Recycled water cools welds, saves money at Johnson Screens

Johnson Screens hosted a MnTAP intern to research water and energy conservation opportunities. The intern improved the facility's water recycling system, and made other recommendations, saving the company $36,000 annually.

Company Description

Johnson Screens, located in New Brighton, Minnesota, is a fabricator of metal filters and screens. Since 1904, the company has been an innovator in screen fabrications.

Process Description

In a typical year, Johnson Screens uses over 10 million gallons of water per year for manufacturing processes such as cleaning and cooling welds. Screen fabrication machines (SFMs) use about 25% of that water to cool the equipment and welds. There is no standard for run time or amount of water used; rather, it is governed by the operators of the machines. SFM cooling water is typically running throughout the entire working day, while the water for weld cooling runs when a screen is being welded. Water used for weld cooling is on an adjusted flow based on the heat that needs to dissipate, depending on wire gauge and amperage.

The wire that enters the machine is cleaned with WD40 to increase the quality of the weld. However, the oil accumulates in the process water along with fine metal slag. Runoff water is captured in a trough in the floor and diverted to a sump pump near the water tank. The pump is operated by an automatic float that sends the runoff into a collection tank, which is part of the facility's water recycling system.

Once the water has entered the recycling system, it must be cleaned prior to being reused in the process. The recycling system has three major tanks that improve the water quality. First, a large tank collects debris heavier than the water at the bottom of the tank. The cleaner water flows over the top of this tank's wall into the next tank. The second tank removes oil by skimming off the top layer of water and oil; water from this tank flows into the third tank through an opening near the bottom of the tank. A float in the third tank adds tap water when necessary as the water is pumped back to the SFMs.

MnTAP intern Zach Zurbey (left) and MnTAP Technical Director Jeff Becker (right) inspect the centrifugal separator before installation.

Incentives for Change

Approximately 2.5 million gallons of tap and recycled water were used annually in the SFMs to directly cool the welds and welding equipment. As water levels dropped in the recycling system, tap water was added to the tanks before the water was directed back to the SFMs. Additionally, not all SFMs were connected to or using water from the recycling system. The large amounts of water being used presented opportunities for improvement through reuse and reduction.

Other equipment and processes throughout the facility were also using excess utilities, including energy sources. Significant amounts of electricity were used to support welding operations, air conditioning, lighting, various motors, and compressed air. The backup compressed air dryer was connected to a secondary air compressor that needlessly used approximately 26,000 kWh per year. The backup compressed air dryer only ran when needed, yet the secondary air compressor

Benefits Overview

Waste Reduction Option	Waste Reduced/ Materials Savings	Annual Cost Savings
Water recycling system upgrade	2,400,000 gal/yr	$9,700
Compressed air repairs and installations	338,000 kWh/yr	$18,200
Wash room ventilator improvements	22,000 kWh/yr	$1,200
Additional recommendations	150 lbs/yr 3,000 therms/yr	$7,500
Total		**$36,600**

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ran continuously. Also, Johnson Screens ran a ventilation motor in the wash room with a 100-hour run limit. There was an opportunity for the the company to improve the compressed air system and the room ventilator.

Johnson Screens wanted to reduce water and energy use at the facility. Therefore, the company hosted a MnTAP intern in 2009 who worked with staff members to explore opportunities to improve processes and upgrade to more efficient equipment. To help Johnson Screens meet their goals, the MnTAP intern focused primarily on water and electricity use.

Water Recycling Recommendations

In an effort to reduce water use at the facility, the MnTAP intern explored non-aqueous cooling alternatives for the SFMs, such as carbon dioxide snow, but found that water was the most cost effective method for cooling the welds. Therefore, the intern evaluated improvements and replacement opportunities for the water recycling system. Changes that incorporated the current pipes and water system were the most economical way to reduce the amount of water used.

The MnTAP intern recommended integrating all SFMs into the current recycling system and installing a centrifugal separator and belt skimmer to the recycling tanks. The centrifugal separator creates a vortex in the first tank that forces debris out of the water and into a chamber that gets manually dumped daily. The belt skimmer provides a more efficient separation of oil from the water in the second tank. The improved water recycling system conserves up to 2.4 million gallons of water per year, providing Johnson Screens with $9,700 in annual cost savings.

Energy Efficiency Recommendations

The compressed air systems at Johnson Screens offered multiple opportunities for the reduction of energy consumption. Through a compressed air audit, the intern determined that the air dryer for the backup air compressor ran almost continuously for about 8,000 hours per year, while its compressor only ran when the pressure of the system dropped to 90 psi or lower, which was about 550 hours per year on average. To conserve energy, a relay switch was installed on the compressed air dryer, so that it only runs when the backup air compressor is on. This improvement conserves approximately 26,000 kWh and saves $1,400 per year. The intern also found and fixed compressed air leaks, saving over 312,000 kWh and $16,800 annually.

In addition to making improvements to the compressed air systems, Johnson Screens implemented other energy efficiency recommendations. The wash room ventilator is a 5 HP motor that vents conditioned shop air to the atmosphere. After an examination of the unit with the facility's maintenance personnel, the intern found that the ventilator ran with a 100-hour run limit. The intern recommended that Johnson Screens use an existing timer to reduce the run time to 15 minutes, which is adequate time for necessary tasks to be accomplished. The reduction of the wash room ventilator saves Johnson Screens nearly 22,000 kWh and $1,200 per year, at no implementation cost.

Additional Recommendations

The intern explored opportunities to reduce waste and increase efficiency in other areas of the facility. The steam humidifier at Johnson Screens consumed about 3,000 therms and 15 gallons of a rust inhibitor chemical per year and required about $5,000 per year in maintenance costs. The intern recognized that boiler steam humidifiers can be replaced with simpler machines that require less maintenance at a lower cost. The intern researched alternative humidifiers and recommended Johnson Screens install a dry fog humidifier. The consumption of energy in the dry fog system is less costly than the natural gas and maintenance expense of the old system. Johnson Screens will save 3,000 therms, 15 gallons of chemical inhibitor, and $7,500 annually by switching to a dry fog humidifier system.

Results and Benefits

As a result of the MnTAP intern project, Johnson Screens implemented recommendations to reduce 150 pounds of waste, 2.4 million gallons of water, over 360,000 kWh, and 3,000 therms per year, with a total annual savings of $36,600. To further improve the water recycling process, the facility is currently investigating a CoMag water filtration system installation, which is an enhanced water polishing technology. As a result of their environmental improvements, Johnson Screens was awarded the Manufacturers' Alliance 2010 Manufacturer of the Year Award for sharing information and experiences that can help strengthen the local manufacturing community.

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For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <mntap.umn.edu>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's Intern Program.

This project was conducted in 2009 by MnTAP intern Zach Zurbey, a junior in automotive engineering technology at Minnesota State University Mankato.