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CVP

Concrete Volute Pump

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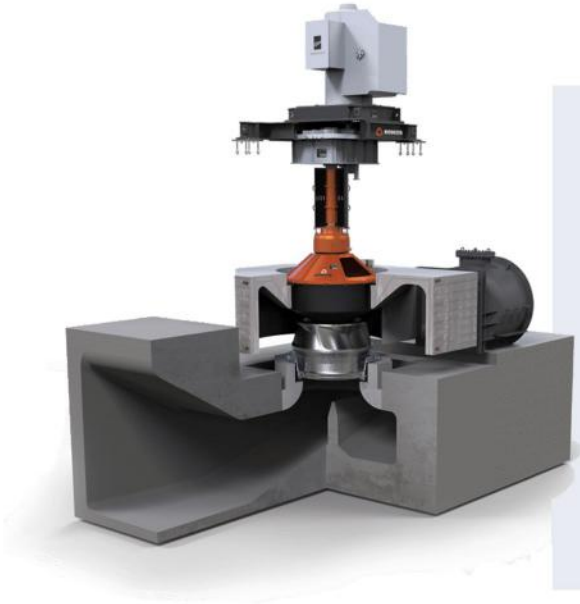
distinctive vision



Rodelta CVP

The pump type CVP is a vertical dry pit pump, single stage with volute pump casing of pre-fabricated concrete material. The CVP have pull-out design rotor. The material of the metal pull-out unit depends on the pump liquid and is available in various materials. The CVP pump is used in cooling water, flood control, drainage- and irrigation applications.

Features:

- Corrosion resistance concrete volute pump casing and few metal parts in contact with pump liquid reducing material cost in corrosive/erosive applications (e.g. seawater)
- Space saving construction (pit depth, hoisting length/building height) compared with vertical turbine pumps
- Less vibration due to robust design with casing of concrete
- Low noise
- Low inspection and maintenance cost

Specifications:

- Delivery size up to 2500mm
- Capacity up to 150000m3/hr
- Head up to 50m
- Suitable for liquid Temperature: Up to 50°C
- Sealing Arrangement: Stuffing box or Liquidyne seal

Applications:

- Cooling water pumps in thermal and nuclear power stations.
- Flood control
- Drainage- or irrigation pumps
- Dry-dock

Constructional features:

Pumpcasing
The pump casing and suction are made of pre-fabricated concrete material and supplied by the pump supplier.

Impeller & shaft
The impeller is closed or open type mounted to the pump shaft.

Thrust bearing assembly
The axial thrust bearing assembly provided with radial roller and spherical thrust bearing.

Discharge metal part (optional)
The discharge metal part is optional and connecting the rectangular volute out to the round discharge piping.

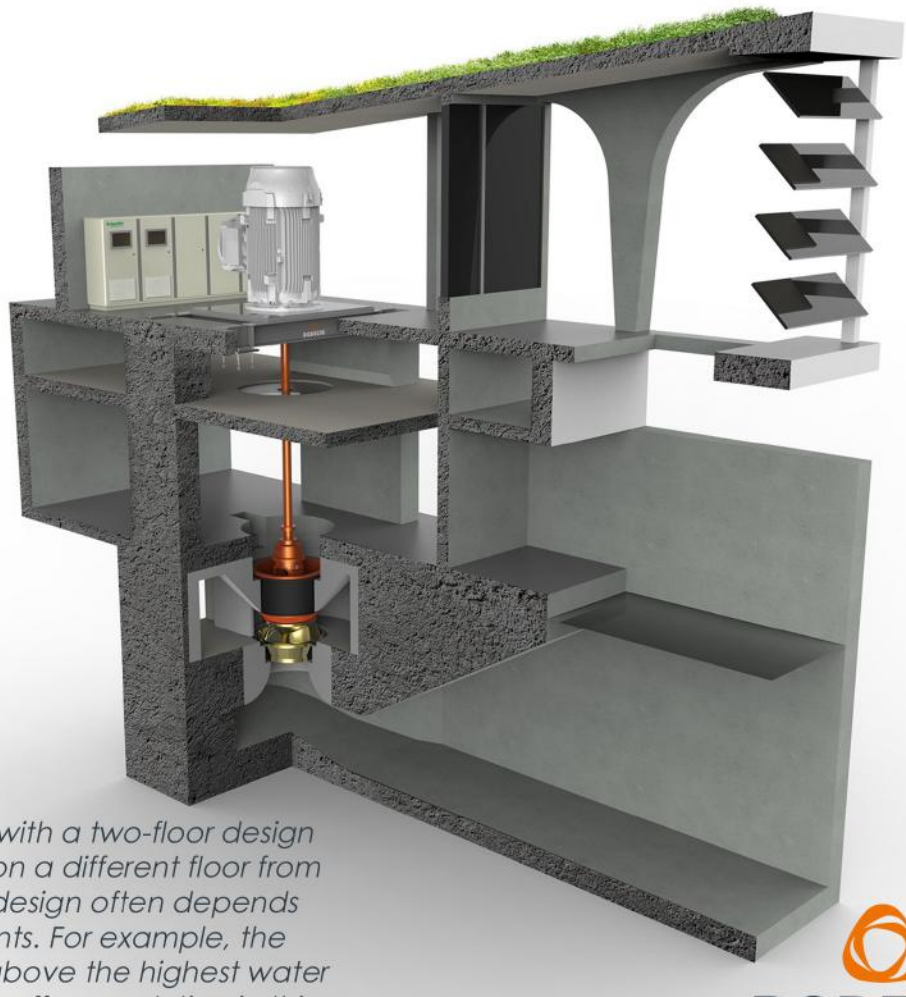
CVP selection criteria and features

Concrete volute pumps, Rodelta type CVP, are pumps that are integrated in civil constructions of pumping stations and are used for applications with a high flow rates while delivering low to medium heads. The combination of steel fabricated rotor units in volutes constructed in concrete makes it possible to pump more cubic meter of liquid with less pump installations. At the same time ensuring higher reliability and efficiency.

