



Spraying Systems Co.
Experts in Spray Technology



Spray
Nozzles



Spray
Control



Spray
Analysis



Spray
Fabrication



Pollution Control Solutions Using Spray Technology

A Full Range of Solutions

Spray Nozzles, Lances and Systems

Outstanding quality, dependable delivery and competitive pricing

When it comes to spray technology used for pollution control, there's little room for error. Nozzles must be thoroughly tested, deliver the promised performance and be available with reasonable lead times. We excel in these areas... and that's why we are the preferred source in the global marketplace for spray products.

A closer look at the capabilities that separate us from other manufacturers:

Extensive product line

- More nozzle types, in more sizes, capacities and connections, in more materials.
- Standard lances and injectors readily available; custom lances designed and manufactured upon request.

Spray laboratories around the world designed for testing

- Our manufacturing facilities have large spray labs with state-of-the-art equipment. Test equipment and protocols are standardized to ensure product and performance consistency from all our manufacturing centers.
- Spray coverage, flow rate, drop size, spray angle and various quality control tests are conducted routinely and test data is available upon request. Specific customer requirements can be met as needed.

Global manufacturing of silicon carbide and other high performance and special materials

- We manufacture silicon carbide nozzles in our own manufacturing facility. Controlling the manufacturing process allows us to control delivery and offer more competitive pricing.
- HASTELLOY®, Stellite® and other high performance alloys are also often required. We frequently produce nozzles in these materials in addition to a wide range of stainless steels, polypropylene, PVDF and more.

A proven track record

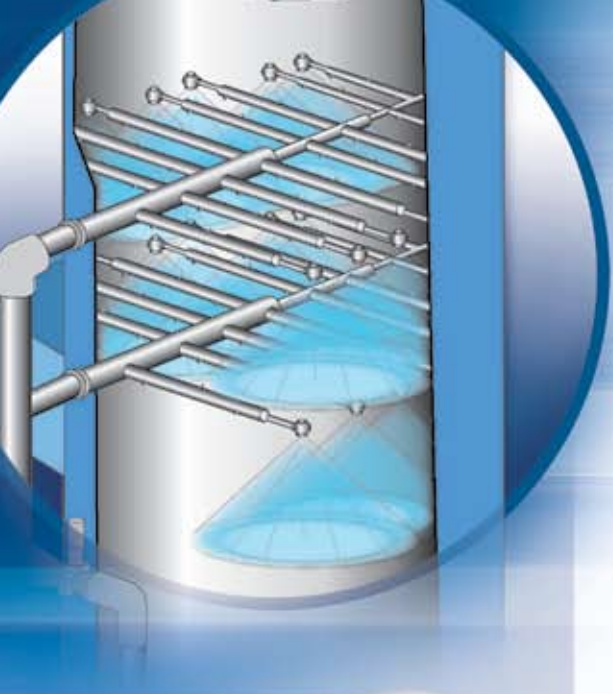
- OEMs, engineering firms, electric utilities, incineration facilities and other plants/mills with pollution control needs depend on us for a wide range of solutions. Once we learn about your requirements, we can provide a list of references so you can check our credentials directly with our customers.



QUICK REFERENCE GUIDE

Solutions	Applications	Page
 Silicon carbide single and dual orifice WhirlJet® nozzles	Wet flue gas desulfurization (FGD)	4-5
 Silicon carbide FullJet® nozzles	Wet FGD and acid gas treatment	4-5
 Standard FullJet nozzles in stainless steel and specialty alloys	Emergency quench, air oxidation and humidification	4-5
 SpiralJet® nozzles in specialty alloys	Emergency quench, air oxidation and SNCR NOx reduction	4-5
 Polypropylene and PVDF FullJet nozzles	Mist eliminator equipment washdown	6-7
 Maximum Free Passage (MFP) stainless steel FullJet nozzles	Mist eliminator equipment washdown	6-7
 FloMax® Series gas atomizing nozzles in special materials and stainless steel	SCR NOx reduction, chemical injection and gas conditioning	8-9
 ¼J Series gas atomizing nozzles	Semi-dry FGD, chemical injection and gas conditioning	8-9
 Custom gas atomizing injectors and lances	Semi-dry FGD, chemical injection and gas conditioning	8-9
 AutoJet® Gas Conditioning System	Gas cooling/conditioning	10
 Performance testing and documentation: Spray characterization, drop size distribution, spray velocity, spray pattern, spray coverage, spray angle, evaporation rate (residence and dwell time)		11





