w h i t e p a p e r

Wet and dry self-priming pumpsets

Many standard centrifugal pumps are located under the water level in the sump. It is a flooded suction application (We use the term: positive suction Head). By gravity, the liquid will flow inside the pump casing. (see figure 1 on page 2). **With the self-priming pumps technology, the pump is located above the liquid. We then speak about Suction Lift instead Suction Head. This situation is common in civil works applications (dewatering for example), in industrial waste water transfer and in sewage and sludge handling in the Municipal market** (see figure 2 on page 2).

For Suction lift application, we need to prime the pump. Two technologies exist:

- **Dry Prime Pumps**
- **Wet Prime Pumps**

In this white paper, we will explain the differences between these two types of self-priming pumps.

Figure 1 : typical flooded Suction Application with Standard Centrifugal pump

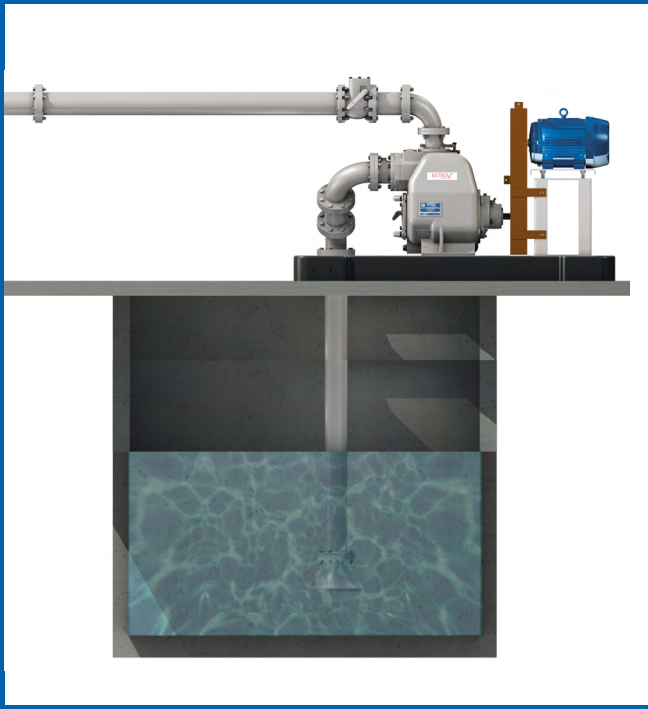


Figure 2: typical self-priming Centrifugal pump application.

Dry self-priming centrifugal pumps

As the name suggests, these pumps can be started even if the entire system including the pump casing, is still empty (hence the name "dry"). These centrifugal pumps are equipped with a second priming assist device. In most cases this is an air vacuum diaphragm pump or a compressor/venturi system. Both (air) pump systems are powered by the same electric motor or diesel engine that drives the centrifugal pump.

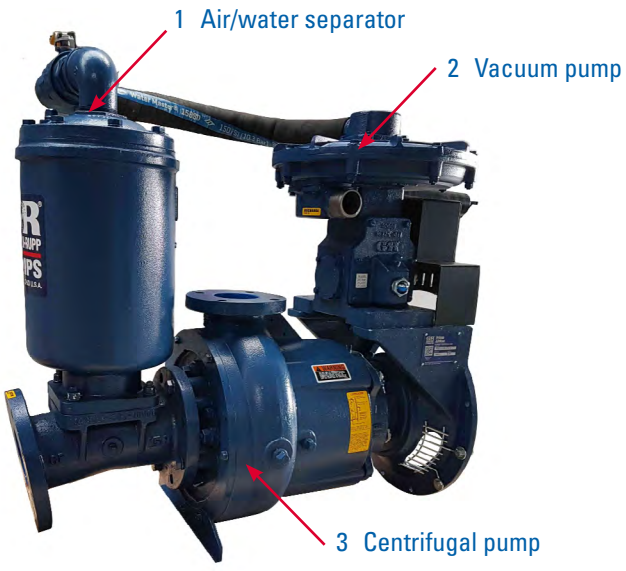


Figure 3

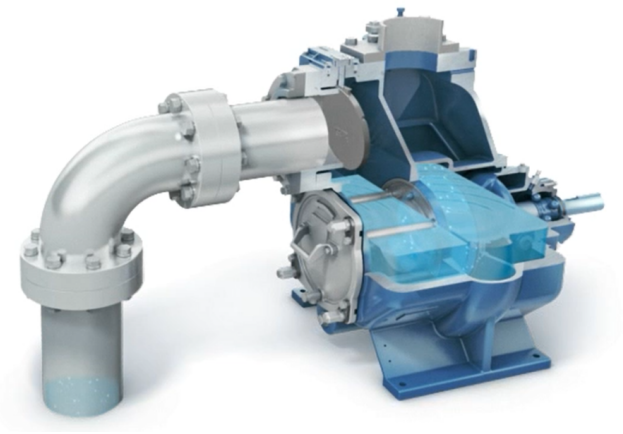
When the pump starts, the vacuum pump will create a vacuum in the suction line. As a result, the atmospheric pressure is pushing the liquid into the suction line. There is an air / water separator (or Vacuum Suction Chamber) between the centrifugal pump and the vacuum pump. This separator is an isolation valve which avoids the introduction of water into the vacuum pump.

Figure 3 shows a typical dry self-priming pump with the various components

Wet self-priming centrifugal pumps

Unlike a dry self-priming pump, the wet self-priming pump must initially be filled with liquid before starting.
The wet self-priming pump consists of two chambers, the vacuum chamber and the pressure chamber, which are connected through a recirculation port.

