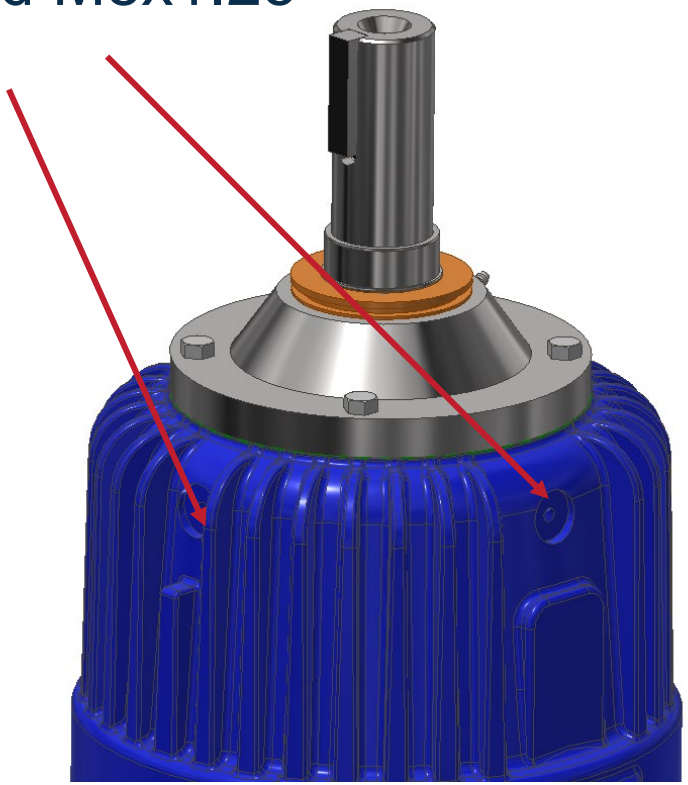




Oil mist Outlet
¼ NPT

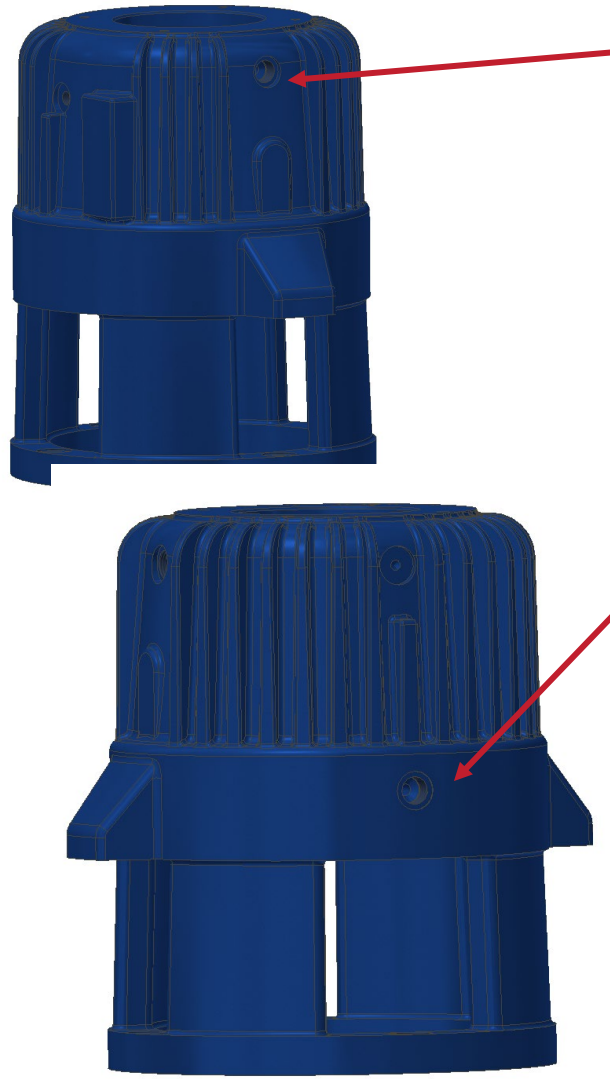
Temperature/Vibration- provision

Vibration provision
1.Flat Surface (standard)
2.Thread M8x1.25

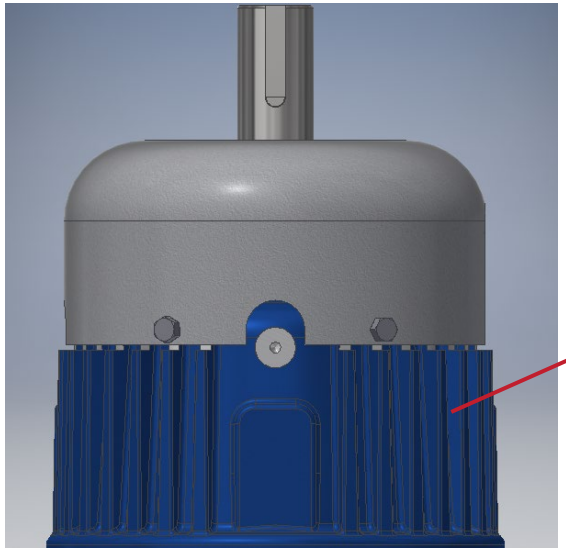


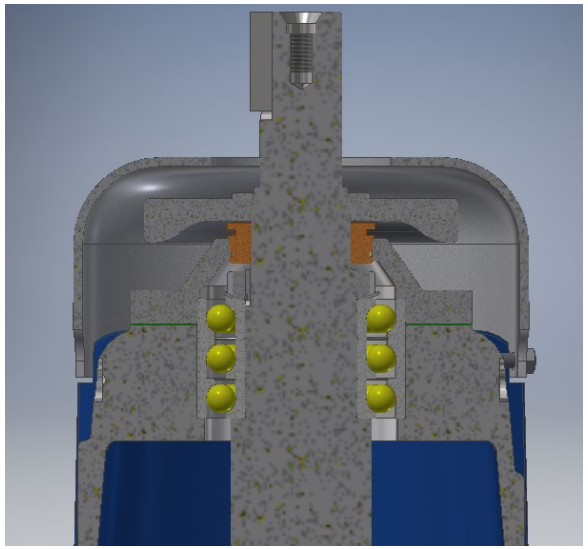
Temperature provision
½ NPT

Temperature
provision
½ NPT



Bearing cooling



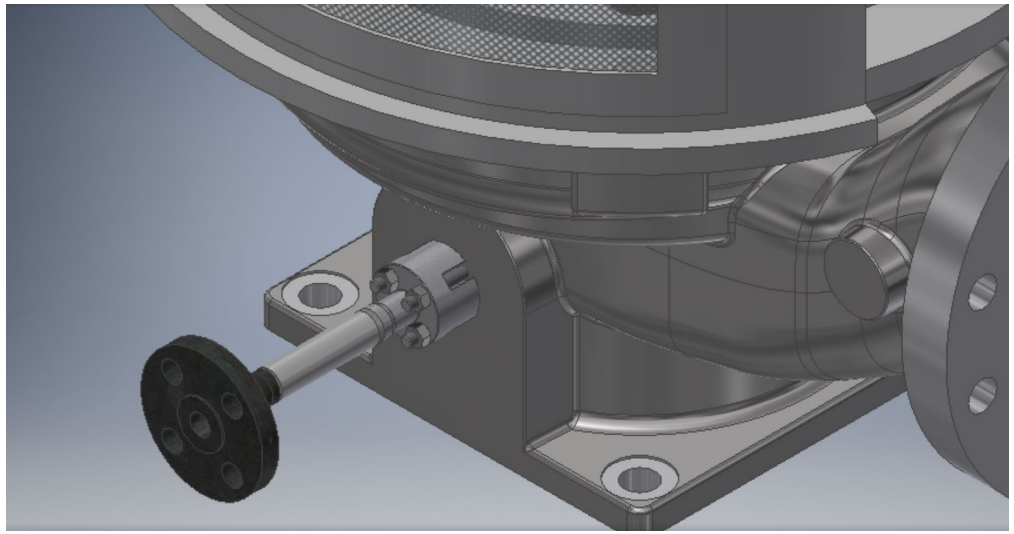


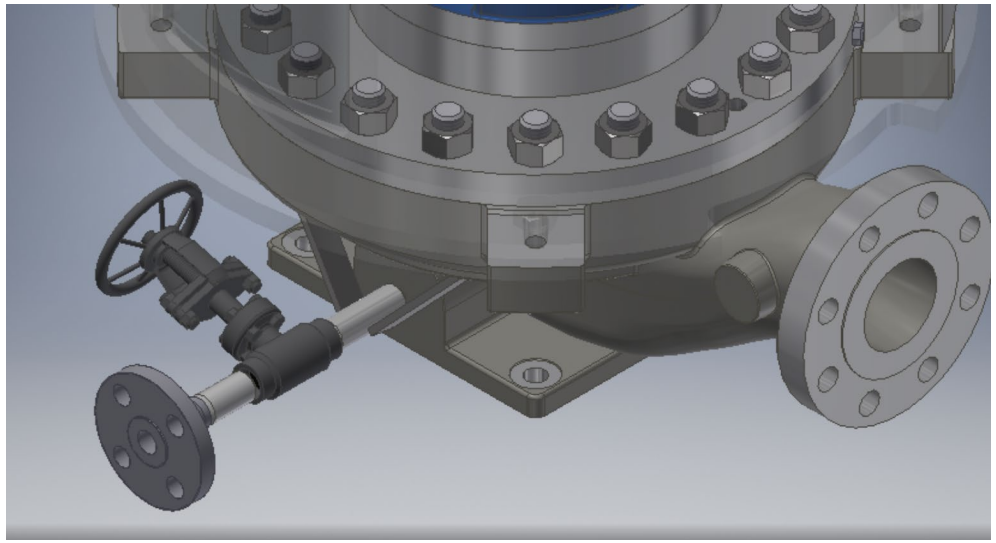
- The bearing bracket has a ribs and fan to assist cooling by natural and forced convection. This design is sufficient for temperatures up to 248 ° F 120° C) as standard.

