Commercial Sump Pump Systems
An A to Z guide on best practices
by Brendan Bates

Introduction

According to the Federal Emergency Management Agency or FEMA, the number one natural disaster in the U.S. is flooding. Whether you are a homeowner or a business owner, a flood can wreak havoc on your property causing many thousands or millions of dollars in damage.

Many Americans understand what it takes to protect a residential basement from flooding; but when it comes to a commercial or industrial application there are drastic differences.

Commercial/industrial sump pump systems are a necessity for any commercial building with a basement. As you will read, commercial grade sump pump systems differ from their residential counterparts by the switching mechanism used, horsepower, control systems, style of pumps and more.

This article will discuss commercial and industrial sump pump system applications, types of pumps used, control systems, sizing of the wet well and variable speed pumping advantages.

Application Challenges

Many commercial/industrial applications requiring the installation of sump pump systems are large-scale facilities, which must be designed to evacuate subsoil drainage and/or surface water from the facility. Due to the large size of the facilities, the volume of water pumped is typically quite large. Because of this, a vast majority of these systems are designed as duplex arrangements, with two pumps in the same wet-well. If the application becomes excessively large, triplex or quadraplex systems can be installed as well.

Types of Pumps

Due to the large flow-rates being pumped, the physical size and weight of the pumps being provided becomes a major consideration. In order to facilitate ease of maintenance, the pumps provided are typically one of two different types: Floor-Mounted Self-Priming pumps, or Guide-Rail Accessible Submersible pumps.

Floor-Mounted Self-Priming pumps are the most common first choice among design engineers and facilities management engineers. The beneficial design of this type of pump allows the entire pump assembly to rest above the wet-well in a clean, dry, accessible location. All pump maintenance and repair is accomplished without the need to lift the pump, or remove the pump from the piping.

Guide-Rail Accessible Submersible pumps are sometimes selected, especially if the floor-space above the wet-well is required for other purposes, such as a walkway or hallway. These pumps are submerged within the wet-well; however, they are installed with guide-rail systems, which allow the personnel to simply lift the pumps using a chain or cable to remove them from the wet-well without the need to enter the hazardous-environment of the wet-well to disconnect the pumps from the piping.

Typical Control Systems Utilized

High flow rates typically require large pumps with 3-phase motors and starters. These systems are designed to operate the pumps on a constant-speed basis. The typical duplex installation utilizes a duplex wall-mounted control panel, which includes dual circuit-breakers, starters, current-overload protection, and an integrated control-logic system which monitors the level-switches in the wet-well to control the operation of the pumps. Capabilities which are essential to the control-logic system include lights which indicate the failure of each of the level-switches, the status of each of the pumps, the status of any faults or pump-failures, and a high liquid level alarm. The control-logic system must be designed to override any level-switch failure, and continue uninterrupted automatic operation of the system, until the switch

Variable speed controllers, such as this one from Metropolitan Industries, can significantly reduce costs, by reducing the size of the emergency standby generator, the sump, and the electrical cost associated with large-capacity pumping.
failure can be addressed. A majority of duplex pump systems utilize four level switches which are suspended at different elevations within the wet-well. The control-logic system uses the signals from these switches to start, stop, and alternate the pumps, as well as to signal a high liquid level alarm condition.

Appropriate Sizing of the Wet-Well

Pump systems which utilize motor-starters operate the pumps under constant-speed conditions. The pumps run at their rated speed, and lower the liquid-level to a particular level, and then turn off until the wet-well level rises again. The wet-well must be sized to retain a sufficient volume of water below the elevation of the inlet, in order to avoid 'short-cycling' the pumps. Short-cycling occurs when the pumps turn on and off in rapid succession. This type of operating condition often leads to a build-up of temperature extremes within the pump's motor. The build-up of heat, over an extended period of time, can lead to eventual motor damage, resulting in premature motor-failure.

