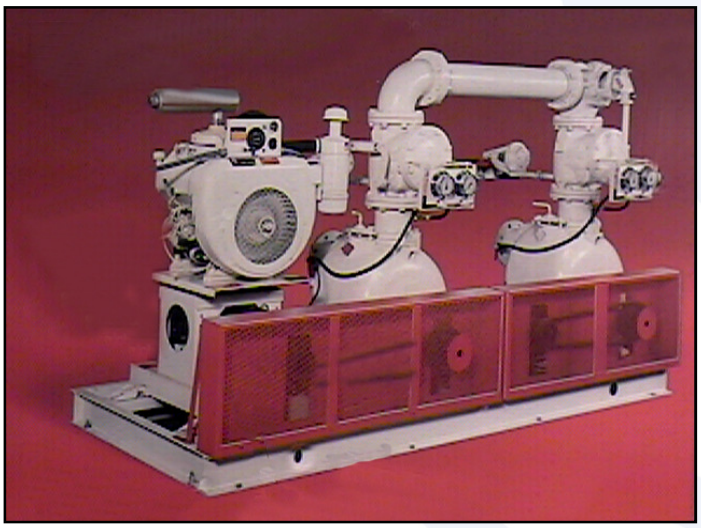
When the storm is raging in the middle of the night, the last thing you want to hear is the phone ringing off the hook to tell you that 4 of your pump stations are down and all hands are needed. Do you have...

Emergency Standby Pumping Capability?

This paper covers the most common ways used to mitigate the potential damage and prevent an overflow, discusses the pitfalls of each, and offers "THE" solution that produces the most effective result...

Gorman-Rupp *"Autostart" pump station*



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Topics:-

1. Considerations for the designers
2. Design options
3. The Optimum Solution

Design Considerations

Designers/Engineers must take many things into consideration when designing their sewerage pumping stations. If it is anticipated there maybe potential for sewage spills or “overflows”, they must also consider the following:-

- Regulating Authorities are approaching ZERO tolerance for sewage overflows.
- Fines for breaches are ever increasing.
- Overflows could pose serious health risks.
- Engineers must review the best available options when designing pumping systems to assure overflows do not occur.
- In the USA, in some states, it is a criminal offence for “the person having responsibility/authority” to have allowed an overflow. These stringent measures could also end up in Australia.

Design Options

The design engineer has several options at his or her disposal to consider when evaluating the most effective way of preventing a sewage overflow. The basically break down to these:-

- Additional Storage Capacity
- Independent Utility Power System
- Internal Combustion Engine Equipment

- Portable Engine Driven Pump
- Portable Engine Driven Generator
- Permanent Engine Driven Generator
- Permanent Auxiliary Engine Driven Pump

Additional Storage

There are several ways to increase the storage capacity of a sewage pumping station, which gives the operators a time "buffer" in times of power outage or equipment failure. Differing regulations will dictate whether this needs to be one (1) hour, two hours or more.

Over-sizing Sumps

Over-sizing sumps is one way of building in some safety margin in times when the pump station is not operational. This will add to the construction costs of the station, and depending on the ground structure and retention time needed, this could prove to be a substantial amount.

Surcharging the Gravity System

Surcharging the system is a way of increasing the retention times, sometimes without additional costs. This will heavily depend on the system's capacity to handle this, and in the majority of cases, this will not help the situation, but possibly "push" it elsewhere. Sometimes this method is built into the gravity system by greatly increasing the size of the gravity lines, but then additional costs could render this solution to the scrap bin.

In both the above cases, they rely on the "buying" of time. If malfunctioning equipment has not been fixed or the power has not been restored, there still may be a need for additional equipment to be brought to site (in the form of a portable generator or portable pump).

Independent Utility Power System

Having a completely independent power supply from a secondary energy provider is an alternative that would work 100% of the time – if a power outage was the only reason for the pumps not to be operating. If the problem was with the controls or with the electric motors themselves, no amount of additional power will get sewage flowing from the station and prevent an overflow.

This method would also be the most expensive, and, in most cases would not be practical.