PROCESS FLUID TEMPERATURE		
[°F]	[°C]	FAN
T ≤ 248	T ≤ 120	Optional
T > 248	T > 120	Standard

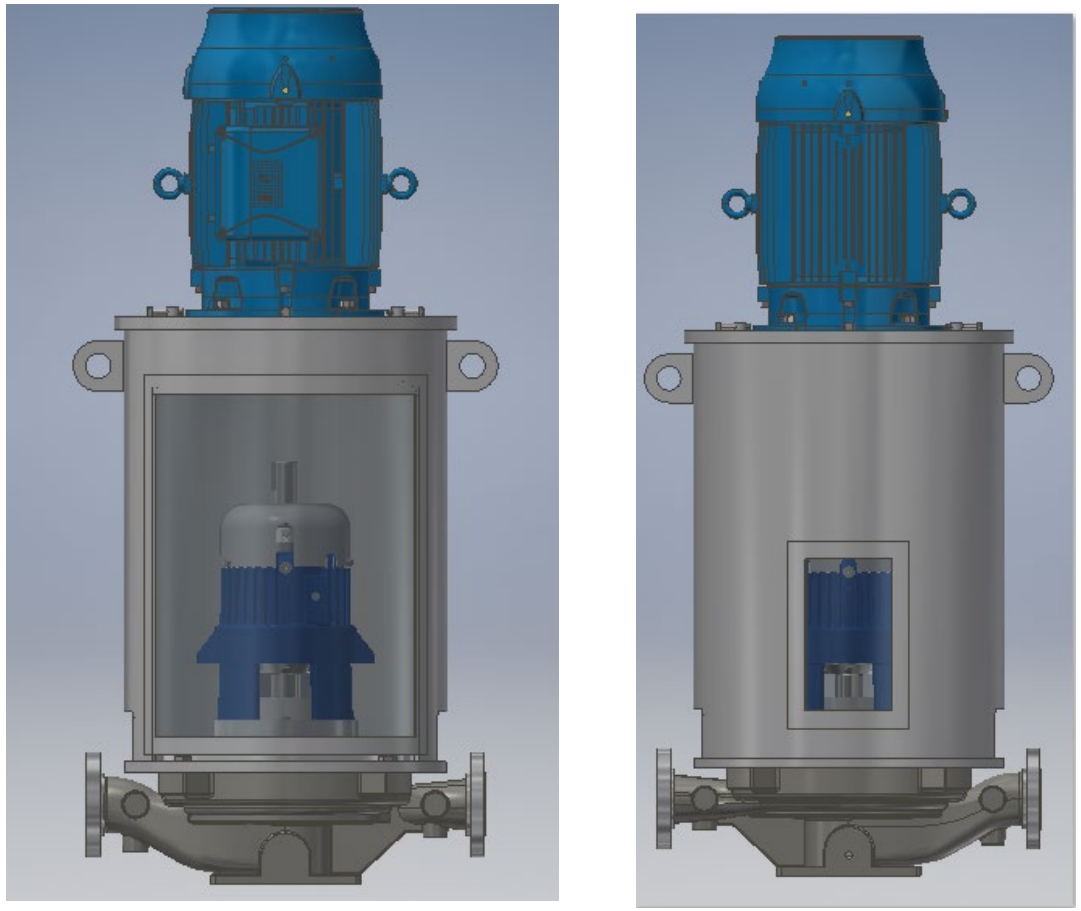
Case connection

- Integrally flanged as standard (see separate presentation)
- Reduced need for welding and therefore NDE
  - Reduced manufacturing time
  - Easy maintenance
  - Integrated orifice for seal plans connected to the casing.
- Option for socket welded case connections if required by specification

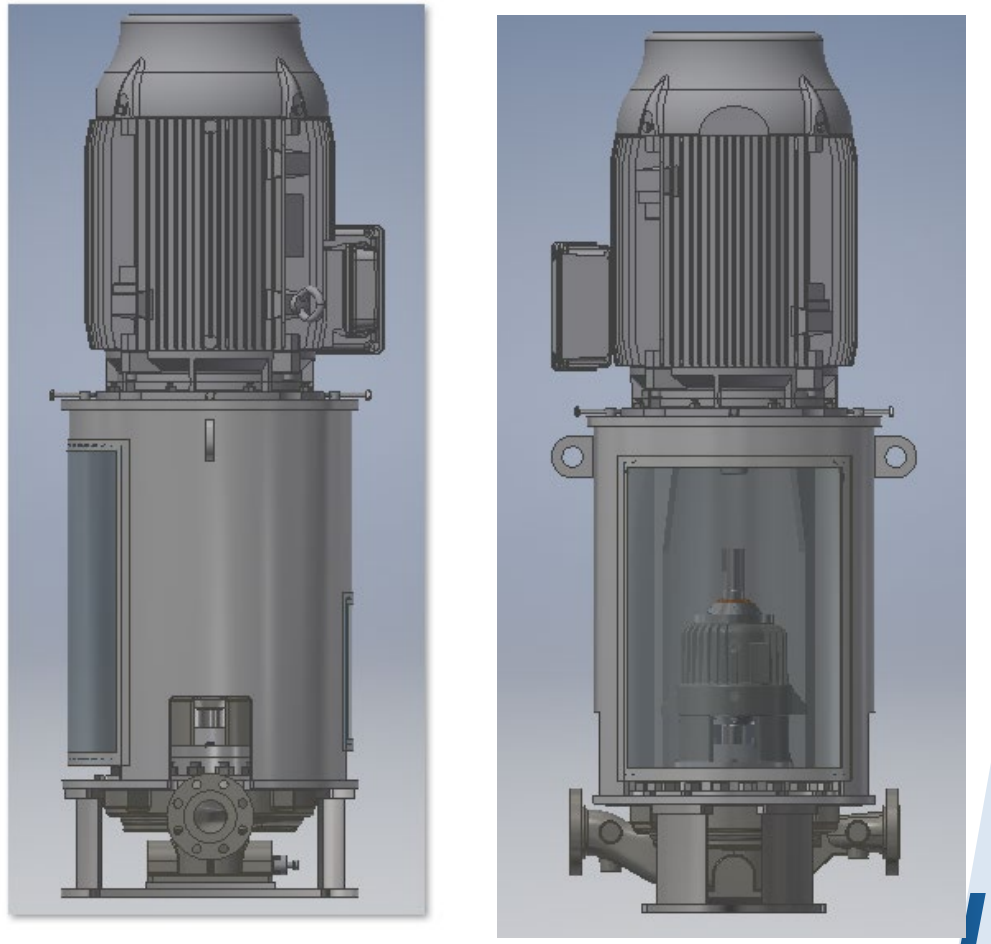




Motor Stool



Standard Design

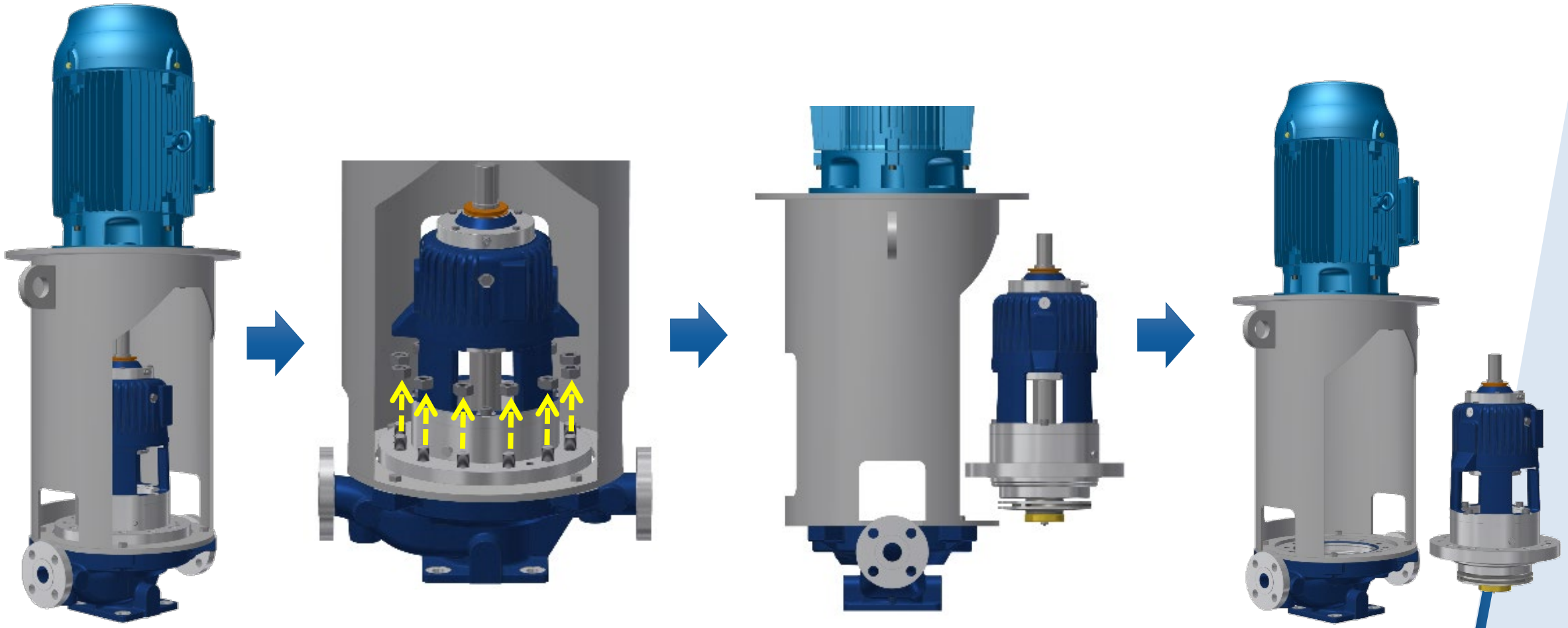


Heavy duty Design

Back Pull-Out

- Easy Installation
- Mount in the pipeline
- Support on pipe or foundation
- Save space
- Save time