In a majority of applications, it is important to design the wet-well to retain enough liquid below the inlet, to ensure that none of the pumps in the wet-well are allowed to start more than ten times per hour. For a typical duplex system, neither pump should start more than once every three minutes. Calculating the wet-well size can become a somewhat complicated process, because new liquid enters the wet-well while old liquid is being pumped out. An experienced pumping system sales-engineer or design-engineer should be consulted to verify proper wet-well sizing. It's important to note that proper calculation methods can sometimes result in surprisingly large wet-well requirements.

Variable-Speed Pumping Advantages

The recent development of relatively low-cost variable-speed control systems has ushered in the use of this technology to solve a number of common operational problems typically associated with large-scale project applications: The advantage of using variable speed control includes reducing wet-well sizes, reducing the effects of large flow-surges, reducing the size of emergency stand-by generator systems, and reduce the electrical-costs associated with large-capacity pumping:

In many cases, properly calculating the wet-well size can result in massive wet-well sizes which can tend to be very expensive to purchase and install; or may not fit well within the geometry of the facility's architecture. For these instances, it is often more logical and much less costly to utilize pump systems which use variable-speed control systems to operate the pumps. The use
of variable-speed controls allows the size of the wet-well to be dramatically reduced; in many cases to a size which is amazingly small when compared to the traditional wet-well sizing method. When using variable-speed controls, the speed of pumps is modulated: controlled in such a way that the discharge-flow of the pumps exactly matches the flow of the liquid into the wet-well as closely as possible. During this modulation of flow, which may last for extended periods of time during major rainfall events, the pumps may run semi-continuously, thus eliminating the possibility of short-cycling completely.

During major rainfall events when extremely large pumps are cycled on and off at constant-speed, the wet-well is evacuated in large 'surges' of flow. This not only requires that the wet-well be excessively large to avoid short-cycling, but the surge-flow out of these pump systems often tends to exceed the capacity capability of storm-sewer systems down-stream of the pumping system. This can cause the storm-sewer systems to become over-taxed and may result in surcharged sewers. This becomes a catastrophe during major storms; at a time when gravity flow from other locations on the sewer-grid can least afford to be hindered. Major flooding of these gravity sewer grids may be the unfortunate result. In most instances, variable-speed pumping will eliminate this phenomenon, by creating a nearly-constant continuous flow of water, instead of major flow-surges.

Due to the critical nature of most large-scale sump pumping systems, it is desirable, or possibly essential, to have an emergency stand-by generator system provided for the pumping system, to ensure continuous availability of electrical power during times when power-outages are more likely. The kilowatt requirement and size (and therefore the cost) of these large equipment items can be greatly reduced on variable-speed systems, due to a direct reduction or elimination of high inrush amperage loads on the electrical gear.

Large pumps which require large motors, tend to create large electric utility invoices. The use of variable-speed controls reduces the electrical demand of the system, and therefore will reduce the cost of operation as well. The bottom line is a vast majority of projects which use variable-speed control systems, greatly reduce overall install cost, due to the cost savings associated with the benefits outlined above.

Even the most critical of commercial or industrial sump pump applications can be successfully addressed with the appropriate and properly-engineered pumping equipment and controls.

For more information about commercial/industrial sump pump systems, contact Brendan Bates at 815-886-9200, ext 257 or by email at bbates@metropolitanind.com.
Commercial Grade Sump Pumps Provide the Answer to Flooding

Commercial grade sump pumps supply a vital need in areas where storms produce frequent flooding, or for businesses located in buildings with high ground water. Commercial grade sump pumps provide the extra muscle needed for excess water removal under flooding conditions.

Doug Shawler, technical service manager at Zoeller Company explains, “In situations where flow capacity is low, the construction and design of commercial pumps may be similar or the same as the residential pump model. However, commercial applications usually require higher volume pumps and stronger motors. Commercial pumps typically have 3-phase motors, higher flow capacities, larger solids handling, and larger inlet and discharge sizes.”

Construction

Commercial grade sump pumps operate at higher voltages than residential models. “Commercial/industrial sump pumps may require 3-phase power in 208, 230 and 460 volts,” Shawler warns.

Commercial-grade sump pumps usually use higher-quality components as well. “The longevity of operation associated with commercial grade sump pumps comes from the well-constructed contacts and high quality materials,” says Mike Bothwell, marketing communications manager at Hydromatic.