By minimising the number of pumps, the overall civil dimensions of the pumping station can be reduced. As a result less handling, less installation and less maintenance costs. All these aspects have a positive effect to the life cycle cost (LCC) and total cost of ownership (TCO).

Furthermore, the installed efficiency of the CVP is higher compared to commonly used conventional Vertical Turbine Pumps (VTP) which are still the default design in this type of applications. The VTP selection often confirms the bowl efficiency instead of pump efficiency and therefore neglects the losses of the pump itself. The higher pump efficiency of the CVP is the result of the hydraulic design and not having the losses of the VTP riser column and discharge bend.

Rodelta engineering capabilities can customize the sophisticated design of the CVP to meet customer preferences and the project required operating conditions. We strongly recommend to start these discussions at the earlier stage of the project. Changing specifications at a later stage may lead to significant impact considering engineering works and/or permits.



Concrete Volute Pump with a two-floor design where the drive train is on a different floor from the pump. The desired design often depends on customer requirements. For example, the motor must always be above the highest water level. A two-floor design offers a solution in this case.

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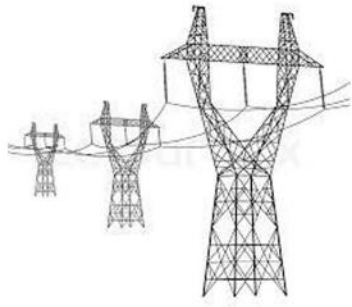
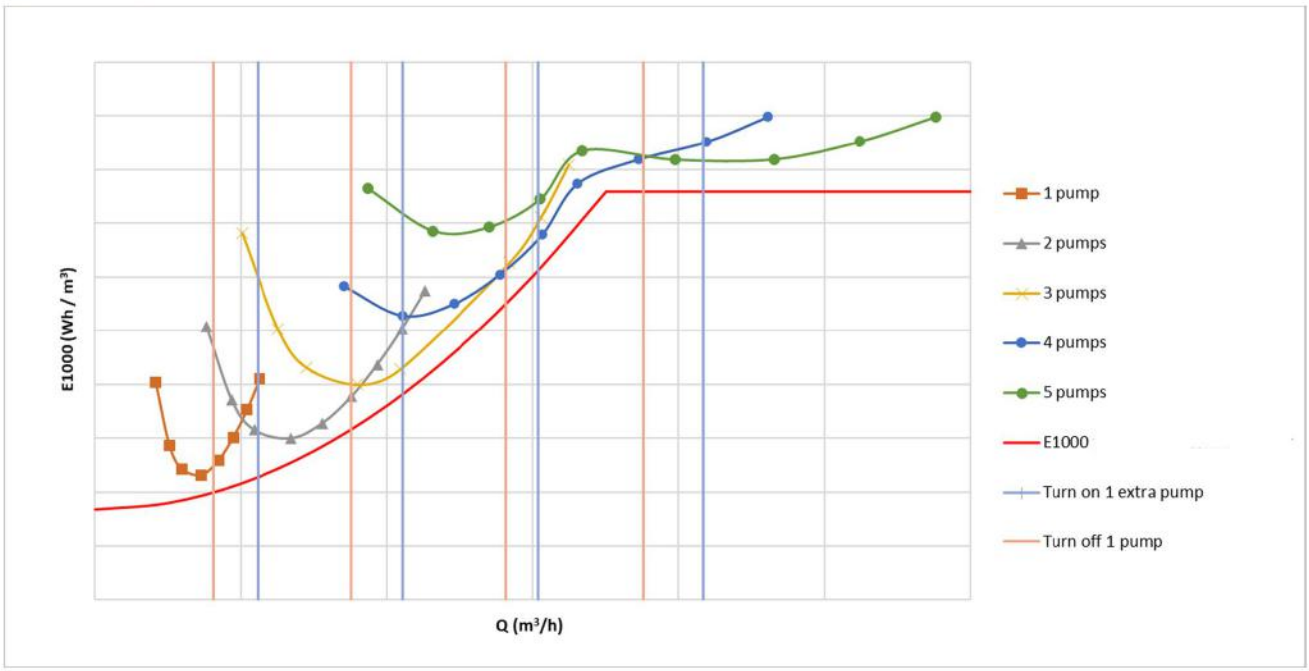
The choice of a specific speed

The choice of a specific speed of the pump influences the pump speed, it's size and it's performance parameters where lower specific speeds have lower rotational speeds, larger impeller diameters. At the same time lower specific speeds are less sensitive to cavitation and have less power required at shut-off pumping conditions. In case of higher specific speed pumps, a shut-off power higher than the rated power may have an impact on the required power rating of the electric motor possible frequency converter and the accompanying electrical network.



