Rodelta ETL

The pump type ETL (OH5) vertically inline mounted, close coupled, radial split case, single stage, single suction, heavy duty centrifugal process pumps. The design complies with the latest edition of the American Petroleum Institute standard 'Centrifugal Pumps For General Refinery Services', also known as API 610/ ISO13709. The inline configuration is a compact pumping solution with mounting the impeller to an extended motor drive shaft presents a very compact pumping solution. The ETL (OH5) offers a space saving footprint and eliminates expensive baseplates.

Features:

- According API 610 (OH5) Latest edition
- Diffuser design reduces radial loads
- Reduces minimum flow requirements
- High efficiency at any duty
- Alignment free construction
- In line suction & discharge
- Space saving construction
- Stable head characteristics
- Meets API nozzle load requirements
- Accommodates API 682 seal systems

Specifications:

- Delivery size up to 200mm
- Capacity up to 600m3/hr
- Head up to 290m (50Hz 3000 rpm) 420m (60Hz 3600 rpm)
- Suitable for liquid Temperature: Up to 250°C depending on Pump size
- Sealing Arrangement: mechanical seals
- Flange rating: Cl. 150/300/600
- API material options available, NACE & ATEX approvals available on request
- Suction and discharge flange according British standard BS 4082
- The footprint of the foundation plate corresponds to the DEP standard drawn up by Shell

Applications:

- Fluid handling in oil refineries and petrochemical industry
- High temperature and high pressure critical applications in chemical and allied industries
- Upstream, midstream, downstream.
- Process transfer, bottom reflux, propane/butane/LPG handling, diesel oil/gasoline/naphtha/lube oils etc., sodium carbonate/caustic sour water, MEA/DEA/TEA
- Fertilizer, carbamates/lean and semi lean solutions, NH3 feed, other removals
- Power plant, Hot water circulation, condensate transfer, fuel oil
- Onshore/Offshore installations, FPSO platform.
- Hydrocarbon storage and Liquid gas plants

Constructional features:

- Suction and discharge flanges are available drilled to either ANSI or DIN-EN standards, flange rating comply with API 610 nozzle load requirements.
- The pump casing, cover and seal cover incorporate a fully confined gasket.
- Mechanical Seals conform to API 682 / ISO21049 and are fitted into the API compliant seal chamber, either single, double or engineered seals can be accommodated that meet the full process requirements. All seals are provided with the relevant API compliant flushing, cooling, heating, quench and buffer fluid systems and associated pipework. Use of standard electric motor design.
- Impeller is directly mounted on extended motor shaft (close coupled design).

Monitoring features

Monitoring features like SPM vibration nipples and PT 100 temperature measurement provisions are optional.

Explaining the ETL redesign

The Rodelta ETL (API 610-OH5) pump is fully designed according to the 12th edition of the API 610. Rodelta's choice was not to lean back on there proven record by their installed base, but to redesign the OH5 successfully to the latest standard of the API without any deviations.
We believe that current markets requests innovators with regard to working according latest guidelines. Mainly because these guidelines are an abstract of the customer processes which ensures smooth running of their critical processes.

Goal of the redesign is maximum reliability with minimum rotating and stationary parts. Our experience of the OH5 pump type in the field made is feasible to conduct this exercise for redesign. Evaluating the hydraulic field chart (figure 1), one can see that both flexibility and coverage were our main parameters for defining the hydraulics of the pump.

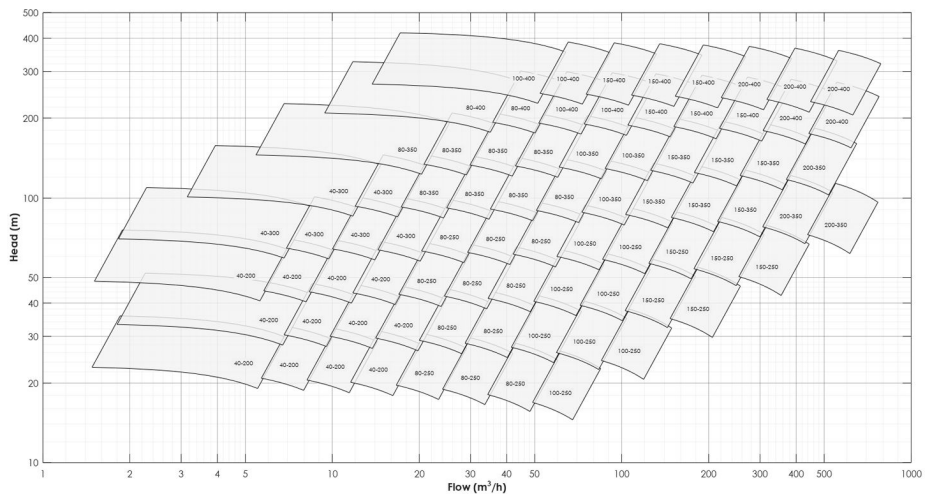


Figure 1

As NPSH is a crucial topic in selecting a pump, we have designed an unique suction box, "on which a patent is pending", enabling the customer to find a good match in the overhung pump range without using tools like an inducer (not allowed by API). Alternative for conditions with low NPSHa would be change of pump type to between bearing type. Besides cost this would also effect footprint.

The OH5-ETL pump type complies with the most stringent emission requirements considering shaft seals. For instance, the seal chamber is fully compliant with the API 682 and suitable for all mechanical seal styles, including advanced gas barrier seal technology.

Maintenance

For easy maintenance we designed the pump to have 240 degrees opening accessibility (figure 2) to the seal. The mechanical seal is positioned to allow seal connections not being affected by the studs and nuts on the pump cover. In conjunction with the redesign of the pump housing, this has no adverse consequences to the shaft span. The shaft span is even one of the shortest in the market and also complies with the shaft flexibility index as described within the API 610.

