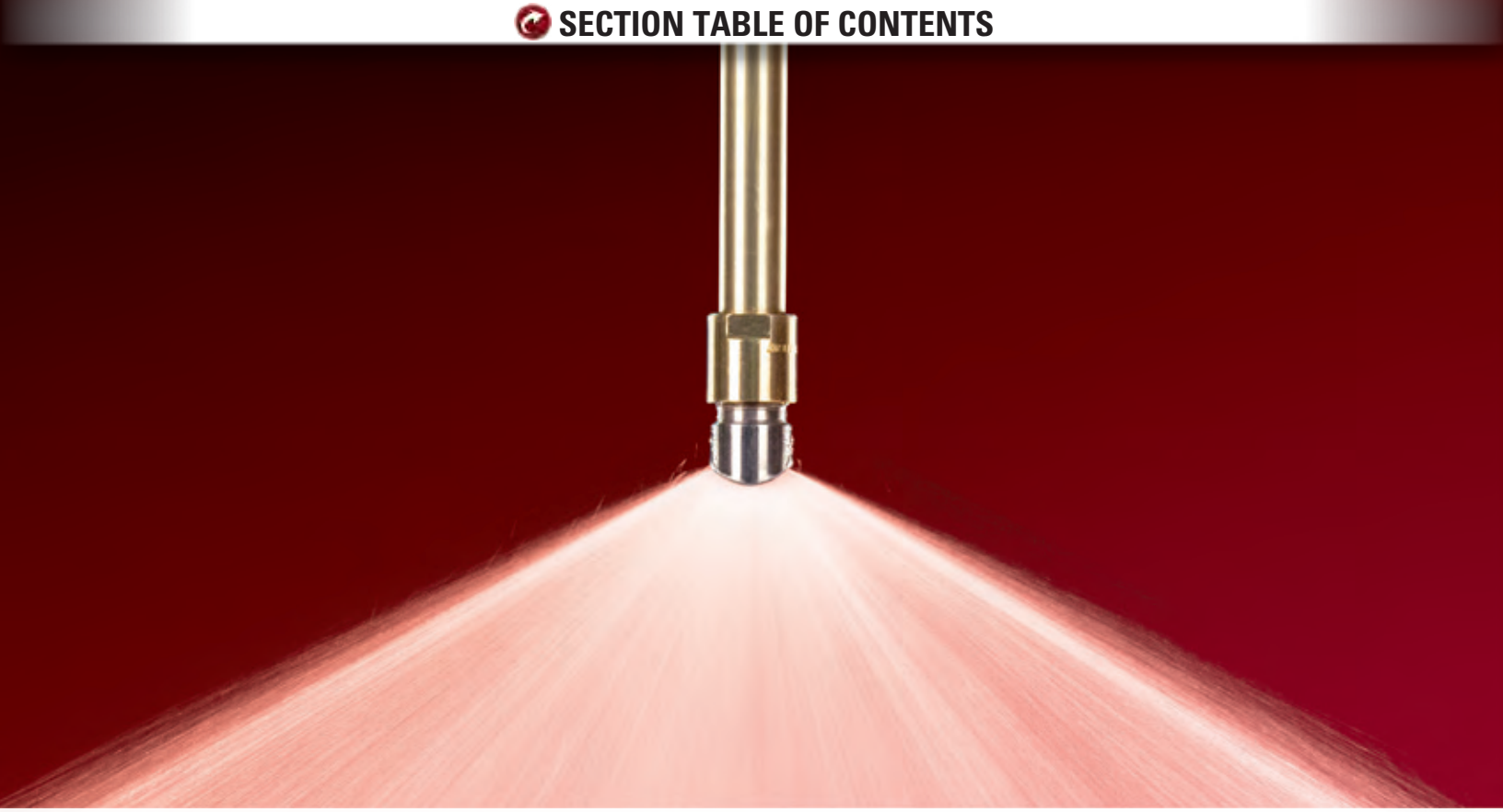
