Spraying Systems Co.®
Experts in Spray Technology

Spray Nozzles
Spray Control
Spray Analysis
Spray Fabrication

Gas Cooling and Conditioning in Cement Manufacturing

A Guide to Improving Efficiency, Increasing Throughput, Reducing Downtime and Lowering Costs

AutoJet TECHNOLOGIES
A Division of Spraying Systems Co.

Spray technology:

better than ever for solving gas conditioning problems

Cement plant customers all have the same basic need — the quick and efficient cooling of gases to lower temperature and reduce volume. Increasing production, minimizing maintenance outages and reducing energy costs are top priorities for users of both wet and dry processes. The use of alternative and low-grade fuels makes effective gas cooling even more complicated.

Effective gas temperature control, gas volume reduction and humidification are best achieved by evaporative spray cooling. There are other options, but they are not as efficient or as effective as spray cooling. In fact, the recent introduction of high-efficiency air atomizing nozzles and turnkey systems has made spray technology an even better solution than it was before.

Consider these issues — many of which you may be facing:

- Unexpected downtime caused by ESP overload
- Reduced production due to gas volumes straining the capacity of downstream equipment
- Excessive maintenance time as a result of wetting and sludge build-up
- Excess emissions
- High energy costs
- Additional maintenance time to repair equipment damaged by breakaway build-up from wet walls and bottoms

From ductwork to dryers and coolers to kilns, spray technology can cool and condition gases more efficiently than other methods

Air pollutants are generated at many points during cement manufacturing and, as a result, gas cooling using spray technology can often be found in multiple plant locations. The diagram below shows typical applications where gas conditioning systems using evaporative cooling are found.

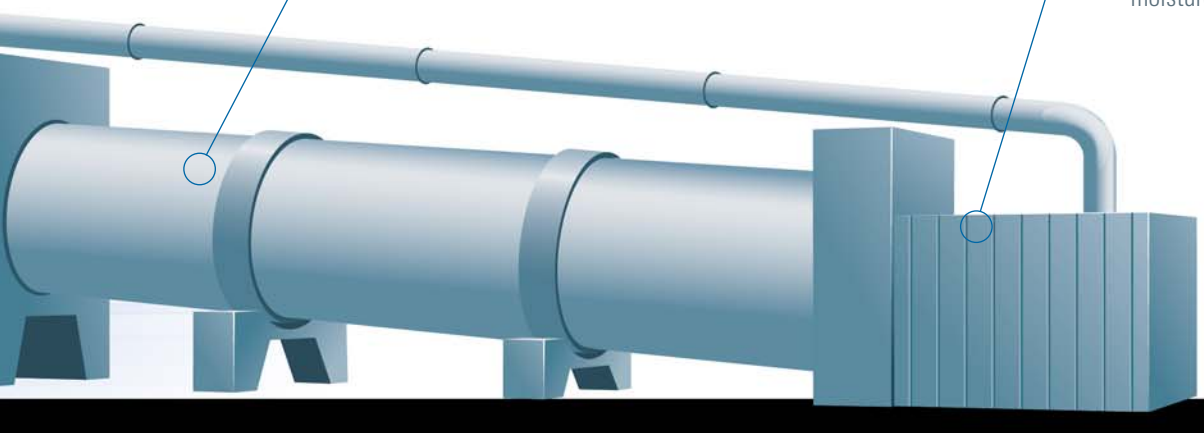
Gas cooling using spray technology can help.
By efficiently reducing gas temperature and volume, you'll experience:

- Precise control of temperature and humidity to maximize dust collection and ESP performance
- Reduced maintenance time to clean ducts, kiln feed hoods, tower walls/bottoms and to monitor, repair and restart equipment
- Significant reductions in the creation and release of toxic dioxins and furans and lower costs associated with government compliance
- Lower energy costs due to optimized ESP performance

Secondary fuel injection helps take advantage of low-cost alternative fuel sources. Finely atomized fluid provides for more complete combustion.

Efficient cooling reduces gas volume, allowing for higher volume production rates without any increase in equipment size.

Controlled cooling prevents excess moisture which improves product quality.



Hydraulic vs. air atomizing:

comparing the evaporative cooling options

Evaporative cooling can be achieved two ways: with hydraulic spray nozzles or air atomizing nozzles. Historically, high-pressure, hydraulic nozzles have been used primarily because high-efficiency air atomizing nozzles weren't available. However, significant technological advances in atomization have occurred in the last decade and air atomizing nozzles are now the preferred solution. The charts that follow explain why.

PERFORMANCE COMPARISON

	AIR ATOMIZING NOZZLES	HYDRAULIC NOZZLES
OVERALL PERFORMANCE	• Precise via control of both liquid and air	• Fluctuates with pressure changes
DROP SIZE	• Small: 200 µm D_{max};* reduces dwell time and risk of wetting	• Large: 290 µm D_{max}* (42% larger than a drop from an atomizing nozzle); more dwell time required, wetting more likely
PARTICULATE COLLECTION DEVICES	• Performance improves due to an increase in gas density and a reduction in volume/velocity	• Performance improvements limited; may require expansion if volume increases
EMISSION CONTROL	• Better temperature/humidity control enables reductions in toxic dioxins and furans and lower cost of compliance	• Particulate release more likely because of variations in drop size and less control over temperature/humidity
ENERGY	• Low-pressure pumps require less energy • Compressors required but nozzles are air efficient • Faster cooling and more efficient reduction of gas volume requires less energy	• High-pressure pumps are not energy efficient • No compressors required
EQUIPMENT COST	• Requires low-pressure pumps and low-pressure piping • High capacity nozzles mean fewer lances required • Smaller cooling tower	• Requires high-pressure pumps and high-pressure piping • Lower capacity limits on nozzles required to ensure drops evaporate effectively • More nozzles mean more lances and larger cooling towers
MAINTENANCE	• Low-pressure pumps require little maintenance • Lack of wetting eliminates clean-up of sludge and build-up • Wear-resistant materials require less maintenance	• High-pressure pumps require more maintenance • Wet walls and bottoms require considerable cleaning • Corrosion due to excess humidity possible • High-pressure atomization results in accelerated wear, higher replacement costs and performance problems
WATER	• River water, basins and run-off water acceptable due to nozzle large free passage	• Clean water supply (drinking water standard or better) required to ensure nozzle clogging is minimized