One of the most challenging topics for these type of projects are the flow conditions in relation to the system resistance. The flexibility to work with different flows during lower and higher demands is often calculated considering the wrong system resistance, this result is wrong duty points and this leads to wrong selection of the pumps. When we can have a discussion on the required output of a station, Rodelta can be the second pair of eyes to look at optimums on size and quantity of pumps. Furthermore we can present a script on timing to start-up and shut-off of pumps during different modes of optimal operation.



Concrete Volute Pumps are, due to their specific characteristics, used in a variety of high flow applications such as power generation industries, as well as desalination, oil & gas, irrigation and flood control applications. The characteristics of the CVP enable a wide operating range under which the pumps can operate. Besides operating range we need to distinguish the mode of operation. For instance CVP pumps can be used in the power market as cooling pumps and operate 24 hours, 7 days a week. Another perfect fit for the CVP pump is for storm water applications, mainly due to great reliability of the design. In this market we see the pumps not running for months, however when the time comes it must do its work immediately and without failure.

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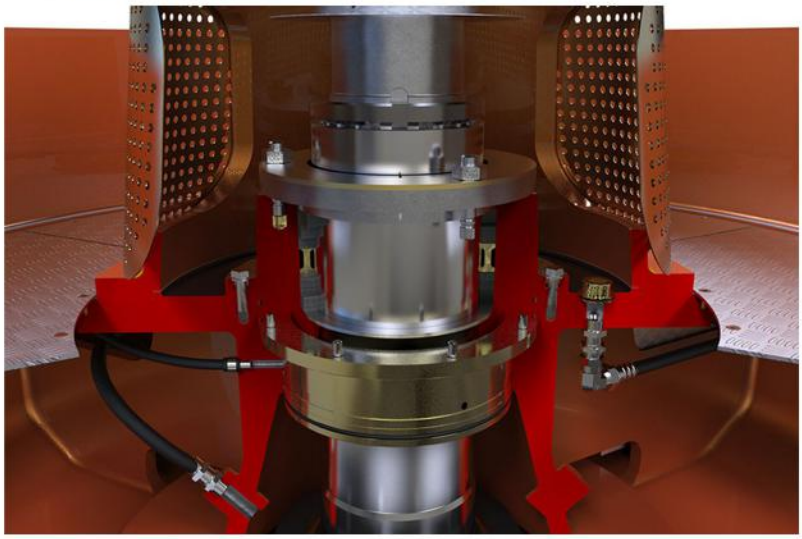
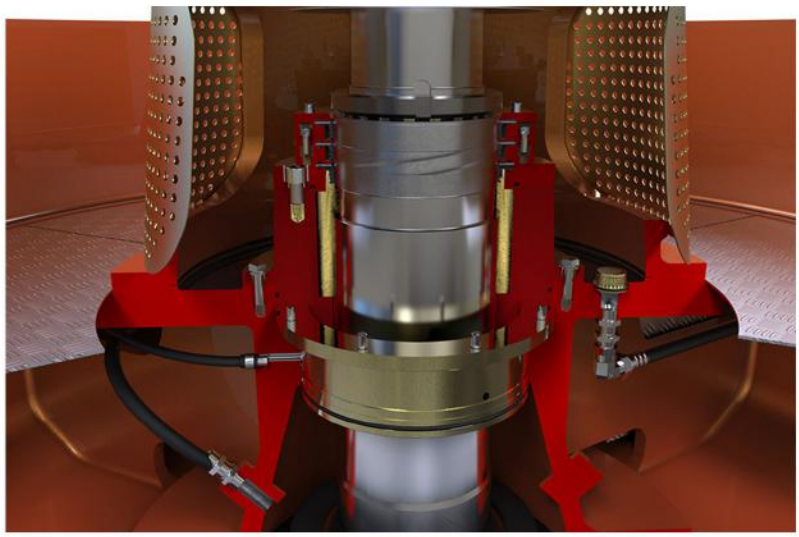
CVP designs

These different operating conditions call for different solutions. Rodelta's CVP is developed in such way that there are suitable designs for every application. For example, the pump can be supplied with a stuffing box gasket, which is very functional in storm water applications. For continuous operation, however we would recommend to use a Liquidyne seal. The Rodelta design offers the possibility to let the pump develop along with your business process or changing circumstances. A pump supplied with a stuffing box seal can easily be converted to a Liquidyne seal without having to make any structural changes to the design or station. The CVP has flexible features in the design, because we know that our products have a long design life and circumstances can change. Taking into consideration the climate changes and the market needs for water and energy.

Shaft sealing options CVP



Stuffing box execution



Liquidyne execution

The bearing design of a CVP is often determined by the discharge head. Similarly, Rodelta has several forms of design execution. A bearing design of the CVP version with slide bearing has a low position in the pump, which results in a short impeller overhang and reduces the radial forces on the shaft.