OH3 (SPI) - Back Pull-out Design



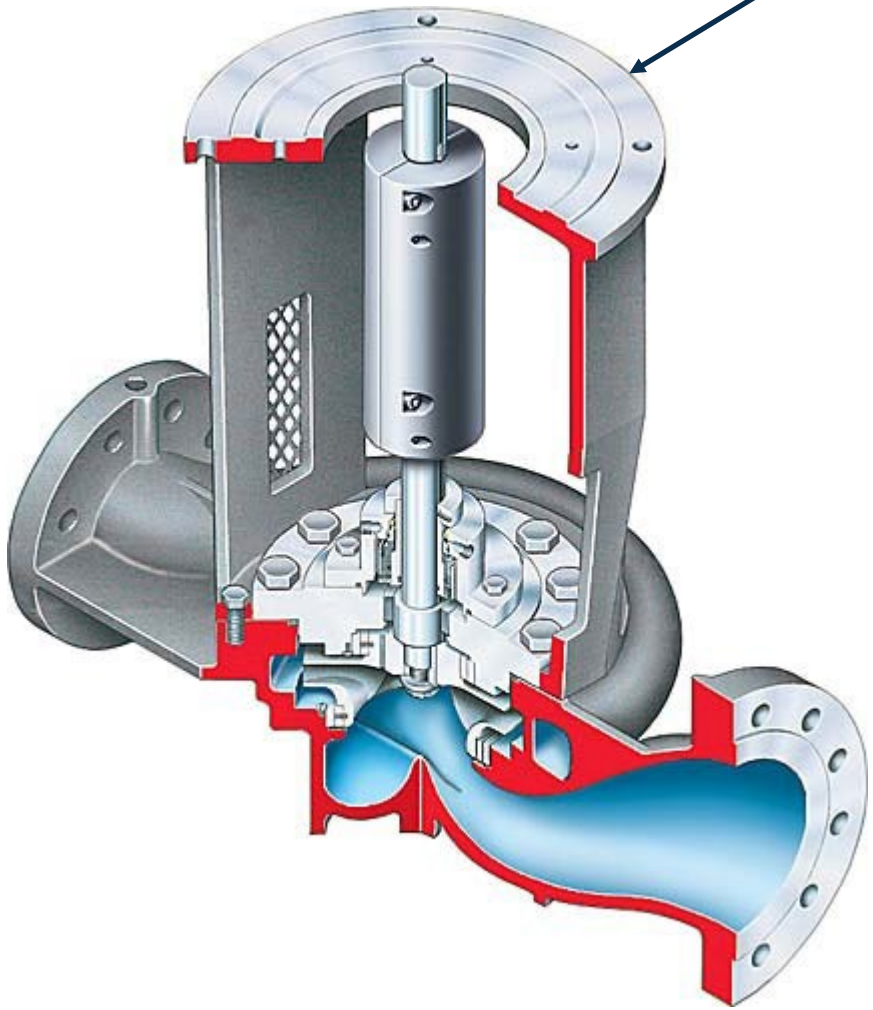
OH4 Pumps

RP Model IVP (Armstrong Heritage) & IIL (Deming Heritage)

OH4 Pumps

Ruhrpumpen Model IVP

Flowserve Model W



OH3, 4, 5 & 6 Pumps

Who Makes Them?

API 610 Pump Models of the Key Global Manufacturers

	API Pump Type	Description	Sundyne	FLOWSERVE	SULZER	GOULDS PUMPS	KSB	EBARA	RUHRPUMPEN	Baker Hughes	CELEROS / CLYDEUNION PUMPS
Over Hung / Single Stage	OH1	Foot Mounted	Not Applicable								
	OH2	Centreline Mounted	SMK	HPXPHL	OHH/PRE	3700	RPH	UCW/UCS	SCE	TC	CUPOH2
	OH3	Vertical Inline Flexibly Coupled, Bearing bracket	LMV 801 CS	HPX-V	OHV	3910			SPI	VP	CUPOH3
	OH4	Vertical Inline Rigidly Coupling		MSP/DSVP				LPWM			CUPOH4
	OH5	Vertical Inline Close Coupled	LMV 80X	PVML		3900		LPW	SPN		
	OH6	High Speed Integrally Geared	LMV 3XX HMP/BMP								

Source – Kirit Domadiya - Sundyne

OH4 Pumps

Not very common in API build
Ruhrpumpen does not offer an OH4 build pump in API build

For these pumps the thrust is taken in the motor. The motor construction might not meet API 7.1.8 / 7.1.9

They might not meet the API shaft deflection at seal requirement of 50 micrometers 6.9.1.3 or runout of 25 micrometers 6.6.9/6.8.5

They will have a product lubricated guide bushing due to the long distance between the mechanical seal and the motor bearings (API 6.10.1.1)

Ruhrpumpen (and several other manufacturers) do have ranges of NON-API OH4 pumps for water and general industrial service

IVP/IVP-CC Performance Data

Non-API Pump

IVP/IVP-CC PERFORMANCE DATA		
Capacity	to 2271 m3/h	to 10000 GPM
Head	to 152 m	to 500 ft
Pressure	to 15 bar	to 217 psig
Temperature	-20 °C to 150 °C	-4 °F to 300 °F
Discharge flange size	25 mm to 200 mm	1" to 8"
Available in 28 hydraulic sizes		

Features & Benefits IVP

Non-API Pump

MOTOR ADAPTER DIRECT TO THE PUMP VOLUTE
The motor adapter mounts directly to the pump volute to save space and provide proper alignment.

ECONOMIC SEAL OPTION (TYPE 1)
Options exist to select between internally or externally mounted mechanical seal, which allows choice between high performance or economical seals.

DIRECT CONNECTION TO THE PIPELINES
The IVP pump design allows direct connection to the pipelines which reduces installation costs and minimizes the footprint.

NO PUMP BEARINGS
to service in the IVP design

BACK PULL-OUT
A back pull-out configuration provides easy access to interior areas without disturbing piping connections.

EASY REPLACEMENT OF THE MECHANICAL SEAL
through a split-coupled design, without disconnecting the pump from the pipeline or removing the motor.

