

SOLUTIONS FOR IRON AND STEELMAKING

GAS COOLING • DUST SUPPRESSION
SINTER COOLING • FIRE CONTROL
COATING • ELECTRODE COOLING
COKE COOLING

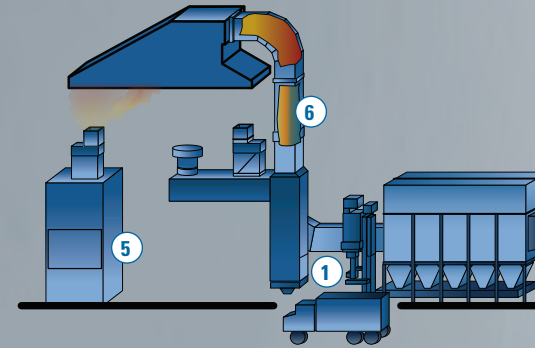
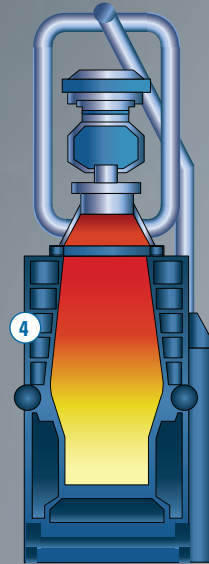
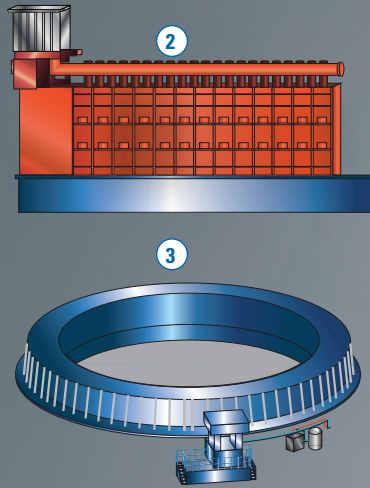


**IRON AND STEELMAKING
INTRODUCTION**

STOCKPILE

IRON PRODUCTION

FURNACE



1

DUST CONTROL

- FullJet® nozzles
- UniJet® nozzles
- Air atomizing nozzles

2

COKE COOLING

- FullJet nozzles

3

SINTER COOLING

- FullJet nozzles
- FloMax® nozzles
- Spray lances

4

BLAST FURNACE COOLING

- Air atomizing nozzles

**PRODUCT SOLUTIONS AND THE EXPERTISE
TO ACHIEVE SUPERIOR PERFORMANCE**

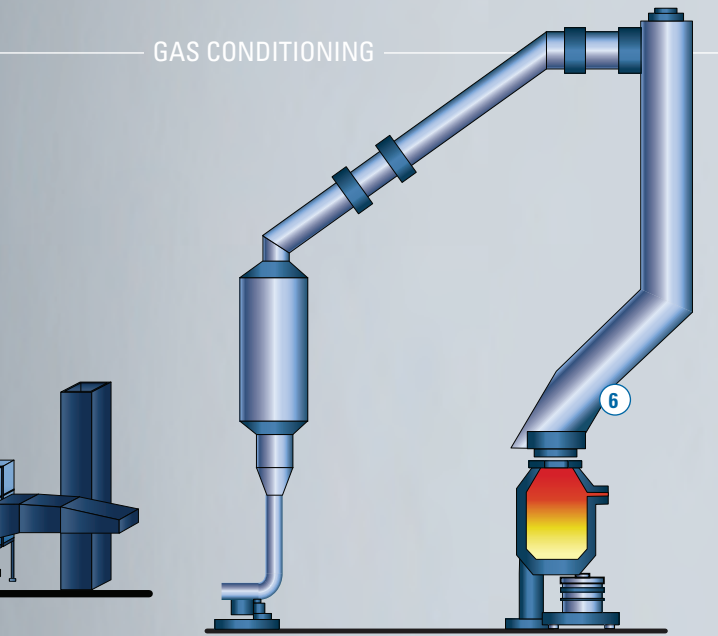
We have a full range of nozzles and systems for your iron and steelmaking requirements. Just as importantly, we have the services and test equipment to help optimize performance in critical operations such as sinter, coke, electrode and gas cooling and more.