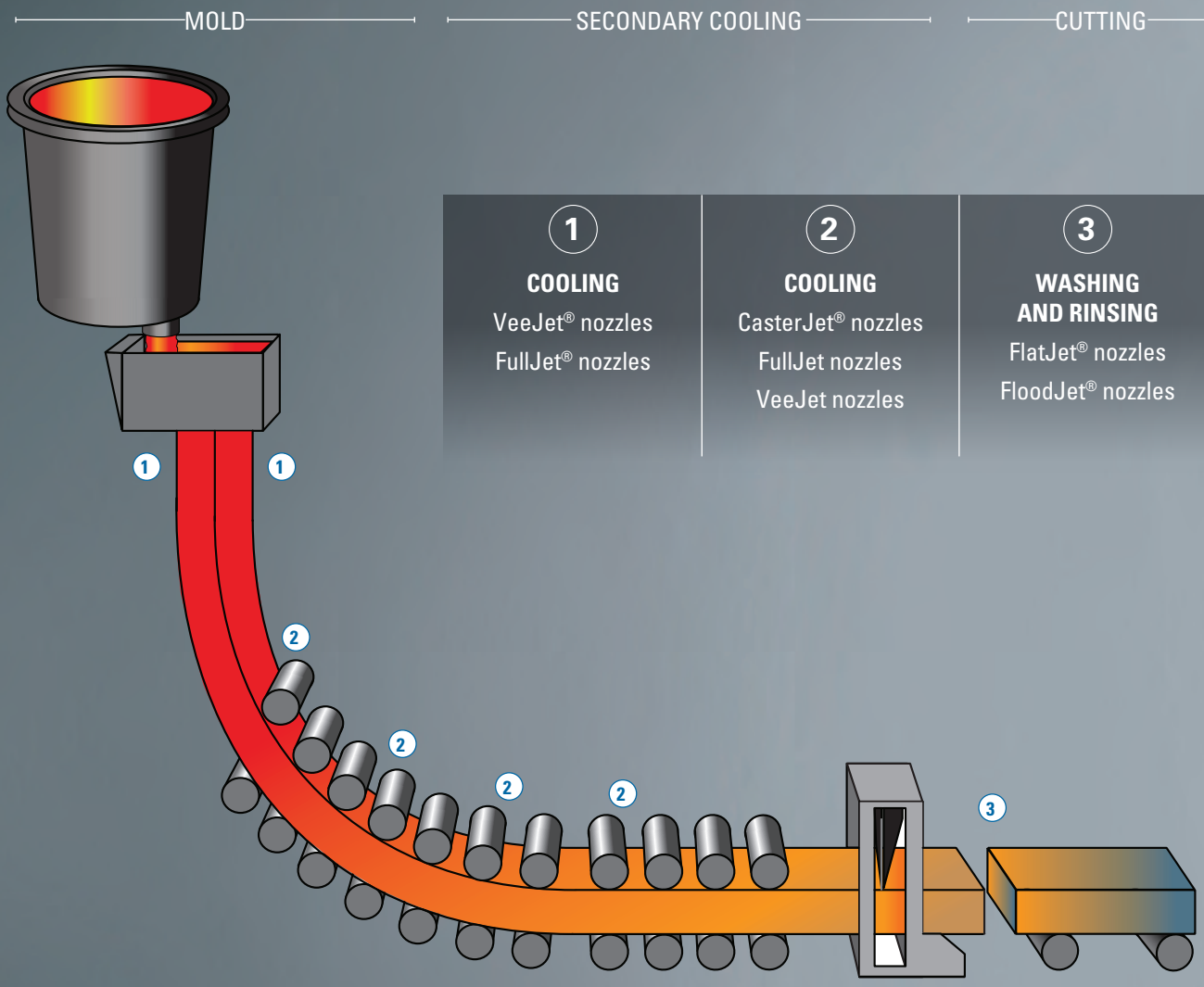