Features & Benefits IVP

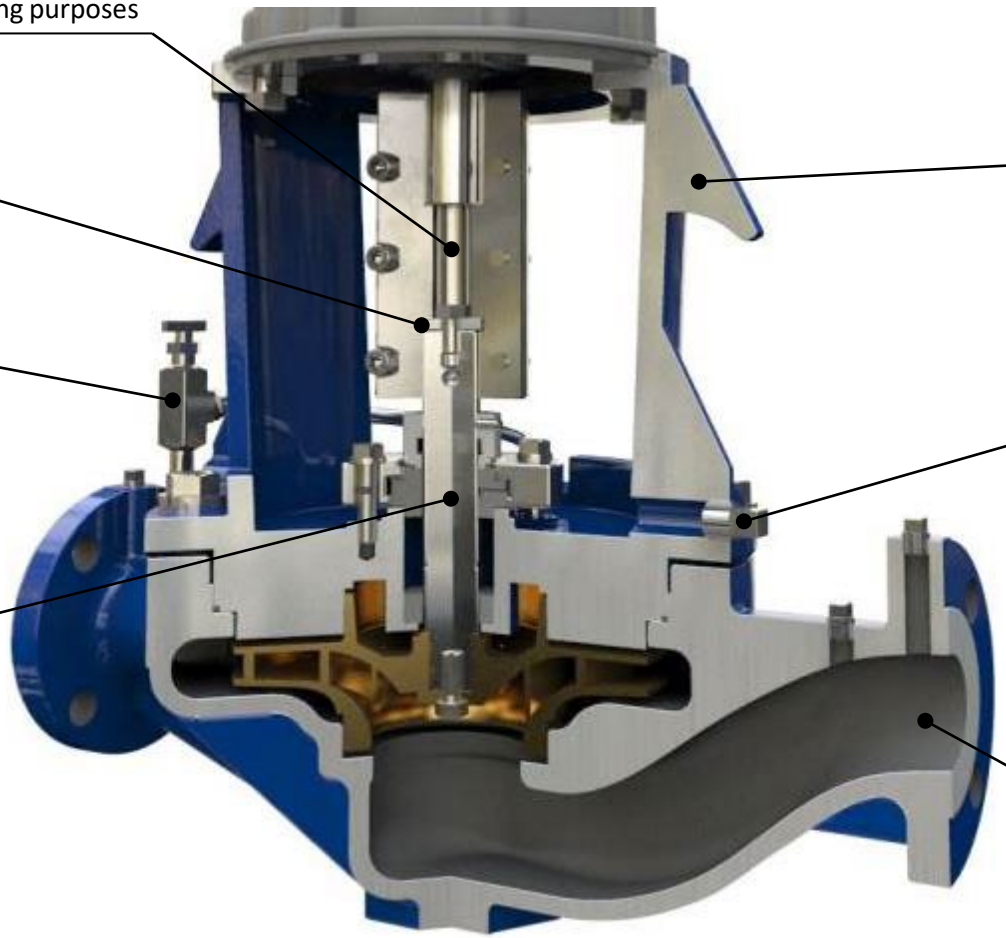
Non-API Pump

SPACER BETWEEN IMPELLER AND SHAFT
In some sizes for manufacturing purposes

WASHERS
for axial retention

AIR RELIEF VALVE
avoids air accumulation

STAINLESS STEEL PUMP SHAFT
with radial support through graphite throat bushing



EASY HANDLE
with lifting ears

DRAINER FOR CONDENSATED WATER
avoids accumulation of condensated water

RADIALLY SPLIT CASE
with ASME flanges FF Class 125 and 250

OH5 Pumps

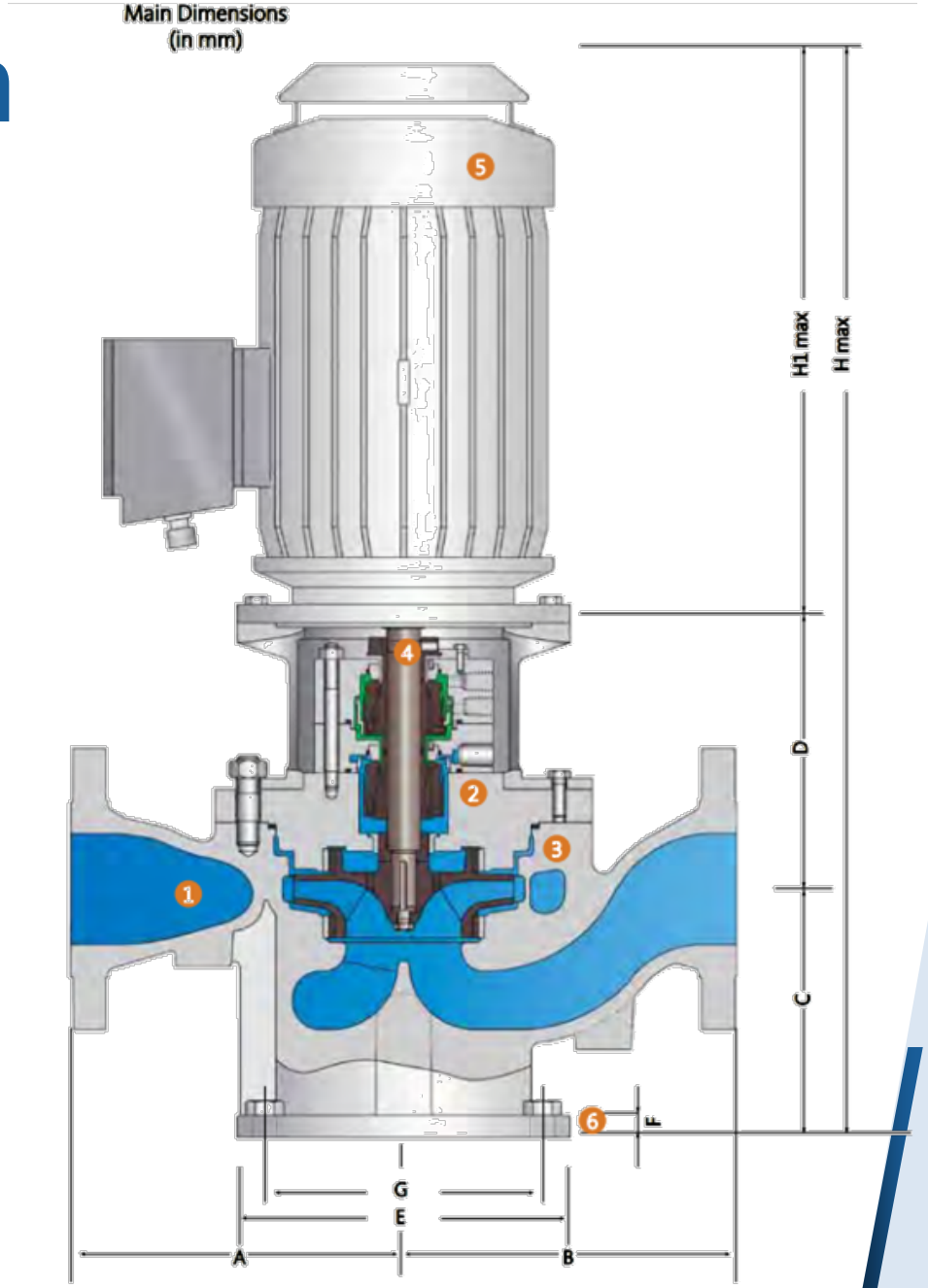
RP Model SPN

General Description

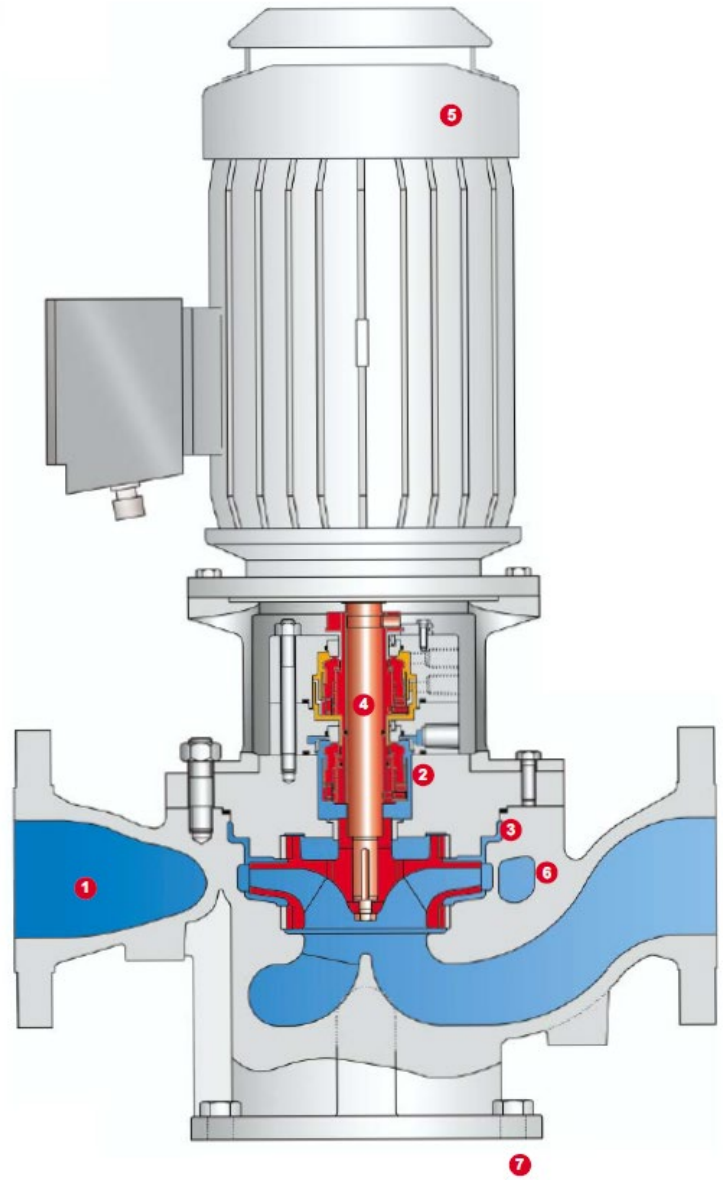
SPN In-Line Vertical Pumps

- Vertical In-line pump
- Close Coupled
- D-Flange Motors
- Impellers mounted directly on driver shaft
- Compliant with Shell DEP and BS4082

Capacity	450 m^3/h	2,000 US GPM
Head	200 m	656 ft
Temperature	450 °C	842 °F
Pressure	80 bar	1160 psi



SPN - Characteristics



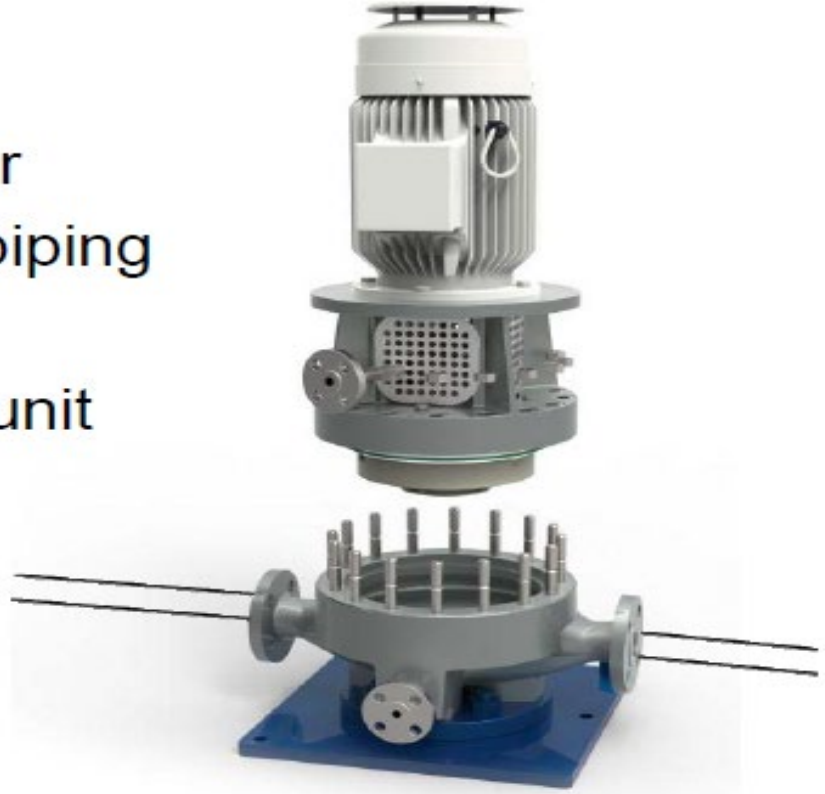
1. Volute Casing
2. Mechanical Seal Chamber full compliance with API 610 and API 682
3. Casing/Casing cover in metal-to-metal contact
4. Motor Shaft
5. Antifriction bearings (motor)
6. A double volute is available for sizes greater than 3”
7. Foundation Support is possible with a separate foot-plate
8. Compliant with Shell DEP & BS4082

SPN - Characteristics

1. 19 volute casing in-line pump sizes for 50 Hz and 60 Hz power supply, in top pull-out design from 1 1/2” to 8” discharge nozzle, acc. to API 610 latest edition, BS 4082 and Shell DEP latest edition.
2. Mechanical seal chamber dimensions in full compliance with API 610 and API 682.
3. Casing and casing cover in metal-to-metal contact. Non-asbestos spirally wound gasket made of stainless steel / graphite foils totally enclosed.
4. Shaft deflection in less than 0.03 mm in the stuffing box area is achieved by correct sizing of the bearings and the use of double volutes. Low vibration values will be achieved.
5. Anti-friction bearings with an operating life of more than 25,000 h. Special double angular contact bearings in the motor are available for compensation of high axial forces.
6. Foundation support is possible with a separate foot-plate.

SPN - Back Pull-out Design

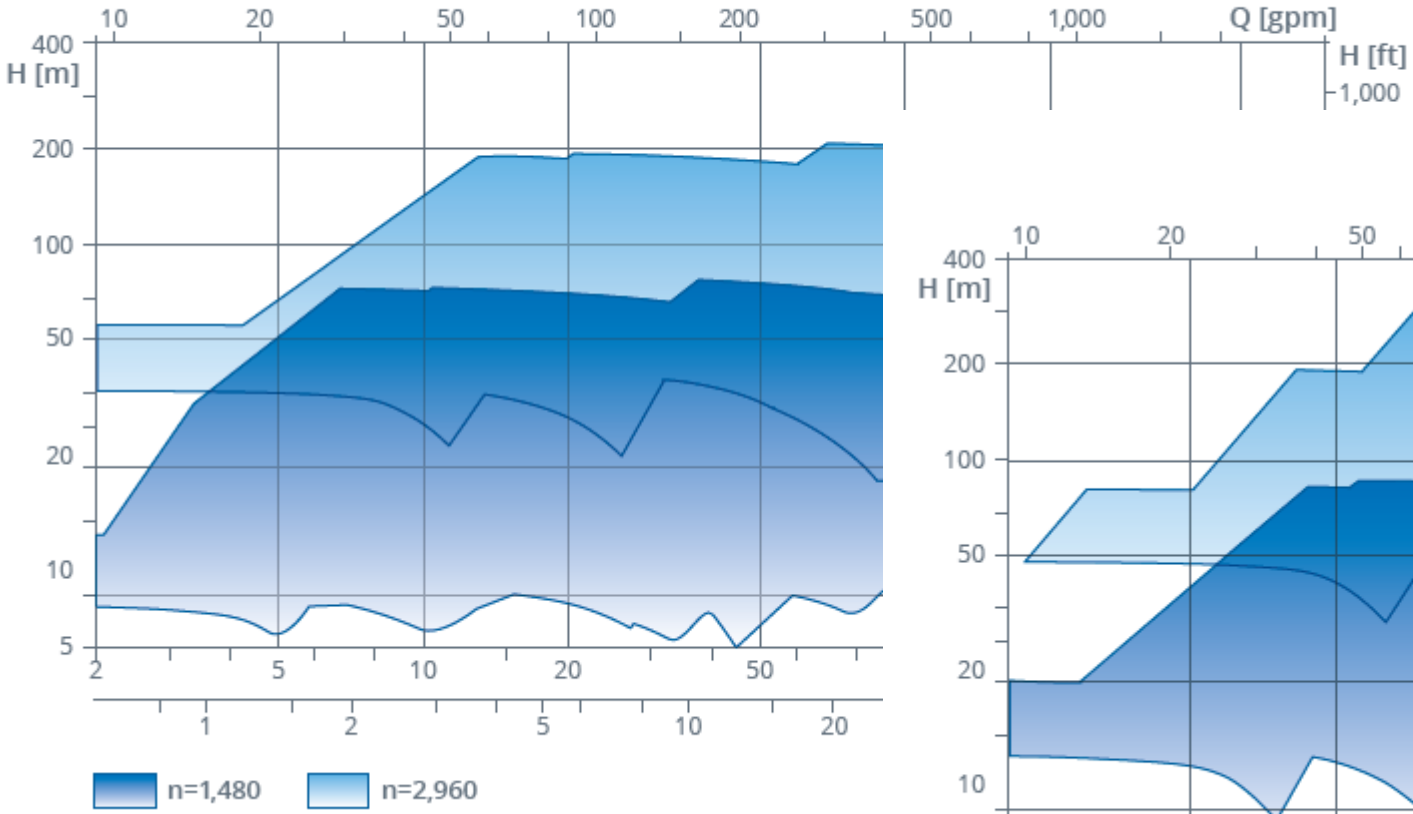
- Disconnect Power
- Disconnect seal piping
- Undo 16 Nuts
- Remove pull out unit



