



# RuhRPumpen Short Courses

## Session 23 – Pumps for the Desalination Market

*This short course will look at the various pumps used in the Desalination Market worldwide.*

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

# Agenda

## Process Overview

## Pump Portfolio – Complete Product Offering

OH1 - CRP  
BB1 - ZW  
HPRO - GPA  
HPRO - GP  
HPRO - SM / JTN  
HPRO - ZM / HS  
HPRO - RDP  
Verticals  
Self-Priming  
Submersibles

## Quality

ITP  
Testing requirements



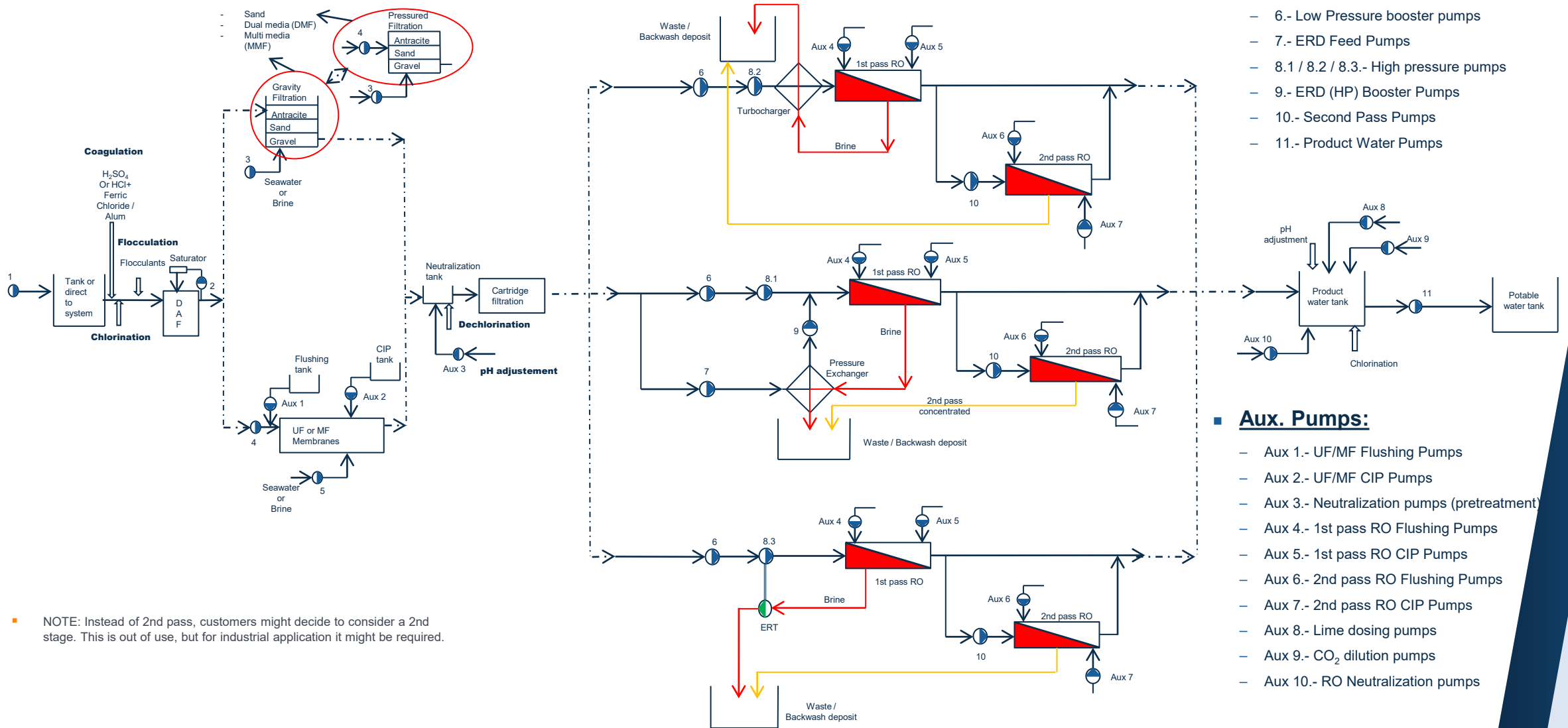
# DESALINATION





# Desalination: Full Line Supplier

## Complete Process Diagram RO



### ■ Main Pumps:

- 1.- Intake pumps
- 2.- DAF pumps
- 3.- Backwash Filter pumps
- 4.- Filter Feed Pumps
- 5.- UF/MF Backwash pumps
- 6.- Low Pressure booster pumps
- 7.- ERD Feed Pumps
- 8.1 / 8.2 / 8.3.- High pressure pumps
- 9.- ERD (HP) Booster Pumps
- 10.- Second Pass Pumps
- 11.- Product Water Pumps

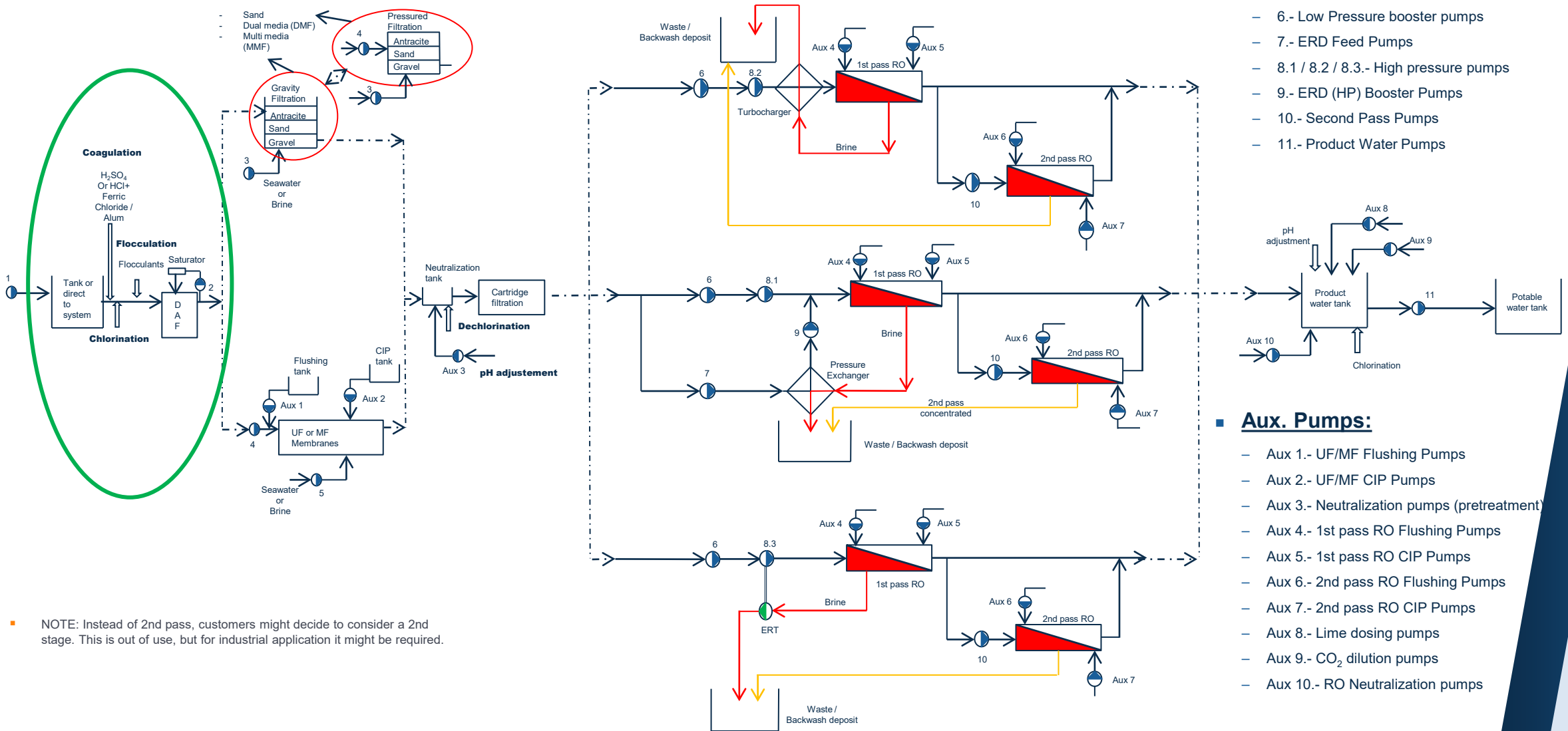
### ■ Aux. Pumps:

- Aux 1.- UF/MF Flushing Pumps
- Aux 2.- UF/MF CIP Pumps
- Aux 3.- Neutralization pumps (pretreatment)
- Aux 4.- 1st pass RO Flushing Pumps
- Aux 5.- 1st pass RO CIP Pumps
- Aux 6.- 2nd pass RO Flushing Pumps
- Aux 7.- 2nd pass RO CIP Pumps
- Aux 8.- Lime dosing pumps
- Aux 9.-  $CO_2$  dilution pumps
- Aux 10.- RO Neutralization pumps

■ NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

# Desalination: Full Line Supplier

## Pre-Treatment 1 - Coagulation



NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

### Main Pumps:

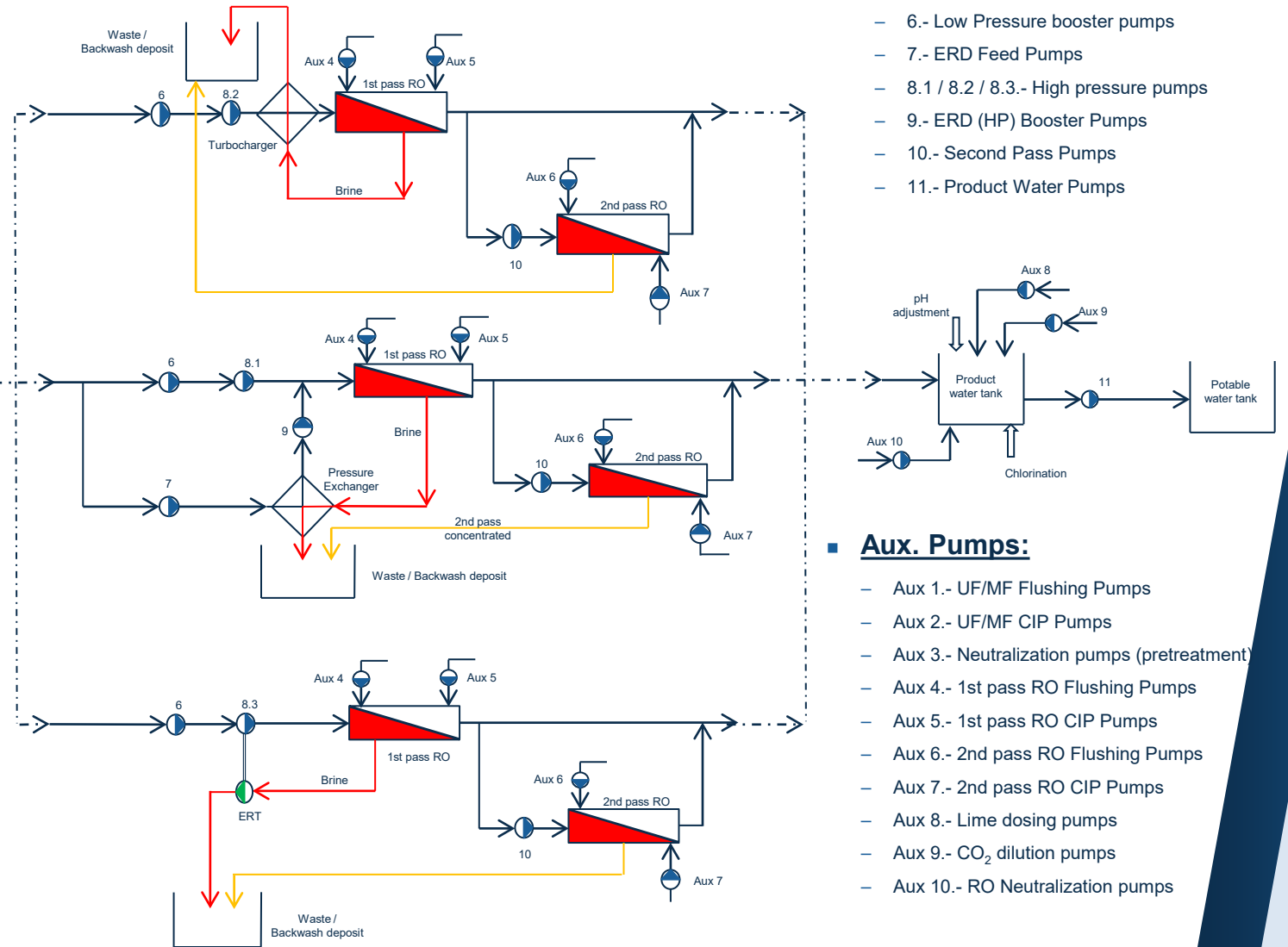
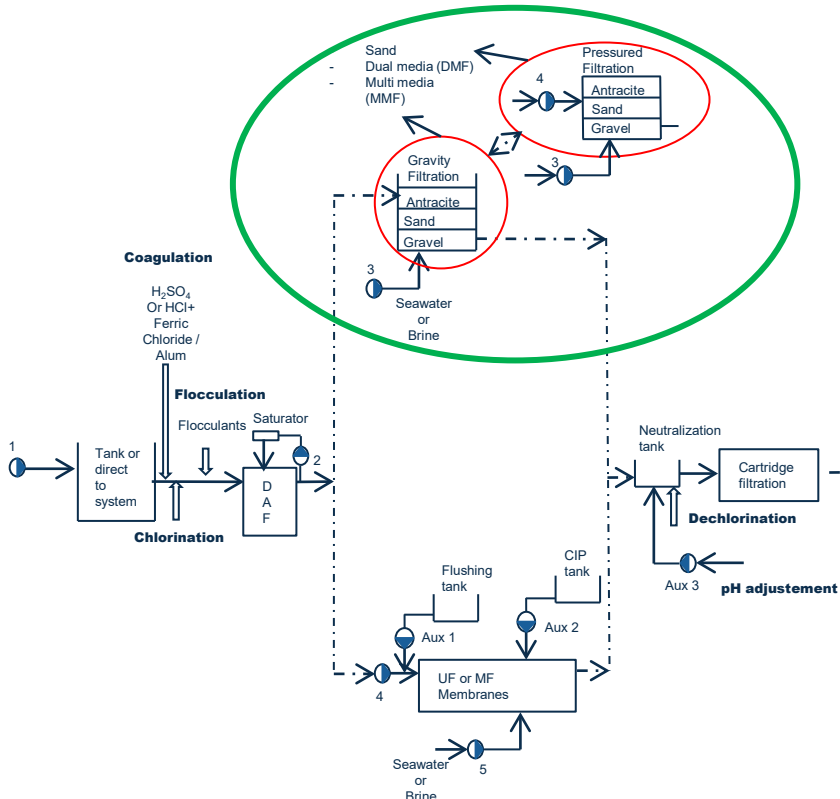
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- Aux 10.- RO Neutralization pumps

# Desalination: Full Line Supplier

## Pre-Treatment 2 - Filtration



### ■ Main Pumps:

- 1.- Intake pumps
- 2.- DAF pumps
- 3.- Backwash Filter pumps
- 4.- Filter Feed Pumps
- 5.- UF/MF Backwash pumps
- 6.- Low Pressure booster pumps
- 7.- ERD Feed Pumps
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- 11.- Product Water Pumps

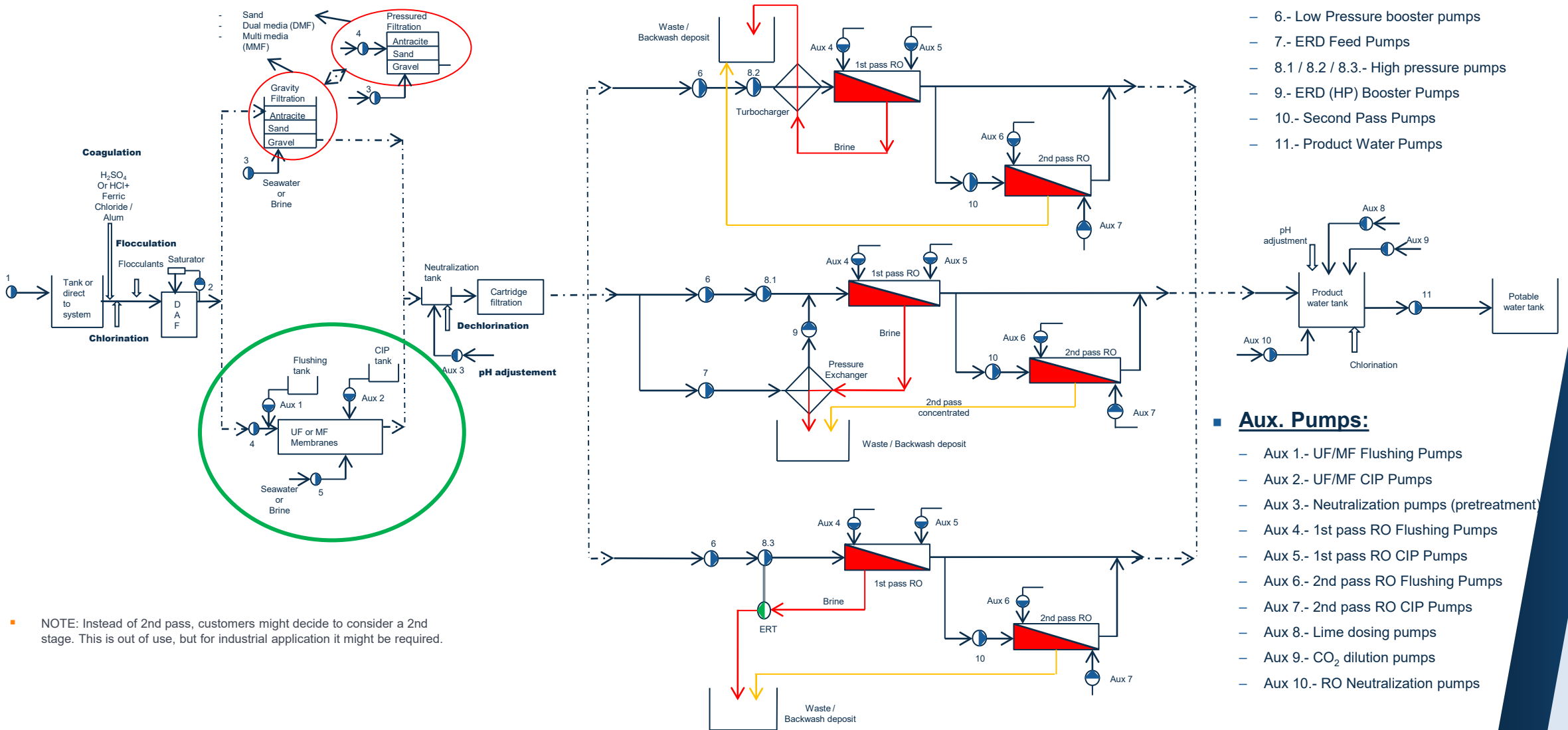
### ■ Aux. Pumps:

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- Aux 7.- 2nd pass RO CIP Pumps
- Aux 8.- Lime dosing pumps
- Aux 9.- CO<sub>2</sub> dilution pumps
- Aux 10.- RO Neutralization pumps

■ NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

# Desalination: Full Line Supplier

## Pre-Treatment 3 – Ultra / Micro Filtration



### Main Pumps:

- 1.- Intake pumps
- 2.- DAF pumps
- 3.- Backwash Filter pumps
- 4.- Filter Feed Pumps
- 5.- UF/MF Backwash pumps
- 6.- Low Pressure booster pumps
- 7.- ERD Feed Pumps
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- 11.- Product Water Pumps