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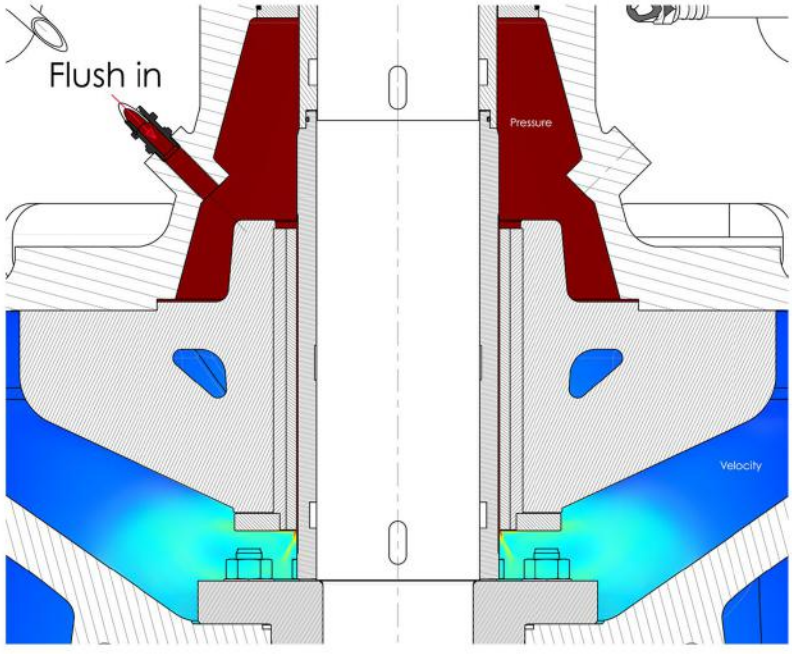
The plain bearing has an ingenious flushing construction. On top of the plain bearing, there is a closed compartment in which water rinses under overpressure. This overpressure ensures that the slide bearing is continuously flushed. As a result, sand and other contaminants in the pumped medium have no chance of settling in the slide bearing and a long service life of the bearing is guaranteed. In the CVP version with Liquidyne, the flushing water from the pressure chamber is linked to the inlet of the sealing.
This ensures that the seal is always flushed and there can be no problems with the seal running dry.



The CVP is always equipped with an inflatable seal that can seal off the flow of fluid along the shaft to the stuffing box. This seal can be inflated when a set of packing from the stuffing box need to be replaced. This allows replacement under circumstances where the water level is higher than the stuffing box level.

At a CVP execution with stuffing box gasket, the leaking water will be collected in the space inside the bearing pedestal. From this point the water is led to a central collecting tank. In the collection tank there is a level sensor that starts a bilge pump when the tank is full. The water will be pumped back to the suction of the pump inlet from the station.

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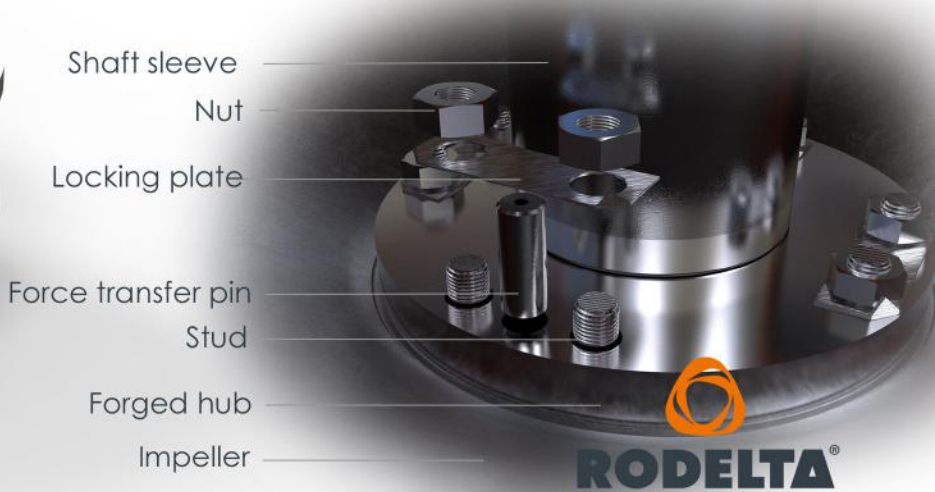
All Rodelta CVP's have a central connection panel. This is a central panel where all water and air connections are gathered. All air and water connections are kept separate from the electrical connections. The connection panel is located to the right of the inspection hatch. The central cable box for the optional monitoring systems is on the left of the inspection hatch. This makes it easy to disconnect the pump when dismantling is required in case of maintenance.

The pump shaft construction of the CVP is a so-called dry shaft construction. This means that all shaft parts that come into contact with the pumped medium are made of high-quality corrosion-resistant materials. This includes the forged hub to which the impeller is attached by means of pins. The pins ensure the transfer of all forces to the shaft. The hub is attached via a crimp connection to the 42CrMo4 drive shaft. This construction in combination with the choice of materials ensures optimum strength and a low-maintenance design.