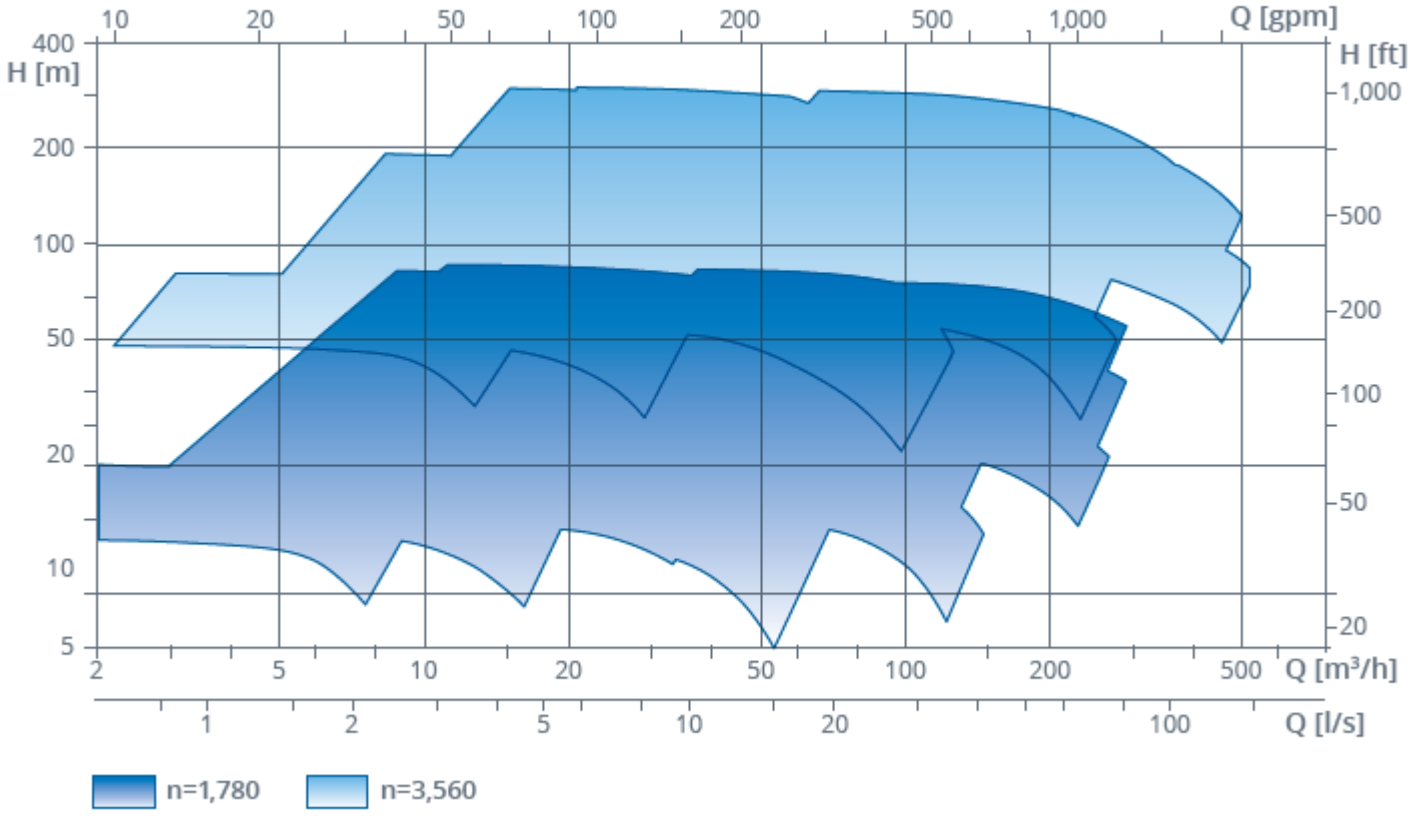
The pump casing and piping remain in place

SPN – Range Coverage

n = 1,480/2,960 rpm **50 Hz**



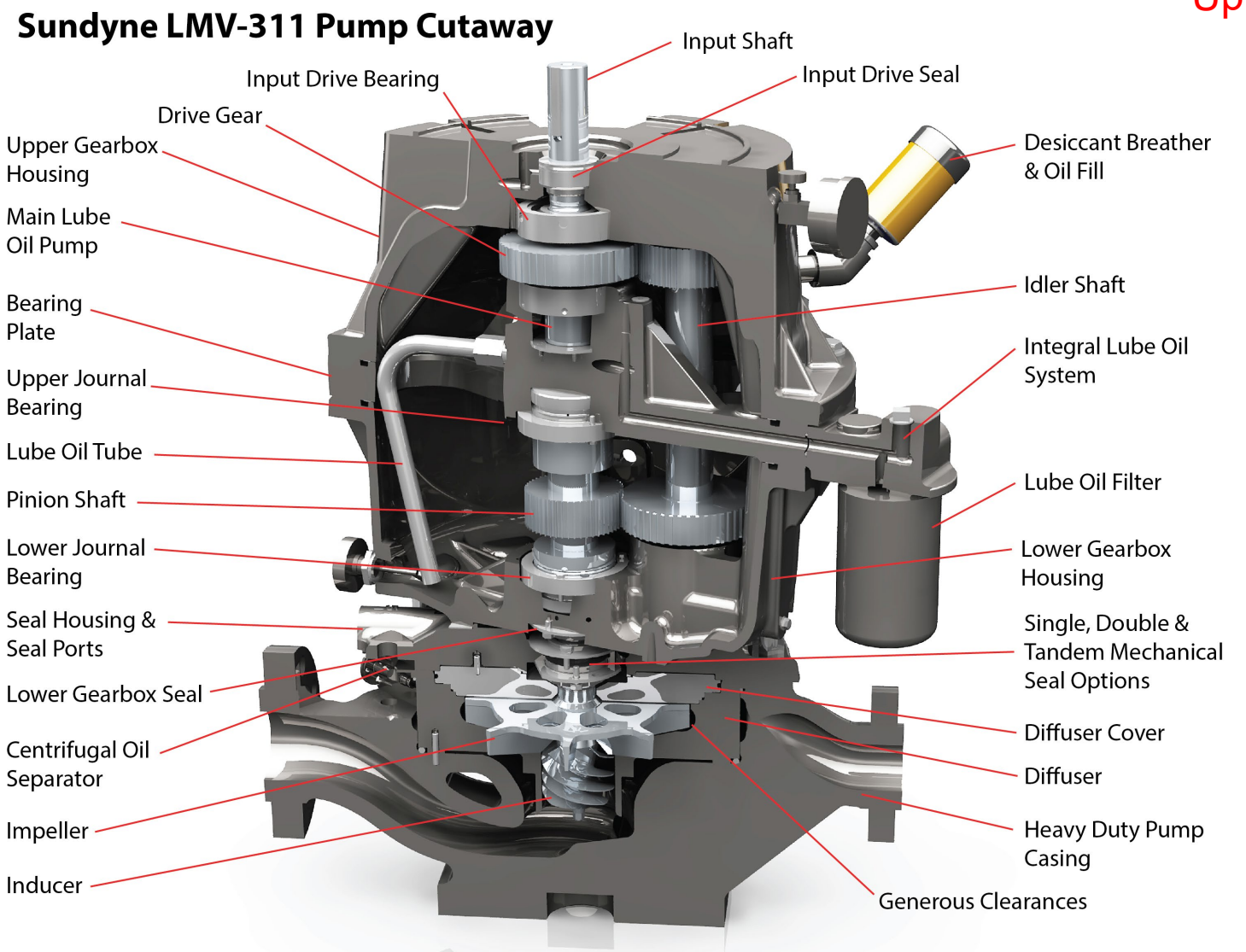
n = 1,780/3,560 rpm **60 Hz**



OH6 Pumps (Sundyne)

OH6 Pumps

Up to 22,000 RPM!!