The exterior is typically high-quality cast iron, sprayed with epoxy or another durable corrosion-resistant coating. Internal components—including fasteners—are often made of stainless steel, and they’ll often have a vertical float switch (as opposed to the typical float arm on residential pumps.)

Many designs eliminate motor seals and rubber sealing boots. Fewer parts on any mechanical device can equal longer life since there are fewer mechanisms which can malfunction.

Shawler points out that commercial, municipal and industrial sump pumps are similar in design and performance. “Non-residential sump pumps have larger, more robust components to handle higher flow rates and larger solids,” he says. “Pump shafts, bearing systems and impellers have all been designed to give more performance over a longer period of time.”

Heavy-duty construction comes at a price, however. Commercial-grade sump pumps require a solid, balanced foundation; they’re never suspended from the ceiling or over the wet well.

This heavy-duty submersible effluent pump from Hydromatic demonstrates the high quality components used in commercial-grade equipment: The cutaway at left shows multiple strainer inlets, a bronze impeller mounted on a stainless steel shaft, top and bottom bearings, and an oil-filled motor.
**Maintenance**

But even the best-rated pumps need regular maintenance, and the more often the sump pump runs, the more often it needs to be checked.

Unlike residential sump pumps, which require little maintenance and are often sealed at the factory, commercial pumps should follow a regular maintenance schedule.

“Commercial pumps are designed to operate for many years,” says Shawler, “so service parts are readily available from the manufacturer. The operation and maintenance manual will provide accurate information about upkeep and service for sump pumps in this category.” It goes without saying that maintenance and repair, when required, should be performed by qualified pump mechanics. The pump manufacturer can provide a list of local authorized service providers.

In addition to the pump itself, the wet well or sump will need to be checked and occasionally cleaned out.

**Installation**

A typical residential sump pit is one or two feet wide and twice as deep. A commercial/municipal wet well or pump station may be six or eight feet across—or larger—and as deep as needed.

“A typical commercial or municipal storm-water pump station can be equipped with two, three or more non-automatic sump pumps,” Shawler explains. “The sequence of operation typically has the pumps alternating to promote equal wear on the pumps and motors and also increases reliability.”

Often, these pumps are installed “in series” so scheduled maintenance on one doesn’t take the entire pumping station offline. It also allows building managers to bring additional pumps online during times of severe rainfall to increase the pump station’s capacity.

A control panel houses the pump power circuits and pilot control system. The power circuits are used to supply power to the pump motors. The pilot control system is responsible for the on/off points during normal operation and can activate additional pumps when needed. Multiple float sensors connected to the pilot circuit are used to define the on/off levels, activate additional pumps, and/or activate the high water alarm.

The circuits in the pilot control system are separate from the pump power circuits. This separation isolates the pilot circuit from the high energy levels in the power circuit and results in increased reliability for control and monitoring of the pump station.

**Cost**

Larger, better-quality pumps, larger volumes of water, higher head pressures, and complex electrical systems may add a few thousand dollars to the cost of a building.

But Bothwell, at Hydromatic, says installing an industrial sump pump is “the best thing you can do for yourself and your business.”

Consider what many businesses lose when their basements flood: office supplies and furnishings, computers, servers, electronic files, client information, even the building itself.

Each building owner has to weigh the cost of a sump pump installation against the risk of catastrophic loss due to flooding.

“Catastrophes cannot be predicted, but can certainly be avoided,” Bothwell says. He claims a commercial grade sump pump from his company is a better form of insurance than a policy, since some insurance plans do not even include flooding in their coverage.

“Why not take preventive measures?” he asks. “Be a smart businessman and prevent the damage before it can even happen; buy an industrial sump pump.”

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*Photo courtesy Liberty Pumps*

This commercial sump pump located at the Brookfield Zoo near Chicago, shows a typical floor-mount application. The twin pumps allow one to be shut down for maintenance while the other stays online. In high-flow situations, they can both be switched on.

*Photo courtesy Metropolitan Industries*
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