Once the pump starts, the centrifugal forces will create a difference of pressure on the impeller (low pressure in the eye and higher pressure at the extremity of the vanes). Therefore, a quantity of air (located in the suction pipe) is mixed with the liquid inside the pump casing. This mixture is forced through the impeller into the pressure chamber (volute), where the heavier water is flushed back by gravity through the recirculation port. The air, lighter than the water, will escape through the discharge of the pump. The liquid will recirculate until all the air located in the suction line is transferred to the discharge. As soon as the water in the suction line will reach the pump casing, the pump will deliver its flow under pressure.



This video gives a good idea of how a wet self-priming pump works
Click here to watch the video.

The advantages and disadvantages of both types of self-priming pumps

THE **DRY**-SELF PRIMING CENTRIFUGAL PUMP

ADVANTAGES

+ Very Fast Priming and Repriming time with a diaphragm vacuum pump assist (a little bit less with the Compressor/ Venturi assist)
+ Priming time = Repriming time because it is a dry prime assist pump
+ Dry prime pump can reach higher flow and higher pressure than Wet prime pump
+ No need to fill the pump casing before starting
+ Maximum Suction Lift not dependent on the pump speed
+ Most of the time Higher Efficiency than wet prime
+ Better technology when it is difficult to use a level regulation in the suction pit
+ More possibilities for direct coupling transmission and trimmed impeller without decreasing the re-primability
+ Extended lifetime for the Vacuum Pump if you use auxiliary electrical motor to drive it (electrical drive only).

DISADVANTAGES

− Need 2 pumps to make the job : the main Centrifugal pump and the Air Vacuum pump (or the Compressor for the Compressor/Venturi assist)
− Need 2 transmissions : one direct (or V-Belt) for the main centrifugal pump and one for the priming assist device (air vacuum pump or compressor)
− Discharge check valve must be a high quality one. If not well seated, priming is impossible
− Most of the time, the NPSH request is higher than for the Wet prime assist pump
− The vacuum priming chamber has an additional valve which can clogged with sewage water or waste water handlings
− Some models cannot accept V-Belt transmission
− Large Oil bath for the mechanical seal is critical for this technology because the pump has no liquid in the casing when starting. If there is no oil anymore in the reservoir, mechanical seal will burn out rapidly. This is not the case with the Wet Prime technology because the liquid inside the pump casing helps the lubrication and the cooling of the mechanical seal.
− There is an additional power consumption for the Vacuum Pump or for the Compressor.

THE **WET** SELF-PRIMING CENTRIFUGAL POMP

ADVANTAGES

+ Only one pump to do the job
+ Less expensive technology for identical flow/pressure duty point
+ Lower NPSH request than for Dry Prime Pump which is in fact a standard Centrifugal Pump. The design of Wet priming Pump is originally made to achieve high suction lift with less risk of cavitation problem.
+ No need for a discharge check valve on some applications (where the static discharge head is low (< 4 meters) and when the risk of water hammer is low (short discharge line < 50 meters length))
+ Easy access to the impeller through the inspection cover plate in case of clogging (Super T, Super U, Ultra V)
+ Easy clearance adjustment thanks to the cover plate
+ Much more models (Super T, Ultra V) available with the Eradicator Solids Management System
+ Less moving parts than for the Dry pump technology
+ Very few spare parts needed in case of pump repair
+ Large material availability for abrasive and/or corrosive liquids
+ Easy installation of pump casing heater for outside application in case of frozen temperature
+ Possible installation of Run Dry Sensor which is impossible on a Dry Prime Pump (because no liquid inside the pump when it starts)

DISADVANTAGES

− Need to fill the pump casing with liquid before the first start
− Maximum suction lift depends on the pump speed
− Priming time
− Less re-primability with trimmed impeller
− Air Release Valve and Discharge Air Valve needed for application where the discharge static head is higher than 3 - 4 meters

Which is the best solution regarding your application?

The choice depends clearly on your specific application. As a rule of thumb:

– For fixed installation, where the pumping conditions are not changing, we will choose a wet self-priming pump.
– For mobile installation with changing applications and circumstances, a dry self-priming pump is generally the best option.

Let's take a look at different sectors of applications where self-priming pumps are used.

Civil Works Construction and Open Mine (Quarries):
Civil engineering contractors and Quarries generally prefer the dry self-priming pump technology because it does not need to be manually pre-filled. In addition, the applications of this type of pump is simpler for operators with less in-depth knowledge of pump systems. This type of pump is actually a plug and play device.

Priming with this type of pump is very fast. The only thing that must be checked before commissioning is the absolute airtightness of the suction hose / pipe.

If it is necessary, a dry self-priming pump can be used without level control and it can run dry for a long time.
Typical applications are dewatering, pumping of drilling muds, sewage by-pass and flooding.

For raw sewage applications, when a level regulation can be installed, the Wet Self-Priming Pump technology is better. The Eradicator Solids Management Systems available for several models decreases the risk of pump clogging. Users need to be trained. Should the pump nevertheless clog, the easy access through the inspection cover plate allows to remove the solids rapidly.

Industry:
For fixed installations, the wet self-priming pump is by far the best solution. These pumps consist of significantly fewer components and when installed correctly, it provides unparalleled reliability. In addition, the simple construction ensures lower maintenance costs compared to a dry self-priming pump.

Waste water / Municipalities:
Both types of pumps are successfully deployed here, whereby the application is again decisive. As stated earlier, for fixed installations the wet self-priming pump is recommended, while the flexibility of the dry self-priming pumps is advantageous in mobile installations.

Conclusion

Both Self-Priming technologies are good solutions of pumping but we highly recommend to ask your pump specialist to analyze deeply the application before any decision.

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