In order to accurately predict performance in a customer's environment, we often use Computational Fluid Dynamics (CFD) modeling. Common uses for CFD include the determination of the best drop size for gas cooling and conditioning and the ideal placement of nozzles and lances in the furnace, cooling tower or other process vessel.

In dust suppression and fire control applications, we often head to our state-of-the-art test laboratories. Drop velocity and distribution studies conducted in our wind tunnel are widely used to simulate the conditions where the nozzles will be used to verify the expected performance can be achieved.



**IRON AND STEELMAKING
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ELECTRODE COOLING

- VeeJet® nozzles
- Air atomizing nozzles
- FlatJet® nozzles

6

GAS COOLING

- AutoJet Gas Cooling Systems
- FloMax nozzles
- FullJet nozzles
- WhirlJet nozzles
- Spray lances

MORE INFORMATION ON OUR MODELING AND TESTING SERVICES CAN BE FOUND IN SECTION A.

YOUR LOCAL STEEL SPECIALIST CAN ALSO PROVIDE ADDITIONAL INFORMATION ABOUT HOW WE CAN ASSIST WITH PROCESS OPTIMIZATION.

AIR ATOMIZING NOZZLES

FloMax® nozzles

J series nozzles

OVERVIEW PAGE	PERFORMANCE	
	ENGLISH	METRIC
E4 ▶	CONTACT LOCAL STEEL SPECIALIST ▶	
E5 ▶	CONTACT LOCAL STEEL SPECIALIST ▶	

FULL CONE NOZZLES

H, HF, R, RF, RR, HMFP and HHMFP FullJet® nozzles

HHSJ and HHSJX SpiralJet® nozzles

TG and TG-SQ UniJet® spray tips

E6 ▶	G48 ▶	G114 ▶
E7 ▶	G54-55 ▶	G120-121 ▶
E8 ▶	G61 ▶	G127 ▶

HOLLOW CONE NOZZLES

AX, BX, CX, CF, E, and BD WhirlJet® nozzles

BSJ SpiralJet nozzles

E9 ▶	G63-68 ▶	G129-134 ▶
E11 ▶	G69 ▶	G135 ▶

SYSTEMS

AutoJet® Gas Cooling Systems and lances

E12 ▶	CONTACT LOCAL STEEL SPECIALIST ▶
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**MORE FULL CONE NOZZLES:
SEE SECTIONS B AND C**



OVERVIEW: FLOMAX® NOZZLES

- Patented multi-stage atomization process produces very small drops using less compressed air than other nozzles
- High turndown ratio for maximum operating flexibility
- Large free passages reduce the risk of clogging and enable the use of lower quality water sources
- Anti-bearding nozzles feature a patented air cap design that resists material buildup near nozzle orifices and prevents performance problems
- Standard and made-to-order lances are also available in a wide range of materials and configurations
- Ideal for evaporative gas cooling and sinter cooling

FLOMAX NOZZLE OPTIONS



FLOMAX NOZZLE QUICK REFERENCE GUIDE

Model	Flow Rate Range gpm (lpm)	Spray Angle	Materials
FM3A and FM3A-AB*	.03 to 3.0 (1.13 to 11.3)	20° and 55°	316 or 310 stainless steel, Hastelloy®; cap options for anti-bearding versions include reaction-bonded silicon carbide, Stellite®, ceramic and tungsten carbide
FM5A and FM5A-AB*	.7 to 7.0 (2.6 to 26.5)	20° and 55° (95° optional)	
FM10A and FM10A-AB*	1.3 to 13.0 (4.9 to 49.2)	20° and 55° (95° optional)	
FM25A and FM25A-AB*	10.0 to 30.0 (37.8 to 114)	20° and 55° (95° optional)	
FM40A and FM40-ABD	20.0 to 45.0 (75.7 to 170.3)	55° and 95°	316 or 310 stainless steel, Hastelloy
FMX015	.03 to .25 (.11 to .94)	20°	
FMX030	.05 to .5 (.19 to 1.89)	20°	
FMX090	.5 to 1.5 (.11 to .94)	20° and 55°	

* Anti-bearding versions not available in 20° spray angle.