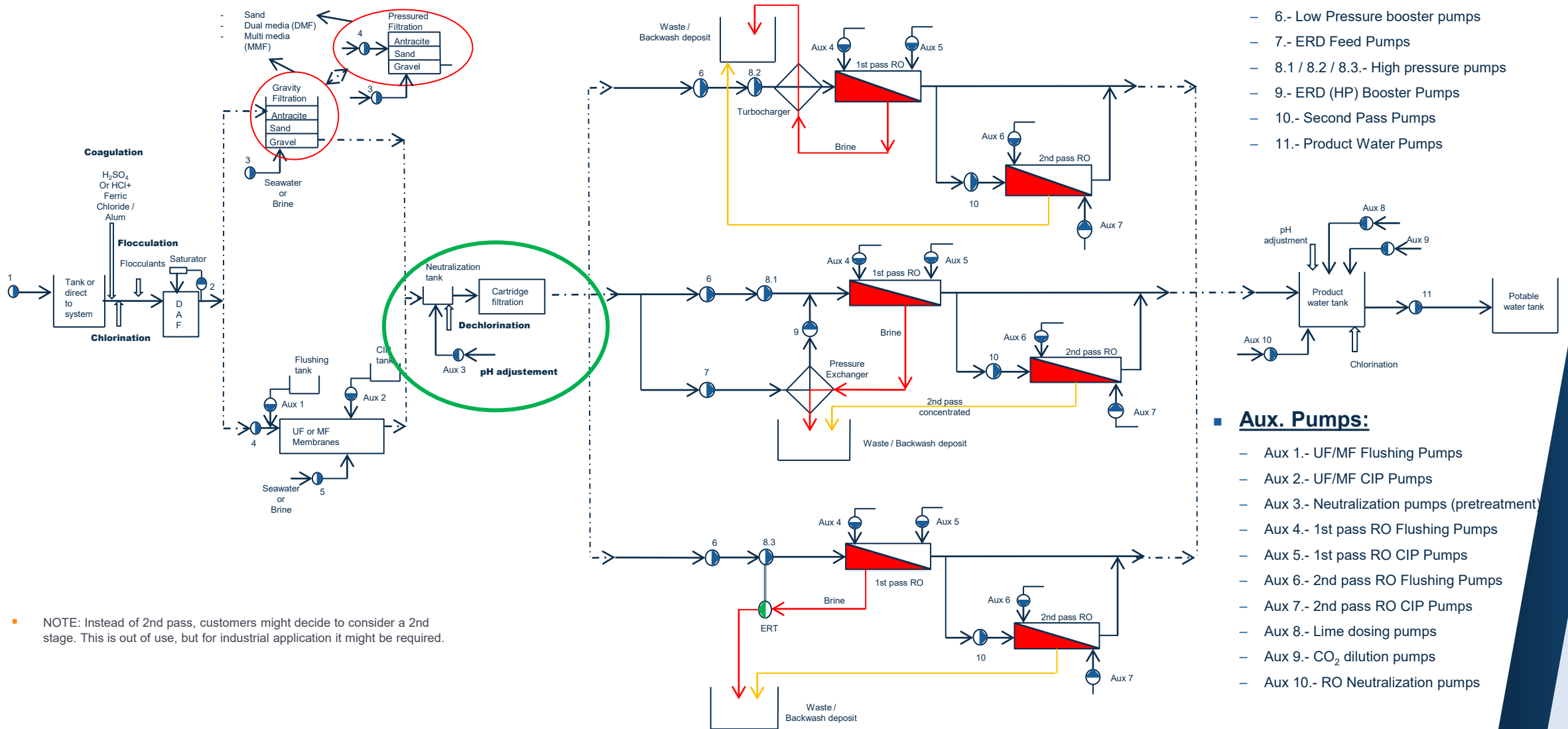
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- Aux 10.- RO Neutralization pumps

NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

# Desalination: Full Line Supplier

## Pre-Treatment 4 - Neutralisation



NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

### Main Pumps:

- 1.- Intake pumps
- 2.- DAF pumps
- 3.- Backwash Filter pumps
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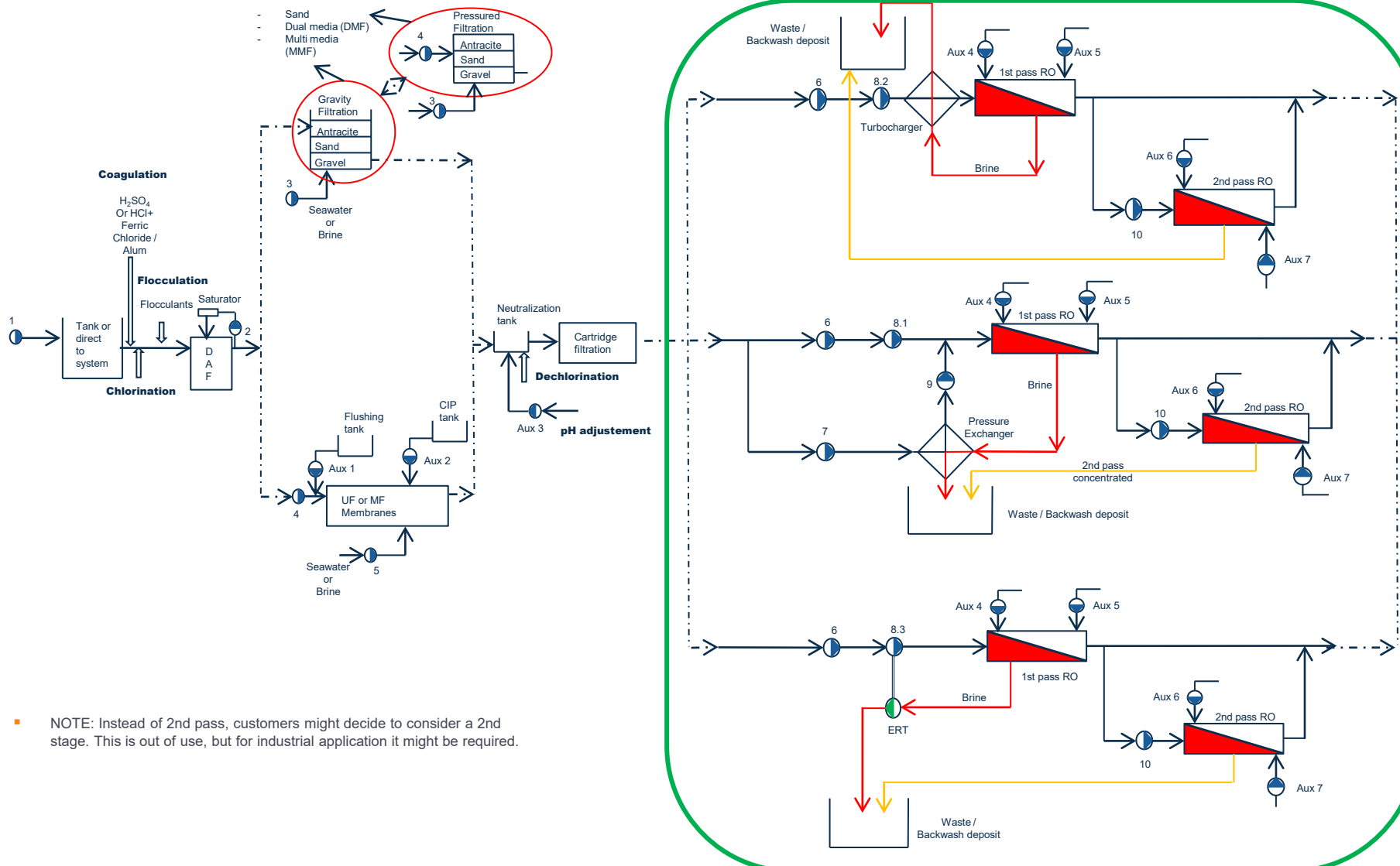
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- Aux 10.- RO Neutralization pumps



# Desalination: Full Line Supplier

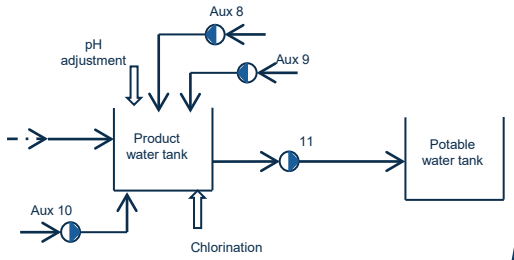
## Main Treatment – 3 Variants



NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

### Main Pumps:

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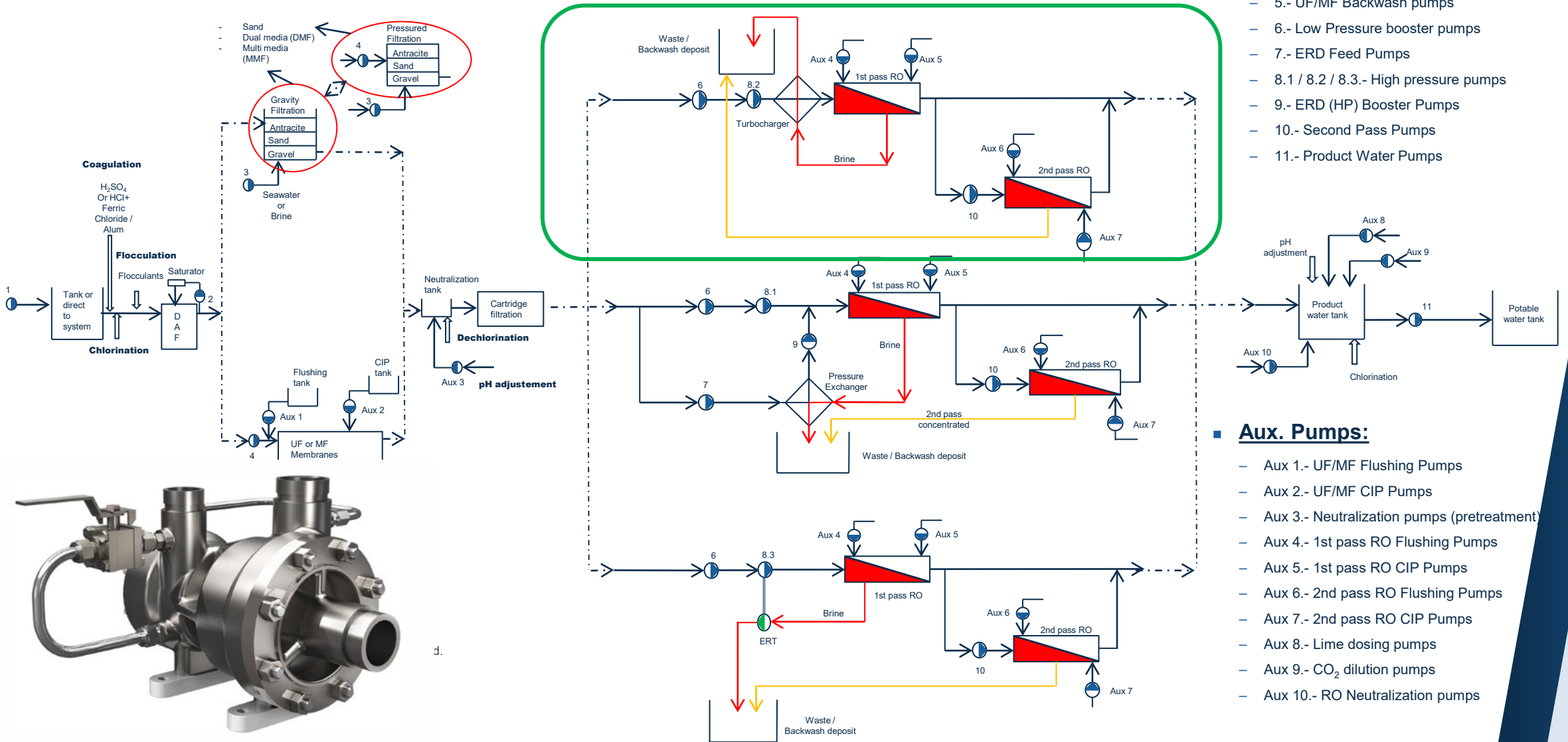


### Aux. Pumps:

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- Aux 9.- CO<sub>2</sub> dilution pumps
- Aux 10.- RO Neutralization pumps

# Desalination: Full Line Supplier

## Main Treatment A – With Turbocharger Energy Recovery



### Main Pumps:

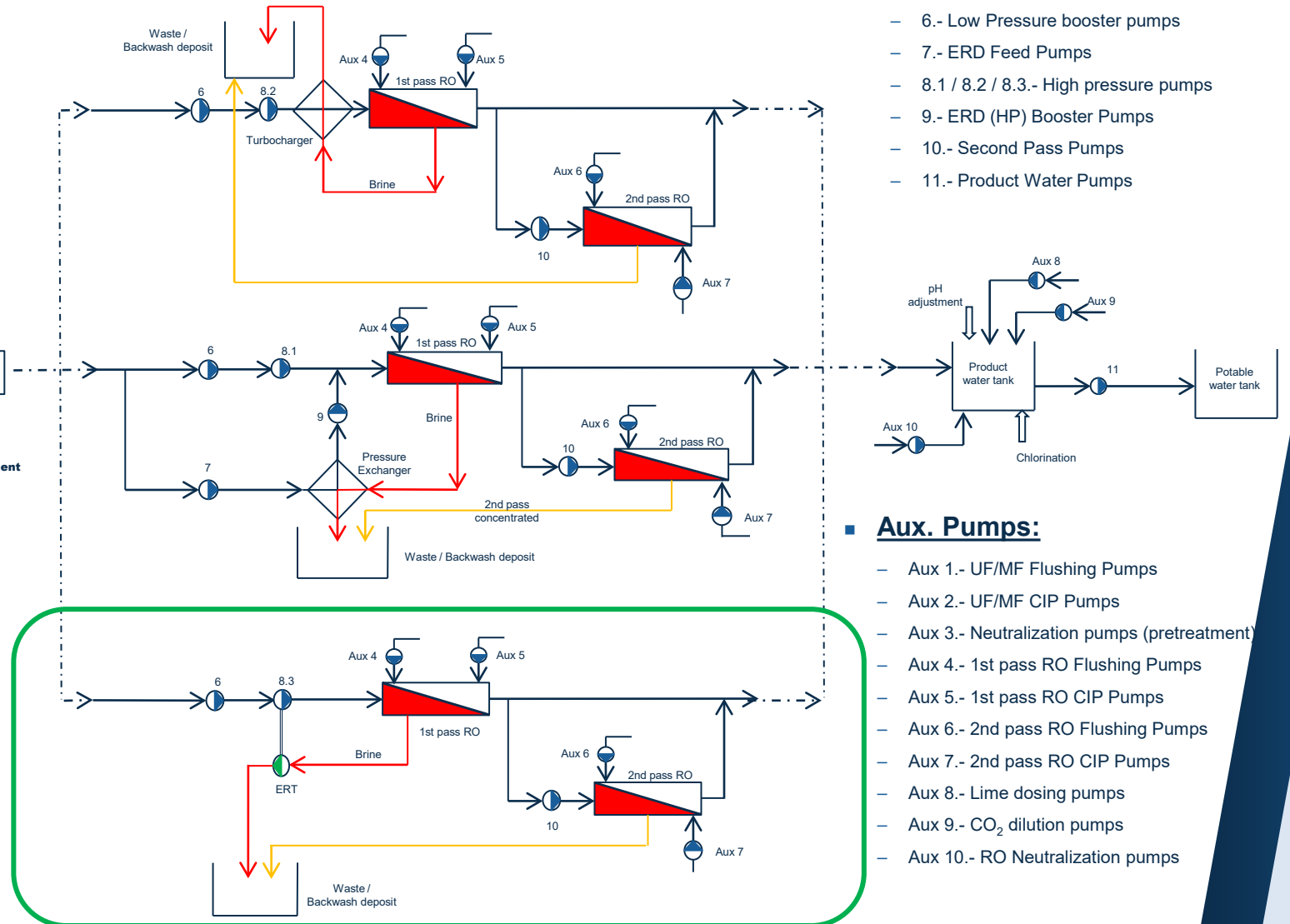
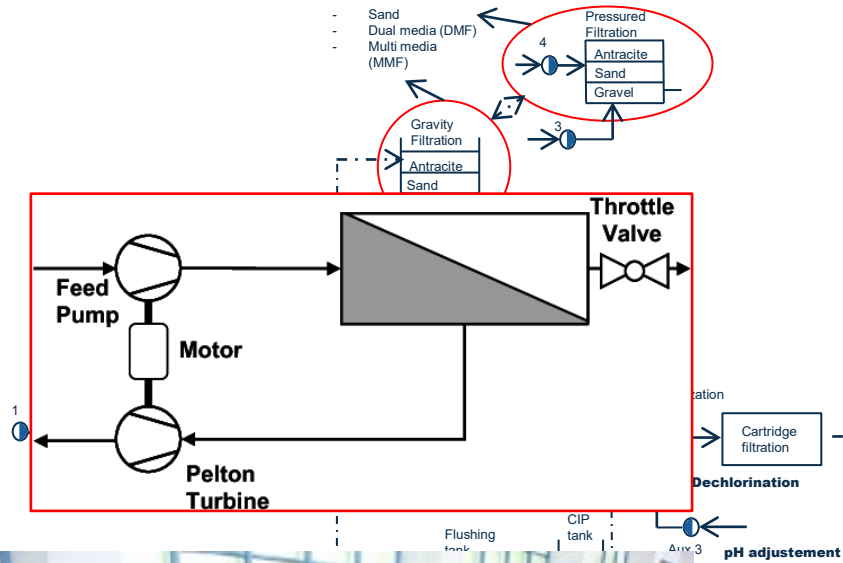
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# Desalination: Full Line Supplier

## Main Treatment C – With Pelton Wheel Energy Recovery



### ■ Main Pumps:

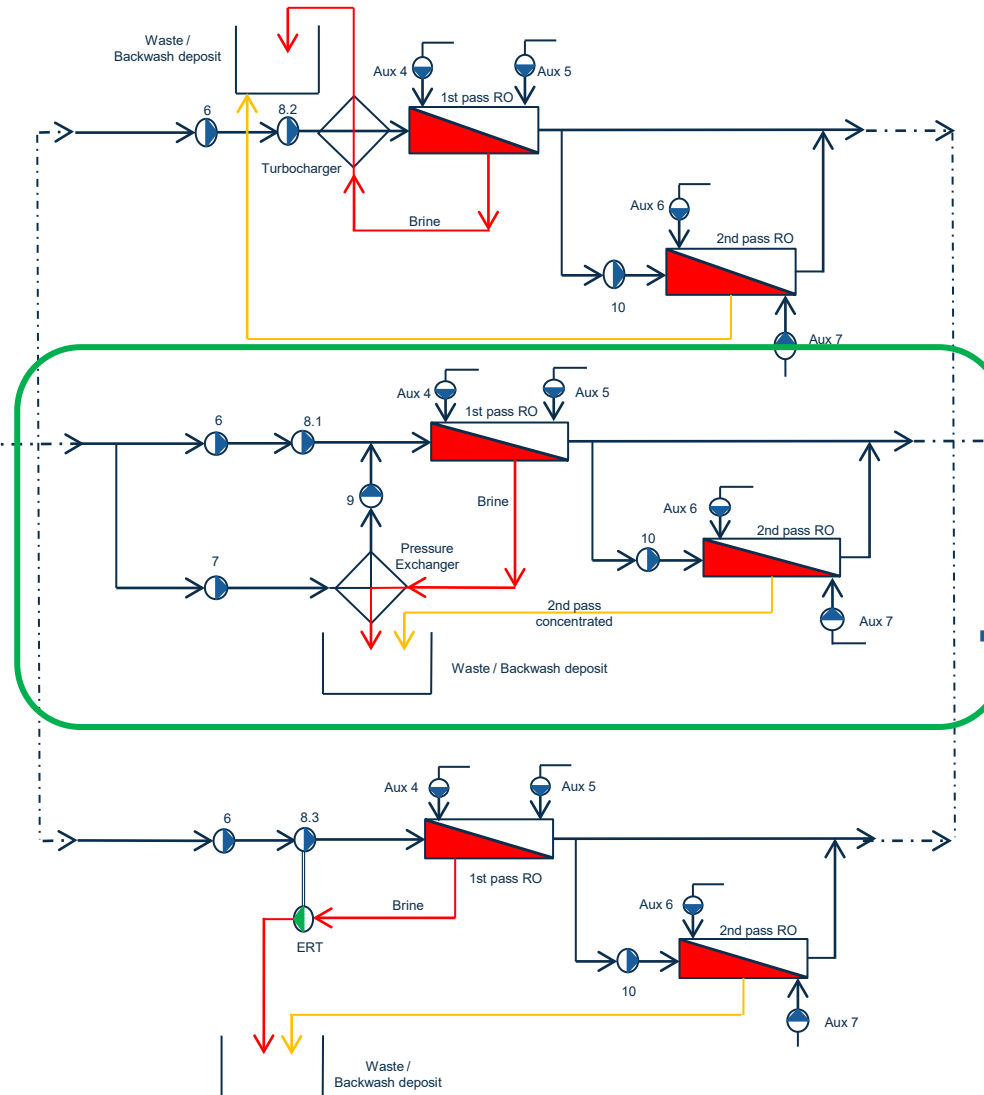
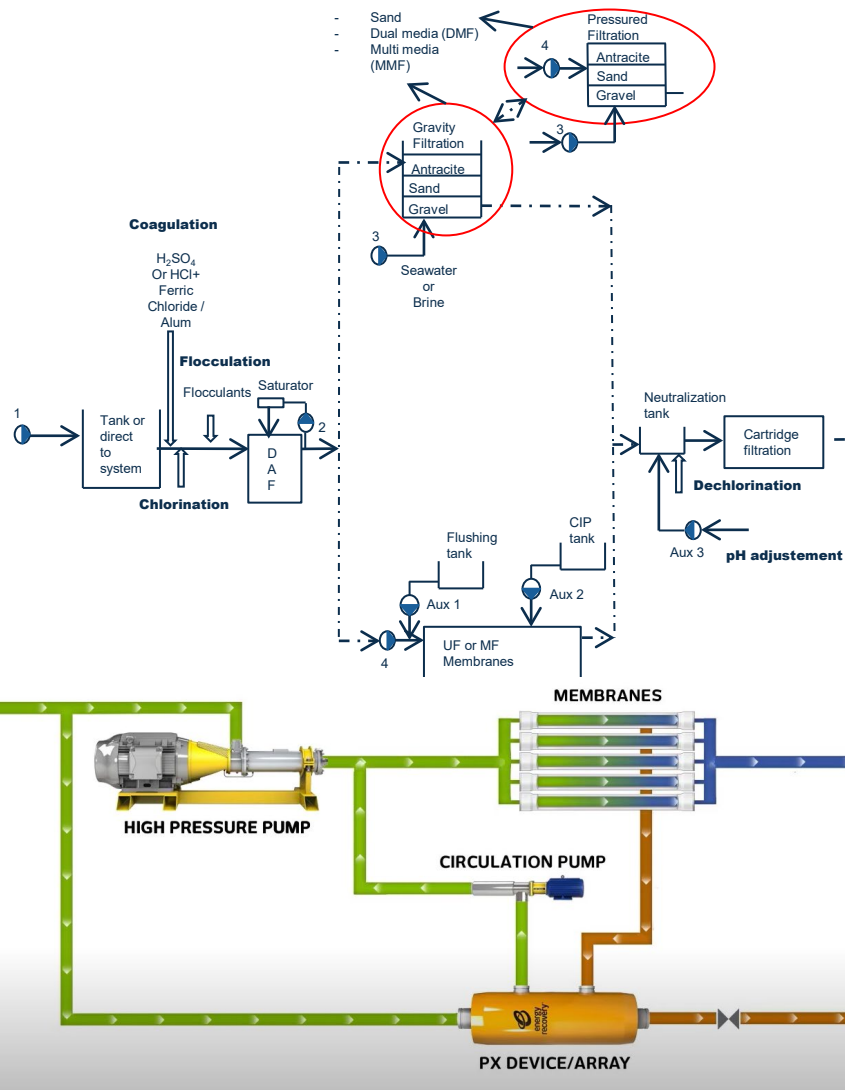
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- Aux 8.- Lime dosing pumps
- Aux 9.- CO<sub>2</sub> dilution pumps
- Aux 10.- RO Neutralization pumps

