

SULZER

Sulzer Pumps

SULZER PUMPS Products for the Hydrocarbon Processing Industry

Chinese Delegation from Shengli Oilfield in Berlin Adlershof, 5th Nov 2010

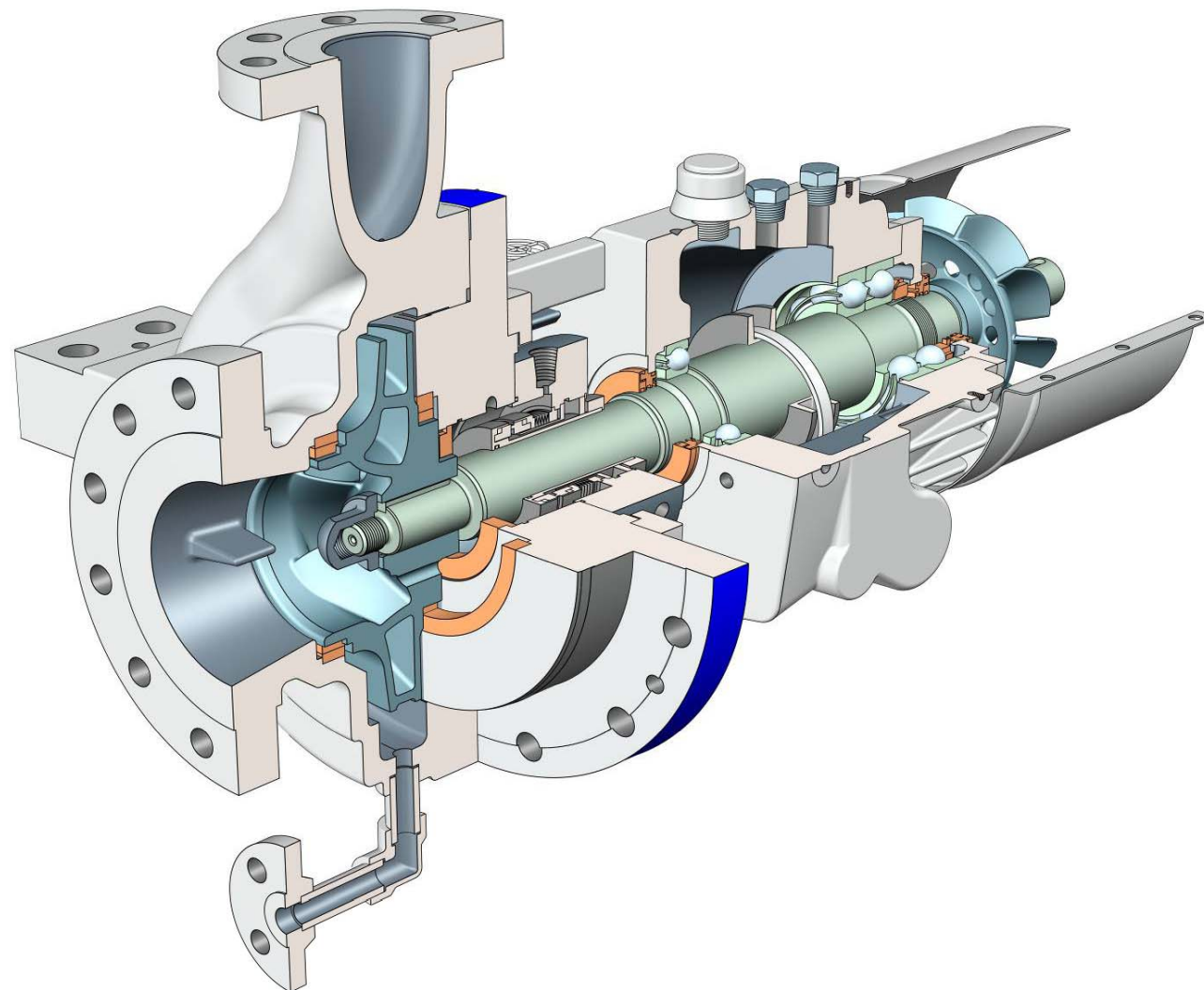


The Heart of Your Process

Type OHH Pump ISO 13709 (API 610)

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Sulzer Pumps



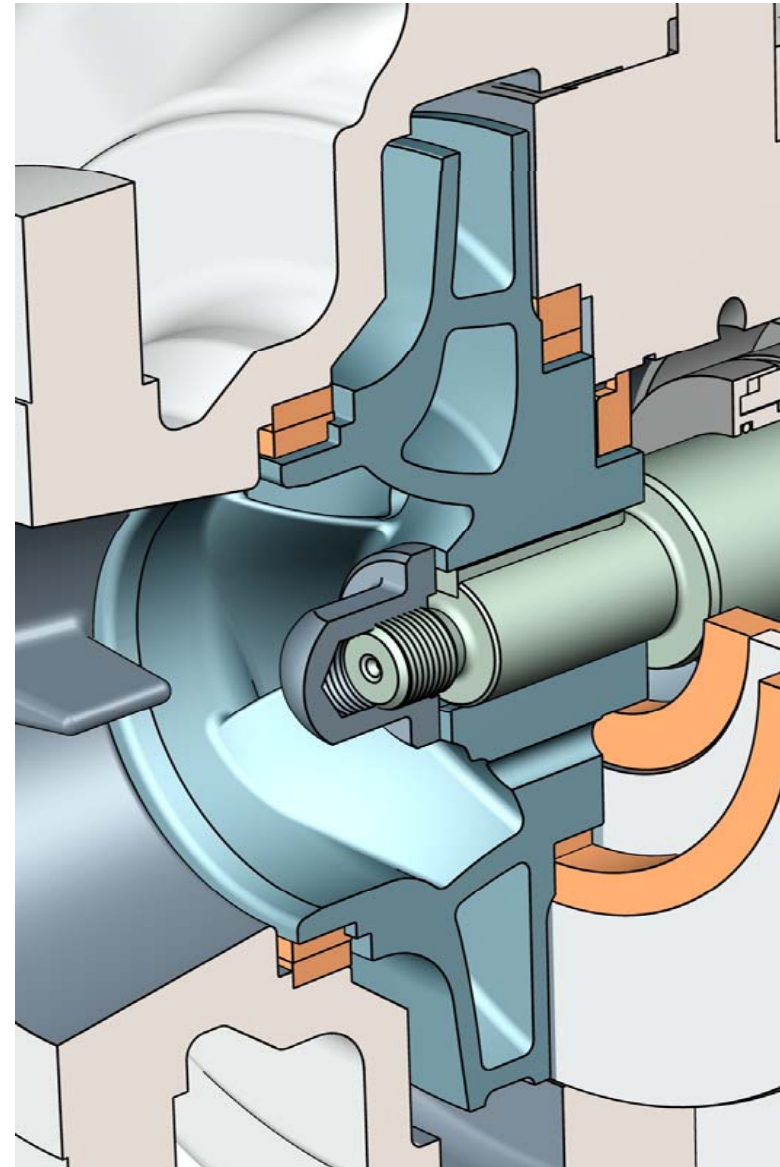
OHH Design Features

Hydraulics

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- Enclosed impellers provided for increased efficiency.
- Over 70 different hydraulics.
- Dynamically balanced impeller.
- Wear rings and balance holes optimized to maximize seal and bearing life.
- Proven Coke Crusher available for coking applications.

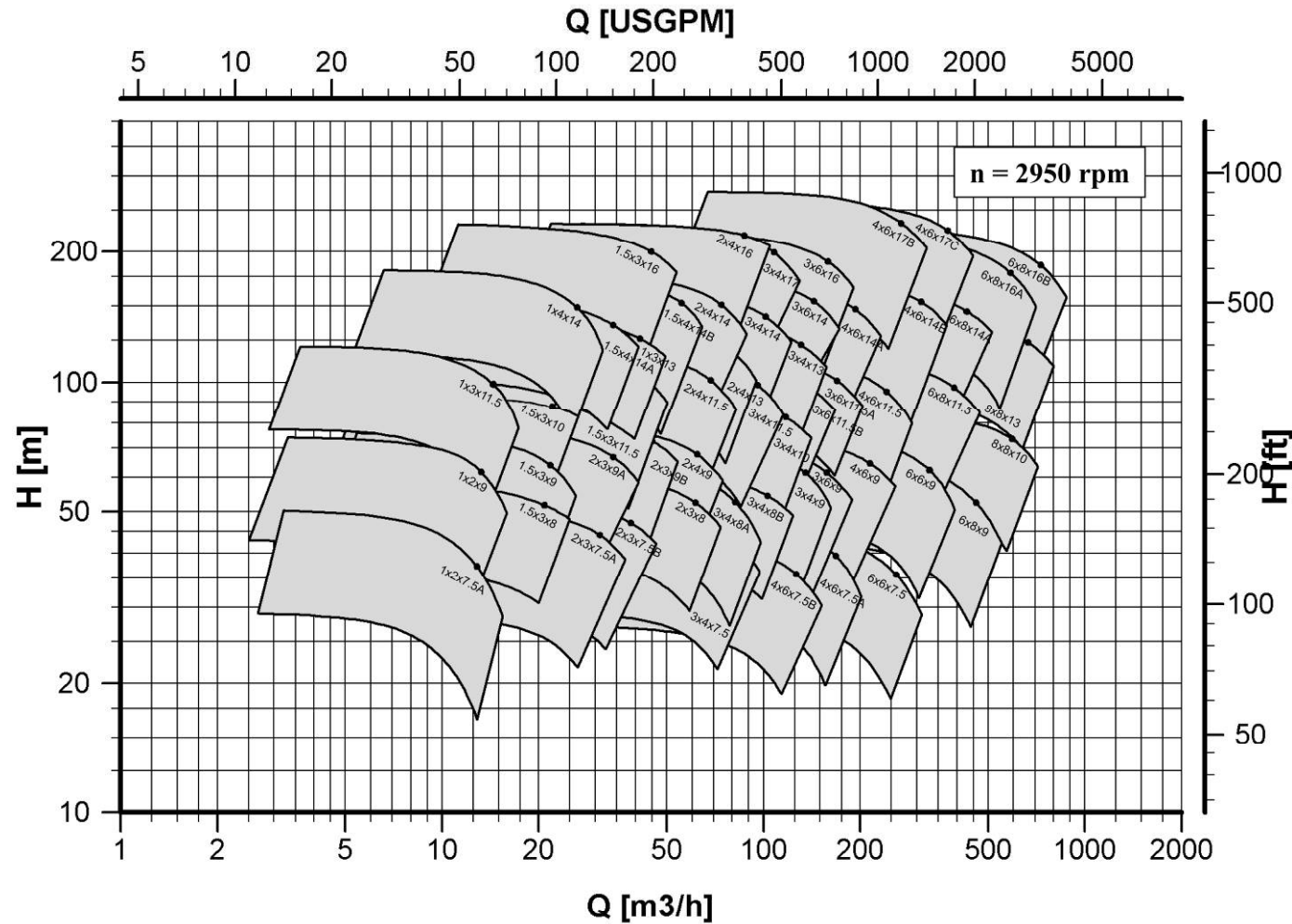


OHH Performance

2950 rpm

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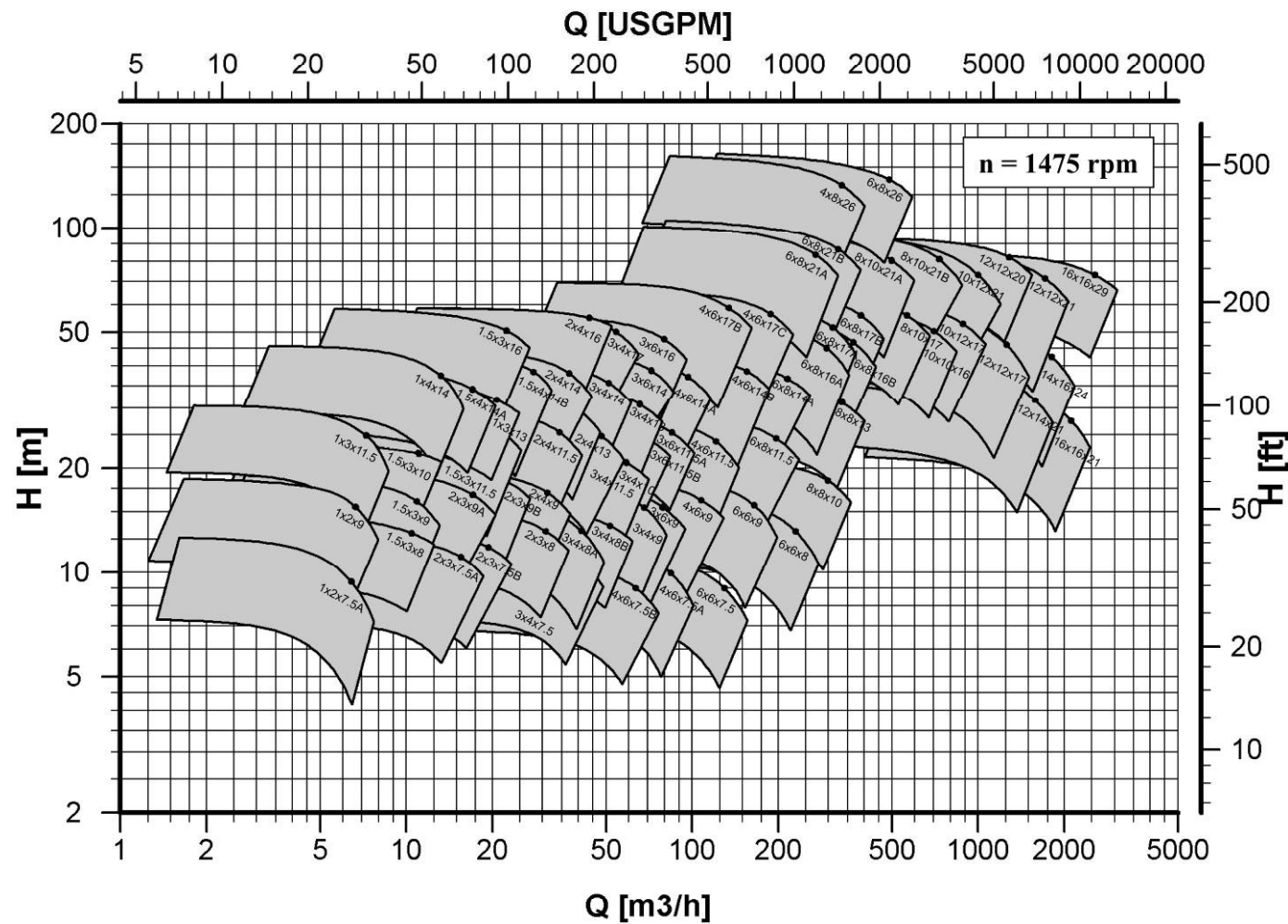


OHH Performance

1475 rpm

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Sulzer Pumps



OHL

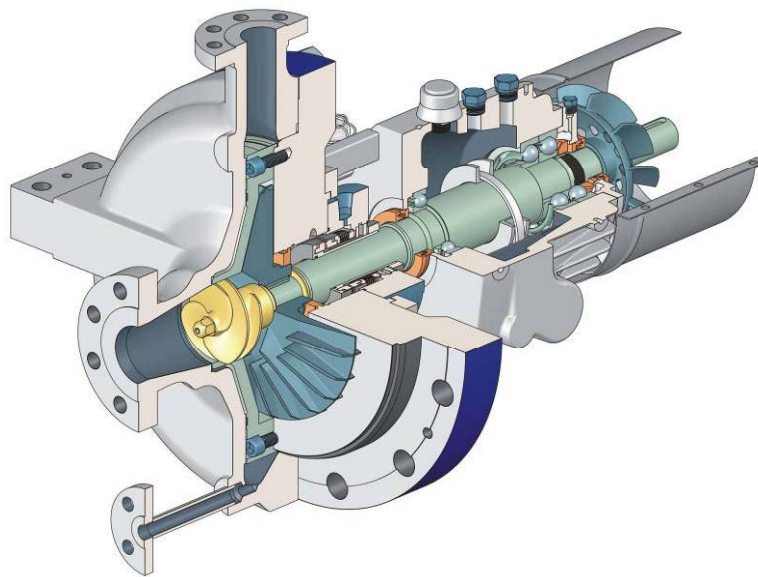
Low flow – high head

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Latest addition to the OH family:

- continuously rising H-Q curve
- flows from 3 m³/hr to 35 m³/hr
- heads to 300 m at 60 Hz
- over 100 combinations
- direct drive – OHH bearing frame
- VFD compatible for higher head



