Lowering Costs AND Improving Safety at Sewage Pumping Stations

If any of your objectives are to:-

- Improve the safety and comfort of operators
- Lower costs over the life of the installation
- Reduce the time operators spend at pump stations
- Reduce chokes/blockages
- Remove confined spaces issues

Then here's why the Gorman-Rupp self priming centrifugal pumps will prove to be your best option in every circumstance.

Hydro Innovations Pty Ltd
ABN - 22 128 896 444
www.HydroInnovations.com.au
sales@HydroInnovations.com.au

Sydney
1/26 Day St Silverwater 2128
PO Box 7075 Silverwater BC 1811
T - (02) 9647 2700
F - (02) 9647 2709

Melbourne
PO Box 155 Moorabbin BC 3189
M - 0404 45 05 31
F - (03) 9503 8245

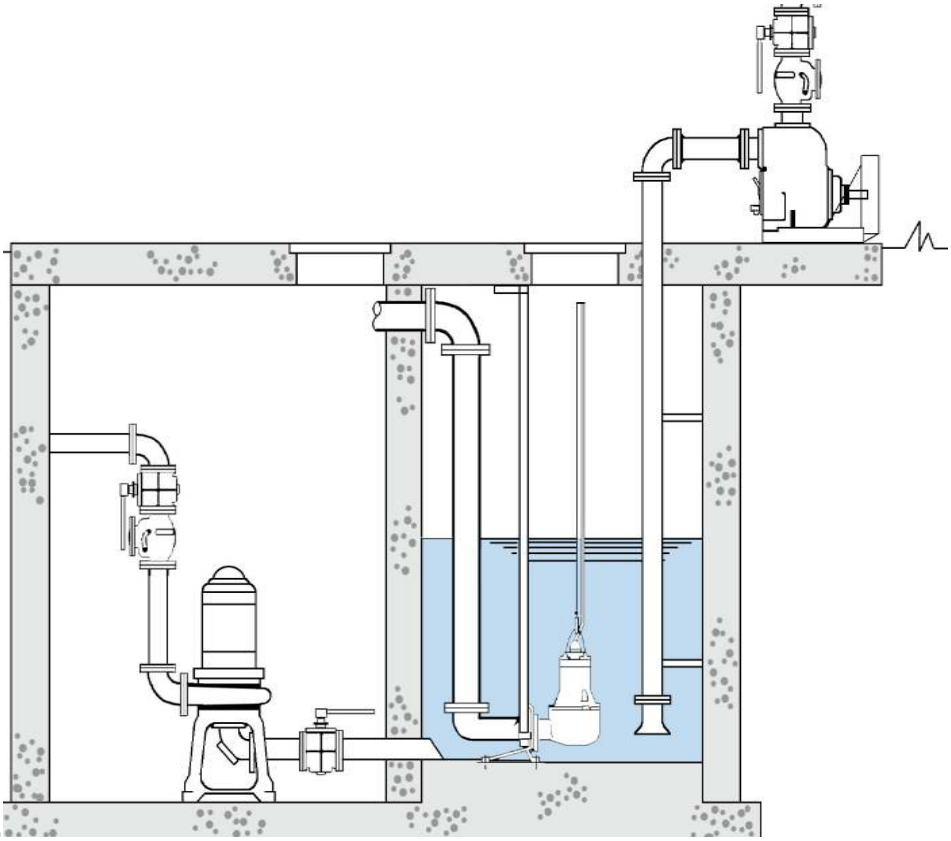
Brisbane
PO Box 105 Beaudesert 4285
M - 0410 52 98 55
F - (02) 9647 2709

Topics:

1. O. H. & S. considerations
2. Easier maintenance (= cost savings)
3. Service Life Costs

1. Occupational Health and Safety Considerations

A picture tells a thousand words.....



Very simply, the Gorman-Rupp self primer sitting above the pit is far safer and easier to service and maintain than a submersible pump under metres of sewage. Let's look at the specifics.

Opening the wet well lids

Whenever maintenance or repairs need to be done on submersible pumps, or their lifting chains, guide rails or discharge bend, the wet well lids need to be opened and the safety screen pulled back. In this situation, this then exposes personnel to the potential of falling into a deep hole, drowning and inhalation of gases. The site needs to be treated with extra precaution.