# Desalination: Full Line Supplier

## Main Treatment B – With Pressure Exchanger Energy Recovery



### ■ Main Pumps:

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- 2.- DAF pumps
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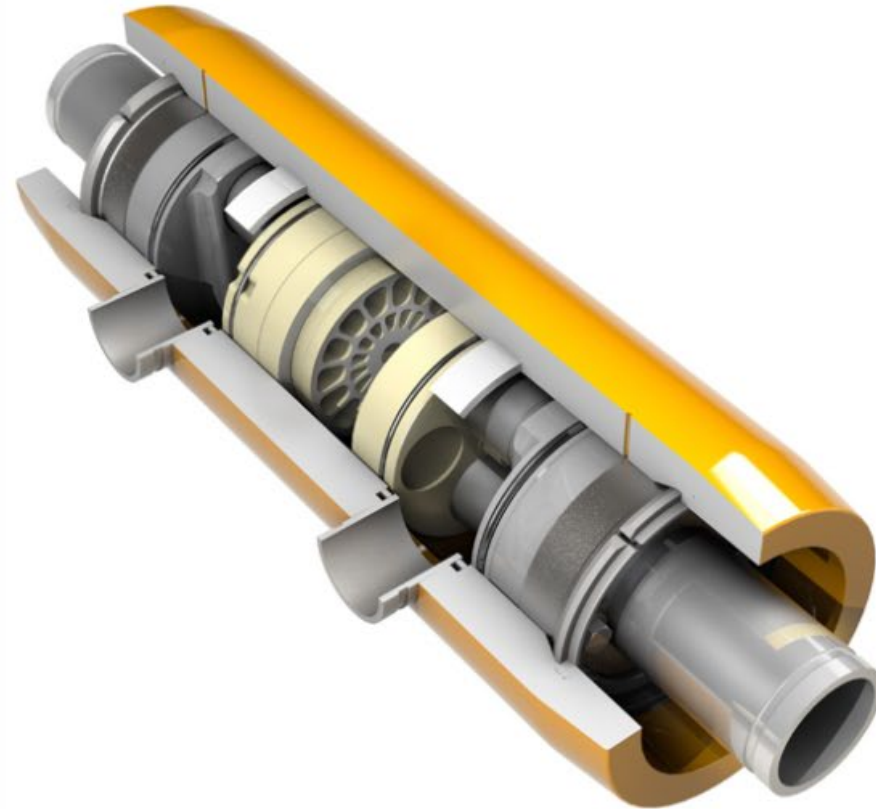
# Pressure Exchanger – Energy Recovery Inc

<https://energyrecovery.com/desalination/px-pressure-exchanger/>

PX<sup>®</sup> Pressure Exchanger<sup>®</sup>

Best-in-class Energy Recovery and  
Desalination

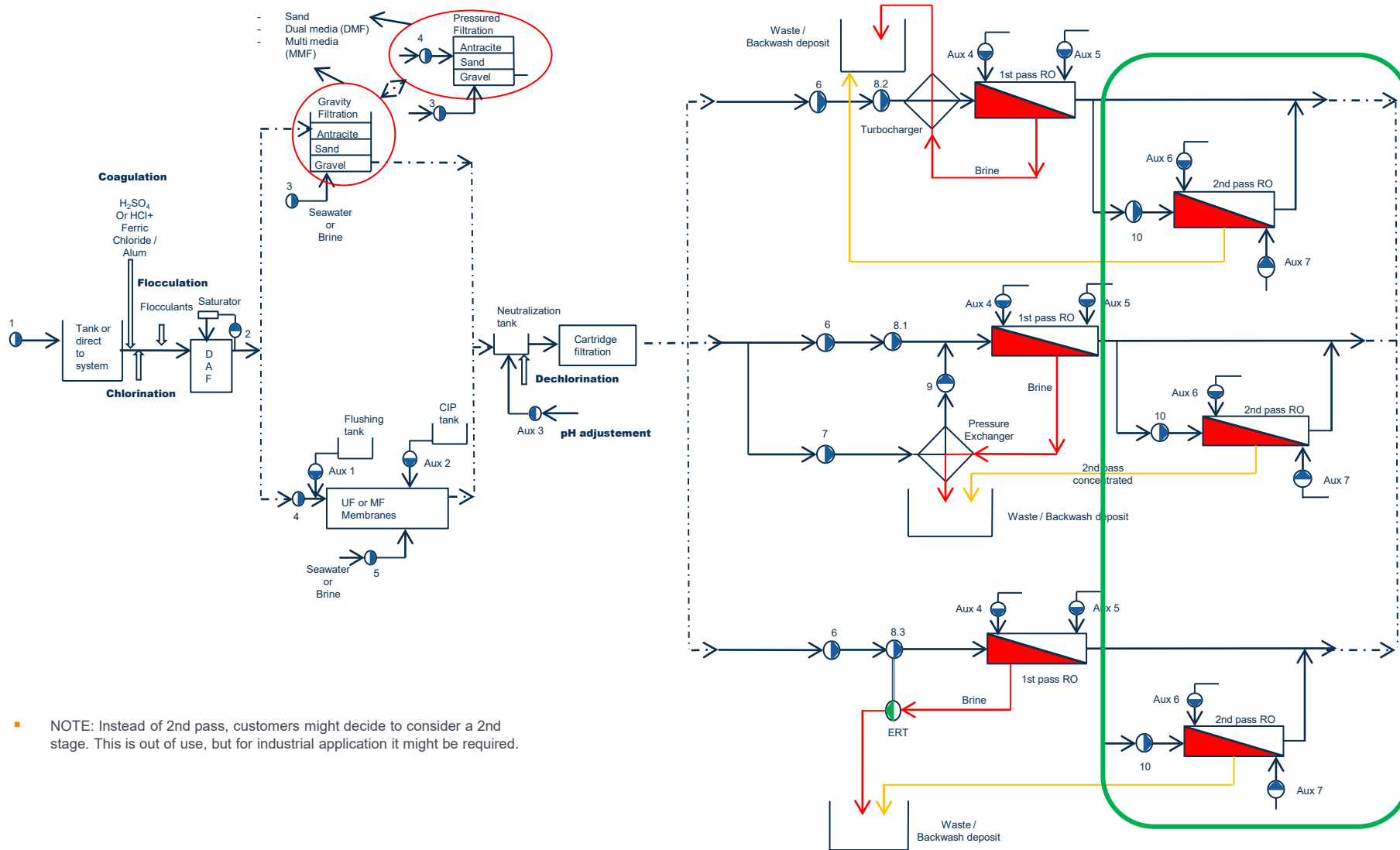
<https://youtu.be/IBwkgrwZYNU>





# Desalination: Full Line Supplier

## Post Treatment



NOTE: Instead of 2nd pass, customers might decide to consider a 2nd stage. This is out of use, but for industrial application it might be required.

### Main Pumps:

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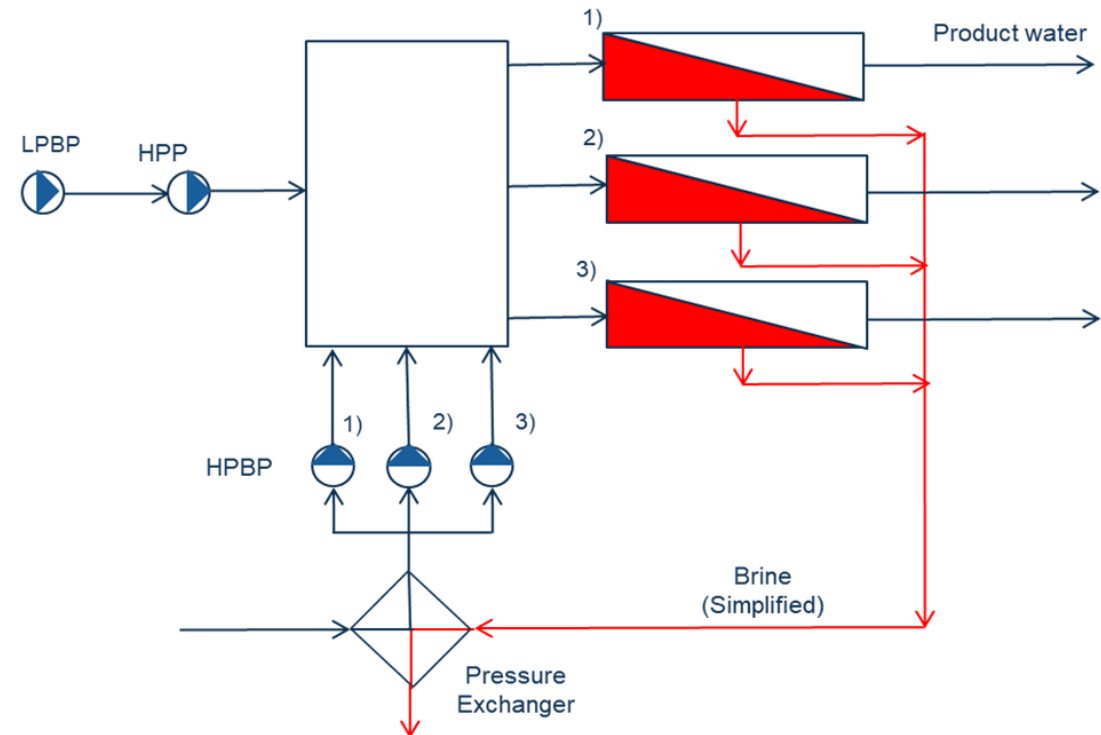
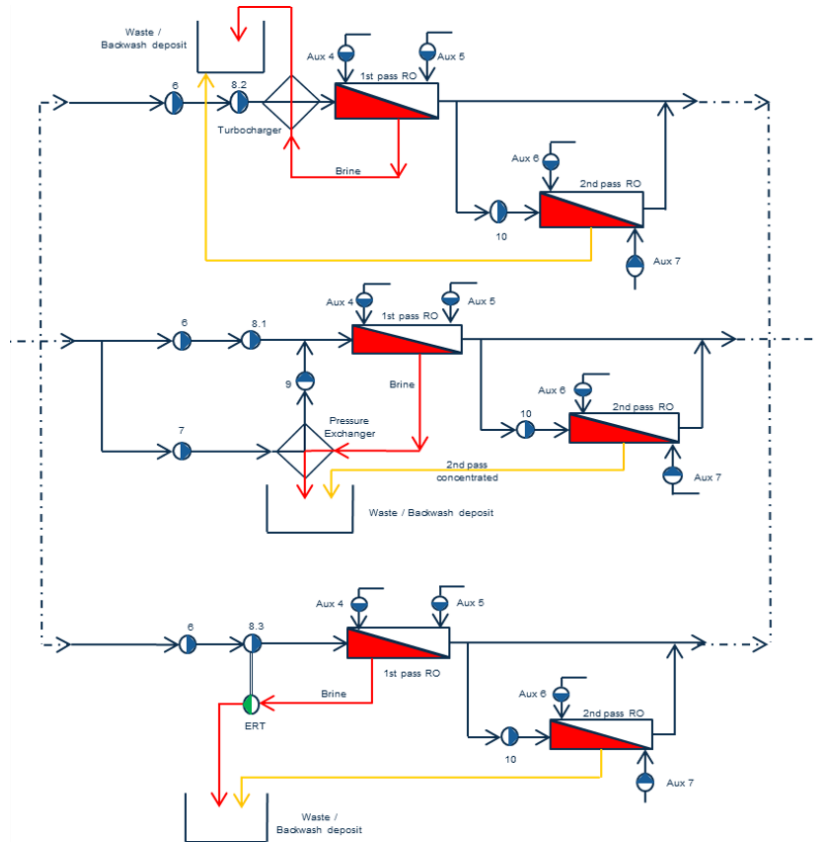


# Desalination: Full Line Supplier.

## HP RO Pump : Dedicated Train / Common Manifold

- Traditional configuration, is dedicated train.
- Each membrane bundle uses one HP RO Pump

- For MEGA plants the trend is to use common manifold
- A group of membrane bundle uses one HP RO Pump





# OH1 Pumps





# OH1 Pumps – CRP

- Designed to exceeds ISO 5199 reliability – CPP for ASME design
- According to ISO 2858 and larger sizes with easy installation, maintenance and service
- Modular interchangeability to reduce inventory
- Industry leading performance and high efficiencies
- High suction pressure design available up to 90 bar

## OPERATING LIMITS

Capacity	up to 8,200 m <sup>3</sup> /h
Head	up to 180 m







# ANSI Chemical Process Pump OH1

**CPO / CPP / CRP**







# C-Frame Configuration

**CPO / CPP / CRP**



# ANSI Chemical Process Pump OH1

# CPO /CPP/CRP

- Horizontal End-Suction pump with open impeller (CPO) or enclosed Impeller (CPP) (OH1)
- ASME (ANSI) B73.1 – 2012 full compliant.

Sizes	70
Flow	36,000 GPM (8200 m3/h)
Head	650 ft (198 m)
Pressures	375 psi (26 bar)
Discharge Flange	1" to 8"
Flange ratings	Cl. 150, Cl. 300, FF and RF
Min. Bearings life	50 000 hrs at BEP, max. speed, max. diameter and no Suction Pressure
Materials in stock	DI / SST DI / Duplex SST / SST Duplex / Duplex
Special materials	Alloy 20 Hastelloy B and C Zirconium Titanium Others







# ANSI Chemical Process Pump OH1

## Lubrication

- Oil sump (standard)
- Re-greasable bearings
- Greased for life
- Oil mist



Luneta Sight Glass: Easy to see and high strength



## ANSI Chemical Process Pump OH1

## CPO Impeller



All impellers made of Stainless or Duplex using Investment Casting process. This gives the best casting quality and hydraulic reliability

### Materials:

- SST 316 (CF8M)
- Duplex (CD4MCu)
- Alloy 20, Hastelloy B or C, Titanium, Zirconium.

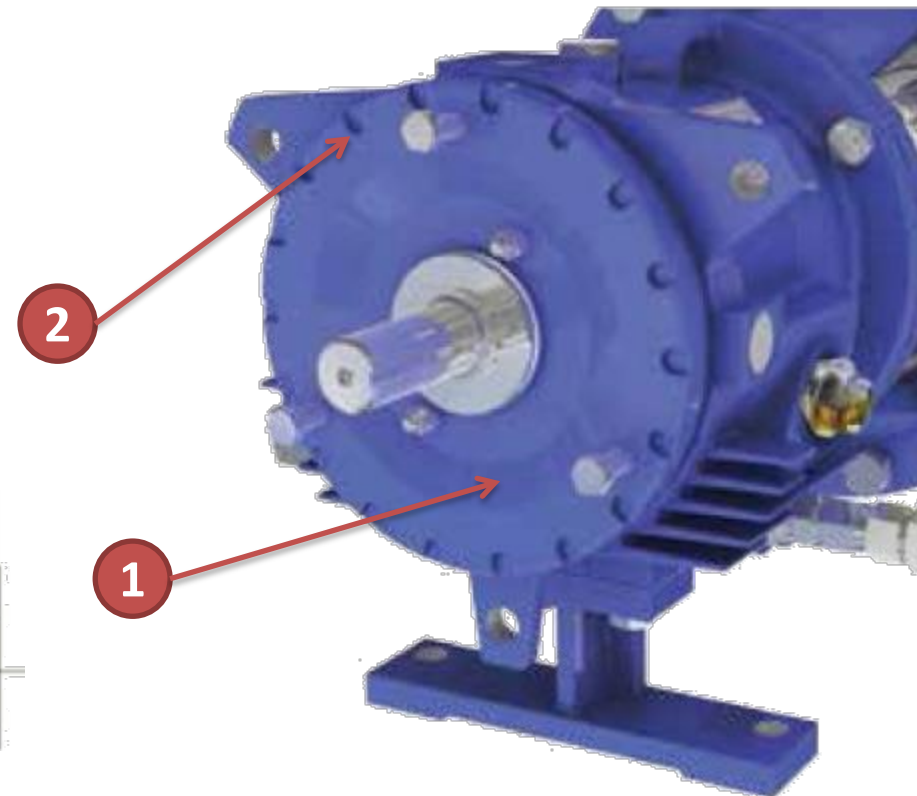
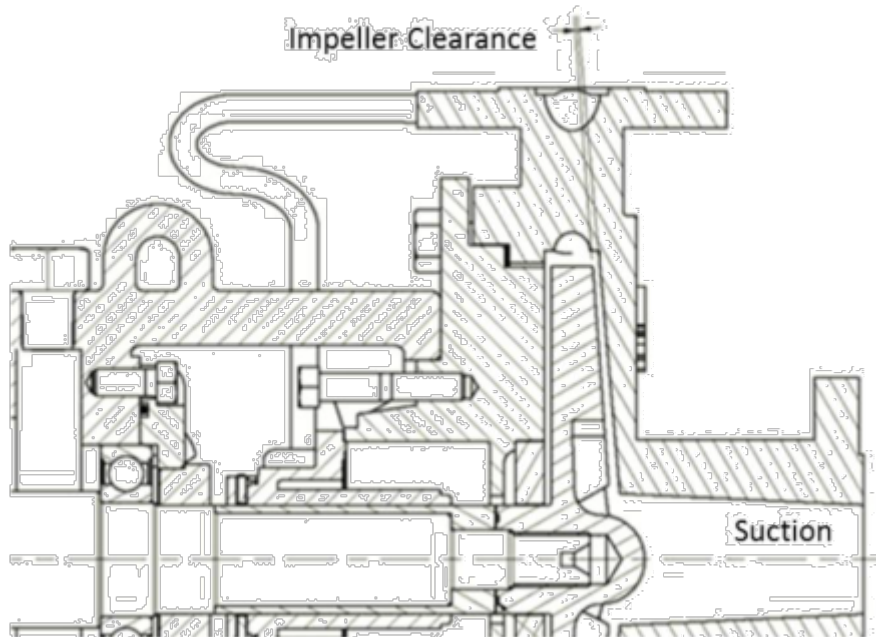