BL impeller Mk0



BL impeller Mk1

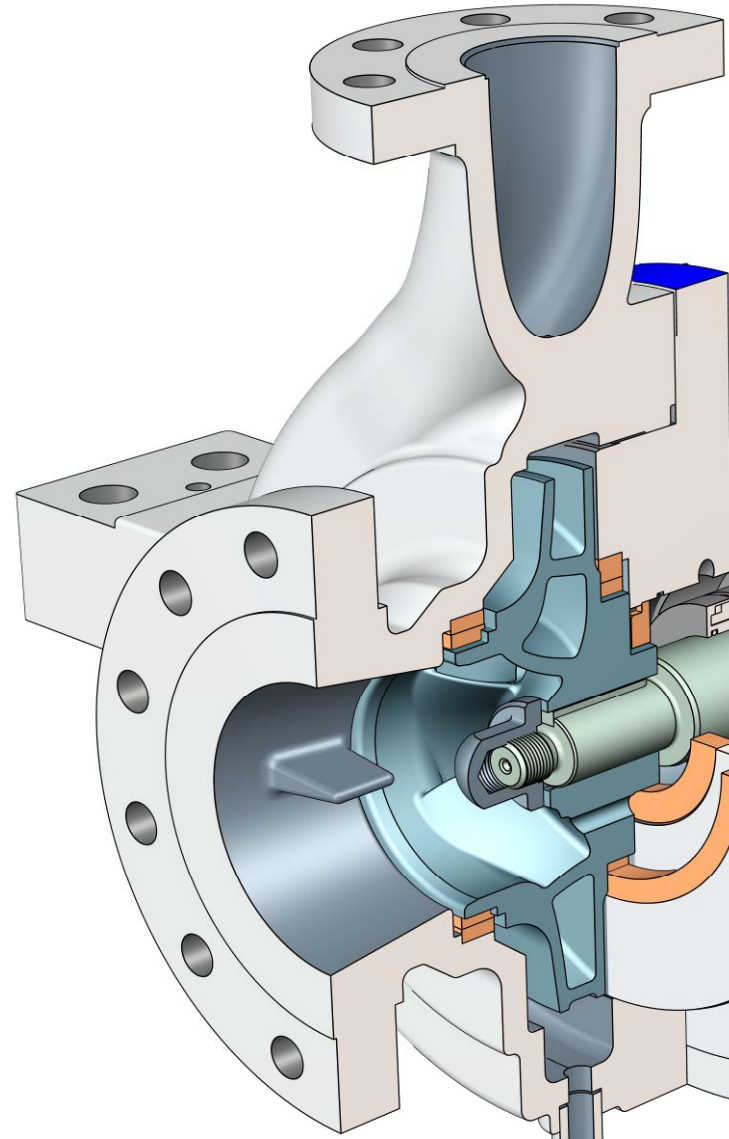
OHH Design Features

Volute Casing

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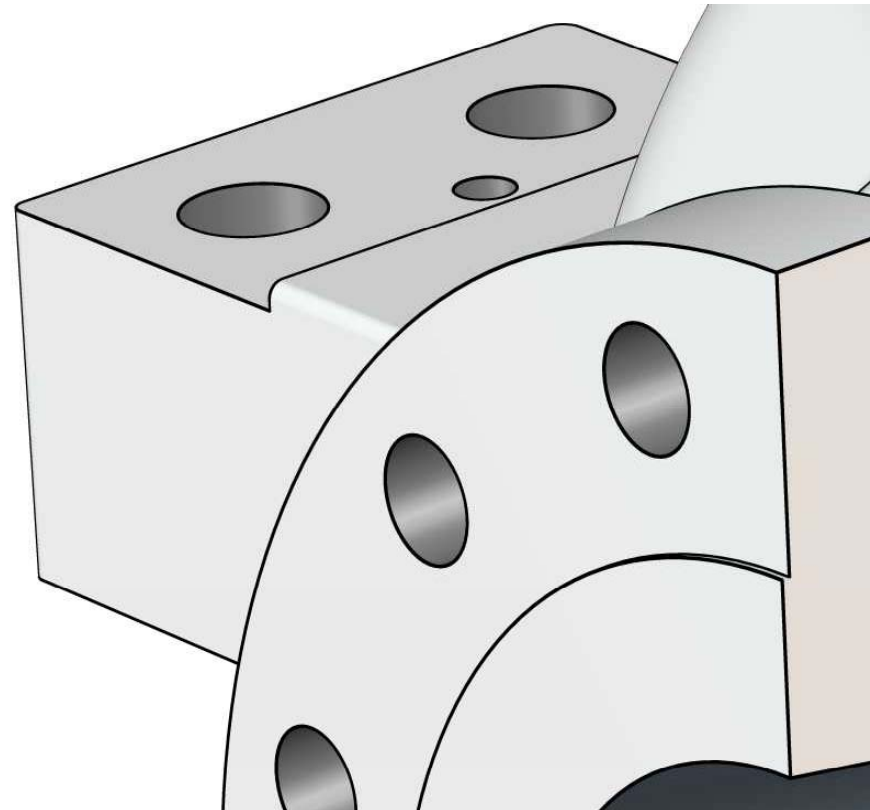
Sulzer Pumps

- Pressure boundary components designed to ASME Section VIII - with 3 mm (1/8") corrosion allowance.
- Self venting, centerline discharge on all but 4 very large sizes.
- Double volutes for larger sizes.
- Confined controlled compression gasket with metal to metal rabbet fit.



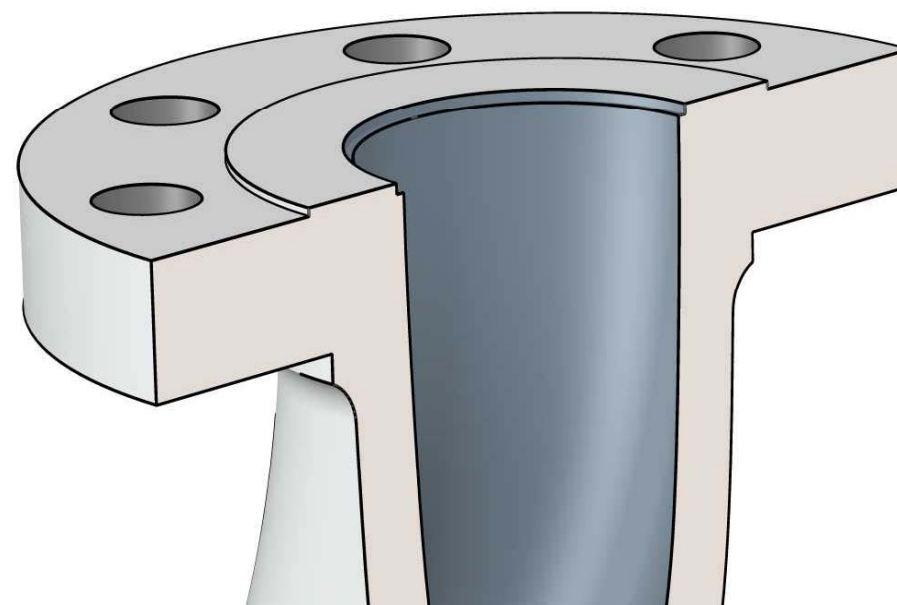
Mounting

- Casing mounting feet and baseplate designed to meet ISO 13709 (API 610).
- 2 x API nozzle load option available.
- Non-grouted baseplates available for motor or steam turbine drivers.
- API 610 defined baseplate dimensions are standard. Similar designs and standards are used where larger bases are required to accommodate oversize pumps or drivers.



Flanges

- Back faced ANSI B16.5 300# R.F. flanges with required serrations.
- ISO/DIN flanges available.
- Top Suction available.



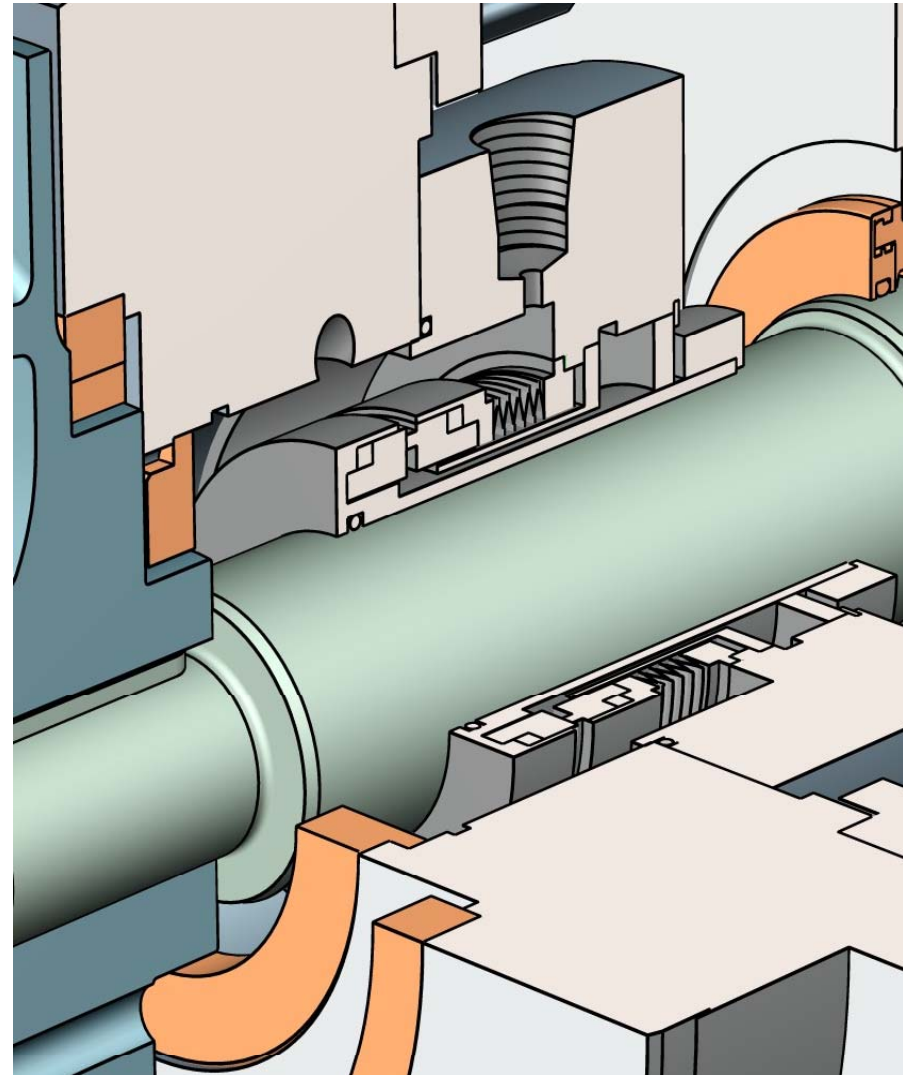
OHH Design Features

Seal Chamber

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- API 682 2nd edition (ISO 24109) seal chambers and flush piping for improved seal life.
- Single or dual cartridge type mechanical seals available to meet all process requirements.
- API 610 cooling water plans available.



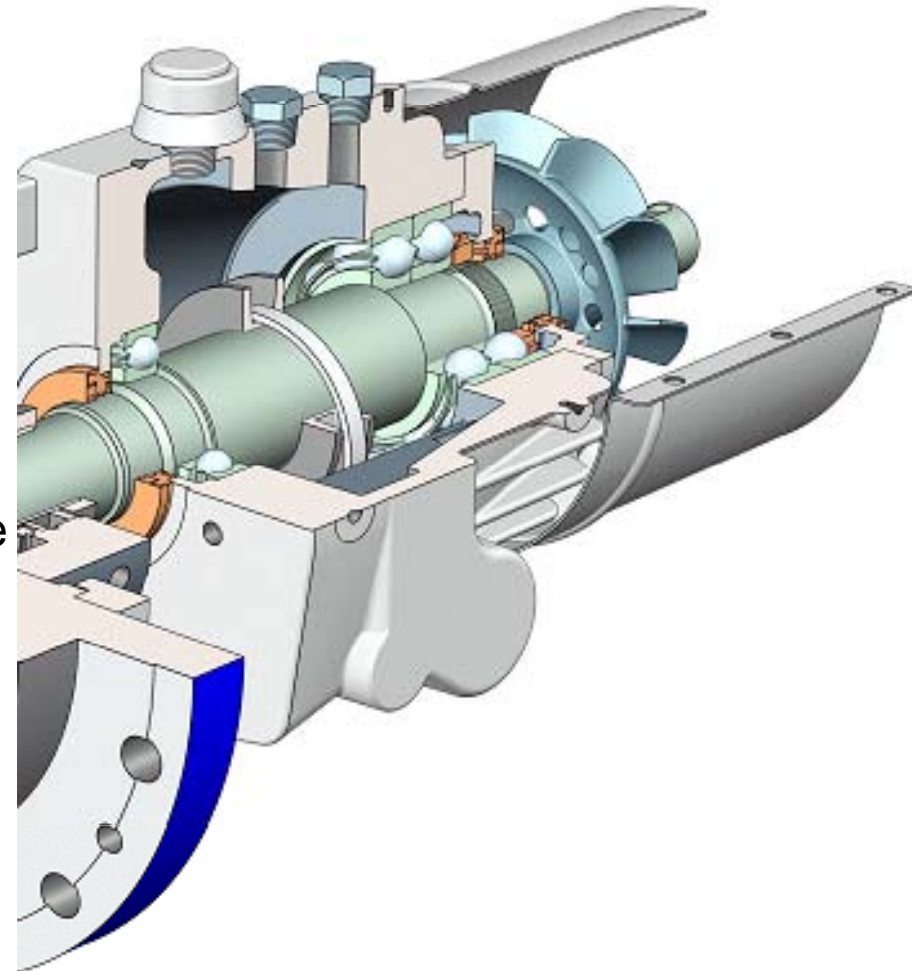
OHH Design Features

Bearing Frame

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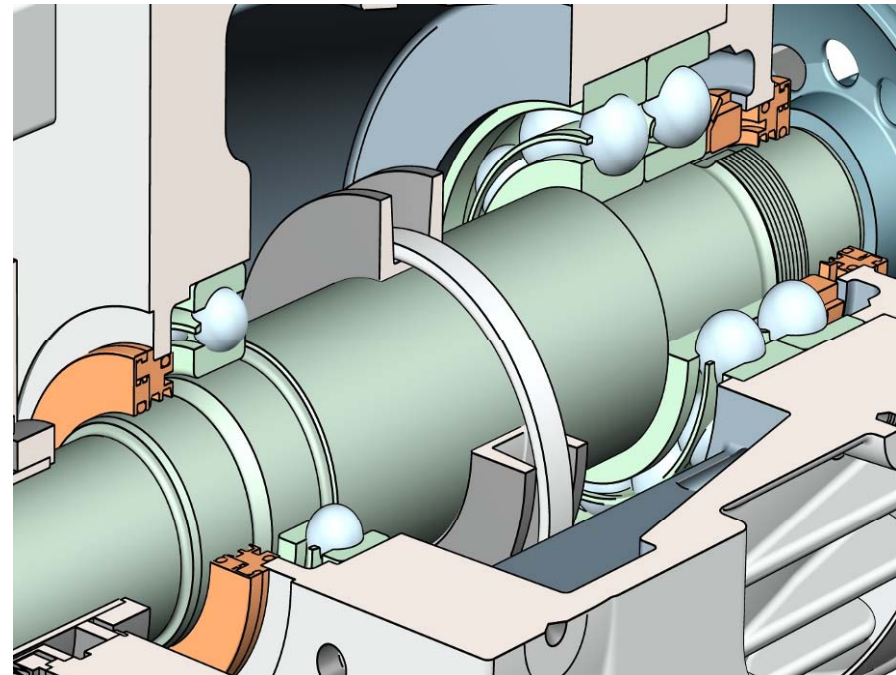
- 6 sizes of bearing housing cover the entire product line for maximum interchangeability.
- Extra heavy duty, large diameter shaft for low shaft deflection and long life.
- The oil ring is located in a deep groove retainer to assure it does not become displaced and rub interior of bearing housing.



OHH Design Features

Bearings and Lubrication

- Thrust bearings are back to back, heavy duty 40 deg. angular contact with machined brass cages.
- Ball radial bearing has C3 clearance required by API 610.
- Bearing housing oil channel routes lubricant to the rear of each bearing assuring adequate oiling under difficult operating conditions.
- Ports for purge mist, and pure mist lubrication are standard.
- Other lubrication options are available.



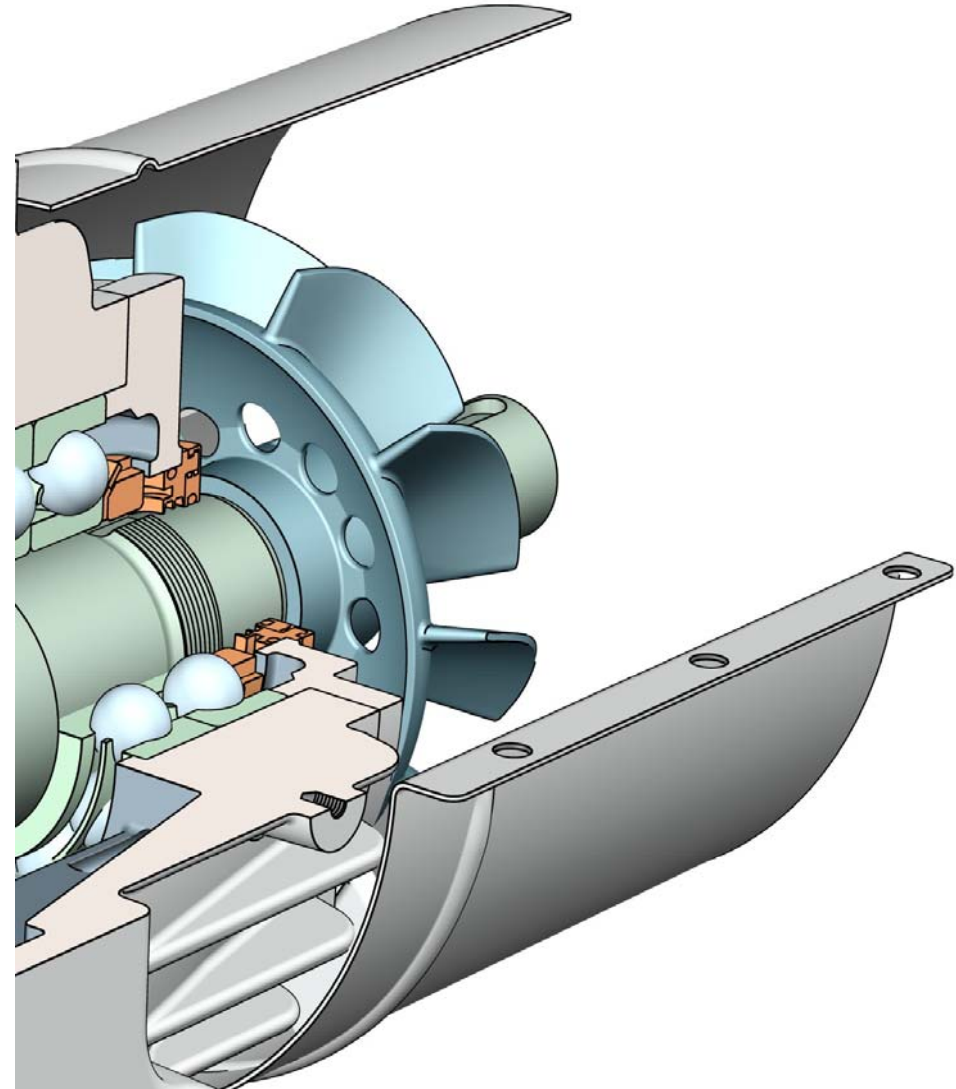
OHH Design Features

Cooling and Coupling Guard

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- The standard coupling guard meets API 610 and OSHA requirements. Other types of guards are available.
- Bearing housing is finned carbon steel for added heat dissipation and API 610 compliance.
- For high ambient or operating temperatures, a low noise fan is added.
- For extremely high operating temperatures a predefined list of features is available to meet the most difficult conditions.
- For cryogenic or low ambient conditions, an oil sump heater is available.



