



COMPREHENSIVE SPRAY TECHNOLOGY SOLUTIONS FROM A SINGLE SOURCE

WE LOOK FORWARD TO HELPING YOU OPTIMIZE YOUR OPERATIONS INVOLVING SPRAY TECHNOLOGY.

Many of our showers and nozzles are specially designed for use in pulp, paper and tissue mills. Our products are optimized for transfer efficiency, impact, precision, water conservation, quick maintenance and more. We have the most comprehensive line of spray products available — and are always willing to make nozzles in different materials and sizes to ensure you get the performance you need. In addition to standard showers, our built-to-order showers are customized to your requirements.

- Use this catalog to research nozzles, shower options, chest cleaners and more. You'll also find additional catalogs on these product lines on spray.com:
 - Industrial hydraulic spray products
 - TankJet® tank cleaning products
 - Automatic & air atomizing spray nozzles
 - GunJet® spray guns
 - WindJet® air products
 - Advance your sustainability goals. Your local expert can offer solutions that reduce waste and use water and energy more efficiently.
 - Implement the best possible solution. By simulating your operating conditions in our spray laboratories or using Computational Fluid Dynamics (CFD) modeling, we can determine which shower designs and nozzles will be most effective. See page A5.
- For nearly 80 years, our sole focus has been on spray technology. We provide engineering and technical support to mills around the world from our ten manufacturing facilities and more than 90 sales offices.

Just give us a call at 1.800.95.SPRAY or visit spray.com to learn more.



TABLE OF CONTENTS

Pulp, Paper and Tissue Production	2	
Fabrication and Testing	A1	
Showers	B1	
Shower Nozzles	C1	
Web-Trimming Nozzles	D1	
Flat Spray Nozzles	E1	
Hollow Cone Nozzles	F1	
Automatic and Air Atomizing Nozzles	G1	
Chest Cleaners	H1	
Air Knife Packages and Air Nozzles	I1	
Spray Guns	J1	
Optimization Tips	K1	
Index	i1	



SOLUTIONS FOR MAKING PULP, PAPER & TISSUE

WOOD PREPARATION & PULPING

PULPING

- Testing and modeling using Computational Fluid Dynamics (CFD)
- VeeJet® flat spray nozzles
- WhirlJet® CF, CX and CRC hollow cone nozzles
- Black liquor nozzles

BLEACHING

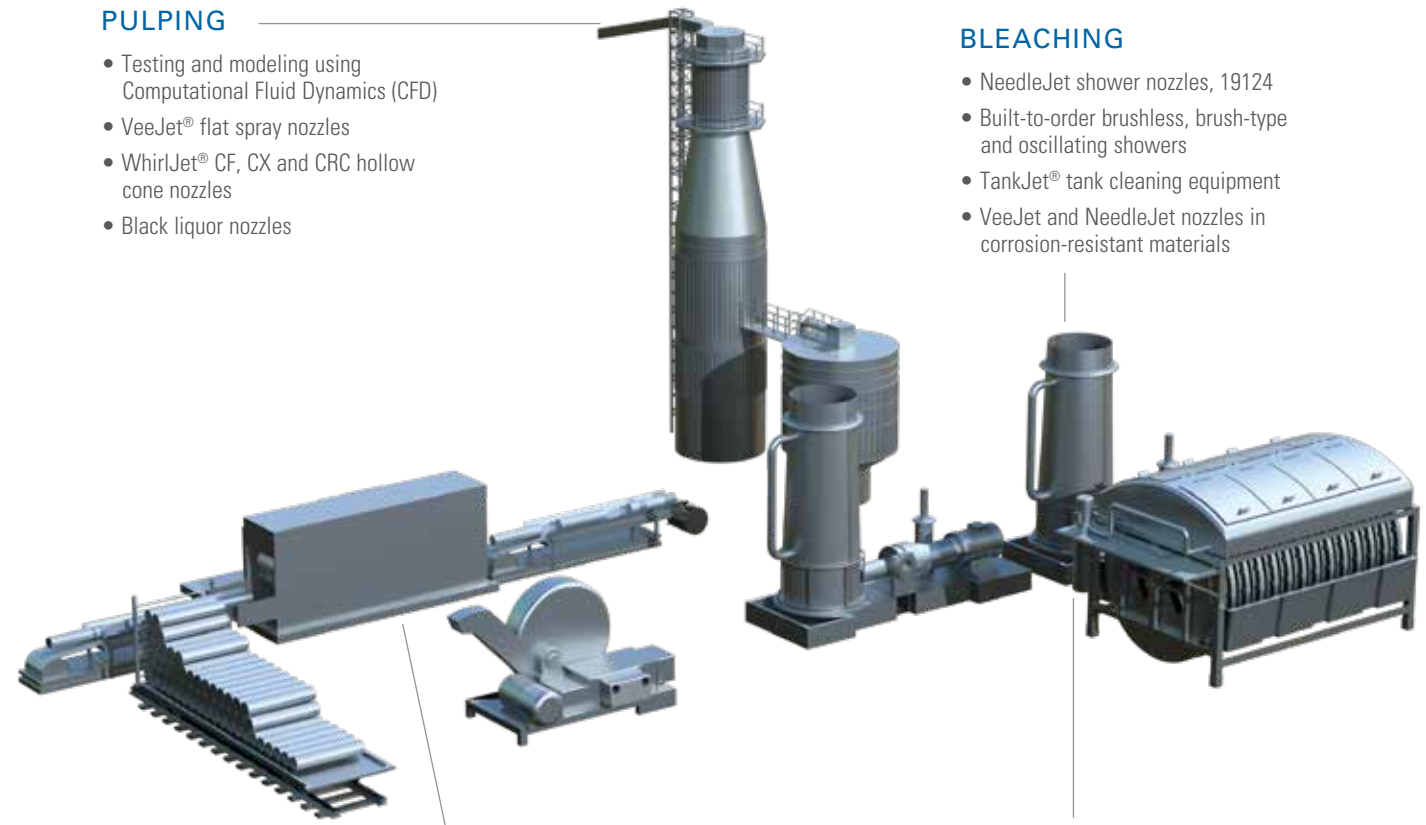
- NeedleJet shower nozzles, 19124
- Built-to-order brushless, brush-type and oscillating showers
- TankJet® tank cleaning equipment
- VeeJet and NeedleJet nozzles in corrosion-resistant materials