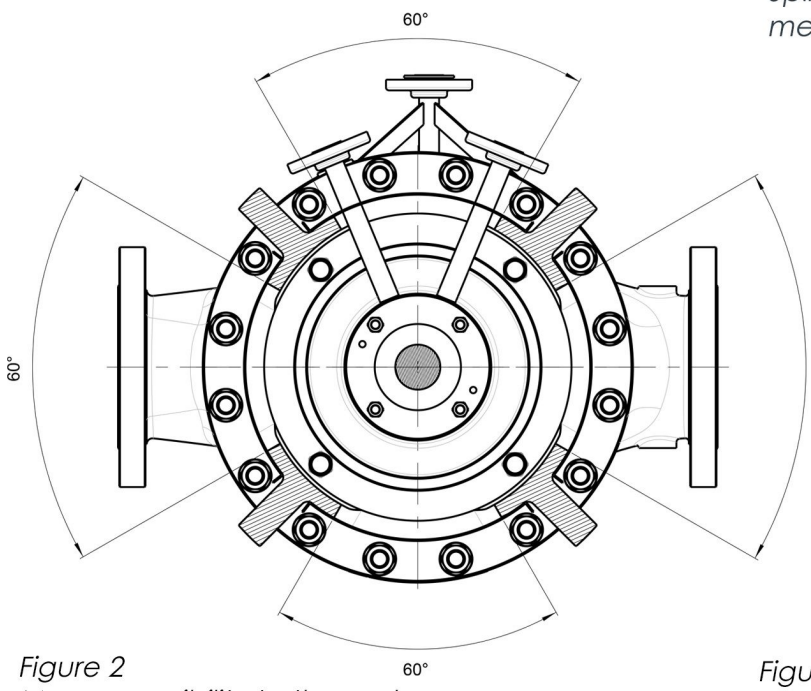


Figure 2
Max accessibility to the seal

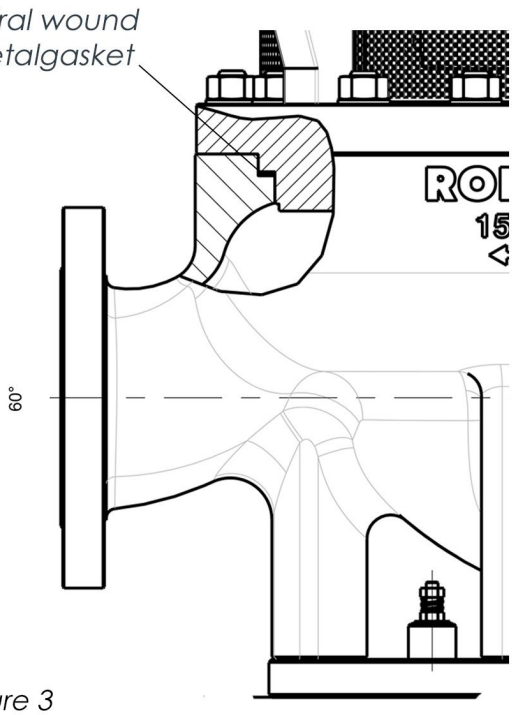


Figure 3
metal to metal fit for controled compression of the gasket.

Pump casing and cover have a metal-on-metal fit (figure 3) to ensure complete enclosed and controllable compression of the gasket. This guarantees good alignment and sealing. There is sufficient space everywhere for the use of mechanical torque wrenches in order to enable easily set pre-tension in a controllable manner. The power cable can be connected to the motor at the closed sides of the motor support. This motor can be positioned in steps of 45° on the motor suport with respect to the pump housing.

The ETL has milled and interchangeable diffuser channels, which are generated specifically for each customer duty. This offers a high degree of flexibility when dealing with changing production parameters. An infinite number of hydraulic solutions can be generated with 13 pump housings and 13 specific speeds on impellers in this family.

The connection dimensions of the pressure- and suction flange are made according to the British Standard BS4082. (figure 4) Complying to the British Standard ensures this OH5 pump type can easily be exchanged in situations where pipe work meets this standard with regard to centreline and distance between flanges. The footprint of the pump is in accordance with the DEP requirements set by Shell in which the anchors and ground dimensions for fixing the pump are normalized.

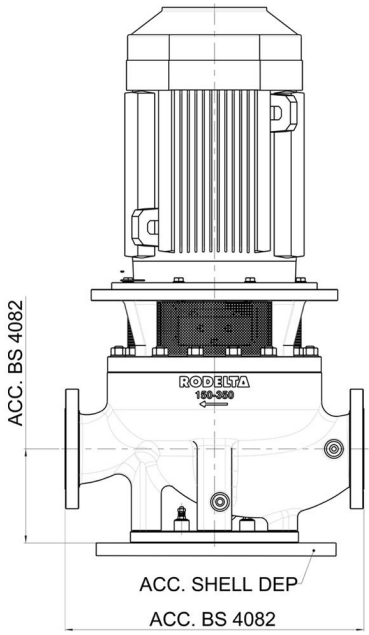


Figure 4
BS 4082
Shell DEP

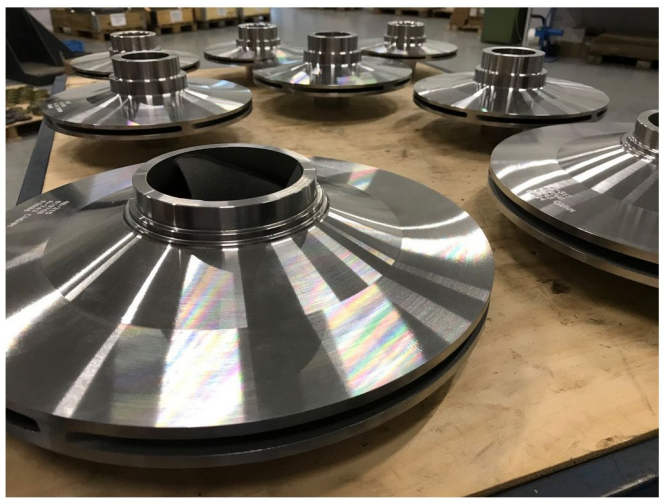


Figure 5 ETL Impeller

The impeller is casted with ceramic mouldings to make sure the high quality and efficiency demands are met with the most sophisticated casting and production techniques (figure 5). All impellers are dynamically balanced according to the latest requirements set by the API. This ensures flawless performance for the given operation range with vibration levels of nearly zero.