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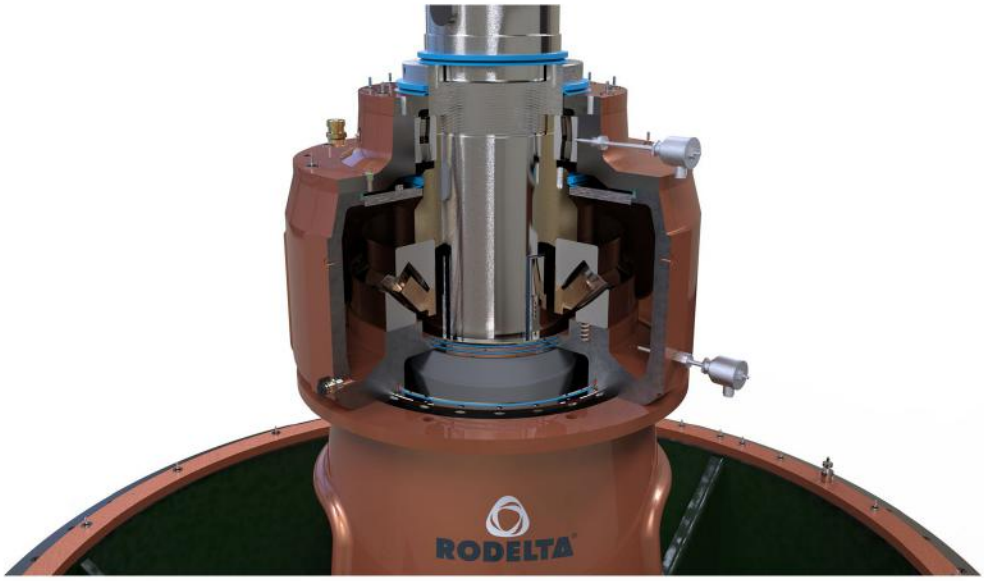
The top bearing of the CVP consists of an oil-lubricated spherical bearing with a grease-lubricated double spherical bearing above. The construction is designed to enable the shaft adjustments by means of a mechanism at the bearing. This allows accurate adjustment of the impeller with the sealing ring (= clearances), which contributes to the high efficiency of the Rodelta CVP.
In an environment where processes are not always predictable, situations may occur in which the forces on the rotor unit are reversed, the so-called 'upthrust'. For this reason the Rodelta design has a bearing that is also a sprung. This ensures that the rollers remain in contact with the bearing at all times and no damage can occur due to a hit in the bearing.



In situations where cooling of the bearing is necessary, because of the high power outputs, the CVP bearing has a cooling chamber. This is different compared to the design of other CVP manufacturers who are using cooling coils.
In the event of leakage from these cooling coils there is an immediate need for repair in order to prevent further damage, because water in the lubricant leads to serious damage to the bearings The CVP construction is designed in such a way that in case of leakage of oil or water, this will be visible before water and oil come into contact with each other. This allows the pumping process to continue as usual but a planned repair can be carried out at a later date. It is obvious that there is leakage but there is no mixing of water with oil yet. Highly desirable if your pump is a crucial link in your business process and cannot easily be switched off.

Closed impeller design *Open impeller design*

The Rodelta CVP can be supplied in different specific speeds with an open or closed impeller design. The impeller rotates in an impeller wear ring and can be neatly adjusted using the previously mentioned upper bearing adjustment construction. This contributes to the high CVP efficiencies Rodelta is known for.

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Benefits of CVP and pre-fab

For years, concrete volute pumps (CVP) have been a proven configuration in the Netherlands. The first concrete volute pump was built in 1935 and is still in good condition. The big advantage of concrete volute pumps is that there are almost no maintenance costs on the volute part. In addition, the concrete construction ensures a very solid foundation of the pumps and contributes to low vibration and noise levels. The construction of concrete volute pumps can be carried out in two ways: pouring the pump volute on-site, or using prefab volute components that can be placed within one day.

Concrete volute construction 1932
Pumping station Gewende..
Photo: the Memory / Stork photo collection

The chosen method is often dependent on the customer's preference. In countries where labor costs and construction time are not a major factor, one can choose the first option. However, pouring the concrete requires proper guidance, in order to guarantee the shape of the volute and the quality of the concrete cast. Another disadvantage to this first concept is that a contractor who builds the building often has no knowledge of pumps and therefore does not want to be held responsible for the volute shape and position. Also, a situation with multiple parties on the work floor in a construction process is not desirable, as this often contributes to waiting hours for the other parties in the consortium.

The mentioned disadvantages have led to the development of a method that overcomes these problems. The result is a construction method, using prefab volute components. By using prefabricated components, the pump supplier can guarantee the correct volute shape and surface quality, as well as the quality of the concrete. Installing the volute elements takes about one or two days on average. This also prevents the issue of multiple parties on the job site, because the placement time is virtually negligible.

CVP Prefabricated concrete ellement
A volute element of a prefabricated concrete volute pump (CVP), A complete volute consists of 2 or 4 prefabricated concrete parts. The suction bell from the intale is also produced from 1 or sometimes 2 prefabricate concrete elements.