WOOD PREPARATION

- WhirlJet AX and BX hollow cone nozzles
- VeeJet and UniJet® flat spray nozzles
- Air atomizing nozzles

STOCK PREPARATION

- TankJet tank cleaning equipment
- Self-cleaning shower nozzles
- FlatJet® flat spray nozzles
- Rotoclean® FlatJet flat spray nozzles, 115220



PAPER & TISSUE PRODUCTION

TISSUE MAKING, DRY END

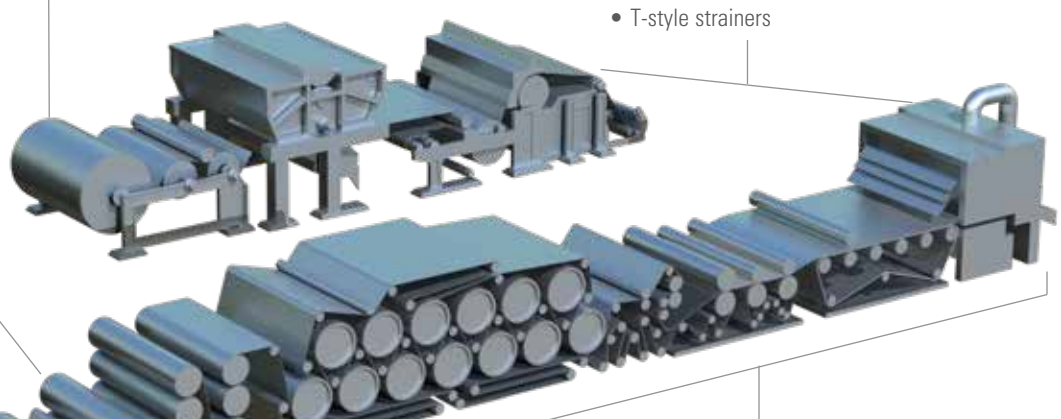
- Quick VeeJet® flat spray nozzles, QVVA and 58106
- Quick UniJet® flat spray nozzles
- Pipe-in-pipe showers
- Trimming nozzles for tail cutting

WET END

- ShowerJet nozzles
- NeedleJet nozzles
- FloodJet® flat spray nozzles
- FlatJet® flat spray nozzles
- VeeJet flat spray nozzles
- Trimming nozzles and alignment devices
- Built-to-order brushless, brush-type, pipe-in-pipe and oscillating showers
- T-style strainers