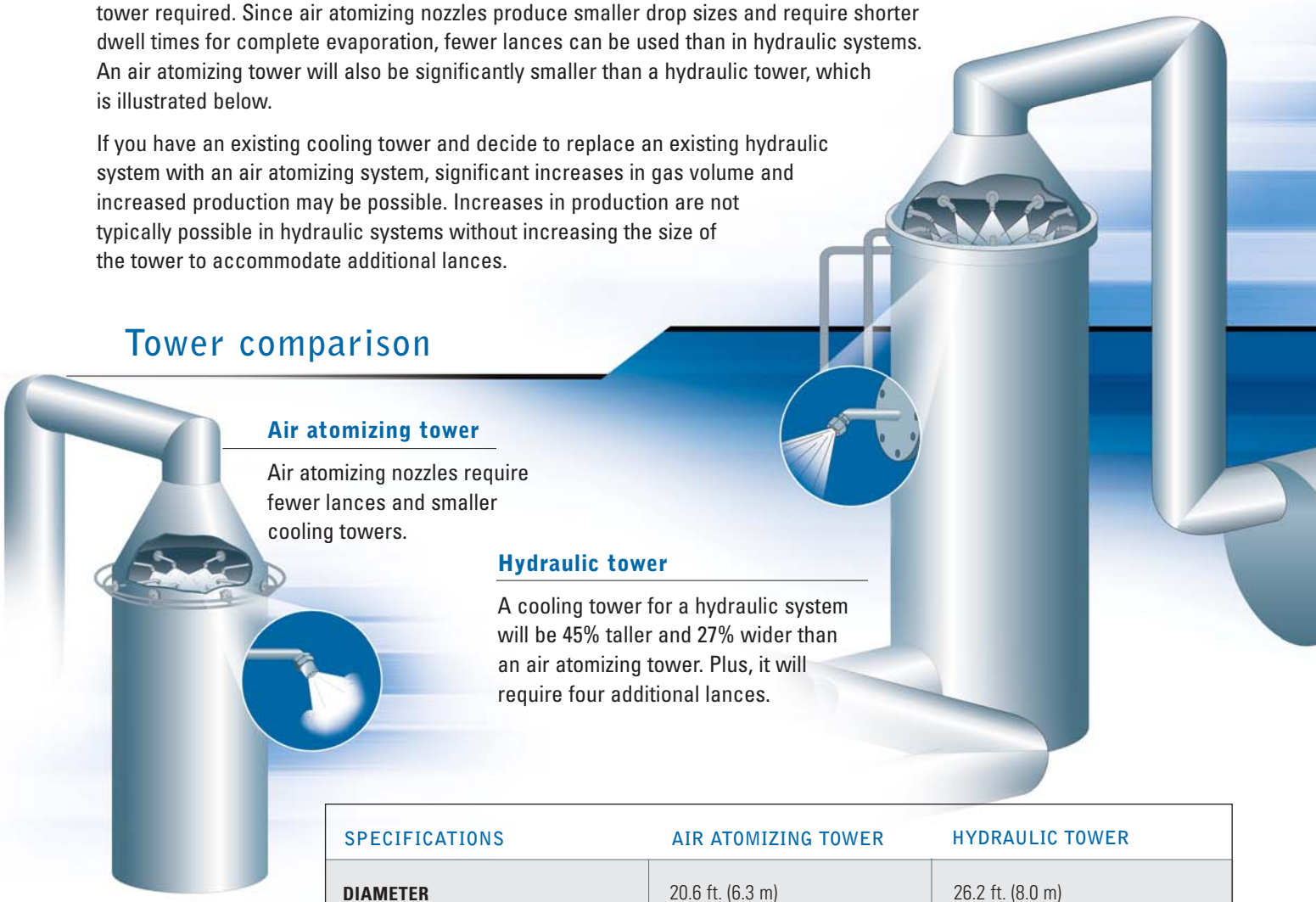
* Based on FloMax® nozzle spraying 10.0 gpm at 50 psig air pressure and the Flowback 7.0 gpm nozzle at 580 psig liquid pressure.

High-efficiency air atomizing nozzles result in more than energy and operational savings — smaller cooling towers are possible

Choosing an air atomizing system can have a significant impact on the design of the cooling tower required. Since air atomizing nozzles produce smaller drop sizes and require shorter dwell times for complete evaporation, fewer lances can be used than in hydraulic systems. An air atomizing tower will also be significantly smaller than a hydraulic tower, which is illustrated below.

If you have an existing cooling tower and decide to replace an existing hydraulic system with an air atomizing system, significant increases in gas volume and increased production may be possible. Increases in production are not typically possible in hydraulic systems without increasing the size of the tower to accommodate additional lances.

Tower comparison



Air atomizing tower

Air atomizing nozzles require fewer lances and smaller cooling towers.

Hydraulic tower

A cooling tower for a hydraulic system will be 45% taller and 27% wider than an air atomizing tower. Plus, it will require four additional lances.