SOLUTIONS FOR CONTINUOUS CASTING

SLAB COOLING • BILLET COOLING
BLOOM COOLING • ROLL COOLING
THIN SLAB COOLING • WASHING
SECONDARY COOLING • RINSING

CONTINUOUS CASTING

INTRODUCTION



RELY ON THE INDUSTRY'S HIGHEST QUALITY NOZZLES FOR COOLING STEEL

For consistent, controlled cooling, you'll find the nozzles you need in our full line. Air mist and hydraulic nozzles are available in a wide range of styles, sizes, flow rates, spray angles and spray patterns. If you're running different widths and grades of steel, our CasterJet nozzles can help improve surface quality, reduce air and water consumption and lower maintenance time. For additional cooling and quenching, our FullJet nozzles provide uniform sprays over a wide range of flow rates and pressures. Our technical experts and sales engineers are available around the globe to assist with caster performance evaluation, heat transfer analysis, spray performance testing, special designs to fit on existing equipment and more. **Contact your local steel specialist to learn more.**

CONTINUOUS CASTING

TABLE OF CONTENTS

MORE FULL CONE NOZZLES:
SEE SECTIONS C AND E

MORE FLAT SPRAY NOZZLES:
SEE SECTIONS C AND D

OVERVIEW: CASTERJET® FLAT SPRAY NOZZLES

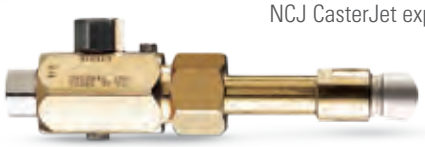
- Specifically designed for highly efficient secondary cooling in the caster
- High heat transfer rates achieved using patented atomization technology to reduce compressed air consumption and lower costs
- Large variety of nozzle configurations to accommodate most space and access requirements
- Wide range of stable spray patterns for controlled zone cooling
- Fine drops evaporate quickly and reduce water build-up under rolls
- Easy tip and tube replacement to minimize downtime when breakouts occur

CASTERJET NOZZLE OPTIONS

50070/50085/56780 NCJ CasterJet nozzles

- Unique mixing process provides uniform spray distribution and even cooling using less water and up to 25% less compressed air. Existing caster lines may be able to turn off some compressors and new lines may require fewer compressors
- Turndown ratio of 25:1 allows flow to be reduced using water pressures as low as 5 psi (.3 bar) without a loss in performance to accommodate a wide range of steel types and allows
- Large free passages allow contaminants to pass through the nozzle
- Ideal for slab and thin slab cooling

NCJ CasterJet exploded view



NCJ CasterJet assembly

56780 NCJ CasterJet body

64010 compact CasterJet nozzles

- Design, performance and benefits comparable to 50070/50085/56780 CasterJet nozzles
- Produces a consistent, uniform drop size distribution across the spray pattern
- Large free passages reduce the risk of clogging
- Ideal for slab cooling in continuous casters with limited frame space or small roll gaps

D40208 block-style CasterJet nozzles

- Compact design permits installation close to slab; spray distance is reduced and cooling efficiency improved
- Positive alignment of spray tip reduces installation errors
- Clog-resistant design
- Ideal for slab cooling

D41968/D41936 anti-pulsing CasterJet nozzles

- Anti-pulsing feature provides constant flow and high heat transfer rates even at low operating pressures
- Uniform water distribution over the entire slab width
- Vertical plate connection simplifies maintenance
- Ideal for slab and beam blank continuous casting

OVERVIEW: FULL CONE, RECTANGULAR AND IMPINGEMENT COOLING NOZZLES

- CasterJet® nozzles
  - – Uniform, stable flows that are unaffected by pressure changes
  - – Low flow operation reduces water use
  - – Large, open flow passages allow contaminants to pass through the nozzles
- D41502 nozzles provide a rectangular spray pattern with large coverage area
- 26010-1/4J nozzles provide softer, impingement-type cooling