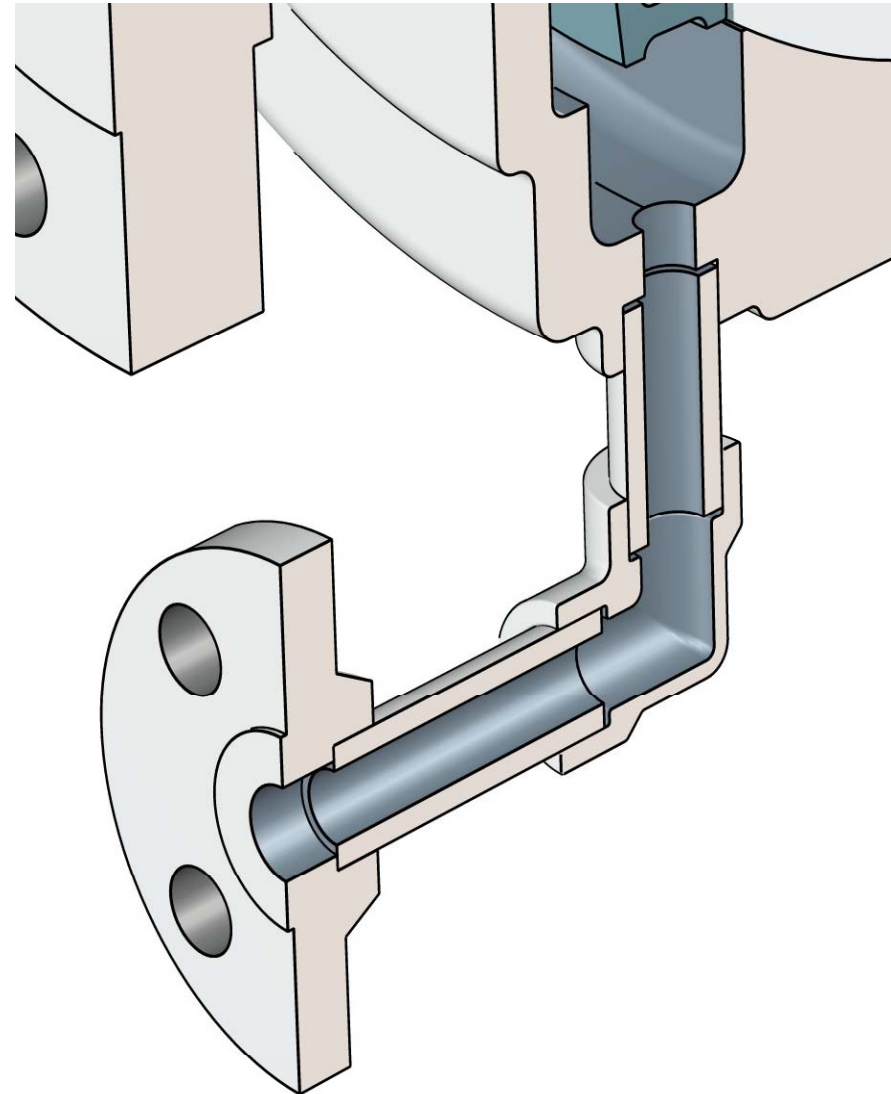
OHH Design Features

Casing Drain

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- Socket welded flanged drains are standard.
- Butt welding is available.
- Gussets or bracing available to suit customer specifications.
- Schedule 160 pipe is standard to first flange per API 610.
- 1" piping available.

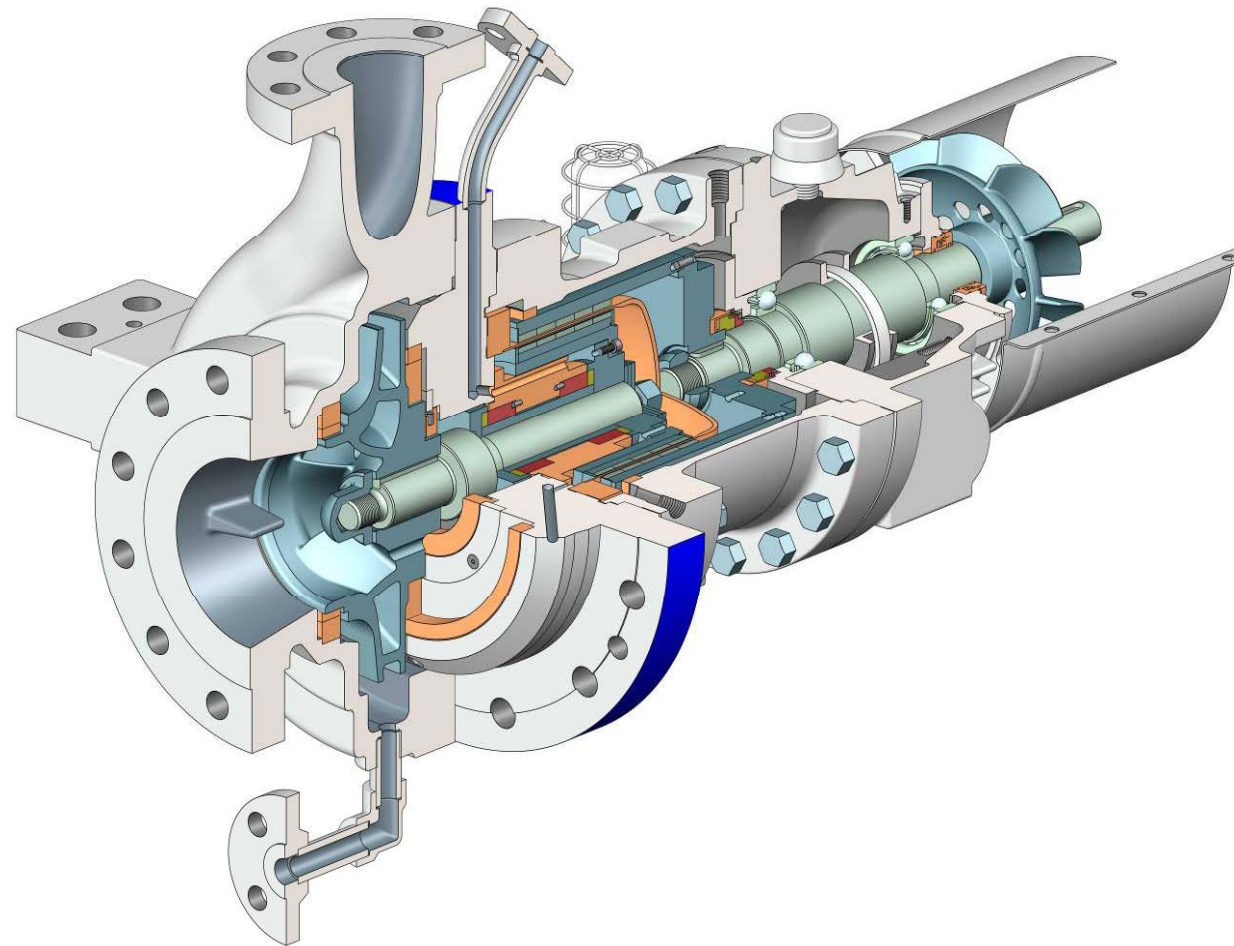


Type OHM Pump

API 685 Magdrive End Suction Pump

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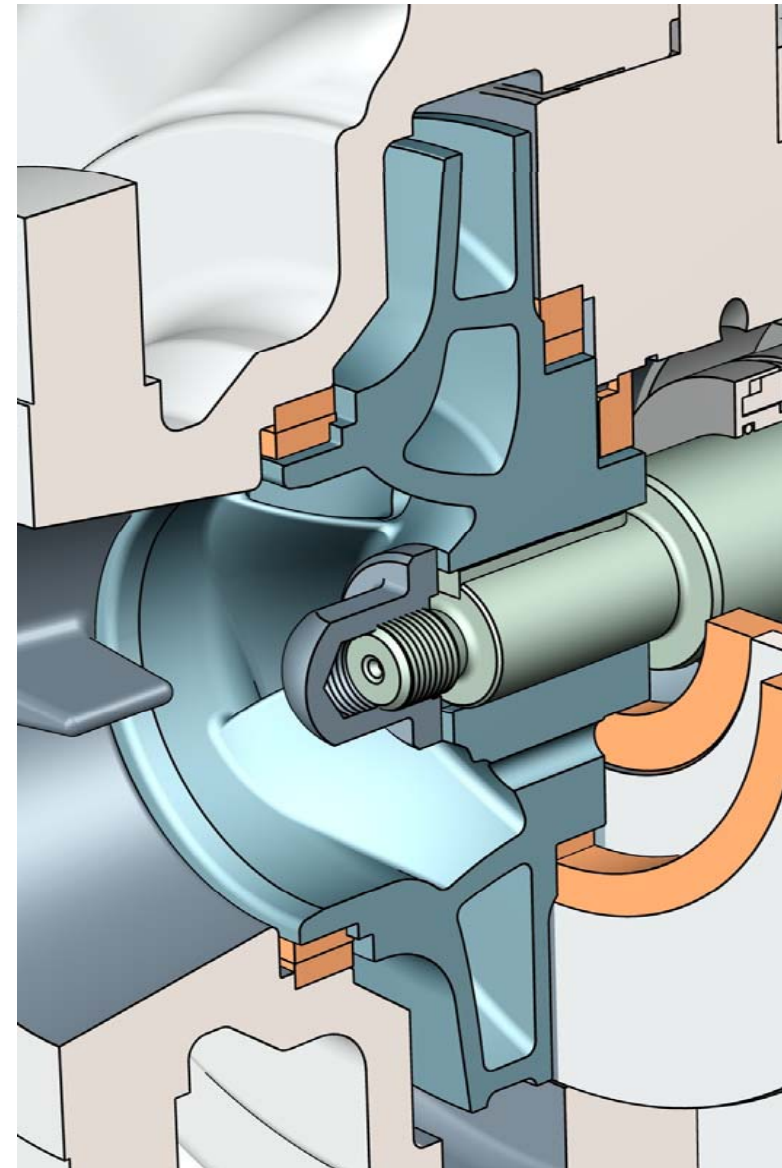
OHM Design Features

Hydraulics

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- Casing, impeller and front wear rings are interchangeable with OHH pump.
- Enclosed impellers provided for increased efficiency.
- Over 40 different hydraulics (limited to 250 kw currently).
- Dynamically balanced impeller.
- Wear rings and balance holes optimized to maximize product lubricated bearing life.

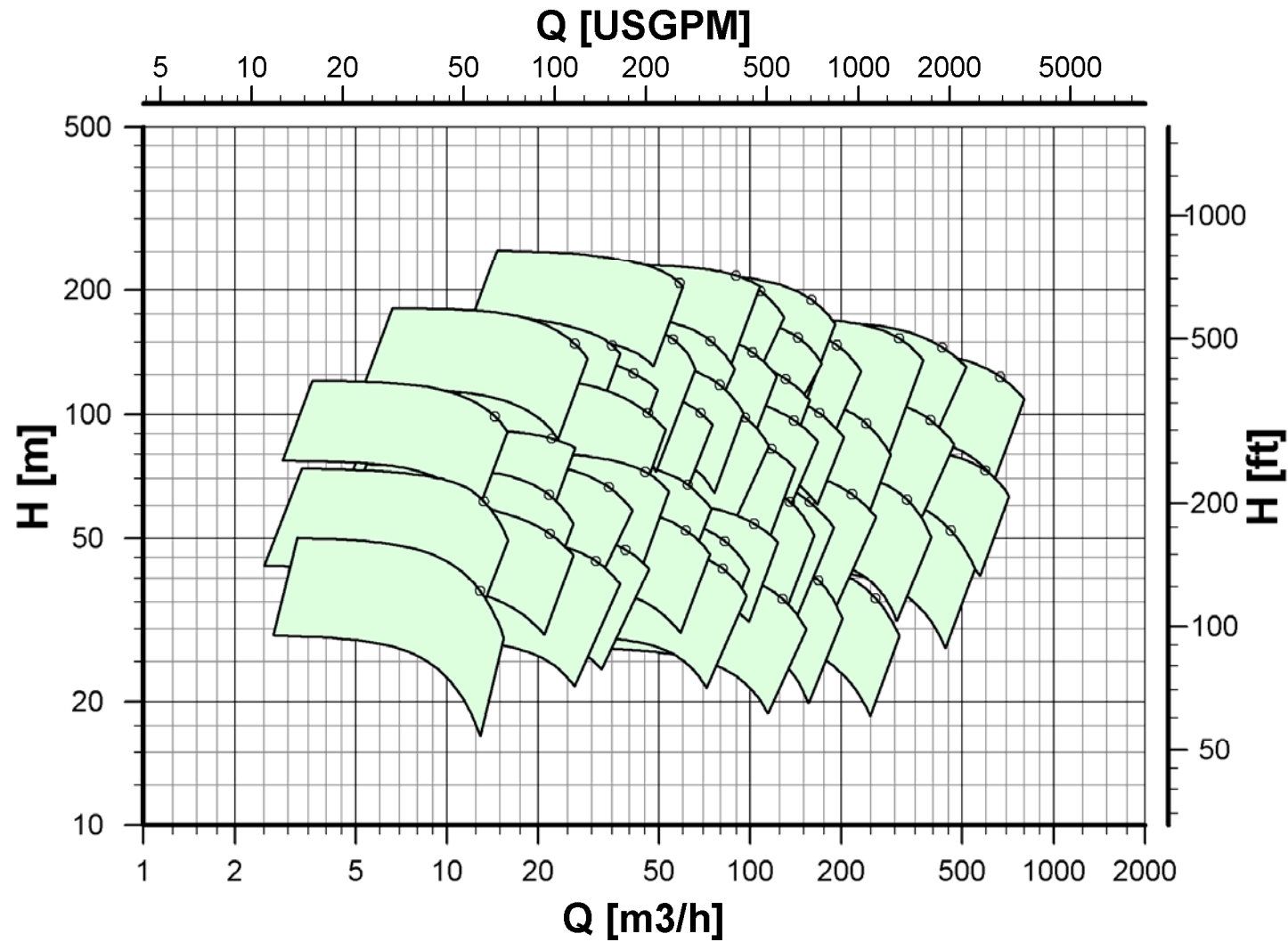


OHM Performance

2950 rpm

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Sulzer Pumps

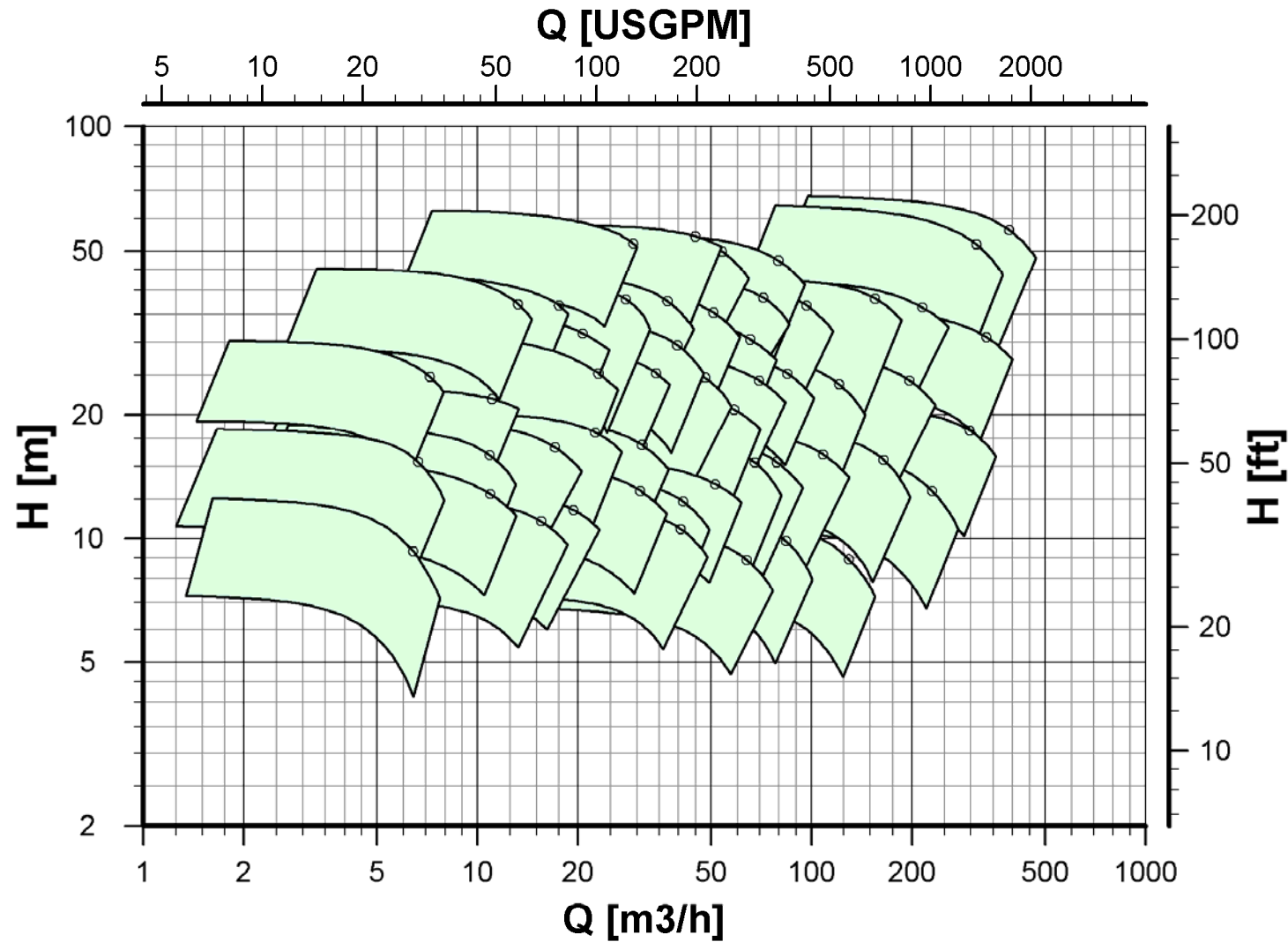


OHM Performance

1475 rpm

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Sulzer Pumps



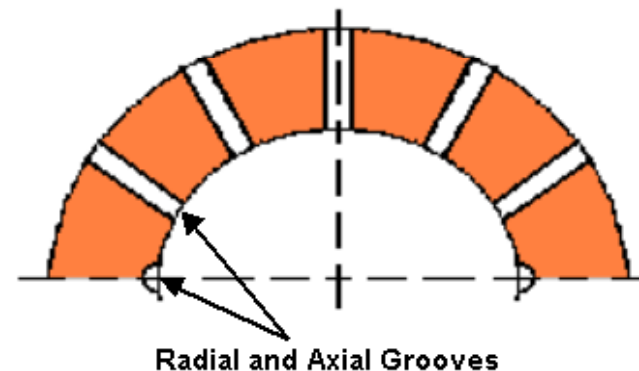
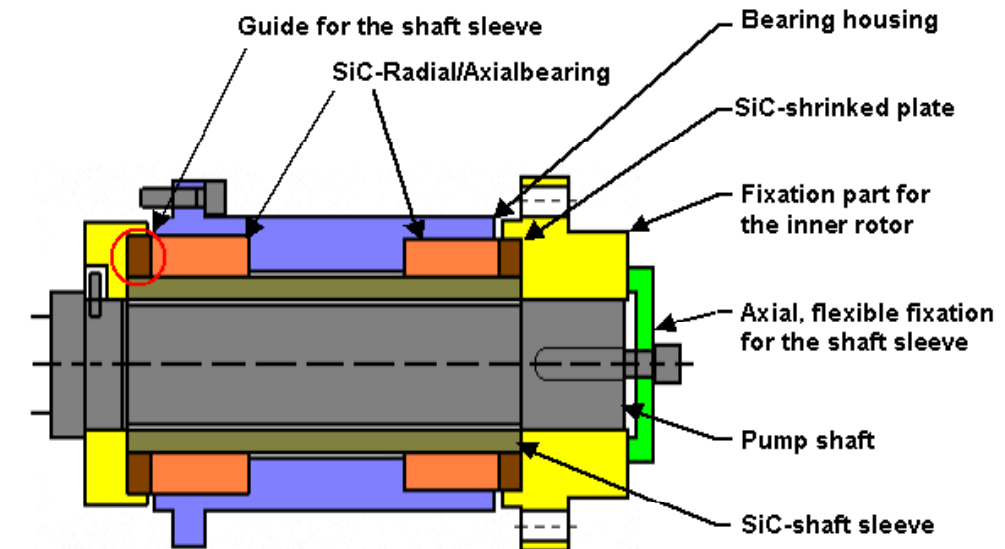
OHM Design Features

Inner Shaft & Bearing System

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- Inner pump shaft is an extra heavy stiff shaft supported in silicon carbide radial and thrust bearings.
- Shaft is protected by a silicon carbide shaft sleeve.
- Sleeve support design allows for thermal expansion of shaft without cracking.
- Grooved radial and thrust bearings are clamped into easily removable bearing carrier for ease of maintenance.