THE PAPER MACHINE, DRY END – SIZE, PRESS AND COATING

- Built-to-order air atomizing nozzles and showers
- Box-style moisturizing showers
- PulsaJet® precision coating showers
- WindJet® air nozzles



CLEANING/WASHDOWN

- GunJet® handheld spray guns
- TankJet® chest cleaners, 6353 and 27500
- WindJet air nozzles and air knife packages
- VeeJet spray nozzles

STORAGE

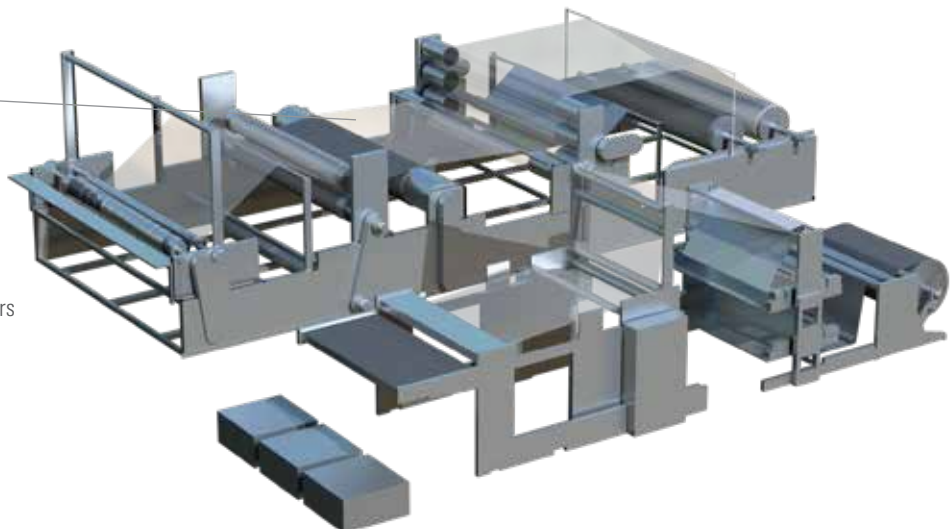
- YMF MiniFogger® III
- 45400 Humidification Unit
- DripSafe™ AirJet® Fogger nozzle
- 1/8JJ air atomizing nozzles



CONVERTING

CONVERTING

- PulsaJet precision coating showers
- Built-to-order air atomizing showers
- AutoJet® 1550+ modular spray system
- WindJet air nozzles
- Self-cleaning web lamination showers





UNIQUE FABRICATION, MODELING AND TESTING SERVICES HELP ENSURE OPTIMAL PROCESS QUALITY

The most critical components in any spray system are the spray nozzles. Choosing the nozzles that will deliver the precise performance required for your operation is essential to quality. Flow rate, coverage, transfer efficiency, precision and other spray characteristics can be the difference between defect-free paper and tissue and high waste and scrap.

Once the nozzles are selected, it is just as important to ensure the equipment feeding the nozzles is optimized. Inadequate or excessive pressure and flow in showers can result in paper breaks and quality problems.

BUILT-TO-ORDER SHOWERS

OVERVIEW

Tell us what you need. Chances are we've built it before. We design and build showers for a wide range of operations. From brushless or brush-type to air atomizing and oscillating, our extensive capabilities allow us to build exactly to your specifications and needs.

Some commonly used shower designs are:

