

PUMPING UNSCREENED SEWAGE

Unscreened raw sewage can, and often does contain:

- Large solid objects, such as bricks, pieces of wood, etc
- Large quantities of rag and fibres, often several metres in length [pantyhose]
- Quantities of abrasive grit and sand
- Corrosive liquids resulting from seawater infiltration on coastal sites or industrial effluents, etc



Typical material removed from a 300mm conventional sewage pump

Network pumping stations, Transfer pump stations, Works inlet or terminal and combined sewage/stormwater pump stations will incur high costs if the pumps installed are not capable of working without blocking.

For many years the sewage industry has assumed that by specifying sewage pumps with impeller free passages of 100 mm or more they will be suitable for handling raw unscreened sewage.

Field experience repeatedly demonstrates that the above assumption is incorrect. Sewage pumps of conventional design and 100 mm ball passages frequently block with rags and fibrous material collecting at the impeller inlet.

In order to achieve the required free passage the designer of conventional pumps has to compromise the hydraulic design which often results in a disappointingly low hydraulic efficiency which impacts directly on the energy consumption and running costs.

Also as Life Cycle Costing [LCC] becomes a major consideration for purchasers there is the alarming trend by some manufacturers to reduce the free passage of waste water impellers and introduce more blades. This produces the desired result of a few extra points of efficiency but can mean that the pump is no longer 'fit for purpose' to pump raw sewage without incurring blockages. If this is the case, then the consequences as regards costs for unscheduled maintenance are huge, often causing the costs to exceed the theoretical LCC many times over.

RAW SEWAGE PUMPS MUST INCORPORATE TWO ESSENTIAL FEATURES:

1. Ability to pass solid objects	Function of impeller free passage
2. Handle rags and fibrous material without blockage of the impeller	Function of blade geometry at impeller inlet

The Hidrostal screw centrifugal impeller is by virtue of its axial extension able to provide for both the above requirements whilst at the same time avoiding compromising the hydraulic design. The axial extension provides sufficient freedom for the hydraulic designer to develop impellers of high efficiency which is important to clients who purchase equipment to minimise life cycle costs as well as providing blockage free operation.



1. IMPELLER FREE PASSAGE (Also referred to as solids passing capability or ball passage)

All Hidrostat screw centrifugal pumps maintain the single spiral vane impeller across the entire range, from 80 mm to 700 mm discharge branch diameters. As a consequence, as the pump size increases so does the impeller free passage. This has proven to be very important in solving numerous blockage problems which occur with sewage pumps of conventional design. Typical examples being pumps of 250 to 300 mm discharge diameter having 100 mm \varnothing ball passages and 2 or 3 impeller vanes. Problems with blockages occurring once or twice per week have been completely eliminated by the use of screw centrifugal sewage pumps.

Size Does Matter

Screw Centrifugal pumps have large free passages
 The free passage of single-vane screw centrifugal pumps increases in proportion to pump size.

Branch Size	Typical Free Passage mm \varnothing
80	70 & 60
100	100 & 76
125	100 & 95
150	125 & 115
200	150 & 100
250	160 & 120
300	220 & 150
400	250 & 180
500	230
700	300



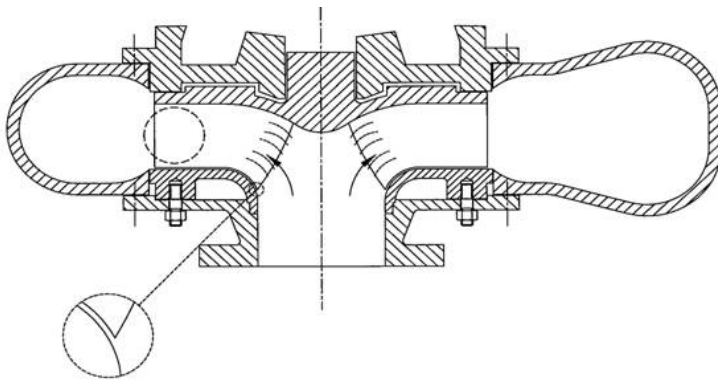
Impeller from 700 mm discharge raw sewage pump

2. ABILITY TO HANDLE RAGS AND FIBRE

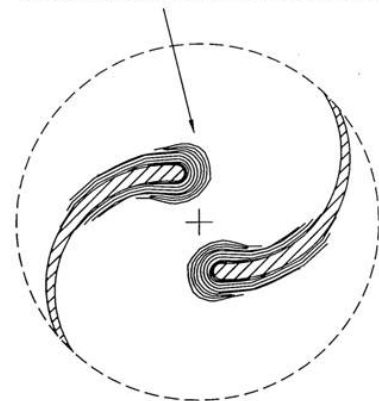
Whilst having a large ball passage to handle solid objects is important the most important feature of raw sewage pumps is the geometry of the blade leading edge, as this determines its ability to run free of partial blockages or complete blockages.

