



# **CVP-NA**

## **CONCRETE VOLUTE PUMPS**

## General Description

Concrete Volute Pumps, type CVP-NA are used for high flow applications, they are larger enough than the conventional pumps, reducing the number of pumps required, whilst achieving high reliability and efficiency. Minimizing the number of pumps, the overall civil dimensions of pumping station can be decreased. Furthermore, reducing the handling, installation and maintenance costs, the total lifecycle cost minimized.

Moreover, installed efficiency is higher than regular bowl pumps and also, CVP due to their design, do not encounter column or bend losses.

DP PUMPS, experienced pump manufacturer since the early 50's, can ensure a high tech level concrete volute pumping solution, focused on customer preferences and project particularity.



Fig. I - Pull out assembly of a CVP-NA

## Applications

Due to their specific characteristics, Concrete Volute Pumps are already used in a variety of high flow applications in power generation industries, as well as to desalination, oil, gas and water level control applications.

### Typical applications include:

- Flood control systems
- Irrigation
- Drainage
- Water diversion
- Seawater intake
- Dry dock dewatering
- Large scale cooling water systems
- High flow water intake systems
- High flow transfer systems



## Features and benefits

- **Pull out assembly.** Construction simplicity and maintenance facility.
- **Concrete volute casing and suction bell.** Reduced vibrations, increased pump life.
- **Low total life cycle cost.** Reduced structure cost, low maintenance cost, low operation cost.
- **High flow rate.** Suitable for flow rates that the conventional pumps could not reach.
- **Low speed.** Slower running speed, shorter submerged setting depth, long bearings life.
- **Low wear rates.** Less mechanical wear because of low speed.
- **High efficiency.** Higher efficiency than conventional pumps.
- **Prefabricated parts.** Optimal hydraulic shape, finest surface quality, simplicity to construction.
- **Steel liner.** Even less maintenance needs, shorter construction period and excellent surface quality.
- **Inflatable static seal.** Ease of maintenance.
- **Smooth operation.** Low noise levels, reduced vibrations.
- **Corrosion and erosion resistance.** Longer operating life.
- **Guide vanes.** Reduction of flow velocity, optimization of the efficiency.

## Operating data

Capacity\* : up to 105000 m<sup>3</sup>/h  
 Head\* : up to 35 m  
 Speed\* : 100 - 300 rpm  
 Temperature\* : 50 °C max

\* For operating data outside the above values, please contact DP Pumps.

## Shaft seal

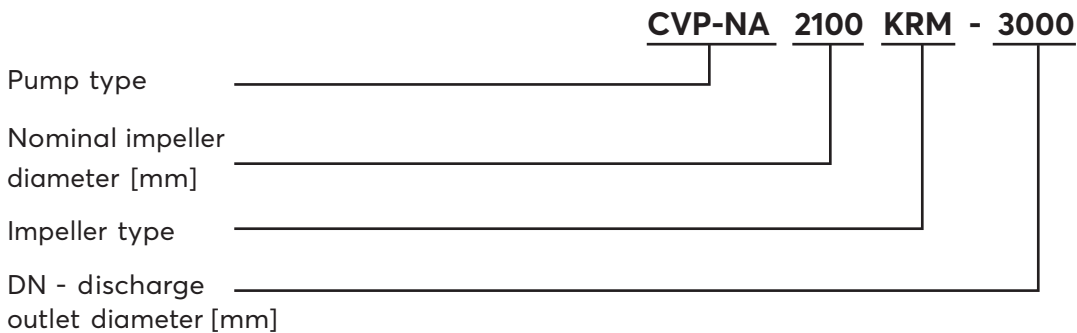
Shaft sealing with choices between gland packing, mechanical seal or liquidyne® seal, with the addition of inflatable static seal for ease of maintenance.

## Standard materials

	Semi-open type impeller	Closed type impeller
Impeller:	Bronze / Stainless steel	Cast iron (JL 1040)
Shaft:	AISI 420	
Impeller liner:	Cast iron (JL 1040)	
Suction / volute liner: *	Fabricated steel	
Shaft seal:	Gland Packing	

\* optional feature

## Designation



Impeller types: Semi-open types: D, DL, F, KMa

Closed types: KQM, KRM, XVF

Discharge outlet & impeller nominal diameters: See below for wide range

## Design

Round, trapezoid, or rounded rectangle type of volute. Cast-in casing, Prefabricated parts casing or Steel liner prefabricated parts casing. Semi-open or closed type impellers.