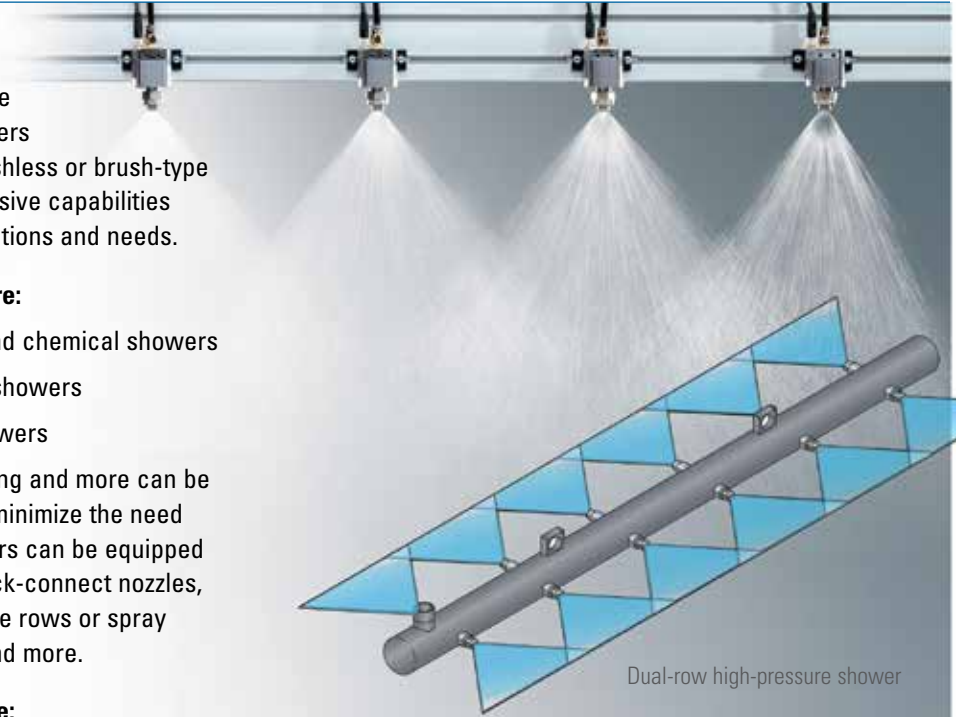
- Brushless and brush-type lubricating and chemical showers
- Brushless and brush-type pipe-in-pipe showers
- Enclosed air atomizing moisturizing showers

Connections, header length, nozzle spacing and more can be customized to fit your requirements and minimize the need for physical rework of equipment. Showers can be equipped with a wide range of conventional or quick-connect nozzles, special nozzle orientations, multiple nozzle rows or spray zones, air barriers or blow-off curtains and more.

Some examples of configurations include:

- Dual rows of nozzles to reduce the number of showers needed
- Customer-specified mounting to fit existing equipment
- Inner pipe inlet position based on existing liquid feed lines

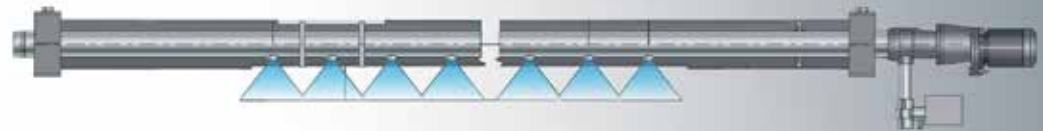
Let us help you optimize shower performance with showers and headers that will retrofit easily into your current operations.



Dual-row high-pressure shower



Two-zone manifold with air atomizing nozzles



ShowerJet automatic brush shower



Oscillating NeedleJet shower with integrated solvent shower

Ask your local spray expert for more information on our fabrication and testing services.

SPRAY CHARACTERIZATION

OVERVIEW

In operations where spray performance is critical, it is important to understand how factors like these affect performance:

- Process conditions such as pressure, temperature and variable line speeds
- The liquid being sprayed
- The placement and position of nozzles in relation to the target

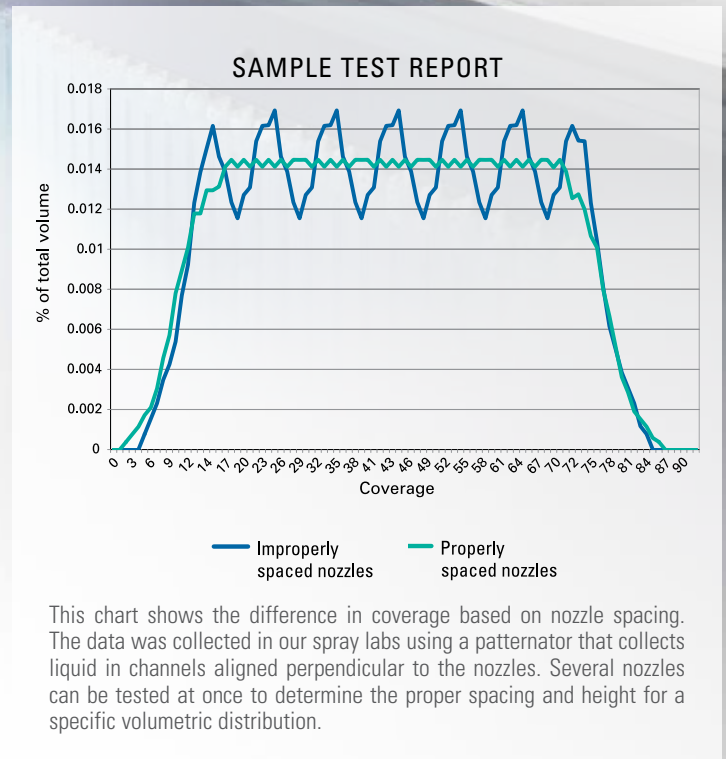
For example:

In many cases, experience and theoretical calculations can provide an indication of actual spray performance. However, testing in our spray labs determines actual performance and can eliminate costly specification mistakes or quality problems after installation.