Internal Combustion Engine Equipment

Portable Engine Driven Pump

The portable engine driven pump is an option that will provide pumping capacity to a station whether the problem is a power outage, controls failure or motor or pump failure. There are no additional controls or electrical switch gear required at the station, and the unit only needs to run when there is

wastewater to be pumped (provided it has a level control built in or has an operator present at all times.

This may be the perfect solution except that not all pump stations require the same flow and they will all certainly have differing pressure requirements. There would therefore need to be a fleet of these pumps available, of varying sizes, with differing heads and flow capabilities, and what if more station than one has gone “off line”?

There is also the response time element. Someone needs to collect the unit (do they need to go get the keys off someone else or pick a big enough towing vehicle first?), then get it to the site and set it up. If the operator/s do get there in time to prevent an overflow, there needs to be a connection into the rising main (this needs to be built into the system in advance) and the wet well lids will need to be opened (requiring all of the usual safety precautions to be taken). There may even be a need for an operator to remain with the equipment.

Portable Engine Driven Generator

Another popular option is the portable engine driven generator. This option though, has many draw-backs, making it far from the “perfect solution”. Portable generators need to be sized to suit the largest station that may need “support”. And the size required is also dependent on the type of starter in the station.

For example, if a 37kW station was fitted with star-delta starters, the pumps need a start current in the order of 220 Amps. This would require a generator engine of some 150kW. Even if the pumps were fitted with soft starters, requiring upwards of 150 Amps of start current, the engine would still need to be in the order of 110 – 120kW. Either way, a large engine and a heavy trailer would be required.

This option also comes with the need to have manual transfer switch gear and suitable receptacle in place on site to transfer the pumps from mains power to the generator source.

Typical “after market” switch gear and receptacle.

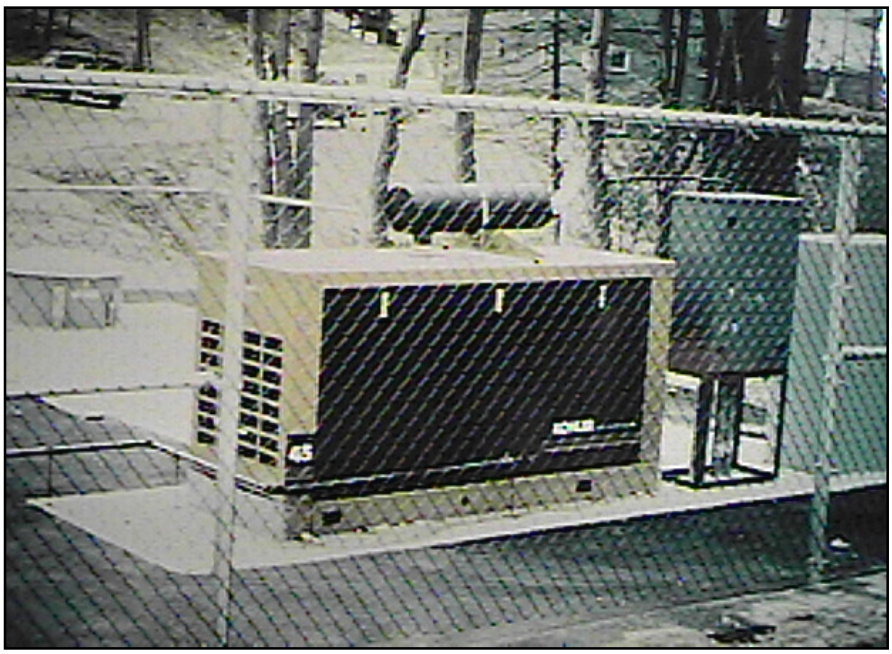
There is also the response time element for this option. Someone needs to be called (possibly someone with a heavy vehicle licence). Have they got the keys to the shed and the vehicle? Can it be done by one person?

And what if the problem is with the controls, the motors or the pumps? The generator won't get things moving even if it is the right size, switch gear is on site, the engine has fuel and there is a suitably qualified operator to get it to site.