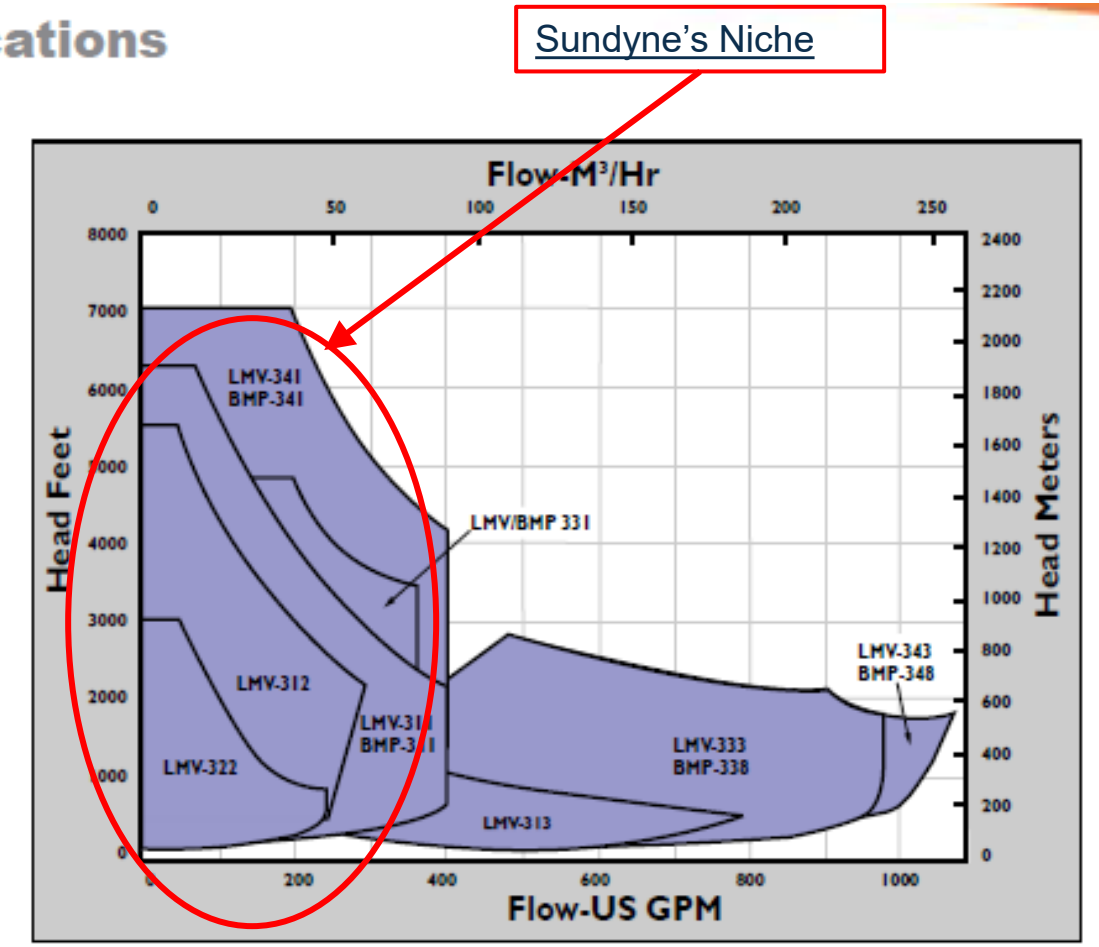
OH6 Pumps

Sundyne

OH6 Pumps

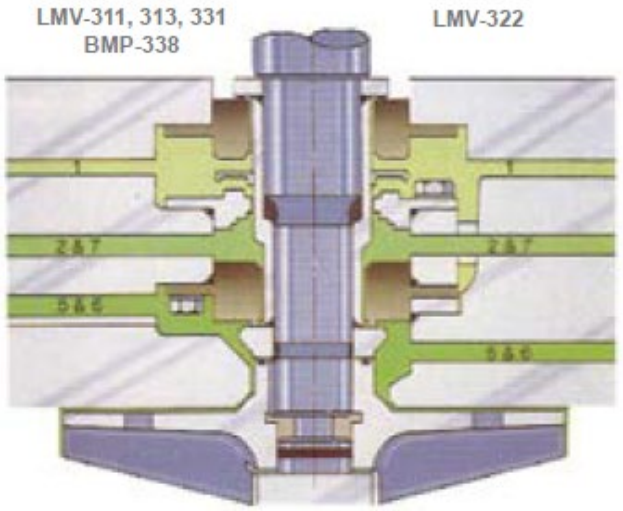
Performance Envelope and Specifications

- Flows to 1,100 gpm (250 m³/hr)
- Heads to 6,300 ft (1,921 m)
- Maximum case working pressure
  3,465 psig (230 barg)
- Maximum suction pressure
  1,000 psig (70 barg)
- Temperature range:
  -200° to 650°F (-130° to 340°C)
- Industry leading inducer designs
  reduce NPSHr
- Multiple API 610 piping plans are available
- ASME B16.5 600# RF flanges standard
  900# RF flanges optional on select models
- Special metallurgies: all machineable
  alloys available



OH6 Pumps

Seal Configurations

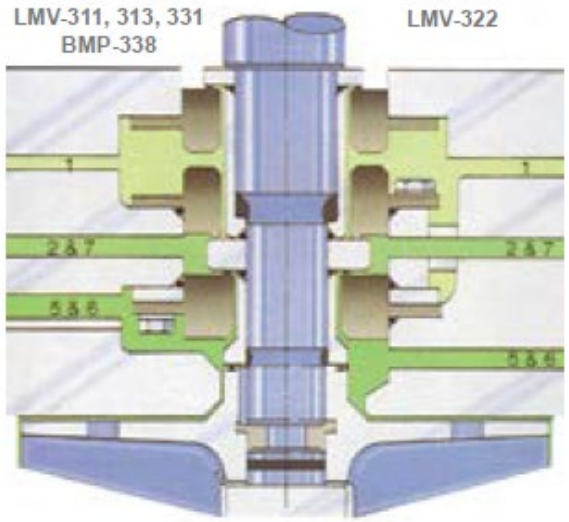


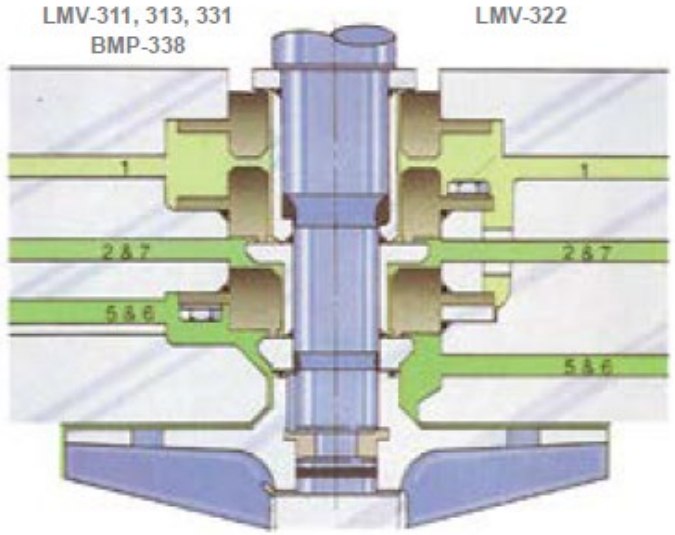
Single Seal ▲

Standard seal used in most applications for non-abrasive or non-hazardous liquid. Bellows seals are also available for higher temperatures and abrasive liquids.

Double Seal ▶

Recommended when the pumped liquid contains abrasive, leakage could be hazardous, or when the pump is likely to run dry.





◀ Tandem Seal

Used to accommodate quenching, automatic shutdown systems and high pressure services. With no requirement for a buffer liquid, a film-riding gas seal may be placed in the upper position, thereby providing a secondary seal backup in the event of main seal failure.

Sundyne

OH6 Pumps

Vertical vs Horizontal

Benefits of the Various Configurations

Vertical vs Horizontal arrangement

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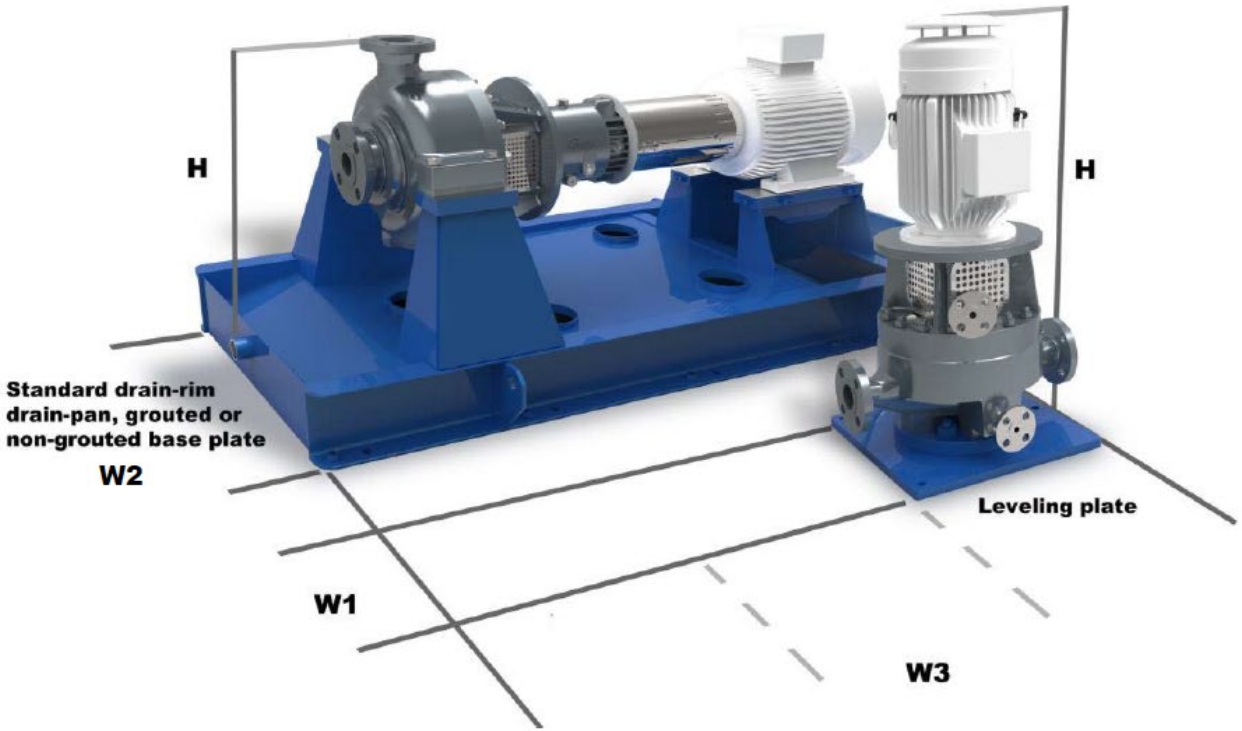
Specialist for Pumping Technology

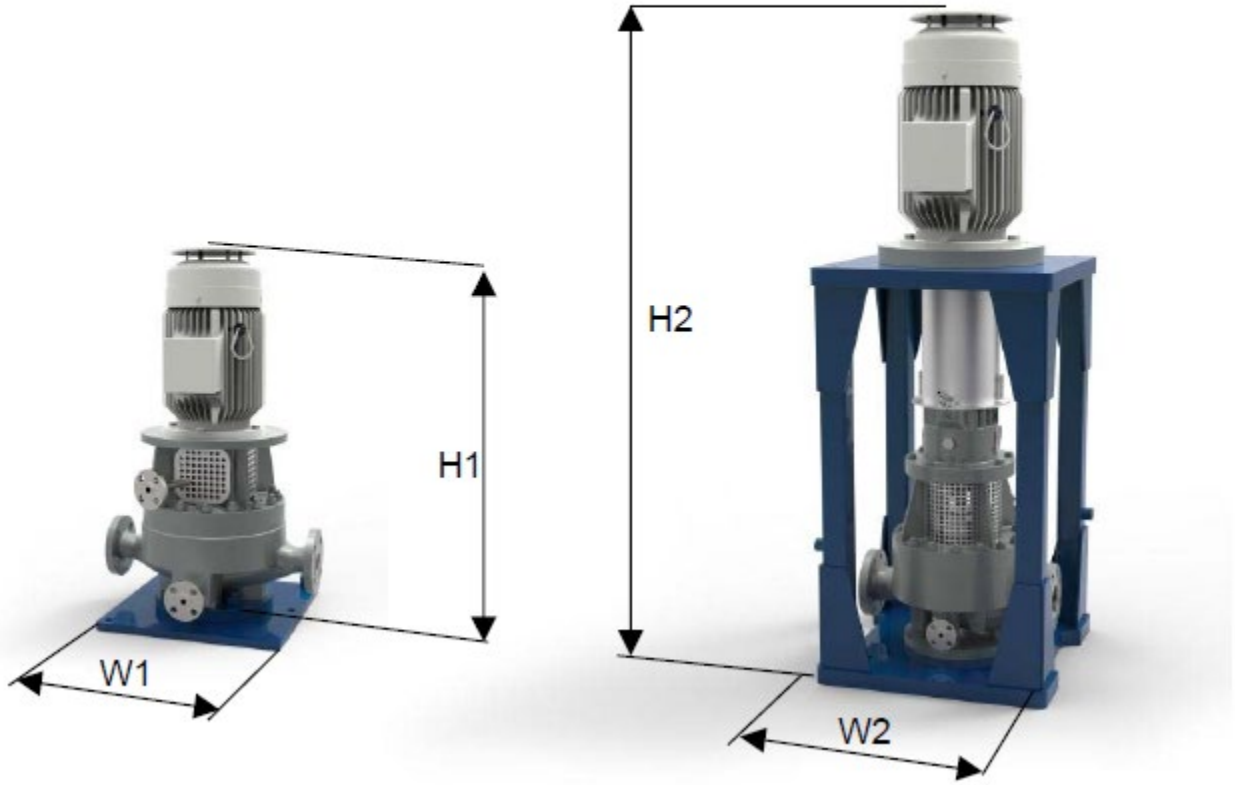
OH5	OH2
Floor space of largest OH5 is square W1 = 450 x 450 mm	Floor space of largest OH2 is W3 x W2 = 4800 x 1800 mm