Dozens of Options to Optimize Wet FGD Operations

The requirements for nozzles used in FGD are extensive and include precise performance, trouble-free operation and long service life. But, that's where the commonality ends and why we have such a broad product line. Many customer requests can be satisfied by our standard product line. When that's not possible, we can usually quickly modify an existing product to meet specific requirements.

Choose from many nozzle types

- WhirlJet® nozzles provide a hollow cone pattern.
- FullJet® nozzles provide a full cone spray pattern.
- SpiralJet® nozzles are available with either a full cone or hollow cone spray pattern.

Choose from several materials

- Nitride-bonded silicon carbide is most widely used in FGD applications.
- Other high performance alloys such as HASTELLOY® and Stellite® are common as well.
- While the service life of our nozzles will vary based on installation-specific variables, most of our FGD nozzles operate for tens of thousands of hours in extremely harsh operating environments.

Single Orifice
WhirlJet Nozzles



Dual Orifice
WhirlJet Nozzle



SpiralJet
Nozzle



FullJet
Nozzle



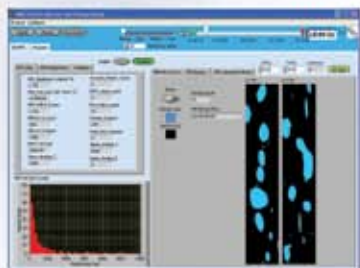
Silicon Carbide
FullJet Nozzle



Choose the configurations and performance you need

- Maximum free passage is part of our design standard for hollow cone FGD nozzles. Large internal flow passages and large inlet/outlet orifices ensure clog-free performance.
- Single and dual orifice options.
- Left- and right-hand inlet orientations.
- Connection sizes: range from 2" to 6".
- Wide range of connection types: standard and custom flanges, tapered edge, ABCO® and Victaulic®.
- Spray angles: 60° to 120°.
- Flow rates: from 30 to 660 gpm (6.8 to 149.9 m³/hr).
- All of our nozzles meet or exceed ASTM® E799-03 *Standard Practice for Determining Data Criteria and Processing for Liquid Drop Size Analysis*. We also routinely provide nozzles designed to produce customer-specified drop sizes along with complete drop size documentation.

For more information on our testing protocols that document performance, see page 11.



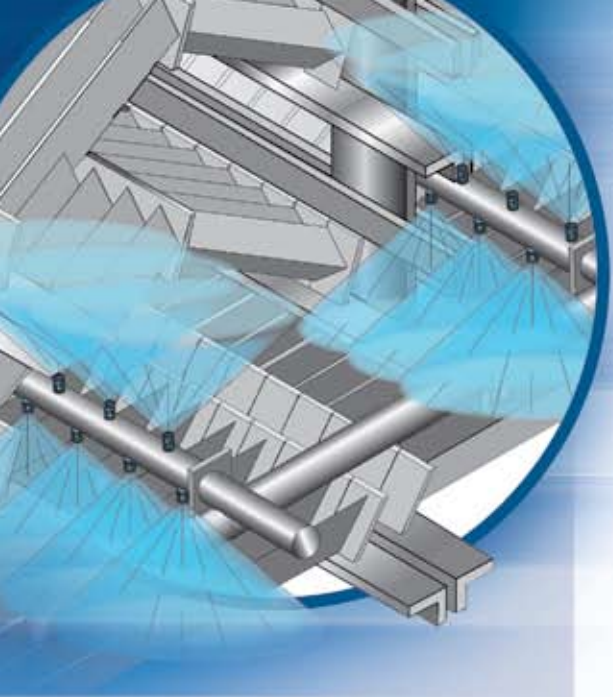
An optical array probe sizes and counts drops in a spray to determine velocity. A data analysis routine converts the raw data into a meaningful drop size distribution.



