OPTIMIZATION & SUSTAINABILITY

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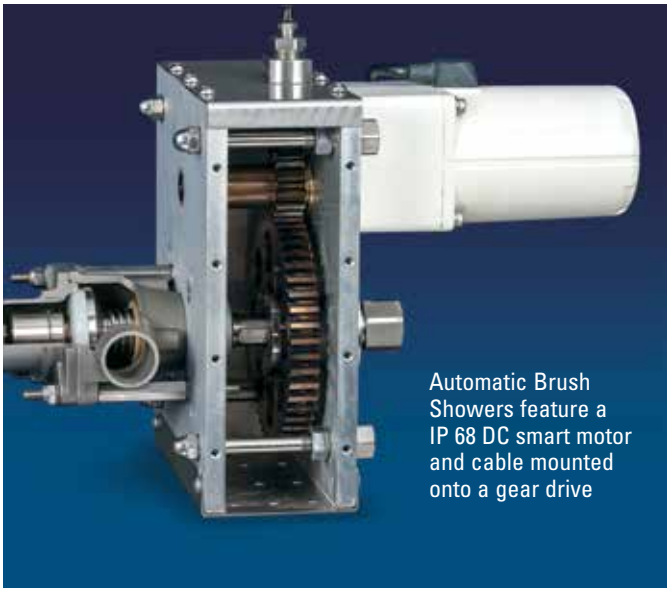
WAYS TO IMPROVE PERFORMANCE

MAKE SURE YOU'RE USING THE BEST PRODUCTS FOR THE OPERATION

Advancements in spray technology can help improve process efficiency and product quality while controlling costs. If you haven't recently evaluated the operations that use spray technology in your mill, you may discover new ways to improve pulping, washing, trimming, coating, converting and other operations. Start by reviewing the information below and then contact your local spray expert for more information.

AUTOMATIC BRUSH SHOWERS

Improve worker safety while implementing an affordable, automated solution. Automatic Brush Showers allow you to eliminate manual brush operation in existing applications and manual cleaning entirely in new applications. If you have manual brush-type showers, our control unit replaces manual handwheel operation, allowing brush activation via a single push of a button. Aside from gear lubrication twice a year, the Automatic Brush Shower requires no other maintenance time. In addition, the cleaning cycle occurs without interrupting operation, maximizing machine uptime.



Automatic Brush Showers feature a IP 68 DC smart motor and cable mounted onto a gear drive

AUTOMATIC SPRAY CONTROL

If your operations require precise, uniform application of costly coatings or moisture, an automated spray system may provide a quick return on investment by reducing waste and scrap. A wide range of dedicated spray controllers is available offering everything from simple on/off control to total automation. Typical benefits of spray control include:

- Quality is improved – under and over-application problems are eliminated, reducing scrap. Some spray controls can adjust the application rate based on changes in operating conditions such as line speed
- Overspray is minimized – chemical and coating waste are eliminated lowering operating costs and improving worker safety

Automated spray systems are being used in mills around the world in operations like these:

- Automatic activation of individual nozzles or a zone of nozzles based on paper width to eliminate scrap during changeover or downtime to change spray set-ups
- Precise control of moisture. The spray controller automatically adjusts the flow rate based on input from a moisture sensor to ensure proper wetting
- Defect detection. The spray controller triggers nozzles to spray based on input received from a vision system

PRECISION SPRAY CONTROL (PSC)

PSC helps reduce chemical use while ensuring uniform application of coatings. PSC is achieved by turning electrically-actuated spray nozzles on and off very quickly to control flow rate.

Benefits include:

- Reduces scrap caused by over- or under-application of coatings
- Reduces the use of costly coatings by applying the proper coating volume directly on the target
- Increases production – fast cycling (up to 25,000 cycles per minute) of nozzles keeps pace with high line speeds

AUTOMATED TANK/CHEST CLEANING PRODUCTS

If chests and tanks in your mill are being cleaned manually or via fill and drain methods, consider improving worker safety and reducing costs with automated tank cleaning equipment. Automated tank cleaning efficiently, effectively and safely cleans stock chests, black liquor storage chests, pulp towers and more. Some mills have reported saving up to USD$50,000 per year per stock chest by changing to automated tank cleaning equipment.

NOZZLES

New nozzle designs offer greater precision, better efficiency and longer wear life. Some examples are:

- Clog-resistant designs minimize performance problems and unscheduled downtime
- Quick-connect styles reduce maintenance time in yankee chemical showers or critical alignment applications
- One-piece, high-pressure ShowerJet nozzles simplify installation and removal by integrating the nut and gasket into the nozzle design

Making a small investment in time to review your showers and chest cleaning operations can result in big savings. You may discover new ways to improve efficiency and lower operating costs.

