

# Guidelines for Spray Nozzle Selection

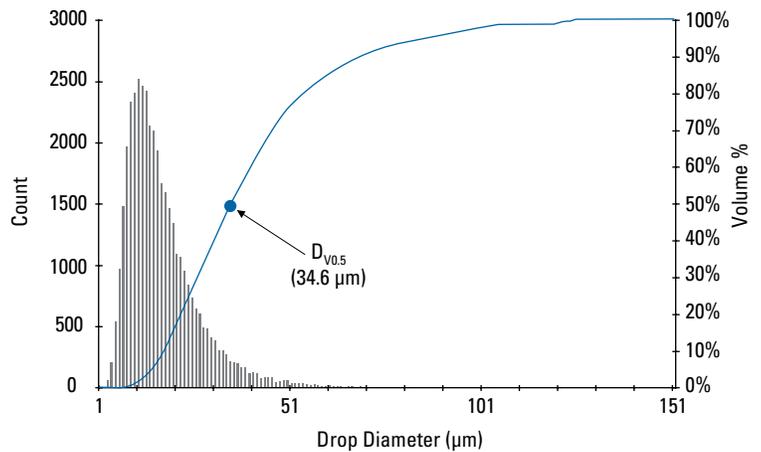
Spray nozzle specification depends on many factors. General guidelines follow. However, it is recommended that you contact a firm specializing in spray technology to ensure you get the performance you need for your specific environment and operating conditions.

## Start By Understanding the Role of Drop Size

Drop size refers to the size of the individual drops that comprise a nozzle's spray pattern. Each spray pattern provides a range of drop sizes. This range is the drop size distribution. See Figure 6.

Many factors can affect drop size: liquid properties, nozzle capacity, spray pressure and spray angle.

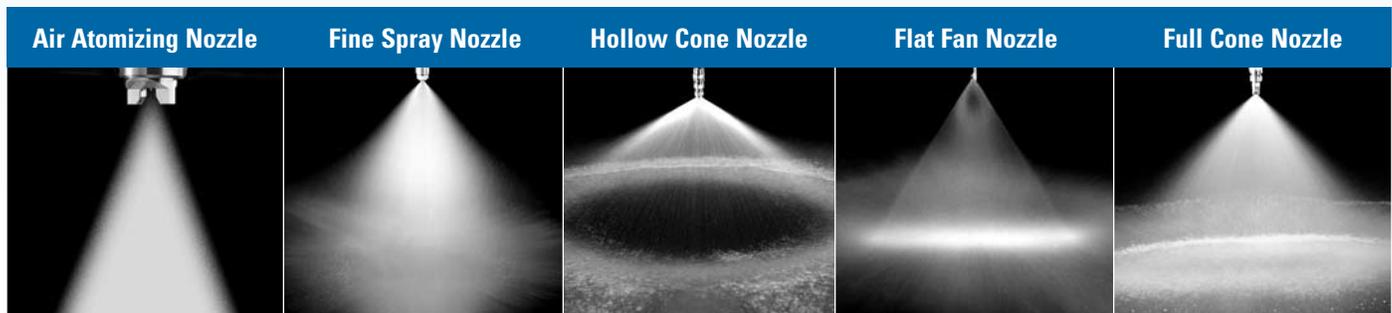
Figure 6



$D_{v0.5}$  is the Volume Median Diameter, which is also known as VMD or MVD.  $D_{v0.5}$  is a value where 50% of the total volume of liquid sprayed is made up of drops with diameters larger than the median value and 50% smaller than the median value.

## Drop Size Basics

- Air atomizing nozzles produce the smallest drop sizes followed by fine spray, hollow cone, flat fan and full cone nozzles
- Higher pressures yield smaller drops and lower pressures yield larger drops
- Lower flow nozzles produce the smallest drops and higher flow nozzles produce the largest drops
- Increases in surface tension increase drop size
- Drop velocity is dependent on drop size. Small drops may have a higher initial velocity, but velocity diminishes quickly. Larger drops retain velocity longer and travel further



Smallest  
Drop Size

Largest  
Drop Size

## Nozzle Types: Hydraulic Atomizing vs. Air Atomizing

In most operations, drops less than 200  $\mu\text{m}$  do a better job of suppressing airborne dust particles, which are also very small. Atomization shears the water into very small particles, reducing surface tension and increasing the number of drops in a given area.

Atomization is achieved by pumping water through nozzles at high pressure or by using a combination of compressed air and water pumped at lower pressure to produce very small drops or fog. Using air atomizing nozzles is usually preferable since they produce smaller drops. However, the cost of installing and operating compressed air may be prohibitive in some operations. Hydraulic fine spray nozzles are widely used and yield acceptable performance in many operations. See Figure 7 for comparison matrix.