FULL CONE, RECTANGULAR AND IMPINGEMENT COOLING NOZZLE OPTIONS

58050 CasterJet nozzles

- Similar design to 50070/50080 CasterJet nozzles with a full cone spray
- Ideal for billet, bloom and pipe continuous casting
- Removable inlets enable quick and easy replacement
- Detachable extension tube allows fast tube and tip replacement

58160 block-style CasterJet nozzles

- Same design as 58050 with a full cone spray in a compact package for areas with minimal space
- Back of nozzle includes O-ring grooves and a threaded or through-hole for mounting
- Available with inlets drilled into the block or threaded inlets for easy cleaning
- Ideal for billet, bloom and pipe continuous casting

D40206 block-style CasterJet nozzles

- Fine droplets in round full cone spray pattern provide effective cooling
- Compact design allows use in areas with limited space
- Ideal for bloom, billet and round continuous casting

FULL CONE, RECTANGULAR AND IMPINGEMENT COOLING NOZZLE OPTIONS

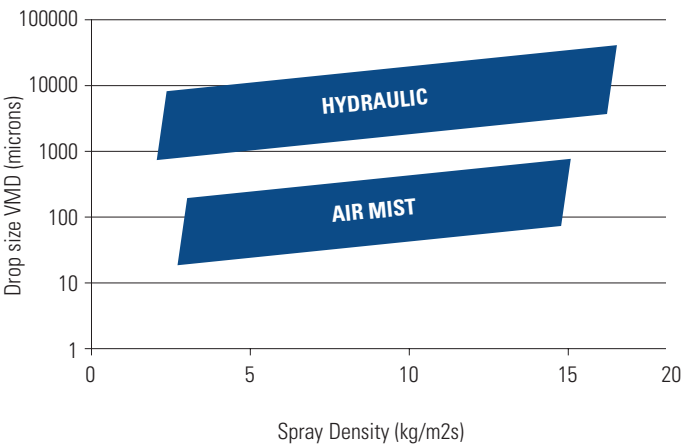
D41502 block-style CasterJet® nozzles

- Use in areas with limited space
- Large rectangular spray coverage
- Reduce use of air and water
- Designed for use in areas with limited space; can be positioned lengthwise as needed
- Ideal for bloom, billet, beam blank and round continuous casting

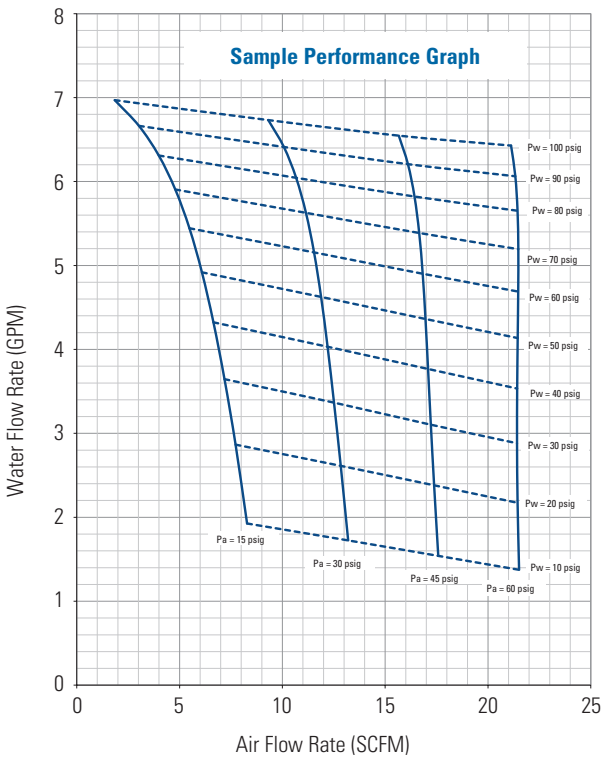
26010-1/4J impingement style nozzles

- Provides softer cooling – similar to cooling achieved with hydraulic nozzles
- Rings on air cap give visual identification of performance rating to facilitate installation and change out
- Often used in facilities running a small number of steel grades
- Ideal for billet and bloom cooling