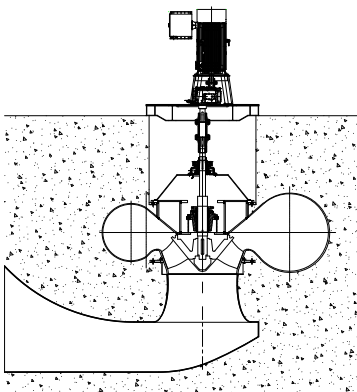


Fig.2 Round type volute

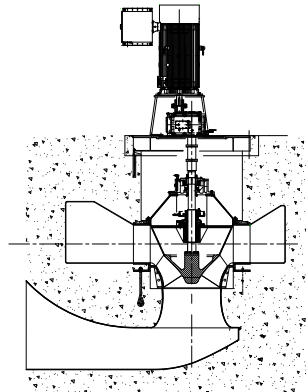


Fig.3 Trapezoid type volute

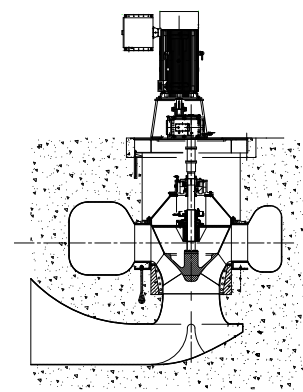


Fig.4 Rounded rectangle type volute

## Bearings

Self-media, clean water, grease or oil lubrication for the bearings, depending on the design.

## Typical installation

A concrete volute pump installation consisted of only one or more pumps in parallel operation, depending the needs of the project and the operating data. The main parts of a typical concrete volute pump installation are shown to the fig.5