FGD nozzles: Timely delivery, competitively priced

The addition of silicon carbide manufacturing capability to our plant in China has significantly shortened lead times for product delivery as we now have multiple manufacturing locations able to produce nozzles for FGD. This increased capacity has also allowed us to be cost-competitive on all our silicon carbide products.





Excellent Spray Distribution Provides Superior Cleaning of Mist Eliminator Equipment

Uneven cleaning of mist eliminator equipment has serious consequences and yet is a fairly common problem. Hard residue often forms on the chevrons, reducing the area for the gas to pass through. These restricted openings will ultimately compromise the performance of the scrubber and the mist eliminator. One of the best ways to avoid build-up is to use spray nozzles for washdown that provide even, thorough cleaning of each chevron.

FullJet® spray nozzles minimize clogging and reduce maintenance time

- Unique vane design produces a true and stable full cone spray pattern that provides superior cleaning.
- Large free passage in some designs minimizes clogging and helps ensure the integrity of the spray pattern.
- Reduced clogging results in less maintenance time.

Specifications:

Molded FullJet nozzles:

Materials: available in PVDF or polypropylene with a PVDF vane for excellent chemical and corrosion resistance.

Capacity range: from 2.4 to 26 gpm (9.1 to 98.4 l/min).

Spray angle: 70°, 90° and 120°.

Maximum Free Passage (MFP) FullJet nozzles:

Materials: 316 stainless steel and high-performance alloys.

Capacity range: from 1.4 to 57 gpm (5.3 to 215.8 l/min).

Spray angle: 60°, 90° and 115°.



Molded FullJet Nozzles

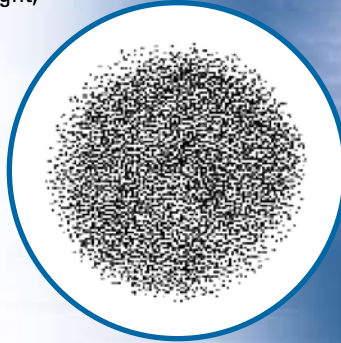


MFP FullJet Nozzles

Spray pattern comparison

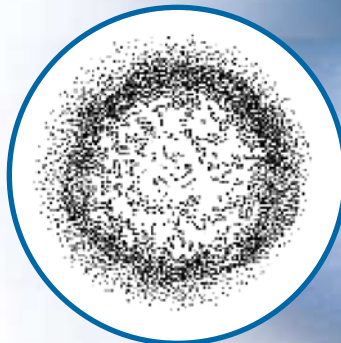
Spraying Systems Co. MFP FullJet® Nozzles

In applications requiring even coverage like cleaning mist eliminator equipment, there is no better choice than our MFP FullJet nozzles. As shown at right, these nozzles produce a very uniform spray pattern across the entire coverage area.