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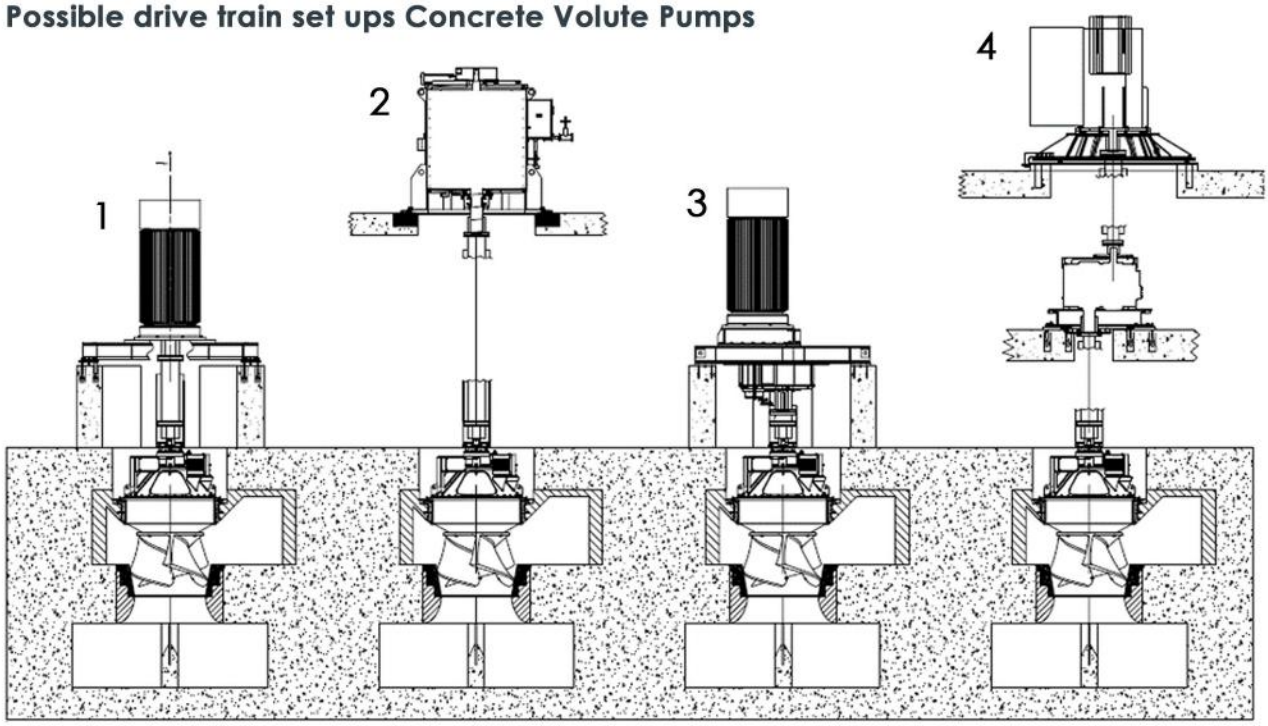
Possible drive train set ups Concrete Volute Pumps



1

Direct drive option where the motor is mounted on a frame sitting on concrete supports located on the pump station base floor.

• Pros:

I No gearbox less capital expense, less parts, less maintenance, no lube oil set required.
II Only 1 spacer coupling required.
III Short spacer coupling
IV All main components in 1 space / room
V When applicable minimal height and cable length of overhead crane required

• Cons:

I Motor usually more expensive due to lager motor (more poles)
II Platform needed to easy access the motor

2

Direct drive option where the motor is mounted on a foundation ring sitting on a separate floor of the pump station.

• Pros:

I No gearbox less capital expense, less parts, less maintenance, no lube oil set required.
II Only 1 spacer coupling required.
III When applicable minimal height of overhead crane required
IV Motor easy accessible due to separate floor.
V Possibility to have a separate overhead crane to maintenance pump pull out unit.
VI Best accessibility pump pull out unit.
VII Possibility to mount motor at level above water level (in case of possible flooding)

• Cons:

I Motor usually more expensive due to lager motor (more poles)
II Need 2 floors in pump building
III Long spacer coupling required

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Possible drive train set ups Concrete Volute Pumps

3

Motor + gear reducer mounted on a frame sitting on concrete supports located on the pump station base floor.

• Pros:

I Cheaper motor
II Short spacer coupling(s)
III All main components in 1 space / room
V When applicable minimal height and cable length of overhead crane required

• Cons:

i Separate gear and possible lube oil set (not displayed) required in some cases more capital expense and in most cases more operating expense.
II 2 separate couplings required.
III Platform needed to easy access the motor and gear.
IV Gearbox not easy accessible.

4

Motor + gear reducer mounted on a frame and foundation ring sitting on a separate floors of the pump station.

