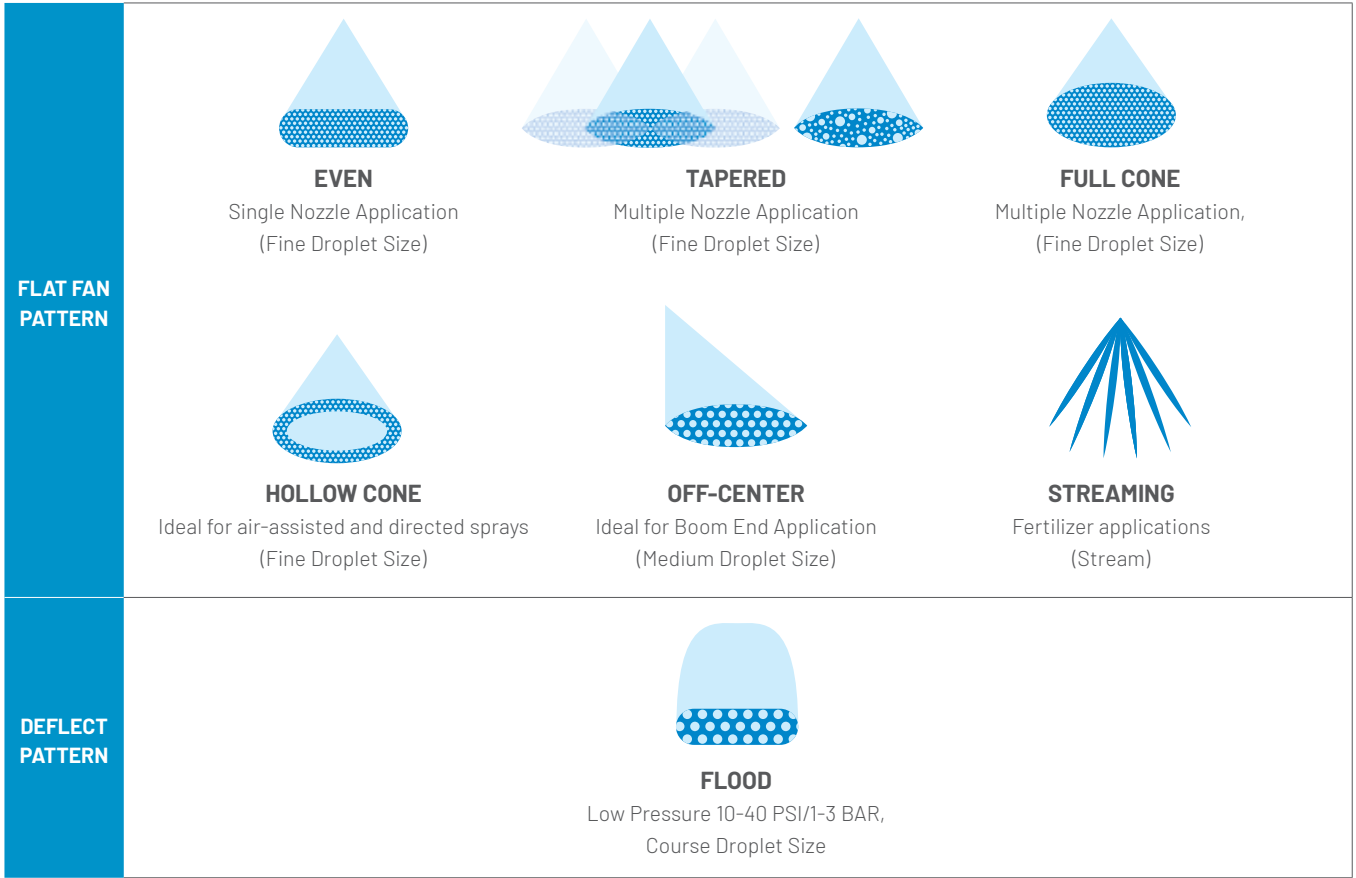


SELECTING THE RIGHT SPRAY NOZZLE

5) SPRAY PATTERN TYPE:

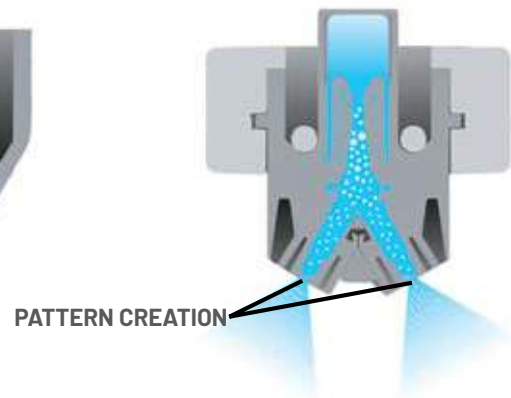
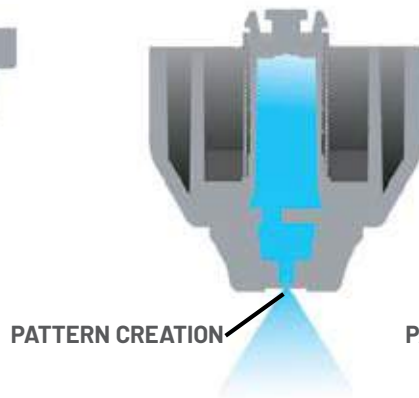
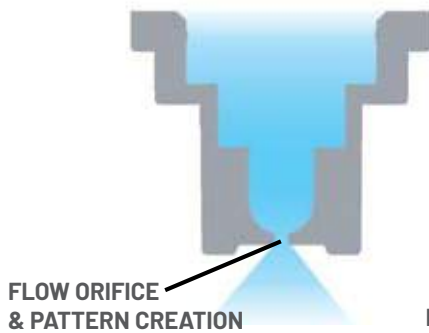


NOZZLE TECHNOLOGY:

STANDARD HYDRAULIC
(Flat Fan - VP)

PRE-ORIFICE
(Guardian-GRD)

AIR INDUCTION
(GuardianAIR Twin-GAT)



EXIT ORIFICE FUNCTION:

- ◆ Pro - Low Cost
- ◆ Con - Increased drift potential

- ◆ Pro - Reduced drift potential
- ◆ Con - Multiple pieces to clean

- ◆ Pro - Increased coverage and Reduced Drift
- ◆ Con - Reduced performance with thick suspension based solutions

6) NOZZLE SIZE AND PRESSURE:

Use the flow rate tables provided throughout this guide to select the nozzle and pressure that provides the flow needed for the application.



SELECTING THE RIGHT SPRAY NOZZLE

7) SPRAY QUALITY:

The size and the variation of droplets determine the spray quality that a nozzle produces. To apply a spray solution safely and with the most agronomic value, it must be delivered with the appropriate droplet size spectrum.

ASABE S572.1 DROPLET SIZE CLASSIFICATION

The American Society of Agricultural and Biological Engineers (ASABE) developed the ASABE S572.1 standard to measure and interpret spray quality from nozzles.

Spray Quality*	Size of Droplets	VMD Range (Microns**)	Color Code	Retention on Difficult to Wet Leaves	Drift Potential
Extremely Fine	Small	<60	Purple	Excellent	High
Very Fine		61-105	Red	Excellent	
Fine		106-235	Orange	Very Good	
Medium		236-340	Yellow	Good	
Coarse		341-403	Blue	Moderate	
Very Coarse		404-502	Green	Poor	
Extremely Coarse		503-665	White	Very Poor	
Ultra Coarse	Large	>665	Black	Very Poor	Low

*Always read the pesticide label to determine which spray quality is required.
 ** Estimated from sample reference graph in ASABE/ANSI/ASAE Standard S572.1.

The ASABE S572.1 standard uses eight droplet classification categories, six of which are common for agriculture and horticulture: Very Fine, Fine, Medium, Coarse, Very Coarse and Extremely Coarse. Most agrochemical applications recommend a fine, medium, or coarse spray.

<div style="background-color: #f4a460; padding: 2px; display: inline-block; margin-bottom: 5px;">Fine</div> <p>sprays provide enhanced retention for directed spraying on the target including:</p> <ul style="list-style-type: none"> ◆ Foliar-acting weed control ◆ Contact-acting fungicides and insecticides 	<div style="background-color: #ffff00; padding: 2px; display: inline-block; margin-bottom: 5px;">Medium</div> <p>sprays are the most widely used spray type.</p> <ul style="list-style-type: none"> ◆ Used by default by most applicators when spray quality is not defined by the label. ◆ Systemic-acting fungicides, insecticides and herbicides. 	<div style="background-color: #0070c0; padding: 2px; display: inline-block; margin-bottom: 5px;">Coarse</div> <p>sprays are used with systemic, residual, and soil-applied herbicides.</p>
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BCPC NOZZLE CLASSIFICATION

The British Crop Protection Council (BCPC) develop a standard for classifying nozzle droplet size. The standard is based on relative comparisons of droplet size using a set of agreed upon reference nozzles.