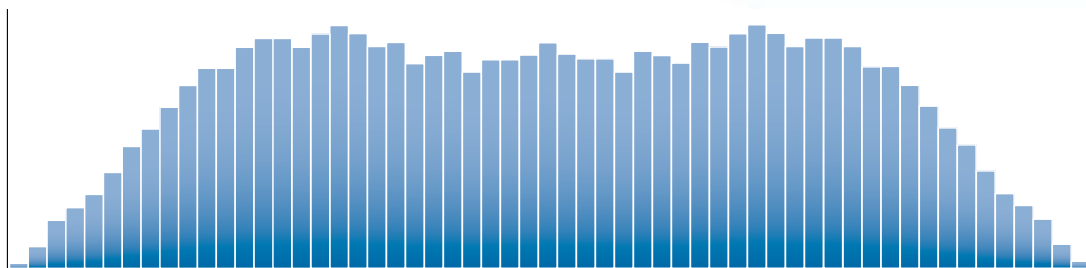
Competitor large free passage nozzles

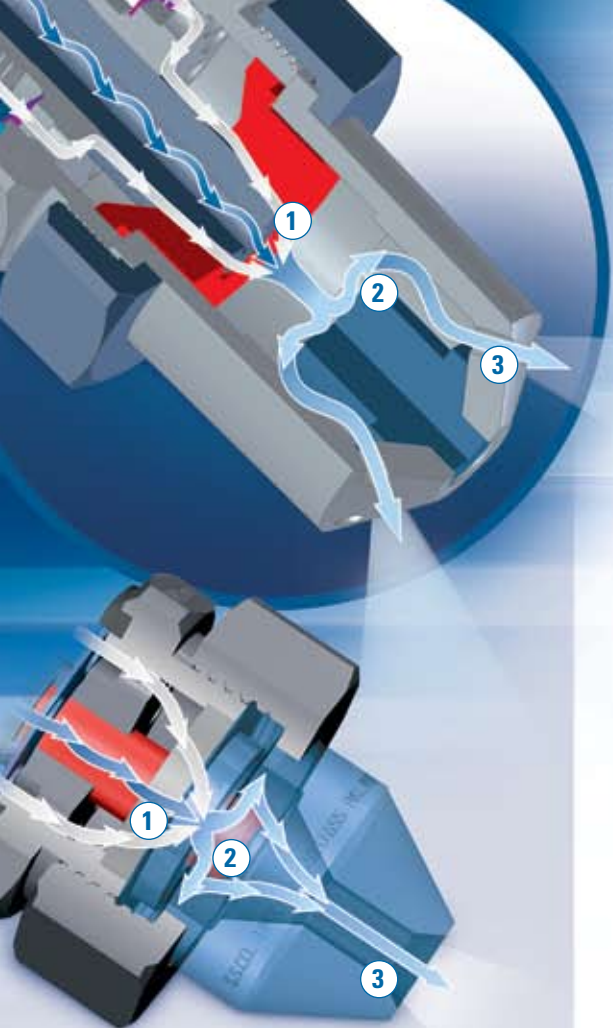
Competitive full cone nozzles tend to have very thick edges and light centers as shown at right and produce sprays similar to hollow cone patterns. When these nozzles are mounted on a header in a mist eliminator, the result is uneven, spotty cleaning due to the poor quality spray pattern.



MFP FullJet sample spray distribution

This data was collected in our spray labs using a spray patternator that collects liquid in channels aligned perpendicular to the nozzles. The graph illustrates the uniformity of the spray and how even coverage is achieved when nozzles are placed on a header.





FloMax operating principle

- ① Stage One: Primary Fluid Breakup
- ② Stage Two: Secondary Fluid Breakup
- ③ Stage Three: Final Mixing



Nozzle, Injector and Lance Solutions for Precise Performance in SCR NO_x Reduction and Chemical Injection

When it comes to effective removal of SO_x, NO_x and mercury, performance of the spray nozzles is critical. Improperly sized drops can cause wetting and incomplete absorption. Tight control of drop size and spray coverage is required – and that's why our FloMax® nozzles are used for removal of a wide range of pollutants.

Patented multi-stage atomization processes result in superior FloMax nozzle performance

FloMax nozzles produce very small drops using minimal compressed air and energy. These small drops reduce the dwell time required for complete evaporation and reduce the risk of wetting.

FloMax nozzle benefits:

- Operates with air, other atomizing gases and steam.
- Uniform spray pattern.
- Significantly higher turndown ratios than standard gas atomizing nozzles for maximum operating flexibility.
- High flow rate per nozzle so fewer nozzles can be used.
- Choice of materials to resist harsh environments – HASTELLOY®, Stellite®, reaction-bonded silicon carbide and stainless steels are widely used.
- Large free passage reduces the risk of clogging and allows use of lower cost water sources such as river water, basins and run-off water.
- Durable, long-wearing parts that require little maintenance.
- Maintenance is fast and easy and requires no special tools.

Specifications:

FloMax A Series:

Capacity range: 0.5 to 30 gpm (1.9 to 113.6 l/min).

Spray angle: 55° and 20°.

FloMax X Series:

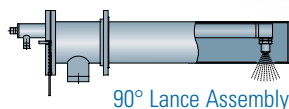
Capacity range: 0.03 to 1.5 gpm (0.11 to 5.7 l/min).

Spray angle: 20° (55° available in some sizes).

