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Wastewater Treatment Applications for Generator Set Systems

1.0 Introduction:

Many elements of our infrastructure provide a critical service function in a modern-day society. One such service is the management of wastewater through treatment centers. Wastewater Treatment Systems are one of the most important services of municipalities. The process of treating wastewater utilizes many types of electrical powered equipment, particularly pumps. Loss of power would result in sewage spillage at lift stations resulting in an environmental impact and costly clean-up.

This Information Sheet discusses the type of generator systems within wastewater treatment plants, the specifications required for generators serving those applications, and codes they must adhere to.

2.0 Definition of Wastewater Treatment Plants:

The treatment process converts wastewater to an effluent that can be returned to the water cycle with minimal impact on the environment or directly reused – the latter is called water reclamation because treated wastewater can then be used for other purposes. The wastewater treatment plant (WWTP) can be called a Water Resource Recovery Facility (WRRF) or sewage treatment plant, where pollutants are removed or broken down through the use of screenings where grit and sludge are treated.

Wastewater Treatment Application Specs.	
Ratings	Prime power ratings to manage continuous loads.
Fuel	Diesel or gas, but some installations utilize bio-gas.
Generator End	PMG to manage high motor load starting requirements.
Enclosure	Weather and sound-attenuated enclosures for outside use.
Alternators	In many cases sized to specific high starting kVA requirements.
Air Cleaners	Heavy duty for operating in a dust laden environment.
Controls	Auto start capability. ATS for automatic transfer from utility.



Codes & Standards Specific to Wastewater Treatment Generator Applications (see details over)		
EPA	Tier 3 if defined as stationary standby application.	
	Tier 4 Final for mobile, trailer mounted, temporary power.	
NEMA	This standard covers switchgear boxes and electrical connections.	
NEC	For this application a minimum of "Class F" insulation for generator.	
Local Codes	Local codes will cover generator use, sound regulations, construction site requirements.	
UL Codes Underwriters Laboratories	2200	This covers entire generator set as a manufacturing standard.
	142	Applicable to above ground storage tanks to specify leak containment and spillage.
	891	Safety criteria applicable to electrical switchgear up to 600 volt systems.
	1008	(When ATS fitted) Standard transfer switches are tested and manufactured to.
	1558	For low voltage power circuit breakers.

To fulfill our commitment to be the leading network service provider in the Power Generation Industry, the USA, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

The installation information provided in this information sheet is informational in nature only, and should not be considered the advice of a properly licensed and qualified electrician or used in place of a detailed review of the applicable National Electric Codes and local codes. Specific questions about how this information may affect any particular situation should be addressed to a licensed and qualified electrician.

3.0 Lift Stations:

As gravity flow cannot move all the incoming wastewater, lift stations are necessary to move the wastewater from lower to higher elevations so that all the elements can reach the WWTP unimpeded. Using lift stations with pumps to permit the gravity flow will reduce the size of the sewage lines thus reducing pipeline costs. The adequate operation of all such pumps is therefore necessary to ensure safe and successful system operation. Most lift stations have the pumps installed below ground level in dry or wet wells (Diagram One), or a combination.

4.0 Potential Effects of Wastewater Pump Failures:

A reliable source of electrical power, usually the utility grid, is critical to the continuous operation of a wastewater treatment plant, hence the necessity of a standby generator system. Should power fail to the pumps, the following adverse results would occur:

- Potable drinking water could be contaminated requiring people to boil water before drinking
- Recreational facilities, such as water parks and pools would be shut down
- Have a negative impact on local economies within served area of the wastewater treatment plant
- Pollute the environment and wildlife within the impacted area
- Negative public opinion

Should the utility power fail, it is critical a reliable standby power system is in place to power critical components of the wastewater treatment facility.