Furthermore, if work needs to be done on the discharge elbow or guide rails, it is a major operation requiring the complete bypassing of the pump station, draining of the wet well, full confined spaces treatment, and requires one or more personnel to be lowered into the pit to perform repair or replacement tasks. This is not a healthy work environment.

There's more. If work needs to be done on the pump, lifting apparatus are needed. The lids and safety screen again need to be pulled back, again creating a potential hazard. The pump then needs to be lifted out of the well. If it comes out easily (which is NOT always the case), it will probably need to be cleaned down with a pressure cleaner, as no one will want to touch a pump dripping in sewage. Even if it is a "simple" clearance adjustment, doing this requires the replacing of wear rings, which still involves all of the above process and may even require a trip back to the workshop (leaving the station one pump short).

NOW consider the Gorman-Rupp alternative

The Gorman-Rupp configuration is vastly different.

- For starters, there is no need to EVER enter the wet well.

- There is nothing mechanical in there – only the suction lines, which can be removed (if ever necessary) from the surface without “lifting the lids”.

- There are no guide-rails or “duck foot” bends to ever maintain or replace.

- If internal clearances need to be adjusted on a Gorman-Rupp Super T or Ultra V Series pump, this can be done by one person, using two small spanners in **under 5 minutes.**

- To accomplish this, the pump does not need to be dismantled, piping does not need to be disconnected, nor does the drive.

- Not a drop of sewage in sight. A much cleaner and safer situation for operators!

Where would **YOU** rather work?

In here.....?

.....or in here?

Or would this be a better environment.....

This is quite a large station, but the concept is the same. It is much cleaner, out of the blazing heat or pouring rain, has no open wet wells, and the equipment is easy to access, monitor and maintain.

2. Easier maintenance = Lower Costs

It is also commonsense that if something is easy to do, it is more likely to be done. This could not be more true than with the submersible vs Gorman-Rupp self primer comparison. Let's look at clearance adjustment, from a cost perspective.

As previously mentioned, clearance adjustments on a Gorman-Rupp sewage pumps are easy to do. If gauge readings suggest the pump is under-performing, the operator simply adjusts the clearance by "10 Thou" (0.25mm). It's very simple:-

1. **One person,** armed with 2 spanners, isolates the power to the pump to be adjusted.

2. They then unscrew the bolts that hold the locking collars.

3. They then pull the collar out, rotate it by two notches, slip it back on, then rotate it back to line up with the locking bolt.

Do this with all 4 collars and you have just adjusted the pump's internal impeller/wear plate clearance by the required amount.

Now compare this with the all too common submersible pump scenario:-

Let's say gauge readings indicate that the pump is performing below its peak. Because you don't want to go to the trouble of opening lids and getting the crane etc, you let it go for now. But deterioration is occurring - the clearances are opening up because of the increased flow of abrasives past the wear ring. Predictably you are called out to attend a choke three weeks later (stringy material has been caught in the widening gap between the impeller and wear ring).

This time the pump will have to come up to the surface, so you decide to replace the wear ring at the same time. Critical, but far from simple. You have to:-

- Go back to the shop for some extra help and the lift truck.
- Back on site, you must disconnect the power, lift the lids and pull back the safety screen.
- For OH&S considerations, you'll need to barricade the entrance.
- After the power is disconnected, you bring in the crane to lift the pump out. It is dripping with sewage.
- The person with the pressure washer cleans it down.
- The choke is removed, but the wear ring is difficult to remove without the oxy to heat up the casing and/or the nitrogen to cool (shrink) the wear ring.
- The electrician must be called upon to disconnect the pump so it can be sent back to the workshop to have the wear ring changed.
- The station is down to one pump until it is fixed and the above process is reversed to get the repaired pump back in position.

Detecting Problems

It's a truism. Preventative maintenance is one of the best investments an equipment manager can make. The problem is that everyone is so stretched that this is one of the first things cut when budgets get tight.

Having said that, Gorman-Rupp self priming pumps take very little time to maintain, and they are so easy to monitor. Because they are located high and dry above the wet well, and in a ventilated building with plenty of lighting, checking gauges, oil levels, oil clarity and generally looking for things like leaks,

is quick and easy. Strange noises indicating hydraulic problems (vortexing or cavitation) can also be easily heard.

