Companies Reduce Energy Costs with Vapor Degreasing

Aqueous cleaning is a common and reliable cleaning choice for many companies. But one of the big disadvantages of water cleaning is the cost of electricity. Water cleaning systems use far more electricity that solvent cleaning systems, so companies with vapor degreasers have a cost-saving competitive advantage.

THE WATER MOLECULE

The energy inefficiency of water cleaning stems from the chemical properties of water itself. These molecular properties cannot be changed. This means there are limited options for equipment companies to improve the energy efficiency of their products.

Cleaning always is done with warm water. The term “specific heat” defines the amount of heat required to raise the temperature of a mass by one degree Celsius. The specific heat of water is 4.186 joule/gram °C, which is four times higher than modern solvents such as popular solvent chemistries. It takes a lot of energy to heat water.

After cleaning, the water must be dried from the newly-cleaned parts. Once a liquid begins to change phase — change from a liquid into vapor — the key characteristic is “the latent heat of vaporization.” And therein is another problem: it takes even MORE energy to evaporate water.

Specifically, water requires 970.4 BTU of energy to vaporize one pound of liquid. In contrast, MicroCare HFC solvents require only 67.1 BTU/pound. So it requires roughly 14 times more energy to evaporate water than an equivalent quantity of cleaning solvent.

SYSTEM DESIGN

Most aqueous cleaners are horizontal systems that move parts through a series of cleaning tanks. A typical aqueous system has one wash tank and several rinse tanks that require 10+ liters/minute of deionized water. These tanks can use about 8-10 kW of electricity per hour of operation. Most aqueous systems also have three or more scrubbing/rinsing tanks with ultrasonics. Each tank of ultrasonics adds another 1-2 kW of energy consumption.

The most common option for speedy drying is an “air knife.” A typical air knife easily will use 5 kW at each drying station. Hot air knives often are necessary which further increases energy consumption.
Aqueous cleaning cycles tend to be longer than vapor degreasing cleaning cycles. Cleaning cycles of 20-60 minutes are not uncommon while most vapor degreasers clean in 5-12 minute cycles, saving electricity.

Water pre-treatment and post-treatment systems also use large quantities of electricity. Deionizing and heating water requires at least 2-3kW of power or more for the pumps and support equipment. Assuming the system processes 20 liters of waste water a minute, even the most frugal waste water system is going to need another 3-5 kW of power.

At many companies the aqueous cleaners never are shut down because of the delays in re-heating. These systems use 2-5 kW of electricity, hour after hour, even when no cleaning is in process.

Aqueous cleaning machines also add heat to the factory, burdening air conditioning systems. A medium aqueous system will add 300,000 BTU/hour of heat to a room plus approximately eight liters of humidity that will need to be removed by the HVAC system. The vapor degreasing process doesn’t have this problem.

**DOING THE NUMBERS**

It’s clear that the fundamental chemical characteristics of water make it inevitable that aqueous cleaning will consume far more kilowatts to operate as the systems need to purify the water, clean the parts, dry the parts and then re-treat the water after cleaning. A general rule-of-thumb is that any aqueous cleaning system will use ten times the energy of a vapor degreaser of comparable capacity.

One company in the Midwest was a long-term aqueous user. It found massive electrical savings by switching to vapor cleaning. In fact, the local electrical utility was so pleased with the potential energy savings it funded 100% of the purchase of the new cleaning system. That company switched to Vertrel® SDG specialty fluid.

Another company, in Malaysia, switched from aqueous cleaning to solvent cleaning and reduced their energy costs 85%. This is a massive savings. That company is using MicroCare HSFR Ultra-Ionics cleaner.

With energy costs rising, it makes sense to give energy-efficient vapor degreasing another look.

**Products Mentioned in this Bulletin:**

Vertrel® SDG specialty fluid is a very strong degreaser and is a flagship product of Chemours Company (the new engineered chemical company that was just divested from DuPont Corp.). MicroCare HSFR Ultra-Ionics Cleaner is a medium-strength cleaning fluid optimized for electronics and other contamination where salt residues may be a problem. MicroCare offers a full range of cleaning answers for vapor degreasing, from very mild, plastic-safe chemistries to the strongest, most aggressive products for the most challenging applications. Call MicroCare today for the latest answers in critical cleaning.