Reviewing the ETL (OH5) pump to a similar size OH2 pump, the ETL offers many advantages. Besides the fact that a large number of parts are made redundant due to the construction, the OH5-ETL has a much smaller footprint. (Figure 6) This makes it ideal for installations where floor space is limited. In addition, the simple drop-in assembly makes maintenance much easier in tight, confined spaces.

For more advantages OH5 over OH2. See Rodelta website ETL

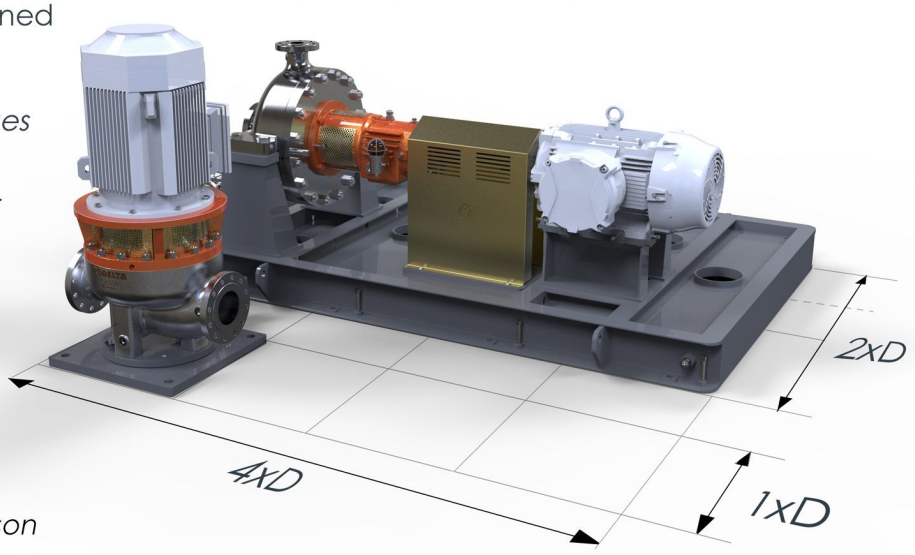


Figure 6
Footprint comparison

Why using diffuser technology in ETL pumps?

The working principle of centrifugal pumps is based on adding energy to the working medium using a rotating impeller. This process, in addition to increasing the static pressure, also increases the velocity of the fluid. The added energy in the form of velocity (or dynamic pressure) can be partially converted into static pressure by properly slowing down the fluid. This is often done by using a volute which is a spiral-formed casing around the impeller, collecting and guiding the fluid towards the discharge pipe while gradually decreasing its velocity.

A volute pump casing combines two functions: providing the hydraulic flow path and the pressure casing for the fluid. In diffuser pumps, these functions are split into two separate parts. A casing (or collector) is used for creating the pressure boundary, while the velocity-pressure conversion is done by employing a diffuser, which is a ring with multiple diverging channels, placed around the impeller. This provides more guidance for the decelerating flow which can be beneficial from several points of view. Especially for pumps made for operation at relatively low flow rates, diffuser pumps outperform volute pumps efficiency wise. In addition to the higher maximum efficiency, the efficiency does not collapse as fast when operating in part load conditions (See *figure 7*)

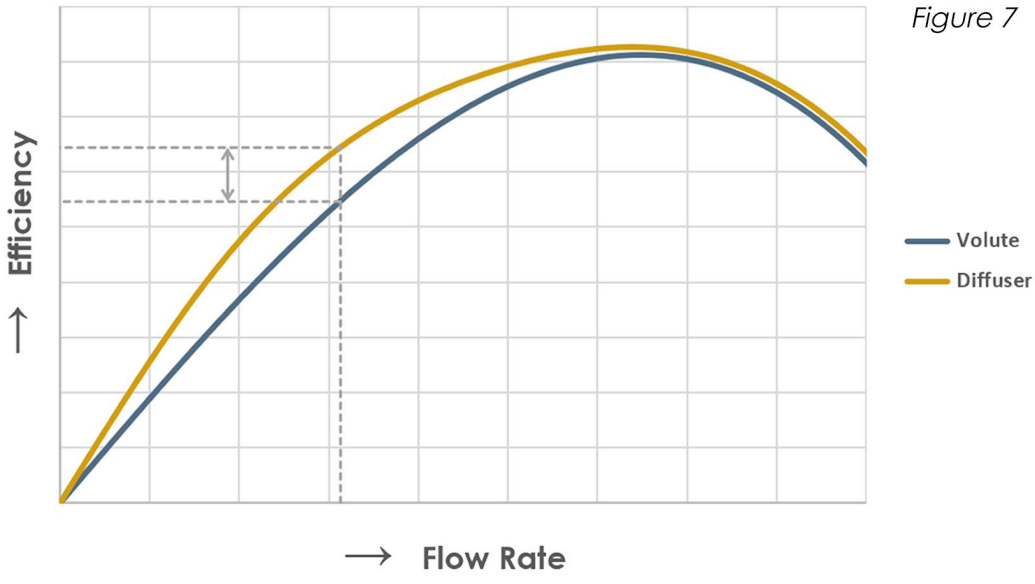
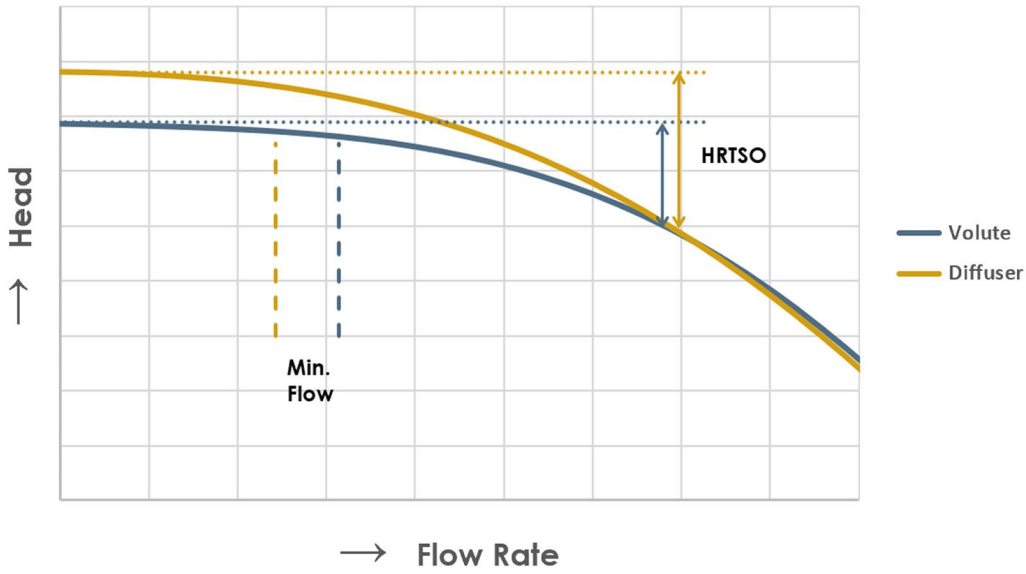