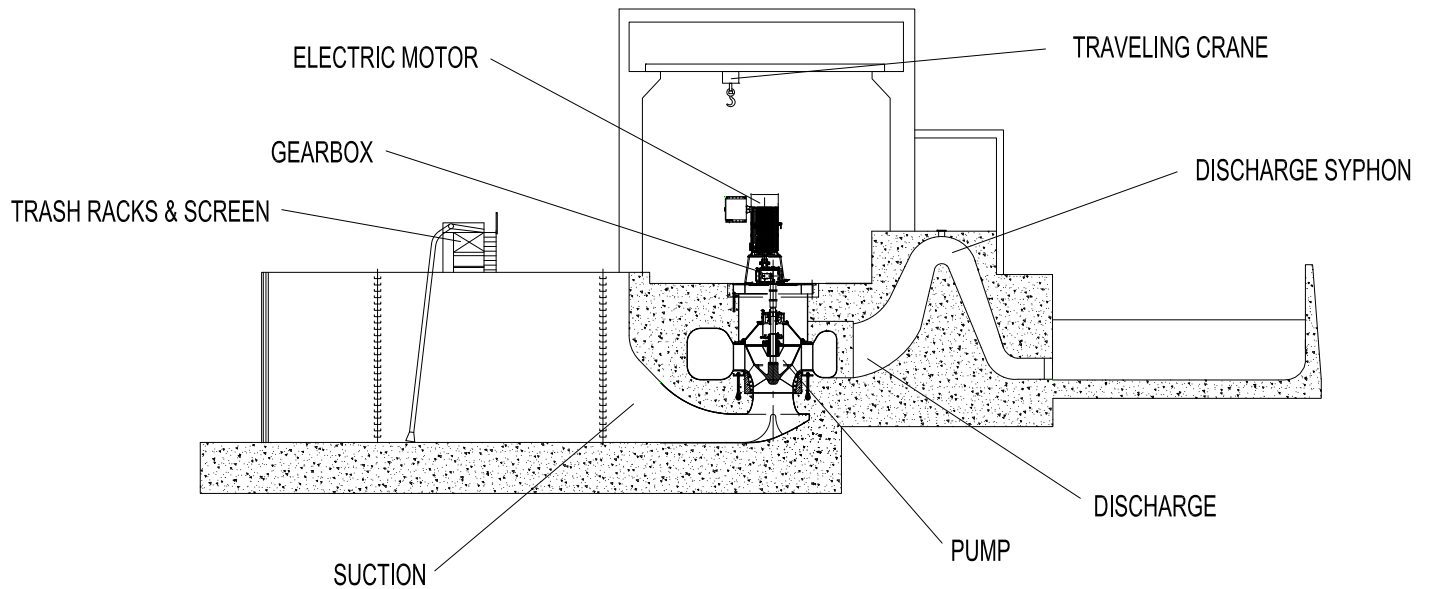


Fig.5 Typical concrete volute pump installation

## General assembly drawing with list of components

Part number	Part name	Typical material of construction
1	* Suction box liner	Steel A-283 / St37.2
2	* Discharge volute liner	Steel A-283 / St37.2
3	Inflatable seal	---
4	Packing seal	---
5	Inlet cone	Steel A-283 / St37.2
6	Wearing casing liner	Stainless steel CF3M
7	Impeller	Stainless steel CF8M
8	Guide vanes	Steel A-283 / St37.2
9	Shaft	Stainless steel AISI 420
10	Guide bearing	Cut-less rubber
11	Stuffing box assembly	Cast Iron GG25
12	Casing cover	Steel JIS G3101 SS400
13	Thrust bearing assembly	Cast Iron GG25
14	Coupling	---
15	Base	Steel A-283 / St37.2
16	Motor stool	Steel A-283 / St37.2

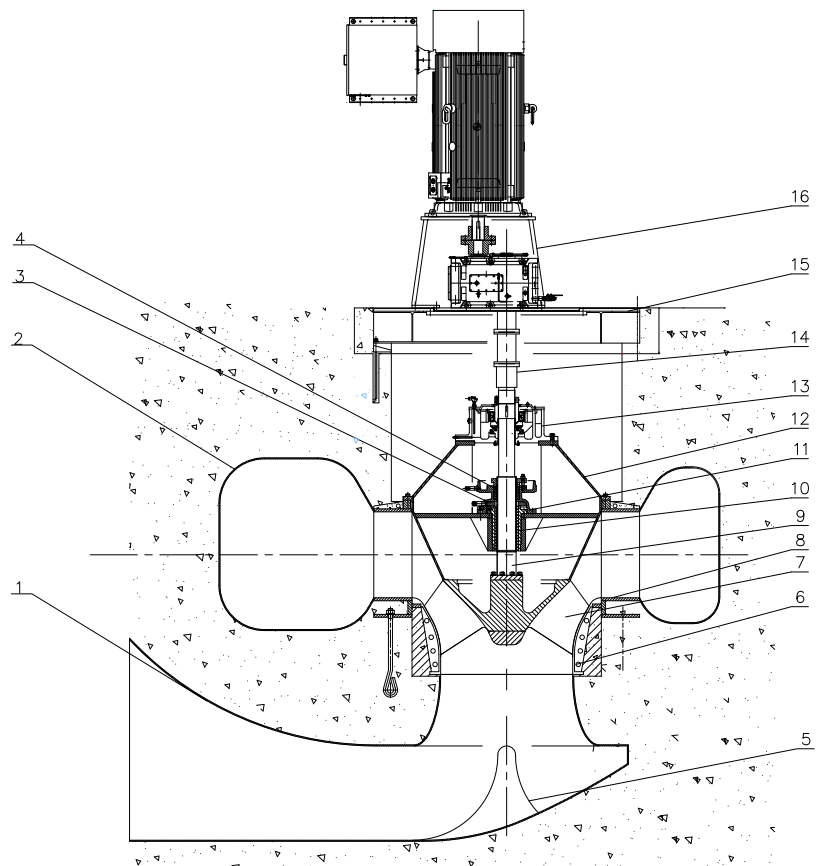
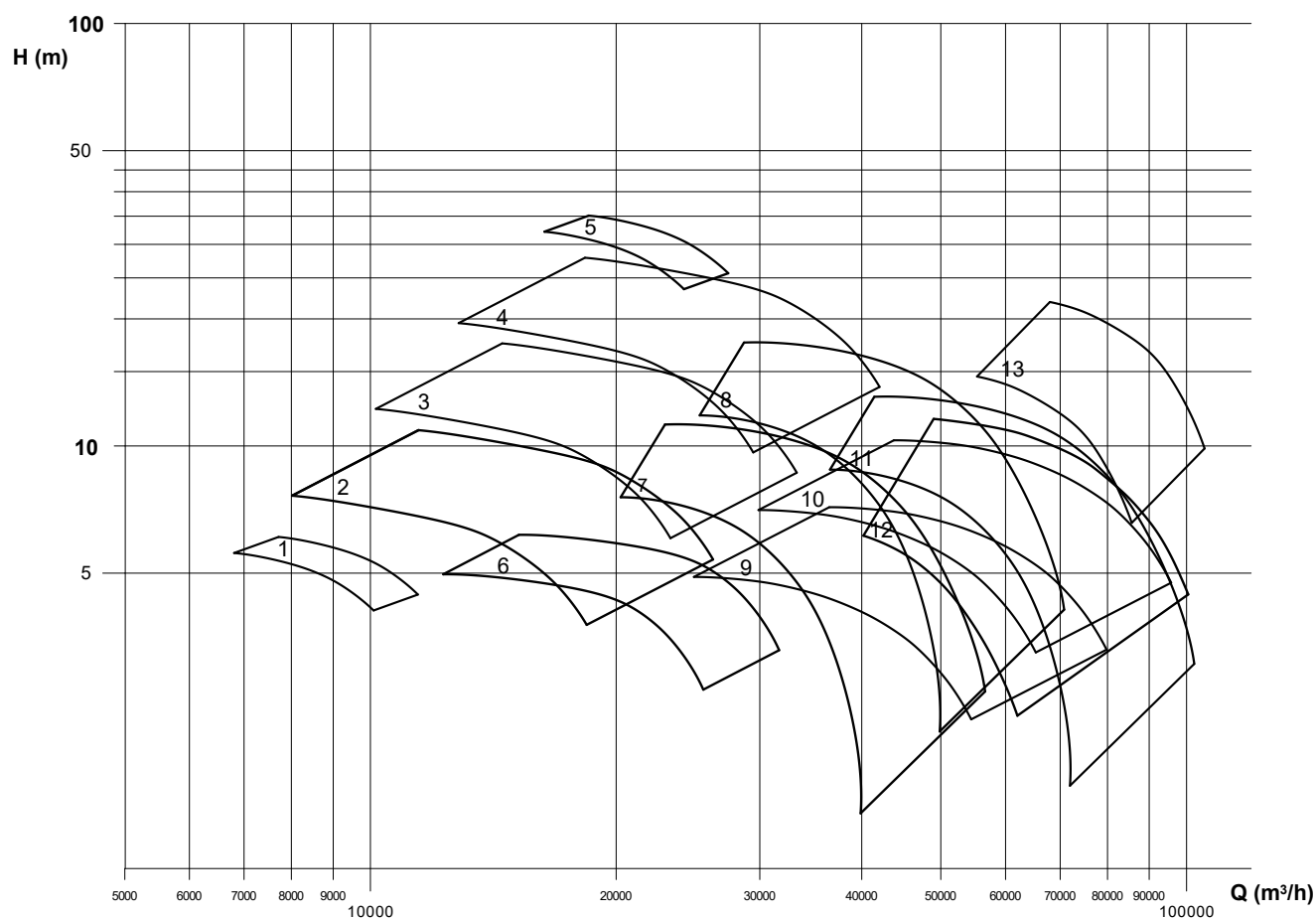