Drop Size Comparison Between Hydraulic and Air Mist Nozzles



Sample Performance Graph



PLACING YOUR ORDER

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

FOR DETAILED NOZZLE PERFORMANCE DATA, SEE **spray.com/steelcatalog/sectionB**

AIR MIST NOZZLE QUICK REFERENCE GUIDE

Model	Spray Type	Spray Angle	Size	Air Pressure = 45 psi (3 bar) Water Pressure = 100 psi (7 bar)	
				Water Flow gpm (lpm)	Air Flow scfm (Nm^3/h)
50070/56780 NCJ CasterJet®	Flat	60° to 135°	2.0 - 6.5	2.0 to 6.5 (7.6 to 24.6)	5.2 to 15.5 (8.4 to 25.0)
50085 NCJ CasterJet	Flat	60° to 135°	8.0 - 12.0	8.0 to 12.0 (30.3 to 45.4)	18.0 to 23.0 (28.9 to 36.9)
64010 compact CasterJet	Flat	60° to 135°	2.0 - 7.0	2.0 to 7.0 (7.6 to 26.5)	5.2 to 16.3 (8.4 to 26.2)
D40208 block-style CasterJet	Flat	30° to 140°	480 - 850	1.3 to 10.3 (4.8 to 39.0)	1.6 to 8.0 (2.6 to 12.8)
D41968/D41936 anti-pulsing CasterJet	Flat	40° to 120°	0.7 - 8.0	0.8 to 6.9 (2.9 to 26.0)	0.8 to 5.9 (1.3 to 9.5)
58050 CasterJet	Full cone	45°, 60°, 90°	075 - 090	0.4 to 0.9 (1.5 to 3.4)	2.4 to 3.8 (3.9 to 6.1)
58160 block-style CasterJet	Full cone	45°, 60°, 90°	075 - 210	0.7 to 2.1 (2.6 to 7.9)	4.7 to 10 (7.5 to 16.0)
D40206 block-style CasterJet	Full cone	60° to 90°	400 - 640	0.6 to 3.8 (2.1 to 14.2)	3.7 to 8.4 (5.9 to 13.5)
D41502 CasterJet	Rectangular	70° to 120°	450 - 610	0.8 to 3.2 (2.9 to 12.0)	3.2 to 5.2 (5.1 to 8.4)
26010-1/4J impingement cooling	Flat	90° to 120°	0 - 5	0.5 to 2.8 (1.9 to 10.6)	3.0 to 10.5 (5.1 to 17.82)

NOTE: Nozzle sizing and performance depends on machine size and requirements. For more detailed information or assistance with CasterJet products, contact your local steel specialist.

PLACING YOUR ORDER

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FOR DETAILED NOZZLE PERFORMANCE DATA, SEE **spray.com/steelcatalog/sectionB**

OVERVIEW: SPECIALTY COOLING FULLJET® FULL CONE NOZZLES

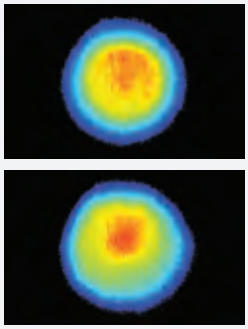
- Designed specifically for demanding conditions in steel mills. Staked-in vane design won't loosen during caster operation
- More uniform distribution across the entire spray pattern than other full cone nozzles to ensure consistent and controlled cooling
- Spray angle is unaffected by changes in operating pressure allowing for wider variations in casting speeds
- Use different HHCC nozzle sizes to obtain the needed mass water flux; a nominal flow rate increase of 25% at every size increment simplifies flow layout for each segment
- Low profile design is suitable for use on risers in billet casters
- Hex body allows the use of standard sockets for easy installation and removal
- Ideal for use in mini mills and on high-speed continuous casting machines