PLACING YOUR ORDER

Call your local steel specialist for application assistance or to place an order.



OVERVIEW: J SERIES NOZZLES

- J Series nozzles consist of a nozzle body and spray set-up
- Standard bodies have liquid and air inlets on opposing sides of the nozzle bodies. Nozzle bodies include a removable plug so needle assemblies can be added in the future. Additional body styles available for 1/2J
- 1/2J nozzles are available with a variety of spray set-ups and flow rates up to 306 gph (1158 lph) in various spray patterns
- 1J nozzles are also available with several spray set-ups and flow rates up to 29 gpm (110 lpm) in various spray patterns
- Ideal for dust suppression and some gas cooling operations

J SERIES NOZZLE OPTIONS



1/2J

1/2JN
Manual shut-off needle to stop liquid flow

1/2JCO
Manual clean-out needle to clear obstructions from the fluid orifice

1J

J SERIES NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Inlet Connection Size (in.)	Max Temp Liquid °F (°C)	Materials
1/2J	F	1/2	400 (204)	Nickel-plated brass or stainless steel construction
1J	F	1	400 (204)	

F = female thread; M = male thread.

PLACING YOUR ORDER

Call your local steel specialist for application assistance or to place an order.

FOR DETAILED NOZZLE PERFORMANCE DATA, CONTACT LOCAL YOUR STEEL SPECIALIST

OVERVIEW: FULLJET® NOZZLES

- Solid cone-shaped spray pattern with round impact area
- Vane design minimizes fluid turbulence to ensure uniform spray distribution and consistent spray coverage
- H and HF nozzles provide uniform distribution from 5.1 to 5324 (35 to 19842 lpm)
- DistribroJet® R, RF and RR extra large free passage versions eliminate clogging, provide uniform spray distribution from 27 to 8728 gpm (122 to 32530 lpm), and are available in six different spray angles ranging from 50° to 95°
- Maximum free passage (MFP) versions provide the largest free passage of nozzles of this type and uniform spray distribution from 50 to 582 gpm (191 to 2282 lpm)
- Ideal for gas cooling, coke cooling, sinter cooling, fire control, and dust control

FULLJET NOZZLE OPTIONS



FULLJET NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
H	F, Cast	1-1/4 to 8	Brass, 316 stainless steel
HF	Flange, Cast	4 to 10	
R	F, Cast	2 to 8	Brass, 316 stainless steel
RR	M, Cast	2 to 8	
RF	Flange, Cast	4 to 12	
HMFP	F, Cast	2 to 3	316 stainless steel
HHMFP	M, Cast	2 to 3	

F = female thread; M = male thread. Other materials available upon request.

OVERVIEW: SPIRALJET® NOZZLES

- Solid cone-shaped spray pattern
- Open passages ideal for use with fluids with particulates
- Maximum liquid throughput for a given pipe size
- Spray angles from 60° to 170°
- Uniform spray distribution from .7 to 3320 gpm (2.7 to 11967 lpm)
- Operating pressures up to 400 psi (25 bar)
- Ideal for gas cooling, dust control, fire control

SPIRALJET NOZZLE OPTIONS



HHSJ

1/4" to 2" male conn.
Hex body style/316 stainless steel



HHSJX

3/8" to 2" male conn.
Extra large free passage design
Hex body style/brass

SPIRALJET NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
HHSJ	M, Hex	1/4 to 2	Brass, 316 stainless steel
	M, Flats, Cast	1/4 to 4	316 stainless steel
	M, Round	1/4 to 4	Polyvinyl chloride, PTFE
HHSJX	M, Hex	3/8 to 2	Brass
	M, Flats, Cast	3/8 to 2	316 stainless steel
	M, Round	3/8 to 2	Polypropylene, polyvinyl chloride

F = female thread; M = male thread. Other materials available upon request.