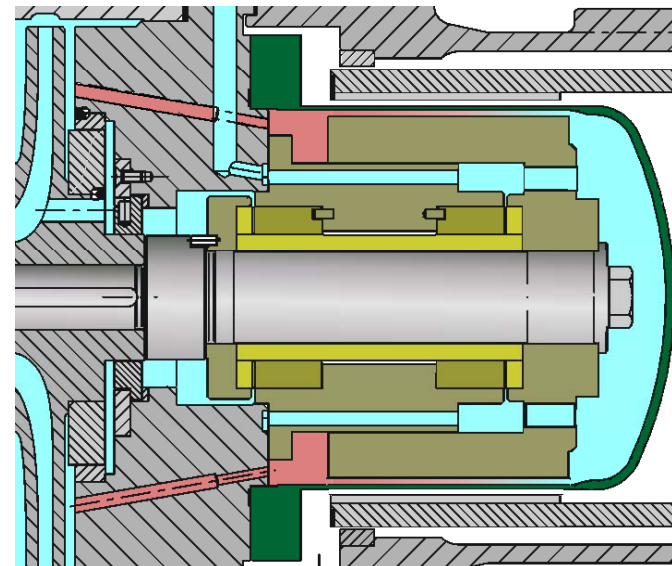
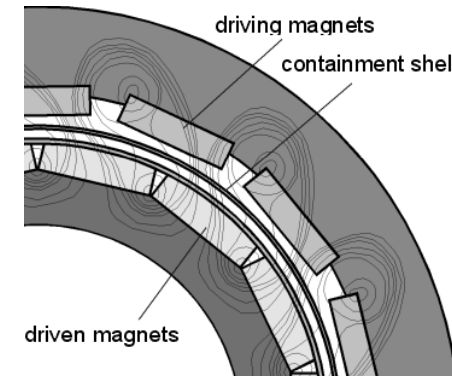
OHM Design Features

MAK Magdrive System

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- Synchronous drive speeds – same head and flow as the OHH pump.
- Neodmium iron boron or samarium cobalt permanent magnets on inner and outer magnet carrier.
- Hastalloy C containment shell and encapsulated inner magnet carrier for low eddy current losses and corrosion resistance.
- High pressure circulation of fluid thru magnetic filter to cool magdrive and lubricate bearings.
- Nonsparking rub ring on intermediate piece to protect containment shell in case of ball bearing upset.



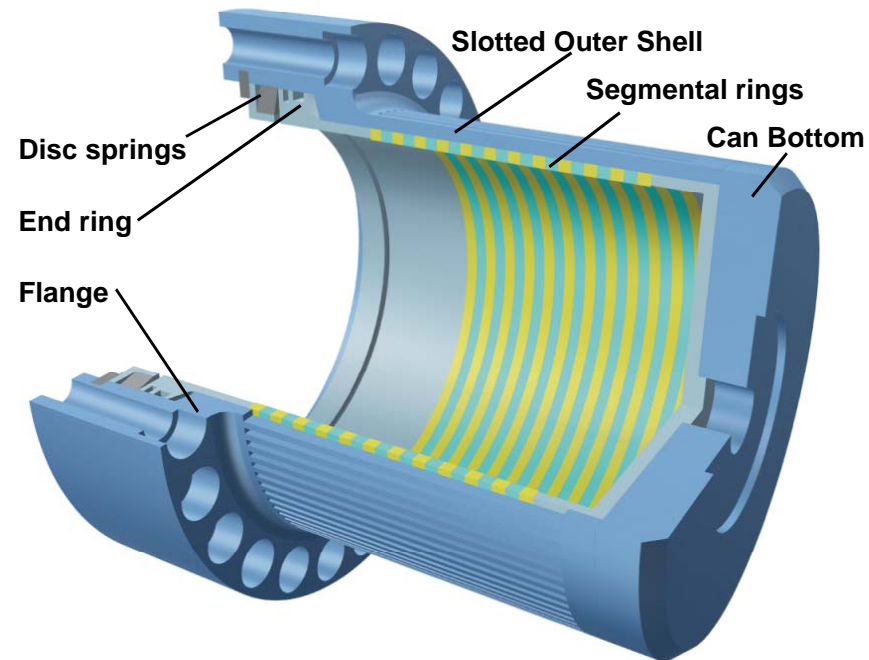
OHM Design Features

NMB Magdrive System

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Sulzer Pumps

- Patented NMB magdrive system is similar to MAK magdrive in function.
- Segmental inner rings of containment shell reduce eddy currents to extremely low levels.
- Allows transmission of much higher torque with lower losses and less heating.
- Most efficient magdrive ever!



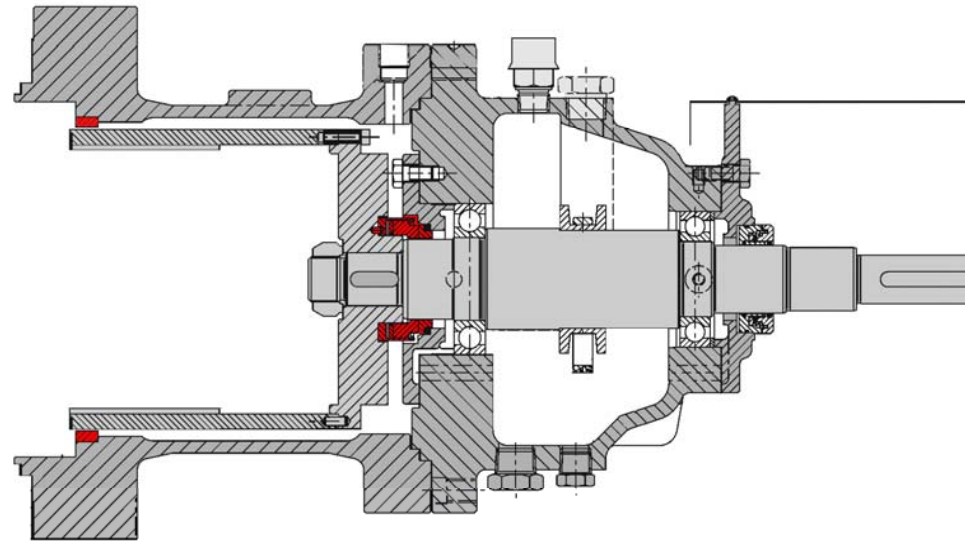
OHM Design Features

Secondary Containment

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Sulzer Pumps

- Intermediate Piece designed for full discharge pressure.
- Includes 12 mm (0.12") corrosion allowance.
- Optional secondary gas seal is non-contacting until leakage pressure closes seal.
- Liquid presence sensor or pressure sensor can detect leakage.



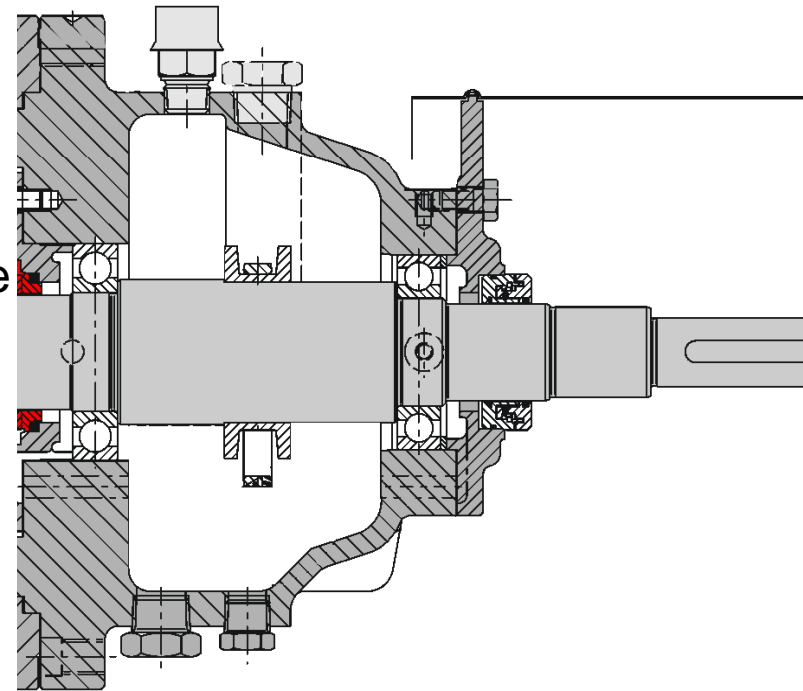
OHM Design Features

Bearing Frame

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Sulzer Pumps

- 3 sizes of bearing housing cover the entire product line for maximum interchangeability.
- Extra heavy duty, large diameter shaft for smooth running and long life.
- The oil ring is located in a deep groove retainer to assure it does not become displaced and rub interior of bearing housing.
- Low noise fan, oil ring, and bearing end cover are interchangeable with OHH fan.
- Ring Oil, Purge Mist, or Pure Mist lubrication is available.



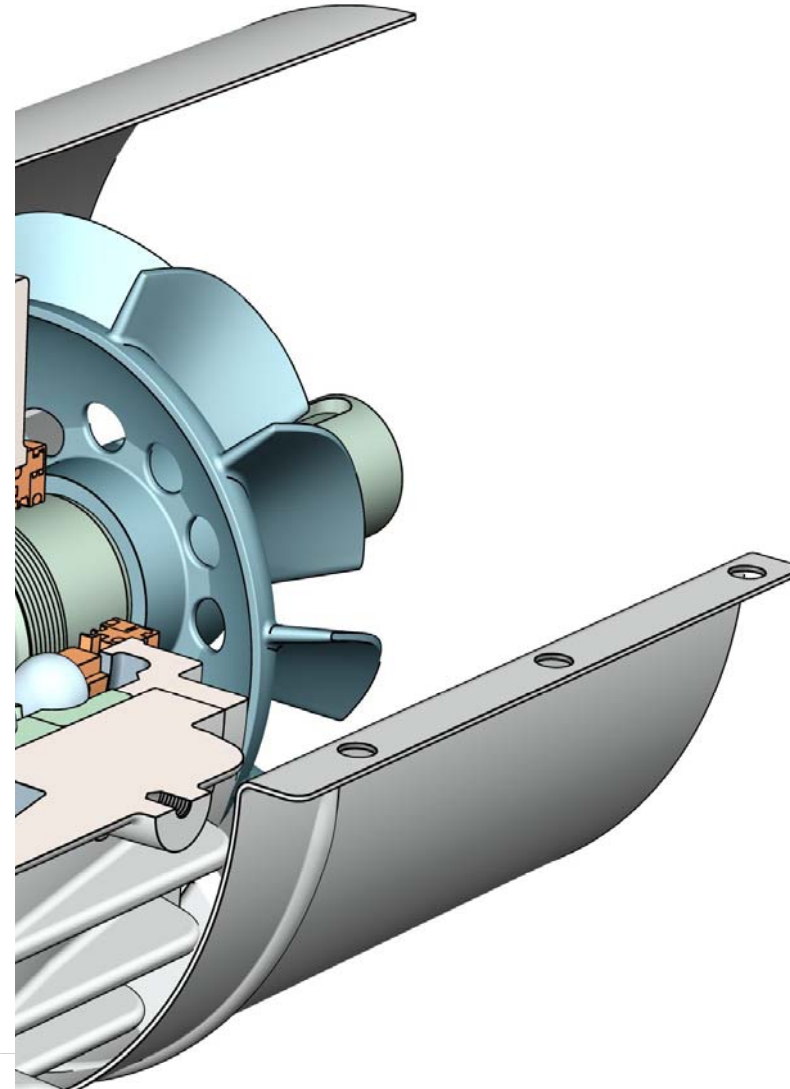
OHM Design Features

Cooling and Coupling Guard

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Sulzer Pumps

- The standard coupling guard meets API 610 and OSHA requirements. Other types of guards are available.
- Bearing Housing is finned Carbon Steel for added heat dissipation and API 610 compliance.
- For high ambient or operating temperatures, a low noise fan is added.
- For extremely high operating temperatures a predefined list of features is available to meet the most difficult conditions.
- For cryogenic or low ambient conditions, an oil sump heater is available.

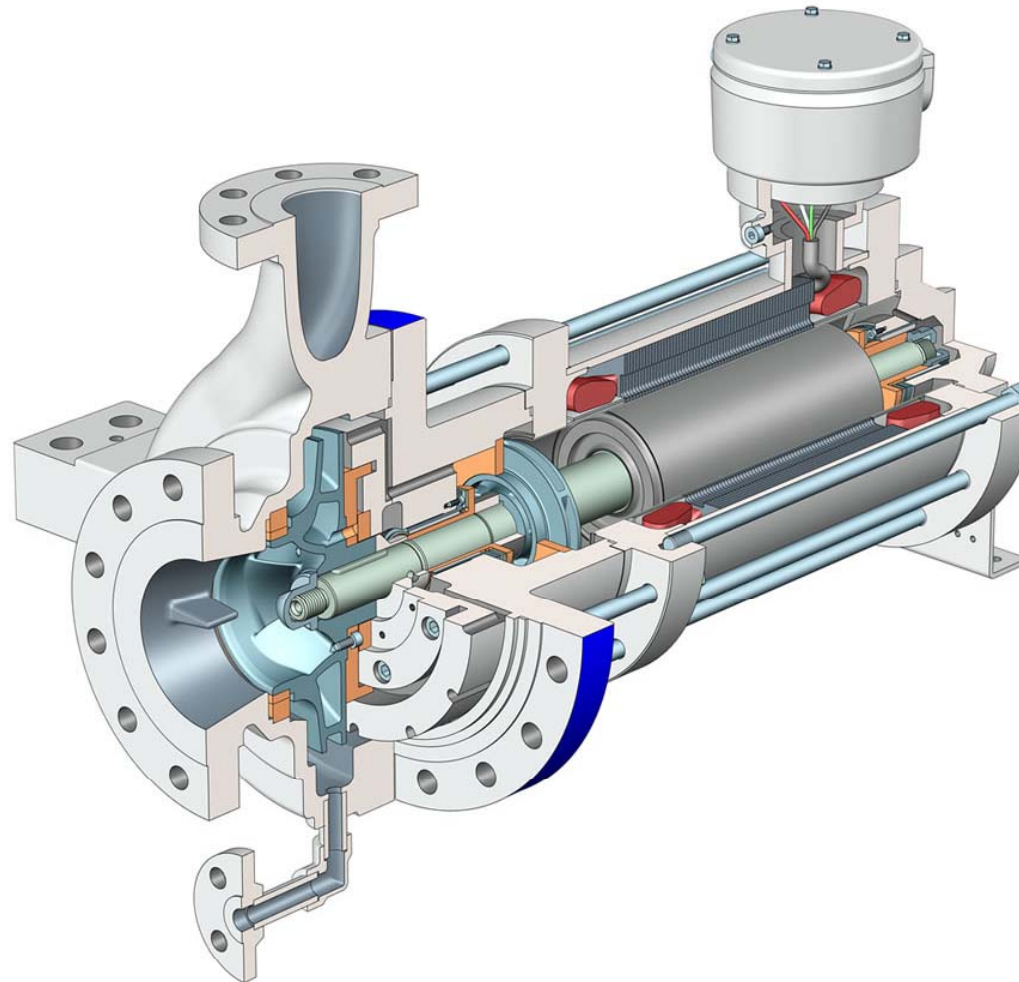


OHC Pump

API 685 Canned Motor, End Suction Pump

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Sulzer Pumps



OHC Pump

API 685 Canned Motor Pump

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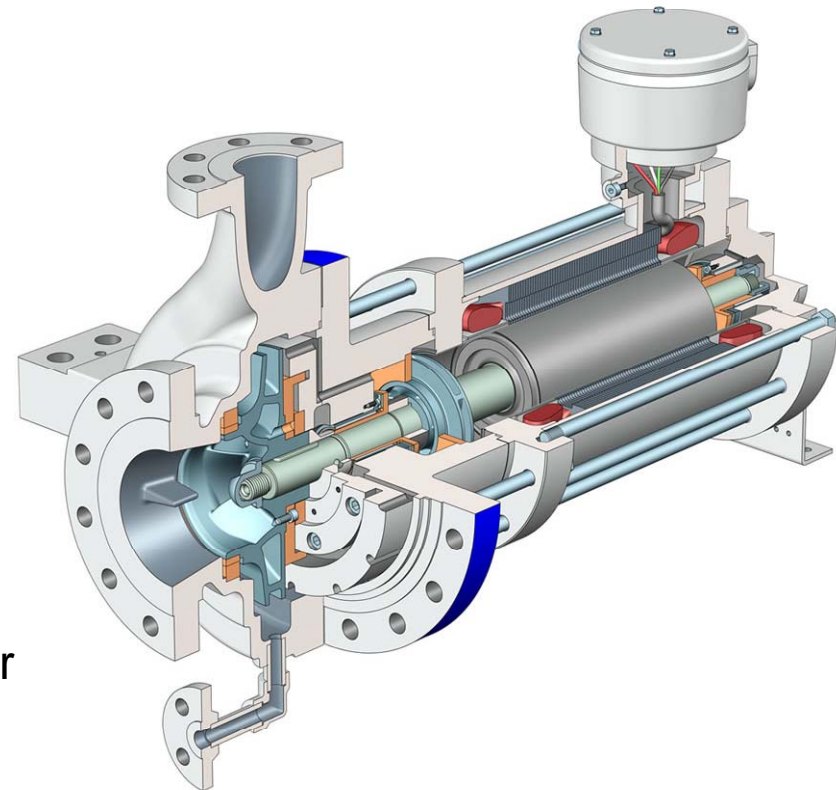
Sulzer Pumps

The OHC canned motor pumps represent the ultimate in pressure containment with two full pressure boundaries and static sealing.