5.0 Types of Standby Generator Systems Used in Wastewater Facilities:

Most pumping systems utilize one or more electric motor-powered pumps requiring an alternative electrical power should a utility outage occur. The specifying engineers have a number of options when selecting a suitable generator system to manage the electrical load:

5.1 Fixed Site Diesel Powered Generator Sets with Auto-Start:

These form part of the overall station design and are normally mounted over a steel base frame or skid, incorporating an adequately sized fuel tank with the unit secured on a concrete pad. The controls within an automatic transfer switch (ATS) monitor the utility feed and should this be interrupted, send an automatic start signal to the generator and transfers the load to the generator. This is normally reached within 10 seconds or less. Some stations incorporate a delayed start to allow the pumps to stop before restarting. When the utility comes back on-line, the ATS returns the pump loads to the utility. After a cool down period the standby generator set is shut down.

Cold start aids and other accessories will be called for depending on the actual site conditions.

Location of the generator system can be within the facility as an open generator or installed outside on a concrete platform. Outside installations would be within a weather protective canopy and in an area where noise abatement is in place, the canopy would be sound attenuated.

For fixed installations, FEMA recommends the generator and its fuel supply are installed above the floodplain. Adverse weather, such as hurricanes, are a reason for the failure of wastewater plants. Most damage from hurricanes is due to flooding.

5.2 Fixed Site Gaseous Powered Generator Sets with Auto-Start:

The specifying engineers may also specify gaseous powered sets. Perhaps the gas line is a more reliable source than diesel that has to be replenished during a prolonged utility outage. Also, some systems use bio-gas recovered from the wastewater plant to power the generator system.

5.3 Portable Generator Sets Powering Through a By-Pass Isolator Switch:

Some municipalities choose to bring in mobile generator set systems to supply power through a docking station when the main electrical power fails or is shut down for maintenance. Use of docking stations with rapid connect cable terminals is a good option for when a portable generator is delivered to the site.

6.0 Sizing Generator Systems to Power Wastewater Facilities:

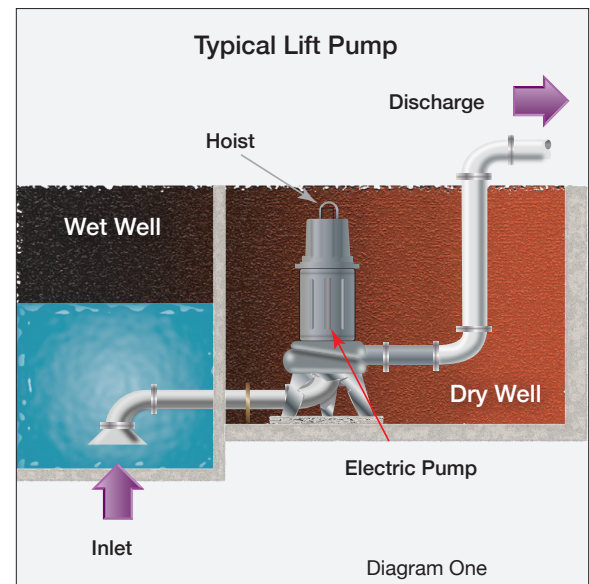
The generator should be sized to manage the starting kVA of the pumps and other inductive loads. Soft-starting devices will reduce starting kVA and size of the generator. The specifying engineer works with the generator supplier to ensure any soft-start devices will not impact the wave form of the generator end.

Generators are usually fitted with Permanent Magnet Excitation (PMG) generators to better manage the starting loads and subsequent voltage drops during start.

Most control relays and motor-starting contactors will tolerate a 35% voltage dip. The motor nameplate will detail the NEMA-based letter code (A to Z) that determines the starting kVA per HP required with a locked rotor. The specifier should ensure equipment meets applicable codes - both local and national.

7.0 Testing and Planned Maintenance Program:

Critical installations such as wastewater treatment plants can fall under NFPA standards written around regular, defined, planned maintenance. Testing of the standby stationary generator should be carried out under load to ensure performance when required.



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