# ANSI Chemical Process Pump OH1

## Bearing Carrier

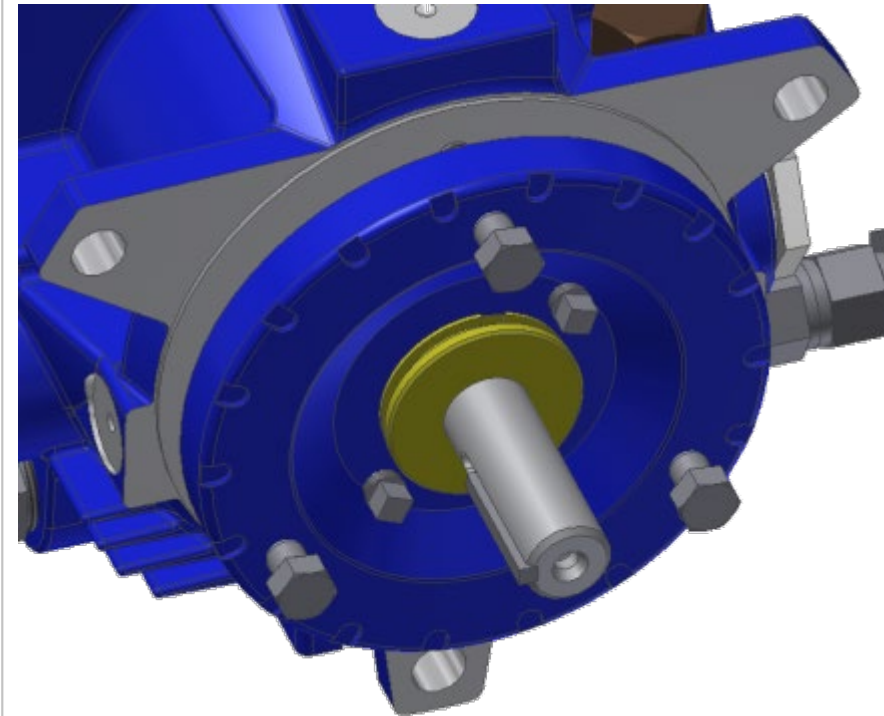
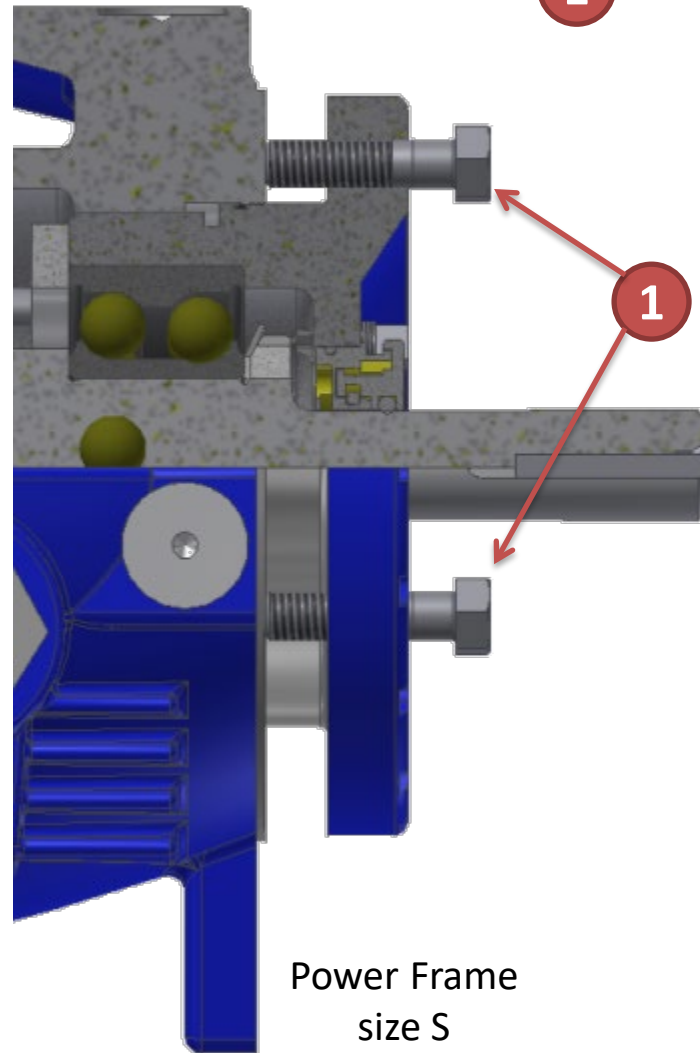
- 1 The Bearing Carrier is threaded to the frame and rotates to displace axially the entire rotor
- 2 Each mark rotation represents an axial movement of 0.003" (0,08 mm)



# ANSI Chemical Process Pump OH1

## Bearing Carrier

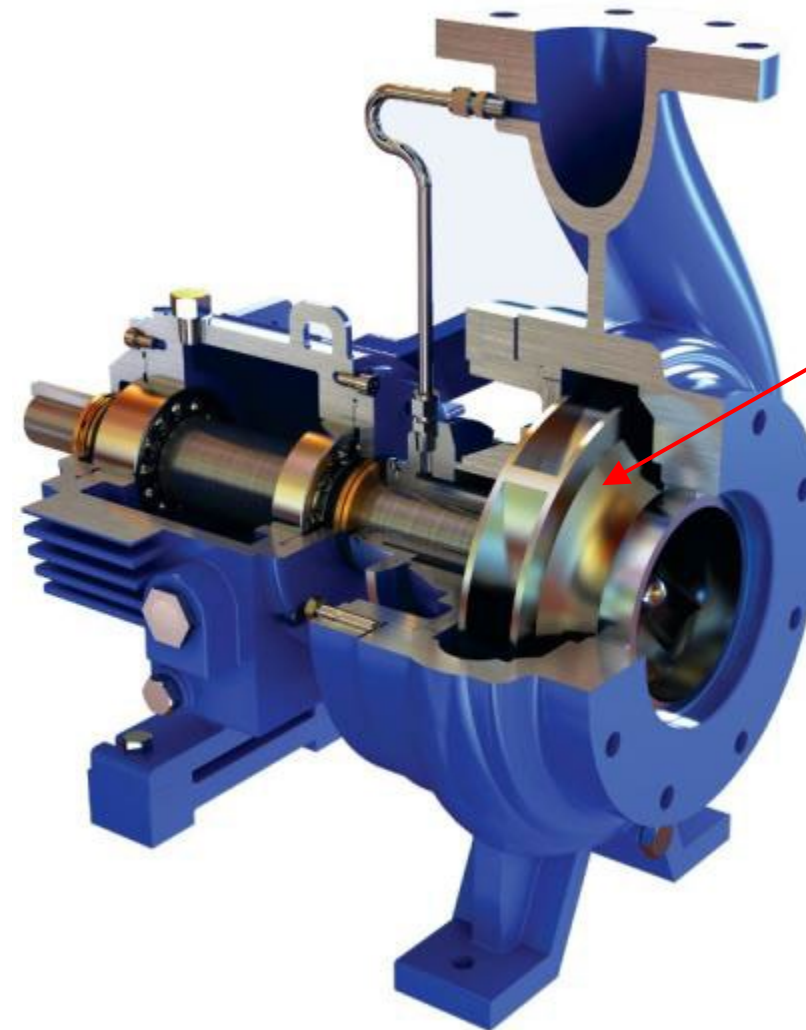
- 1 Three hexagonal bolts to lock the bearing carrier rotation once we have the axial clearance required





# ANSI Chemical Process Pump OH1

# CPP Impeller



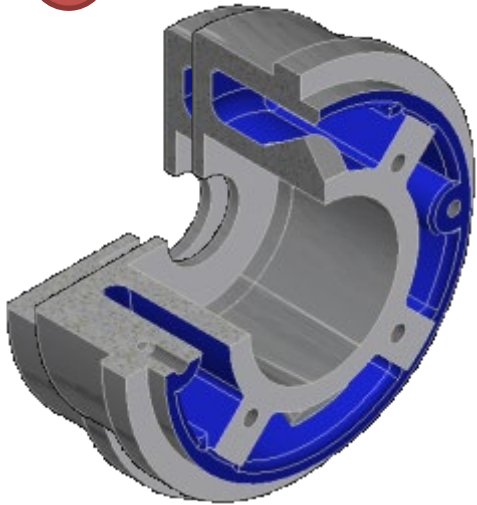
CPP has Enclosed Impeller



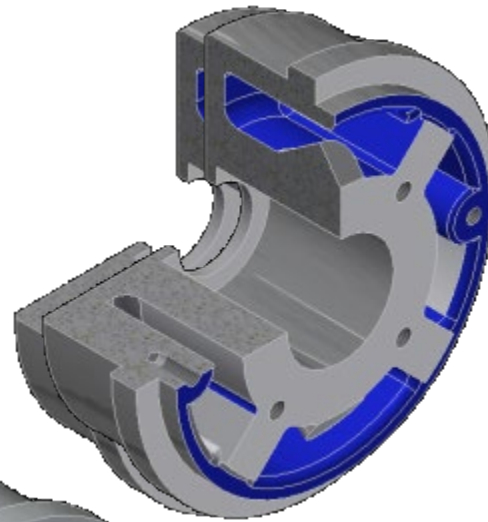
# ANSI Chemical Process Pump OH1

## Case Cover

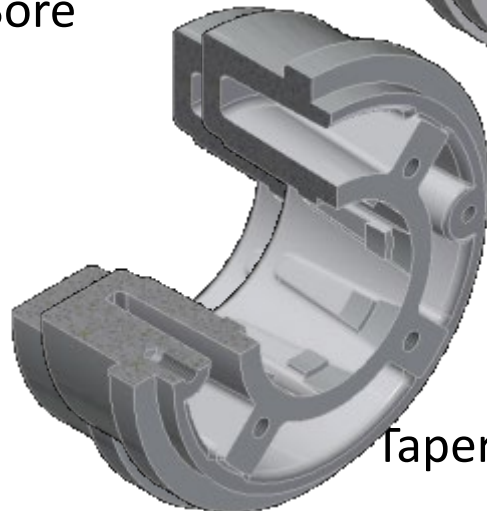
1 Packing, Single & Double mechanical seal



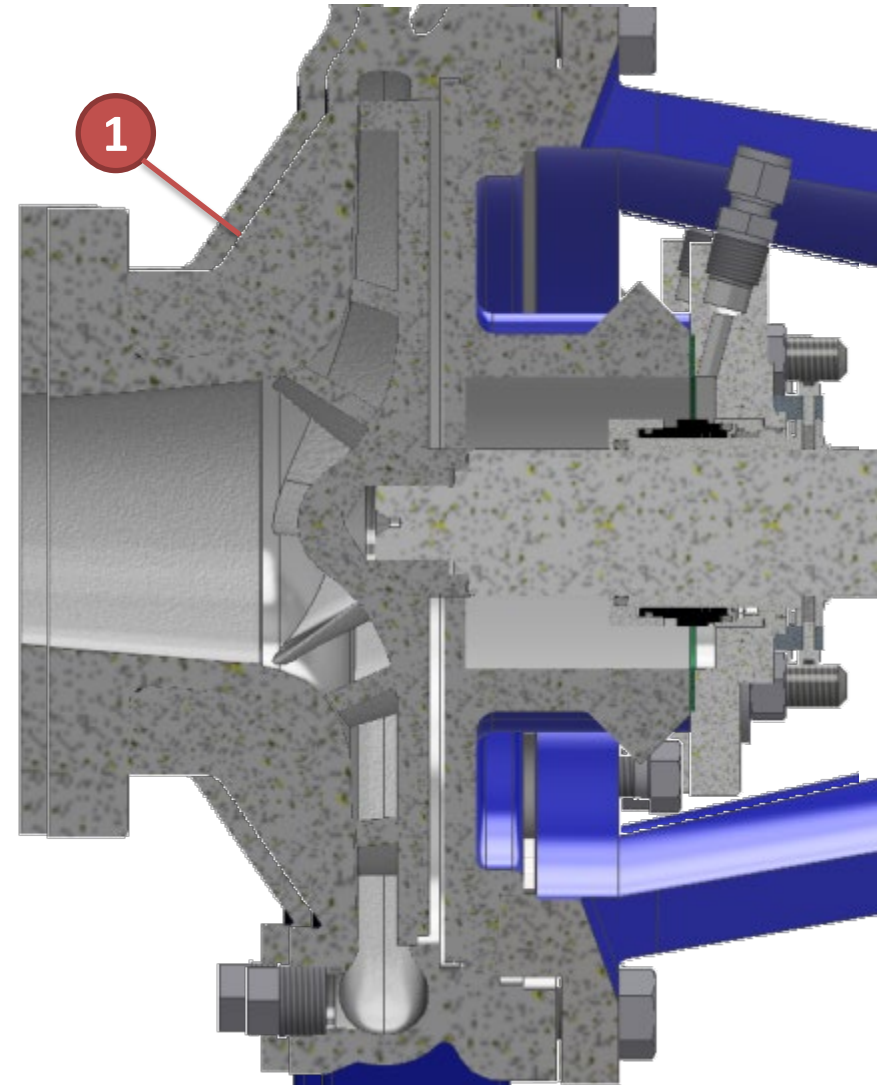
Big Bore



Small Bore



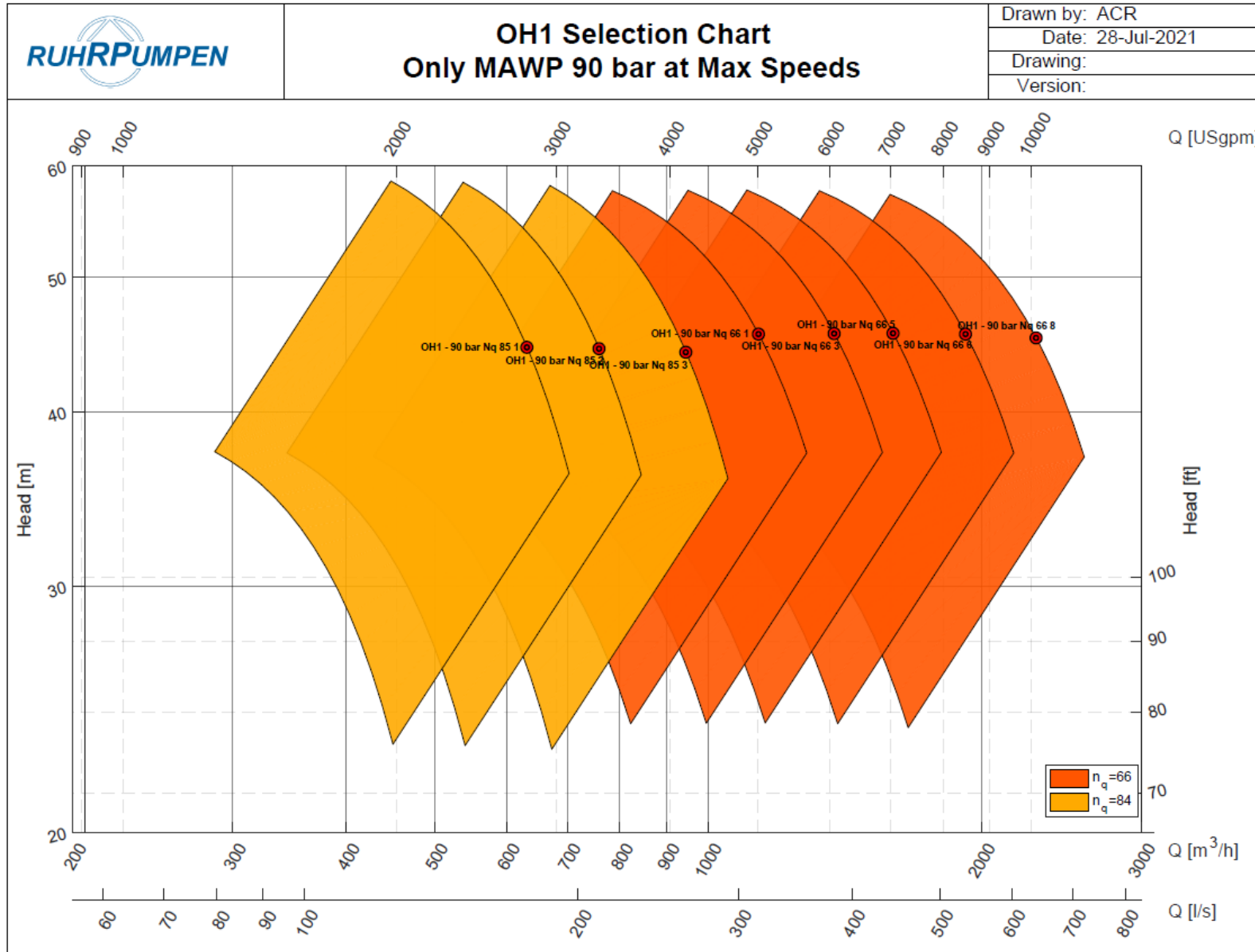
Tapered Bore





# OH1 Pumps: CRP

## Overall OH1 Pumps Graph

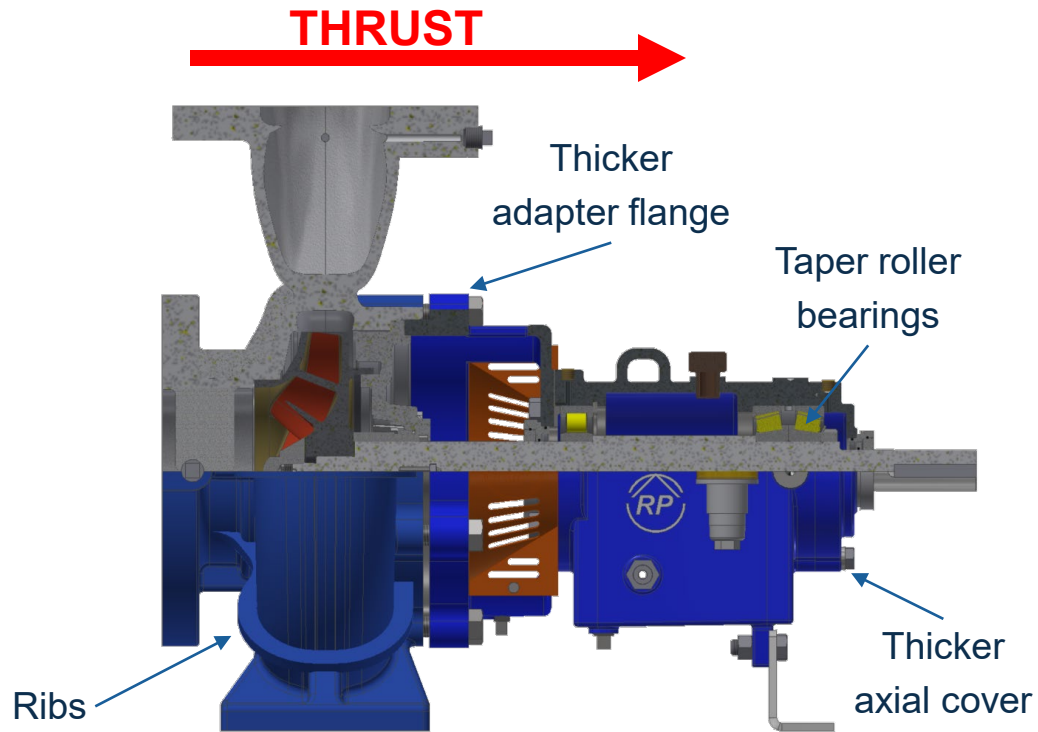




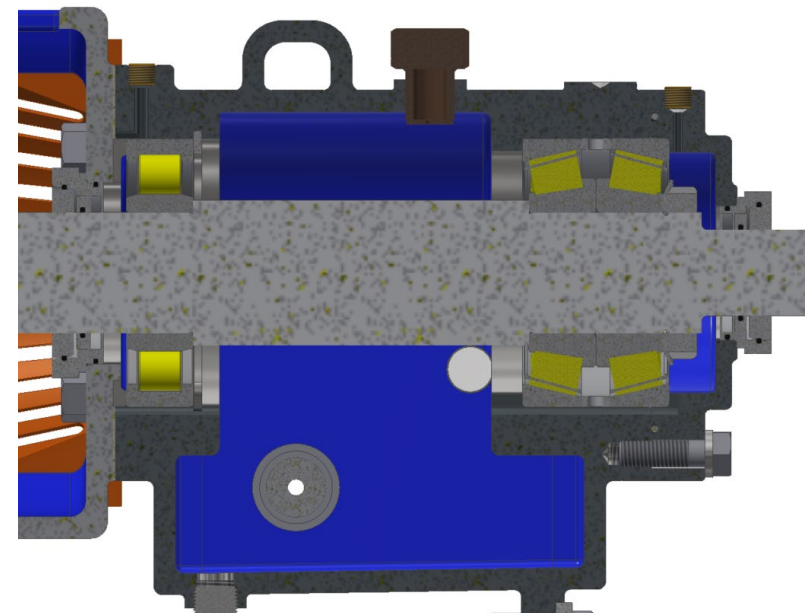


# OH1 Pumps

- 90 Bar MAWP Pumps: (82 bar max inlet suction pressure)



Taper Roller Bearings only for the 4 Smallest Units – Rest of units Angular Contact ball bearings





# BB1 Pumps – ZW / HS

- Designed according to HI guidelines with easy installation, maintenance and service.
- Double suction, enclosed impellers provide hydraulic balance eliminating axial thrust
- High reliability, easy maintenance machine
- Verticalized construction available.
- Axially split case, single- and double- volute design minimizes thrust loads and allows operation in a wide range of capacities.
- The ZW is NSF ANSI 61/372

## OPERATING LIMITS

Capacity	up to 30,000 m <sup>3</sup> /h
Head	up to 340 m



# FEATURES AND BENEFITS IMPELLER AND BEARING BRACKET

## IMPELLER

All impellers are double suction, dynamically balanced and held in place by separate nuts. (investment casting and sand casting manufacturing).