SPECIALTY COOLING FULLJET NOZZLE OPTIONS

HHCC
1/8" to 1/2" male conn.
Staked-in vane

HHX
1/4" to 3/8" male conn.
Staked-in vane

P45075
1/4" to 3/8" female conn.
Staked-in vane



HHCC (top) and HHX FullJet (bottom) full cone nozzle spray comparison using laser sheet imaging in our spray laboratories.*

*The light intensity in the spray is directly proportional to the volume of liquid. Red is the highest light intensity, which is the heaviest volume in the spray. Black is the lowest or no light intensity.

SPECIALTY COOLING FULLJET NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Flow Rate Range gpm (lpm)	Spray Angle	Materials
HHCC	M	1/8 to 1/2 NPT	0.65 to 9.4 (2.5 to 35.6)	68° to 74°	Brass, 303 stainless steel
HHX	M	1/4 to 3/8 NPT	0.36 to 7.8 (1.6 to 6.2)	45° to 90°	Brass, 303 stainless steel
P45075	F	1/4 to 3/8 BSPP	0.42 to 5.6 (1.6 to 22)	45° to 120°	Brass, 303 stainless steel

F = female thread; M = male thread.

PLACING YOUR ORDER

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FOR DETAILED NOZZLE PERFORMANCE DATA, SEE **spray.com/steelcatalog/sectionB**

OVERVIEW: SPECIALTY COOLING RECTANGULAR AND FLAT SPRAY NOZZLES

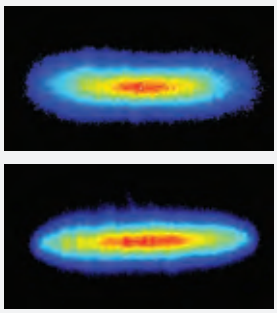
- Designed specifically for demanding conditions in steel mills; ideal for slab casting
- 25381 spray tips produce a thick, rectangular, uniform pattern and feature a smaller orifice to minimize fluttering and maximize cooling efficiency. Widely used in upper section cooling in slab, billet and bloom casting
- New D41828 spray tips provide similar performance to 25381 spray tips but feature a design optimized for efficient heat transfer
- D41539 rectangular spray tips are ideal for cooling billets and blooms
- VeeJet® XT flat spray nozzles produce an extra-thick spray with a transverse spray angle of 20° and 30° for use with different shapes
- 49784 dovetail spray tips are ideal for roll cooling operations where alignment is critical
- 56862 cross spray nozzles produce an extra heavy edge pattern; ideal for cooling two rolls in a caster with a single nozzle

SPECIALTY COOLING RECTANGULAR AND VEEJET FLAT SPRAY NOZZLE OPTIONS

25381
dovetail spray tip

D41828
dovetail spray tip

D41539
spray tip
Steel positioning pin



VeeJet XT (top) and standard VeeJet (bottom) nozzle spray comparison using laser sheet imaging in our spray laboratories.*