Permanent Engine Driven Generator

This option alleviates all the issues associated with getting a unit to site. The unit is permanently installed and will "cut-in" when there is a power failure. It will also be sized to suit the pumps for that station. And if it is a power supply issue, no personnel are needed to get things going, it is all automatic.

Could this be the perfect solution?



Permanently installed generator.

This option is quite expensive, and once again, the engine needs to be sized to suit the START CURRENT of the pumps in the station, not their run current. The

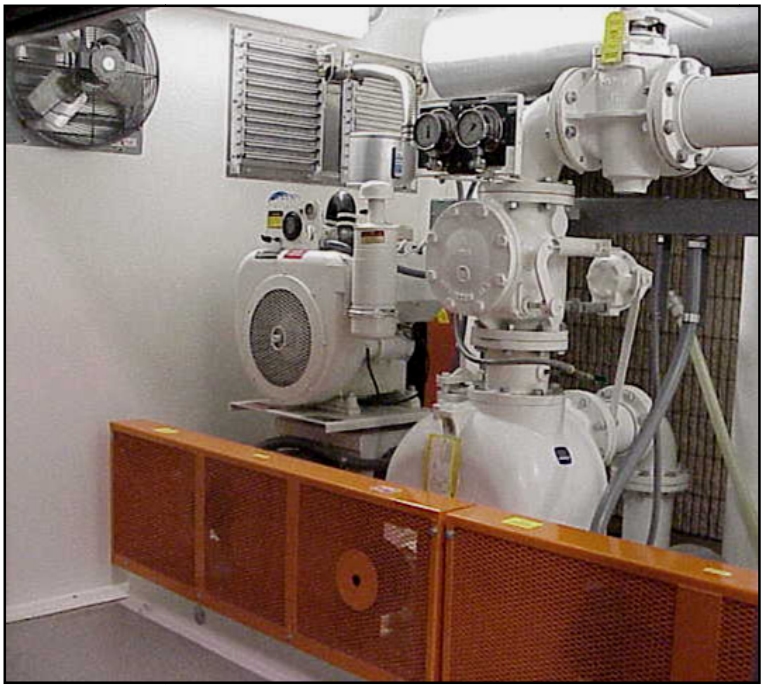
unit will also take up quite a bit of space on site, and even if this is not a consideration, what about noise? Pump stations are often located adjacent to local residential property, so acoustic enclosures will be needed. Also, the switch gear also needs to be automatic – more expensive than the manual version.

Another thing to consider is that the generator runs all the time the power is out. If this is late at night, even more consideration needs to be given to the acoustics.

Also, what if the problem is not with the power supply? What if it is with the motors, controls or pumps? The expensive generator with its bunded fuel area, acoustic canopy and automatic switch gear, can't help.

What's the solution then?

The Gorman-Rupp Autostart Pump Station is the closest thing to the perfect solution for the prevention of sewage overflows when electric pump units "go down".



The *Autostart* is standard duplex pump station (two pumps operating alternately) which is fitted with an auxiliary engine that will drive a pump in the station under the following conditions:-

- Power outage
- Motor control centre failure
- Electric motor failure

In this respect, the Autostart is equivalent to additional storage space. The only difference is that if the power was out for an extended period of time, all the *Autostart* needs is some additional fuel (additional storage space eventually reaches its limit and further measures will be needed to prevent an overflow).

And unlike the "generator option", the *Autostart* only runs while pumping (it starts when the "on level" is reached, and stops when the "off" level is reached).

The addition of the auxiliary engine does not take up much additional room. This puts it well in front of a permanent generator in the respect of civil costs.

