PNR

SPRAY NOZZLES FOR INDUSTRIAL APPLICATIONS

SPRAY NOZZLES & ASSEMBLY FITTINGS

GENERAL CATALOGUE

INTRODUCTION

PNR ITALIA

PNR Italy, founded in 1968, has always dedicated itself to the design and manufacturing of industrial spray nozzles and systems. In all these years PNR made major investments both in machinery and human resources to develop top quality products and today is one of the most modern spray nozzles manufacturing facilities in the world. We manifacture thousands of different products to offer our customers one of the most complete product ranges in the world, and keep focused on research plus innovation. Our machine tool park includes all high quality and latest model CNC machines, many of these built to our requirements to accomplish special manifacturing jobs. All products and their performance are strictly controlled and our Quality control system is certified by DNV according to ISO 9001 norms.Our nozzles design requires expertise in hydrodynamics and fluids handling technology as well as a deep manufacturing know-how to give the best performances. It's not just a matter of mechanical processing.

Nozzles play an important role in industry and only the use of reliable quality products prevent the risk of damage and serious losses in production processes.PNR has extended it sales network to 55 Countries all over the world in 2015. Our sales engineers, fully trained in all industrial applications of our products and with a high technical knowledge, can help customers in finding the best solution for their needs, from process planning to production facilities improvement. We do not supply products only but also provide integrated services and technical assistance.

DISCLAIMER

Our products are manufactured with the best care and according to the latest developments of the technology available. However we cannot assure that every one of our products is perfectly fit for every specific application. The information in this catalogue is provided “as seen” and so we offer no warranty of any kind with respect to the subject matter or accuracy of the information contained herein. This publication may include technical inaccuracies or typographical errors and changes may be periodically made to the information herein without prior notice.As a result of continuous product improvement our documentation is regularly updated: please visit our website www.pnr.eu to be always updated.

PRODUCT WARRANTY

PNR products will be replaced or repaired at the option of PNR and free of charges if found defective in manufacturing, labelling and packaging. The above conditions will apply if notice of defects is received by PNR within 30 days from date of product installations or one year from date of shipment. The cost of above said replacement or repair shall be the exclusive remedy for any breach of any warranty, and PNR shall not be held liable for any damage due to personal injuries or commercial losses coming from product malfunction.
It is self-understood that no warranty may apply in case our products have been operated under nonacceptable conditions, like for example (but not limited to):
– Operation at pressures exceeding those shown in catalogue performance table
– Operation with or exposure to liquids containing abrasive particles
– Operation with or exposure to liquids producing a chemical attack on the nozzle material
– Mechanical damages to nozzle orifices, nozzle spray edge or body due to careless handling or assembling.
In all above cases, the costumer must accept a nozzle life reduction below life expected, or performance parameters below the values in the catalogue.
The guarantee may be exercised as follows:
– By sending a precautionary report to PNR on the detected damages. This report can also be sent by email to this address: quality@pnr.it
– If PNR ascertains that the manufacturing faults are actually subject to the warranty, the product shall have be returned to the manufacturer in its original packaging prior request of authorization to the manufacturer and receipt of manufacturer’s written authorization.
– The rejected goods shall have be returned by the means that PNR will communicate to the customer and the transportation costs of returned merchandise will be entirely borne by the manufacturer.