Standard and custom injector and lance options facilitate installation, ensure optimal nozzle performance

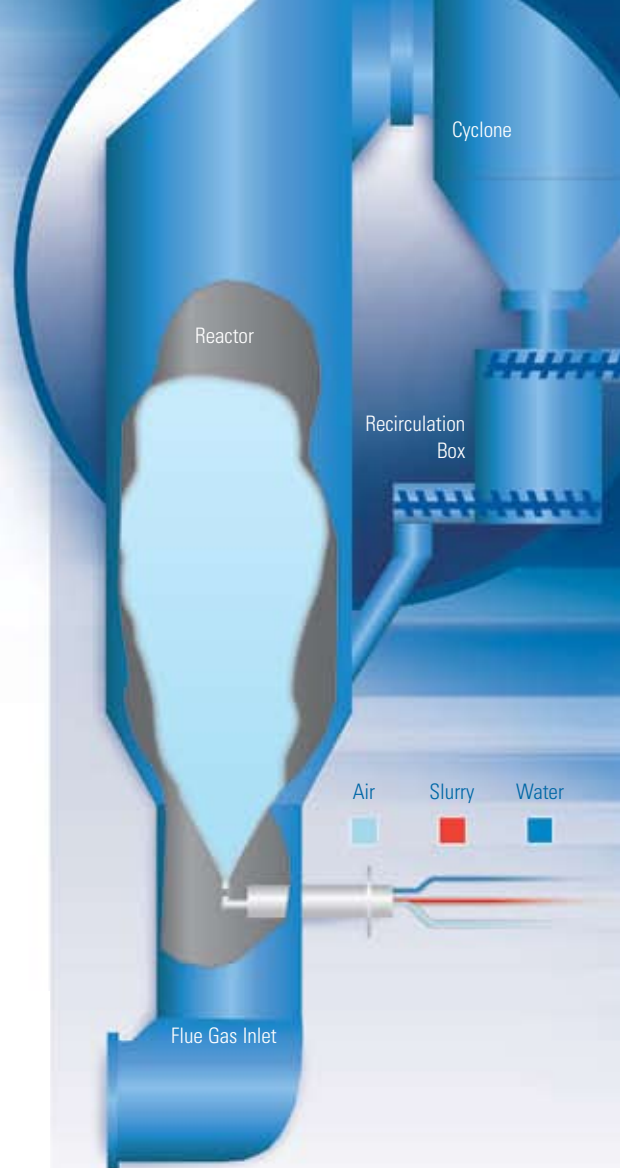
FloMax® lances

- Choose from 0°, 45° and 90° configurations.
- Standard materials of construction.
- Lightweight.
- Quick-release or bolt-on flanges.
- Optional adapters, cooling jackets, purge tubes and protective tubes.
- Quick delivery.



Custom injectors and lances

- Custom designs to meet challenging physical spaces.
- Special materials/coatings to withstand high-temperature, erosive and corrosive environments.
- Insulated, water- or steam-jacketed and recirculated designs for high temperature applications.
- ASME® code compliance – B31.1, B31.3 and more.



A mixture of water and lime slurry is fed to the injector in the base of the reactor. High velocity flue gas and the sorbent spray are fed to the injector simultaneously. The sorbent cools and neutralizes the gas prior to the cyclone. The partially reacted sorbent is recirculated and fed back into the injector to reduce sorbent consumption.

1/4J Series gas atomizing nozzles ideal for small volume applications

In some low flow NOx control applications, our 1/4J gas atomizing nozzles are an economical alternative. 1/4J nozzles are well suited to applications where clog resistance, anti-buildup, lightweight construction and quick changeout are important.