Figure 7

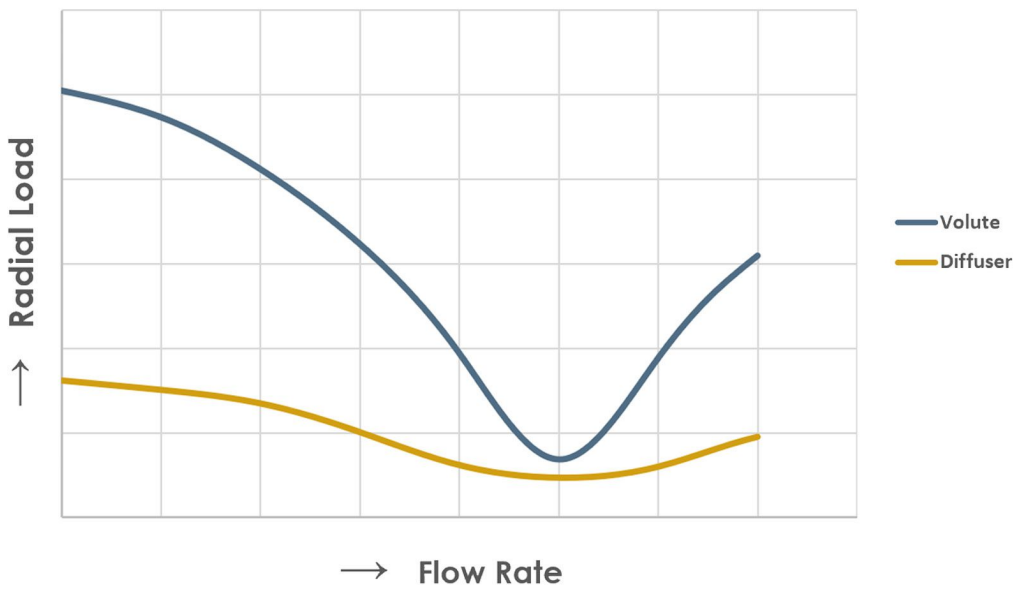
Furthermore, diffuser pumps mostly have higher head rise to shut-off (HRTSO) and greater steepness and stability of the head curve, which is especially required for pumps operating in the API market and for parallel operation (see *figure 8*).

Figure 8



Diffuser pumps are not just advantageous from an efficiency standpoint. The multi-channel diffuser geometries show more axial symmetry than the asymmetric volute shapes. As this axial symmetry is also present in the pressure distribution of the flow field, most of the radial loads are cancelled out (see *figure 9*)

Figure 9



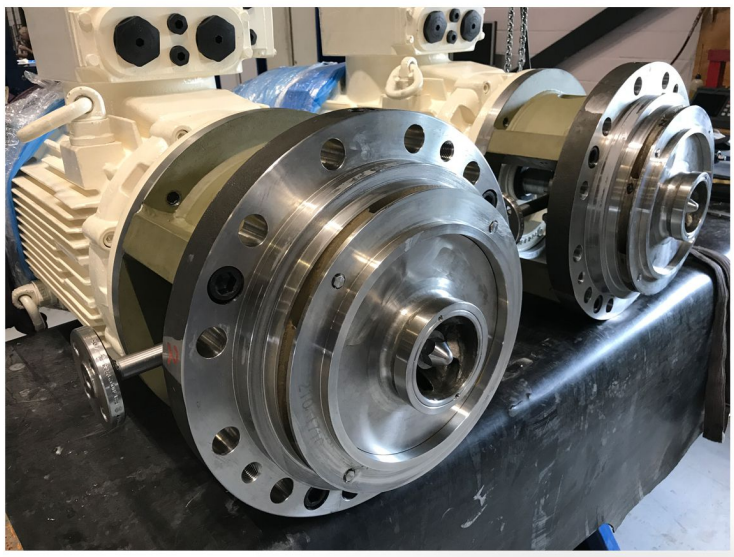
Also, due to a series of diffuser vanes as opposed to a single volute tongue, pulsations from the passing impeller blades and other unsteady flow phenomena are greatly reduced. Lower unsteady behavior means lower vibration and noise levels, which is especially noticeable at off-design operating conditions. The reduced loading and vibrations in turn lead to longer mean time between maintenance, mean time between failure and lower minimum continuous safe flow rates. Although diffuser pumps are generally more expensive than their volute counterparts, the higher investment can be easily returned by the longer life-cycle of the pump, lower spare part cost and the significant reduction in down-time of the entire process.