## BEARING HOUSING

360° bearing housing arrangement to ensure mechanical stability and low vibration levels. Design allows to use the housing for packing (Standard seal) or mechanical seal (Optional seal).

## BEARINGS

Interchangeable line and thrust bearings (conservatively rated at 100,000 hours "plus" bearing life) guarantee maximum life at minimum maintenance cost. Either oil or grease lubrication available.



## SHAFT SLEEVE

Separate shaft nuts feature provides the greatest simplification of sleeve replacement. Sleeves are sealed to shaft by an "O" ring to prevent leakage and subsequent erosion. 11-13% chrome sleeves are available for extended sleeve life on packing.

## SHAFT

A rigid shaft combined with double - volute casing - results in low shaft deflection at all operating points. Low deflection reduces packing wear, ring wear and bearing loading, which ultimately results in sustained efficiency and economic operation.

## VERTICAL MOUNTING



All HS/ZW pumps can also be mounted vertically if required by the customer







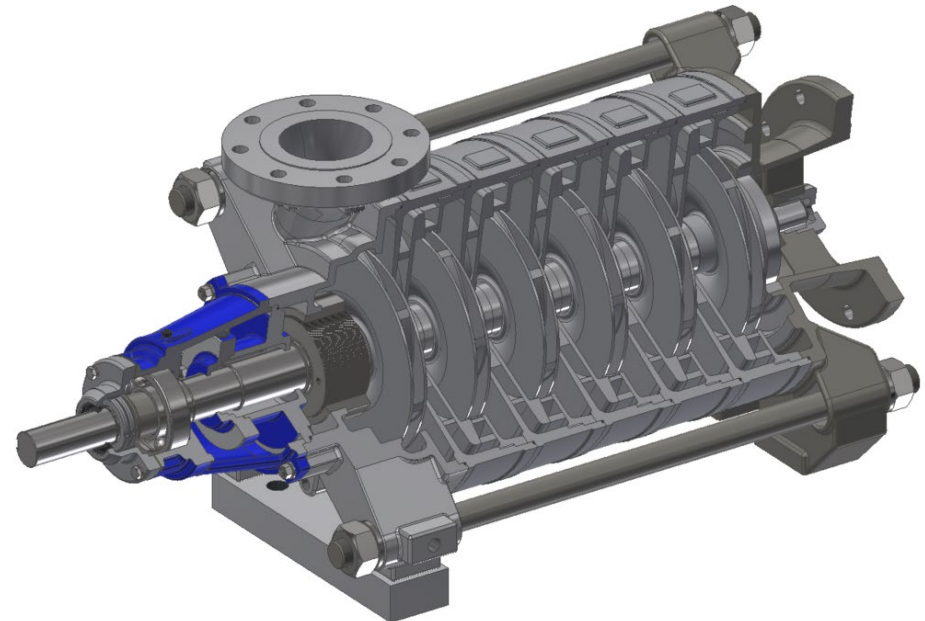
# HPRO Pumps – GPA

- Designed according to HI guidelines.
- Easy access for maintenance
- Different flanges configuration available (end-right/top/left)
- Balance drum design for optimal axial thrust compensation.
- One single mechanical seal to minimize components



## OPERATING LIMITS

Capacity	up to 300 m <sup>3</sup> /h
Head	up to 720 m







# HPRO Pumps – GP

- Designed according to HI guidelines with easy installation, maintenance and service
- Optimized diffuser construction & Hydraulics for enhanced pump efficiency
- Different axial thrust compensation methods available.
- A and B series stage hydraulics available to match different head/flow requirements with maximum efficiency
- Low NPSH (type IS) first stage impeller designs



## OPERATING LIMITS

Capacity	up to 1,000 m <sup>3</sup> /h
Head	up to 2000m



**Pump Type BB4**  
**Single Case, Multistage, Radially Split**  
**Case Pumps**  
**(also called “Ring-Section”, “Segmental**  
**Ring”, and “Tie-rod” pumps)**

- 20 GP pumps 6x4x11 supplied by RP India



**GP** 6X4X11 (A) 12 STAGE  
20 PUMPS



## Ruhrpumpen BB4 Pump – “GP”

The GP pump is a diffuser type, horizontal, multi-stage, between bearings, ring section pump-type BB4. It is engineered to be the most reliable and exceptional pumping solution for the most demanding high-pressure and high temperature applications across many industries.

Its compact design, together with high efficiency hydraulics, provides superior performance and exceptional reliability combined with easy maintenance and minimal operating costs.





Designed for speeds up to 2 poles - 50 Hz/60 HZ design



Wide range of hydraulics (A and B impellers for same casing are available to cater to different flow/head requirements with optimum efficiency)



Optimum NPSH performance with special, low NPSH first stage available

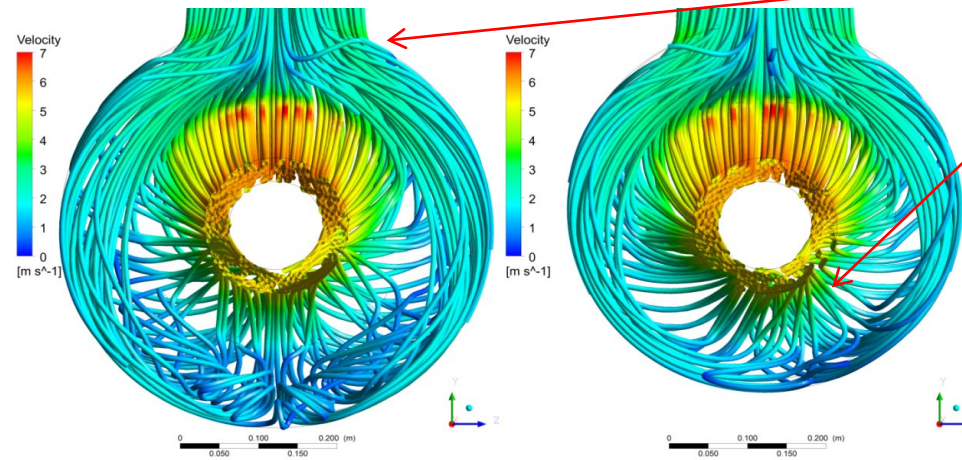


Specially designed stages to accommodate interstage take-off flow





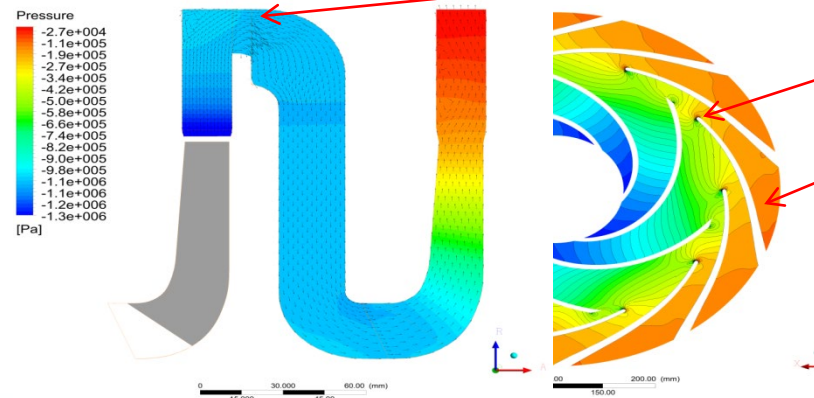
## Flow simulation and optimization of the suction chamber with CFX \*



flow optimization in the transition to the suction chamber (vortex reduction)

flow alignment in the suction chamber (reduction of turbulence losses)

## Verification of impeller and return stage design with CFX \*



Minimizing flow separations

adaptation of inlet angle

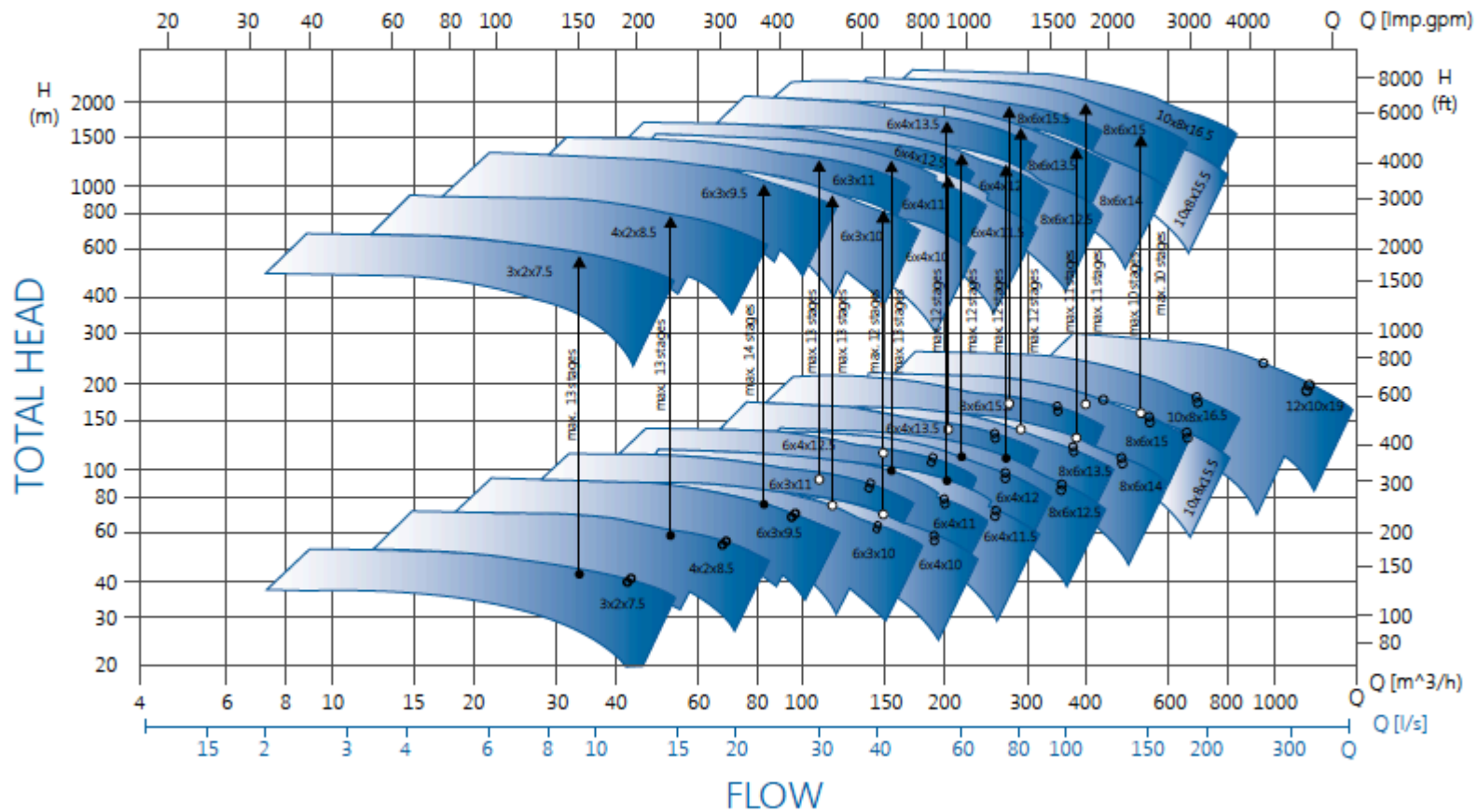
continuously rising pressure



# GP RANGE CHART

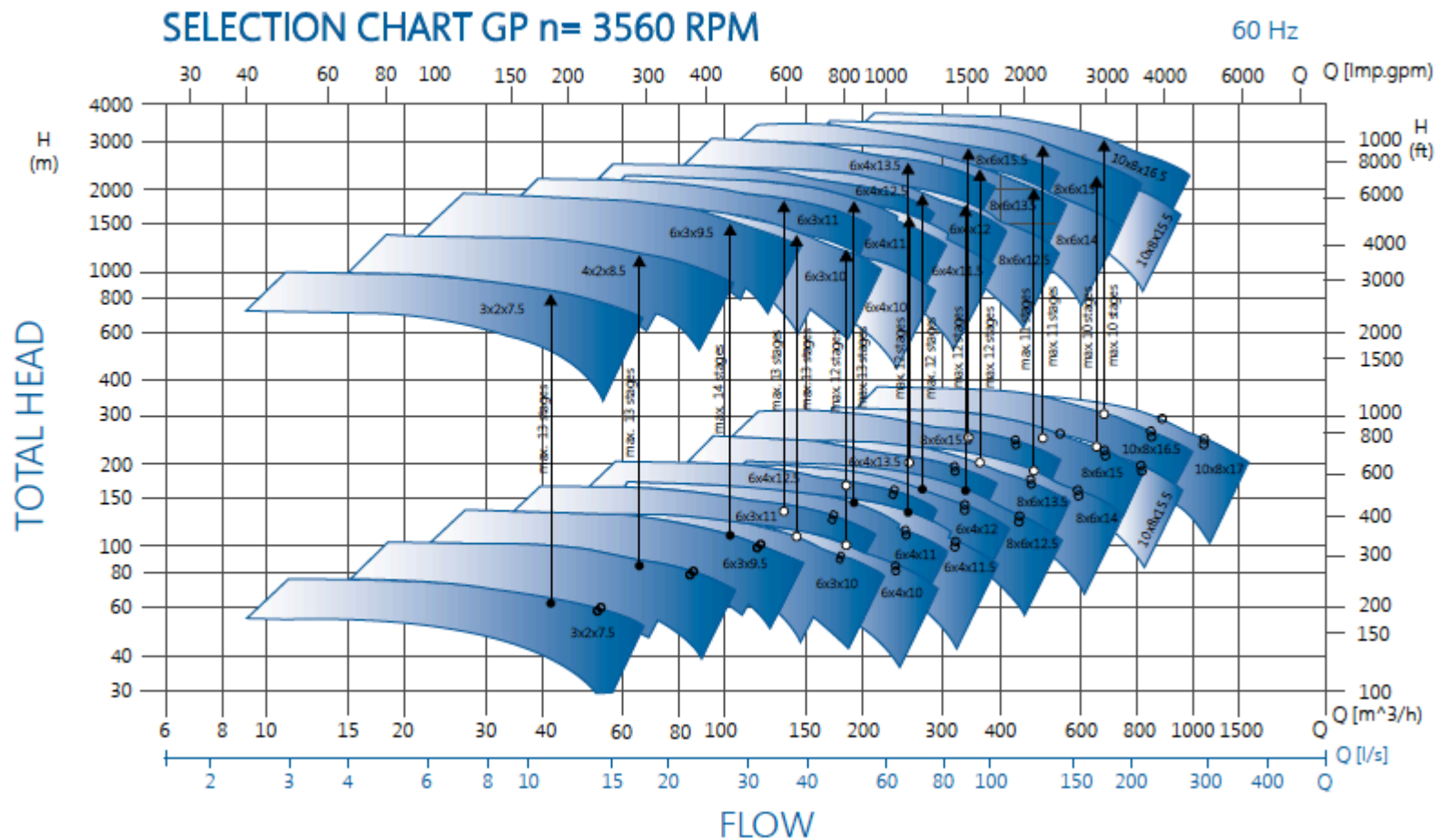
SELECTION CHART GP n= 2960 RPM

50 Hz





# GP RANGE CHART





Design with typical features for Industrial Services



Design with typical features for Desalination Market Applications



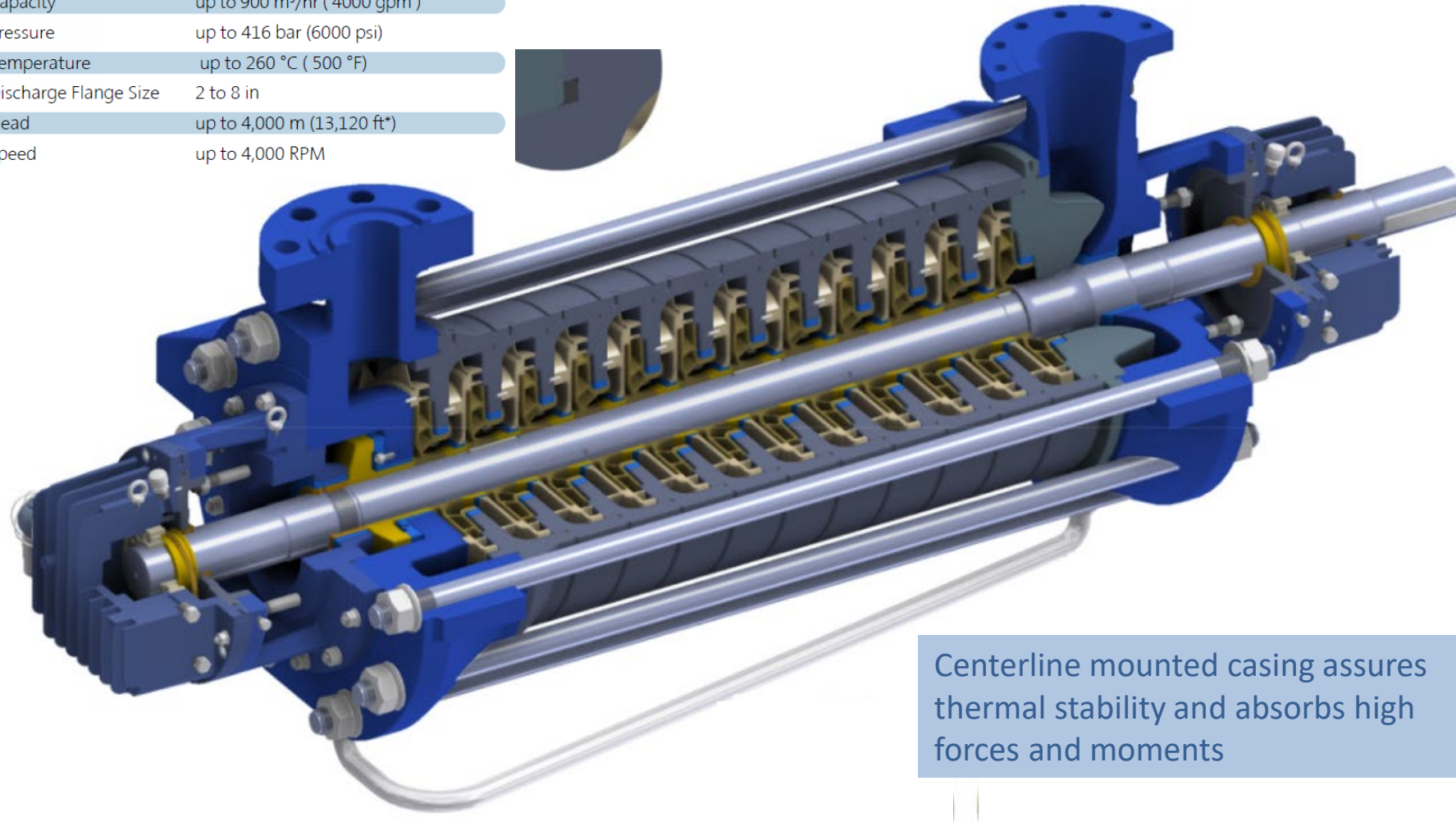
Design with typical features for API 610 Applications



# GP PUMP

## PERFORMANCE DATA

Capacity	up to 900 m <sup>3</sup> /hr ( 4000 gpm )
Pressure	up to 416 bar (6000 psi)
Temperature	up to 260 °C ( 500 °F)
Discharge Flange Size	2 to 8 in
Head	up to 4,000 m (13,120 ft*)
Speed	up to 4,000 RPM

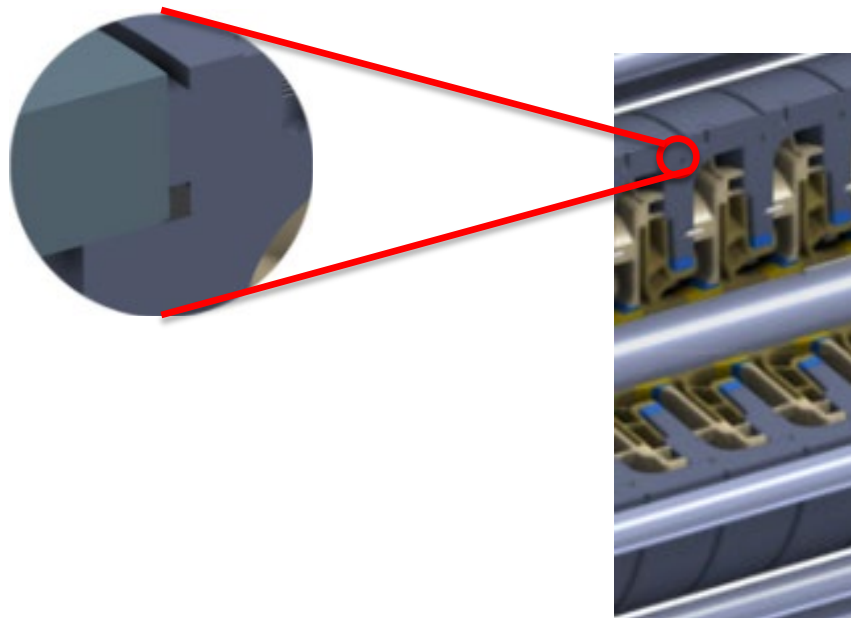


Centerline mounted casing assures thermal stability and absorbs high forces and moments