The OHM magdrive is next in line with primary static containment shell and gas seal secondary.

The OHH conventional API 610 pumps provide security with mechanical sealing technology.

All use hydraulic components of the Sulzer OH family .



OHC Design Features

Axial Thrust Compensator

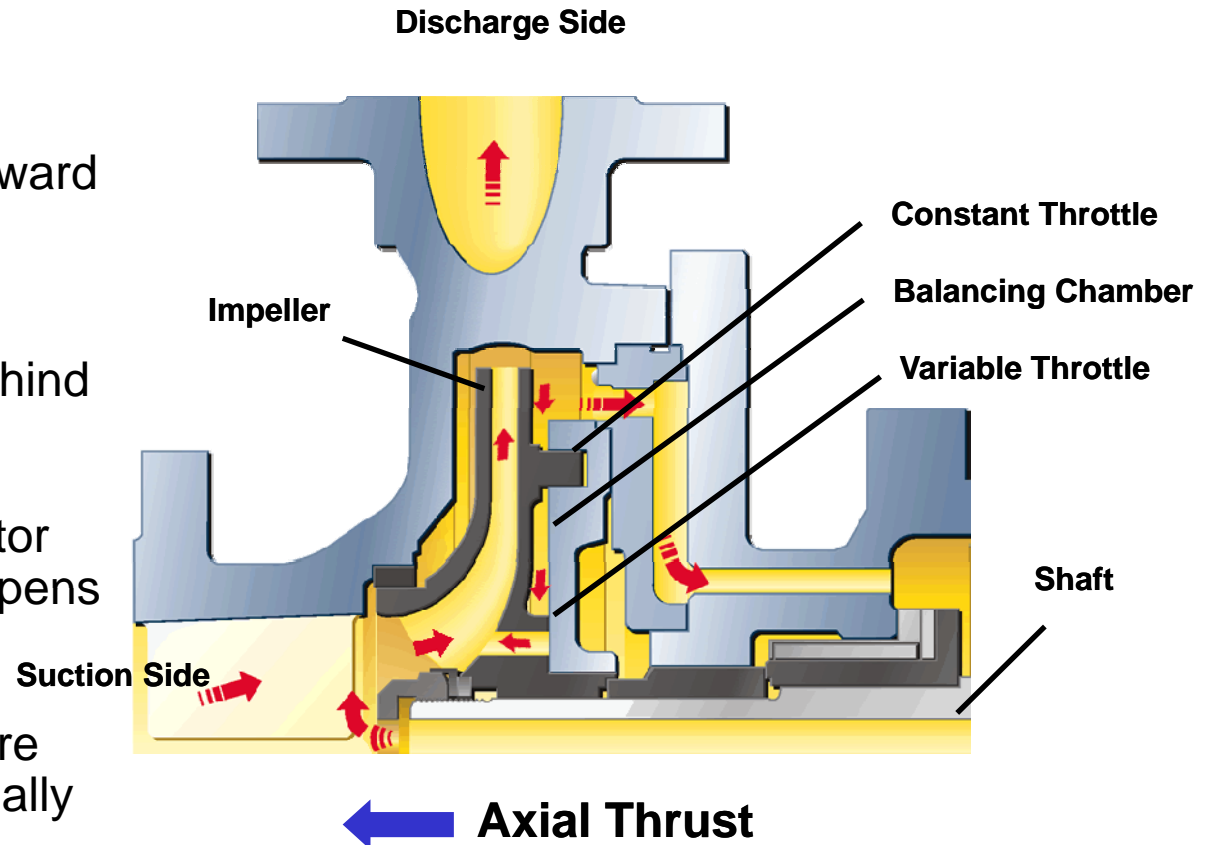
SULZER

Sulzer Pumps

Thrust compensator is effective over entire operating range

How it works:

- Any increase in suction pressure forces rotor toward motor, closing "variable throttle".
- That builds pressure behind impeller.
- That pressure forces rotor toward suction, which opens "variable throttle".
- Compensator is therefore self-equalizing and virtually unaffected by wear.



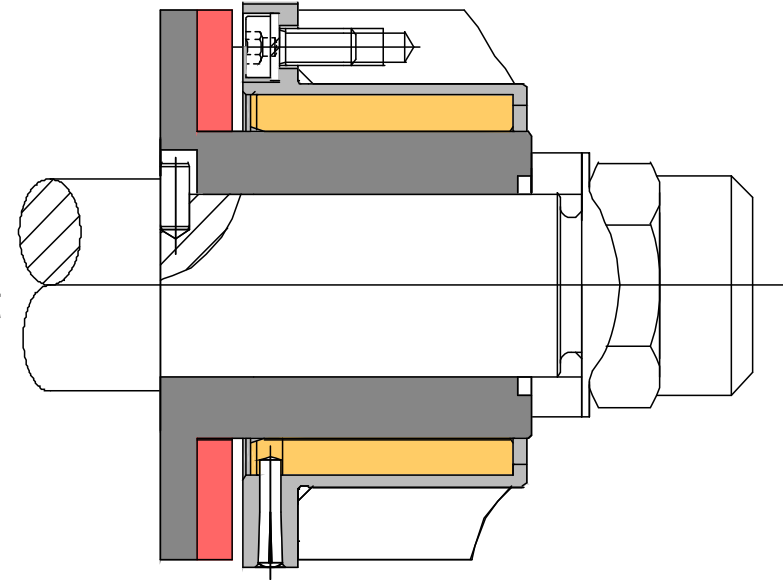
OHC Design Features

Bearing System

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Sulzer Pumps

- Canned motor pumps are inherently axially balanced since both ends of the shaft are normally exposed to suction pressure.
- In the OHC, the hydraulic thrust compensator takes most of the axial thrust load; grooved thrust pads take the remainder.
- The OHC rotor is supported in silicon carbide bearings with Teflon/carbon residual thrust pads.
- Shaft is protected by a tungsten carbide coated stainless steel sleeve at each bearing.



OHC Design Features

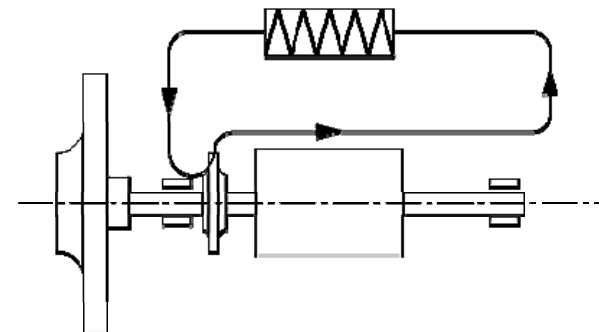
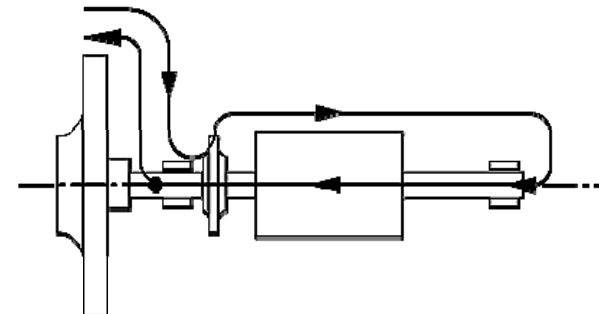
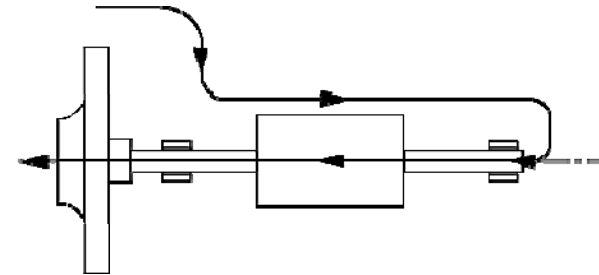
Circulation Flow Paths

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Sulzer Pumps

3 Flow paths cover virtually all applications

- Standard flow is from impeller discharge through the motor and exiting into the impeller eye.
- For fluids near their vapor pressure, an auxiliary impeller is used to boost pressure within the motor cavity. Flow exits radially thru the shaft behind the impeller into a pressurized zone to avoid flashing.
- Depending upon power rating and ATEX temperature class, either ceramic insulation, or aux impeller and heat exchanger are used for high temperatures.



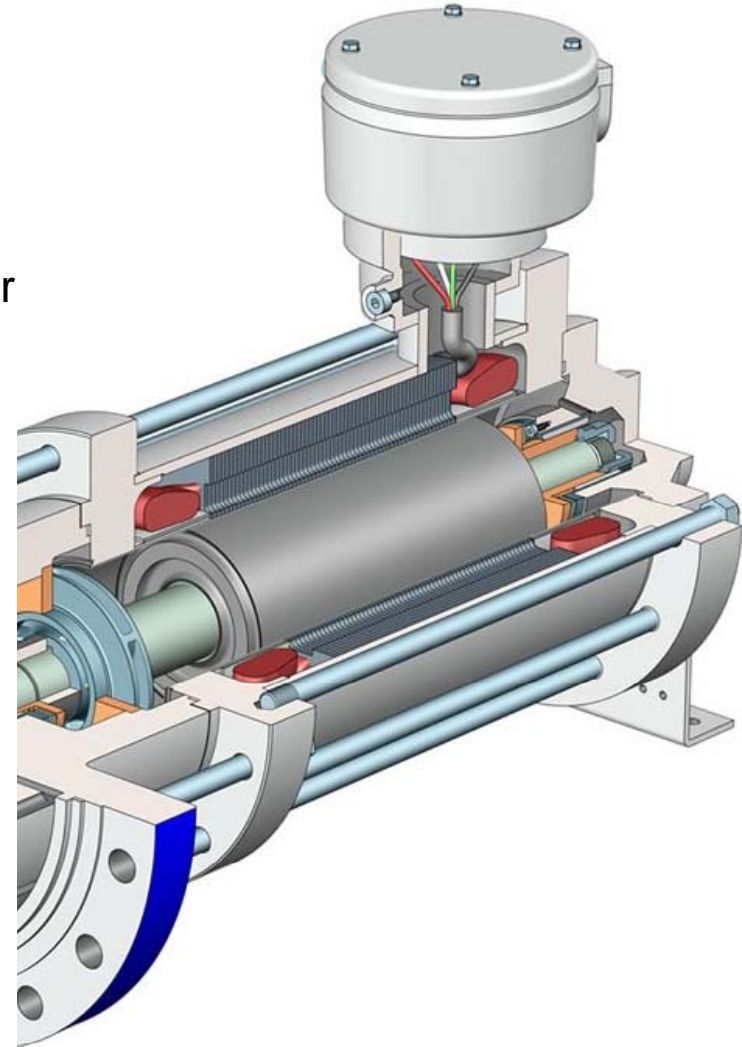
OHC Design Features

Canned Motor Types

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Sulzer Pumps

- Standard Motor is designed for services up to 100° C (212° F).
- Adding the heat exchanger and auxiliary impeller extends its capability to 427° C (800° F).
- Up to 360° C (680° F), depending upon power rating and ATEX temperature class, ceramic insulation can be used to provide longterm operability without the need for cooling water.
- Motors are certified to the new European Explosion Proof requirements – ATEX.



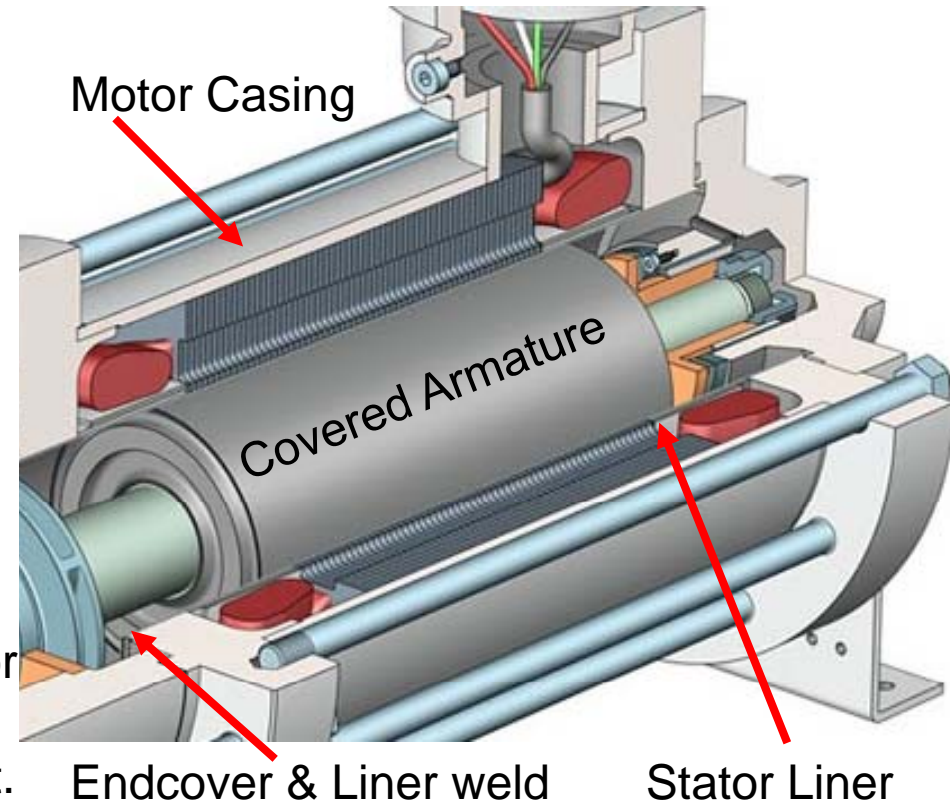
OHC Design Features

Secondary Containment

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Sulzer Pumps

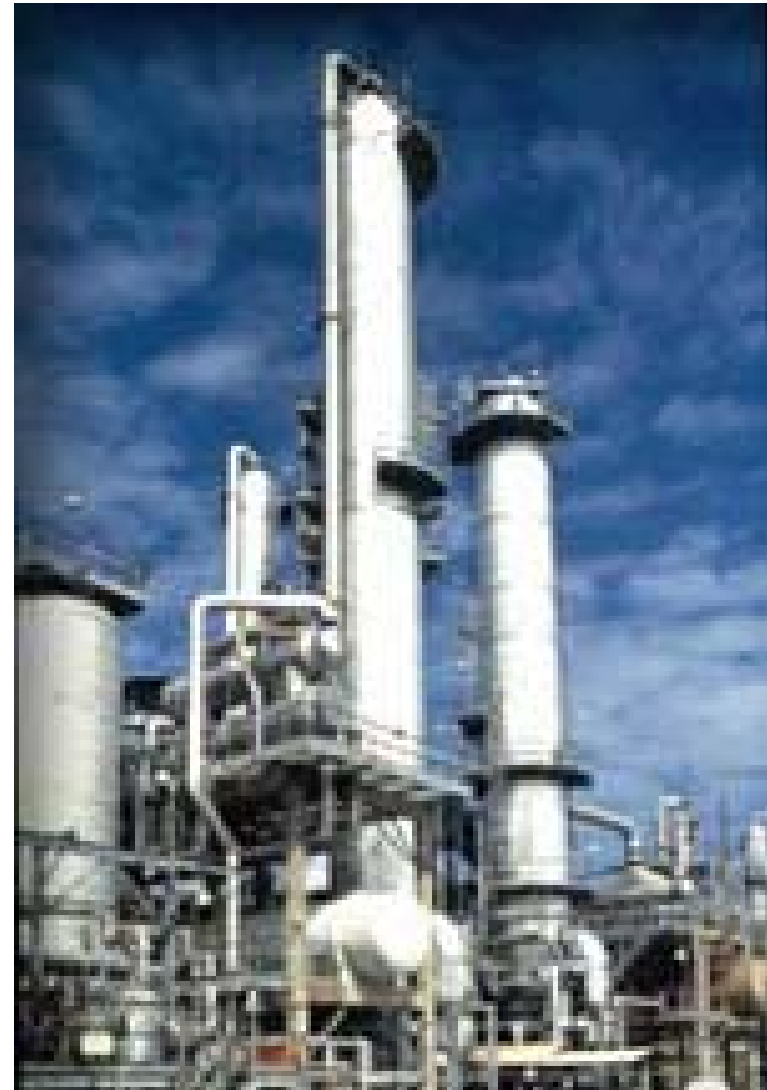
- Hastalloy stator liner is welded to SS stator endcovers to form a permanent pressure boundary.
- Armature cover is welded SS or Hastalloy depending upon application.
- Secondary containment is formed by CS motor casing, conduit box, and endcovers.
- If some foreign object causes a stator liner breach, the full pressure secondary containment will contain it.
- Motor frame bolts are not part of primary pressure boundary; they are for rigidity.