OPERATIONAL PARAMETERS

GAS VOLUME
250,734 acfm
(426,000) Nm3/hr

INLET GAS PRESSURE
514° F (268° C)

OUTLET GAS PRESSURE
302° F (150° C)

TOTAL LIQUID SPRAYED
63.4 gpm (240 l/min)

SPECIFICATIONS	AIR ATOMIZING TOWER	HYDRAULIC TOWER
DIAMETER	20.6 ft. (6.3 m)	26.2 ft. (8.0 m)
HEIGHT	39.3 ft. (12.0 m)	52.5 ft. (16.0 m)
NUMBER OF LANCES	6	10
LIQUID PRESSURE	59 psig (4.1 barg)	600 psig (41.4 barg)
LIQUID VOLUME PER LANCE	10.5 gpm (39.7 l/min)	7.0 gpm (26.5 l/min)
AIR PRESSURE	50 psig (3.5 barg)	—
AIR VOLUME PER LANCE	57 scfm (98 Nm3/hr)	—
DWELL TIME FOR EVAPORATION	3.5 seconds	7.6 seconds

A closer look

at high efficiency FloMax® Air Atomizing Nozzles

All air atomizing nozzles are not alike

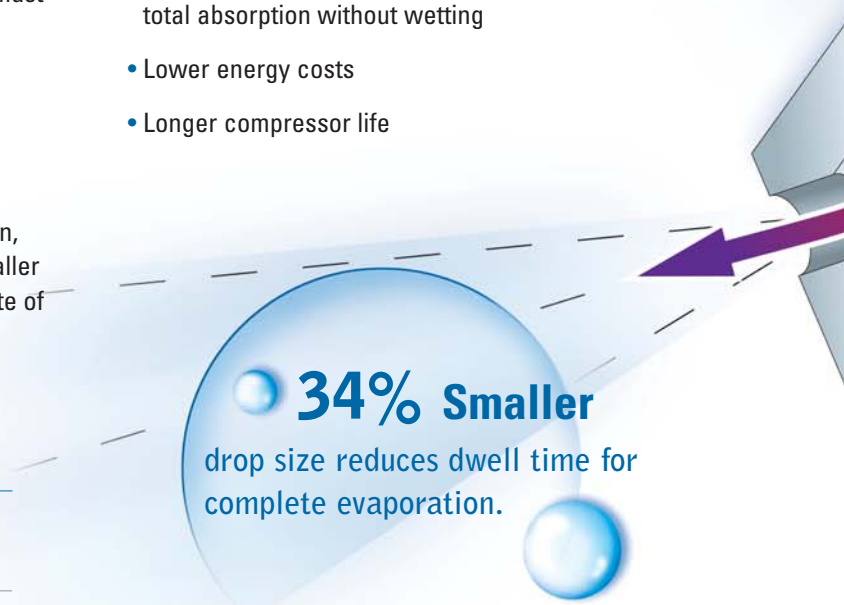
In fact, very few are suitable for use in gas conditioning. High efficiency nozzles offer tight control of drop size and spray coverage. The goal is to minimize D_{max} and achieve a finely-atomized spray with D_{32} less than 100 microns at 10 gpm (37.8 l/min). A multi-stage atomization process must be used to achieve this very small drop size.

The patented three-stage atomization process used by FloMax Air Atomizing nozzles is extremely air efficient and is the primary reason why it is the preferred nozzle for gas conditioning in cement plants.

Unlike competitive nozzles using single-step atomization, FloMax nozzles produce a D_{32} drop size that is 34% smaller utilizing 20% less air than competitive nozzles. [Flow rate of 10 gpm (37.8 l/min)]

Smaller drop size benefits:

- Lower installation and maintenance costs due to the wide range of flow rates per nozzle
- The liquid being sprayed generates more surface area per gallon for a more complete reaction and total absorption without wetting
- Lower energy costs
- Longer compressor life



FloMax nozzles are available in a wide range of flow rates

NOZZLE TYPE	CAPACITY (gpm)	CAPACITY (l/min)
FM 1	0.5 – 2.5	1.8 – 9.5
FM 5	2.0 – 7.0	7.6 – 26.5
FM 10	4.0 – 13.0	15.0 – 49.2
FM 25	15.0 – 30.0	57.0 – 114
FM 40	14.0 – 52.0	53.0 – 197

Drop size data:

Why it is important in gas conditioning and what you need to know

Drop size is the critical consideration in evaporative cooling. It impacts virtually every aspect of gas cooling and can have a significant impact on cooling effectiveness. However, it is not enough to obtain drop size data.

Other factors must be evaluated and considered as well:

- **The data measurement technique used**

  Be sure the data adheres to ASTM Standard E799. This standard allows D_{max} to make up as much as 1% of the volume. However, tighter standards are better. D_{max} less than .20% of volume is preferable.

- **The type of drop size analyzer used**

  The measurement device should use a high power laser to offset the obscuration caused by high density sprays. Plus, these instruments are capable of measuring drop size and velocity for every drop in the spray.

- **The data analysis and reporting techniques used**

  Report information should be consistent with ASTM Standard E1296-93 (1.3). Information on D_{32} (Sauter Mean Diameter), D_{max} and D_{min} should be provided at a minimum.

FloMax principle of operation

Stage One: Primary Fluid Breakup

Air and liquid combine behind the air guide. The pressure drop across the air guide orifice provides primary atomization of the liquid stream.

Stage Two: Secondary Fluid Breakup

Focused stream impacts the target bolt forcing additional mechanical breakup.

Stage Three: Final Mixing

Air cap acts as a final mixing chamber. As liquid crosses multiple orifices, an additional pressure drop provides the final atomization.

The best method to determine drop size is to conduct specialized testing that simulates your specific environment. If that's not possible, be sure the drop size data you received is based on actual testing, not theoretical calculations.