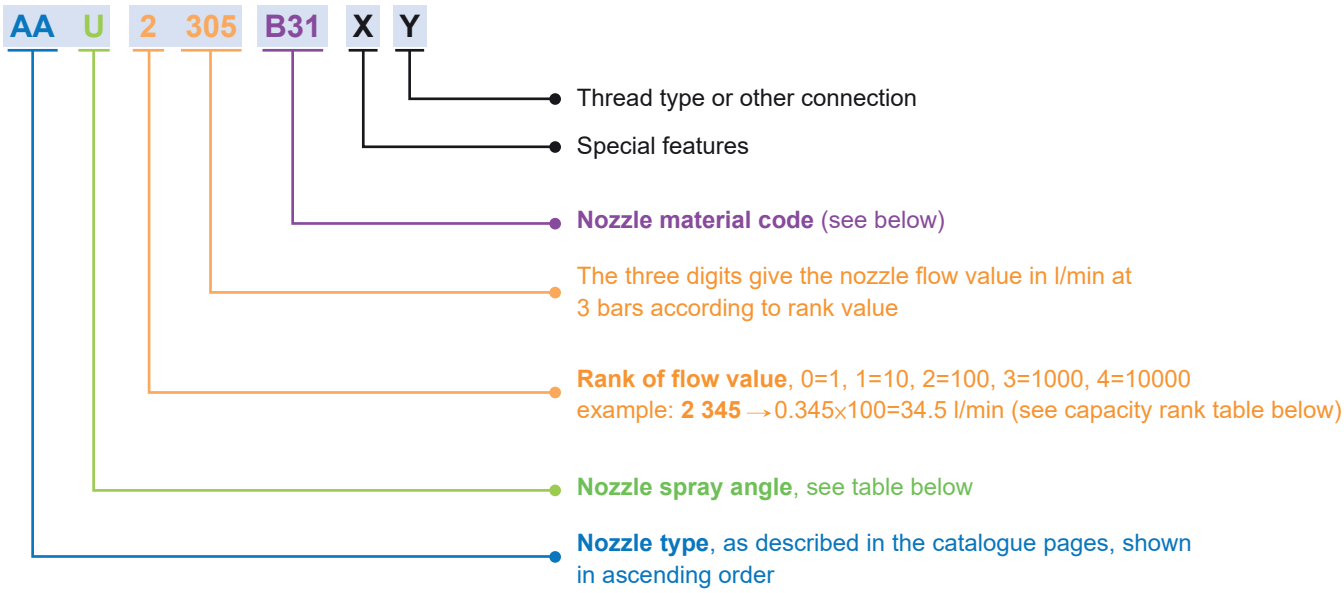
COPYRIGHT

Our Quality System is certified ISO 9001:2015
COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001:2015 =

NOZZLE IDENTIFICATION CODES

As any other industrial product, spray nozzles need to be precisely identified by means of a code in order to avoid mistakes.
PNR coding system was created bearing in mind the following requirements:
- Codes must be easily processed by a computer, in ascending order.
- Codes must be self-explaining with no need of additional descriptions.
- Codes must give the basic nozzle specifications so to be easily found in the catalogue.

Therefore, we have created our coding system as described here below:



Capacity rank

Nozzles nominal flow rate, measured at 3.0 bar are highlighted on a yellow background in the catalogue tables. Flow values were calculated at different pressures.

Rank	Flow digits	Actual flow (l/min)
0	0 490	0.49
1	1 490	4.90
2	2 490	49.0
3	3 490	490
4	4 490	4900

Some spray angle codes (degrees)

These codes serve as an indication only. Based on different types of nozzles, their significance can be occasionally different.

Code	Spray angle	Code	Spray angle	Code	Spray angle
A	0°	L	40°	T	80°
B	15°	M	45°	U	90°
C	20°	N	50°	J	110°
D	25°	Q	60°	W	120°
F	30°	R	65°	Y	130°
H	35°	S	75°	Z	180°