Another advantage arises from the fact that the diffuser is a separate part from the pump (pressure) casing. A lot of design flexibility is introduced because a single casing can fit a

wide range of diffuser geometries. As the diffuser channels are machined, they do not suffer from the limitations of a casting process, which is the case for volute casings. This also provides the opportunity to make custom diffusers for every order, which can be done very rapidly. Doing this for a volute would be an almost impossible task, as designing a volute is more complex and casting patterns would have to be made and stored for every single volute. This means that volute pumps will mostly be a compromise: due to the limited number of volute pumps in a range, the customer duty point will deviate from the best efficiency point of the pump. This problem can be circumvented using diffusers. By trimming the impeller diameter and creating a custom diffuser geometry, the required pump performance can be achieved where the best efficiency point is located exactly where the customer needs it. This even provides possibilities for retrofitting existing diffuser pumps with a new impeller and/or diffuser, in order to completely change the duty point of the pump, increasing the life cycle of the pump even further.

Machined diffuser

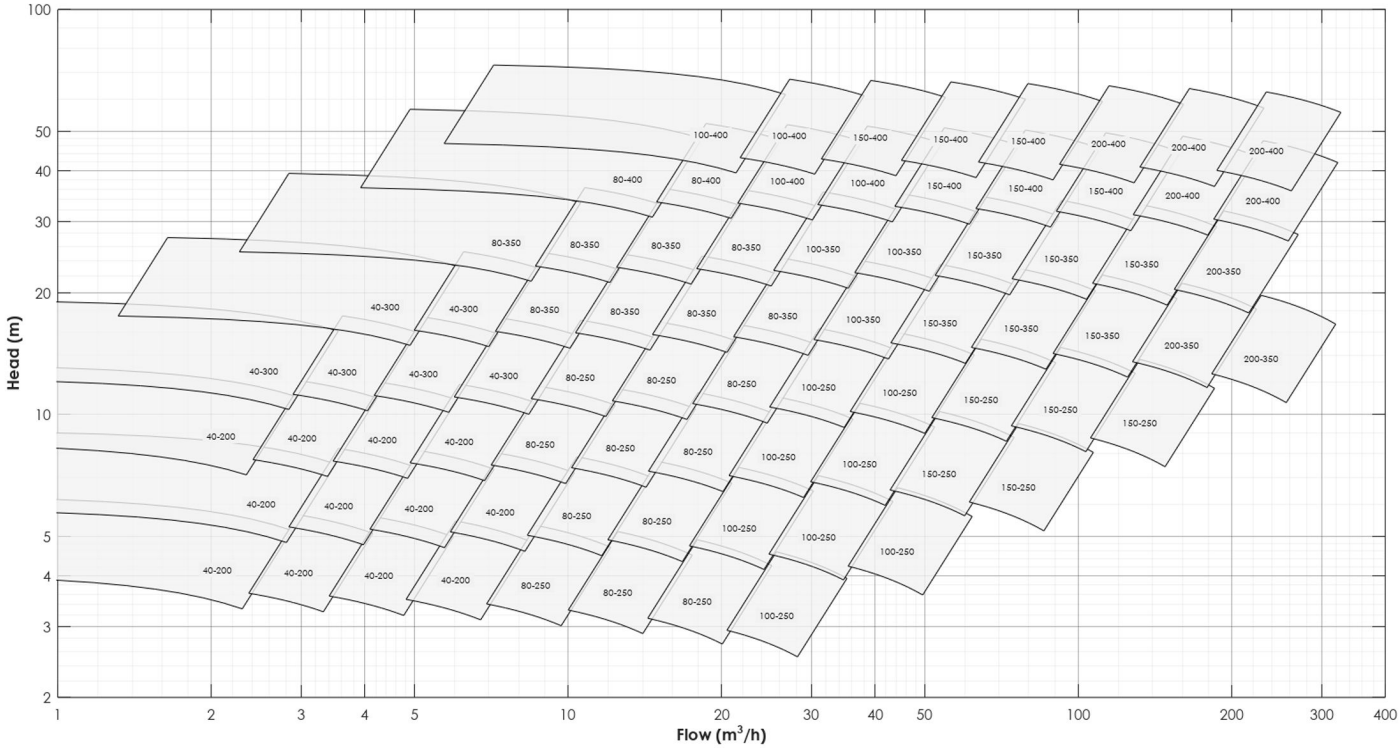
Pull out unit OH5



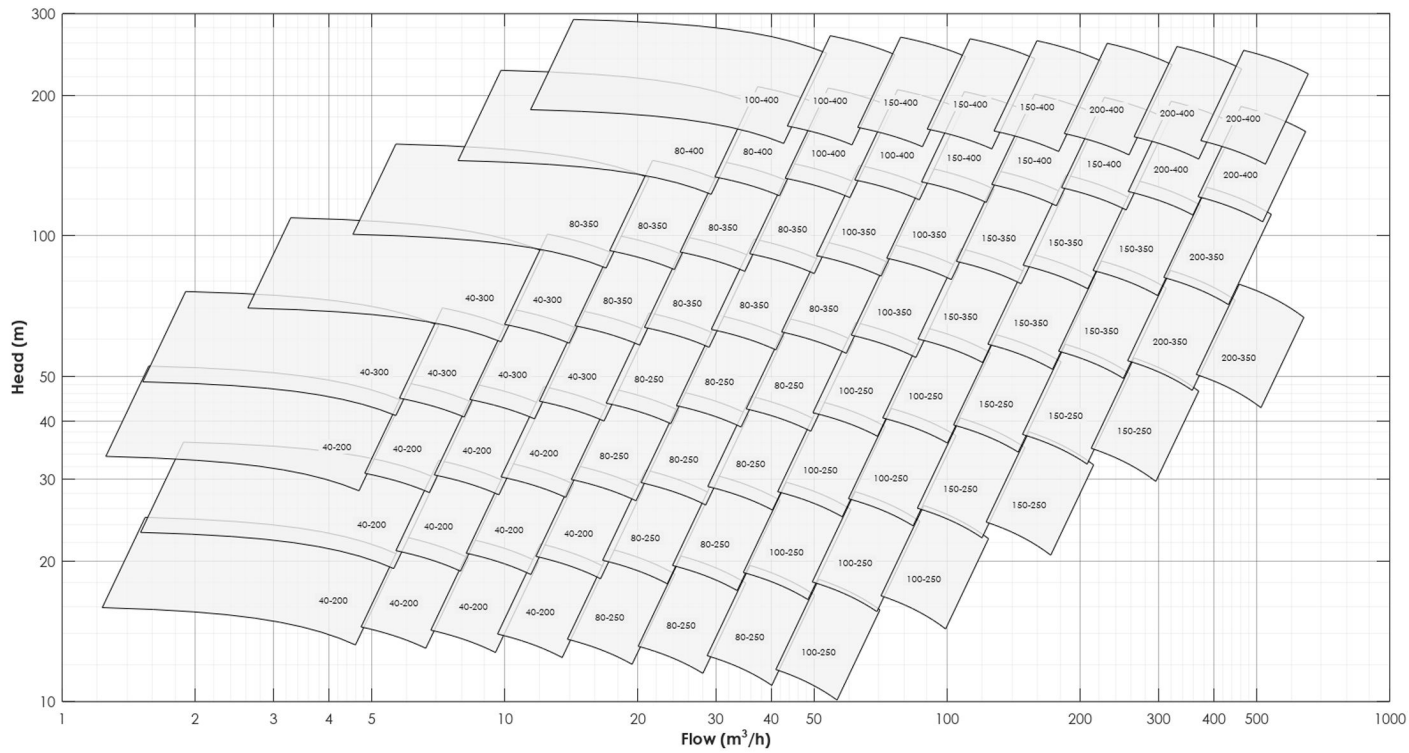
the simple drop-in assembly ensures easy installation. especially in places where space is limited.

