OPTIMIZING YOUR SPRAY SYSTEM FOR MAXIMUM PERFORMANCE

Few areas of an industrial operation offer as much potential for dramatic savings, yet are as often overlooked as spray nozzle systems. Without proper evaluation and maintenance, your spray system can drain a surprising amount of money from your operations. The cost of wasted water alone can amount to tens of thousands of dollars annually even in a system with relatively minor performance problems.

But there are many additional, related expenses to consider: the cost of excess chemicals, the cost of wasted energy, the cost of extra scrap resulting from quality problems, the cost of unscheduled production downtime and, of course, the cost of unnecessary labour. In many cases, the true total can reach hundreds of thousands of dollars per year.

To understand the value of a spray optimization program, you need to get a handle on the reality of your own situation first. Fortunately, a fast and convenient calculator is now available online at www.spray.com/save to help you estimate the actual costs of sub-par spray nozzle performance in your own application. Plug in your own numbers to quickly determine how much money you could be saving.

Once you appreciate the significance of the issue, you're ready to begin the process of optimizing your spray system. A good way to start is by understanding the typical sources of spray problems.

Identifying worn spray nozzles

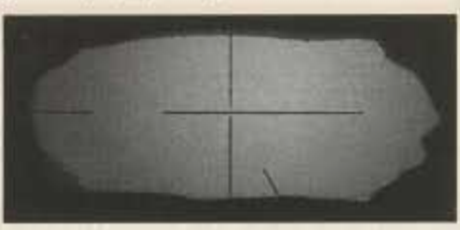
The human eye is a remarkable instrument, but it simply cannot give you the complete story when it comes to spray nozzle wear.

good spray tip

worn spray tip

These graphics illustrates the problem dramatically. The spray tip on the left is new. The spray tip on the right is badly worn and sprays 30% over capacity, yet the difference is totally undetectable with the naked eye. Only under magnification is the difference revealed – unmistakably.

good spray tip magnified



worn spray tip magnified

However, there are other tip-offs that something is amiss. You can watch for these clues: flow rate change, deterioration of spray pattern quality, spray drop size increase, lowered spray impact, quality-control issues and increased scrap, and increased maintenance time.

Causes of spray nozzle troubles

They may look simple enough, but in reality spray nozzles are highly engineered precision components that can wear over time or suffer damage during normal operations or even cleaning. The most common problems are erosion and wear, corrosion, high temperature, caking/bearding, clogging, improper assembly, and accidental damage.

Erosion and wear

Gradual metal removal causes the spray nozzle orifice and internal flow passages to enlarge and/or become distorted. As a result, flow usually increases, pressure may decrease, the spray pattern becomes irregular, and liquid drops become larger.

Corrosion

Spray nozzle material may break down due to the chemical qualities of the sprayed material or the environment. The effect is similar to that caused by erosion and wear, with possible additional damage to the outside surfaces of the spray nozzle.

High temperature

Certain liquids must be sprayed at elevated temperatures or in high-temperature environments. The spray nozzle may soften and break down unless special temperature-resistant materials are used.

Caking/bearding

Material build-up on the inside, on the outer edges or near the orifice is caused by liquid evaporation. A layer of dried solids remains and obstructs the orifice or internal flow passages.

Clogging

Unwanted solid particles can block the inside of the orifice. Flow is restricted and spray pattern uniformity disturbed.

Improper assembly

Some spray nozzles require careful reassembly after cleaning so that internal components – such as gaskets, O-rings and vanes – are properly aligned. Improper positioning can cause leaking and inefficient spray performance.

Accidental damage

Damage can occur if a spray nozzle is dropped or scratched during installation, operation or cleaning.

The spray checklist

A comprehensive maintenance program will help ensure optimal spray nozzle performance. The checklist that follows should become the foundation of your maintenance program.

[√] Flow rate

For centrifugal pumps, monitor flow meter readings to detect increases or collect and measure the spray from the spray nozzle for a given period of time at a specific pressure. Compare these readings to the flow rates listed in the manufacturer's catalogue or to flow rate readings from new, unused spray nozzles.