PLACING YOUR ORDER

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FOR DETAILED NOZZLE PERFORMANCE DATA, SEE PERFORMANCE SECTION G



OVERVIEW: UNIJET® NOZZLES

- Quick-connect nozzles reduce maintenance time – bodies remain on pipe/header
- Save on nozzle replacement costs – bodies can be reused, only spray tips are replaced; tips fit on male or female bodies
- Solid cone-shaped spray pattern with round impact area or cone-shaped spray pattern with square-like impact area for coverage of rectangular areas or spray zones
- Spray angles: Standard – 43° to 91°
- Uniform spray distribution from .08 to 7.4 gpm (.3 to 28 lpm)
- Operating pressures up to 300 psi (20 bar)
- Ideal for dust control

UNIJET NOZZLE OPTIONS



TG spray tip
Standard spray pattern



TG-SQ spray tip
Cone-shaped spray with square-like impact area

UNIJET NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Materials
TG	T male and TT female body options	Brass, 303 stainless steel
TG-SQ	T male and TT female body options	

PLACING YOUR ORDER

Call your local steel specialist for application assistance or to place an order.

FOR DETAILED NOZZLE PERFORMANCE DATA, SEE PERFORMANCE SECTION G

OVERVIEW: WHIRLJET® NOZZLES

- Hollow cone spray pattern with a circular impact area
- Large, unobstructed flow passages minimize clogging
- Good atomization of liquids at lower pressures
- Removable caps for easy inspection and cleaning on some models
- Slope-bottom design models reduce the drilling effect of the fluid vortex in the fluid chamber and premature wear
- AX and BX nozzles form smaller drops and operate at flow rates from .03 to .38 gpm (.19 to 145 lpm)
- CX and CF nozzles feature higher flow rates – 4.4 to 2362 gpm *17.1 to 9010 lpm)
- E nozzles offer extra wide spray angle and provide flow rates from .20 to 16.8 gpm (.76 to 64 lpm)
- BD nozzles have a lower profile and provide flow rates from 11 to 38 (41 to 145 lpm)
- Ideal for gas cooling and dust control

WHIRLJET NOZZLE OPTIONS



AX
1/8" to 3/4" female conn.
Slope-bottom design
Removable cap



BX
1/8" to 3/4" male conn.
Slope-bottom design
Removable cap



CX
1" to 2-1/2" female conn.
Slope-bottom design
One-piece cast-type



CF
4" to 6" flange conn.
Two-piece cast type



E
1/4" to 3/8" female conn.
One piece bar stock



BD
3/8" to 1-1/2" male conn.
In-line nozzle
Removable cap

PLACING YOUR ORDER

Call your local steel specialist for application assistance or to place an order.

FOR DETAILED NOZZLE PERFORMANCE DATA, SEE PERFORMANCE SECTION G



WHIRLJET® NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
AX	F	1/8 to 3/4	Brass, mild steel, 303 stainless steel, 316 stainless steel
BX	M	1/8 to 3/4	
CX	F, Cast	1 to 2-1/2	Brass, 316 stainless steel
CF	Flange, Cast	4 to 6	Brass, 316 stainless steel
E	F	1/4 to 1/2	303 stainless steel
BD	M	3/8 to 1-1/2	Brass, 303 stainless steel

F = female thread; M = male thread.

PLACING YOUR ORDER

**Call your local steel specialist for
application assistance or to place an order.**

**FOR DETAILED NOZZLE PERFORMANCE DATA, SEE
PERFORMANCE SECTION G**

OVERVIEW: SPIRALJET® NOZZLES

- Hollow cone spray pattern with a circular impact area
- Minimal clogging – maximum flow through passages of any nozzle of comparable size
- Spray angles: Standard – 50° to 180°
- Uniform spray distribution from .49 to 3320 gpm (2.0 to 11967 lpm)
- Operating pressures up to 400 psi (25 bar)
- Precision impact blade angles distribute drops and provide excellent coverage – ideal for washing, rinsing and cooling
- Compact size

SPIRALJET NOZZLE OPTIONS



SPIRALJET NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
BSJ	M, Hex	1/4 to 2	Brass, 316 stainless steel
	M, Flats	1/4 to 4	316 stainless steel
	M, Flats, Cast	1/4 to 4	316 stainless steel
	M, Round	1/4 to 4	PTFE, polyvinyl chloride

F = female thread; M = male thread.