ETL performance curves 50Hz

ETL 50Hz 1500 rpm

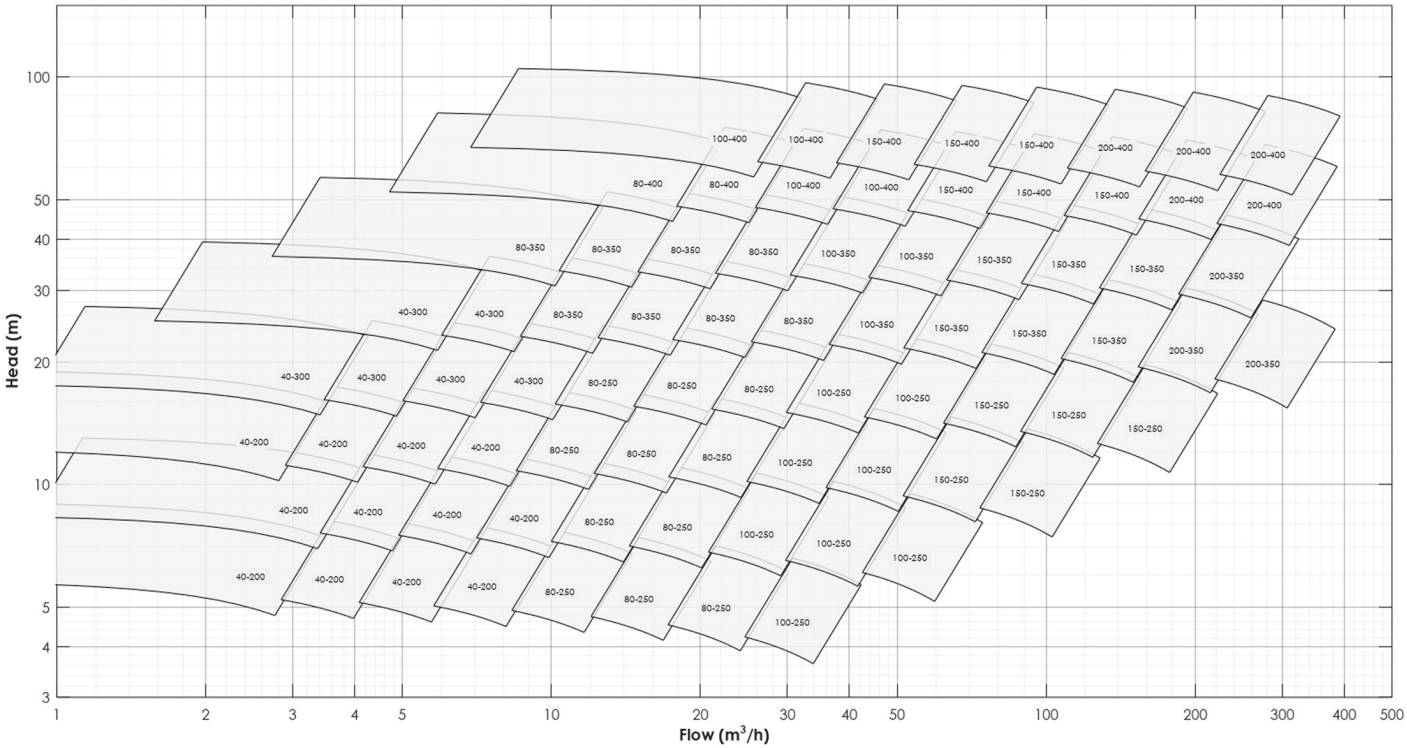


ETL 50Hz 3000 rpm

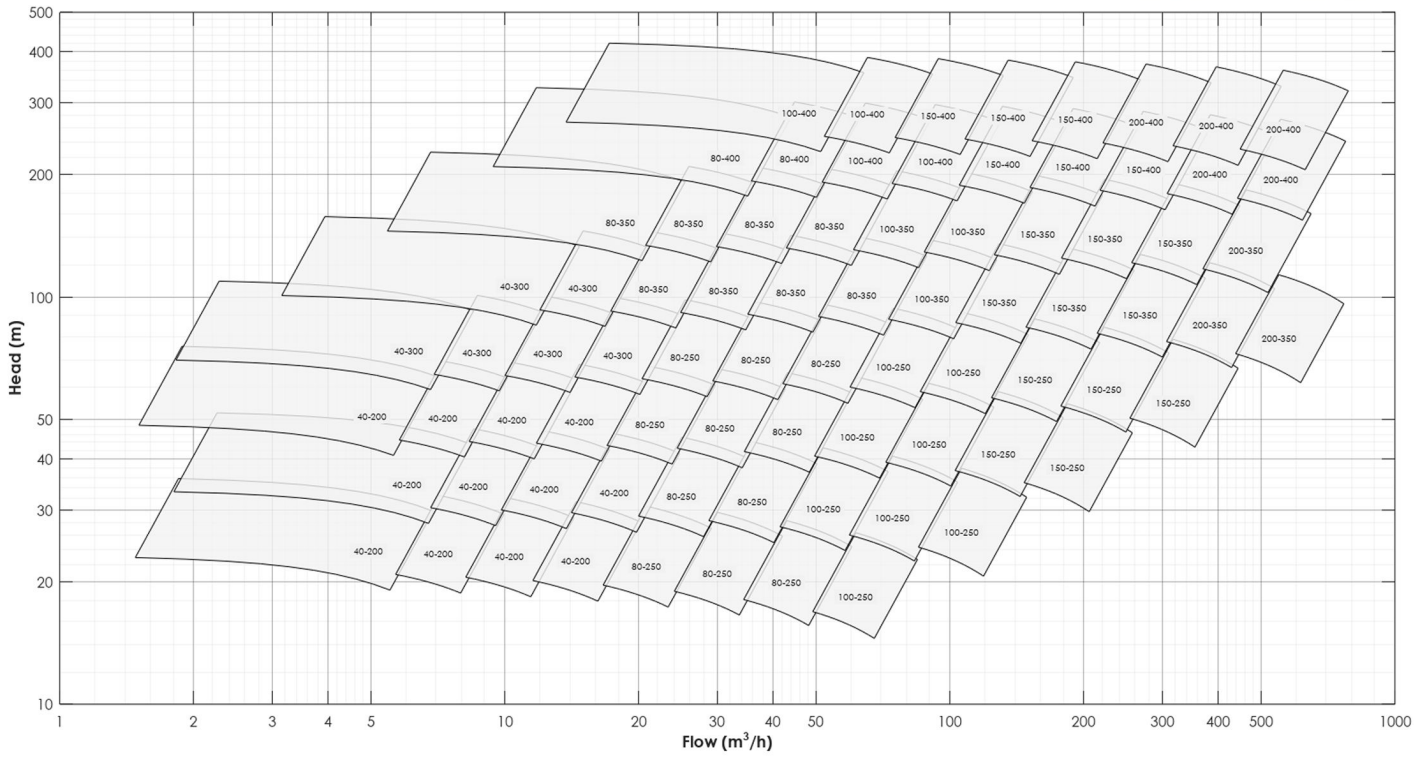