23530-XT
3/8" male conn.
One-piece body

58090-XT
1/4" to 3/8" male conn.
One-piece body

49784-XT
dovetail spray tip

56862
1/2" male conn.
One-piece body

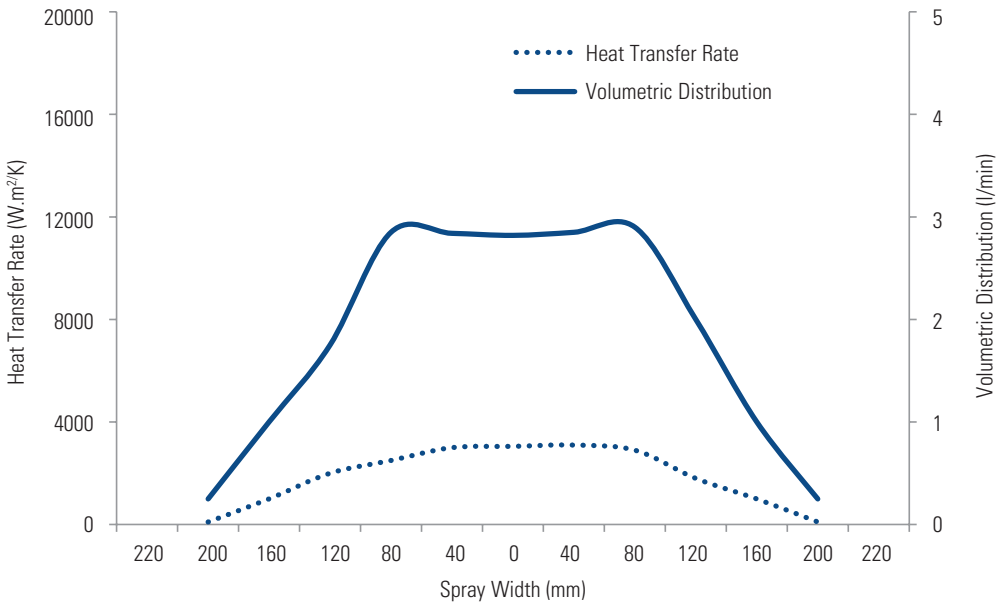
*The light intensity in the spray is directly proportional to the volume of liquid. Red is the highest light intensity, which is the heaviest volume in the spray. Black is the lowest or no light intensity.

SPECIALTY COOLING RECTANGULAR AND VEEJET® FLAT SPRAY NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Flow Rate Range gpm (lpm)	Materials
25381/D41828	Dovetail tip; threaded and weld body options	NA	0.44 to 20.1 (1.7 to 76.1)	Brass, 303 stainless steel
D41539	Special	1.34	1.1 to 9.1 (3.6 to 34)	Brass
23530-XT	M	3/8	0.8 to 4.5 (3.5 to 14.7)	Brass, 303 stainless steel
58090-XT	M	1/4 to 3/8	1.0 to 8.9 (4.7 to 28.3)	Brass, 303 stainless steel
49784-XT	Dovetail tip; threaded and weld body options	NA	1.4 to 21.9 (6.4 to 81)	Brass, 303 stainless steel
56862	M	1/2	1.1 to 4.8 (4.7 to 14.8)	303 stainless steel

F = female thread; M = male thread.

Heat Transfer Comparison Curve and Distribution Data for Specialty Cooling Nozzles



PLACING YOUR ORDER

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FOR DETAILED NOZZLE PERFORMANCE DATA, SEE **spray.com/steelcatalog/sectionB**

OVERVIEW: FULL CONE FULLJET® NOZZLES

G and H FullJet nozzles:

- Solid cone-shaped spray pattern with round impact area
- Unique vane design minimizes turbulence and ensures uniform cooling
- Large, unobstructed flow passages minimize clogging
- G, GG, GA and GGA models provide uniform spray distribution from .10 to 13.9 gpm (.38 to 52 lpm) at operating pressures up to 300 psi (20 bar); spray angles from 43° to 94°
- H and HH models provide uniform spray distribution from .10 to 49 gpm (.38 to 183 lpm) at operating pressure up to 300 psi; spray angles from 46° to 94°
- Ideal for cooling billets, blooms and narrow side slab castings

VK FullJet nozzles:

- Solid cone-shaped spray pattern with round impact area
- Uniform spray distribution from .16 to 26.5 gpm (.5 to 89.1 lpm) at operating pressures up to 300 psi (20 bar); spray angles from 45° to 120°
- Ideal for slab cooling