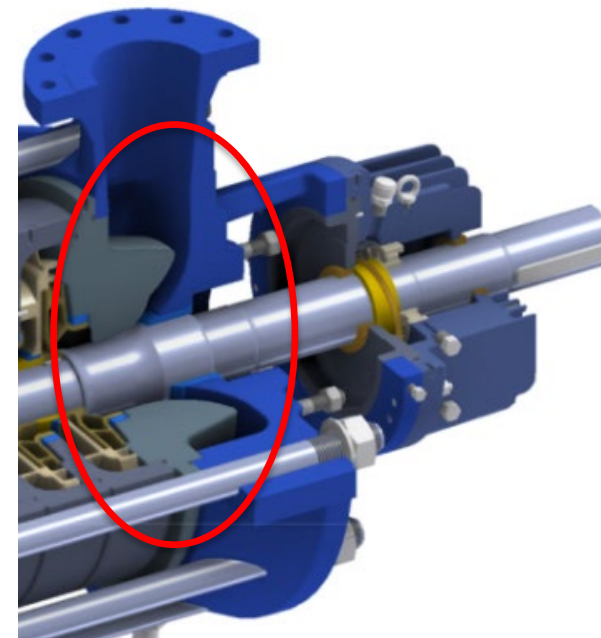


# FEATURES AND BENEFITS

Casings are sealed with elastomeric o-rings suitable for rapid temperature variations. Elastomers are confined in grooves and therefore not subject to shear forces and so are less likely to be damaged during assembly and disassembly

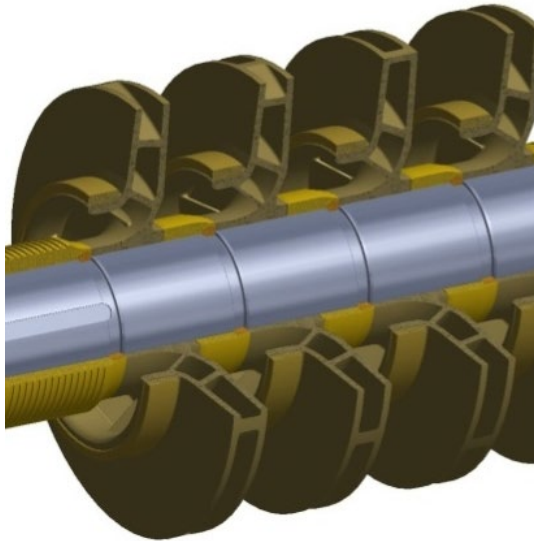


## CASING



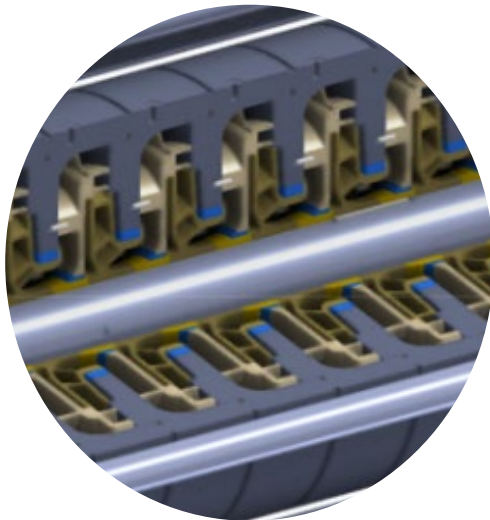
Suction chamber with inlet channel ensures optimum flow distribution

## IMPELLERS AND ROTOR



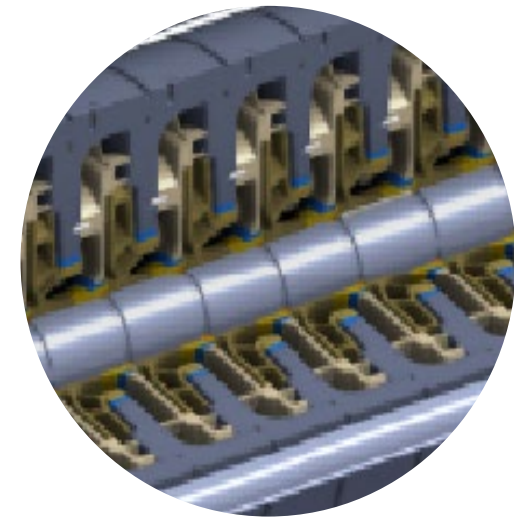
- Closed, single suction impeller design
- Investment casting offers best efficiency and repeatability of hydraulic data
- Keyed to shaft
- Impellers and complete rotor balance to G 2.5 of ISO 1940 (~8w/n) (G 1.0 ~4w/n is optional)
- First stage impeller design for low NPSH is available
- Inline rotor arrangement

## IMPELLER MOUNTING AND SHAFT



### TYPICAL FEATURE FOR POWER MARKET DESIGN

Stacked rotor design with staggered keyways



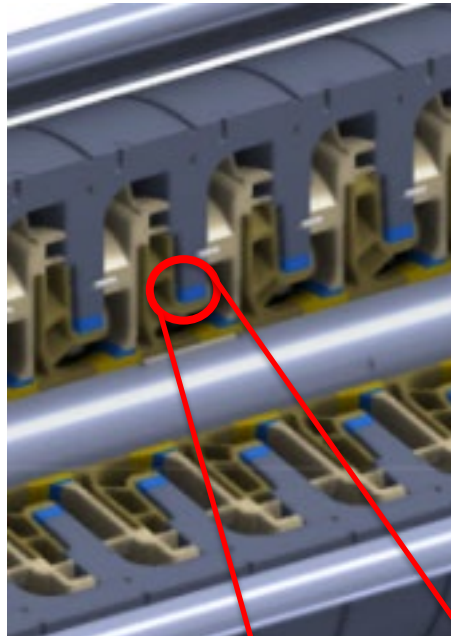
### TYPICAL FEATURE FOR API 610 PUMP DESIGN

Stepped rotor design with light interference/transition fit allows easy assembly and disassembly.  
Individually secured impellers by split ring

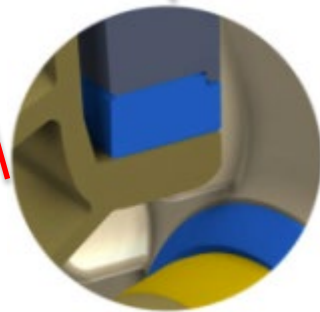




## WEARING PARTS

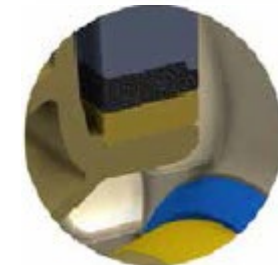
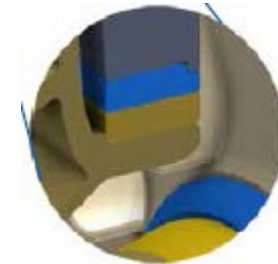
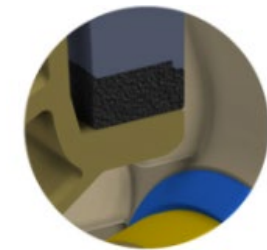


Stationary casing wear rings and interstage bushings are standard

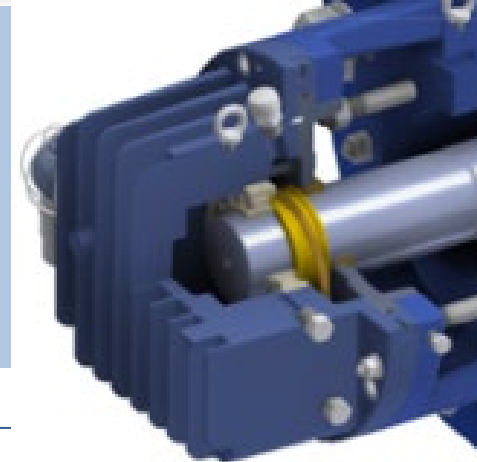


### OPTIONAL FEATURES

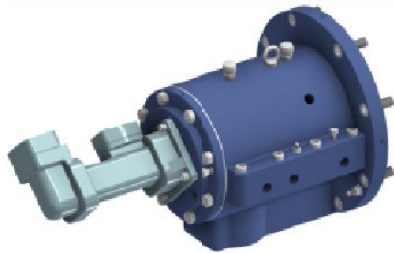
- Non-metallic casing wear rings with reduced clearances for enhanced efficiency
- Replaceable impeller wear rings
- Optional non-metallic casing wear rings + replaceable wear rings with reduced clearances for enhanced efficiency



- Rigid, 360° bearing support ensures low vibration
- Clamped bearing cover without screws provides better access to the seals
- Bearing housing with vertical fins provides optimal cooling
- Radial bearing - single row cylinder roller anti-friction with splash oil lubrication and constant level oiler is standard
- “Inpro” bearing isolator



## OPTIONAL FEATURES



Shaft driven main oil pump for forced feed lubrication (API 610 is standard with API 614 optional available)

- Oil Mist lubrication
- Water cooled bearing housing
- Radial sleeve bearings for higher loads
- Thrust bearing where required
- Double acting tilting pad thrust bearing with radial sleeve, axial split hydrodynamic bearing with forced feed lubrication in high power applications.

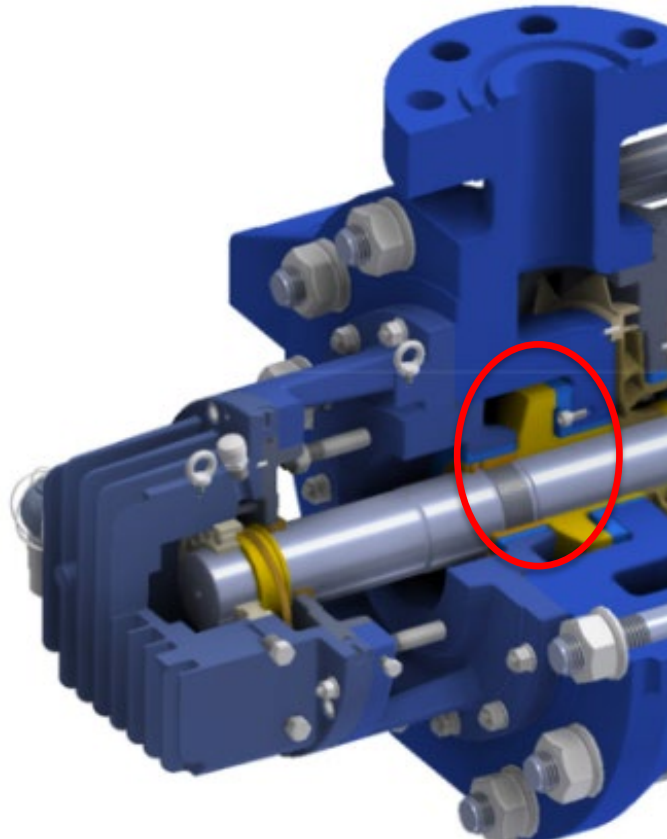


## HYDRAULIC BALANCING

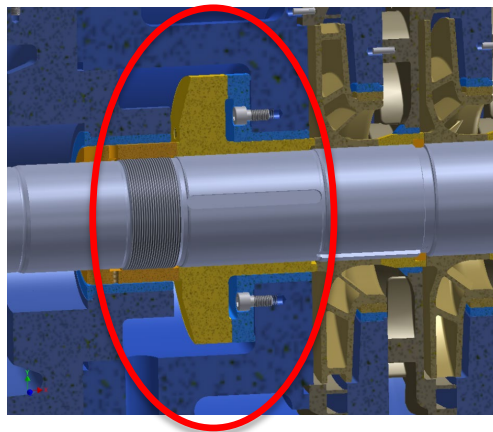
- In any centrifugal pump, the rotor tends to produce some amount of thrust because of different pressures and different geometries on the two sides of the impeller. This thrust is handled by the pump thrust bearing.
- In a high pressure multi-stage pump (such as BFW) the number of impellers is high, thus the net thrust would be large (putting high load on thrust bearings) unless something is done to reduce it.
- Main ways to reduce the net thrust are to oppose the impellers (for example AB pump) or to use a balance disk/drum (for example in GP pump)
- The balance device (disk or drum) is located after the last stage so it has full discharge pressure on one side. On the other side the balance line is routed back to the suction.
- The main difference between a balance disk and a balance drum is whether the pressure drop is across a radial clearance (drum) or an axial face (disk).



## BALANCE DISK



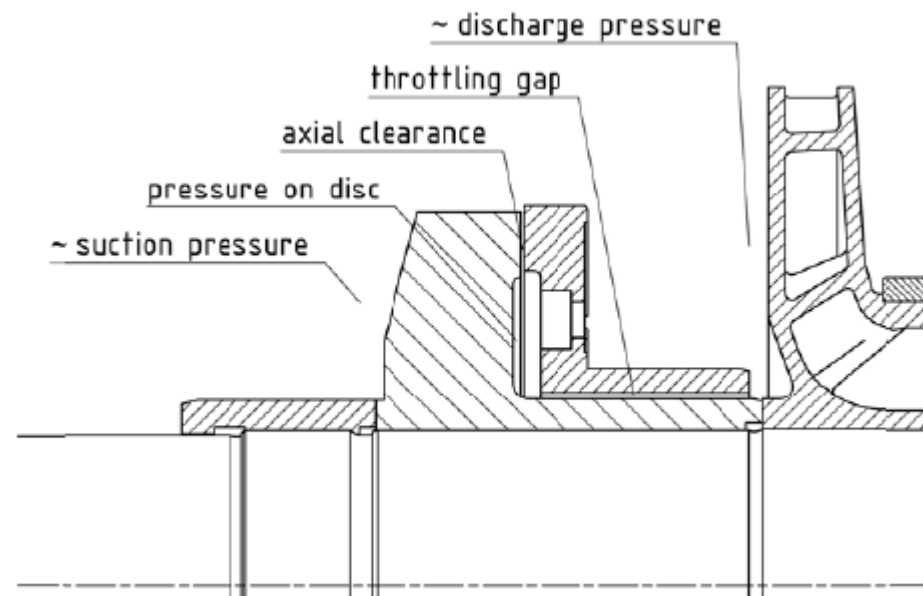
- Uses a close axial clearance to compensate 100% of the axial thrust across the complete pump operating range therefore removing the need for a thrust bearing
- Self adjusting because the clearance increases and decreases with the axial position of the impellers and shaft based on the actual thrust produced
- Suitable for applications with non-abrasive pumping fluid and constant pressure



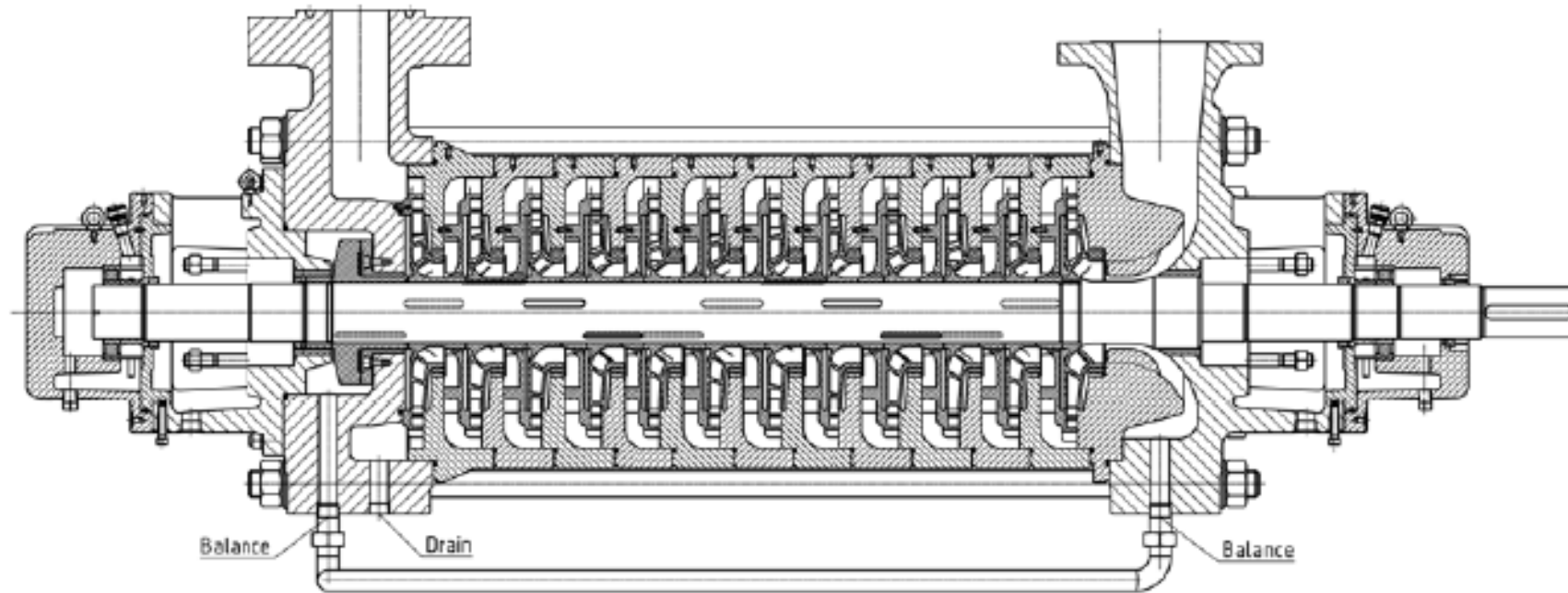
- Highest efficiency balancing method because this has the lowest leakage rate
- Accurate axial rotor setting during assembly is important because there is a risk of contacting of pump and disk

## BALANCE DISK

- Available for GP pump
- Clearance is in range 50-100  $\mu\text{m}$
- Suitable for use in:
  - Non-API applications
  - Non-abrasive process fluids
  - Applications without frequent pressure changes
  - Applications without frequent transient conditions such as pressure drops
  - Applications with head > 160m



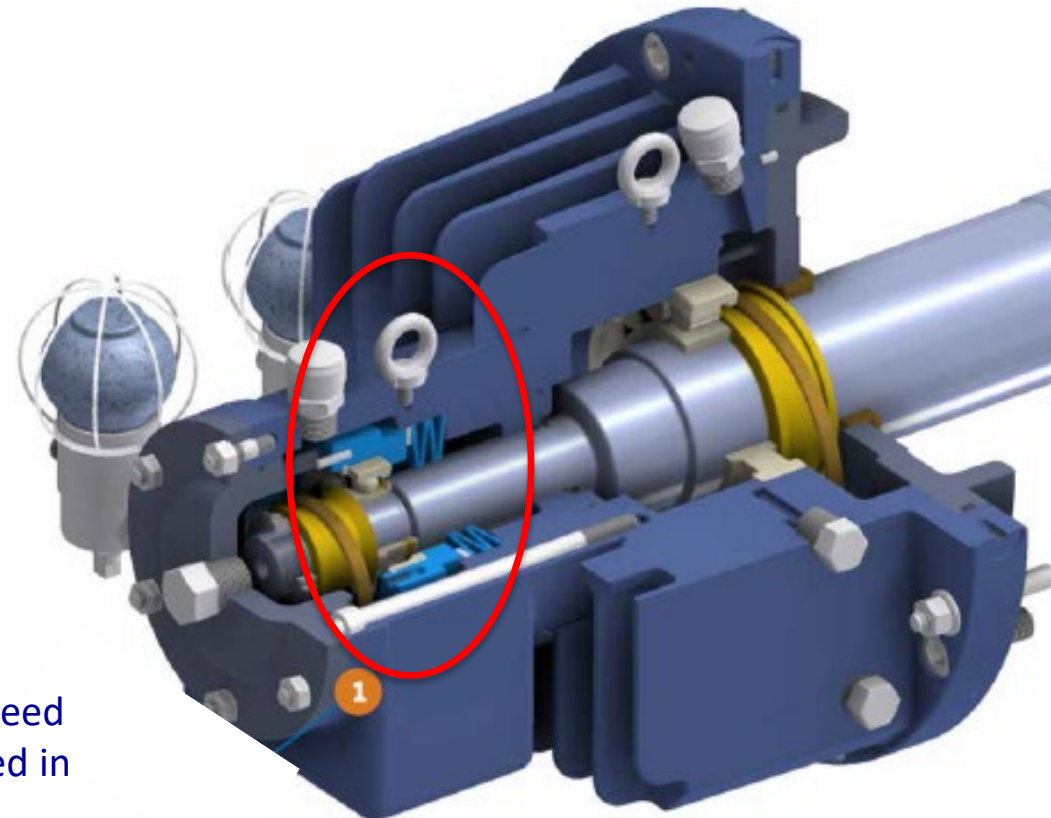
# SECTIONAL DRAWING OF GP PUMP SHOWING BALANCE LINE AND BALANCE DISK



## LIFT OFF DEVICE

### FEATURE FOR POWER APPLICATIONS WITH FREQUENT START/STOP OR LOW SPEED

- Optional feature to work alongside balance disk
- The lift-off device ensures that the balancing disk is open during the rest, start-up and run-down of the pump by means of preloaded springs and an angular contact ball bearing.
- It is required in applications with frequently start and stop and/or operating speed below 1000 rpm
- Frequent start-stop is often seen in Boiler Feed Applications, so this feature is often required in pumps for such Power Plants