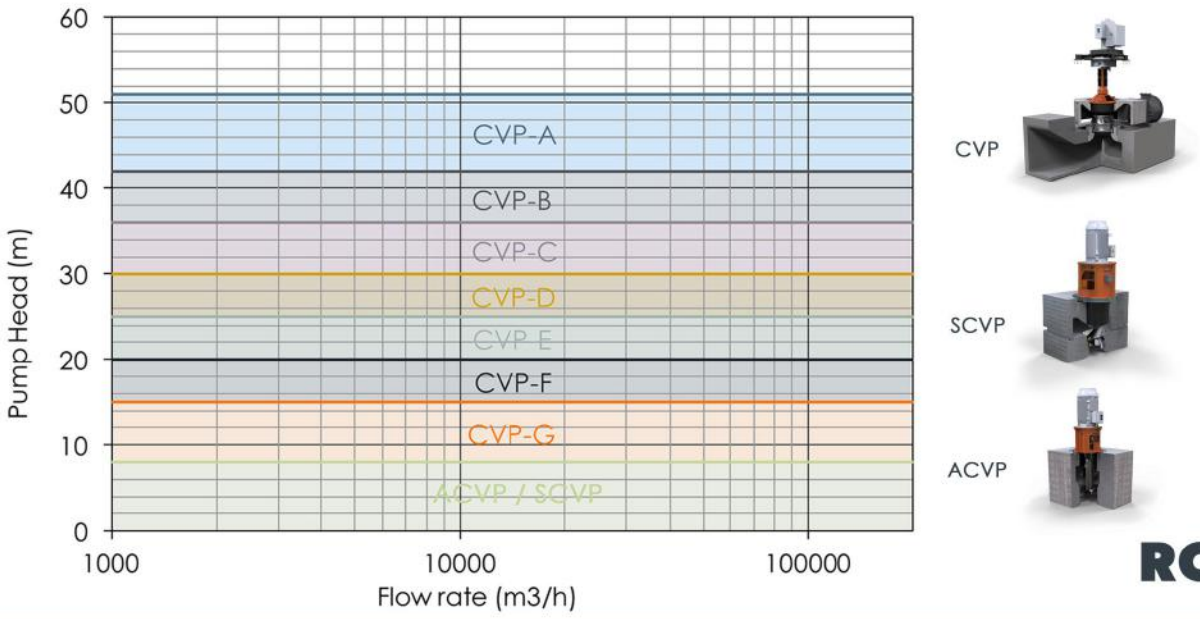
• Pros:

I Cheaper motor.
II Motor easy accessible due to separate floor.
III Possibility to have a separate overhead crane to maintenance pump pull out unit / gearbox.
IV Best accessibility pump pull out unit, gearbox , motors.
V Possibility to mount motor / gearbox at level above water level (in case of possible flooding)

• Cons:

I Separate gear and possible lube oil set (not displayed) required in some cases more capital expense and in most cases more operating expense.
II Need 3 floors in pump building
III Long spacer couplings required

CVP pump version within the Concrete Volute pump range



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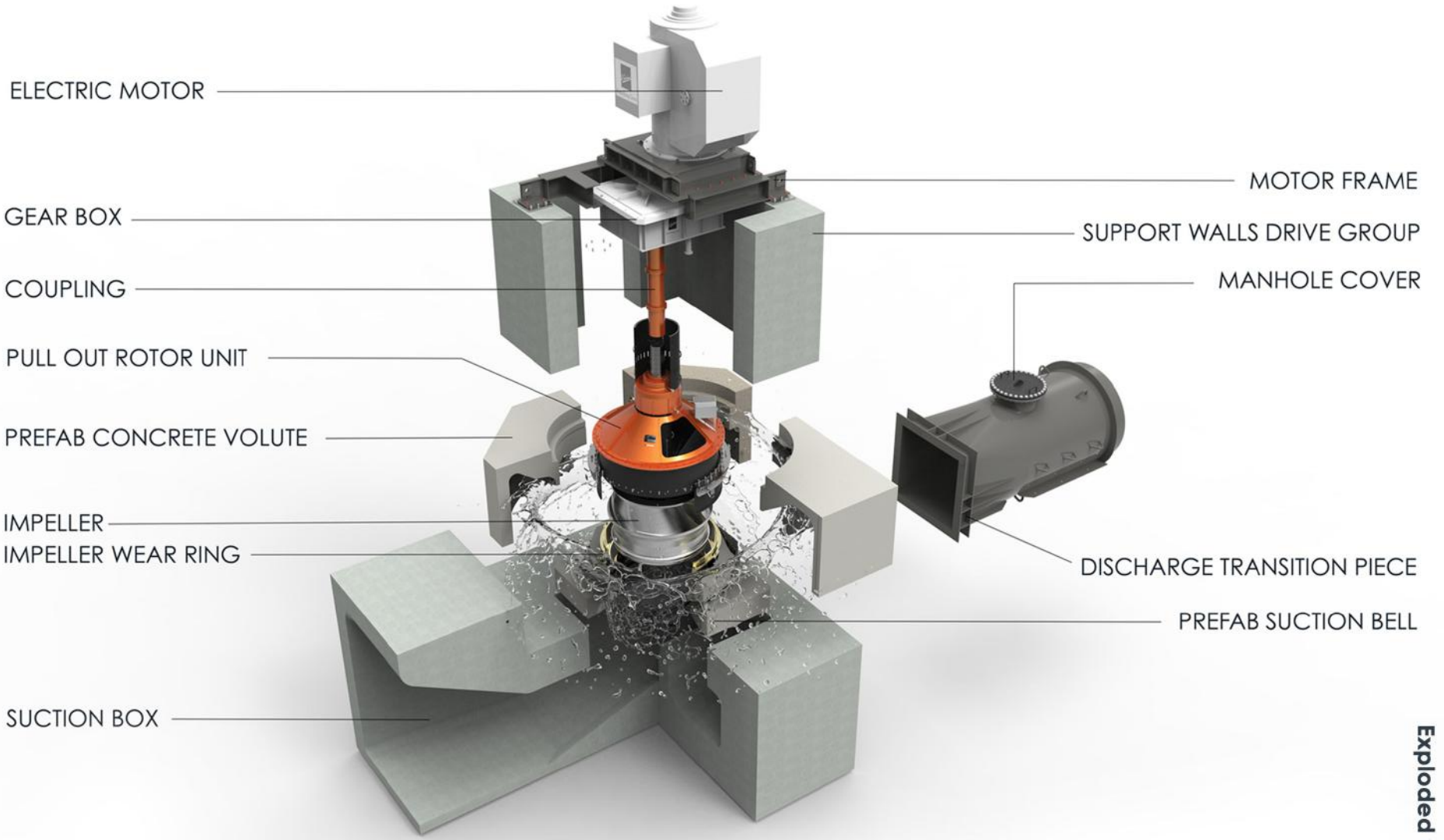