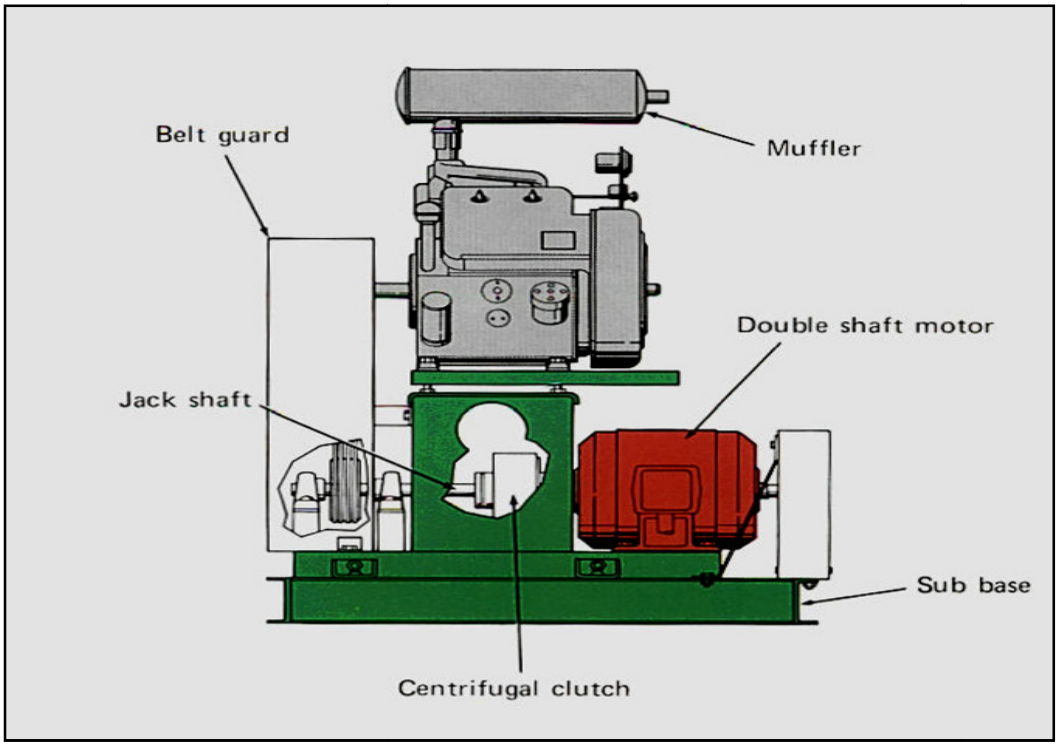
Also, unlike either generator option, the engine needed to drive the pump only needs to be as big as the electric motors running the pumps during normal operation. In our 37kW pump example, only a 37kW engine is needed to drive the *Autostart.* Running costs, parts and servicing are therefore much less expensive than either generator option.

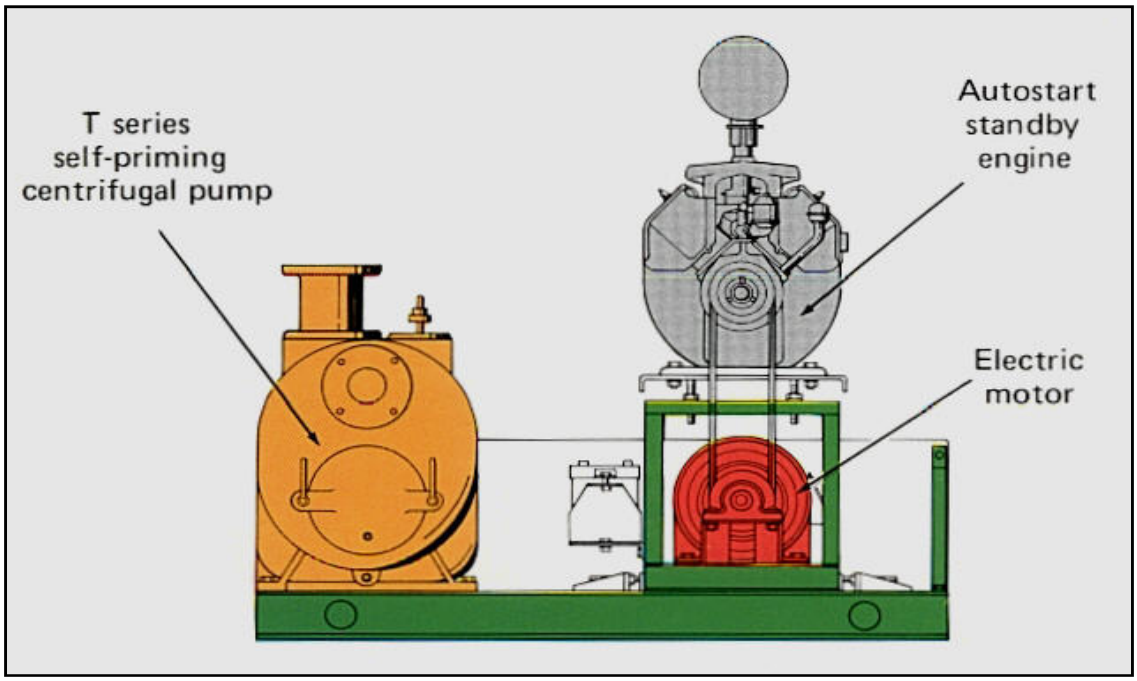
One more point of difference between the *Autostart* and all other options, is that the *Autostart* is a completely integrated packaged pump system that is