ETL performance curves 60Hz

ETL 60Hz 1800 rpm



ETL 60Hz 3600 rpm



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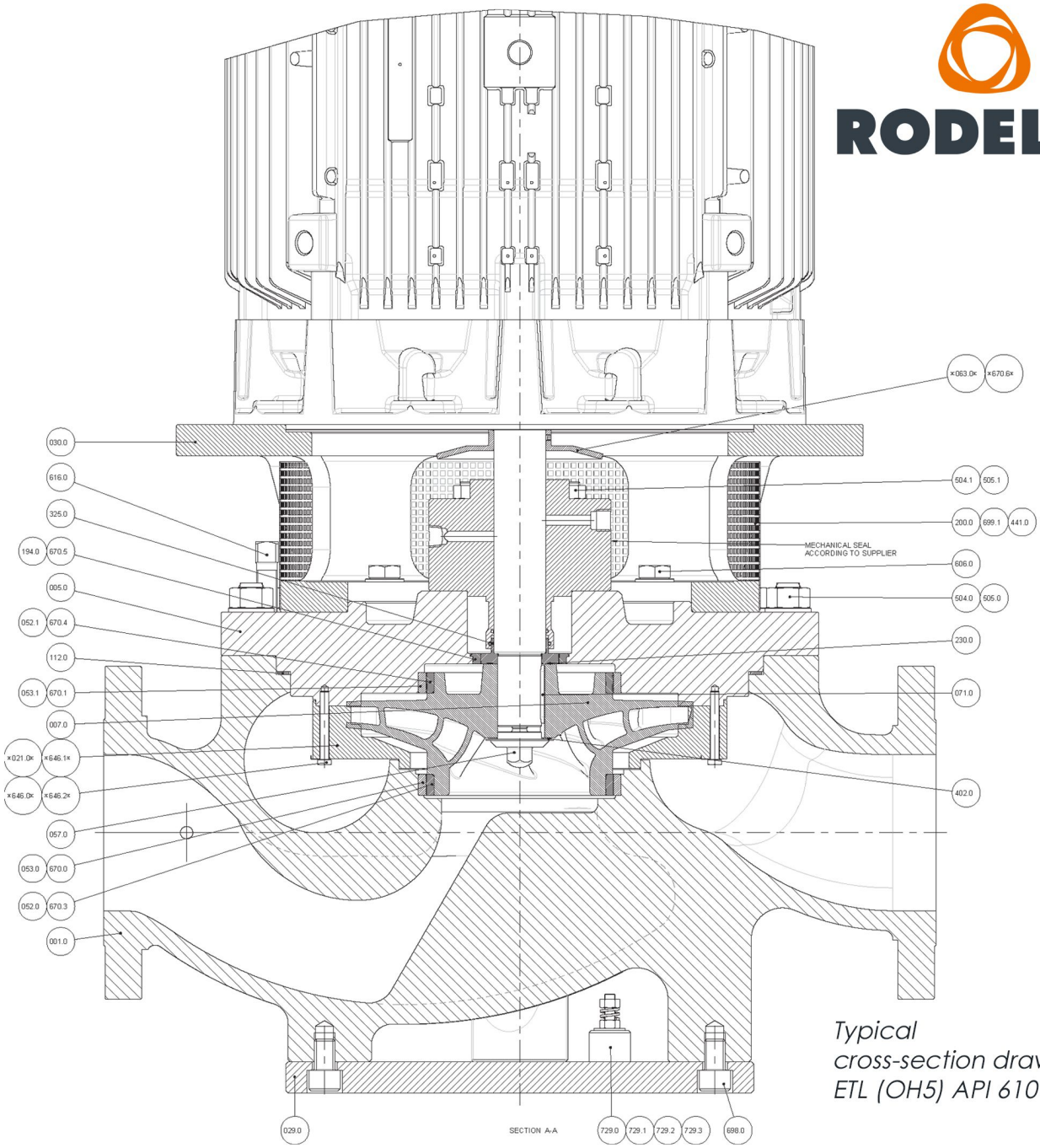