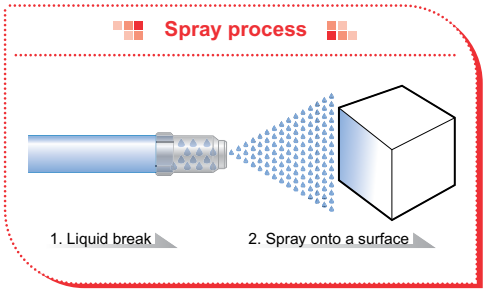
Nozzle material codes

A1	Carbon steel
A2	High speed steel
A8	Zinc coated steel
A9	Nickel coated steel
B1	AISI 303 Stainless steel
B2	AISI 304 Stainless steel
B21	AISI 304L Stainless steel
B3	AISI 316 Stainless steel
B31	AISI 316L Stainless steel
C2	AISI 416 Stainless steel, hardened
D1	Polyvinylchloride (PVC)
D2	Polypropylene (PP)
D3	Polyamide (PA)
D4	Nylon, Glassfibers reinforced
D5	Talcum filled Polypropylene
D6	Glassfibre reinforced PP
D7	High density polyethilene
D8	Polyvinylidenefluoride (PVDF)
D82	PVDF, Injection molded
E0	EPDM
E1	Polytetrafluorethylene (PTFE)
E2	PTFE (15% glassfibers)
E31	Acetalic resin (POM)
E6	LUCITE ® (PMMA)
E7	Viton
E8	Synthetic rubber (NBR)
F5	Ceramic
F30	Ruby insert, 303 body
F31	Ruby insert, 316 body
F32	Diamond insert, 303 body
F33	Diamond insert, 316 body
G1	Cast iron
H1	Titanium
L1	Monel 400
L2	Incolloy 825
L8	Hastelloy C276
P6	Acr. But. Styrene (ABS)
P8	EPDM 40 Shore
T1	Brass
T2	Brass, chrome plated
T3	Copper
T5	Bronze
T8	Brass, nickel plated
T81	Brass, electroless nickel plated
V1	Aluminum
V7	Aluminum, electroless n. plated

THE PROCESS OF ATOMIZATION

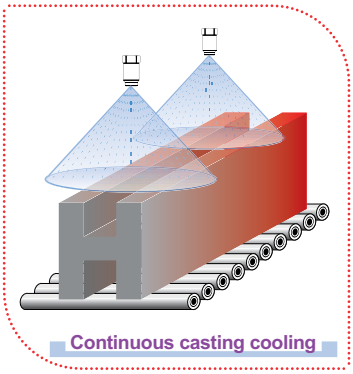
A liquid spraying process can be described as consisting of two phases, namely:
1. breaking of the liquid into separate droplets
2. directing the liquid drops onto a surface or an object, to achieve the desired result.

Modern technology allows for a strict control of different parameters of a liquid spray; for example precise information can be obtained about droplet size spectrum, droplets speed and liquid distribution onto the spray target. In recent years we've supported our customers in improving their productivity and market share by providing them cutting edge industrial techniques.
PNR is you best partner to help you enhance your productivity and quality.

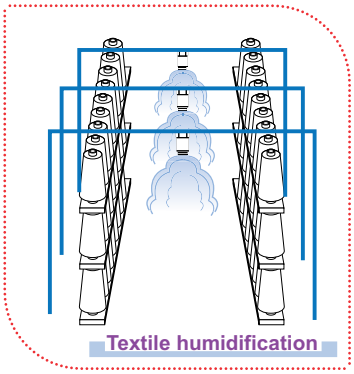


APPLICATIONS

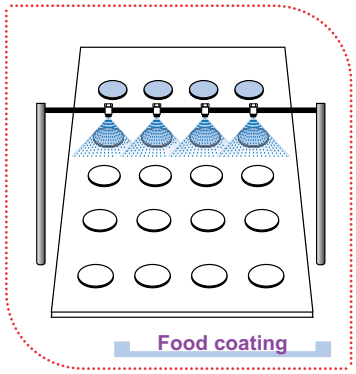
Spraying a liquid through a spray nozzle can serve different purposes, among which the most important are the following:



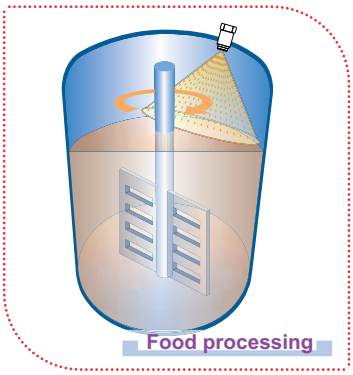
Cooling: heat transfer by spraying liquids onto the products surface for a rapid cooling, such as continuous casting cooling in steelworks.



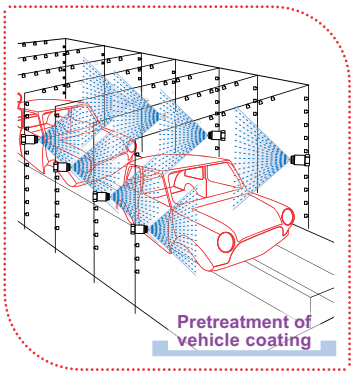
Humidification: spray of very little quantities of liquid onto the products surface into special chambers or rooms to raise relative humidity. A typical application is textiles humidification.



