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Facility Focuses on Motors to Prevent Energy Waste

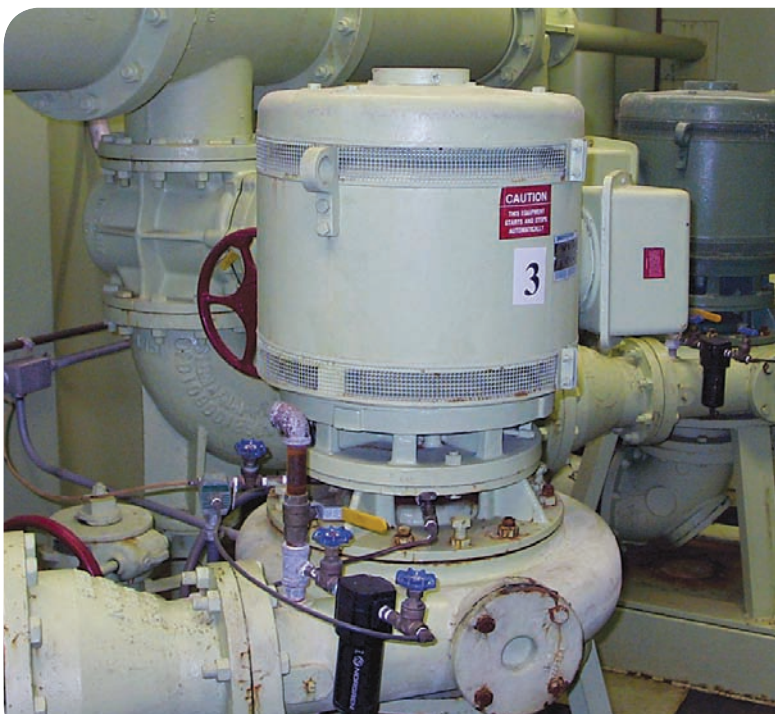
Sheboygan Regional Wastewater replaced its bi-metallic overload relays with overload and monitoring relays to detect conditions that could have resulted in motor or pump failure. The result was the ability to trend motor conditions in real time, and respond before failure occurred.

Adam Krug
Eaton

Sheboygan Regional Wastewater has five remote wastewater pumping stations throughout the city of Sheboygan, WI. These pumping stations are monitored remotely with a SCADA system that does not monitor motor load conditions. Therefore, maintenance personnel routinely go 30 ft. below ground to check the health of the pumps and motors.

"The average daily flow at the facility is about 11 million gallons," explains Dale Doerr, Sheboygan Regional Wastewater superintendent. "If we have a rain event or substantial snow melt, we can reach peak flows of 64 million gallons. This makes it essential for all our pumps to operate at capacity, to ensure that we can manage the increased flow levels and avoid adverse sewer problems for the 68,000 people we serve."

If a pump is partially restrained, the pump and motor would still run, albeit inefficiently, until the bi-metallic overloads eventually trip.



With its pumps typically located 30 ft. below ground, Sheboygan Regional Wastewater monitored its pumping stations remotely with a SCADA system, but the system was unable to detect motor load conditions. The facility turned to overload and monitoring relays to obtain real-time information. Source: Eaton

This happens if current draw is sustained at a level above 115% full load amperage (FLA) for a period of time.

Lift station retrofit

With this motor issue in mind, Doerr looked into using Eaton's Motor Insight overload relay. Eaton explained that these relays would allow Sheboygan Regional to monitor its entire system including line, load, and motor from a headquarters location, thus avoiding the manual pump checks. With real-time data, maintenance personnel would only need to be sent to a location when data suggested there was a problem.

Sheboygan Regional agreed to be a beta site and retrofit its Indiana Avenue lift station with Motor Insight relays, remote displays, and Modbus communication modules on the station's three 60 hp pump motors.

For Sheboygan Regional, it is critical that all the pumps are able to function at capacity to make sure that flow levels can be managed to avoid severe problems. When pumps were partially restrained, the pumps and motors would operate inefficiently until the overloads would trip. As a result, they routinely sent maintenance personnel to go 30 ft. below ground to check the pumps and monitors. Source: Eaton

