

PREROSTAL™ FLOW MATCHING

Prerostal™ is a unique simple system developed by Hidrostal to provide two key benefits to pump users

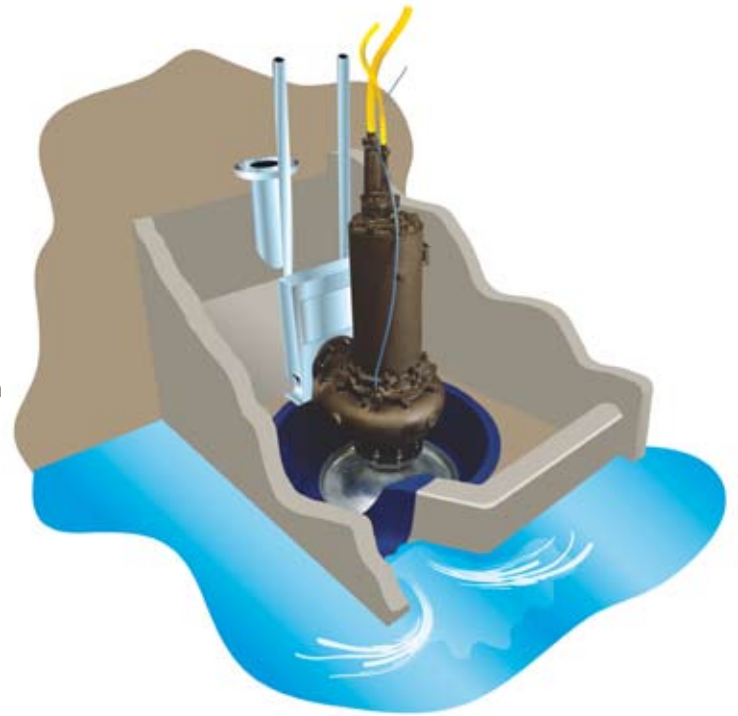
1. To provide a method of matching pump outflow to pump station inflow without the need for any additional items of moving plant or additional electrical equipment such as inverter drives.
2. To provide a highly effective sump cleaning system without the need for any additional items of moving plant.

Explanation of how Prerostal™ works

Elements of a Prerostal System

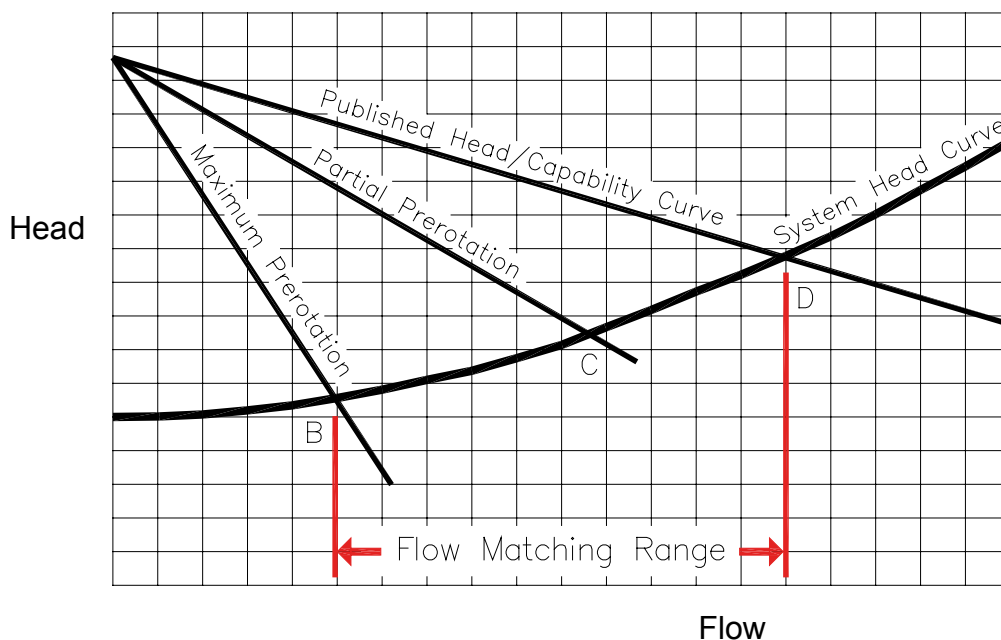
A guide rail mounted screw centrifugal pump fitted with a specially profiled bellmouth located centrally in a moulded prerotation basin.