built, tested and warranted (for 5 years) by one supplier - pump manufacturer, Gorman-Rupp, with over 75 years of experience and integrity within the pumping field. All the other options are combinations of civil contractors, pump suppliers/manufacturers, generator manufacturers and switchgear suppliers.

How does the *Autostart* work?

The *Autostart* is equipped with an auxiliary engine, connected by V-belts, to a centrifugal clutch which drives one of the pumps in the system.





This “set-up” also gives rise to another excellent feature of the *Autostart.* The pulleys can be sized to run the pumps faster than their usual duty speed. They can therefore pump at increased flow rates during times of power outage, which are normally preceded by storm conditions and the accompanying infiltration demands placed on the station.

The *Autostart* system is equipped with a completely independent DC controller, which after a time delay, locks out the AC control side upon primary AC failure. This controller has its own liquid level sensing device.

During an “outage”, the DC system takes over. It is powered by a 12V battery that is “trickle charged” by the AC power when it is available and an alternator when the engine is running during a pump cycle. So it is always “ready to go”. When the control system “senses” the pump start level, the DC engine control starts the engine, which engages the clutch, which drives one of the pumps in the station. When the control senses “stop”, the engine is shut down.

The state-of-the-art auxiliary engine control protects the system against: high engine temperature; low oil pressure; engine over-speed; and engine over-crank. The system also includes a 24/7 timer that is able to “exercise” the DC system on a weekly basis.

Recapping the Options

	Additional Storage	Additional Power Supply	Portable Pump	Portable Generator	Permanent Generator	The Autostart
Costs	M to H	H	M	M	M to H	M
Power Outage Protection	y	y	y	y	y	Y
Control Failure Protection	Temporary	N	Y	N	N	Y
Motor Failure Protection	Temporary	N	Y	N	N	Y
	Additional Storage	Additional Power Supply	Portable Pump	Portable Generator	Permanent Generator	The Autostart
Immediate Response Capability	For a Time	Y	N	N	Y	Y
Space Efficient	Some options are	Y	N	N	N	Y

Engines are also available in a variety of fuels, including natural gas, LPG and diesel.

With its moderate cost, the *Autostart* has a combination of advantages that puts it way in front of any other option. Combine this with the advantage of using Gorman-Rupp’s self priming Super T and Ultra V series of sewage pumps, which are easy for operators to access, service and maintain, and you have a

system that will deliver years of operator friendly operation with automatic overflow prevention built-in.

We trust this paper has been thought provoking and of value to you. There are several other papers that Hydro Innovations can make available to designers of pumping systems. We also have information discs and presentations on these subjects.

Call us on 02 9647 2700 so you can have a real 'person' contact when you have ANY questions on pumps and their applications. We'll also arrange for you to receive priority advice on any new technical developments, new product releases, tips on cost savings and maintenance, etc. Our mission is to be a valuable resource to help YOU do your job better.

Hydro Innovations General Manager & author of the white paper series, Garry Grant