Spray Analysis and Research Services, a service of Spraying Systems Co., is home to the most fully-equipped spray laboratory in the world and can help you accurately predict drop size and evaporative cooling in your specific environment. In addition to several instruments for drop size measurement including Phase Doppler Particle Analyzers, Laser Imaging (PMS Probe), Particle/Image Analyzers and Laser Diffraction Particle Analyzers, other instruments such as our custom-built wind tunnel to create co-, counter- and cross-flow air are frequently used in spray nozzle characterization.

The best-equipped lab in the world isn't of value without experienced personnel to manage and maintain it. Our staff has more than 30 years of experience and is active in the international drop size community. To provide information on the differences in drop size measurement and to offer guidelines for data interpretation, we've developed "An Engineer's Practical Guide to Drop Size." It is available upon request and has become an industry standard on drop size measurement.

For more information, please visit www.SprayConsultants.com or contact your Spraying Systems Co. sales engineer.

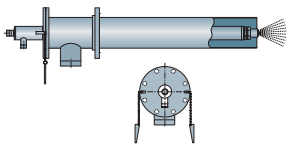
FloMax® nozzles

outperform other air atomizing nozzles in many areas in addition to drop size

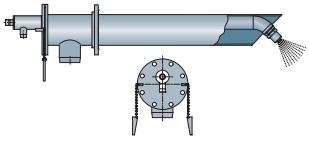
PERFORMANCE COMPARISON

	FLOMAX AIR ATOMIZING NOZZLES	OTHER AIR ATOMIZING NOZZLES
TURNDOWN RATIOS	• High turndown of flow rate to maintain air pressure while liquid pressure and flow vary	• Limited turndown ratio typical of standard air atomizing design
FLOW RATES	• Large flow rate per nozzle. Fewer nozzles required for cooling resulting in lower initial purchase cost and less maintenance. Wide range of flow rates available, 0.5 gpm to 52 gpm (1.8 l/min to 197 l/min)	• Larger drops are produced by nozzles that provide equivalent flow rates. To avoid wetting, 2 to 3 times as many lances are used. Higher initial purchase cost and greater ongoing maintenance
MATERIAL SELECTION	• Hastelloy®, Stellite® and reaction-bonded silicon carbide to ensure optimal performance in harsh environments • Typical materials include 316 and 310SS	• Limited choices
FREE PASSAGE	• Large free passage enables flexibility in water sources	• Small free passage increases risk of clogging and limits water supply options
MAINTENANCE	• Durable, long wearing parts require little maintenance • Easy to replace components when required — no special tools needed	• Small free passage requires more frequent maintenance • High air and liquid pressures lead to more frequent nozzle replacement
CONTROL SYSTEM	• Single	• Separate control of air and water required
MOUNTING/INSTALLATION	• Lightweight lances, manifolds and headers available to facilitate installation • Adapters, cooling jackets, purge tubes and protective tubes also available for special requirements	• More lances required. Lances are typically larger and heavier

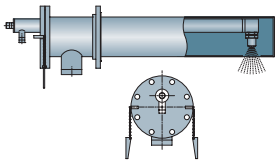
EXAMPLES OF OPTIONAL LANCE DESIGNS



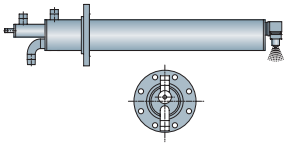
0° Lance Assembly
Quick-release flange with bolt-on type protective air/purge tube.



45° Lance Assembly
Quick-release flange with bolt-on type protective air/purge tube.



90° Lance Assembly
Quick-release flange with bolt-on type protective air/purge tube.



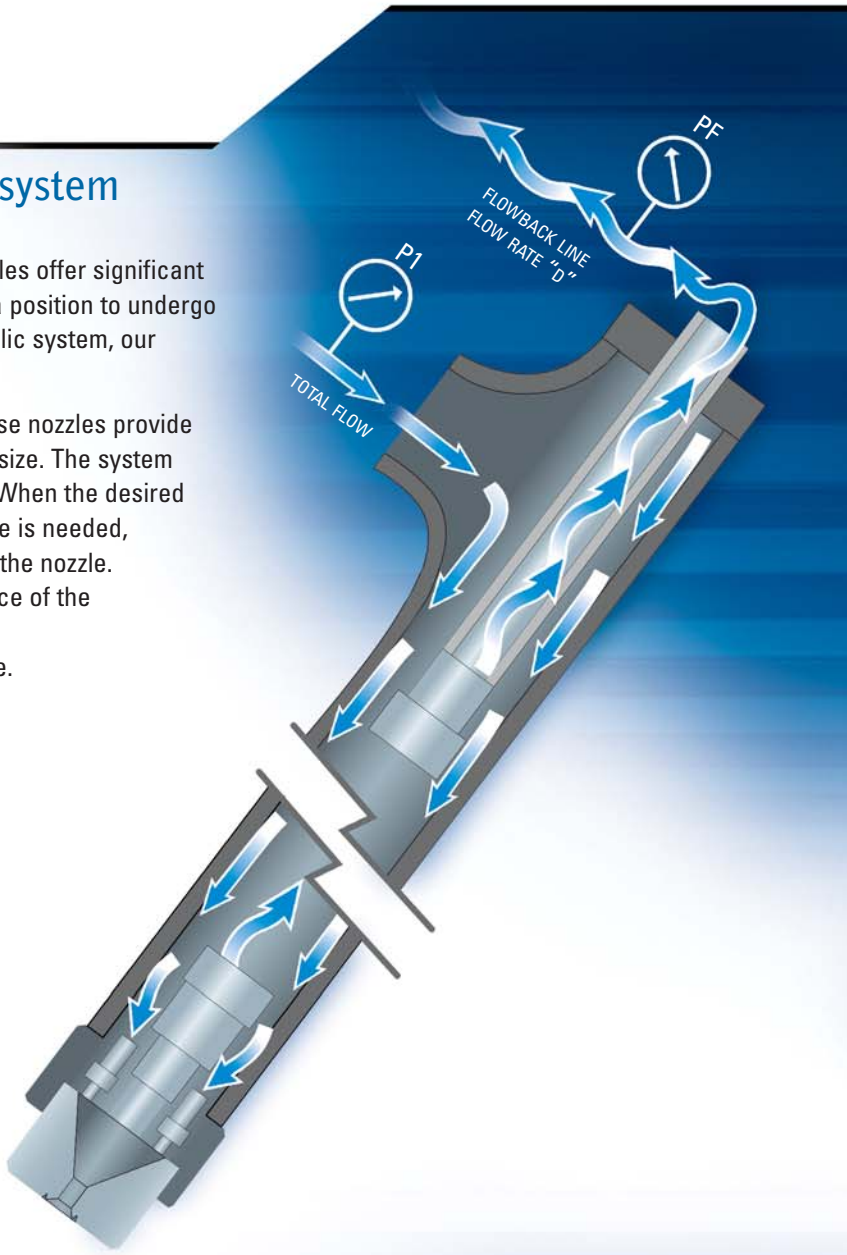
90° Lance Assembly
Bolt-on lance assembly with cooling jacket.