For positive displacement pumps, monitor the liquid line pressure for decreases. The flow rate will remain constant.

[√] Spray pressure (in spray nozzle manifolds)

For centrifugal pumps, monitor for increases in liquid volume sprayed. The spraying pressure is likely to remain the same.

For positive displacement pumps, monitor pressure gauge for decreases in pressure and reduction in impact on sprayed surfaces. The liquid volume sprayed is likely to remain the same. Also, monitor for increases in pressure due to clogged spray nozzles.

[√] Spray pattern

Visually inspect the spray pattern for distortion or changes in uniformity. Check the spray angle with a protractor. Measure the width of the spray pattern on the sprayed surface. If the spray nozzle orifice is wearing gradually, you may not detect changes until there is a significant increase in flow rate. If uniform spray coverage is critical in your application, request special testing from your spray nozzle manufacturer.

[√] Drop size

Drop size increases cannot be visually detected in most applications. An increase in flow rate or decrease in spraying pressure will affect drop size.

[√] Spray nozzle alignment

Check the spray coverage uniformity of the flat spray nozzles on a manifold. Spray patterns should be parallel to each other. Spray tips should be rotated five to 10 degrees from the manifold centerline.

[√] Product quality/application results

Check for uneven cleaning, uneven drying, and changes in temperature, dust content, and humidity.

If you determine that your current spray nozzles aren't performing as well as they should, it's time to replace them. Your own application and experience will determine how often nozzles should be replaced. Consult your spray nozzle manufacturer for suggestions on extending nozzle life and establishing preventive nozzle maintenance programs.

Proper spray system maintenance and automation can drive extraordinary savings.

Automate for superior performance

For many users, automation is the best way to optimize spray performance. Installing a dedicated spray controller equipped with software designed specifically for spray applications can significantly reduce your labour and materials costs, cut maintenance downtime dramatically, and minimize scrap.

A dedicated spray controller can monitor liquid pressure, atomizing air pressure, fan air pressure, spray gun cycle time, external conditions, such as temperature and humidity, liquid level, flow rates, conveyor speed, and spray system integrity.

Any deviations the controller cannot correct immediately can trigger alarms or shut down the entire system to prevent needless waste. Look for the following five features in an automated spray controller: that it is compact for easy integration into work areas, that it has the proper input/output mix, that it is designed specifically for spray and fluid applications, that it has a very fast response time (one millisecond or less), which is critical to precision spraying, that it has alarm priority, enabling trigger signals to interrupt the microprocessor when needed, and that it has software specifically designed for precision spray control.

Automated spraying systems can function independently or can be integrated with existing plant control systems if necessary. Through standard communication protocols like Object linking and embedding for Process Control (OPC), automated spraying systems can also provide remote control and remote monitoring capabilities – highly useful tools if you manage all equipment operations from a central point in your facility.

You can even choose to have all spraying system data displayed graphically on a touchscreen panel, putting information and control literally at your fingertips. This makes monitoring and evaluation a snap and dramatically reduces staff training time.

Profitable results from the real world

Numbers tell the story when it comes to the effectiveness of spray automation. These are just two results from companies that have made the move to dedicated spray control systems.

A major commercial bakery saves US$225,000 annually by automating its coating system to eliminate viscous liquid misting and overspray. The new system saves on material costs, increases safety, slashes maintenance time, and significantly improves the working environment for employees. Moreover, the increased precision and accuracy of the automated spraying system enables the bakery to produce an additional 2000 lbs (907 kg) of dough every day. That's literally a ton of increased productivity and, to top it off, the system paid for itself in just seven months!

A leading construction products manufacturer is on track to realize annual savings of nearly US$200,000 on a single production line by replacing a less-efficient method of cooling its products with an advanced spraying system. This manufacturer has purchased several automated spray systems.

The figures don't lie. If your production process involves spraying, then an intelligent Spray Optimization Program – featuring proper spray nozzle selection, maintenance and automation – can deliver significant savings in time, money and efficiency.

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