Fig.6 General assembly sectional drawing

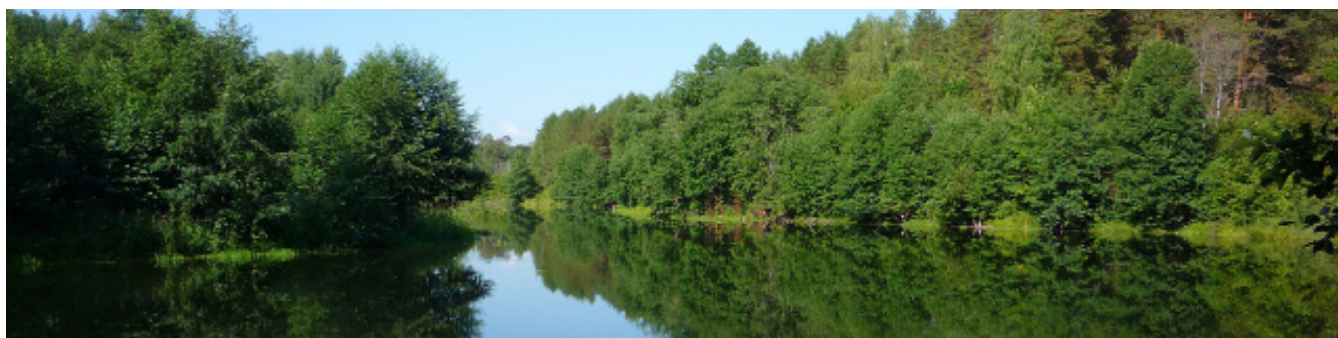
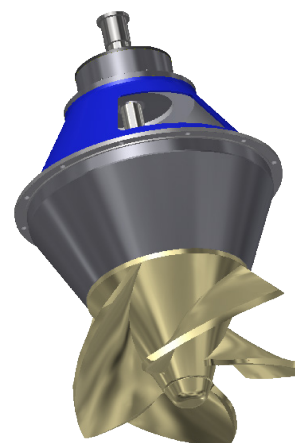
\* optional feature