In our state-of-the-art spray laboratories, we can adjust and/or test different nozzles and shower configurations to find the exact performance required for your operation.

Common tests include:

- Spray characterization
- Spray angle
- Drop size distribution
- Evaporation rate
- Spray impact
- Residence time
- Spray pattern
- Dwell time
- Spray coverage



**Ask your local spray expert for more information
on our fabrication and testing services.**

WEAR TESTING

OVERVIEW

Like any precision component, nozzles will wear over time. This wear is not always visible – especially in the early stages. However, even slight wear (10 to 15%) can cost thousands of dollars per month in wasted water, energy and disposal costs. In addition, you may experience quality problems since wear increases the amount of liquid being applied.

Shower nozzles that are even slightly worn will spray over capacity and waste precious water, chemicals and electricity.

We offer a free nozzle wear testing program for our customers.

Program details:

- Ship nozzles from various points on a single shower to us after they've been in use for several months
- Tests will be conducted in our spray labs to determine the wear rate
- Your nozzles will be returned to you along with recommendations for optimal replacement intervals

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

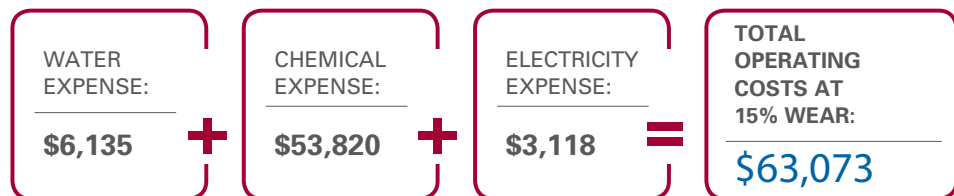
EXAMPLE #1: DRYER SECTION SHOWER

One shower with 70 nozzles spraying a release agent on dryer felt

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.

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



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

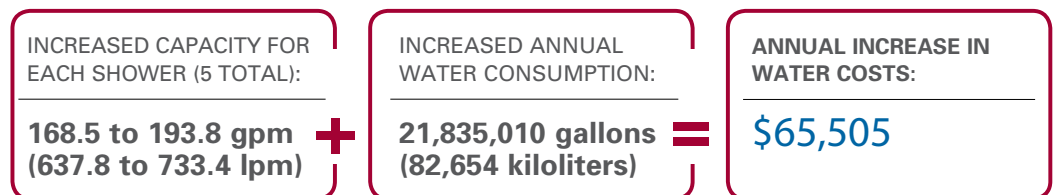
EXAMPLE #2: FABRIC CLEANING SHOWER

Five showers – each with 72 high-pressure nozzles

The increased capacity for just one shower increases water consumption costs by over \$13,000 annually. Multiply that by five showers and water costs quickly escalate to over \$65,000 a year.

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



Note: Assumes water cost of \$3.00 per 1000 gallons. All costs are in USD.

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

Ask your local spray expert for complete details on our complimentary nozzle wear testing program.



COMPUTATIONAL FLUID DYNAMICS (CFD) MODELING

OVERVIEW

When exact operating conditions cannot be replicated in our labs, we use CFD modeling to help achieve an optimized spray solution. Simulation provides more information about the key factors that impact the success of an application. Our models use known inputs collected in our spray labs. This proprietary data improves model accuracy and illustrates flow patterns, velocity, turbulence, droplet trajectories, internal system pressure and more.

Typical uses for CFD modeling include:

- Determination of optimal shower design and nozzle placement
- Transfer efficiency in high-speed web lines
- Turbulence analysis
- Internal flow characteristics of spray nozzles under specific operating conditions
- Gas cooling/conditioning analysis to determine lance and nozzle placement in ducts, scrubbers, furnaces, cooling towers and more



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