Flowback nozzles

optimize your existing hydraulic system

Although the newer, high efficiency air atomizing nozzles offer significant benefits over hydraulic systems, not every plant is in a position to undergo a technology upgrade. If you are maintaining a hydraulic system, our Flowback nozzles can help you improve performance.

Easily interchangeable with competitive products, these nozzles provide superior performance by delivering a consistent drop size. The system applies consistent pressure to the nozzle at all times. When the desired gas temperature is achieved and a reduction in volume is needed, a valve is adjusted to alter the amount of fluid leaving the nozzle. The excess fluid "flows back" through the center orifice of the nozzle body. The nozzle offers a 10:1 turndown ratio to accommodate variations in gas temperature or volume.



Advantages of a Flowback nozzle system

Flowback nozzle

Large selection of nozzle capacities.
Sizes range from 1.2 to 45 gpm (4.5 to 170.3 l/min) at 600 psi (41.4 bar).

A simple but unique two-piece design makes installation and maintenance quick and easy. No special tools are required — the orifice slides into the nozzle and can be tightened with a wrench.

Competitive nozzle

Complex bellows design with four separate components.
The design of these nozzles is delicate. As a result, they are often damaged during operation or maintenance. Internal leaking, poor atomization and wetting in the tower result. Special tools are required for both installation and maintenance.

AutoJet® Gas Conditioning Systems:

a completely automated solution that results in even greater efficiencies

Many cement plant customers are looking for a totally automated solution to ensure optimal performance and savings on labor and downtime. However, until recently, the only options have been to integrate components from a variety of manufacturers to create a system or to select a system with limited control capabilities. Our recently introduced AutoJet Gas Conditioning System provides another option — one that includes a proprietary control system designed to maximize the performance of FloMax nozzles and to provide total system automation. It's unique in many other ways too — and they all add up to more effective and efficient gas cooling.

Nine benefits

the AutoJet System can bring to your gas cooling application

1. Optimal performance

Our AutoJet Spray Controller, with patent-pending SprayLogic® firmware and software, monitors and automatically adjusts the closed loop system. By regulating liquid and air flow to the nozzles based on data gathered from RTD temperature sensors, the controller offers the highest level of reactivity and accuracy for the system.

2. Plug and spray convenience

The AutoJet Spray Controller is pre-programmed with parameters and function screens specific to gas conditioning applications, saving time and money during system implementation. Full LabVIEW® simulation and system pre-testing prior to shipping ensure full functionality upon set-up.

3. Total automation minimizes labor and downtime

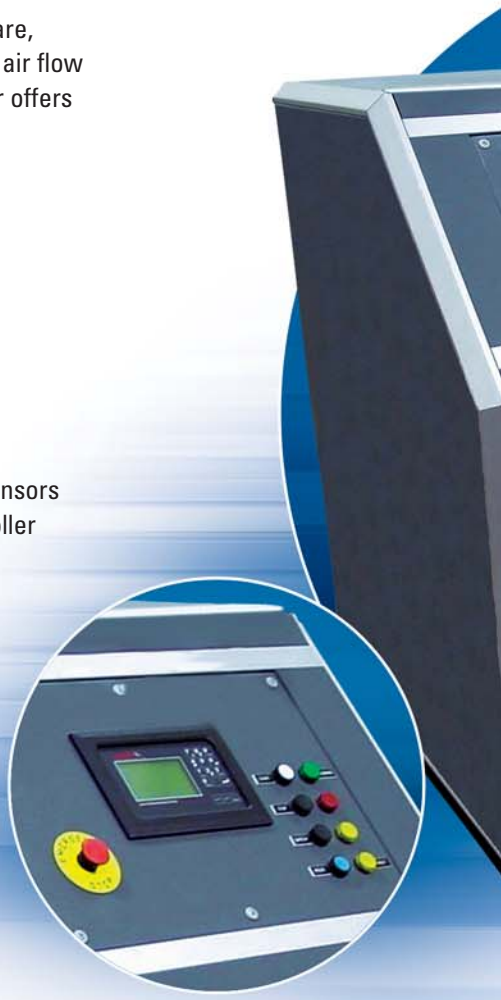
The AutoJet Spray Controller controls all system components — nozzles, pumps, sensors and other hydraulic/pneumatic components. If a problem is detected that the controller can't resolve automatically, operator warnings will be displayed or sounded.