Conventional sewage/wastewater impeller

The diagram shows a typical hydraulic profile of a conventional sewage pump whether it be of the fully shrouded [closed] or open types. The number and shape of the blades will be very similar in both cases but different to a screw centrifugal impeller.



RAGS ACCUMULATING ON BLADE



The flow enters the impeller approximately at right angles to blade leading edge. Any material contacting the blade is held on the leading edge by the force of the incoming flow.

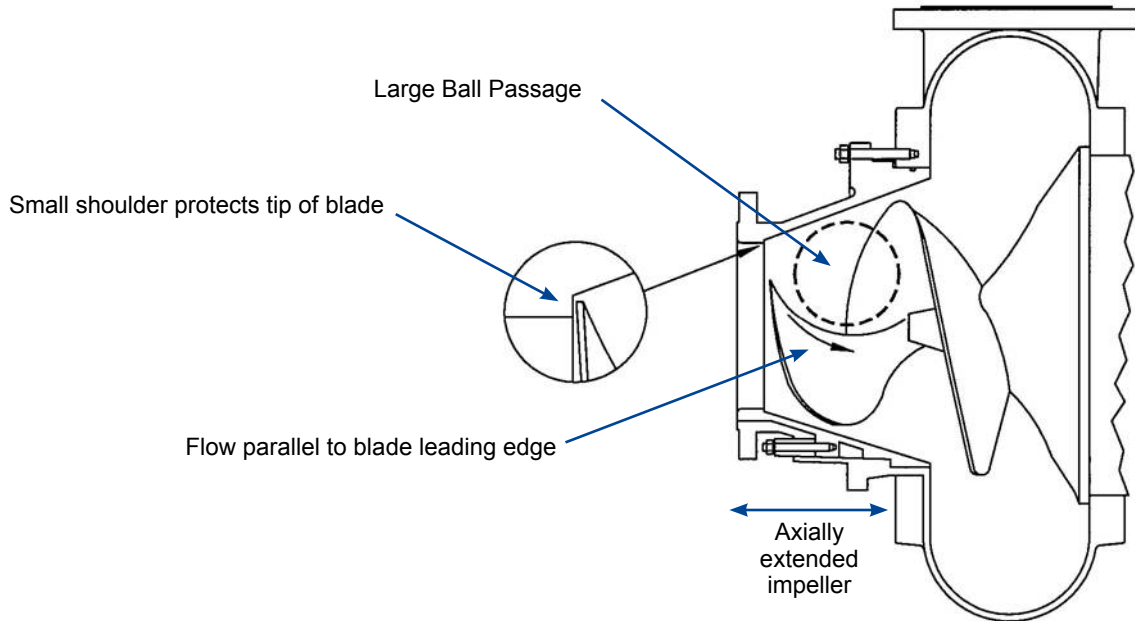
As the pump continues to run, rags and fibre steadily build-up closing off the flow passage causing the pump output to fall and the efficiency to decrease. Both combine to increase energy consumption.

If the steady accumulation of rags is allowed to continue the pump will become fully blocked and an unscheduled maintenance visit will be made to remove the blockage.



Screw Centrifugal Pumps

Unlike conventional sewage pumps where the inflow is approximately at right angles to the blade leading edge, the inflow on a screw centrifugal impeller is approximately parallel to the leading edge. This has the effect of the inflow sweeping any material that tends to collect on the blade to the centre of the impeller where it falls-off into the channel and passes freely through the pump.



Note: The inlet tip of the impeller runs behind a small shoulder so that rags or fibre contact the inlet edge of the blade and cannot hang up on the point of the blade

Sequence of Events



Rags and fibre initially contact leading edge of blade



Velocity of incoming flow sweeps rags and fibre along blade towards centre of impeller



At centre of impeller the material makes a smooth transition from the blade to being deposited into the impeller channel thereby passing freely through the pump

This action is only possible when the impeller is axially extended and comprises a single spiral vane. The self cleaning action of the impeller continuously transports any material contacting the leading edge to the centre of the impeller which ensures the pump does not run partially blocked; thereby maintaining the output and efficiency and avoiding the additional energy costs associated with conventional impellers which have a tendency to block. Additionally by moving the material towards the centre of the impeller the risk of material entering the close clearance between the rotating impeller and fixed liner/suction cover is significantly reduced thereby reducing wear and maintaining pump efficiency.