To complete the system dividing walls are provided between each pump. A weir is formed in front of the basin leaving a tangential channel to one side.



Principle of operation – flow matching

The system is able to vary its output to match incoming flow by inducing varying degrees of swirl in the prerotation basin. The degree of swirl depends on sump level relative to the weir. On a typical system a variation in sump level of 500 mm will vary the output from 100% [normal pump curve] to 50% at lower sump levels.



At start-up the liquid level is above the weir and the pump operates on its normal curve. If the inflow is less than normal pump output the liquid level falls and a progressively increasing proportion of the liquid enters the basin via the tangential channel and progressively increases the swirl as it enters the pump. Thus producing a family of pump curves each depending on sump level. If pumps are operating duty/assist/assist etc. a wide range of flows can be obtained

How Prerostal™ cleans sumps**Prevention of Settlement**

During each pumping cycle the liquid level is drawn down to a very low level in the sump [minimising the residual volume] but still resulting in sufficiently high velocities in the sump/forebay area to move any settled material towards the tangential channel where it enters the basin. The rotational flow of the liquid created by the geometry of the moulded basin, weir and benching ensures settled solids are entrained by the liquid and pumped away.

Removal of Floating debris

As the liquid level in the sump is being drawn down and approaches the level of the weir, it is surface water along with all floating materials that enters each pump cell. Initially this material remains floating above the basin. However, as the sump level continues to fall the weir becomes totally exposed and all liquid enters the basin via the tangential channel. Under these conditions a high degree of liquid rotation occurs and the specific geometry of the basin and bellmouth ensures all floating material is entrained by the liquid and pumped out of the wet well. This has been proven to be especially effective on wet wells handling unscreened raw sewage and waste water with oils, fats and greases on the surface

Simplicity

The system automatically directs all materials which tend to settle or float every pumping cycle to a screw centrifugal pump having a proven track record for solids handling [see section 2]. With this system there are no additional moving parts, electrical controls or serviceable items. Reliability and simplicity are the bywords.



Floating material is entrained and pumped from the wet-well



Self-cleaning action occurs at end of pump cycle

NOTE: For applications where the primary aim is maintaining clean sumps without the need for flow matching a simplified version of the Prerostal™ system is available. This option fixes the weir height and tangential channel dimensions for each pump size allowing these features and the basin to be moulded into a single-piece, simplifying the civil construction. See write up on “Self Cleaning Sumps”.

Typical Applications for Prerostal™

- Sewage Inlet and storm pumping stations
- Activated sludge pump stations
- Oily water pump stations
- Wash down systems
- Pump sumps with a high fat and grease inflow
- Pump sumps with floating materials
- Pump stations where stored volume is limited
- Where a shallow construction is a benefit

Reduced Civil Costs

The stored volume requirements of a Prerostal system is significantly less than for a conventional pump station with on-off controls. This when coupled with the small variation in sump level required to operate the system results in a smaller and in particular shallower construction. An important benefit when working in difficult ground conditions

Solids Handling

The combination of the screw centrifugal pump with its superb solids handling capabilities used in conjunction with the Prerostal™ system ensures reliable operation on the most arduous applications i.e. Inlet pump stations handling raw unscreened sewage.

Gentle Handling

Because the arrangement is used in conjunction with the Hidrostal screw centrifugal pump which has low shear characteristics which minimises emulsification, the system not only keeps the sump clean, but optimises the performance of downstream oil/water separation processes. In sewage treatment, return activated sludge [RAS] can be effectively pumped using the system [because the floc is not damaged during pumping] which is not the case with conventional solids handling pumps.



Skimming floating oil from sump

WET PIT INSTALLATIONS

This is the most popular and cost effective arrangement for pumps up to 300 mm discharge diameter. The pumps are guide rail mounted and are fitted with immersible motors having either safe area or ATEX rating

**DRY PIT INSTALLATION**

For larger pumps 400 - 700mm discharge the pumps are generally dry installed with the pump mounted on a sealing plate located above the prerotation basin.