FULL CONE FULLJET NOZZLE OPTIONS

G
1/8" to 1/2" female conn.
Removable cap and vane

GG
1/8" to 1/2" male conn.
Removable cap and vane

GA
1/8" to 1/2" female conn.
Angle-type
Removable cap and vane

GGA
1/8" to 1/2" male conn.
Angle-type
Removable cap and vane

H
3/4" to 1" female conn.
One-piece body

HH
1/8" to 1" male conn.
One-piece body

VK
3/8" to 3/4" male conn.
One-piece body

FULL CONE FULLJET® NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
G	F	1/8 to 1/2	Brass, mild steel, 303 stainless steel, 316 stainless steel, polyvinyl chloride
GG	M	1/8 to 1/2	
GA	F, angle-type	1/8 to 1/2	Brass, mild steel, 303 stainless steel
GGA	M, angle-type	1/8 to 1/2	
H	F	3/4 to 1	Brass, mild steel, 303 stainless steel, 316 stainless steel, polyvinyl chloride
HH	M	1/8 to 1	
VK	M	3/8 to 3/4 BSPP	Brass, 316 stainless steel, 303 stainless steel
VK	F	3/8 BSPP	Brass, 316 stainless steel, 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 **spray.com/steelcatalog/sectionB**

OVERVIEW: SQUARE, OVAL AND VANELESS FULLJET® NOZZLES

G-SQ, GG-SQ, HH-SQ FullJet nozzles:

- Full cone square spray pattern
- Uniform spray distribution from .26 to 37 gpm (1.1 to 140 lpm) at operating pressures up to 150 psi (10 bar); spray angles from 40° to 82°
- Ideal for cooling slabs, billets, and blooms in the upper section after the mold

G-VL, GG-VL and HH-VL FullJet nozzles:

- Full cone oval spray pattern; length is approximately twice its width
- Uniform spray distribution from .59 to 3.2 gpm (2.2 to 11.9 lpm) at operating pressures up to 150 psi (10 bar); spray angles: 80° by 45° to 106° by 64°
- Ideal for cooling slabs, billets, and blooms in the upper section after the mold

GANV and GGANV FullJet nozzles:

- Full cone round spray pattern
- No vane for unrestricted flow – coarse spray is projected at 90° from axis at the inlet
- Uniform spray distribution from .35 to 23 gpm (1.4 to 87 lpm) at operating pressures up to 100 psi (7 bar); spray angles: 68° to 95°
- Ideal for use in cooling applications where clogging is a concern

SQUARE, OVAL AND VANELESS FULLJET NOZZLE OPTIONS

G-SQ
1/8" to 1/2" female conn.
Removable cap and vane

GG-SQ
1/8" to 1/2" male conn.
Removable cap and vane

HH-SQ
1/8" to 1" male conn.
One-piece body

G-VL
3/8" female conn.
Removable cap and vane

GG-VL
3/8" male conn.
Removable cap and vane

HH-VL
1/2" male conn.
One-piece body

GANV
1/4" to 1/2" female conn.
Vaneless design
Removable cap

GGANV
1/4" to 1/2" male conn.
Vaneless design
Removable cap

SQUARE, OVAL AND VANELESS FULLJET® NOZZLE QUICK REFERENCE GUIDE

Model	Connection/Type	Connection Size (in.)	Materials
G-SQ	F	1/8 to 1/4	Brass, mild steel, 303 stainless steel, 316 stainless steel
GG-SQ	M	1/8 to 1/4	Brass, mild steel, 303 stainless steel, 316 stainless steel
HH-SQ	M	1/8 to 1	Brass, mild steel, 303 stainless steel, 316 stainless steel, polyvinyl chloride
G-VL	F	3/8	Brass, 303 stainless steel
GG-VL	M	3/8	Brass, 303 stainless steel
HH-VL	M	1/2	Brass, 303 stainless steel
GANV	F	1/4 to 1/2	Brass, 303 stainless steel
GGANV	M	1/4 to 1/2	Brass, 303 stainless steel

F = female thread; M = male thread.

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