- A variety of instrumentation is available for pump protection, rotor position and rotation direction

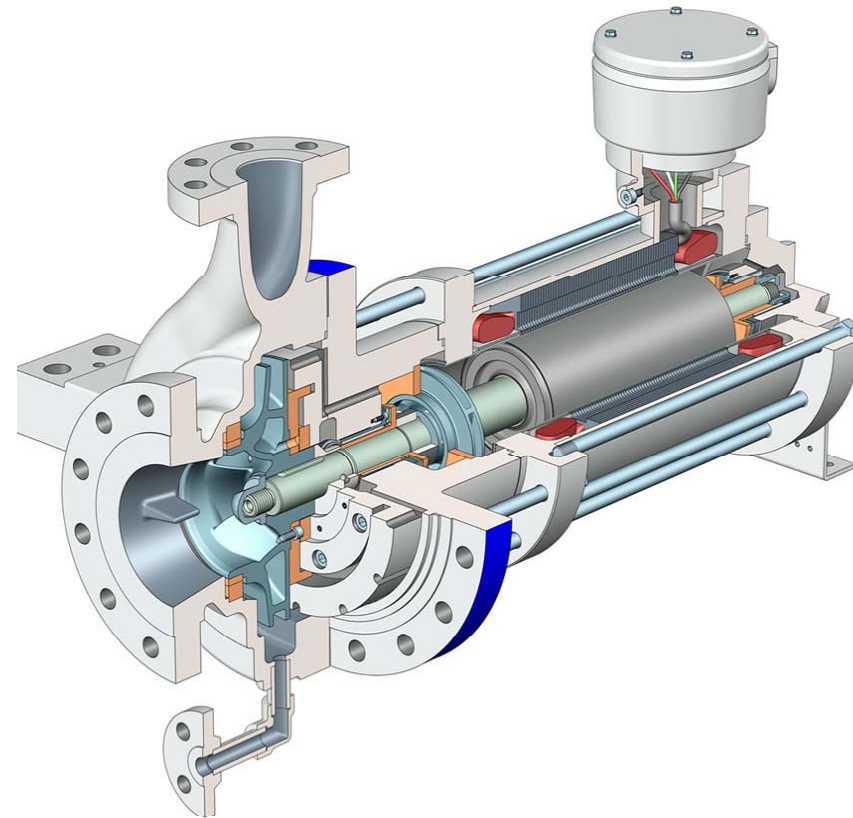
OHC Applications

- Aromatics
- Phosgene
- Carbon Dioxide Loading
- Ethane Loading
- LPG transfer or booster
- Dowtherm circulation
- Freon/134A refrigerant transfer
- Cryogenics
- Deethanizer reflux
- Demethanizer reflux
- Amine, Acids, Caustic, Sulphur
- The normal ISO canned motor pumps are available for lower pressures. Hermetic also builds canned motor pumps to over 1000 bar (15,000 psi)



OHC Experience

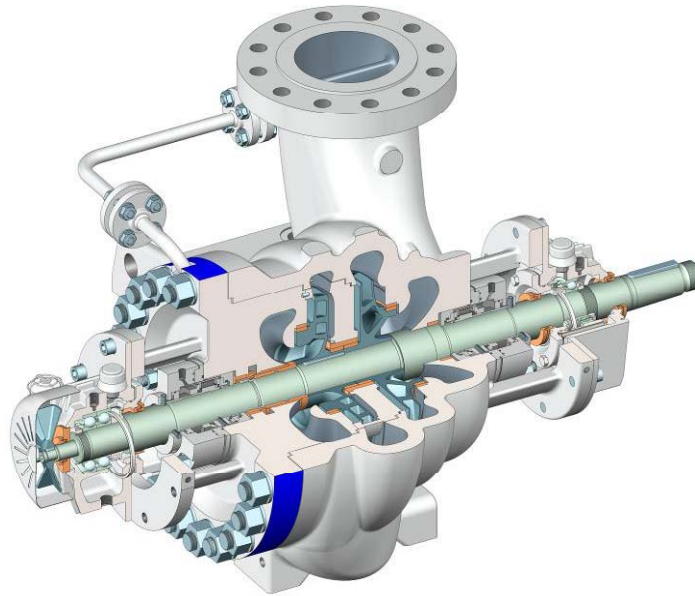
- Hermetic is believed to be the largest industrial canned motor supplier in Europe and has sold over 100,000 canned motor pumps in the past 30 years.
- Virtually all the major chemical and refining companies have installations; many on toxic or critical service.
- The Sulzer OHH hydraulics are a combination of the Sulzer ZE and CAP8 pumps from Europe and America.
- Over 13,000 of those pumps are installed around the world.
- The OHC represents the best in canned motor technology combined with the best in API pump hydraulics.



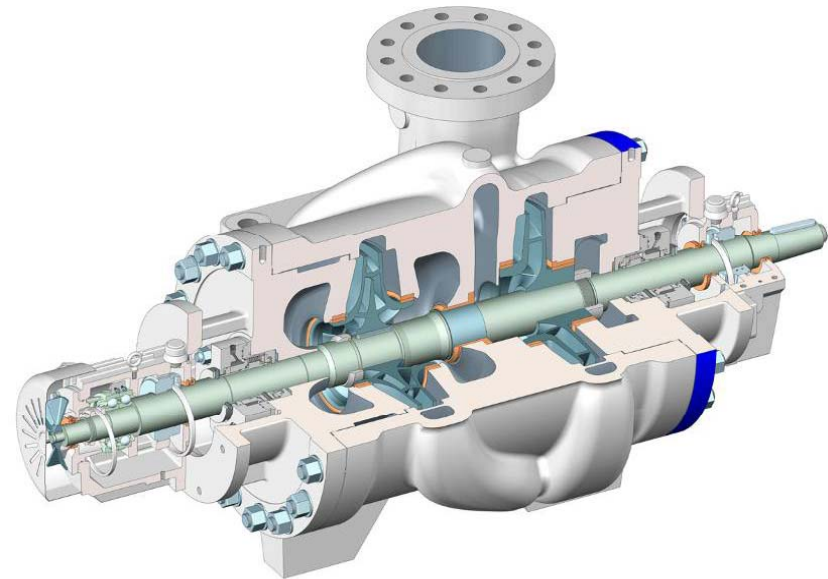
Type BBT, BBT-D Pumps ISO 13709 (API610)

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Sulzer Pumps



BBT single suction, 2 stages,
radially split



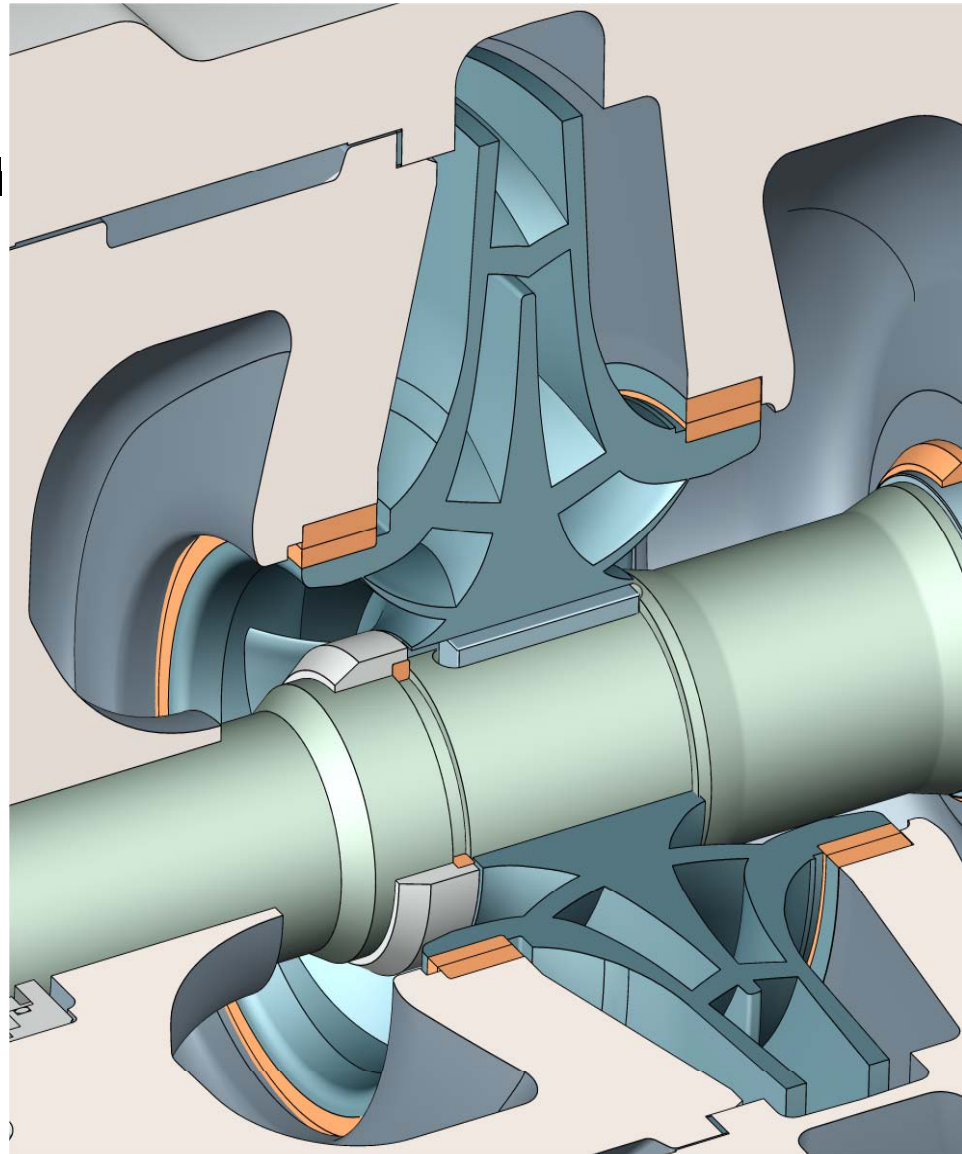
BBT-D double suction,
2 stages, radially split

Type BBT & BBT-D Pumps Hydraulics

SULZER

Sulzer Pumps

- High efficiency impellers
- individually secured against axial displacement.
- Variety of wear ring materials for clean, corrosive or abrasive applications.
- Over 25 different hydraulics.
- BBT-D double suction first stage impellers reduce NPSHr – ideal for processing unit capacity increases.
- Coke Crusher available for coking applications.



Coke Crushers

The Challenge:

- Some processes produce coke particles or chunks. If those particles are too large, they are trapped between impeller vanes and reduce or stall flow.
- Sulzer's Coke Crusher is used on the first stage to break up those particles and help maintain pump output.

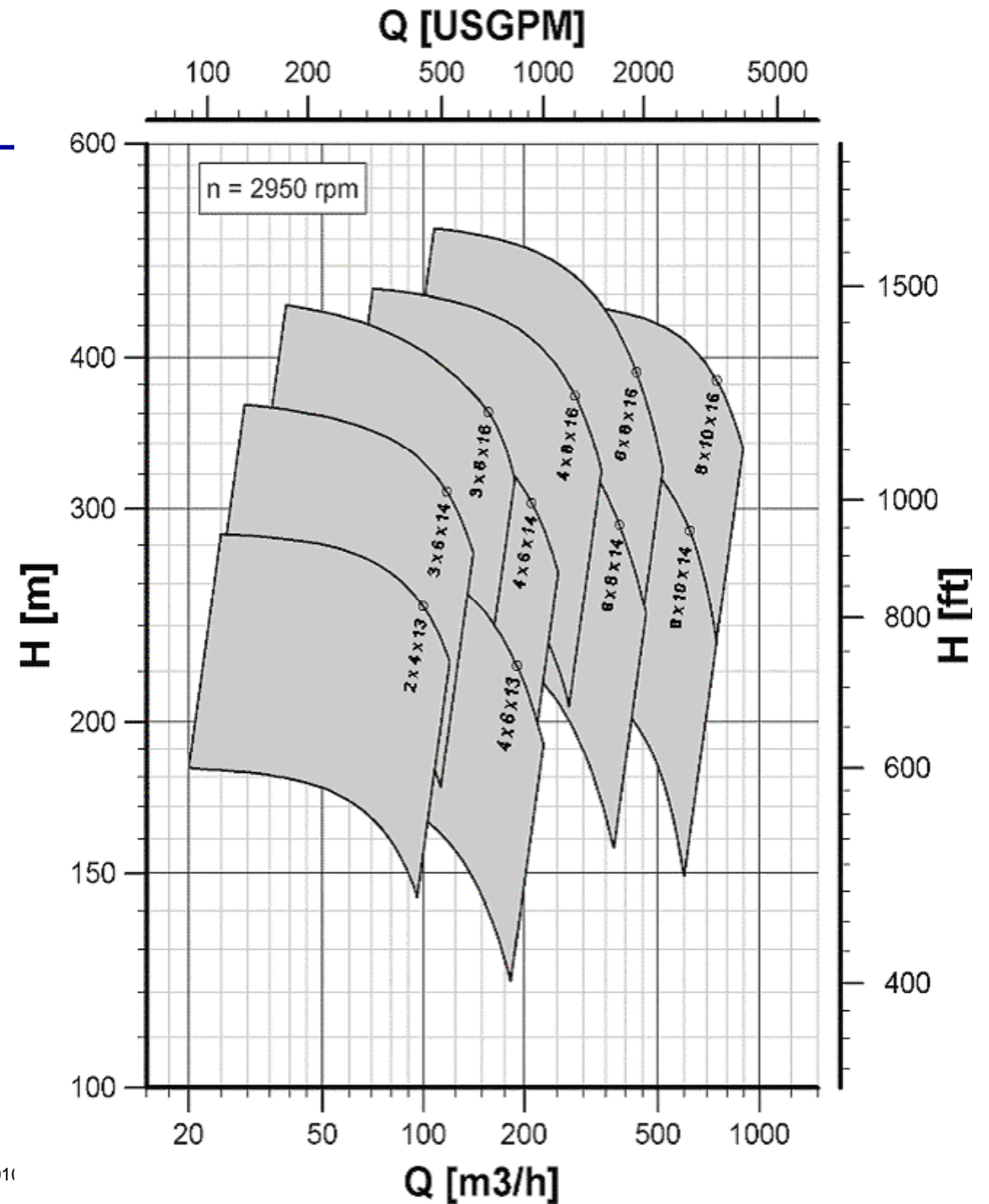
How it works:

- Flat spot on coke crusher rotor vane impales coke particles that are too large to travel between impeller vanes.
- Rotation carries particle around to next stator lug where the particle is crushed.
- Coke Crushers are designed for each application. They provide a slight flow inducement so that NPSHr is not impaired from that of a normal pump.

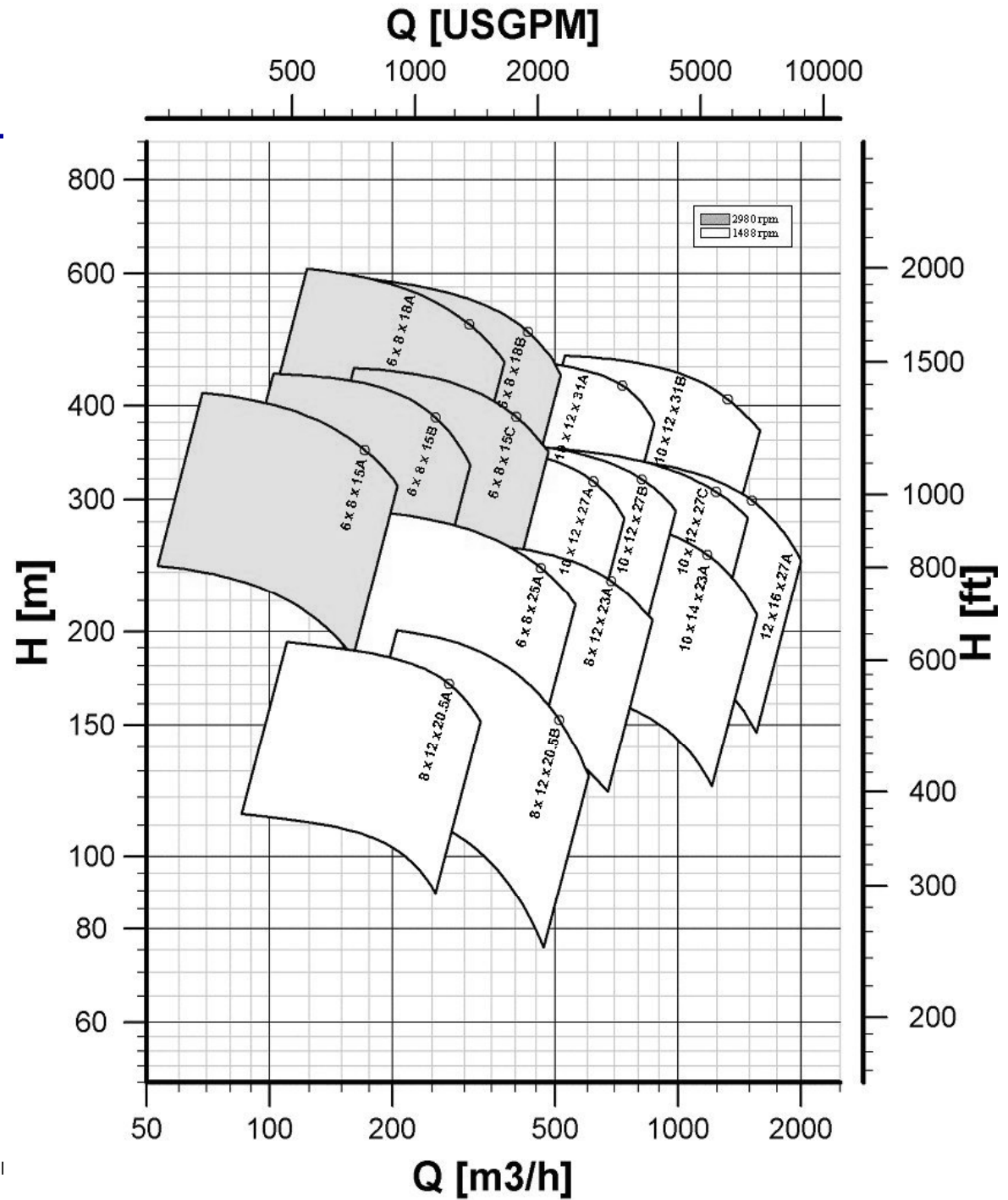


BBT Performance

50 Hz



BBT-D Performance 50 Hz



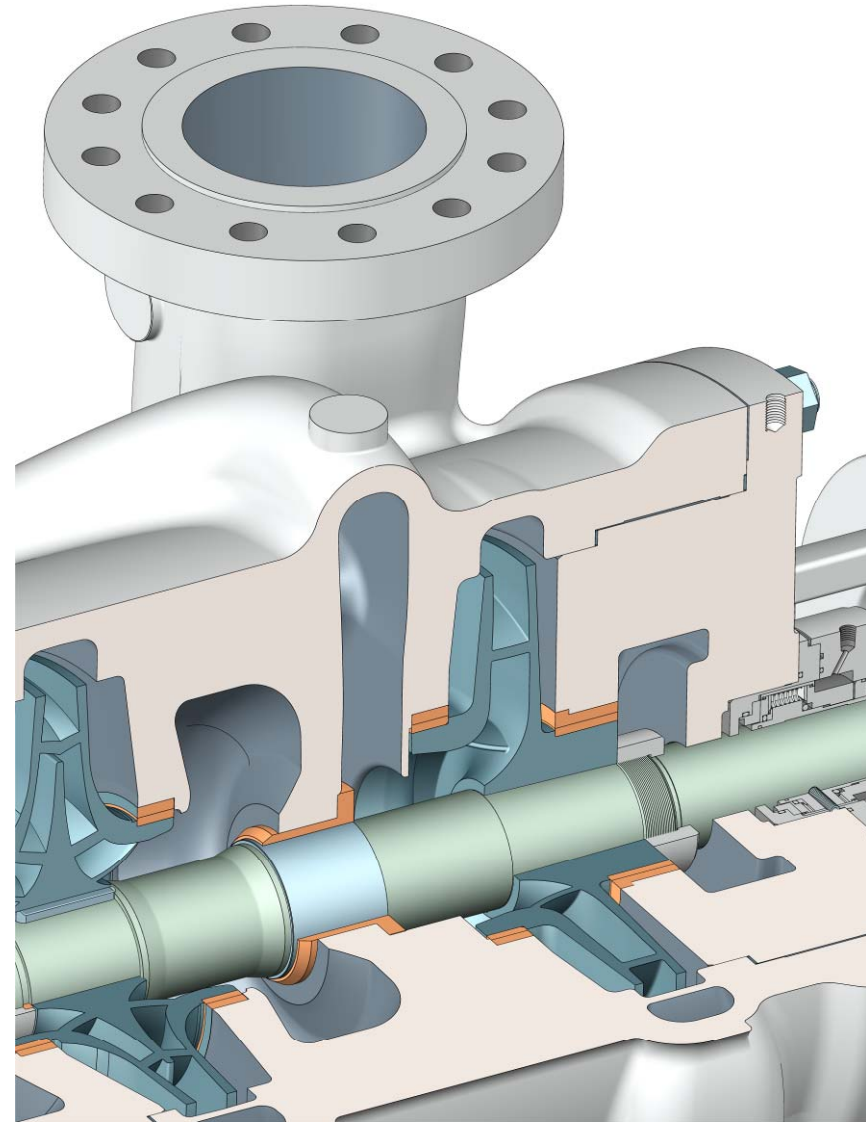
Type BBT & BBT-D Pumps

Volute Casing

SULZER

Sulzer Pumps

- Pressure boundary components designed with 3 mm (1/8") corrosion allowance.
- Top suction and discharge nozzles are standard with back spot facing required by API 610.
- ANSI 300# RF or 600# RF flanges provided; DIN flanges available.
- Volute casings are opposed on BBT to balance radial loads.
- Double volutes used on larger sizes.
- End covers are confined controlled compression gaskets with metal to metal rabbet fit.