PERFORM REGULAR NOZZLE INSPECTIONS

Spray nozzles are at the heart of all the applications that use consumables throughout the mill. These seemingly simple components have a significant impact on performance and operating costs in moisturizing, cleaning, lubricating, edge trimming, bleaching, knock-off, gluing and dozens of other applications.

Like all precision components, spray nozzles will wear over time with use and should be monitored and maintained according to a schedule. It's important to determine the wear rate for your application. For example, shower nozzles that are used for trimming, separating the formed edge and creating a cleaner edge have a very high wear rate. When nozzles are worn, the patterns break up and can cause an irregular cut. A good maintenance program to replace the nozzles regularly will help prevent issues due to worn nozzles.

Even slight wear can cost tens of thousands of dollars annually in increased operating expenses. As spray nozzles wear, their orifices become larger and, at any given pressure, the flow rate increases. Worn nozzles that spray over capacity are wasting more than water. Electricity costs will rise due to excess pump operation and chemical costs will also increase.

HERE ARE TWO EXAMPLES THAT ILLUSTRATE THE EXPENSE AND WASTE ASSOCIATED WITH USING WORN NOZZLES.

EXAMPLE #1: DRYER SECTION SHOWER – One shower with 70 nozzles spraying a release agent on dryer felt

OPERATING CONDITIONS:

- System sprays 5 gpm (19 lpm) of a 1:20 aqueous solution of chemical at 40 psi (2.76 bar)
- Chemical consumption: .25 gpm (.95 lpm); $0.50 per gallon
- Operation: Three shifts, five days per week = 120 hours per week

15% NOZZLE WEAR = 15% INCREASE IN WATER, CHEMICAL & ELECTRICITY COSTS

Water expense:	$6,135
Chemical expense:	$53,820
Electricity expense:	$3,118
Total operating costs at 15% wear:	**$63,073**

Note: Does not include water filtration and recovery costs. All costs are in USD.

The cost to operate this one shower increases from $54,803 to $63,073. **If you have six showers in the dry end, your costs increase by $49,620 annually.**

Use our online Nozzle Wear Calculator to help expedite your calculation: www.spray.com

EXAMPLE #2: FABRIC CLEANING SHOWER – One shower with 72 high-pressure nozzles

OPERATING CONDITIONS:

- Nozzle size: 2.34 gpm (8.8 lpm) at 350 psi (24.1 bar)
- Operation: 60 hours per week, 48 weeks per year

15% NOZZLE WEAR = WASTE OF MORE THAN 4,000,000 GALLONS OF WATER ANNUALLY FOR ONE SHOWER

Increased capacity for the shower:	168.5 to 193.8 gpm (637.8 to 733.4 lpm)
Increased annual water consumption:	**4,367,002 gallons** (16,531 kiloliters)

There are 660,430 gallons of water in an Olympic-sized pool.

The water wasted each year from this one shower alone is enough to fill nearly seven Olympic-sized pools. Meet your commitment to reduce water consumption waste by replacing nozzles regularly.

Protecting the Environment Through Process Optimization

LOWER UTILITY BILLS BY IMPROVING BLOW-OFF AND DRYING EFFICIENCY

Many mills use pipes with drilled holes or slits for drying or blow-off. This approach consumes high volumes of costly compressed air. Use of compressed air nozzles or air knife packages powered by regenerative blowers are good alternatives and can dramatically reduce energy consumption.

COMPRESSED AIR NOZZLES

Compressed air nozzles convert low-pressure volumes of air into a targeted, high-velocity stream or flat fan air patterns and provide many benefits:

- Significant improvements in drying or blow-off by increasing impact on the target
- A significant decrease in air consumption compared to open holes or slits in pipes
- Reduced noise level

AIR KNIFE PACKAGES WITH BLOWER AIR

Using regenerative blowers and air knives eliminates the need for compressed air. Regenerative blower benefits include:

- Low noise operation
- Low maintenance
- Dependable operation and long wear life
- Low operating costs
- Improved drying due to warm air use

Air knives produce a uniform, high-volume, constant air stream along the entire knife length. The result is uniform, complete drying without blotches or spotting or highly efficient blow-off.

WindJet® Air Knife packages are customizable based on application requirements.

SIGNIFICANT SAVINGS OPPORTUNITY:

A single operation in a mill using a 4' (1.2 m) pipe with slits can cost	$350,000+ annually
Different approaches to drying and blow-off can cost just	$30,500 annually
A possible savings of more than	**$300,000 per year**

Note: All costs are in USD.