Specifications:

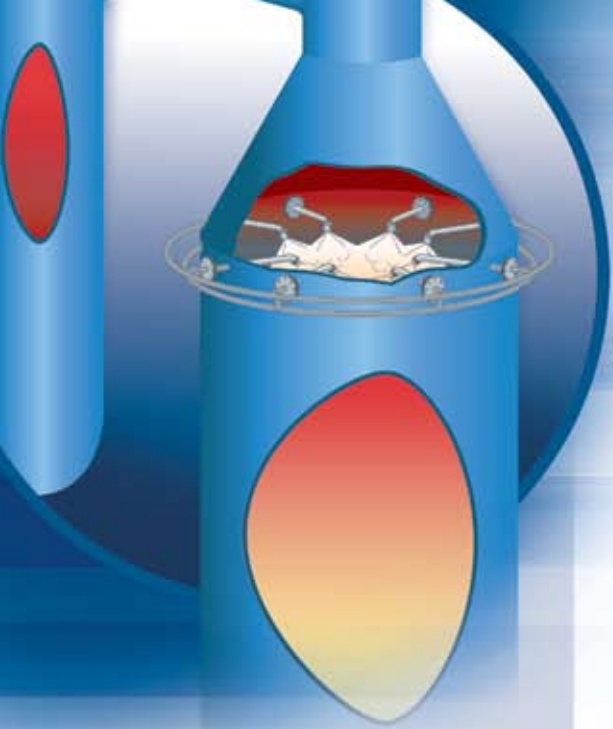
1/4J Series:

Capacity range: 0.46 to 72.17 gph (1.74 to 273.19 l/hr).

Wide range of spray set-ups.

Materials: 316 and 316 stainless steel and HASTELLOY® C.





Reduce Emissions, Boost Production by Precise Control of Gas Temperature and Volume

The nozzles of choice in gas conditioning are our FloMax® A Series (described on page 8). FloMax nozzles outperform all others when it comes to drop size, evaporation, spray pattern uniformity and efficiency. And, that's why FloMax nozzles are the key component in our automated gas conditioning system.

Our turnkey system from AutoJet® Technologies, the systems division of Spraying Systems Co., optimizes the performance of FloMax nozzles and controls all other system components including pumps, sensors and other hydraulic and pneumatic components. The AutoJet Spray Controller monitors and automatically adjusts the closed-loop system. By regulating liquid and air flow to the nozzles based on data gathered from temperature sensors, the controller offers the highest level of reactivity and accuracy for the system.

AutoJet® Gas Conditioning System benefits

- Plug and spray convenience – the spray controller is pre-programmed ensuring quick set-up.
- Total automation minimizes labor and downtime.
- Multiple lance zones can be configured to allow greater turndown of flow rate under variable system conditions.
- Reliable operation is ensured by emergency modes, system redundancy, intelligent fault sensing and more.
- Reduced energy costs are the result of Variable Frequency Drive (VFD) pumps that provide proportional liquid regulation.
- Easy integration with other systems.
- Single source convenience – eliminate integration issues and the need to contact multiple suppliers if you have questions.



AutoJet Gas
Conditioning System



FloMax A
Series Nozzle

Eliminate Guesswork with Performance Testing and CFD

In pollution control applications, there's no room for guesswork. That's why our spray laboratories are so critical to effectively serving customers with sophisticated applications.

To assist with nozzle specification, we routinely conduct testing in our labs to determine the optimal drop size/distribution and best nozzle placement, spray pattern type and angle.

When performance testing isn't feasible, we use Computational Fluid Dynamics (CFD) and proprietary drop distribution functions to determine spray performance in ducts or cooling towers.

