

NOZZLE FEATURES

Spray nozzles are used in a wide array of industrial applications ranging from odour control and dust suppression through to metal paint pre-treatment and fire protection systems. This extreme versatility is due to the ability of the nozzles to operate over a wide range of spraying conditions. Nevertheless, whatever the application, the function of the nozzle still remains the same - to control the flow of liquid, atomise liquid into droplets, distribute the droplets in a specific pattern and generate impact over a specific surface area. The following section is a step-by-step guide to the characteristics of spray nozzles and will help you select the correct nozzle to suit your application. A summary chart is provided on page 8.

CONTROL OF LIQUID FLOW

The flow rate (capacity) of a fluid through a nozzle is affected by a number of factors including pressure, specific gravity and viscosity of the fluid.

Pressure

Assuming that all factors remain constant, increasing pressure will result in an increase in flow through a nozzle.

For the majority of industrial nozzles, this is expressed as:

$$Q_1 = Q_2 \sqrt{\frac{P_1}{P_2}}$$

Where Q represents flow rate and P represents pressure.

Most Lurmark nozzles are calibrated at 3 bar pressure with water, however, should you require the flow rate of a nozzle at a specific pressure, please consult us at Lurmark and we will be happy to calibrate your nozzle under laboratory conditions.

Movement of the liquid through pipe and fittings will create resistance in the flow of liquid towards the nozzle and as a result, pressure loss will occur. To ensure that the correct pressure is maintained at the spray tip the pipe must be of adequate diameter (see Table 2) and pressure losses must be taken into account when designing systems (see page 47).

Specific Gravity

The specific gravity or density of a liquid represents the ratio of a mass

of given volume of liquid to the mass of the same volume of water, i.e.:

$$\text{LIQUID FLOW} = \frac{\text{Water flow rate} \times \text{Specific Gravity}}{\text{Specific Gravity}}$$

Generally, the higher the specific gravity of a liquid the smaller the flow rate of liquid through the nozzle. The following conversion factors can be used to calculate specific gravity effects (Table 1).

Table 1
SG CONVERSION TABLE

SG	$\sqrt{\text{SG}}$	$\frac{1}{\sqrt{\text{SG}}}$
0.70	0.84	1.20
0.80	0.89	1.12
0.90	0.95	1.05
1.00	1.00	1.00
1.10	1.05	0.95
1.20	1.10	0.91
1.30	1.14	0.88
1.40	1.18	0.85
1.50	1.23	0.82
1.60	1.27	0.79

Viscosity

The viscosity of a liquid is a measure of the extent to which the liquid resists a tendency to flow. In general, increased pressure is required to atomise more viscous liquids resulting in sprays with a smaller angle compared with water alone.

Nozzle design governs the extent of this effect, but in general, as viscosity increases, so the flow rate of hollow and full cone nozzles is increased and conversely, the flow of flat sprays are decreased.

Surface Tension

Surface tension is the condition existing at the free

surface of a liquid resembling the properties of an elastic skin under tension. This tension is a result of the intermolecular forces exerting an unbalanced inward pull on the individual surface molecules.

Surface tension affects the development of the liquid sheet and hence directly influences minimum operating pressures, droplet-size and spray angle as summarised on page 8.

Temperature

Temperature influences liquid viscosity, specific gravity and surface tension, and can affect the performance of spray through a nozzle. Data presented in this handbook are based on water only applications at room temperature - for more extreme conditions, please consult Lurmark.

Atomisation

Droplet formation (atomisation) begins when a liquid is forced through a hydraulic nozzle under pressure so that the liquid forms a thin sheet that subsequently breaks-up into droplets. Each nozzle produces a range of droplet-sizes, known as the droplet spectra or drop-size distribution. Droplet-size is measured in microns (µm).

In general, the range of droplets produced by a nozzle depends on nozzle design - the smallest droplets, ideal for applications such as odour control and dust suppression, being produced by air atomising nozzles and the

RELATIVE DROPLET SIZE BY NOZZLE TYPE