The cost of a new drying or blow-off system is quickly offset by the tremendous savings in operating expenses.

Your local spray expert can help you compare the options and costs of using compressed air nozzles versus air knife packages with blower air.

ASK FOR EXPERT HELP

Our local spray experts are available to help evaluate your operations and identify ways to improve performance.

Nozzle wear

In most cases, nozzle wear is difficult to detect because it isn't visible. The gradual erosion of nozzle orifices can't be seen when inspecting the nozzle or observing the spray. Measuring nozzle flow rate is generally required so actual flow rate can be compared to the rated flow rate. In other cases, the most effective way to determine wear rate and determine the optimal replacement interval is to evaluate the worn nozzles in our spray laboratories using specialized test equipment.

Complimentary visual inspections

- Occur while machine is running
- Include visual inspection of all showers and nozzles on the machine for obvious spray problems
- Include documentation of nozzle and shower locations
- Include a written report of inspection results along with recommendations for operational enhancements if appropriate

Complimentary nozzle audits

- Occur during shut-down
- Include an inspection of all nozzles on the machine; size and condition of nozzles are noted
- Include identification of nozzles that need replacement
- Can be completed in one to four hours depending on machine
- Include a written report with optimization tips, documentation on every nozzle and shower by location and maintenance recommendations

Contact your local spray expert today for on-site assistance.

PRACTICE PREVENTIVE MAINTENANCE

MAINTENANCE TIPS

Implement these tips into your maintenance programs to extend product life and minimize downtime.

PLUGGING

- Use proper water clarification devices
- Use strainers
- Be sure to specify nozzles with adequate free passage
- Conduct maintenance on a regular basis
- Use automated self-cleaning showers

CORROSION

- Specify nozzles in the appropriate materials: 316 or 303 stainless steel bodies and synthetic ruby or ceramic orifices depending on chemical concentration. Avoid iron and mild steel

New

Corroded

SCALE BUILD-UP

- Control hardness level of the water
- Use chemical additives as needed
- Conduct maintenance on a regular basis

SLIME AND ODOR

- Implement an effective biocide program to control biological growth
- Use chemical additives as needed
- Eliminate areas with stagnant water
- Conduct frequent wash-ups

CAKING

- Conduct maintenance on a regular basis

New

Caked

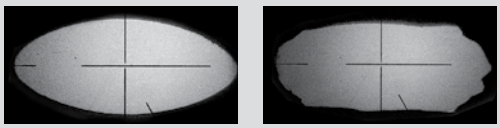
NOZZLE MAINTENANCE GUIDELINES

- Examine spray patterns and watch for changes in spray angles, distribution and heavy edges
- Wear may be hard to detect so go beyond visually inspecting nozzles. Check flow rate and spray pressure at a system level
- The nozzle orifice is precision engineered so be careful to avoid damage or replacement will be necessary
- Cleaning tools should be significantly softer than the construction material of the nozzles, such as a toothbrush, toothpick or brushes in the showers. Never clean the orifice with metal objects
- Soak nozzles in mild solvent to loosen debris for easier removal with proper equipment

NOZZLE WEAR IS DIFFICULT TO DETECT BUT WORTH THE EFFORT TO PREVENT WASTE

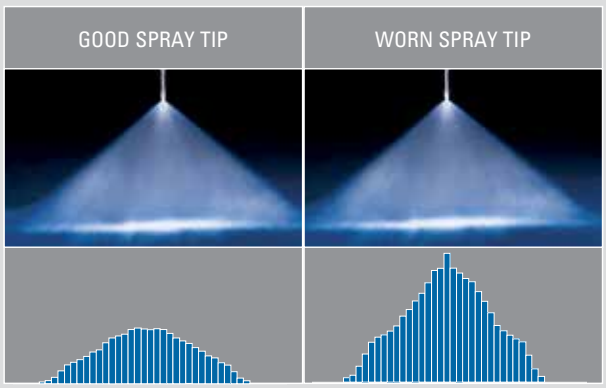
GOOD SPRAY TIP WORN SPRAY TIP

Nozzle tips show little visible difference. The tip on the left is new. The same size tip shown to the right has worn to the point at which it sprays 30% over capacity. Visual inspection shows little evidence of wear.



GOOD SPRAY TIP WORN SPRAY TIP

Orifice viewed through an optical comparator shows evidence of internal wear. A closer inspection and an analysis of spray collection data shown in the image on the right reveal the difference between the two tips.