Type BBT & BBT-D Pumps Mounting & Baseplates

SULZER

Sulzer Pumps

- Casing mounting feet and baseplate designed to meet ISO 13709 (API 610).
- 2 x API 610 nozzle loads available on most sizes.
- Non-grouted baseplates available for motor or steam turbine drivers.
- API 610 defined baseplate dimensions are standard. Similar designs and standards are used where larger bases are required to accommodate larger size pumps or drivers.



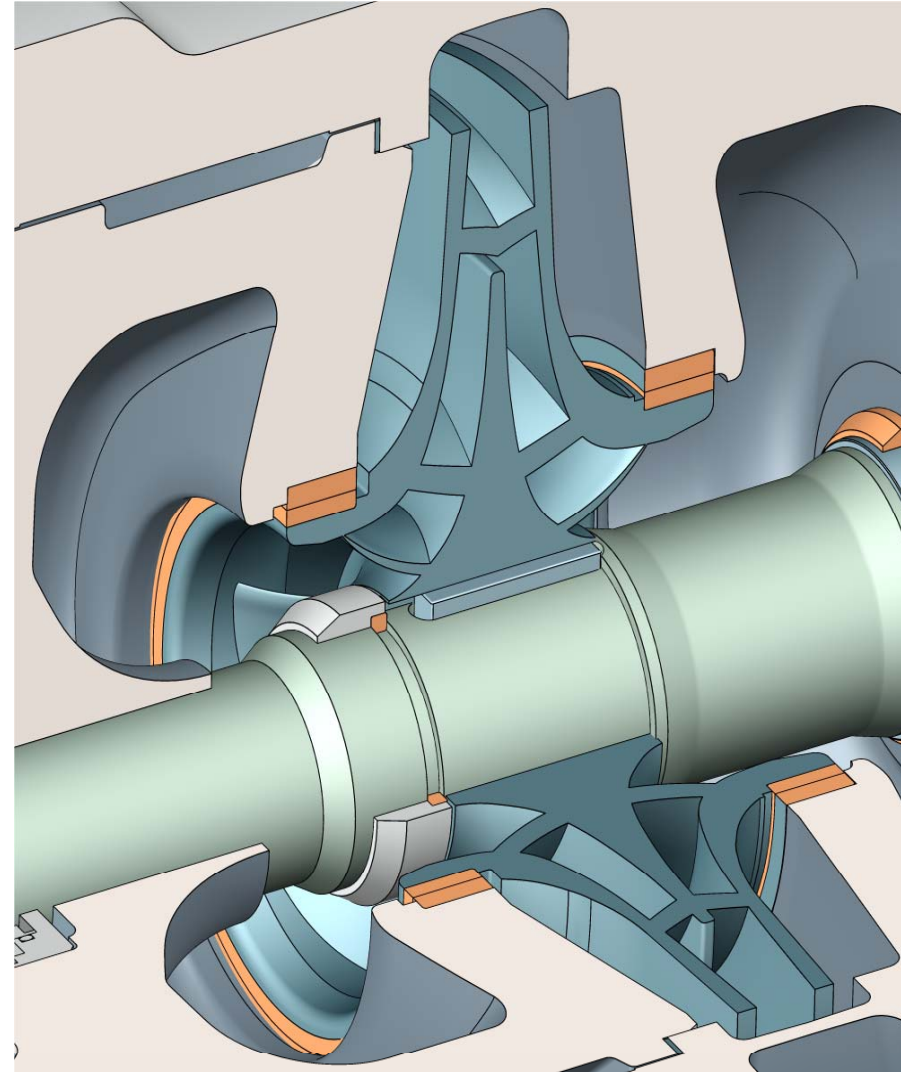
Type BBT & BBT-D Pumps

Rotor & Seal Chambers

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Sulzer Pumps

- Extra heavy stiff shaft rotor system as required by API 610 does not rely on wear rings for rotor stability.
- Sulzer's year long wear testing study improved wear part materials and reduced galling tendencies.
- ISO 24109 (API 682) seal chambers and flush piping are provided for improved seal life.
- Single or dual cartridge type mechanical seals available to meet process requirements.



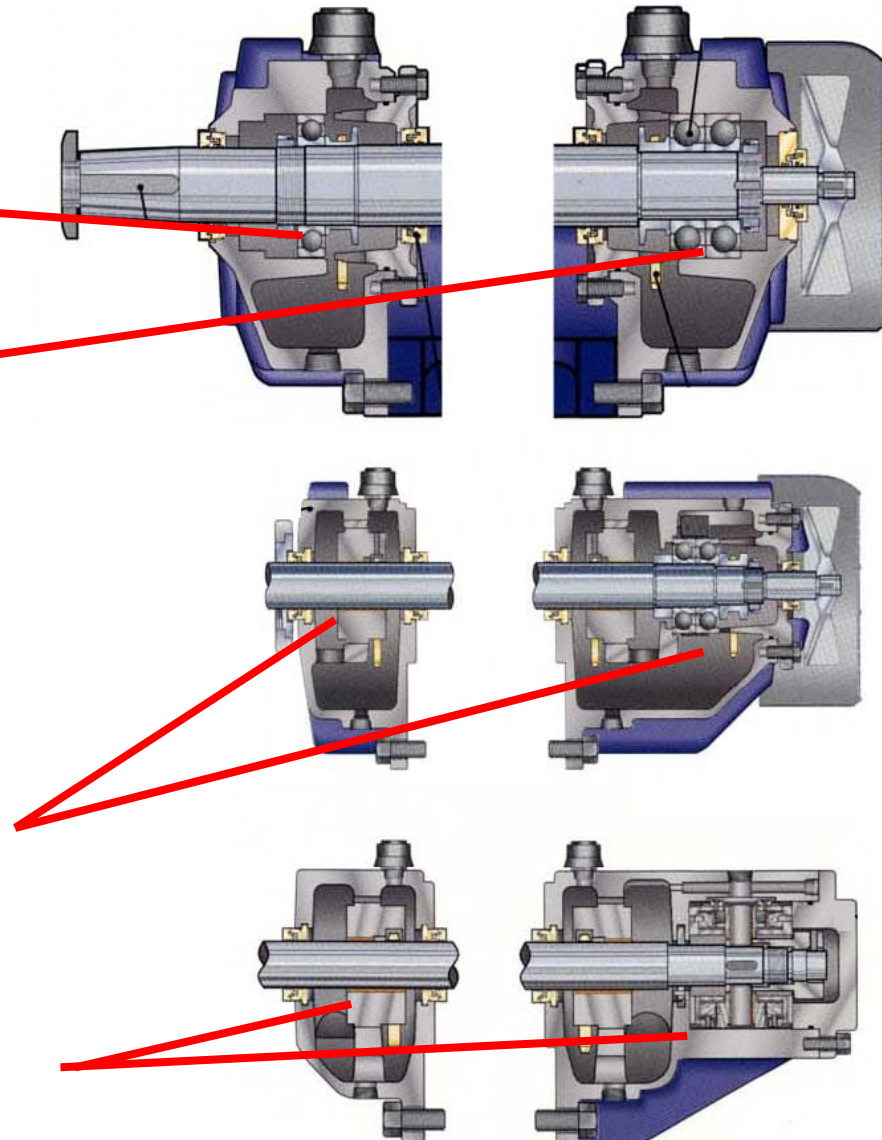
Type BBT / BBT-D Pumps

Bearing Systems

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Sulzer Pumps

- C.S. finned bearing housings readily dissipate heat
- Ring oil lubricated ball bearings are standard on most sizes and speeds
- Radial bearings are ball with C3 clearance. Thrust bearings are 40 degree angular contact with machined bronze cages. Roller bearings used on some sizes.
- Cooling fans, water cooling, oil mist taps and a variety of instrumentation are available.
- Isolators are standard.
- Larger sizes and higher speeds utilize sleeve radial, ball thrust bearings.
- Sleeve radial, pivot shoe thrust bearings and force feed lube systems are available.

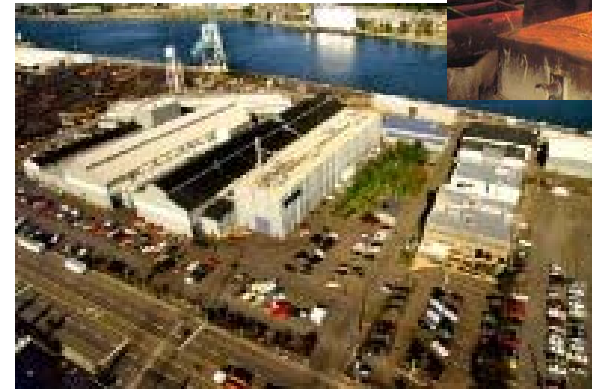
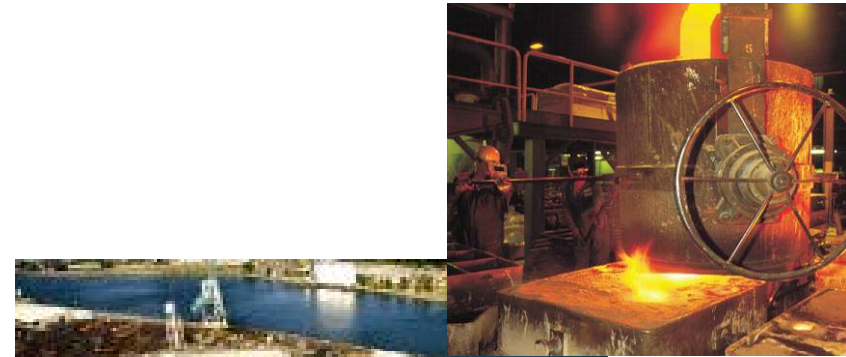


Type BBT & BBT-D Pumps Manufacturing & Testing

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Sulzer Pumps

- Castings are procured from Sulzer owned or qualified foundries.
- Most BBT / BBT-D components are produced on multi-axis CNC machining centers.
- Quality checks are accomplished with calibrated equipment in accordance with ISO 9001 and other standards.
- A variety of non-destructive examination methods are available to meet customer requirements.
- Performance test data is captured using Sulzer's CATS data capture software in many manufacturing locations.



Type BBT & BBT-D Pumps

Total Life Cycle Care

SULZER

Sulzer Pumps

- Over 55 Sulzer Pump service centers around the globe provide a variety of pump services:

- Parts

- Repairs

- Hydraulic & Mechanical Upgrades

- Performance Based Maintenance Agreements

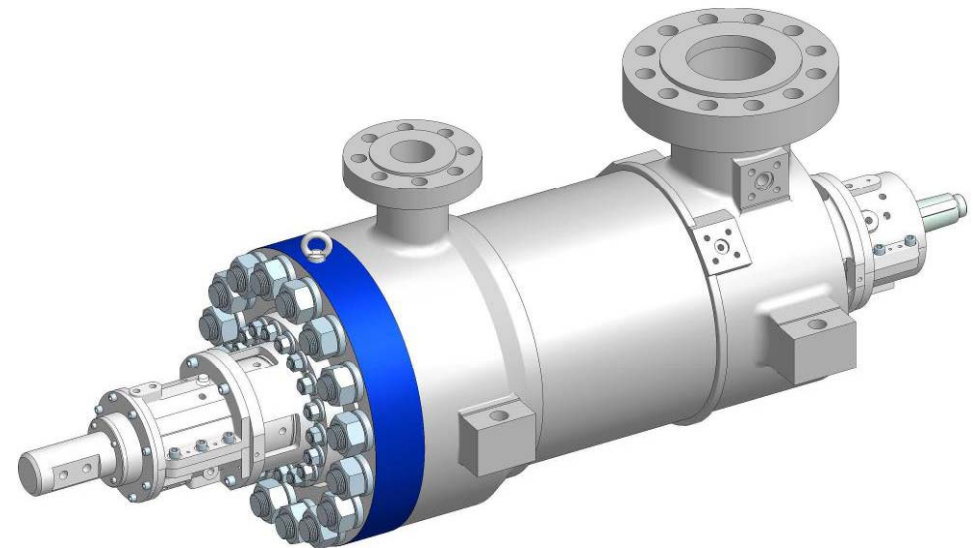
- For Sulzer and non-Sulzer pumps



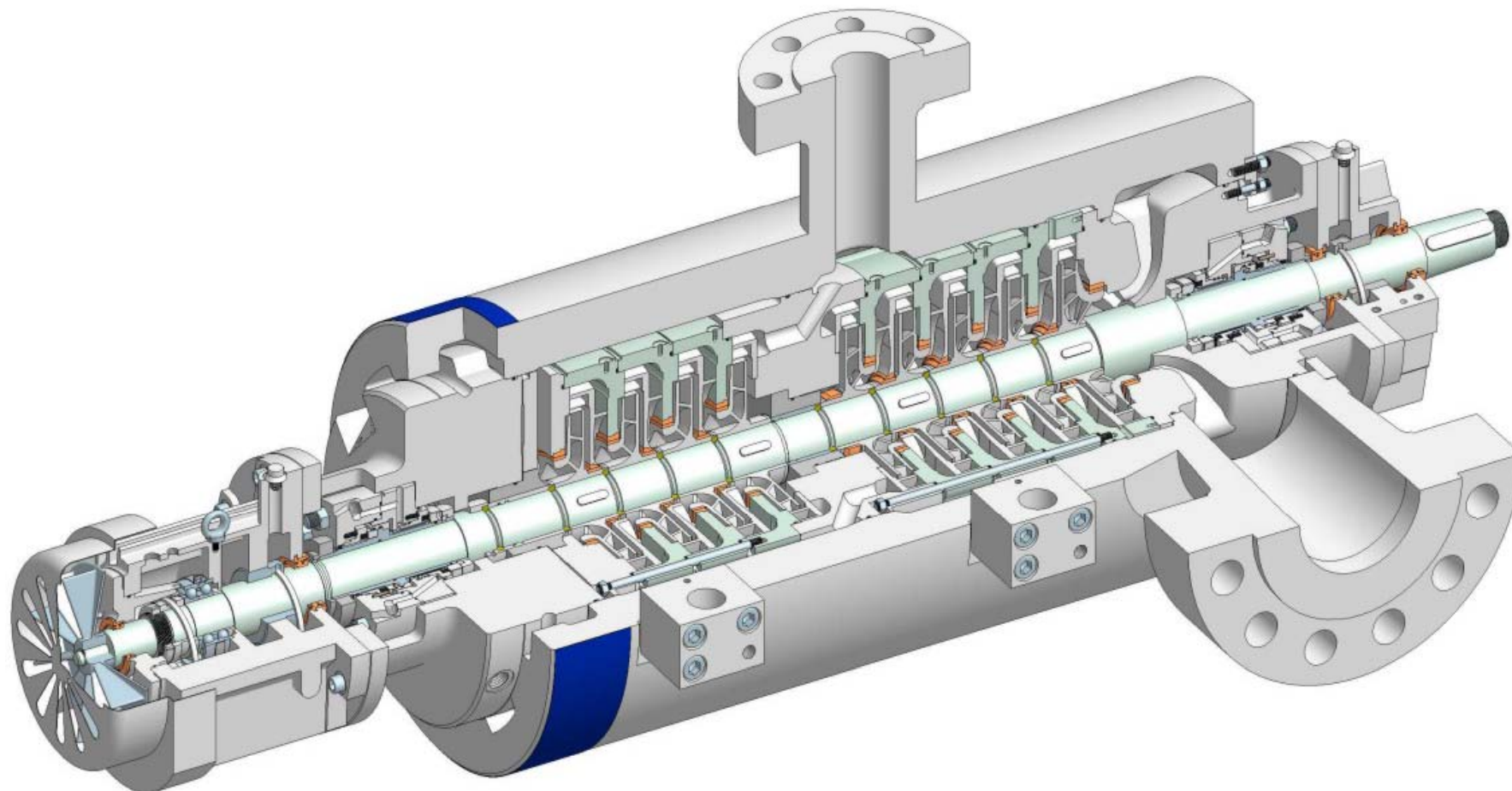
GSG Barrel type pump

- The Sulzer type GSG is a horizontal, radially split, multistage diffuser pump with outer barrel casing, designed for heavy duty applications in
 - Refineries,
 - Petrochemical plants,
 - Gas processing,
 - Coal processing,
 - Offshore installations and Injection

- API 610 9th Edition
Pump Type BB5



GSG Back-to-Back Design



Operating data

GSG - HPI

SULZER

Sulzer Pumps

6 Pump sizes	DN	40 to 150 mm	(1.5" - 6")
Capacities	Q	up to 800 m ³ /h	(3,500 USgpm)
Heads	H	up to 2450 m	(8,000 ft)
Temperatures	T	-60 °C up to +450 °C	(-20° F to 840 °F)
Pressures	p_d	up to 275 bar	(4,000 psi)