4. Multiple lance zones

AutoJet Gas Conditioning Systems can be configured with multiple lance zones to allow greater turndown of flow rate under variable system conditions. The AutoJet Spray Controller can precisely control spray performance of multiple FloMax nozzle lances in multiple lance zones.

5. Built for reliability

Emergency modes, system redundancy, intelligent fault sensing and patent-pending continuous system integrity checking are just a few of the reasons why you can count on long-term, trouble-free performance.



6. Reduced energy costs

Variable Frequency Drive (VFD) pumps provide proportional liquid regulation and significant electricity savings. In addition, energy-efficient proportional air regulation reduces air consumption and operating costs.

7. Easy integration

You can easily integrate the AutoJet Gas Conditioning System with other systems through direct wiring and current splitters for access to critical data. For full control of all available data, an optional OPC communication link to SCADA systems is available.

8. Ease of use

The AutoJet Spray Controller is easy to use and is equipped with complete spray "knowledge." Just provide information about your operation using the menu system and the controller will essentially configure itself.

9. Single source convenience

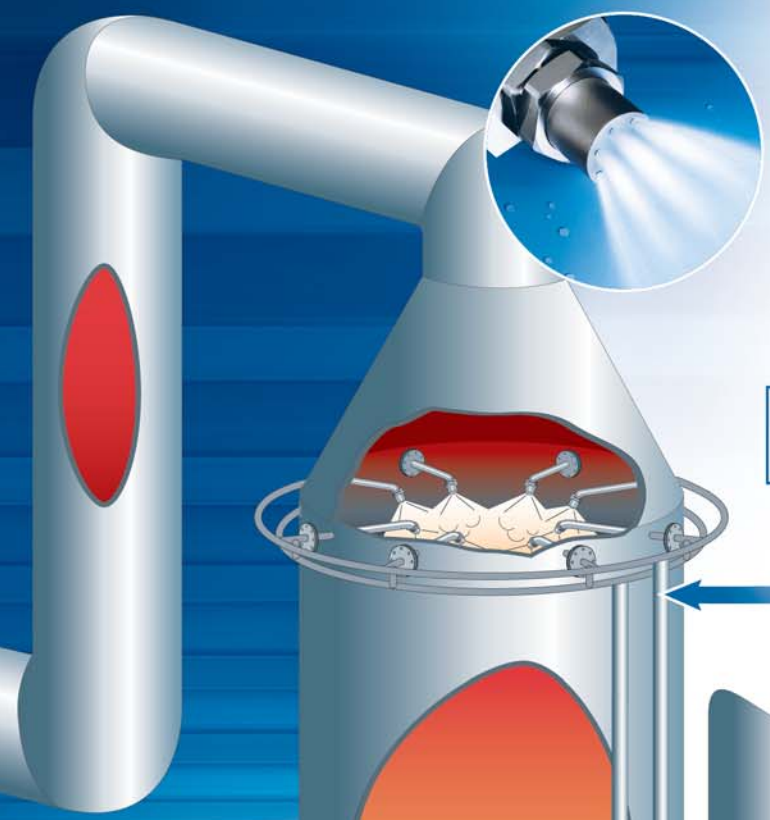
Should you have a question about your system, just give us a call. No need to contact multiple suppliers to coordinate their efforts should a problem occur.

About AutoJet Technologies

AutoJet Technologies, the systems division of Spraying Systems Co., provides turnkey systems for gas conditioning, tank cleaning, marking, low-mist and other applications. AutoJet Modular Spraying Systems are also available for moistening, lubricating, marking, disinfecting and coating applications.

For more information, visit www.autojet.com.

How the AutoJet® Gas Conditioning System works



FloMax® Air Atomizing nozzles

deliver optimal drop size without creating excess moisture. The nozzles offer the greatest energy efficiency available today and maximum flexibility with a high turndown ratio of flow rate.

LIQUID LINE

Liquid line includes redundant pumps, double filtration and a liquid regulator with its bypass.

LIQUID REGULATION ← REDUNDANT PUMPS ← DOUBLE FILTRATION

AIR LINE

Air line includes air filtration and either manual or proportional air regulation with its bypass. Proportional regulation is used when a high turndown ratio is required and energy can be saved by accurately monitoring air flow.

AIR REGULATION ← COMPRESSOR OPTION

TEMPERATURE SENSOR

Experience significant savings

with an AutoJet System and FloMax nozzles

Installation Savings

5% less than hydraulic systems

Operating Savings

Lower operating pressures, wear resistant materials and easier maintenance result in:

30% less in electricity usage

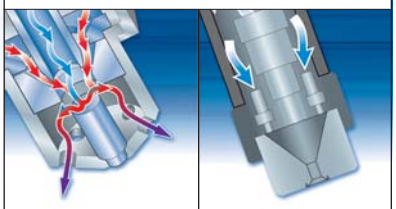
50% less in replacement parts

75% less in labor maintenance

Estimated First Year Savings..... **US $20,000**

Estimated Ongoing Annual Savings ..... **US $12,000**

SYSTEM COMPONENTS*



FloMax System	Hydraulic System
5 FloMax Nozzle Lances	8 Hydraulic Nozzle Lances
2 Pumps (5 HP)	2 High Pressure Pumps (50 HP)
Piping, Valves, Skid, Thermocouples, etc.	Piping, Valves, Skid, Thermocouples, etc.
2 Compressors (30 HP)	—

* 45-50 GPM (170-190 l/min) systems for existing cooling tower installation

Model 2250 AutoJet Spray Controller

- Pre-programmed for "plug-and-spray" convenience
- Closed-loop temperature control
- Easy to use, menu-driven user interface
- "Smart Keys" allow easy navigation and data entry
- SprayLogic® firmware and application software contain more than 100,000 lines of debugged code for robust built-in functionality
- Industry-leading SprayLogic software allows advanced user programming
- Full LabVIEW® simulation and system pre-testing prior to shipping ensures that each installation works right "out of the box"
- Clear digital display of real-time system status and other critical information on an easy-to-read 240 x 128 pixel LCD
- System integrity checking and error handling capabilities provide worry-free automation by constantly monitoring and adjusting system operation
- Communication with other systems through direct wiring and current splitters. For advanced remote control applications, AutoJet Technologies recommends the use of OPC (Object linking and embedding for Process Control) technology.