For conventional hydraulic nozzles, spray quality varies according to nozzle size (defined by nozzle flow in l/min) and with pressure, larger sizes and lower pressures produce larger droplets. Spray quality is defined by Volume Median Diameter (VMD) which is the mid-droplet size where half of the volume of spray is in larger and half in smaller droplets. The BCPC International Spray Classification System, groups nozzles into five categories: VERY FINE, FINE, MEDIUM, COARSE AND VERY COARSE, each category covering a range of VMDs.

Air Induction (AI) nozzles incorporate air as well as fluid in the droplets. As a result they are not classified by BCPC in the same way as standard hydraulic nozzles. AI nozzles tend to have a more uniform droplets size and less of the driftable fines. Those at the finer end of the spectrum can be successfully used in place of conventional 'medium' spray quality whilst at the same time reducing spray drift.

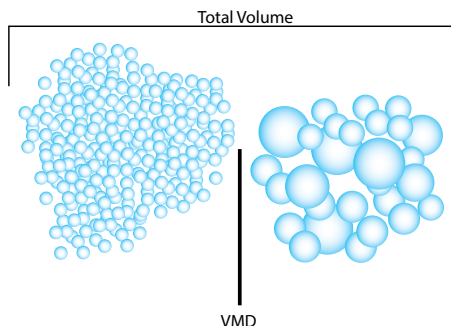
SELECTING THE RIGHT SPRAY NOZZLE

The following chart has been designed to simplify selection of the correct spray nozzle type for the agrochemical to be applied. It is based on having good conditions for spraying and should be used in conjunction with the agrochemical manufacturer's label. Increased carrier rates may allow for coarser sprays to reduce risk of drift. Always follow the agrochemical label exactly.