The dry pit arrangement offers a number of options regarding the pump/motor arrangements. These are:

- I. Immersible pump unit
- II. Vertically mounted end suction pump with direct mounted EFF1 TEFV motor
- III. Vertically mounted end suction pump with line shafting and an EFF1 motor mounted on a separate floor.

NOTE: The bearing frame and line shafting can be made water tight if flooding of the dry pit is an issue.

For both arrangements there is a choice of material options for the hydraulic end to suit the application

Why Prerostal?

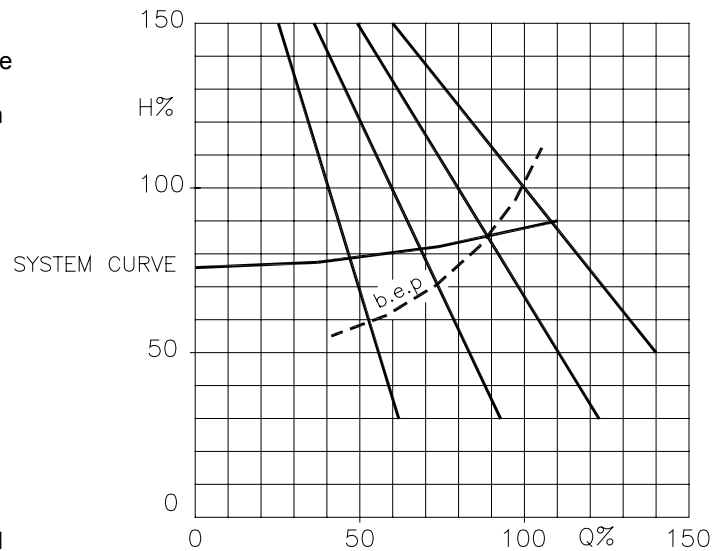
With the water industry using Life Cycle Costing [LCC] as one of its primary focuses in decisions regarding the design and selection of waste water pumping plant, the Prerostal system has much to offer in this respect.

ENERGY SAVING

Where variable flow is required and the system curve comprises mainly of static head and a small proportion is friction which is often referred to as a flat system curve the Prerostal system offers real benefits in respect of energy saving.

A flat system curve will closely track the BEP of a screw centrifugal pump when operating as an integral part of a Prerostal system. Operating close to BEP maximises pump efficiency and hence minimises energy consumption.

In addition it does not incur the 4% efficiency loss associated with variable frequency drives.

**When to consider Prerostal**

- When flow matching is required [pump(s) output matches inflow to pump station]
- In situations when continuous cleaning of the sump is required including skimming only applications
- When the product is shear sensitive
- Raw sewage inlet pumping station
- Inter stage lift on WWTP
- Return Activated sludge [RAS]
- Storm water
- Oily water mixtures
- Final effluent