Spray patterns of both tips show little difference. Spray collection in tubes gives dramatic evidence of 30% increase in capacity.

NOZZLE MATERIAL

Nozzles made from harder materials generally provide longer wear life. In addition to standard materials such as brass and stainless steel, more durable spray nozzles are often available in specialty materials, carbides or with ruby orifices. Nozzles with a synthetic ruby orifice are frequently used for web trimming because they provide up to 2000 times greater wear resistance than brass. In addition, the stream remains steady even in the early stages of wear. Many solid stream shower nozzles also are available with ruby orifices to help extend wear life and ensure proper cleaning of fabrics for longer periods of time.

To help determine if you should consider a change, the standard abrasion resistance ratios for many of these materials are listed below.

APPROXIMATE ABRASION RESISTANCE RATIOS

Spray Nozzle Material	Resistance Ratio
Aluminum	1
Brass	1
Polypropylene	1–2
Steel	1.5–2
Stainless Steel	4–6
Hardened Stainless Steel	10–15
Silicon Carbide (Nitride Bonded)	90–130
Ceramics	90–200
Carbides	180–250
Synthetic Ruby or Sapphire	600–2000

SELF-CLEANING NOZZLES OR STRAINERS

In many applications, orifice deterioration and clogging are caused by dirt particles in the sprayed liquid. This is particularly common in systems using continuous spray water recirculation. In an average production process, recycling of water enables approximately 17 uses before discharge, as opposed to one or two uses without recirculation.

Self-cleaning nozzles feature a piston-type design. When line pressure is low, the piston retracts to purge debris from the nozzle orifice. Self-cleaning nozzles are ideal for use inside showers and machines because of their compact design.

Strainers, or nozzles with built-in strainers, trap larger particles and prevent debris from entering the nozzle orifice or vane to significantly reduce wear.

TAKE ADVANTAGE OF OUR EXPERTISE

EXPERT ADVICE IS RIGHT WHERE YOU NEED IT – IN YOUR MILL BY LOCAL EXPERTS

Our specialty is finding ways to improve efficiency in operations and help you achieve greater profitability and sustainability. For example, one tissue manufacturer was able to develop a coreless tissue line that allows more sheets of tissue to be wound on each roll using an AutoJet® spray system. Eliminating the cardboard tubes and plastic end caps has generated an annual savings of over USD$40,000 and removed the tubes and end caps from the waste stream.

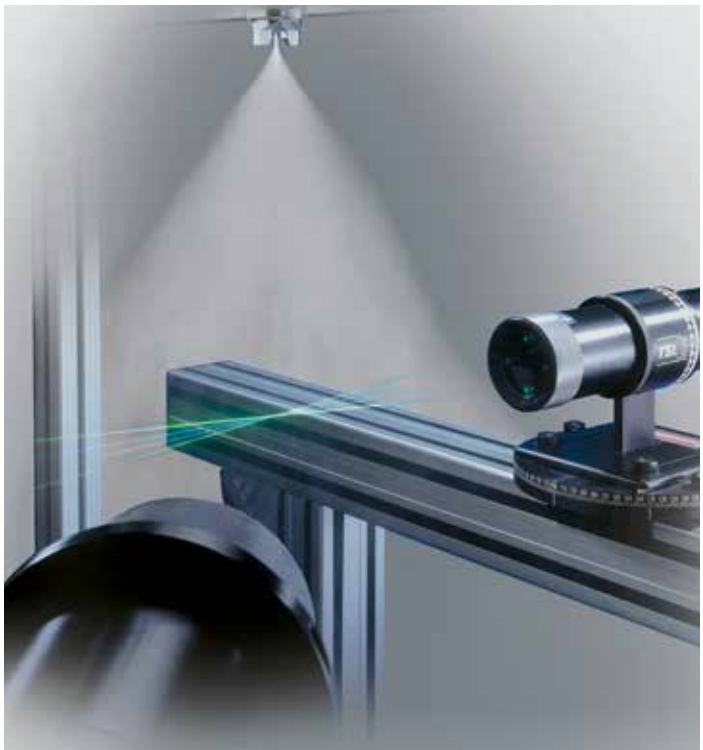
COMPLIMENTARY LUNCH AND LEARN WORKSHOPS

Select a topic, choose a date and invite your colleagues. We'll provide lunch and an informative 60-minute session. Popular topics include How to Reduce Water and Energy Use, How to Optimize Transfer Efficiency, Maintenance Workshops and more.