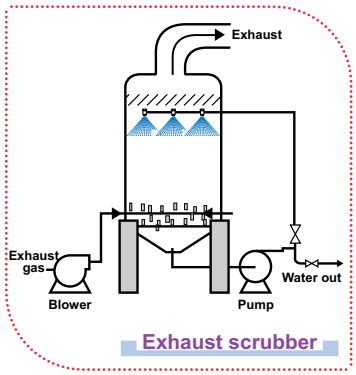
Coating: application of coatings or liquids on the food products surface. For example: oil-spraying on bread.



Food processing: spray to add specific ingredients or substances to speed up chemical reactions.
For ex.: addition of fructose in fruit juices, etc.



Washing: remove dirt from the product surface spraying liquids at high pressure, like in vehicles pre-wash treatment.



Pollution control: use of atomized scrubbing liquids to capture particulate matter and/or gaseous pollutants in liquid droplets, like in web scrubbers and spray towers.

How to choose the most suitable nozzle among those listed?

This is the first question most customers ask themselves. Do not be afraid to choose the wrong one. Contact us, tell us what you need and we will help you to make the right choice explaining how our nozzles work in a simple and user-friendly way.

SPRAY NOZZLES TECHNICAL FEATURES

Several technical features must be taken into account to select the proper nozzle. This will be dealt with on the following page.

1. NOZZLE EFFICIENCY

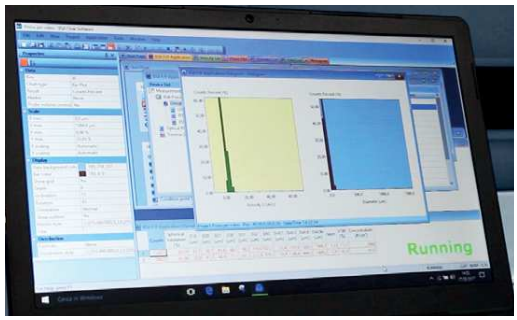
A spray nozzle is a device that turns the pressure energy of a liquid flow into kinetic energy. The nozzle efficiency can be defined as the ratio between the energy available at the nozzle inlet and the energy wich is actually used to increase the liquid speed and create the spray, the difference being the energy lost during the process because of friction. Depending on the nozzle type and for a good quality machining, the nozzle efficiency varies between 55% and 95% for the types that are commonly used in industrial processes. What above stated is not valid for air-assisted atomizers which require a much higher energy because of the losses inherent in the energy transfer from compressed air to liquid surface.

2. DROPLETS SIZE

The droplets size depends on the structure of the atomizer, intensity of the liquids energy, liquid surface tension and density. The size of the atomized droplets is not uniform. Therefore, the average droplets size becomes an important factor. For example, the droplets size in gas quenching towers is extremely important. If their size is too big, they do not fully evaporate leading to dust bag failure. On the contrary, if the droplets size is too small, it's not possible to lower the temperature to the desired level and high temperature may cause the dust bags burn out.

There are four ways to express the droplets size:

The Sauter Mean Diameter (SMD) is the most commonly used. It refers to the drop volume/surface area ratio and it's often shown as D_{32}, µm(Micron) unit. (1µm=10^{-3}mm)



ARITHMETIC MEAN DIAMETER

This is a diameter value which, multiplied by the local number of droplets in the sample, equals the addition of all droplets diameters.

SURFACE MEAN DIAMETER

This is a diameter of such a droplet whose surface, multiplied by the total droplets number, equals the sum of all droplets surfaces.

1 2 3 4

VOLUME MEAN DIAMETER

This is the diameter of such a droplet whose volume, multiplied by the total droplets number, equals the sum of all droplets volumes.

SAUTER MEAN DIAMETER (D_{32})

This is the diameter of such a droplet whose volume/area ratio, equals the ratio between the sum of all droplet volumes divided by the sum of all droplet surfaces.

MEASUREMENT METHODS

SMD is tested using pure water at 30°C

Method by immersion

A glass dish containing 60% of silicone oil is passed quickly under the spraying nozzle. Silicon oil is heavier so the water droplets float on the oil surface. Every droplet diameter is recorded and the resulting average is the SMD. This is a difficult method to perform and for this reason it's rarely used.