Vertical vs Horizontal arrangement

RUHRPUMPEN
Specialist for Pumping Technology

OH5	OH3
Floor space of largest OH5 is square W1 = 450 x 450 mm	Floor space of largest OH3 is square W2 = 1300 x 1300 mm



Back Pull-out

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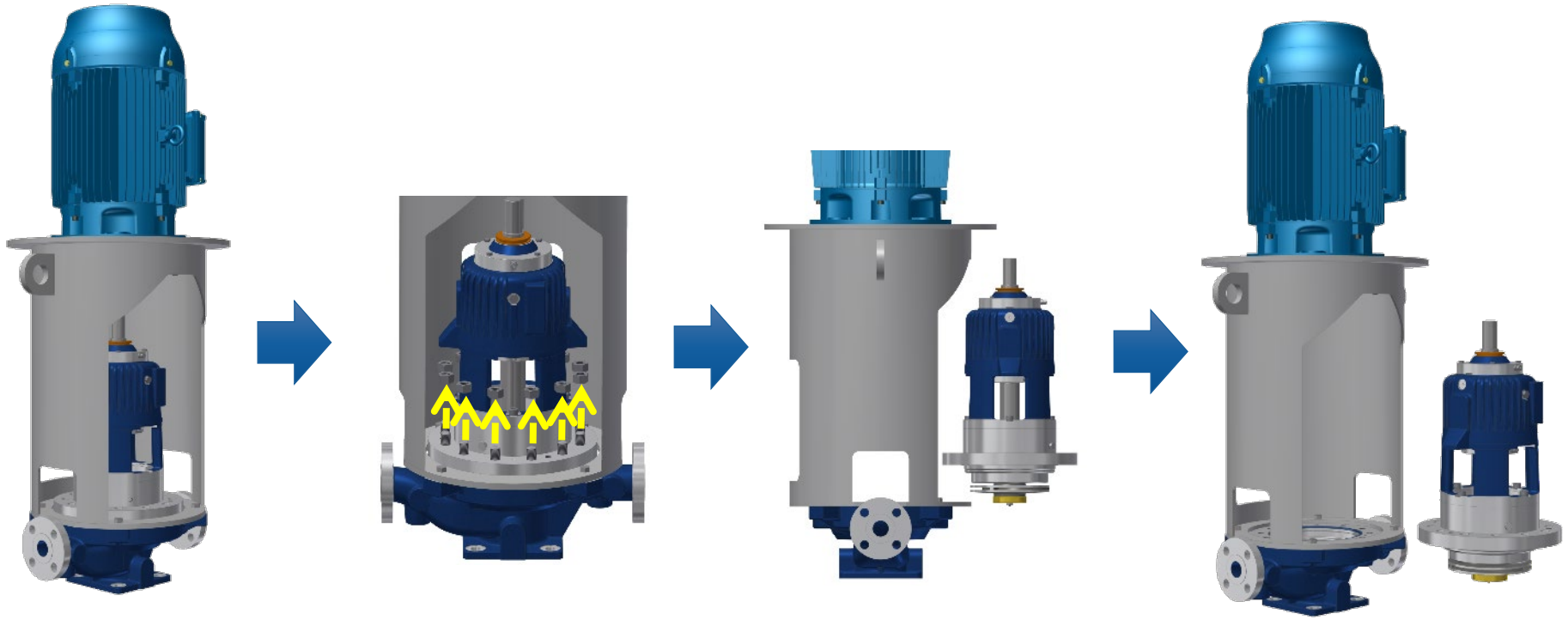
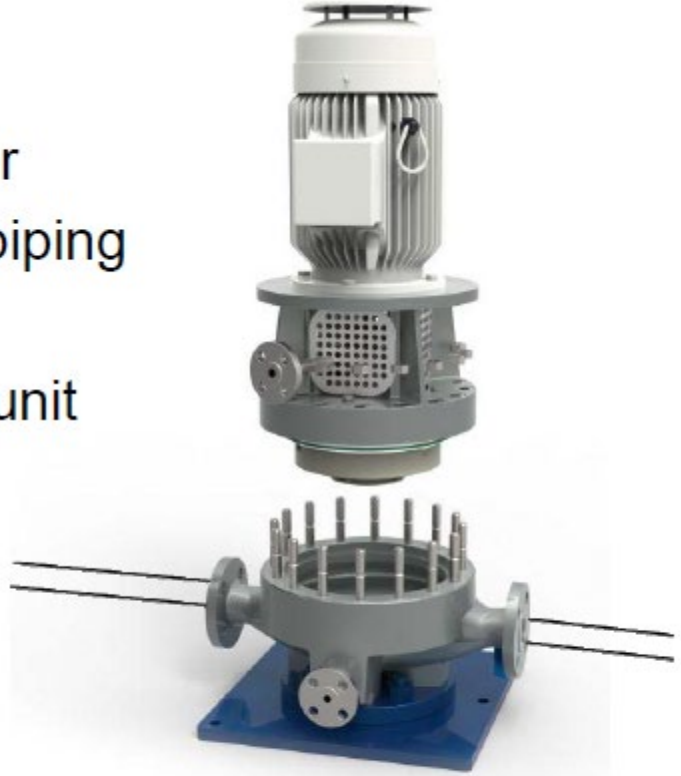
Specialist for Pumping Technology



SPI

Back Pull-out

- Disconnect Power
- Disconnect seal piping
- Undo 16 Nuts
- Remove pull out unit



The pump casing and piping remain in place

SPN

Vertical vs Horizontal arrangement

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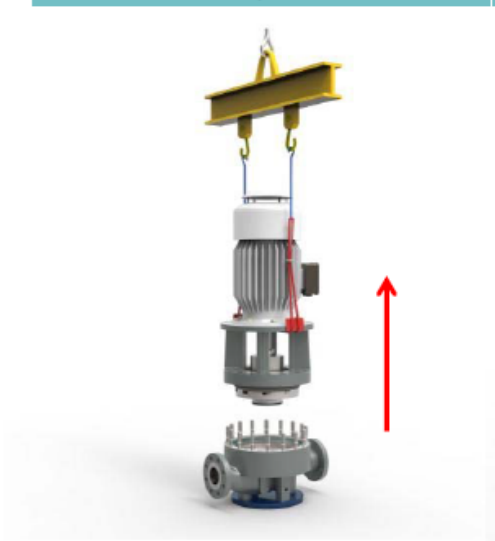
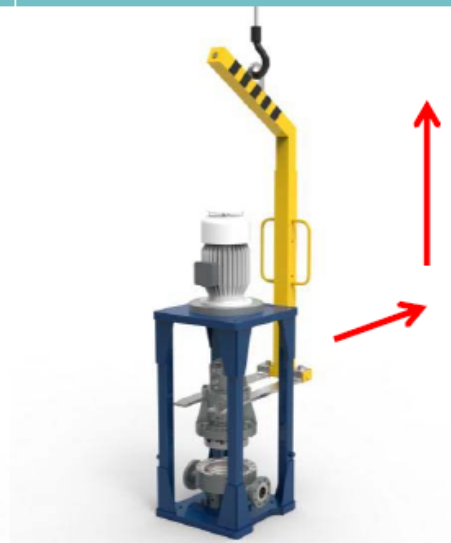
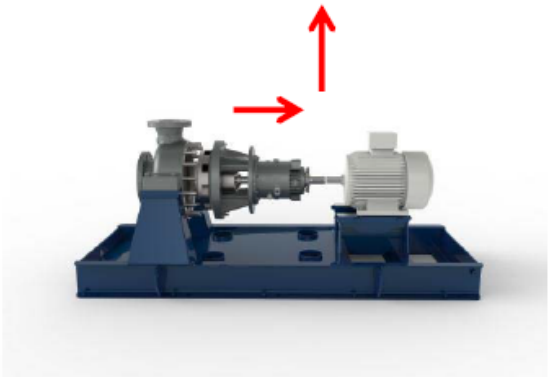
Specialist for Pumping Technology

OH5	OH3	OH2
Minimum dismantling space required (only vertical)	Considerable dismantling space required for use of lifting tool	Dismantling requires movement in multiple directions
Motor alignment not needed as motor is part of the pull-out and rabbet fitted	Alignment of motor towards pump with a alignment ring, flat mounted on the motor support head	Alignment of motor towards pump, independent, depending on flatness of baseplate
No pump alignment at re-installation of pull-out unit	Pump alignment check at re-installation	