TESTS AND DEMONSTRATIONS AVAILABLE AT REGIONAL SPRAY TECHNOLOGY CENTERS

Throughout North America, we have several Spray Technology Centers. These facilities are equipped to conduct proof-of-concept tests and technology demonstrations. Seminars including live demonstrations on various topics are also conducted throughout the year. Schedules vary by region so contact your local spray expert for information.

TAKE ADVANTAGE OF OUR EXPERTISE



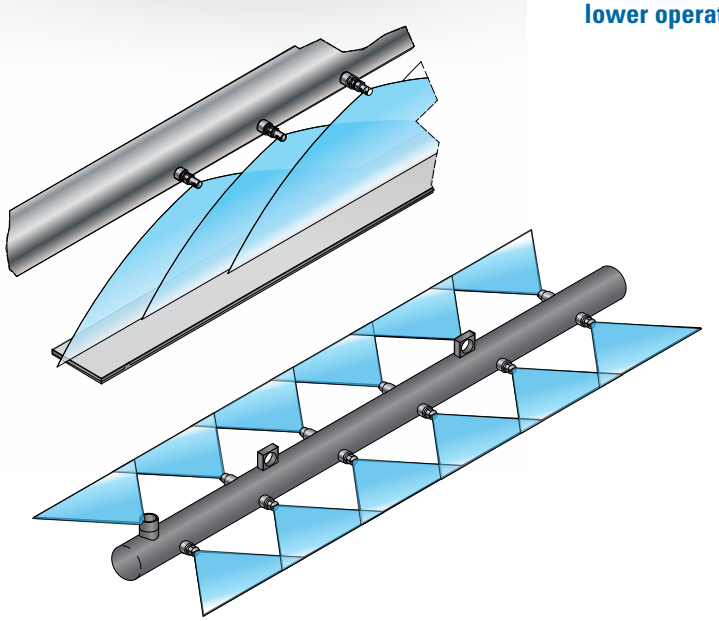
RESEARCH SERVICES THAT OPTIMIZE CHALLENGING OPERATIONS

Many spray operations require high precision and there is little or no margin for error. For example, if you're spraying glues, starches, adhesives or other coatings, selecting correct nozzles and determining optimal nozzle spacing, height and position can be challenging. In addition, nozzle clogging and frequent process interruptions are unacceptable so it is important to select the best nozzle for spraying viscous liquids. In our state-of-the-art spray laboratories, we can simulate your operating conditions using your chemicals/liquids to determine how to achieve the exact performance you need. Conducting spray performance testing prior to nozzle and shower selection in new applications or in critical operations helps ensure optimal performance.

BUILT-TO-ORDER SHOWERS AND HEADERS

When a standard shower doesn't provide the required performance or fit into your current environment, we can design and fabricate one that will. Built-to-order showers are available in a wide range of styles – brushless, brush-type, air atomizing, oscillating and more. Shower length, number and placement of nozzles, connections and more can be customized.

Let us show you why mills around the globe rely on us to help boost production, improve paper and tissue quality, lower operating costs, minimize waste and more.



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AUTOMATIC & AIR ATOMIZING NOZZLES

Air Atomizing

Air-Actuated Air Atomizing

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Electrically-Actuated Hydraulic PulsaJet

Fogging & Humidification

FLAT SPRAY NOZZLES

Black Liquor

FlatJet® Narrow Angle Spray

FloodJet® Wide Angle Spray

Quick-Change QuickJet® Standard Spray

UniJet® Standard Spray

Quick-Change QuickJet Wide Angle Spray

Quick-Change UniJet Wide Angle Spray

Quick-Change QuickJet Narrow Angle Spray

VeeJet®

GUNJET® SPRAY GUNS

HOLLOW CONE NOZZLES

SpiralJet Standard Angle Spray

WhirlJet Standard Angle Spray

WhirlJet Wide Angle Spray

SHOWER NOZZLES

DiscJet®

NeedleJet

ShowerJet Disc-type

Lock Rings

ShowerJet One-piece, High-pressure

Self-cleaning

SHOWERS

CHEST CLEANERS

TankJet®

Strainers

WEB TRIMMING

Adapters

Alignment Devices

UltraStream Nozzles

Trimming Feed Converters

SPRAYING SYSTEMS CO.'S TRADEMARK USAGE

The following is a current list of Spraying Systems Co.'s trademarks registered in the United States. Some marks are registered in other countries as well.

AirJet®
AutoJet®
DiscJet®
DripSafe™
FlatJet®
FloodJet®
FogJet®
FullJet®
GunJet®
MiniFogger®
QuickJet®
RotoClean®
SpiralJet®
TankJet®
UniJet®
VeeJet®
WashJet®
WhirlJet®
WindJet®

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