CHOOSING THE NOZZLE

The nozzle transforms the total energy of a flow of liquid into kinetic energy. The latter is exploited to shatter the flow of liquid into small particles and distribute them uniformly based on the section required. In some cases, kinetic energy is used to give greater penetration force to the resulting water flow or blade. The nozzle also makes it possible to achieve flow rates depending on the pressure, as is readily determined by the tables in the catalogue.

TYPE OF NOZZLE

Hollow cone: The particles are distributed uniformly and form the outer surface of a hollow cone. Thus, its footprint is a circumference whose diameter depends on the distance from the nozzle and the angle of spray.

Solid cone: With this type of nozzle, the internal area of the cone is also filled uniformly with particles of liquid. The footprint on a surface perpendicular to the axis of the jet is a circle whose diameter depends on the distance from the nozzle and the angle of spray.

Flat jet: Here, the footprint of the jet on a perpendicular surface takes the form of an elongated oval. The size of the shorter axis depends on the distance of the nozzle from the surface. The dimension of the larger axis depends both on the distance from the surface and the angle of spray.

Atomiser nozzles: With these nozzles, the pressurised air is mixed with the liquid so it becomes an ultra fine spray. The tables show how to identify the best type of atomiser to cater for the needs of specific applications.

FLOW RATE

The flow rate is determined by the internal diameters where the liquid passes through and by the operating pressure. Generally speaking, the relationship between flow rate and pressure is: Q1 and P1 are the known flow rate and pressure. Q2 is the resulting flow rate based on the required pressure P2.

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

SPRAYING ANGLE

The angle of the spray is generally measured close to the orifice. The measurement of the width of the jet becomes less precise if this distance is increased due to the effect of the force of gravity and the conditions on site. An increase in the viscosity of the product to be sprayed also reduces the spraying angle.

DROP DIAMETER (ATOMISATION)

The main factors that have an impact on the diameter of the drops are the flow rate, the pressure and the type of spray. Generally speaking, with no change in the pressure, an increase in the flow rate will lead to an increase in the diameter of the drops. The diameter of the drops is reduced by increasing the pressure or by increasing the spraying angle. The finest droplets are obtained using pneumatic atomisers; larger droplets are produced with solid cone nozzles.

IMPACT

The force of the impact of a spray depends mainly on the flow rate, the pressure and the shape of the jet. The highest impact is obtained with straight jet nozzles producing a flat jet; the lowest impact is achieved with wide solid cone jets or wide hollow jets.

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NOZZLE LIFE

A worn nozzle orifice leads to an increase in the flow rate and deterioration in the spray configuration in general. By way of comparison, given the same operating conditions, stainless steel has a lifespan around five times longer than brass.

NOZZLE SIZE

Choose the best nozzle capable of regularly releasing at least 5% of the total flow rate of the system through the bypass in order to obtain constant pressure and prevent annoying pressure spikes when the system is closed. The pressure will drop if the nozzle is worn. When fitting a new nozzle, reset the system to the original pressure.

NOZZLE TABLE: the table below is an example of how to choose the nozzle correctly based on the pump specifications (maximum pressure and flow rate factor).

For example: pump with Pmax=100 bar and Flow rate =15 l/min

Select the pressure in the first line and go down the table to the flow rate factor that is closest to that of the pump, rounded down, to get the best type of nozzle to achieve the values followed. To be sure the pressure ratings will remain constant over time, choose a nozzle matching the flow rate factor immediately below the next one (in the example, the value is circled in green) guaranteeing at least 5% of flow rate released.

FATTORE PORTATA	PORTATA (L/MIN) ALLA PRESSIONE (BAR)									
	BAR	50	60	70	80	90	100	110	120	130	140
O2		3,3	3,6	3,8	4,1	4,4	4,6	4,8	5,0	5,2	5,4
O3		4,8	5,3	5,7	6,1	6,5	6,8	7,1	7,4	7,8	8,0
O4		6,4	7,0	7,6	8,1	8,6	9,1	9,5	10,0	10,4	10,8
O45		7,3	8,0	8,6	9,2	9,8	10,3	10,8	11,3	11,7	12,2
O5		8,1	8,8	9,5	10,2	10,8	11,4	12,0	12,5	13,0	13,5
O55		8,8	9,7	10,5	11,2	11,9	12,5	13,1	13,7	14,3	14,8
O6		9,7	10,6	11,5	12,3	13,0	13,7	14,4	15,0	15,6	16,2
O65		10,5	11,5	12,4	13,2	14,0	14,8	15,5	16,2	16,9	17,5
O7		11,3	12,4	13,4	14,3	15,2	16,0	16,8	17,5	18,2	18,9
O75		12,1	13,2	14,3	15,3	16,2	17,1	17,9	18,7	19,5	20,2
O8		12,9	14,1	15,2	16,3	17,3	18,2	19,1	19,9	20,8	21,5
O85		13,7	15,0	16,2	17,4	18,4	19,4	20,3	21,3	22,1	23,0
O9		14,8	16,3	17,6	18,8	19,9	21,0	22,0	23,0	23,9	24,8
O95		15,6	17,0	18,4	19,7	20,9	22,0	23,1	24,1	25,1	26,0
10		16,3	17,8	19,2	20,6	21,8	23,0	24,1	25,2	26,2	27,2
11		17,7	19,4	20,9	22,4	23,7	25,0	26,2	27,4	28,5	29,6
115		18,4	20,1	21,8	23,3	24,7	26,0	27,3	28,5	29,6	30,8
12		19,1	20,9	22,6	24,1	25,6	27,0	28,3	29,6	30,8	31,9
125		19,8	21,7	23,4	25,0	26,6	28,0	29,4	30,7	31,9	33,1

The complete table is provided in the “HAWK General Catalogue” or datasheet “S016-13 – NOZZLES TABLE”

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