Vertical vs Horizontal arrangement

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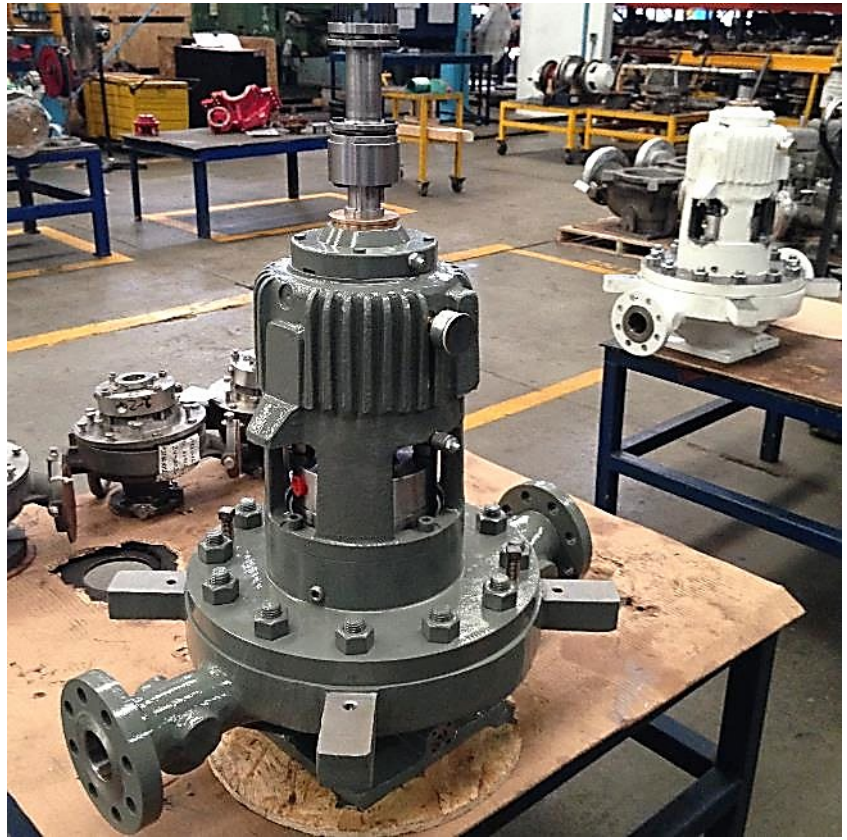
OH5	OH3	OH2
Minimum floor space, therefore low civil cost for pump foundation	Higher civil costs due to larger footprint & weight	Highest civil costs due to largest footprint & weight
Higher NPSH margin due to lower centerline position of impeller Centerline height varies from 250 – 350 mm		Lower NPSH margin Centerline height of >700mm
Initial cost	Initial cost higher than OH5 (+/-10%)	Initial cost higher than OH5 (+/- 25%)
Sturdy and robust design, not sensitive to earthquake's, rapid displacements and alike	Due to separate motor support head, less robust and more sensitive to earthquake's, rapid displacements and alike	Due to horizontal centerline mounting robust, but more sensitive to earthquake's, rapid displacements and alike
Due to compact design, not sensitive to natural frequency vibration.	Due to combination factors as motor, motor support head and pump each unit is checked for natural frequency vibrations	Due to centerline and robust mounting not sensitive to natural frequency vibrations

Photo- Album

SPI pumps

"Most Sold"
2x2x12 during Test
#111000457 (2 pumps)
API S-6 with SST Shaft
Bracket Size 35, grease lubricated

Other sold projects
- 111000477
- 101000057
- 101000058



Bare shaft pump

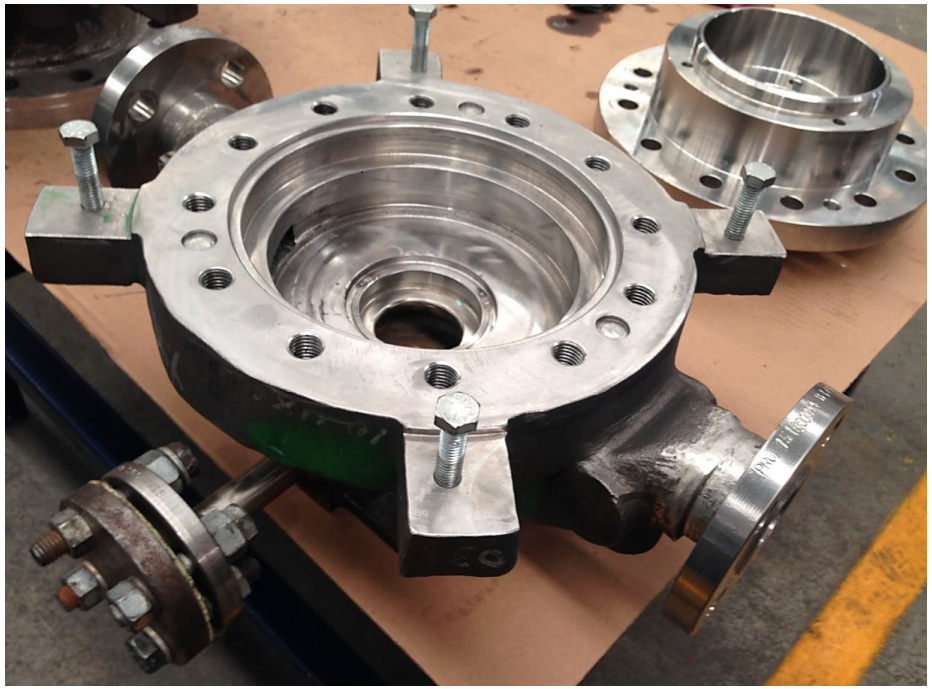
Ready for shipment

8x8x15
#121000294 (2 pumps)
API S-5, Bracket Size 55
For a 1,500Kg - 2 poles motor

"The big one"

8x6x26
#121000295, #121000296, #121000297
API S-5, Bracket Size 75
For a 2,000Kg - 4 poles motor, to be tested in Tulsa

1,5x1,5x8
#151000044
API A-8, Bracket Size 35



1.5x1.5 & 8x8x15 During Test

1.5x1.5x8	8x8x15
3600 RPM	3600 RPM
Motor 7.5HP, 85 Kg	Motor 215 HP, 1500 Kg
0.6 x 1.2m	1.0 x 3.2m
Total weight 300 Kg	Total weight 2,500 Kg

Coming Attractions ☺

To be Decided – I welcome your suggestions for topics to cover

Send your suggestions to: ssmith@ruhrpumpen.com

Next session will be in the New Year – Date TBA

Probably 12th or 19th January 2023

RUHRPUMPEN

Specialist for Pumping Technology

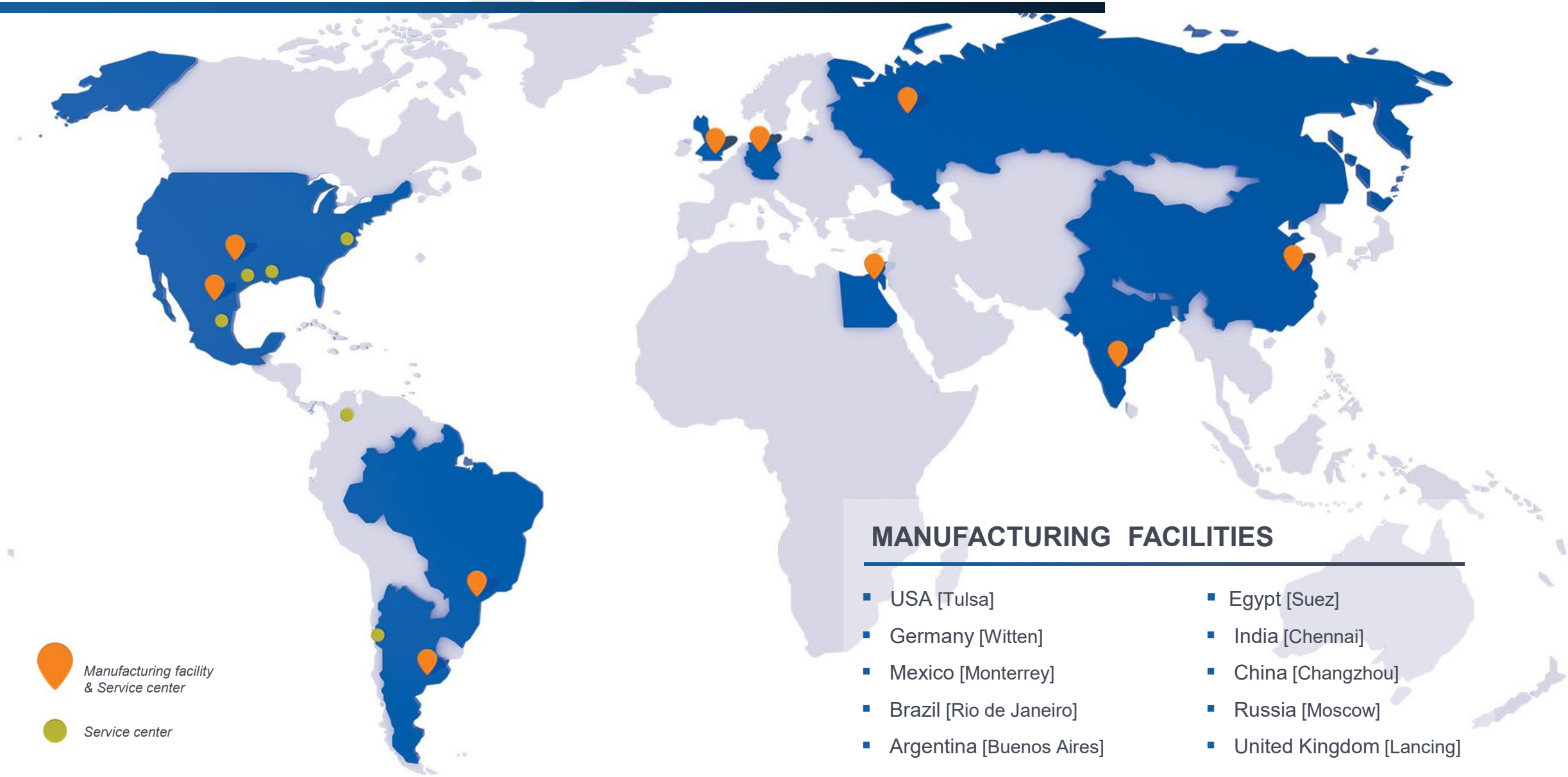
Q & A

info@short-courses.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

RUHRPUMPEN



MANUFACTURING FACILITIES

- USA [Tulsa]
- Germany [Witten]
- Mexico [Monterrey]
- Brazil [Rio de Janeiro]
- Argentina [Buenos Aires]
- Egypt [Suez]
- India [Chennai]
- China [Changzhou]
- Russia [Moscow]
- United Kingdom [Lancing]

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:

RUHRPUMPEN

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 m^3/hr). Moreover, our pump designs cover temperatures from cryogenic temperatures of -310 °F (-196 °C) up to 752 °F (400 °C).

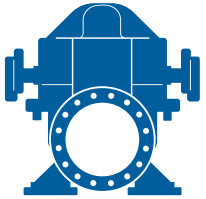
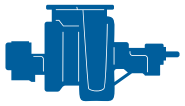
Products include:

- 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 *single casing*	**GP**	API design (BB4)	
	Radially split *double casing*	**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)	
	Separate discharge line	**VSP / VSP-Chem**	HI & API 610 (VS4)	
Double casing	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