## Selection diagram



\* For hydraulic data outside the above curves, please contact DP Pumps.

- |     |                        |           |
|-----|------------------------|-----------|
| 1.  | CVP-NA 2100 KRM - 3000 | (100 rpm) |
| 2.  | CVP-NA 2500 XVF - 2500 | (150 rpm) |
| 3.  | CVP-NA 2500 XVF - 2500 | (190 rpm) |
| 4.  | CVP-NA 2500 XVF - 2500 | (240 rpm) |
| 5.  | CVP-NA 2100 KRM - 3000 | (240 rpm) |
| 6.  | CVP-NA 2100 KQM - 2500 | (120 rpm) |
| 7.  | CVP-NA 2400 D - 3000   | (120 rpm) |
| 8.  | CVP-NA 2400 D - 3000   | (150 rpm) |
| 9.  | CVP-NA 2750 KMa - 3500 | (100 rpm) |
| 10. | CVP-NA 2750 KMa - 3500 | (120 rpm) |
| 11. | CVP-NA 3000 DL - 3600  | (100 rpm) |
| 12. | CVP-NA 2360 F - 4000   | (120 rpm) |
| 13. | CVP-NA 2400 KMa - 2800 | (200 rpm) |



## Technical approach

### • VOLUTE

DP PUMPS introduce three types of volute design: round, trapezoid and rounded rectangle. The main target of its design is to pretty match with the impeller layout, resulting in maximum efficiency. The volute can be produced: a) by cast-in concrete on site, b) by prefabricated concrete parts on or off site, c) by prefabricated concrete parts with steel liner on or off site and d) by prefabricated steel liner parts off site. To the fig.7 are shown the four prefabricated steel liner parts of a typical volute with steel liner volute construction.

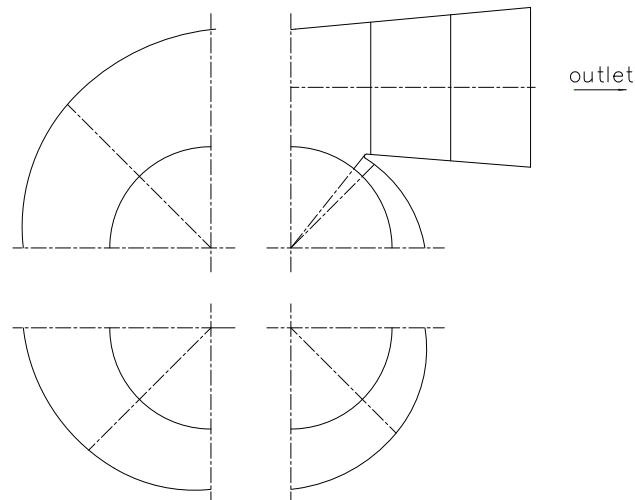


Fig.7 Prefabricated steel liner parts

### • GUIDE VANES

With a long experience to the pump manufacturing since the early 50's, DP PUMPS R&D dept. had to solve several issues in order to ensure a high tech level concrete volute pumping solution, focused on customers' preferences and projects' particularities.

Such issue was the high head rise problem resulting in an important radial thrust on the shaft. DP PUMPS solution is the addition of guide vanes between the impeller and the volute (fig.8). This solution has the advantages to solve the problem of the radial thrust and hence avoid to over-size the shaft or the bearings, but also, due to the increase of the distance between the impeller and the volute, will naturally reduce the flow velocity on the concrete compared to the case without guide vanes. Moreover the addition of guide vanes has as result the increase of the efficiency. Compared to traditional solutions, this one has the advantages to solve both problems at once, but especially to fix the origin of the problems and not only to deal with the consequences of it. For the sake of clarity, one could say that present solution has curative effect while traditional solutions have palliative effect. These guide vanes are designed for very long life time, however they are constructed such way for easy repair or replacement if needed.