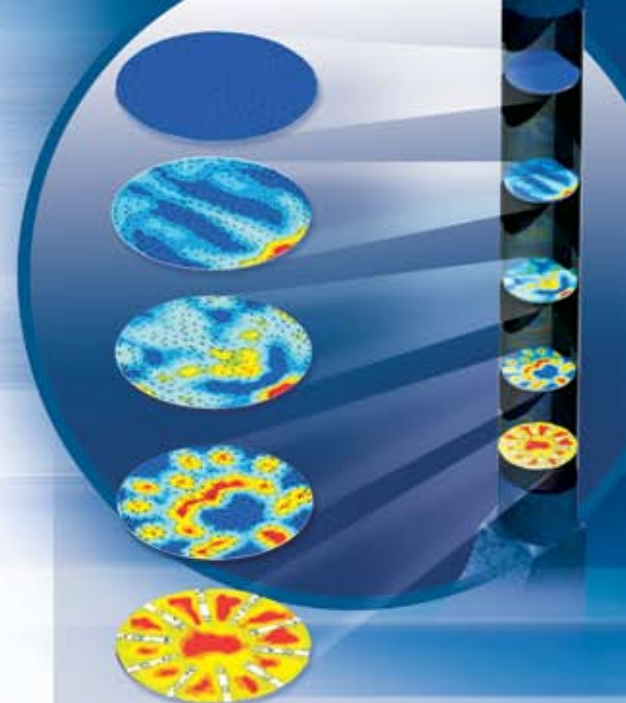
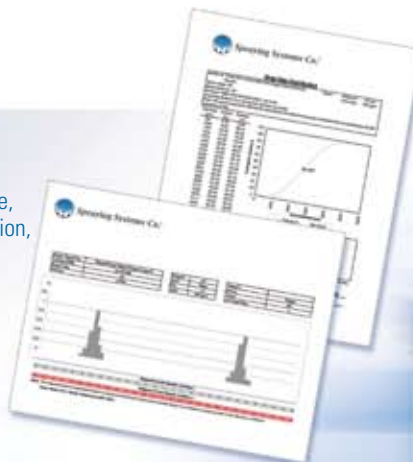
Our labs are also instrumental in our quality control program and allow us to provide documentation on our nozzles to comply with customer requests.

Lab capabilities

- All our major manufacturing facilities have spray laboratory protocols.
- Instruments include several different types of drop size analyzers, patternators, custom wind tunnel, PMS probe for laser imaging and more.
- Typical testing conducted on pollution control nozzles:
 - Spray characterization
 - Drop size distribution
 - Spray impact
 - Spray pattern
 - Spray coverage
 - Spray angle
 - Evaporation rate
 - Velocity
 - (residence and dwell time)
- CFD studies that utilize data collected in our labs to verify precise nozzle performance.

Spray Performance Test Reports,

available upon request, include the results of customer-specified tests. Flow rate, spray angle, physical dimension, hydrostatic, spray distribution, spray coverage and drop size distribution at specific pressures are the tests requested most frequently.



Spray Droplet Concentration



This illustration created using CFD shows spray droplet concentration at various locations in a gas conditioning tower.



Other Helpful Resources

Gas Cooling and Conditioning Guide Bulletin 540

12-page bulletin describes how to optimize efficiency and performance in gas cooling and conditioning applications.



FloMax® Air Atomizing Nozzles: High Efficiency Nozzles Offer Tight Control of Drop Size and Spray Coverage, Provide Precise Performance Bulletin 487C

Eight-page bulletin provides detailed performance and application information on the unmatched energy-efficient FloMax nozzles and lances.



Improving Process and Product Quality in Chemical Production through Spray Technology Bulletin 568

12-page bulletin provides an overview of how spray technology is used in a wide range of applications.



Industrial Spray Products Catalog 70

Full-line catalog including spray nozzles and accessories, technical data and problem solving ideas.



A Guide to Optimizing Spray Injector Performance Bulletin 579A

12-page bulletin addresses key specification, design and fabrication considerations for custom injectors.



Spray Technology Reference Guide: Understanding Drop Size Bulletin 459B

36-page educational guide takes an in-depth look at atomization, drop size measurement techniques, analyzers, data collection and analysis and more.



HASTELLOY® is a registered trademark of Haynes International, Inc.; Stellite® is a registered trademark of Deloro Stellite; ASTM® is a registered trademark of ASTM International; Victaulic® is a registered trademark of Victaulic Company; ASME® is a registered trademark of American Society of Mechanical Engineers (ASME, ASME International).



Spraying Systems Co.®
Experts in Spray Technology



Spray
Nozzles



Spray
Control



Spray
Analysis



Spray
Fabrication

P.O. Box 7900, Wheaton, IL 60189-7900 USA

Tel: 1.800.95.SPRAY Intl. Tel: 1.630.665.5000

Fax: 1.888.95.SPRAY Intl. Fax: 1.630.260.0842

www.spray.com



Bulletin No. 615 Printed in the U.S.A. ©Spraying Systems Co. 2007