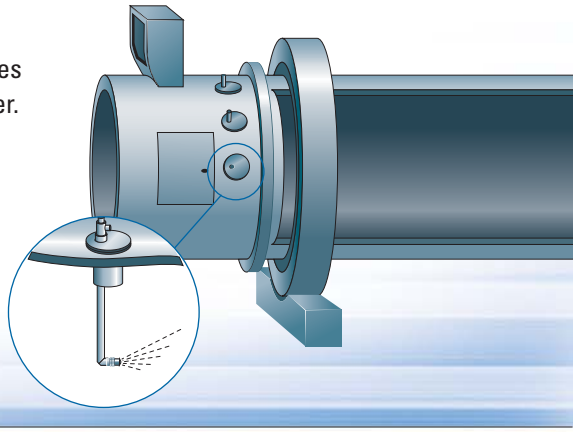
LabVIEW is a registered trademark of National Instruments Corporation.

See how your peers are benefiting

Below are examples of the benefits other cement manufacturers are experiencing from FloMax Air Atomizing nozzles and AutoJet Gas Conditioning Systems. It's likely you can benefit too. Our sales engineers are available for a no-obligation consultation at your convenience to help you determine how to improve your gas conditioning application.

FloMax nozzles enable increase in clinker throughput and production

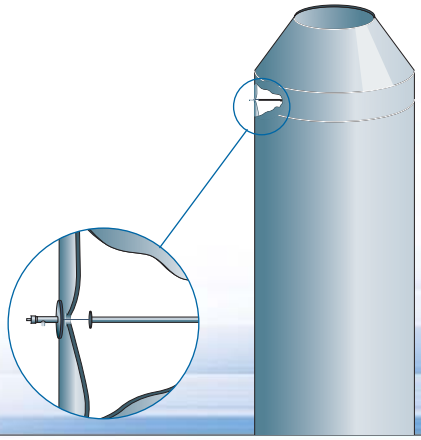
A leading grey cement clinker producer in Southeastern U.S. uses a single dry process rotary kiln with ore calciner. This plant relies on our FloMax FM 25 nozzles to increase the capacity of the rotary coolers. Six lances are used for each cooler. Nearly 400,000 acfm of dust laden gases are cooled from 640° F to 270° F (338° C to 132° C). The 370° F (188° C) temperature reduction efficiently reduces gas volume enabling increased clinker throughput and production.



AutoJet Gas Conditioning System plays critical role in plant reopening

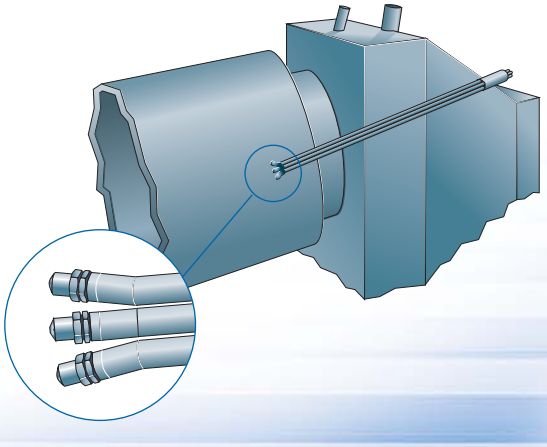
Closed for more than 10 years, this grey cement clinker plant in Romania underwent a total modernization. State-of-the-art equipment was installed including a hydraulic AutoJet Gas Conditioning System equipped with Flowback lances and a custom-designed control package. Performance and price were important considerations for this plant during the selection process, but the fact that all system components were supplied by a single source was perceived as very advantageous.

This single rotary kiln is now rated at 3,000 tons per day of grey cement clinker. Our system processes more than 325,000 acfm at 716° F (380° C) cooling to 312° F (156° C) and a dust load of .17 lbs/35 cfm of gas.



FloMax nozzles replace less efficient air atomizing nozzles and return plant to full production

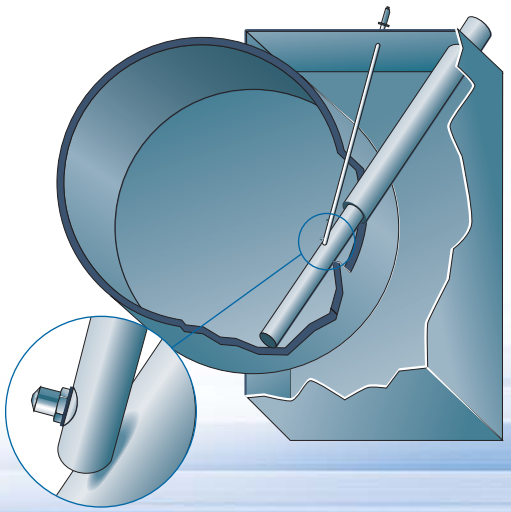
To prevent damage to the baghouse, a cement plant in Central U.S. was forced to reduce production by 20% during the hottest three months of the year. This was an unacceptable revenue loss and plant management quickly turned to Spraying Systems Co. to analyze the gas composition, volume and temperature range. Once we'd completed the testing and analysis, new lances equipped with FloMax nozzles, specialized lance assemblies and shuttle tubes were designed to fit existing entry points. The nozzles and lances shipped in a matter of weeks, helping the plant return to full production as quickly as possible.