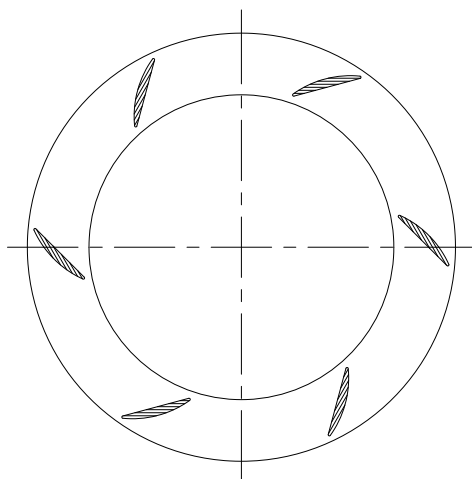


Fig.8 Guide vanes (sectional view)

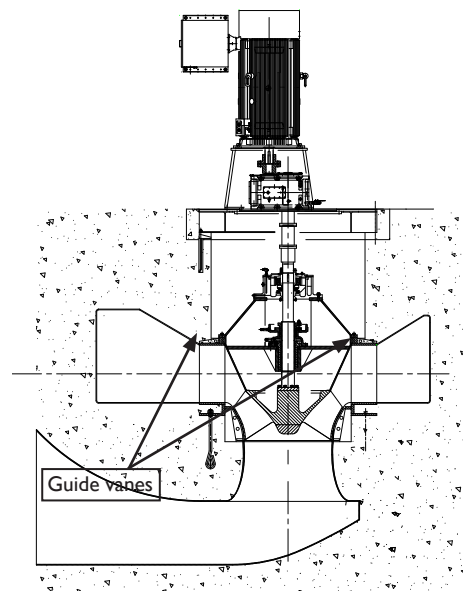


Fig.9 Guide vanes (detail on assembly)



## • SUCTION BOX

The suction box is one more crucial point to the construction of a CVP-NA. The design of the suction box has been developed with extended finite elements analysis and computer flow simulations, in order to minimize friction losses and to limit the possibility of formation of vortices that take air into the pump. The installation of a hydrodynamic cone in the intake box conduces to this vortex avoidance. Moreover there is the optional feature to be used steel liner to the suction box.

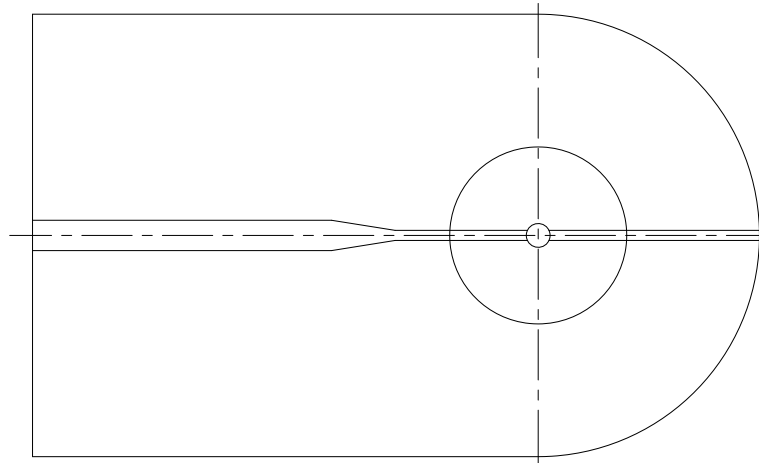


Fig.10 Suction box with steel liner

## • IMPELLER

There are several types of impeller on DP PUMPS concrete volute pumps, CVP-NA manufacturing program: closed types (KQM, KRM & XVF) and semi-open types (D, DL, F & KMa) (see fig.11). They can be manufactured from various materials with the exception that the semi-open type impellers could not be made by Cast Iron. The impeller is manufactured as cast in one piece, machined and balanced.

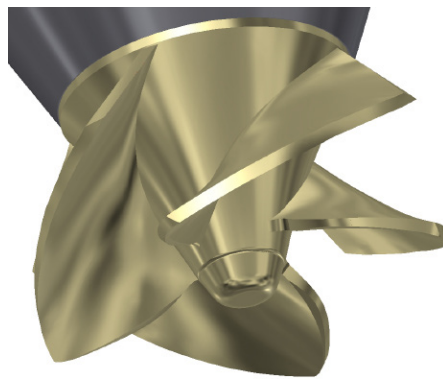


Fig. 11 Semi-open type impeller

## • STATOR

The pump stator consisted of the thrust bearing assembly, the stuffing box assembly, the inflatable seal, the guide bearing, the casing cover, the motor base and the guide vanes. It is a welded construction. There is a manhole on the casing cover for inspection and maintenance purposes.