**Technical Support**

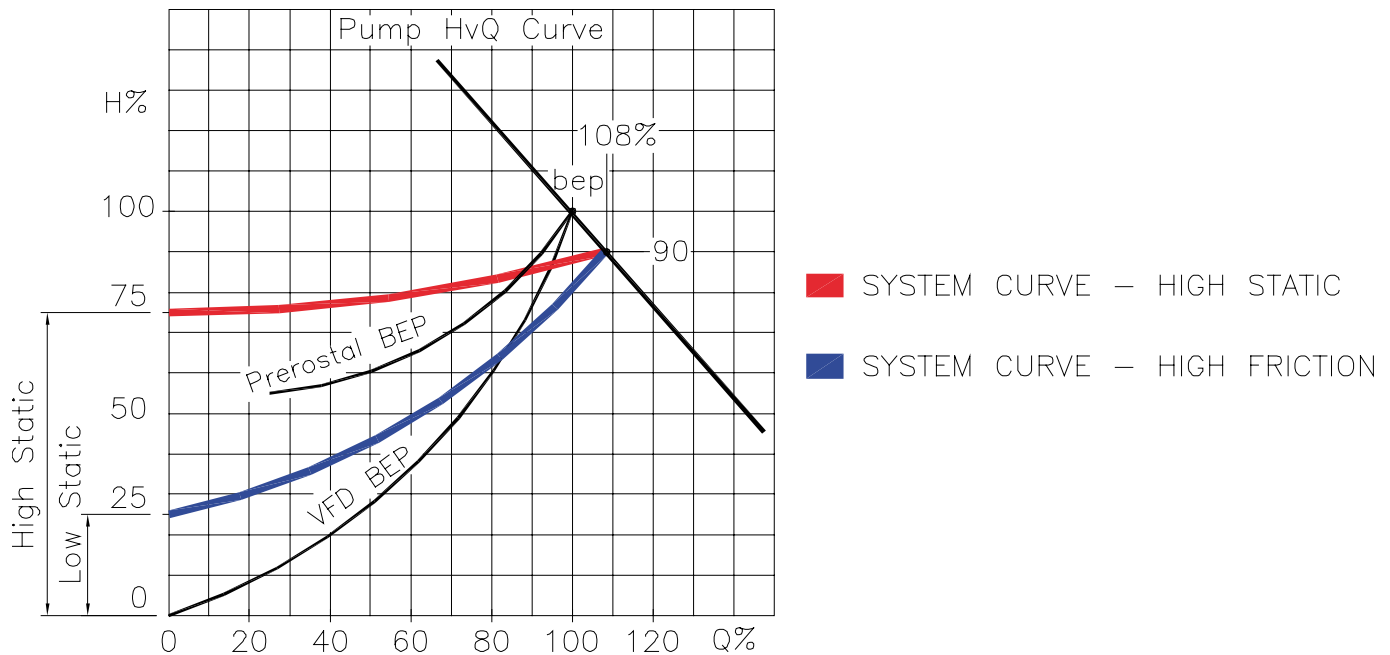
- Hidrostal take full responsibility for the pump selection, sizing of the sump, etc
- Detailed drawings will be prepared in AutoCAD format and emailed to the consultant/contractor for incorporation into the composite station layout.
- Specific instructions will also be provided to assist the civil contractor installing the basins and associated elements that make-up Prerostal systems.

For assistance at the early stages of a project contact our Area Sales Engineer or Head Office. They will be delighted to help evaluate the options to arrive at the optimum solution for a particular project.

PREROSTAL™ or VARIABLE FREQUENCY DRIVE [VFD]

Matching the outflow of a pump station to its inflow can be achieved by using a Hidrostal screw centrifugal pump either as Prerostal™ system or fitted with a Variable Frequency Drive [VFD].

The decision which to use will be highly influenced by the need to minimise energy consumption over the pumping cycle. This requires the pump to run as close to its BEP as possible over the range of flows.



The diagram shows the variation of BEP as the flow is varied for both a Prerostal™ and VFD system, which are significantly different. Two system resistance curves, one high static, one low static have been superimposed, both having the same head and flow at maximum duty.

Reference to the diagram clearly shows energy consumption will be minimised when:-

- A Prerostal™ system is used on systems where static head is a high percentage of the total head i.e. [a flat system resistance curve]
- A Variable Frequency Drive [VFD] is used on systems where the static head is a small percentage of the total head i.e. [A steep system resistance curve]
- NOTE. When carrying out an LCC analysis on a VFD system do not forget to reduce the overall efficiency of the pump/motor unit by 3-4% to allow for inverter losses.

This diagram shows an important principal when applying either a Prerostal™ or VFD in that the maximum duty point should be selected to the right of BEP. This ensures the line of BEP cuts across the system resistance curve in approximately the middle of the flow range. Thus ensuring the pump is always operating as close as possible to BEP.

Prerostal™ or Archimedean Screw?

Both systems provide flow matching on waste water systems. In the UK and Europe Archimedean screw pumps have fallen out of favour due to high capital and maintenance costs and are not considered here due to low usage. A copy of a technical write-up comparing Prerostal™ versus Archimedean screw pumps is available, on request, from Hidrostal Ltd.