Exploded view CVP

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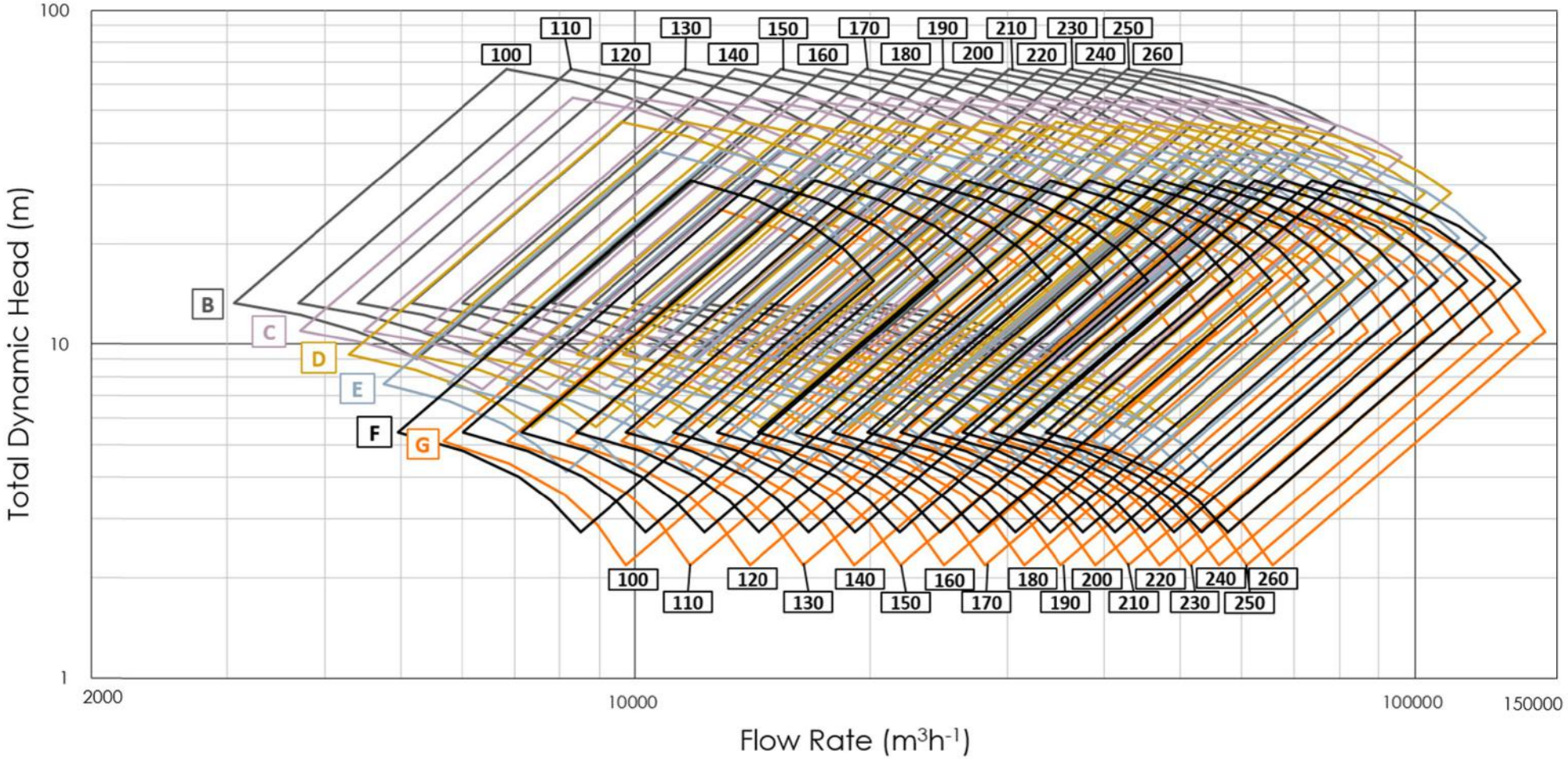
Overview CVP hydraulic field



** Larger flow rates and heads than indicated in this table are possible.*
Please contact our sales department for more information.

CVP project

Features	Prefabricated concrete volute, enclosed impeller design
Capacity @ BEP	Upto 150000 m^3/hr
Head	Upto 50 m
Temperature range	-10 to 50 °C
Efficiency	Upto 92 %
Material (Casing/Impeller)	Nickel Bronze,SS,Duplex,Super Duplex
Nozzle Orientation (suc/dis)	Formed suction intake and horizontal discharge
Standard Motor Sync. Speed	600 rpm
Options	Direc drive / Gear box drive
Flange drilling standard	BS EN/DIN/ANSI /AWWA
Max. Operating Speed	600 rpm

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