## • PUMP SHAFT

The pump shaft is a single unit, equipped with shaft sleeves for increased wear resistance and ease of maintenance. The typical material of construction is stainless steel AISI 420 and optional can be used Duplex SS, Super Duplex SS etc.

## • SHAFT SEALS

There are three types for shaft sealing: gland packing, mechanical seal and liquidyne® seal, depending on the project needs and the pumped media. Moreover, an inflatable static seal is used when the pump is not running for ease of maintenance. With this seal, the replacement of packing seals can be done while pump is flooded.

- **THRUST BEARING ASSEMBLY**

The pump has its own thrust bearing assembly for the absorption of the thrust forces. Usually it is used a combination of thrust bearings in tandem with radial bearing, depending the application and the overall design.

- **GUIDE BEARING ASSEMBLY**

There are many choices for the guide bearing material, depending on the pumped media and the application. It is no need for external lubrication, it is lubricated from the pumped fluid. It is placed near to the point of action of radial forces, in the impeller boss. It attributes adequate heat transfer due to submerged position.

### **Prefabricated parts assembly procedure**

The use of prefabricated parts from concrete, steel liner, or combination of them has many benefits. First advantage is the simplicity of the production procedure. The critical dimensions of the suction box, or the volute are already obtained, resulting in a better quality and shorter construction period. The project management is smoother, with clearly separated parts of construction on both mechanical, as well as civil works. The total construction cost is decreased.

The production of concrete prefabricated parts can be done on- or off- site depending the site facilities and the project needs.

The prefabricated volute parts are placed and aligned (fig.12) and after that it follows the concrete casting. When the concrete part is ready, the pull out assembly is placed and the pumping unit is ready to pump when the drive is connected.