PLACING YOUR ORDER

Call your local steel specialist for application assistance or to place an order.

FOR DETAILED NOZZLE PERFORMANCE DATA, SEE PERFORMANCE SECTION G



AUTOJET® GAS COOLING SYSTEMS**OVERVIEW:**

AutoJet Gas Cooling Systems provide effective emission control using closed-loop control of all automated spray system components – nozzles, pumps, sensors and other hydraulic and pneumatic components – to simplify and streamline the gas cooling process. They can be used with a wide range of nozzles including our standard and anti-bearding FloMax® nozzles.

BENEFITS:

- Precise control of gas temperature enables increased production and improved operating efficiency
- Automated control of spray nozzles optimizes performance, reduces energy costs
- Closed-loop control ensures precise cooling even with variable operating conditions
- Total control of all system components minimizes the need for operator involvement
- If system cannot make a needed adjustment based on operating conditions, operators are notified via alarms
- Total solution from a single source eliminates integration problems and the hassles of working with multiple vendors

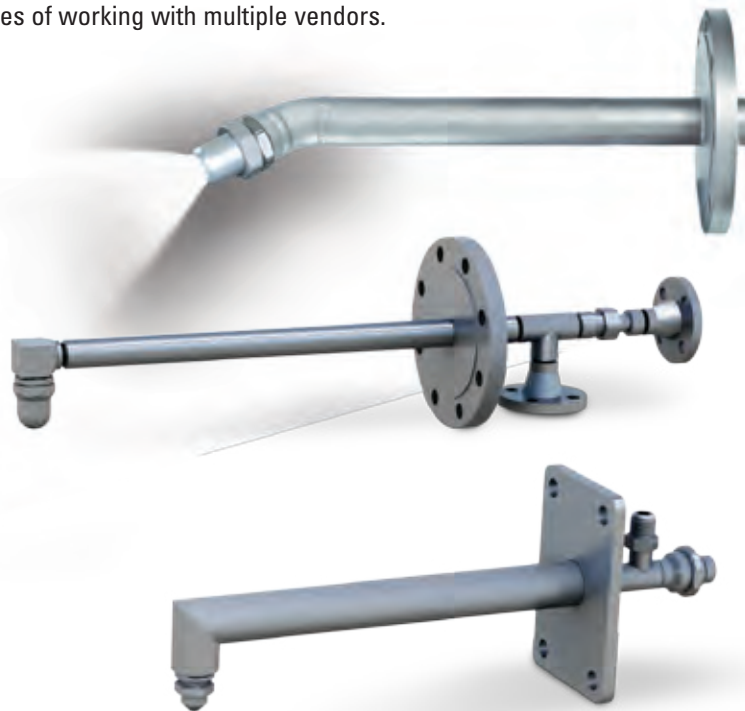
Note: System availability may vary by region. Contact your local steel specialist for assistance.

**SPRAY LANCES**

We provide a wide range of design, fabrication and testing services for spray lances:

- Assistance with lance design, placement in the gas stream and spray direction
- Computational Fluid Dynamics (CFD) modeling to determine how the injected fluid interacts with the receiving stream to validate performance
- Manufacturing to meet a wide range of code requirements
- Spray and flow testing, radiographic, ferrite weld, ultrasonic examination and more

Spray lances can be controlled by AutoJet Gas Cooling Systems for automatic adjustment of spray performance based on operating conditions. In addition, a total solution from a single source eliminates integration problems and the hassles of working with multiple vendors.

**PLACING YOUR ORDER**

Call your local steel specialist for application assistance or to place an order.

**MORE INFORMATION ON SPRAY LANCES:
SEE SECTION A**