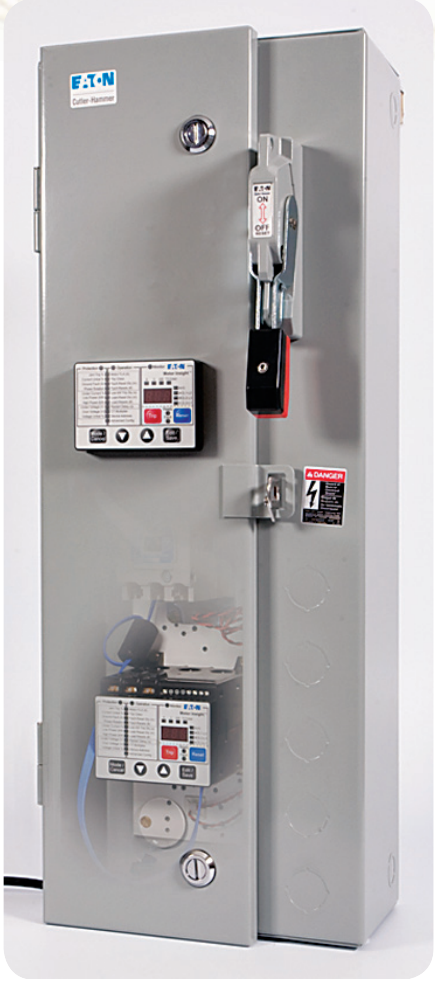
Impact of early detection

Soon after installing the devices, maintenance personnel noticed a problem with one of the pumps. While two pumps were drawing around 60 amps when flow was at its maximum level, the third pump was drawing closer to 90 amps. Sheboygan Wastewater's maintenance supervisor immediately noticed this higher current level and dispatched a maintenance technician, who then found a foreign object wrapped around the impeller of the third pump.

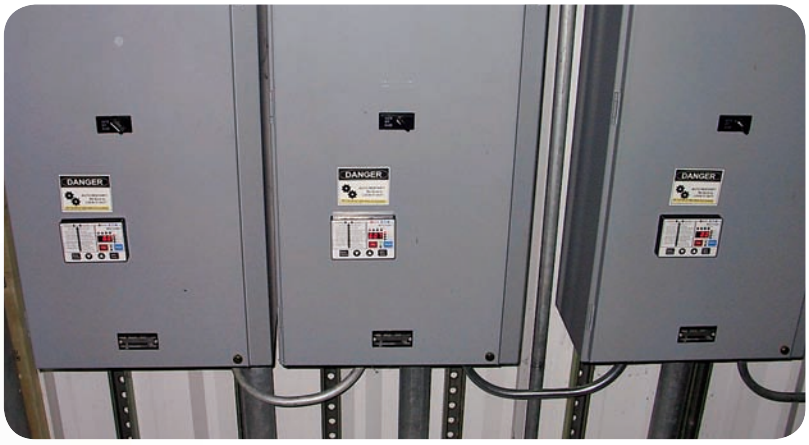
"Prior to the Motor Insight installation, the issue may have never been noticed because the facility only looked at its flow meter, which reports gallons per minute," says Steve Meifert, Sheboygan Regional Wastewater controls engineer. He noted that the flow was still the same for all three pumps.

In addition, Meifert noted that the increase in current caused by the obstruction may not have been large enough to trip the previously used bi-metallic overloads. Thus, the extra power draw could have gone on for an extended period of time without being detected, leading to large energy losses.

Meifert explains that, from a cost standpoint, had this problem gone unnoticed, it would have equated to: 30 amps x 480V = 14,400 Watt-hours or 14.4 kW-hrs x $0.104/kw-hr or to $1.50/per hour of unnoticed run time. If this condition had gone unnoticed for an extended period of time, this could amount to $252 in wasted energy for



An optional remote display eliminates the need to open the panel to configure the device. External interface is the same as on the base unit device (shown at the bottom of this composite photo). Source: Eaton



Sheboygan Regional retrofitted its Indiana Avenue lift station with Motor Insight relays, remote displays and Modbus communication modules on three 60 hp motors. Source: Eaton

one week ($1.50 x 24 x 7 = $252); $1,096 of wasted energy for one month; and $13,154 in wasted energy over a year.

The facility is currently using Motor Insight to monitor volts, amps, thermal capacity, frequency, power, and power factor. It has set alarm levels for overcurrent and undercurrent, and set a displayed fault for an overload condition. If the situation had been a more severe deviation from the normal operating conditions, the Motor Insight's load, line, or motor protection settings would have created a fault to protect the system.

Preventing equipment failure

In another instance, Motor Insight paged out an alarm of an undercurrent over the weekend. Maintenance personnel investigated, and found and removed a blockage in the check valve. Without Motor Insight, this issue would not have been detected until the next week when staff looked at the flow charts and realized that, when the pump was running, there was either no flow or only a partial flow.

Doerr said, "If the problem was not detected until Monday or Tuesday, you could possibly have a second pump come on to compensate, which would mean additional energy costs. Although pumps can run with a valve closed, the pumps can heat up, damaging the mechanical seals that rely on water as a cooling agent. This happens when the overheated pump heats up the water because there is nowhere for it to go, therefore it cannot cool the unit. The mechanical seal can then be damaged and lead to about $1,000 in repair cost, in addition to the cost of wasted energy.

"We now have the ability to find and resolve a situation before it becomes a failure," Meifert says. "For a bi-metallic to trip, an object like a piece of wood or chunk of asphalt would have to wedge in the sidewall of the pump. Since the motor would not be able to turn in that case, it would overload. To fix the problem, you cannot just go to the location and remove an inspection cover and remove the obstruction. You have to disassemble the motor and impeller, remove the foreign object and then reassemble the entire unit."

Doerr adds, "With Motor Insight's ability to monitor the pump motors and loads in our hard-to-access areas, Sheboygan now has the ability to trend motor conditions in real time that could have gone unnoticed for days and even weeks. The Motor Insight overload and monitoring relay allows us to send out maintenance personnel when a problem occurs, potentially saving us thousands of dollars annually." **ce**

Adam Krug is product manager of power protection at Eaton. For more information, visit www.eaton.com.