Typical cross-section drawing ETL (OH5) API 610

Pos nr	Description		Material	Standard	Qty	Unit
001.0	Casing	Machining	A216 Gr. WCB (C 0.25% max., CE<0.43%) NACE - Normalized		1	Pcs.
		Casting				
		Drilling				
005.0	Stuffingbox cover		A516 Gr. 70 (C 0.23% max. and CE < 0.43%) NACE - Normalized		1	Pcs.
007.0	Impeller	Machining	A487 CA6NM Cl. B		1	Pcs.
		Casting				
021.0	Diffuser		A240 Gr. 410		1	Pcs.
029.0	Foundation plate		S275 JR		1	Pcs.
030.0	motorstool	Machining	A216 Gr. WCB		1	Pcs.
		Casting				
052.0	Impeller wear ring front		A276 420 (325-375 HBW) - Hardened		1	Pcs.
052.1	Impeller wear ring back		A276 420 (325-375 HBW) - Hardened		1	Pcs.
053.0	Casing wear ring		A276 420 Annealed (NACE)		1	Pcs.
053.1	Cover wear ring		A276 420 Annealed (NACE)		1	Pcs.
057.0	Impeller screw		A276 316L (NACE)		1	Pcs.
063.0	Deflector ring		EN AW 5754		1	Pcs.
071.0	Impeller key		C45	DIN 6885	1	Pcs.
112.0	Spiral woumd gasket type R		AISI 316L + graphite		1	Pcs.
194.0	Throat bush		A276 Gr. 420		1	Pcs.
200.0	Guard motorstool		Aluminium		4	Pcs.
230.0	Gasket throat bush		EGRAFLEX GTC		1	Pcs.
325.0	Stub sleeve		A276 Gr. 316L (NACE)		1	Pcs.
402.0	Gasket impeller screw		EGRAFLEX GHE		1	Pcs.
441.0	Hexagon socket head cap screw guard		A4-70	DIN912	16	Pcs.
504.0	Casing stud		A193 B7M	DIN939	16	Pcs.
504.1	Mechanical seal stud		A193 B8M	DIN976-1B	4	Pcs.
505.0	Hexagon nut casing cover		A194 2HM	DIN934	16	Pcs.
505.1	Hexagon nut mech seal		A194 8M	DIN934	4	Pcs.
606.0	Hexagon head bolt motorstool-cover		8.8 - Electrolytic Zinc Plated	DIN933	4	Pcs.
614.0	Hexagon head bolt motor-motorstool		8.8 - Electrolytic Zinc Plated	DIN933	4	Pcs.
616.0	Jack screw casing-pumpcover		8.8 - Electrolytic Zinc Plated	DIN479	2	Pcs.
646.0	Hexagon head bolt diffuser		A193 B8M	DIN933	4	Pcs.
646.2	Diffuser lock washer		SS316		4	Pcs.
670.0	Set screw wear ring casing		A 193 B8M	DIN916	3	Pcs.
670.1	Set screw wear ring cover		A 193 B8M	DIN916	3	Pcs.
670.3	Set screw wear ring impeller front		A 193 B8M	DIN916	3	Pcs.
670.4	Set screw wear ring impeller back		A 193 B8M	DIN916	3	Pcs.
670.5	Set screw throat bush		A 193 B8M	DIN916	3	Pcs.
670.6	Set screw deflector		A 193 B8M	DIN916	3	Pcs.
698.0	Socket screw casing-soleplate		A 193 B8M	DIN912	4	Pcs.
699.1	anti loss washer		poly ethyleen		16	Pcs.
729.0	Earthing boss stud		A193 B8M	DIN 976-1B	2	Pcs.
729.1	Plain wahser		A4-70	DIN554C	4	Pcs.
729.2	Hexagon nut		A194 8M	DIN934	4	Pcs.
729.3	Spring washer		A4-70	DIN127	4	Pcs.

Project 44 pieces of ETL (OH5) API 610 pumps

RODELTA®

Design standard	BS 4082-1, ISO 13709	
Features	Vertical In-line Overhung OH5, Closed coupled (API 610)	
Capacity @ BEP	Upto 600 m^3/hr 50Hz 3000 rpm	720m/hr 60Hz 3600 rpm
Head	Upto 290m (50Hz 3000 rpm)	420 m (60Hz 3600 rpm)
Temperature range	-40 to 250 °C	
Discharge pressure	Default. 300#	
Nozzle Orientation (suc/dis)	In line position	
Standard Motor Sync. Speed	1000/1500/3000 rpm	1200/1800/3600 rpm
Options	API material options available, NACE & Atex approvals available on request	
Suction Pressure	Upto 20 Bar	
Max. Operating Speed	3600 rpm	
Flange ratings(#RF)	Cl. 150/300/600	