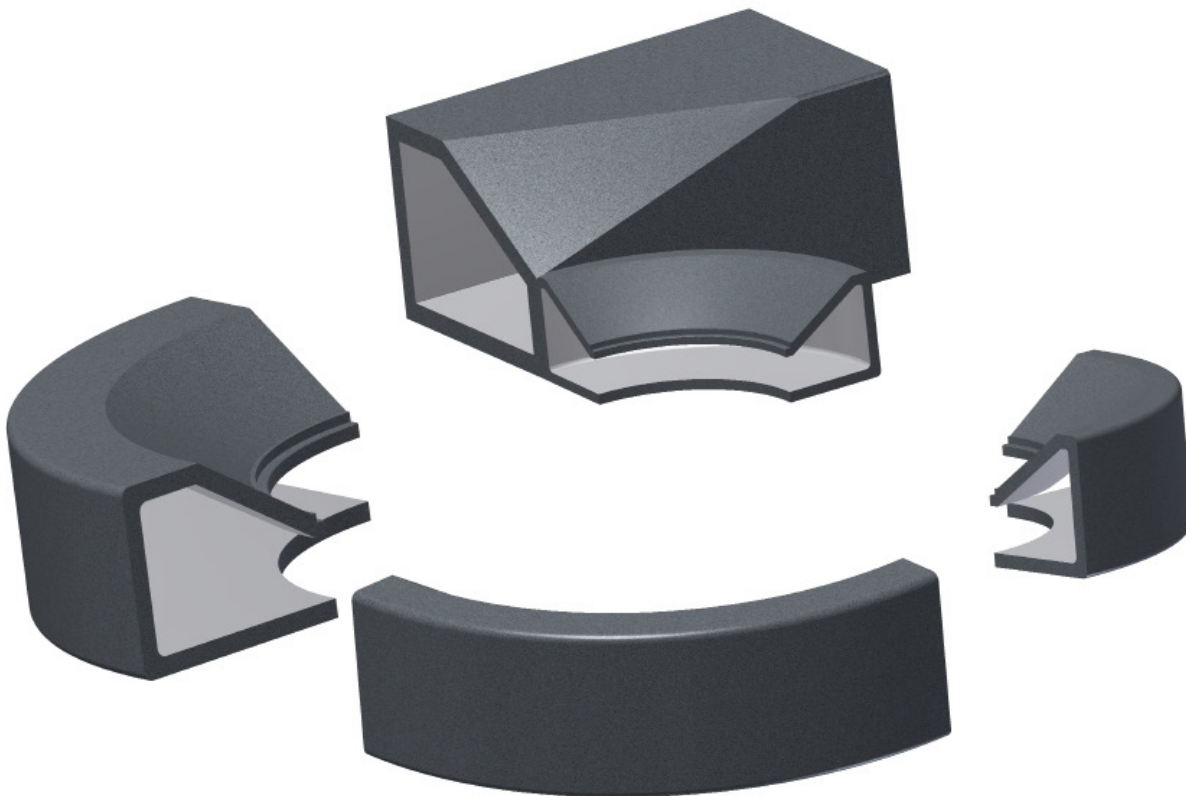


Fig.12 Prefabricated parts assembly procedure



## Available materials and specifications (\*)

	Type	Description	DIN Designation	W.K. Number	EN Designation	USA Designation
Castings	Cast Iron	Grey Cast Iron	GG-20	0.6020	BS-EN 1561:2012 EN-GJL-200 (EN-JL1030)	A48 Class 30
		Grey Cast Iron	GG-25	0.6025	BS-EN 1561:2012 EN-GJL-250 (EN-JL1040)	A48 Class 40
		Ductile Iron	GGG40.3	0.7043	BS-EN 1563:2011 EN-GJS-400-18 (EN-JS1025)	A536 60-40-18
		Ni-Resist	GGG-NiCrNb 20 2	0.7661	EN-ISO2892 EN-GJS-AXNiCrNb20-2	A571 D-2
	Bronze	Tin-Lead Bronze	G-CuSn5Zn5Pb5	2.1096	EN-1982:2008-G-CuSn5Zn5Pb5 (CB491K)	B62 C83600
		Zinc-Free Bronze	G-CuSn10	2.1050	EN-1982:2008-G-CuSn10 (CB480K)	
		Ni-Al Bronze	G-CuAl10Fe5Ni5	-	EN-1982:2008-G-CuAl10 Fe5Ni5	A148 C95500
	Cast Steel	Non alloy steel	GS-45	1.0446	EN-10293-GE240	A 27 (65-35)
		Non alloy steel	GS-52	1.0552	EN-10293-GE260	A 27 (70-40)
		Structural Steel	GP240GH	1.0619	EN 10213-2-GP240GH	A216 (WCB)
	Stainless Steel	Austenitic (316)	GX5CrNiMo19-11-2	1.4408	EN-10213-GX5CrNiMo19-11-2	A351 (CF8M)
		Austenitic (316L)	GX2CrNiMo19-11-2	1.4409	EN-10213-GX2CrNiMo19-11-2	A351 (CF3M)
		Full Austenitic (904L)	GX2NiCrMoCu25-20-5	1.4584	EN-10213-GX2NiCrMoCu25-20-5	~AISI-904L
		Duplex (1B)	GX2CrNiMo-CuN25-6-3-3	1.4517	EN-10213-GX2CrNiMoCuN25-6-3-3	A890 (CD4MCuN)
		Duplex (3A)	-	-	-	A890 (CD6MN)
		Super Duplex (5A)	GX2CrNiMoN26-7-4	1.4469	EN-10213-GX2CrNiMoN26-7-4	A890 (CE3MN)
Wrought Steel	Stainless Steel	Martensitic (420)	X20Cr13	1.4021	EN-10088:2005-3 X20Cr13	A 276 UNS S42000
		Martensitic (431)	X17CrNi16-2	1.4057	EN-10088:2005-3 X17CrNi16-2	A 276 UNS S43100
		Austenitic (304)	X10CrNi18-8	1.4310	EN-10088:2005-3 X10CrNi18-8	A 276 UNS S30400
		Austenitic (316)	X5CrNiMo17-12-2	1.4401	EN-10088:2005-3 X5CrNiMo17-12-2	A 276 UNS S31600
		Austenitic (316L)	X2CrNiMo17-12-2	1.4404	EN-10088:2005-3 X2CrNiMo17-12-2	A 276 UNS S31603
		Duplex (2205)	X2CrNiMoN22-5-3	1.4462	EN-10088:2005-3X2CrNiMoN22-5-3	A 276 UNS S32205
		Super Duplex (2507)	X2CrNiMoN25-7-4	1.4410	EN-10088:2005-3 X2CrNiMoN25-7-4	A 276 UNS S32750





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