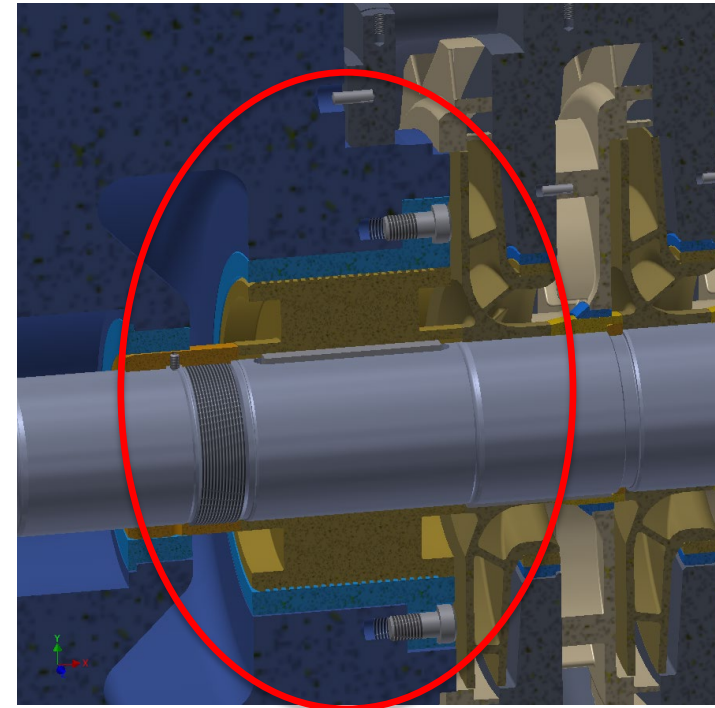




## BALANCING DRUM

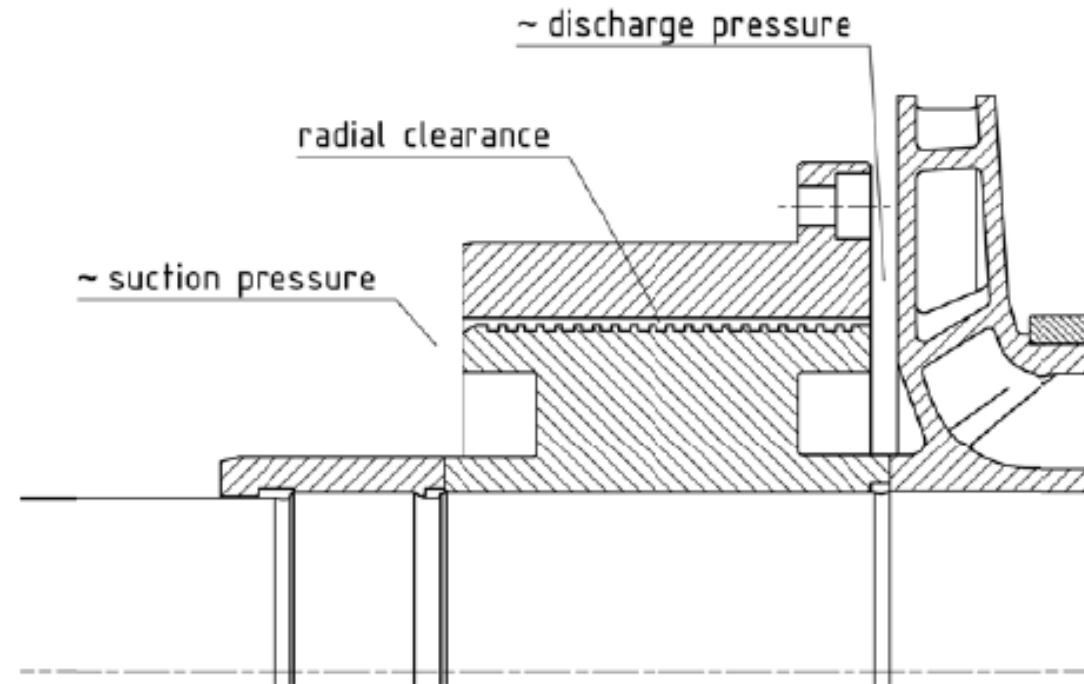
### REQUIRED FEATURE FOR API 610 COMPLIANT PUMPS

- Unlike the balancing disk the balancing drum has a constant radial clearance set by the pump design
- Balances large proportion (85-90%) of generated axial forces at the rated operating point
- Residual forces are handled by a thrust bearing which retains the rotor axial position
- Constant clearance allows the use of a balancing drum in all applications and it provides high reliability in applications with transients such as start up and run down, temperature changes, frequent starts and stops
- Used for API 610 pumps because the standard precludes thrust balancing by use of axial clearances (API 610 11<sup>th</sup> edition 6.7.1) so balance disk cannot be used



## BALANCING DRUM

- Available for GP pump
- Slightly reduced efficiency compared with balance disk due to marginally higher leakage rates
- Easy and safe axial rotor setting due to radial clearance (compared with more critical rotor setting for balance disk method with axial clearance)



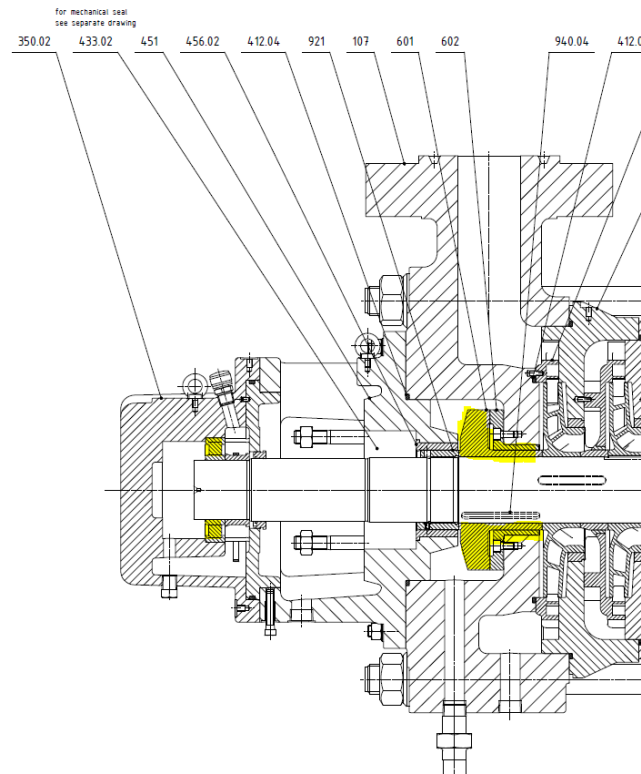


## BEARING SELECTION

# AVAILABLE BEARING SELECTIONS WITH BALANCE DISK

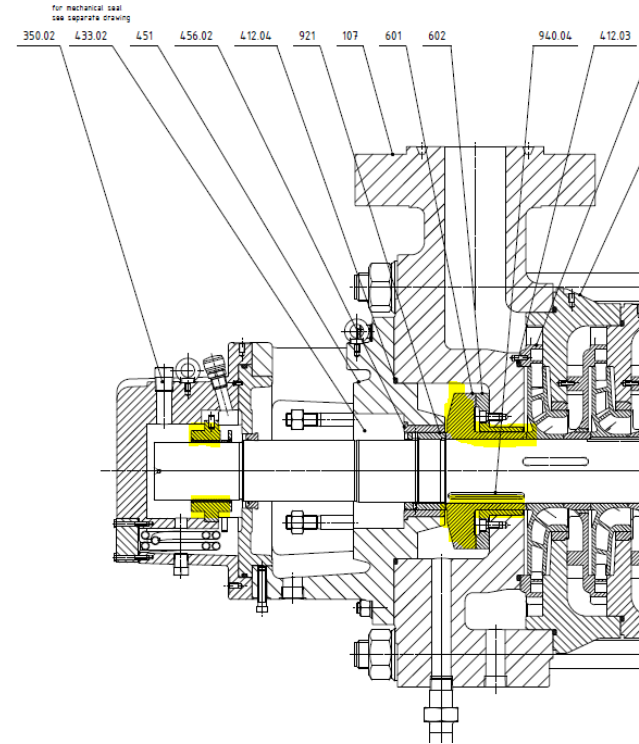
## Antifriction

- DE/NDE: Single row, cylindrical roller bearing (no thrust bearing required)
- Lubrication: Ring oil lubrication with Constant Level Oiler and Sight Glass [Option for Oil Mist]



## Hydrodynamic

- DE/NDE: Radial Sleeve bearing (no thrust bearing required)
- Lubrication: Ring oil lubrication with Constant Level Oiler and Sight Glass
- Cooling: Water cooling coil

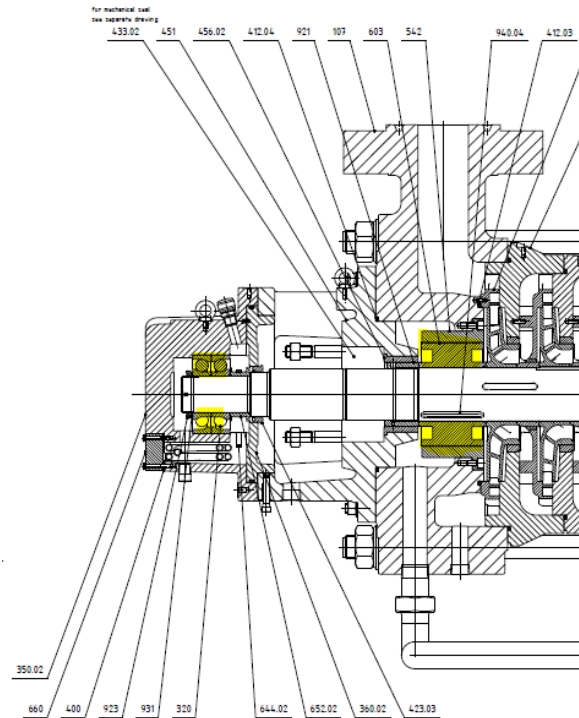




# AVAILABLE BEARING SELECTIONS WITH BALANCE DRUM

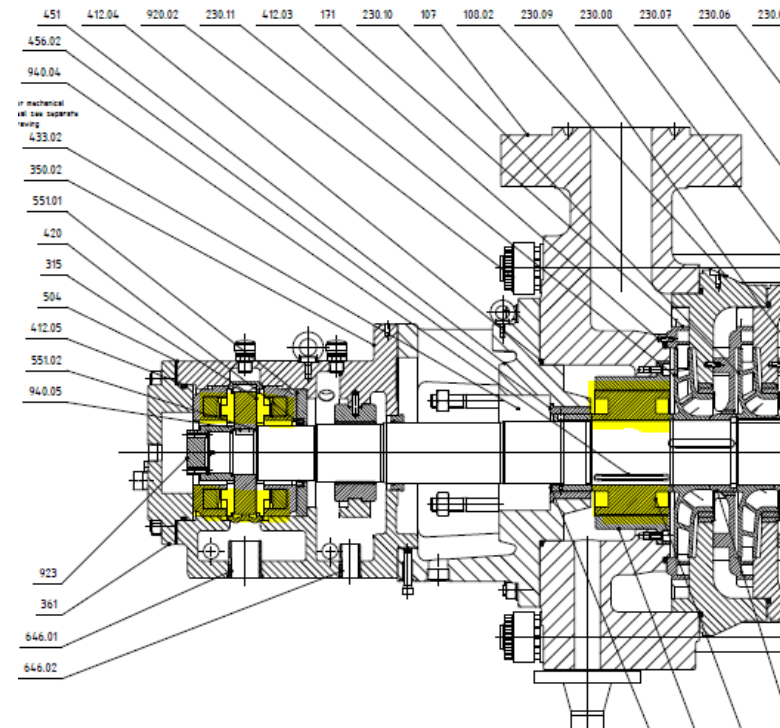
## Antifriction

- DE: Single row, deep groove ball bearing
- NDE: Paired back to back, single row, angular contact ball bearings
- Lubrication: Ring oil lubrication with Constant Level Oiler and Sight Glass [Option for Oil Mist]



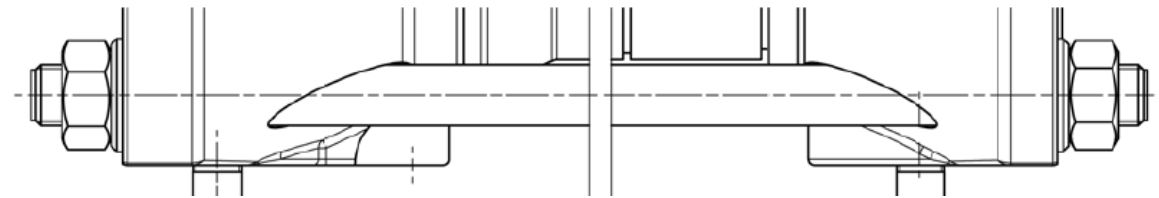
## Hydrodynamic

- DE: Radial Sleeve Bearing
- NDE: Radial Sleeve and double acting tilting pad thrust bearing
- Lubrication: Forced Feed Lubrication



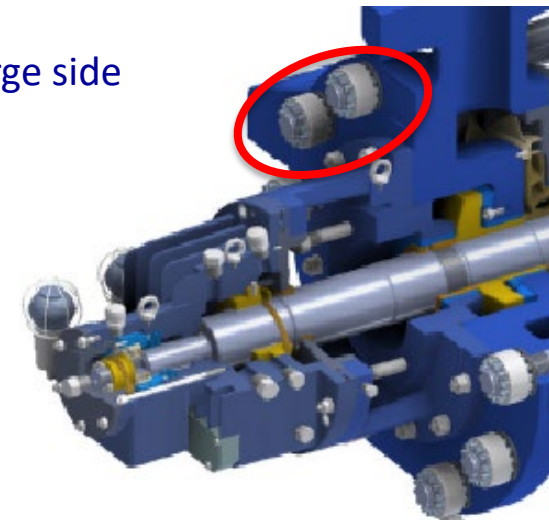
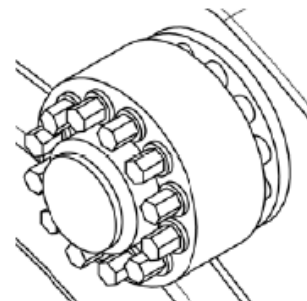
## TIE RODS AND BOLTING

Pump casings held together by tie rods and hexagonal bolts with washers



### FEATURE FOR HIGH PRESSURE PUMPS, APPLICATIONS REQUIRING COLD START AND LARGER PUMP SIZE

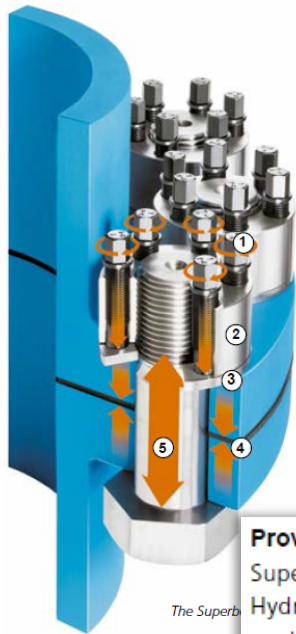
- Ruhrpumpen uses multiple screw mechanical tensioners on the discharge side of the pump (for example „Superbolts“)



## MULTIPLE SCREW MECHANICAL TENSIONERS –SUPERBOLTS\*

### What is Superbolt?

Superbolt tensioners are designed as direct replacements for conventional nuts and bolts. These devices can be threaded onto a new or existing bolt, stud, threaded rod or shaft. The main thread serves to position the tensioner on the bolt or stud against the hardened washer and the load bearing surface. Once it is positioned, actual tensioning of the bolt or stud is accomplished with simple hand tools by torquing the jackbolts which encircle the main thread. The jackbolts transfer the preload evenly into the main thread and, consequently, onto the joint. The main thread is tightened in pure tension.



### How Superbolt tensioners work:

- 1) By tightening the jackbolts, a strong thrust (axial) force is generated. This thrust force is directed against a hardened washer. Jackbolts have a small friction diameter and can therefore create a high thrust force with relatively little torque input.
- 2) The loads are transferred through the nut body which is positioned on the main thread by hand.
- 3) A hardened washer is used to transfer the force while protecting the flange face.
- 4) The thrust (axial) force of many jackbolts and the opposite reaction force of the main bolt head create a strong clamping force on the flange.
- 5) The thrust (axial) force from the jackbolt creates an equally strong reaction force in the main bolt.

### Proven in the field

Superbolt tensioners are used in many industries: Hydropower, wind turbines, gas and steam turbines, nuclear, steel, mining, shipbuilding, offshore, chemical, transportation, to name a few.

