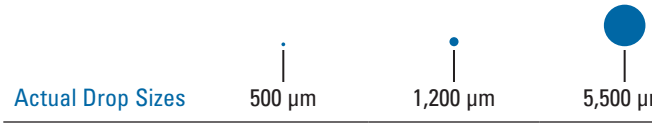
Spray Drop Size (Atomization)

Accurate drop size information is an important factor in the overall effectiveness of spray nozzle operation particularly in industrial applications such as gas cooling, gas conditioning, fire suppression and spray drying.

Drop size refers to the size of the individual spray drops that comprise a nozzle's spray pattern. Each spray provides a range of drop sizes; this range is referred to as drop size distribution. Drop size distribution is dependent on the spray pattern type and varies significantly from one type to another. The smallest drop sizes are achieved by air atomizing nozzles while the largest drops are produced by full cone hydraulic spray nozzles.



One inch = 25,400 µm
One millimeter = 1,000 µm
µm = micrometers

Liquid properties, nozzle capacity, spraying pressure and spray angle also affect drop size. Lower spraying pressures provide larger drop sizes. Conversely, higher spraying pressures yield smaller drop sizes. Within each type of spray pattern the smallest capacities produce the smallest spray drops, and the largest capacities produce the largest spray drops.

Drop Size

by Spray Pattern Type at Various Pressures and Capacities

Spray Pattern Type	10 psi (0.7 bar)			40 psi (2.8 bar)			100 psi (7 bar)		
	Capacity gpm	Capacity l/min	VMD microns	Capacity gpm	Capacity l/min	VMD microns	Capacity gpm	Capacity l/min	VMD microns
Air Atomizing	.005 .02	.02 .08	20 100	.008 8	.03 30	15 200	12	45	400
Fine Spray	.22	.83	375	.03 .43	.1 1.6	110 330	.05 .69	.2 2.6	110 290
Hollow Cone	.05 12	.19 45	360 3400	.10 24	.38 91	300 1900	.16 38	.61 144	200 1260
Flat Fan	.05 5	.19 18.9	260 4300	.10 10	.38 38	220 2500	.16 15.8	.61 60	190 1400
Full Cone	.10 12	.38 45	1140 4300	.19 23	.72 87	850 2800	.30 35	1.1 132	500 1720

Based on a sampling of nozzles selected to show the wide range of possible drop sizes available.

Drop Size Terminology

Terminology is often a major source of discrepancy and confusion in understanding drop size. To accurately compare drop sizes from one nozzle to another, the same diameters have to be used. Drop size is usually expressed in microns (micrometers). Following are the most popular mean and characteristic diameters and their definitions.

Volume Median Diameter (VMD)

also expressed as $D_{v0.5}$ and Mass Median Diameter (MMD):

A means of expressing drop size in terms of the volume of liquid sprayed. The Volume Median Diameter drop size when measured in terms of volume (or mass) 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% with smaller diameters.

Sauter Mean Diameter (SMD)

also expressed as D_{32}:

A means of expressing the fineness of a spray in terms of the surface area produced by the spray. The Sauter Mean Diameter is the diameter of a drop having the same volume-to-surface area ratio as the total volume of all the drops to the total surface area of all the drops.

Number Median Diameter (NMD)

also expressed as $D_{N0.5}$:

A means of expressing drop size in terms of the number of drops in the spray. This means that 50% of the drops by count or number are smaller than the median diameter and 50% of the drops are larger than the median diameter.

More complete drop size data is available on all types of spray nozzles. For more information, request "An Engineer's Practical Guide to Drop Size" or contact your local Spraying Systems Co. sales engineer.