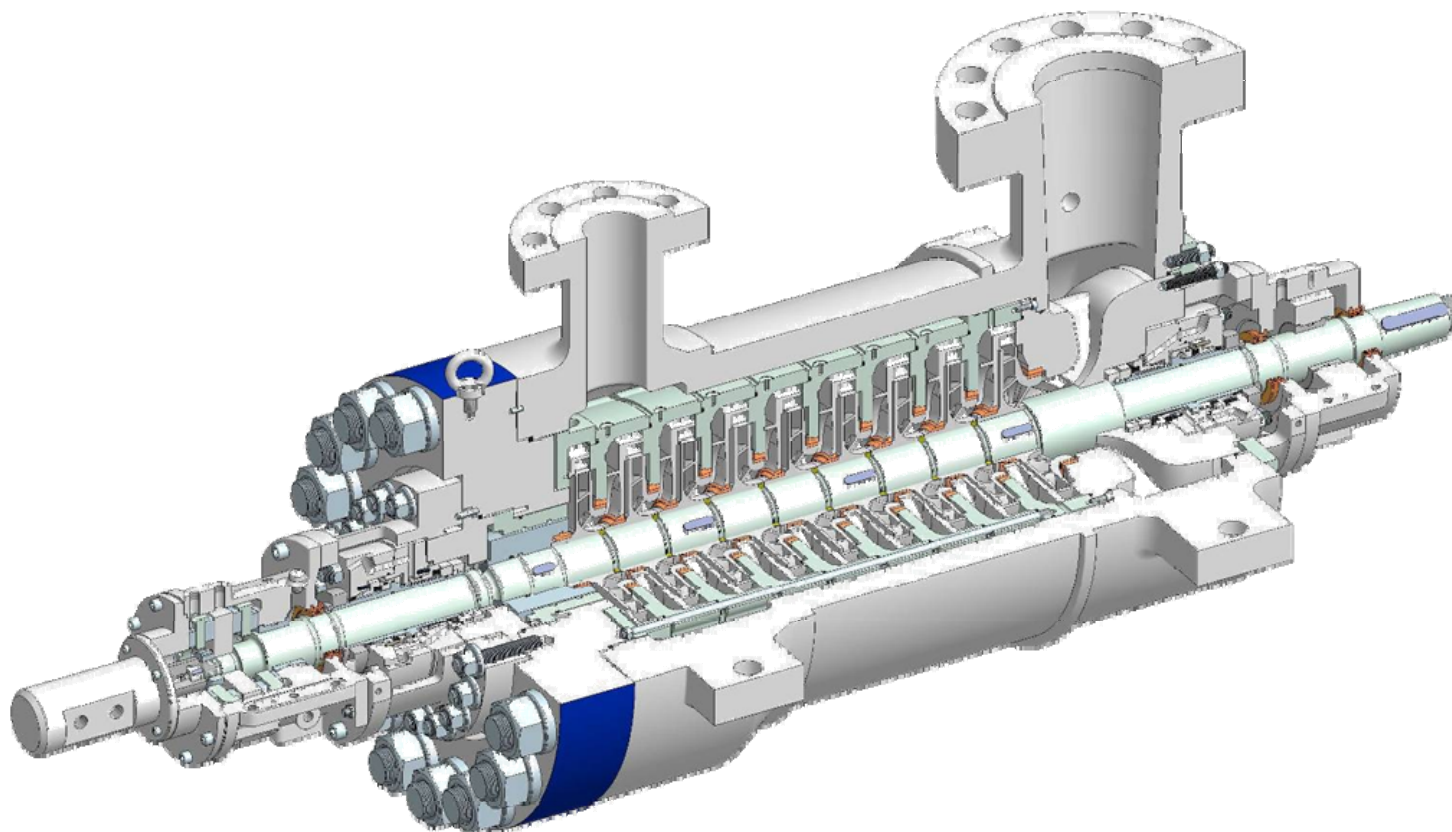
GSG Barrel type pump

Design features

- Casted barrel for low pressure / forged for high pressure - DIN/ANSI flanges
- Hydraulic set (impeller, diffuser) from
 - MC/MD - range – single stage fixation incl. wear rings
 - double suction 1st stage impeller (option)
- Hydraulic axial thrust compensated by balance piston or back-to-back design
- Stage casings sealed by o-rings < 180° C
- API 682 Seal Chambers with or without cooling jacket
- Materials acc. to API 610 S-6, C-6, A-8, D1, D2
- Mechanical seals according to API 682

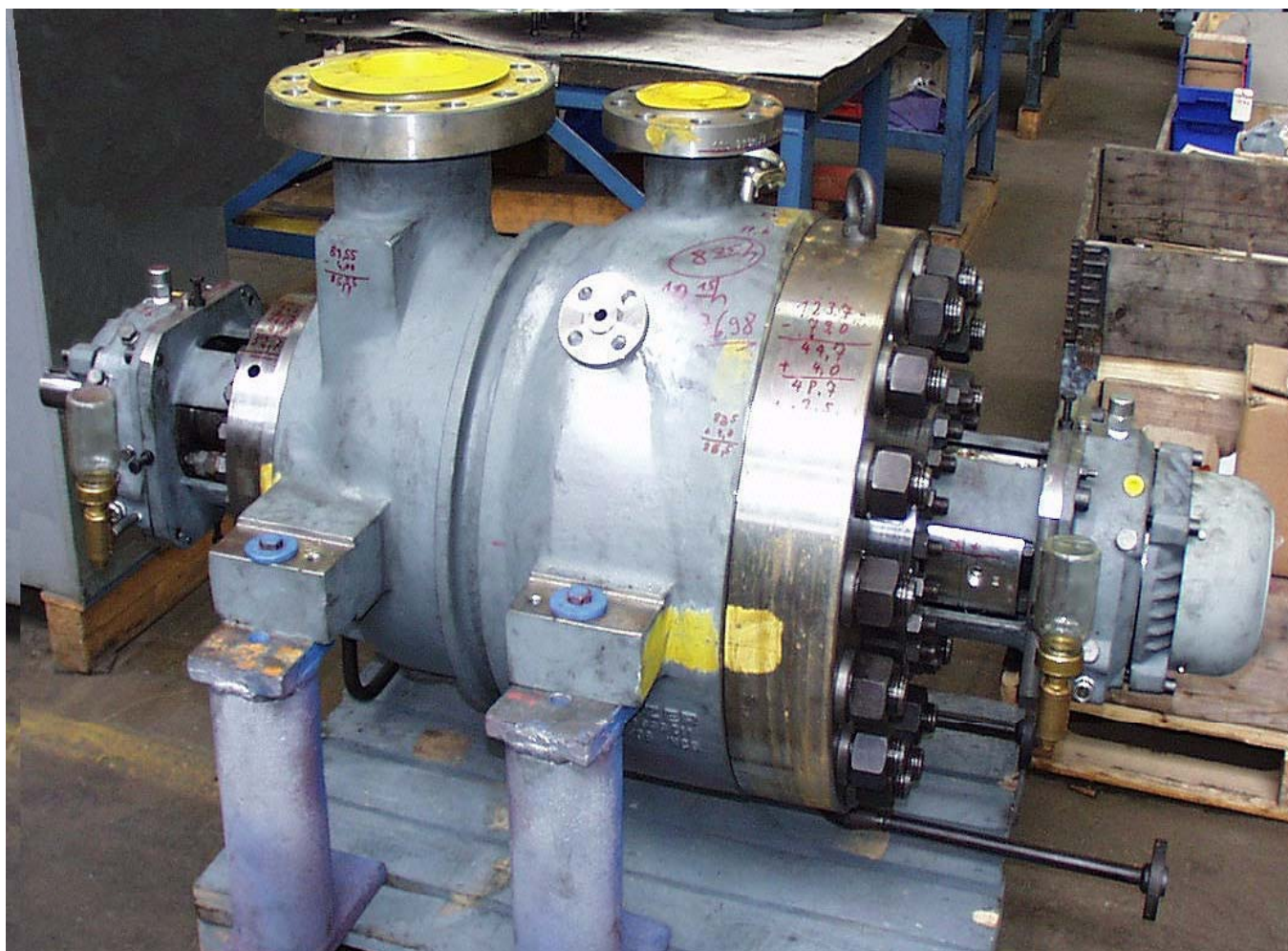
GSG Barrel type pump

GSG with roller bearings



HPI application

GSG 80-260 / 5 stg.



GSG twist lock design / high pressure

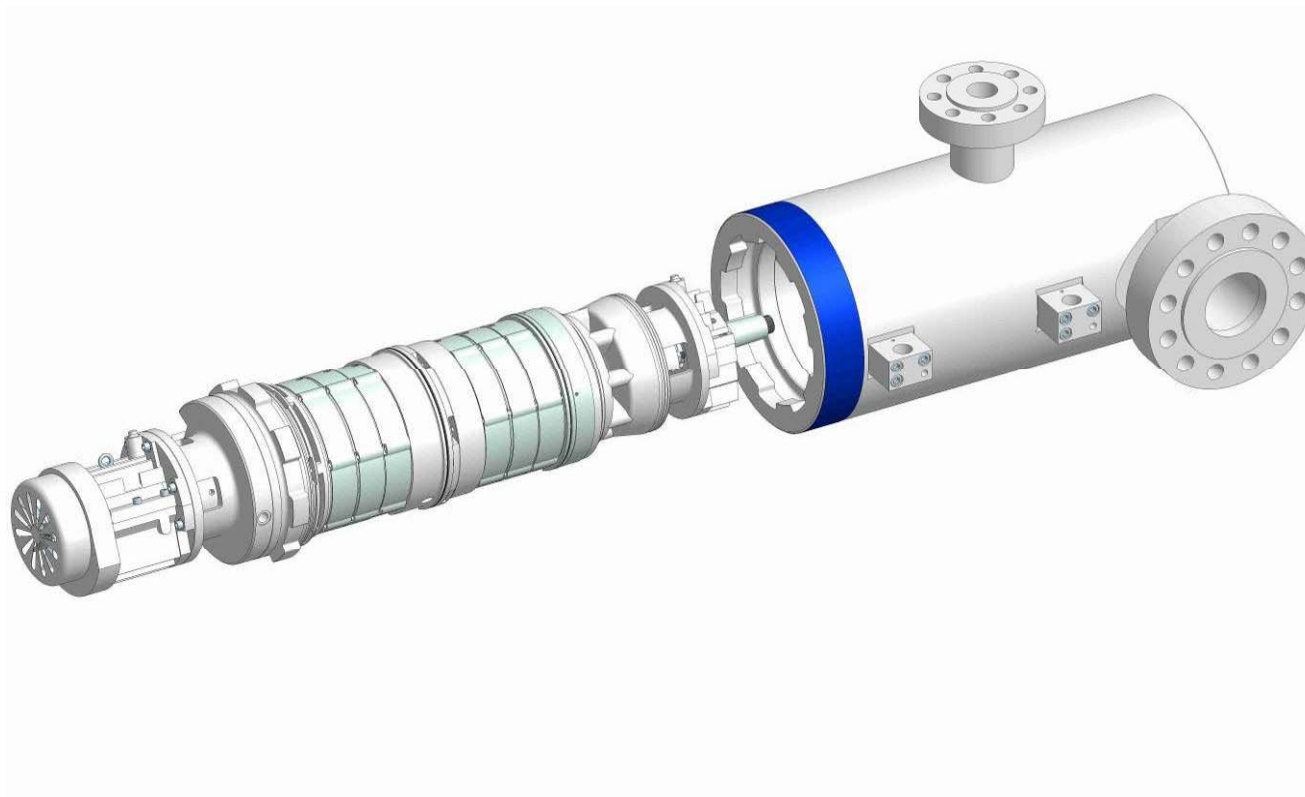
- Twist lock is an existing Sulzer patent used for high pressure injection pumps
- Successful tests with testrig shows new development
- Cross section of new design

Main advantages:

- Larger casing studs and nuts eliminated including torque procedure
- Barrel casting/forging easier
- Savings in assembly/disassembly time
- Quick cartridge changes

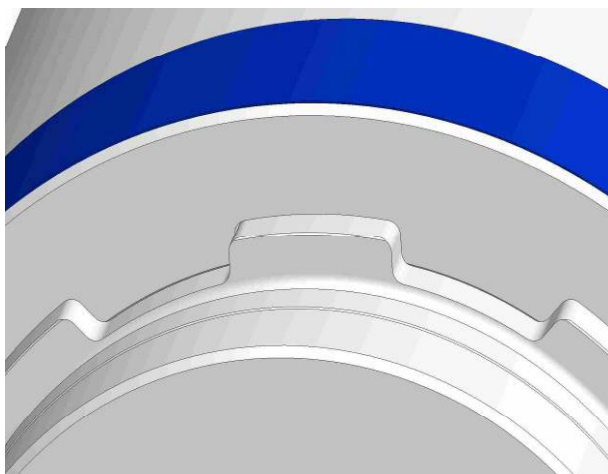
GSG twist lock design / high pressure

Twist lock design

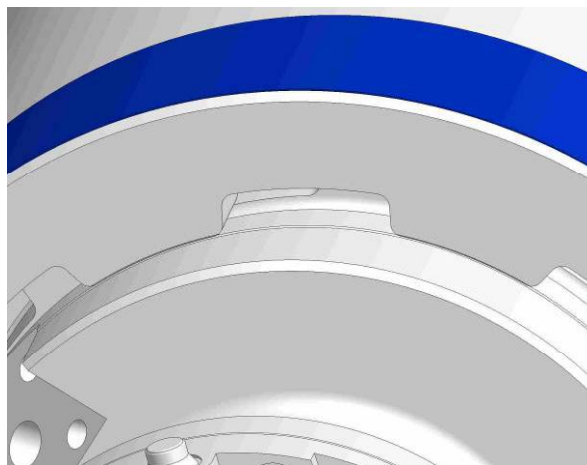


GSG twist lock design / high pressure

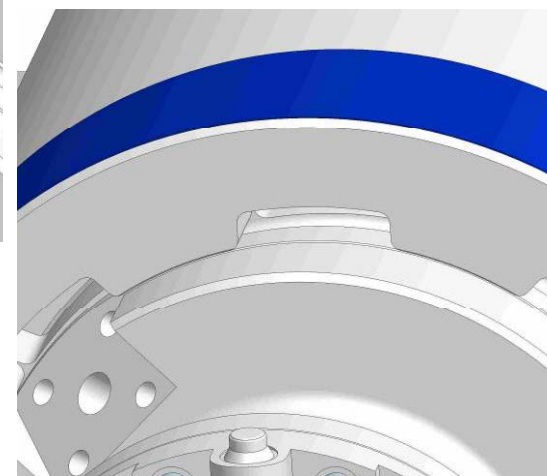
Twist lock assembly in steps



Insert



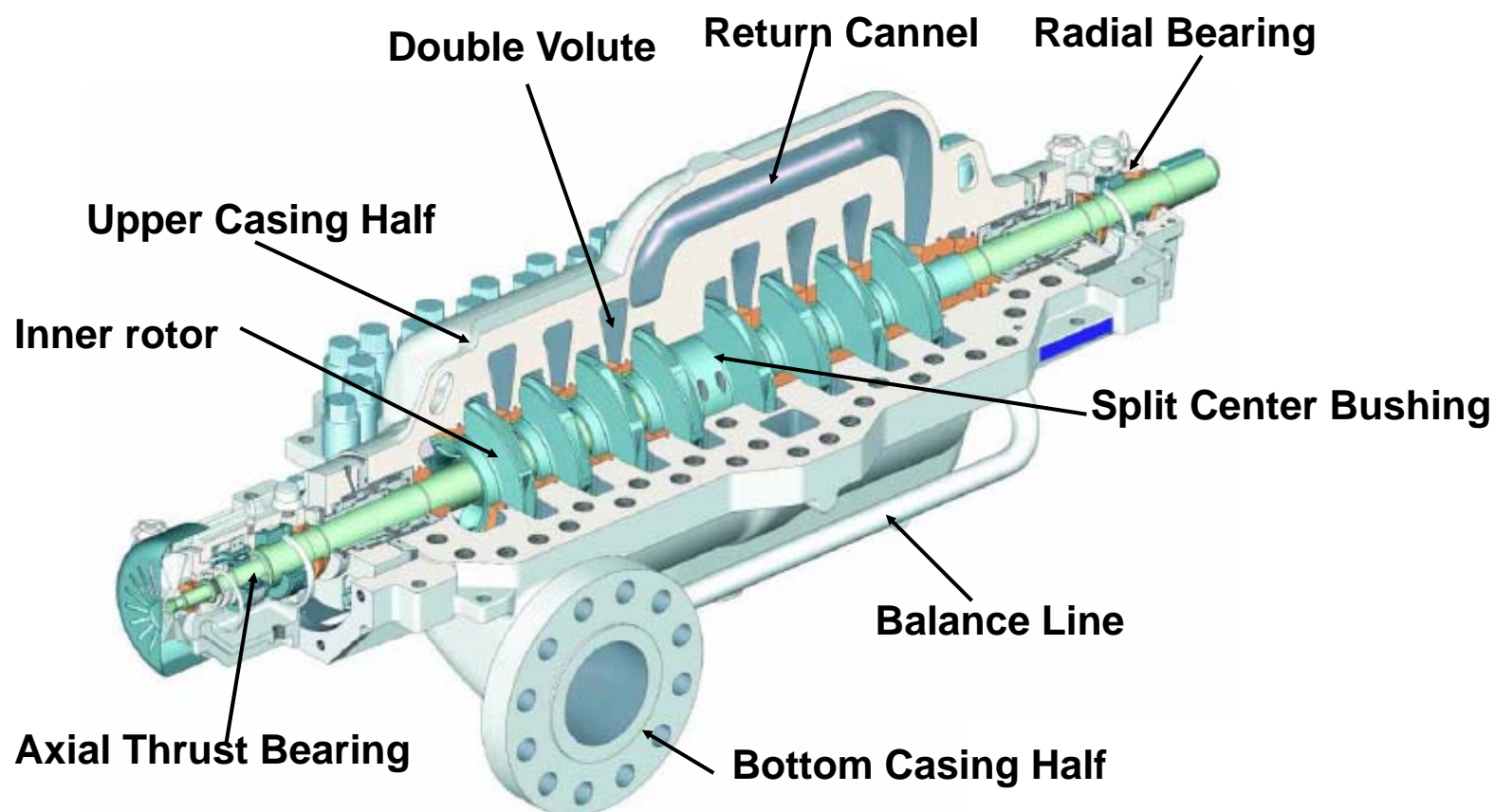
Twist



Lock

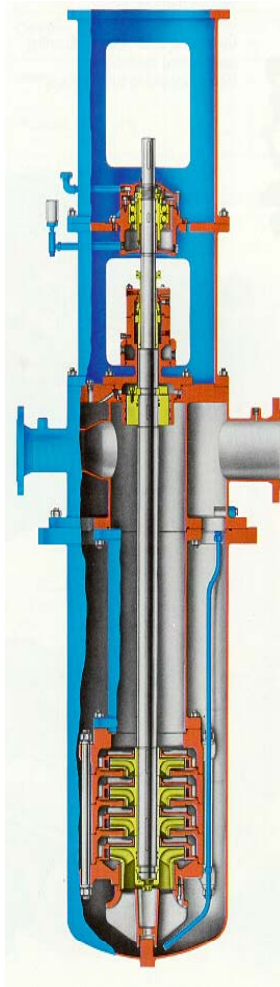
MSD

Horizontal, Multistage, Axially Split Pump



TTMC for HPI

Vertical can pumps



- ◆ The Sulzer type **TTMC-HPI** is a vertical suspended, double casing multistage diffuser pump, designed for heavy duty applications in refineries, petrochemical plants, gas processing
- ◆ API 610 9th Edition Pump Type VS6