### Benefits

- Pure tensile load on tie rods – absence of axial stresses allows higher capability of the rods
- Ensures uniform tightening on all tie rods
- Tie rod elongation can be measured as the gap between the nut body and the washer, giving additional verification of the tightening torque used
- Allows bolt tightening by use of simple hand tools (no need for heavy hydraulic tool) meaning that re-assembly is faster and more simple in the field and no special tools needed

\* Trade Mark - Nordlock Group

## MULTIPLE SCREW MECHANICAL TENSIONERS – SUPERBOLTS \*



<https://www.nordlock.com/superbolt/products/superbolt-tool/>

\* Trade Mark - Nordlock Group





# HPRO Pumps – SM / JTN

- Back to back impellers configuration for an optimum thrust balance
- Various hydraulics to match different head/flow requirements with maximum efficiency.
- Available double suction first stage Impeller or single suction low NPSH for critical suction needs.
- Based on API 610, gives a robust, easy maintenance product



## OPERATING LIMITS

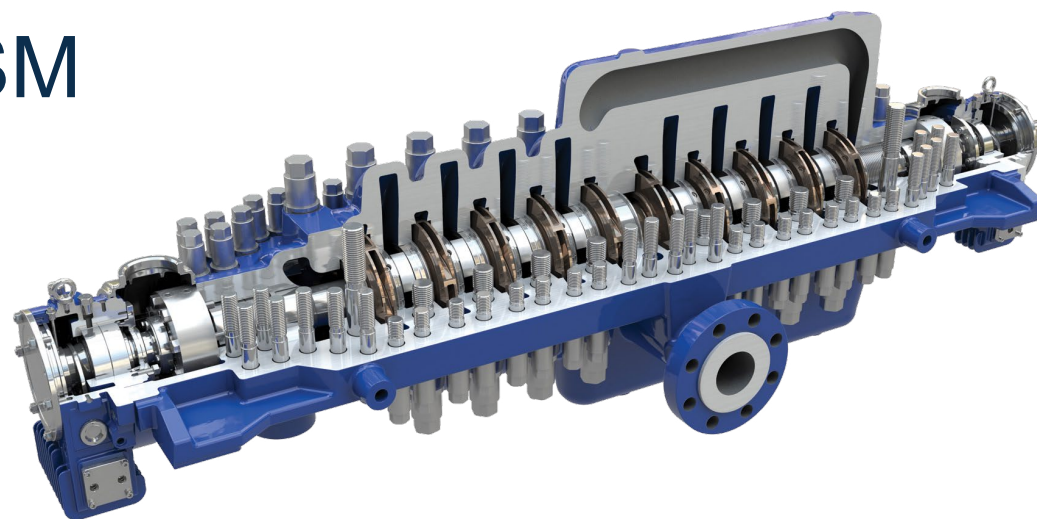
Capacity	up to 1,400 m <sup>3</sup> /h
Head	up to 650 m

# OVERVIEW

JTN

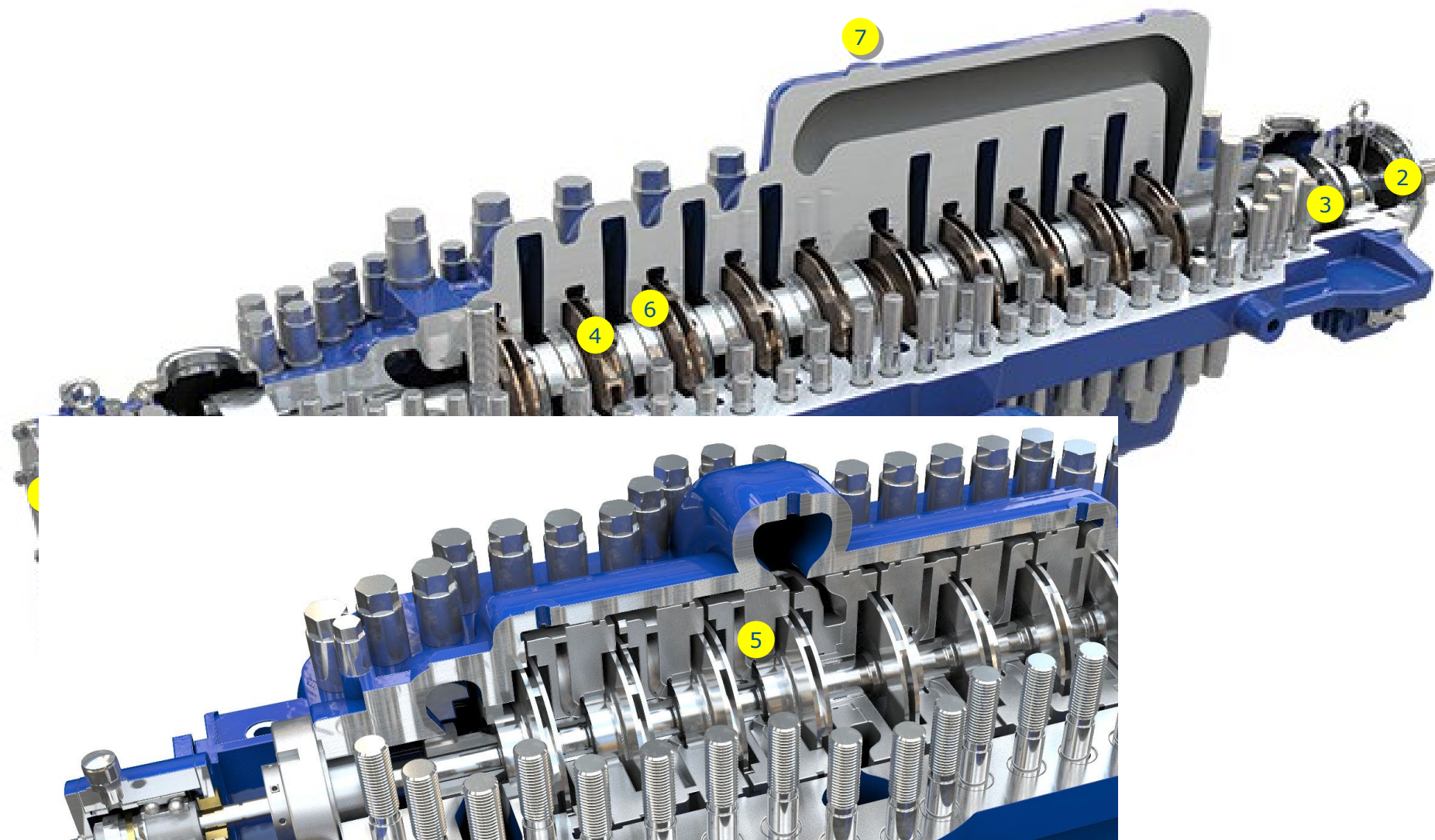


SM



# PUMP DESIGN

- 1 Pump casing
- 2 Bearing housings
- 3 Seal chamber
- 4 Impellers
- 5 Diffusers (JTN only)
- 6 Wear rings
- 7 Vent / Drain





# HPRO Pumps – ZM

- Tailor made design for a perfect fit solution
- Single and two stages design available.
- Double volute design
- Industry leading performance and high efficiencies.
- Foot or Near-centerline mounted



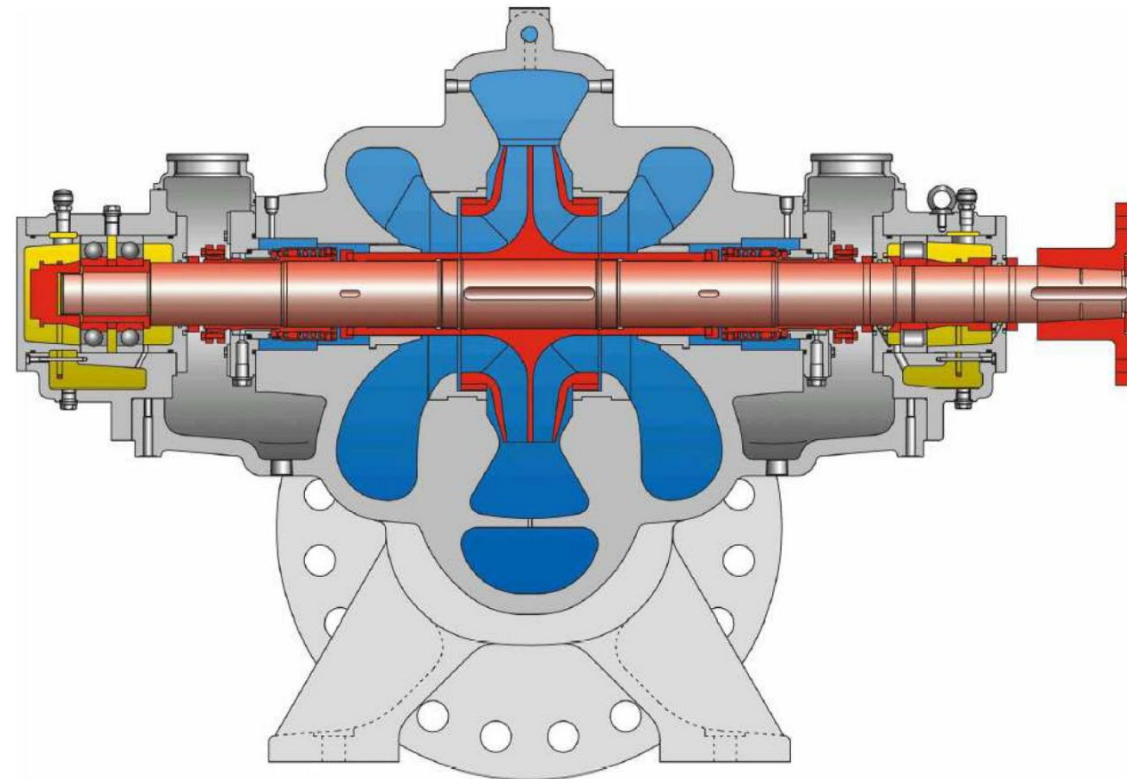
## OPERATING LIMITS

Capacity	up to 9,000 m <sup>3</sup> /h
Head	up to 650 m





# ZM PUMP

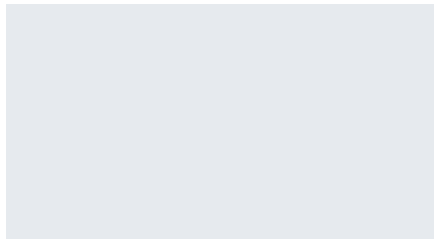
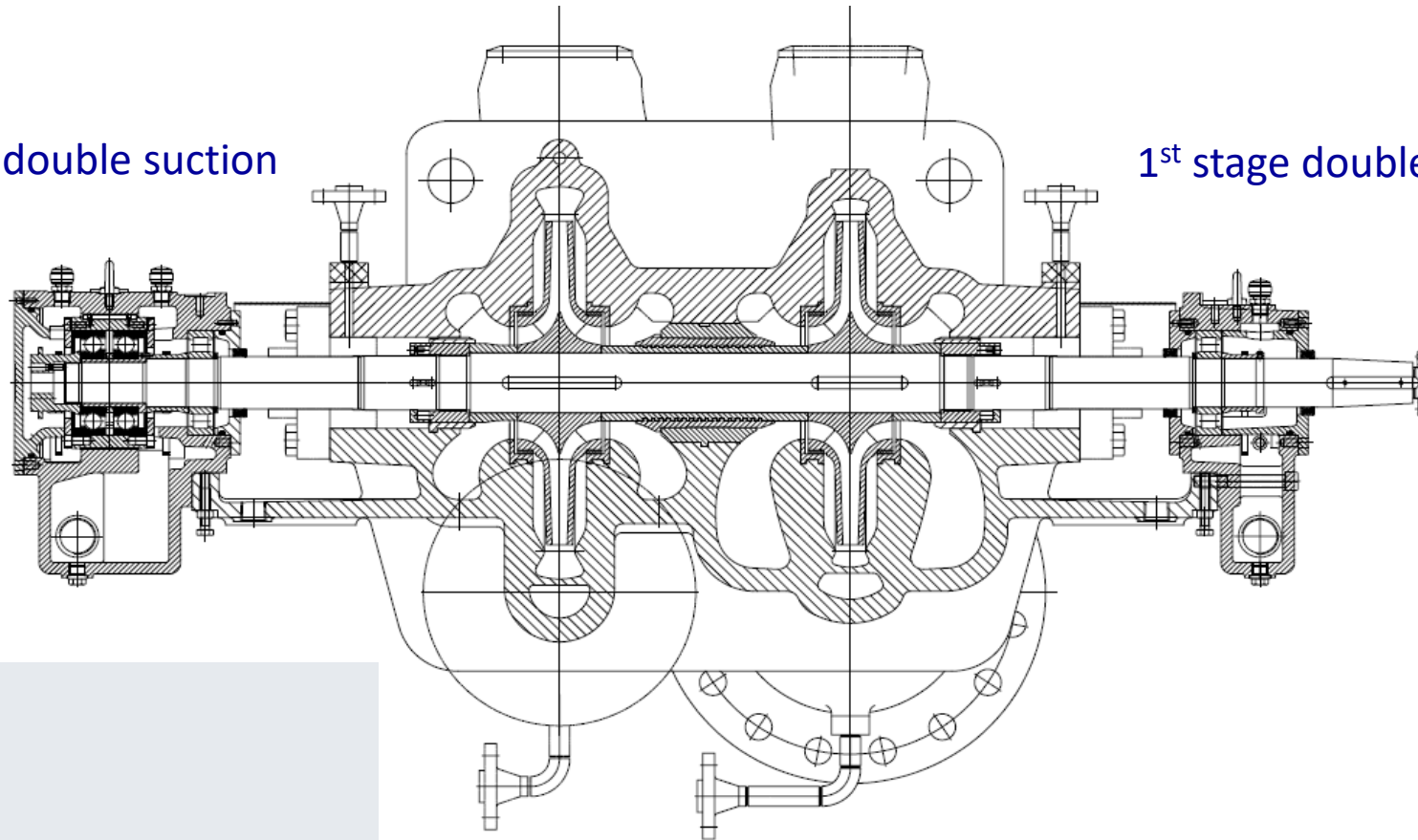




# ZM x2

2<sup>nd</sup> stage double suction

1<sup>st</sup> stage double suction



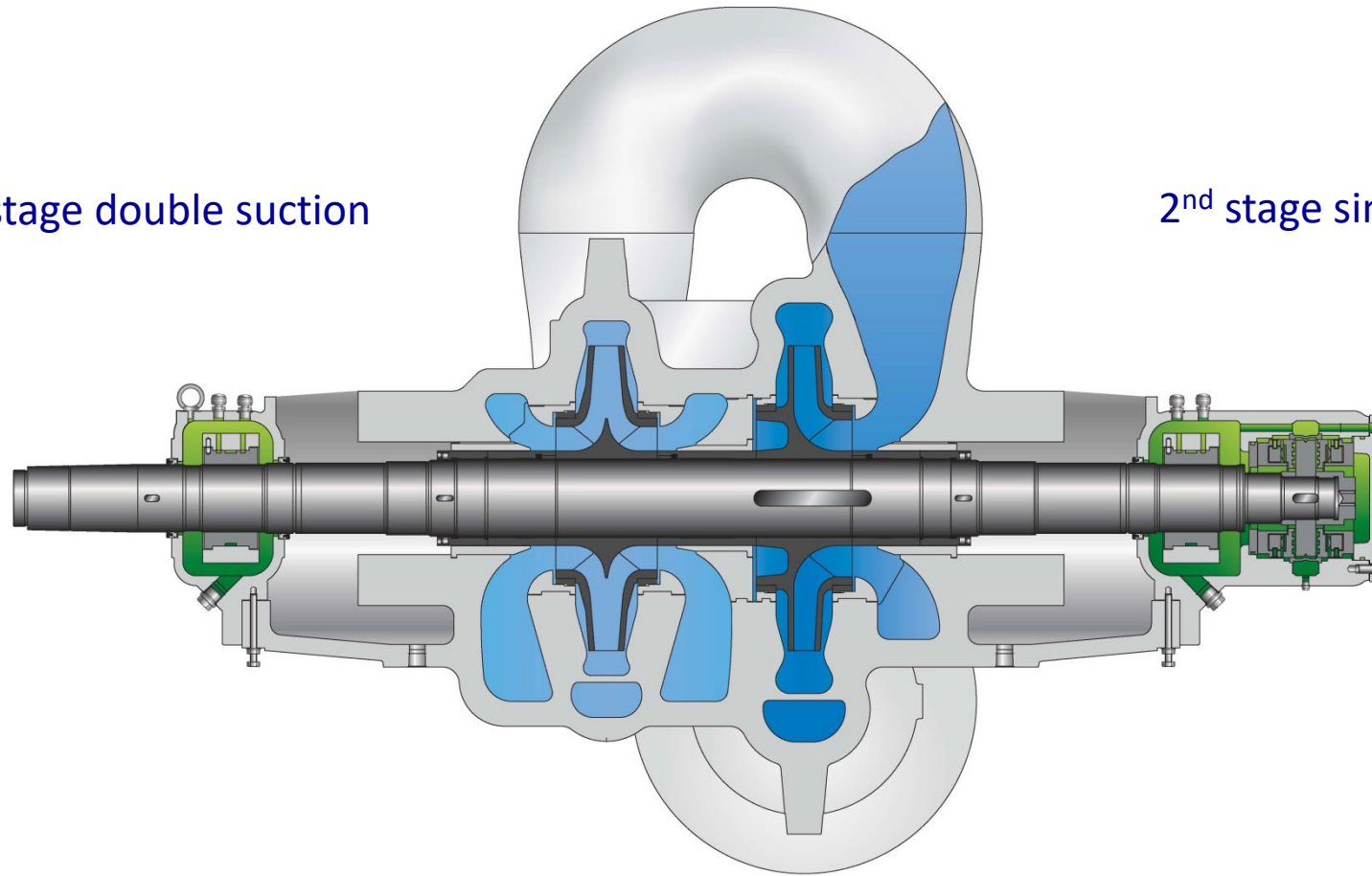
Double Volute



# ZMS x2

1<sup>st</sup> stage double suction

2<sup>nd</sup> stage single suction



Double Volute



# HPRO Pumps – RDP

- Triplex & Quintuplex Plunger Pumps
- Design according to API 674
- Easily accessible service points reducing maintenance time.
- Excellent noise and vibration characteristics < 85dB(A)
- 95% volumetric and 90% mechanical efficiency, exceeding API standards

## OPERATING LIMITS

Capacity	up to 366 m <sup>3</sup> /h
Head	up to 1100 m







# Vertical Pumps – VTP / VCT

- This broad product line complies with the most demanding quality specifications
- Wide range of impellers & Hydraulics for perfect fit
- Pull out design available for some sizes
- Barrel / can applications available for some sizes
- Submersible deep well available for some sizes

## OPERATING LIMITS

Capacity	90,000 m <sup>3</sup> /h
Head	up to 70 m

\*Higher heads upon request





# Self-Priming

- Self Priming Pump
- Easy maintenance without the need of disconnecting piping
- Easy access to impeller and seal.
- Availability of mounting above the liquid being pumped.
- Designed to allow up to 3 inch diameter solids.
- Lift up to 8,2 m



## OPERATING LIMITS

Capacity	1,440 m <sup>3</sup> /h
Head	up to 50 m



# Submersible pumps

- Designed according to HI guidelines with easy installation, maintenance and service
- Modular interchangeability to reduce inventory
- Semi-open impeller with Large solid handling
- Double Row Thrust Bearings. Grease lubricated and free of maintenance

## OPERATING LIMITS

Capacity	up to 9,000 m <sup>3</sup> /h
Head	up to 73 m





# **RUHRPUMPEN**

**Quality**







# ITP to be Considered

## STANDARD QUALITY CONTROL PLAN - DESALINATION

Item	DESCRIPTION	Standard	Optional	COMMENTS
1	Performance test	Not witnessed Values of tolerance factors based on EN ISO 9906:2012 and HI 14.6-2011. (OSE to check with customer) Testing procedure ISO 9906 Gr 2 With certificate	Option 1) Witness qty. Option 2) Testing Procedure ISO 9906 Gr 1	Normally only 1 witnessed per service. The performance test shall be carried out at pump discharge flows of 0, 25, 50, 75, 100 (rated) and max.
2	Vibrations test	na	Option 1) ISO 10816-7 Cat II Option 2) ISO 10816-7 Cat I Option 3) API	Always during Performance test Standard to be considered to be approved by engineering.
3	Bearing temperature test	na	Option 1) Bearing temperature stability analysis. Option 2) Witnessing. Included when performance test is witnessed.	Always during Performance test
4	Noise level measurement	na	Option 1) Noise level check Option 2) Witnessing. Included when performance test is witnessed	Always during Performance test Always no Warranty
5	NPSH	na	Option 1) Qty Option 2) Witnessed	If mandatory, only 1 per service.



# ITP to be Considered

6	Strip test	na	Option 1) Light Strip test (only bearings) Option 2) Complete Strip test	
7	Hydrostatic test	Not Witnessed Standard Hydro Test, 10 minutes. With certificate	Option 1) 30 minutes test. Option 2) Witness Qty.	Witness if mandafotyr only 1 per service
8	Balancing	Impeller to ISO 1940 Gr 6.3, with certificate.	Option 1) Impeller to ISO 1940 Gr 2.5. Option 2) ISO 1940 Gr. 6.3 Rotor Assembling dynamic balanced	
9	Balancing (Coupling)	na	Couplings dynamic balancing certificate to 6.3 ISO 1940	
10	Material certificate	Material test according to EN 10204-2.1 for all parts Material test according to EN 10204-2.2 for all wetted casting components	Material test according to EN 10204-3.1 for all wetted casting components and shaft	1x Certificate for each pump
11	PMI	na	Option 1) Non-witnessed PMI. Qty. Option 2) Witnessed PMI. Qty	All wetted casting components and shaft



# ITP to be Considered

12	Liquid Pentrant Test (LPT)	na	Liquid penetrant examination to EN 1371-1 Level 3 - QTY	If required normally is one LPT for each pump. For pressure holding components (Volute case, Case cover, Stuffing box housing, Case)
13	Liquid Penetrant Test on Welds	na	Liquid penetrant examination to EN 1371-1 Level 3 - QTY	
14	Magnetic Particle Examination (MPE)	na	Magnetic particle examination to EN 1369 Level 3 - QTY	If required normally is one MPE for each pump. For pressure holding components (Volute case, Case cover, Stuffing box housing, Case)
15	Ultrasonic Test (Shaft)	na	UT for Shaft examination - QTY	If required normally is one UT for each pump shaft
16	Radiographic Examination	na	Radiographic examination on wet casting parts according to ASTM E1320 Level 7. Only on accessible areas.	Number of shots to be defined by RP engineering and only on accessible & critical areas
17	Radiographic Examination (welds)	na	Radiographic examination on welds	



# ITP to be Considered

18	Painting thickness check	na	Painting thickness check	
19	Pickling/Pasivation stainless welds	na	Pickling/Pasivation stainless welds	
20	Metallic Blasting	na	Metallic blasting	
21	Galvanizing	na	Galvanized	
22	Welding and Welder Qualification	na	Docuements to be provided	ASME
23	Visual Examination of Cast Parts	Visual 100%		
24	Frame Assembly, Alignment and Overall Dimensions. Suction and Discharge Flanges	Check 100%	Option 1 ) With Report Option 2) Witnessed - QTY	If Witnessed normally only one.
25	Nameplate Data Control.	Check 100%	Option 1) With Report	





## Coming Attractions 😊

### “Cryogenic Pumps”

Thur 25<sup>th</sup> May – 08.00 (UK GMT+1) (Eastern Hemisphere) & 17.00 (UK GMT+1) (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 short course will look at Cryogenic Pumps used in Liquid Oxygen, Liquid Nitrogen and LNG / LPG Services.*

*Future sessions :*

*– Magnetic Drive Pumps for the Chemical Process and API Industries (Thursday 22<sup>nd</sup> June (to be confirmed))*