Section	Code	Spray Nozzle	Common Use	Pattern	Technology	Orifice Material	Nominal Spray Angle	Pressure Range		ASABE Droplet Classification										
								PSI	BAR	XF	VF	F	M	C	VC	XC	UC			
Broadcast	ULD	Ultra Lo-Drift	Weeds	Tapered Flat Fan	Air Induction	Polyacetal	120°	20-115	1-8											
	3D	3D Nozzle	General	Tapered Flat Fan	Elliptical Orifice	Polyacetal	100°	10-90	0.7-6											
	GAT	GuardianAIR Twin	Plant Health	Tapered Flat Fan	Air Induction	Polyacetal	110°	30-115	2-8											
	ATW	Air Injected Twin Fan	Plant Health	Tapered Flat Fan	Air Induction	Ceramic	110°	40-100	3-7											
	GA	GuardianAIR	Plant Health	Tapered Flat Fan	Air Induction	Polyacetal	110°	20-115	1-8											
	AVI	Air Injected Anti-Drift	Weeds	Tapered Flat Fan	Air Induction	Ceramic	80°, 110°	30-100	2-7											
	GRD	Guardian	Plant Health	Tapered Flat Fan	Pre-Orifice	Polyacetal	120°	20-115	1-8											
	LD	Lo-Drift	Plant Health	Tapered Flat Fan	Pre-Orifice	Polyacetal	80°, 110°	20-70	1-5											
	ADI	Drift Reduction	Plant Health	Tapered Flat Fan	Air Induction	Ceramic	110°	30-70	2-5											
	VP	Variable Pressure	General	Tapered Flat Fan	Elliptical Orifice	Polyacetal	80°, 110°	20-70	1-5											
Wide	AXI	Wide Range Fan	General	Tapered Flat Fan	Elliptical Orifice	Ceramic	80°, 110°	20-70	1-5											
	F	FanTip	General	Tapered Flat Fan	Elliptical Orifice	Polyacetal	80°, 110°	30-60	2-4											
	HF	Hi-Flow	Fertilizer	Tapered Flat Fan	Pre-Orifice	Polyacetal	140°	20-80	1.5-6											
	DT	DeflectTip	Weeds & Fertilizer	Flood	Deflection	Polyacetal	80°-160°	10-60	1-4											
	ESI	Six Stream	Fertilizer	Streams	Pre-Orifice	Ceramic or Polyacetal	110° Equivalent	15-60	1-4										S	
	DC	Flow Regulating Disc	Fertilizer	Stream	Round Orifice	Polyacetal	0°	10-150	1-10											S
	AMT	Flow Regulating Disc	Fertilizer	Stream	Round Orifice	Ceramic	0°	10-725	1-50											S
	DC/CR	SwirlTip Disc/Core	Plant Health	Hollow Cone	Swirl	Polyacetal	25°-110°	10-150	1-10											
	DCC/CRC	Disc and Core	Plant Health	Hollow Cone	Swirl	Ceramic	13°-93°	10-300	1-20											
	Streaming & Directed	HCX	HollowTip Hollow Cone	Plant Health	Hollow Cone	Swirl	Polyacetal	80°	40-150	3-10										
ATR		Hollow Cone	Plant Health	Hollow Cone	Swirl	Ceramic	80°	40-350	3-24											
TVI		Hollow Cone	Plant Health	Hollow Cone	Air Induction	Ceramic	80°	70-360	5-25											
AVI		Air Injected Anti-Drift	Plant Health	Tapered Flat Fan	Air Induction	Ceramic	80°	40-350	3-24											
AXI		Wide Range Fan	Plant Health	Tapered Flat Fan	Elliptical Orifice	Ceramic	80°	40-350	3-24											
DCC/CRC		Disc and Core	Plant Health	Full Cone	Swirl	Ceramic	14°-71°	10-300	1-20											
FCX		Full Cone	Plant Health	Full Cone	Swirl	Polyacetal	80°	15-150	1-10											
E		FanTip Even Flat	Weeds	Even Flat Fan	Elliptical Orifice	Polyacetal	80°	30-60	2-4											
OC		Off-Center Flat	Unspecialized	Off-Center Fan	Elliptical Orifice	Brass	80°	30-60	2-4											
OCI		Off-Center Ceramic	Unspecialized	Off-Center Fan	Elliptical Orifice	Ceramic	80°	30-60	2-4											
Special	AVI-OC	Air Injected Off-Center	Weeds	Off-Center Fan	Air Induction	Ceramic	80°	40-100	3-7											
	XT	Boom X Tender	Weeds	Boomless Fan	Pre-Orifice	Stainless or Polyacetal	105°	30-60	2-5											
	TUR	Sudden Impact	Car Wash	0° Rotation	Turbo	Stainless or Brass	24° or 30°	800-3000	55-207											
	HP	High Pressure	Car Wash	Flat Fan	High Pressure	Hardened Stainless Steel	0°, 5°, 15°, 25°, 40°	300-4000	21-276											
	FP	FulcoJet	Car Wash	Full Cone	Swirl	PVDF	45°-80°	10-150	.7-10											
	CM	FanJet	Car Wash	Flat Fan	Elliptical Orifice	PVDF	0°-110°	30-500	2-35											
	MISTING	F, HAF, PF, AFD, AF	Cooling & Humidification	Fan or Hollow Cone	Elliptical Orifice or Swirl	Polyacetal	65°-110°	40-150	3-10											
	E	Even	Knapsack	Even Flat Fan	Elliptical Orifice	Polyacetal	80°	15-45	1-3											
	DT/AN	Deflect Nozzle/PoliJet	Knapsack	Flood	Deflection	Polyacetal	53.-127°	15-45	1-3											

S These nozzles produce streams to minimize atomization

UNDERSTANDING DROPLET VMD



VMD is the droplet size at which 50% of the spray volume is in droplets larger than the VMD and 50% of the volume is in droplets smaller than the VMD (adapted from Matthews 1992).

UNDERSTANDING MICRON SIZE

Degree of Atomization	Droplet Size (Microns)	Relative Size Related to Common Objects
Fog	Up to 25	Point of a Needle (25 Microns)
Fine Mist	20-100	Human Hair (100 Microns)
Fine Drizzle	100-250	Sewing Thread (150 Microns)
Heavy Drizzle	250-500	Toothbrush Bristle (300 Microns)
Light Rain	500-800	Staple (550 Microns)
Heavy Rain	800-1000	Paper Clip (850 Microns)
Thunderstorm Rain	1000-4000	#2 Pencil Lead (2000 Microns)

- ◆ Droplet sizes are usually expressed in microns (micrometers).
- ◆ One micron equals one thousandth of a millimeter.
- ◆ Lower spraying pressures provide larger droplet sizes, while higher spraying pressures yield smaller droplet sizes.
- ◆ The smallest droplet sizes are achieved by air atomizing nozzles.
- ◆ Generally speaking, the largest spray droplets are produced by wide-angle, flat hydraulic spray nozzles.