Air pollution compliance issues resolved by AutoJet Gas Conditioning System with FloMax nozzles

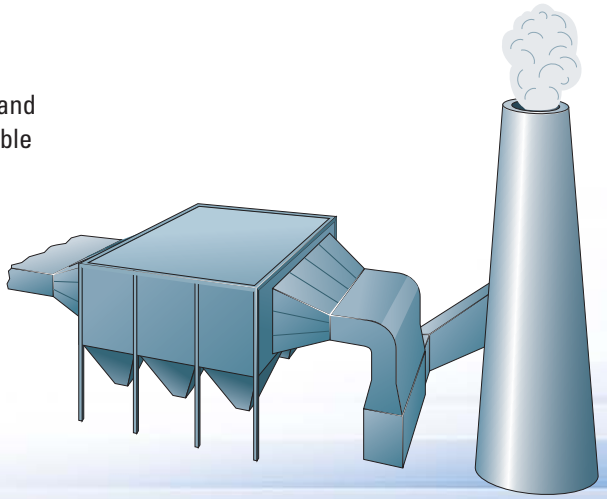
Another U.S. plant, located in the heart of the Midwest, is home to one of the largest wet process kilns in operation. A single kiln produces more than 4,000 tons of grey cement clinker per day. Faced with dioxin and furan regulatory issues, this plant needed a complete, single-source, gas cooling system that could process 750,000 acfm to government required exit temperatures without adding excess moisture to the system. The kiln, 25 feet in diameter, required the FloMax nozzles to atomize, cool and evaporate up to 200 gpm (757 l/min) of liquid within the confines of the windbox without wetting or resulting in maintenance issues.

Our solution included a turnkey system including our Model 2250 AutoJet Spray Controller and custom lances and mounting hardware.



Gas conditioning system problems contributed to plant closing. New AutoJet Gas Conditioning System helped improve quality and minimize pollution so plant could return to production

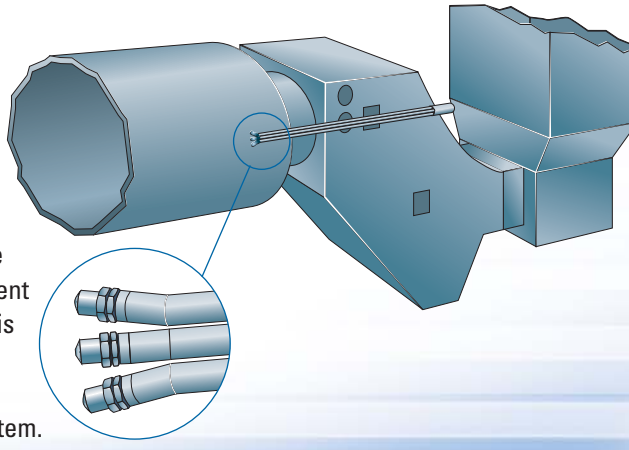
A cement plant in China was closed as a result of ongoing quality issues and unacceptable stack opacity levels. The old cooling system released a visible plume of pollutants and dust. Company officials knew the system must be replaced if the plant was to reopen. Spraying Systems Co. was invited to review system requirements and propose a solution. Our AutoJet Gas Conditioning System was selected over competitive alternatives and is performing as specified. The plant is on target to produce 300,000 tons of cement clinker annually and the stack plume has been eliminated.



Kiln feed hood and cooling tower challenges resolved by AutoJet Gas Conditioning System equipped with FloMax nozzles

A cement plant in Midwestern U.S. had an aging hydraulic gas cooling system that needed to be replaced. Wetting and performance issues with downstream equipment were negatively impacting production. Understandably, complete evaporation of all liquid prior to ductwork leading to the ESP was an essential requirement. Spraying Systems Co. installed our AutoJet Gas Conditioning System with FloMax nozzles to provide cooling at the kiln feed hood — to maintain critical system components — and in the cooling tower.

Space issues during installation were challenging but custom-designed FloMax air atomizing lances solved the problem. The lances consisted of three separate FloMax lances within a carrier tube. Each nozzle was positioned to target different areas of the kiln and was independently controlled to provide zoned cooling. This configuration allowed more precise control of water and air and made it easy to change flow rates for system start-up, shutdown and regular operation. Twin control systems were also used in the cooling tower and feed-hood cooling system.



Other gas cooling and conditioning resources:

FloMax Air Atomizing Nozzles
Bulletin No. 487B
Features details and performance data on the unmatched energy-efficient FloMax nozzles and lances.


Bulletin No. 487B

FloMax Nozzle Performance Data Reference
Technical Manual TM406D
Provides comprehensive performance data, dimensional information and sample lance configurations.

Flowback Nozzle Performance Data Reference
Technical Manual TM408B
Provides comprehensive performance data, dimensional information and sample lance configurations.

An Engineer's Practical Guide to Drop Size
Bulletin 459
An invaluable technical guide. We've taken 60 years of spray drop knowledge and condensed it into a 28-page booklet to teach you the fundamentals of evaluating and interpreting drop size data.

Bulletin 459

Optimizing System Performance with Precision Spray Control
Bulletin AT103B
Provides an overview of the benefits of automated spray systems. Included are application examples that show how to reduce overspray, improve product quality, increase throughput and improve regulatory compliance.

Bulletin AT103B

Model 2250 AutoJet Spray Controller
Bulletin AT105B
Features the specification information and details of our unique control package that automates and optimizes spray performance.

Optimizing Your Spray System:
Spray Nozzle Maintenance and Control for Improved Production Efficiency
Technical Manual 410
Explains how to maximize performance and quality in your spray application.

Technical Manual 410

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