NOT SO with a submersible pump. For all the reason stated above, and because the pump is generally in a 6 metre deep pit with 1-2 metres of sewage above it, checking the oil won't happen. Listening for strange hydraulic noises with the pump under water is very difficult. And gauges? What if they are located in the valve pit? You go back to the van to get your keys, open up the lids, get down on your hands and knees and read the gauges.

107 of their 108 pumping stations converted to above ground Gorman-Rupp

On one occasion, during a visit to Myrtle Beach in North Carolina a few years ago, our General Manager got to talk to the operators about their pump stations. Over a 20 – 30 year period, they had converted 107 of their 108 pumping stations to above ground Gorman-Rupp. The entire operations team (3 teams of 2 men) spent all of their time just going from station to station, checking oil, looking for damage and listening to anything unusual. The labour saving and costs savings in that have been huge.

Furthermore, they were able to detect problems long before they happened, and only needed to schedule an extra call if a wear plate or something else needed replacing. Because the entire rotating assembly can be removed in a cartridge, they kept a few of these in their inventory and swapped them over if an impeller or bearings needed attention. All in under an hour. (The picture tells a thousand words.) The defective part is taken back to the workshop to replace needed parts, and the station is up and running with both its 2 pumps within the hour.

Savings in paperwork

The Myrtle Beach team also did not have to write out reams of orders to have submersible pumps repaired or have sub-contract documents raised to have wet well guide rails and duck-foot bends replaced by outside contractors. The overwhelming bulk of their repairs were done “in-house” by their small team.

They also had many of their stations set up with a “self cleaning wet well” design to minimise fat build-up (see separate white paper on this subject) because many of their stations were near the beach, and the town did not want the tourists upset.

They also installed Gorman-Rupp’s “Autostart” stations (with auxiliary back-up combustion engine - see separate white paper on this subject also) at their

most critical spots so that if the power went down, the station would not overflow, but keep pumping waste to the treatment plant.

One of the Myrtle Beach stations, 50 metres from the beach

3. Service Life Costs

Even from the discussion to this point, it is evident that the lifecycle cost of a pump station can far exceed its initial installation cost. Things to consider are:-

- Energy costs
- Maintenance costs
- Inventory carrying costs
- Replacement costs

Energy Costs

There is a standard calculation to determine cost per kW hour per thousand litres pumped and then the overall energy costs for a pump station installation. It is based on head, pump efficiency and motor efficiency, and how much flow the pump station receives.

Doing this calculation will give design engineers an idea of running costs per year. What it does not factor in, is the lost efficiency as clearances open up in submersible pumps.

A submersible pump losing efficiency – incidence of choking goes up

A submersible pump is losing efficiency from the day it is installed, to the day the wear-rings are replaced. Some manufactures advise that wear-rings should be changed after optimum clearances of approx. 0.5mm have opened up to 2.0mm. By this time, the pump efficiency could be down by upwards of 5% (that is if rings are even changed at that point because of the messy task to do so). And more importantly than the efficiency, during this time of wear, the incidence of choking on stringy materials increases substantially. The cost to send operators to site to remove chokes can dwarf even the increase in energy costs.

Gorman-Rupp self primers do not suffer from this problem. As discussed, in a very clean and easy 5 minutes of work, they can be kept at their peak efficiency (and tightest clearances). This, combined with Gorman-Rupp's new "self-cleaning wear plate" technology, ensures choking at Gorman-Rupp stations is virtually non-existent. As well as this, Gorman-Rupp wearing parts (wear plates) do not have to be replaced until a full 6mm of metal has worn

away (3 times longer than a submersible). During this time though, the “as-new” clearances can be kept. And on top of this, when the wear plate does need replacing, it too is only a 5 – 10 minute job.

Self primers are much easier and cheaper to maintain

Again, Gorman-Rupp self primers are demonstrably easier and cheaper to maintain than submersible pumps. There is no confined spaces regulations to comply with (requiring a minimum of 3 persons, gas detection equipment, lifting apparatus, breathing apparatus etc), less hazards to allow for, and little to no lifting equipment needed.