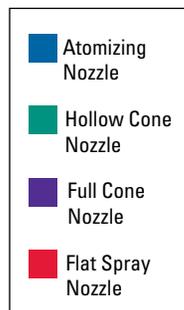
**Figure 7**

### Hydraulic Fine Spray vs. Air Atomizing Nozzle Comparison

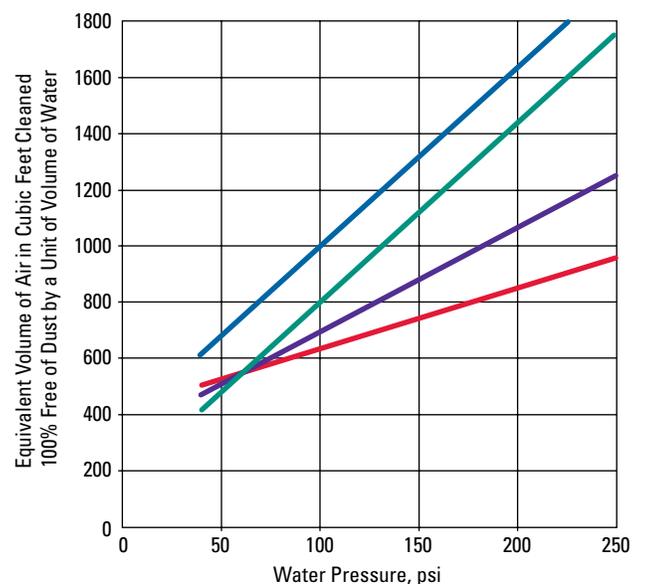
NOZZLE TYPE	PROS	CONS
 <p><b>Hydraulic Fine Spray</b> (Wall-Mount)</p>	<ul style="list-style-type: none"> <li>• Simple installation</li> <li>• Lower operating costs – no compressed air required</li> </ul>	<ul style="list-style-type: none"> <li>• Operating at high pressures increases electrical consumption and increases pump wear</li> <li>• Water quality is critical. Small orifices are prone to clogging by small contaminants</li> <li>• Best used in enclosed areas with little turbulence</li> </ul>
 <p><b>Air Atomizing</b></p>	<ul style="list-style-type: none"> <li>• Smaller drop size</li> <li>• Larger flow passages and less clogging</li> </ul>	<ul style="list-style-type: none"> <li>• Expense of compressed air</li> <li>• Possibility of injecting additional air into the area – increased velocity could stimulate additional dust movement</li> <li>• Best used in enclosed areas with little turbulence</li> </ul>

For dust prevention, standard hydraulic nozzles that produce drops between 200 and 1200  $\mu\text{m}$  are generally used.

For suppression of airborne dust, air atomizing nozzles or hydraulic fine spray nozzles that produce drops between 20 and 200  $\mu\text{m}$  are used. Figure 8 illustrates the effectiveness of airborne dust suppression by nozzle type.



**Figure 8**



Bureau of Mines Technology News 150, July 1982, "Dust Knockdown Performance of Water Spray Nozzles"

# Guidelines for Spray Nozzle Selection

## Spray Pattern Selection

Operating conditions will determine which nozzle style and spray pattern will offer the best performance. These guidelines provide an overview that can help you narrow the options, but be sure to consult performance tables and drop size data to refine your selection. Figure 9 provides an overview of typical operations for many nozzle types.

### Hollow cone nozzle features:

- Circular ring of water
- Large nozzle orifices that reduce clogging
- Small drop size – generally smaller than other nozzle types
- Typically used in locations where dust is widely dispersed
- Most widely used for dust prevention



**B and BD WhirlJet®**  
hollow cone nozzles

### Flat spray nozzle features:

- Tapered-edge, rectangular or even spray pattern
- Small- to medium-size drops
- Typically used in narrow or rectangular enclosed spaces
- Widely used for dust prevention



**VeeJet®**  
flat spray nozzle

### Full cone nozzle features:

- Round spray pattern
- High velocity over a distance
- Medium- to large-size drops
- Commonly used when nozzles must be located a good distance away from the area where dust suppression is needed or to clear mechanical obstructions
- Widely used for dust prevention



**FullJet®**  
full cone nozzle

**Air atomizing nozzle features:**

- Choice of spray patterns – round, full and flat
- Very small drops
- Commonly used to capture small dust particles in enclosed areas to minimize drift
- Widely used for airborne dust suppression



**Hydraulic fine spray nozzle features:**

- Hollow cone spray pattern
- Very small drops
- Commonly used to capture small dust particles in enclosed areas to minimize drift
- Widely used for airborne dust suppression and operations requiring a light fog



**Figure 9**

**Typical Applications by Spray Nozzle Type**

Application	Air Atomizing	Hydraulic Fine Spray	Hollow Cone	Flat Spray	Full Cone
<b>Dust Prevention</b>					
Stackers, reclaimers		•			•
Stockpiles		•		•	
Transfer points		•	•		•
Transport areas/roads			•		
<b>Airborne Dust Suppression</b>					
Jaw crushers	•	•	•		
Loading terminals	•	•			
Primary dump hopper	•	•			
Transfer points	•	•			