Replacement or repair of the electric motors

Gorman-Rupp pumps only use standard TEFC motors which can be purchased from dozens if not hundreds of suppliers in a most competitive field. Submersibles on the other hand are manufactured by only a handful of companies, and they are mostly not interchangeable. This makes them expensive, along with the fact that they are IP68 motors and can be re-wound only by specialists (still expensive – and time consuming) to get done.

Inventory carrying costs

This is an area frequently overlooked. It is rare to have 2 stations, even in a “fleet” of 100, that have the same head AND flow. For this reason, municipalities with upwards of 100 pump stations could have as many as 30 different pump models with as many differing sizes of impeller to match each station’s duty. The cost to “cover” each one could be anywhere from $350,000 - $500,000.

This is not the case with Gorman-Rupp pump stations. They are capable of handling 99% of the duties of a “standard” pump station with only 8 models of pump. The following table will demonstrate that flows from 10 l/s through to 150 l/s can be handled by this handful of models, as well as heads in some instances to 90 metres. The below performances are for one pump running (although it takes in 8 models), but it must be said, that if self primers are used, it is simple to run pumps in parallel to double the flows below, because pumps do not have to fit into a wet well, only the suction lines do.

	10m	20m	30m	40m	50m	60m	70m	80m	90m
10 l/s	X	X	X						
20 l/s	X	X	X	X	X	X	X		
30 l/s	X	X	X	X	X	X	X	X	
40 l/s	X	X	X	X	X	X	X	X	X
50 l/s	X	X	X	X	X	X	X	X	X
60 l/s	X	X	X	X	X	X	X	X	X
70 l/s	X	X	X	X	X	X	X	X	X
80 l/s	X	X	X	X	X	X	X	X	
90 l/s	X	X	X	X	X	X	X	X	
100 l/s	X	X	X	X	X	X	X	X	
150 l/s	X	X	X						

If a municipality used all of Gorman-Rupp’s pump models to meet the duties of all 100 pump stations at our hypothetical location, it would cost ratepayers less than $100,000 to carry an inventory of rotating assemblies per model, along with wear plates and flap valves per model.

Replacement Costs

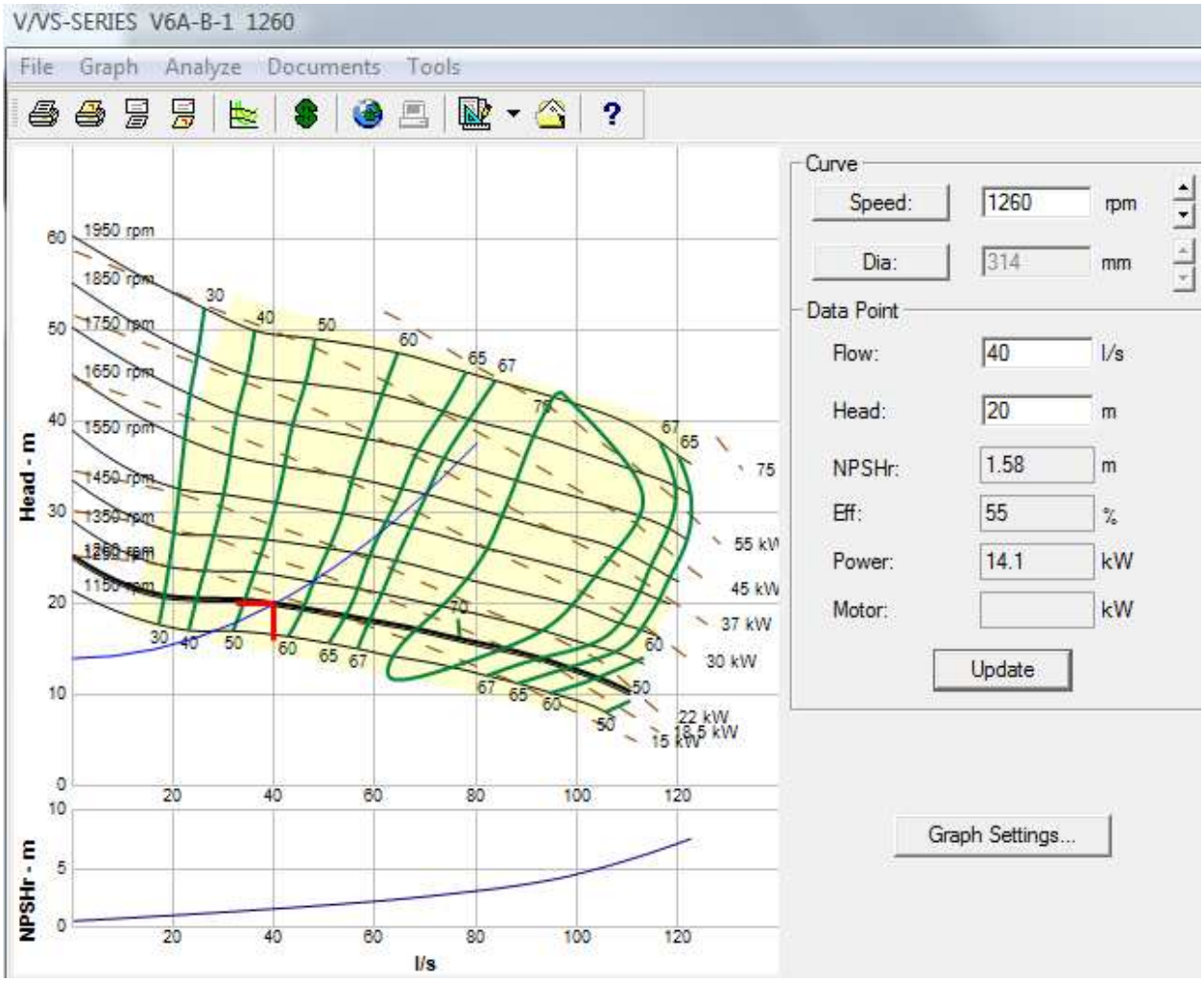
Generally, the time to replace the equipment in a pump station is when the needs of the population (increased flow into the station) exceed the capacity of the station. The station may well only need to go up a size or two in pump, but with submersible systems, this could mean a large expense. The larger pumps may need different guide rails or discharge elbows, but more than likely, the new submersible pumps will not fit into the existing wet well, and it too will need to be replaced.

Compare this to the Gorman-Rupp self priming pump scenario. Because they are belt driven, pullies and belts can be very easily and inexpensively changed to increase the speed to achieve the newly calculated duty point.

Let's look at an example - a station has a current duty of 40 l/s, with 14m of static head and a 200mm rising main 1000m long. The new demand is 70 l/s.

With a set of Gorman-Rupp V6A60-B pumps, all we would have to do is speed the pumps up (by replacing pulleys and belts only). As can be seen from the below excerpt from the Gorman-Rupp selection program, the V6 can not only handle the step-up to the new duty, but do so easily.

The following diagram is an excerpt from Gorman-Rupp's selection program. With this program, system head curves can be plotted, along with several duty points, pump efficiencies and numerous other facts to help designers select the right pump system for their pumping station.



Alternatively, a new pump can be installed to run in parallel with the existing system, and the old wet well could still be utilised, potentially saving thousands of dollars.

In summary

Pumping raw sewage or any kind of wastewater can be expensive, with many hidden costs and safety issues. OH&S issues at submersible pump stations are many because most of the mechanical equipment is located at the bottom of a six metre deep pit, under a metre of sewage. Any repairs or replacement need to be done with the “lids” open, exposing personnel to dangerous risks. Some of this work requires personnel to enter the wet well, which is a dangerous confined space. The use of Gorman-Rupp self priming Super T Series or Ultra V

Series sewage pumps almost eliminates the need to ever enter the wet well, and any maintenance does not require the opening of wet well lids. Personnel are therefore not put at risk of falling and are not exposed to confined spaces.

The minimising of these risks also has a positive impact on cost. Less personnel need to attend site, and the cost of the confined spaces equipment can be greatly reduced. When these savings are combined with the reduced time to monitor and service a Gorman-Rupp “self-primer”, and the energy savings they deliver, a substantial saving can be made over the life of an installation.

Australian Councils and Water Authorities using Gorman-Rupp self primers in their pump stations are already enjoying the reduced risk to personnel and the lower costs of running their stations. The benefits are real and self-primers can be applied to almost any waste water application. Hydro Innovations provide free selections and advice for new applications or upgrades of existing stations.

Call us on 02 9647 2700 so you can have a real ‘person’ contact when you have ANY questions on pumps and their applications.