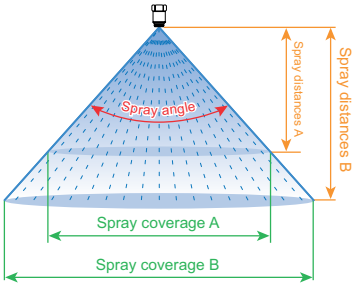
Laser interpherometer test

As different droplets have different PI, they produce different refraction angles. Therefore laser light can be used to measure their size. This type of method is fast and precise. PNR can perform this test with technologically advanced equipments and provide complete documentation containing test reports. Please contact us for more information.

SPRAY NOZZLES TECHNICAL FEATURES

3. SPRAY ANGLE

A spray angle is the angle formed by the cone of liquid leaving a nozzle orifice.
The spray angle and the distance between the nozzle orifice and the target surface to be covered determine the spray coverage. (See page 116)



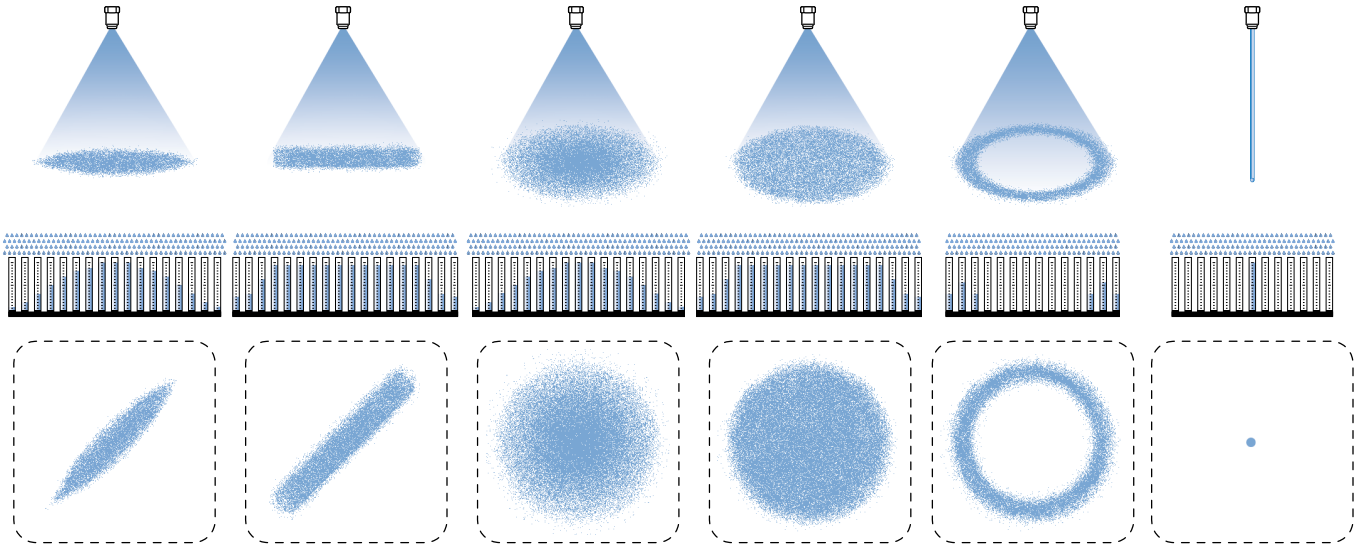
4. IMPACT FORCE

The impact force is the force generated by the jet of water deflected by the impact surface and its strength can be expressed as a force in kg or pounds or as a pressure in a given point in kg/mm^2 or lb/inch^2. The uniformity of a jet impact force and distribution influence the washing effect. Under the same operating conditions (same pressure and capacity), different types of nozzles can be used to perform an impact force test and the results are shown here below.

Straight nozzles > Flat fan nozzles > Hollow cone nozzles > Full cone and square nozzles

5. DISTRIBUTION

Engineers design nozzles with different spray distribution patterns. Patterns can be solid stream, full cone, hollow cone, flat spray, spoon flat fan. The nozzle design aims at the uniformity and impact force of the jet sprayed whether nozzles are used individually or overlapping. Below figures show detailed information for a variety of capacities and spray sections. We mark distribution on every page for your convenience.



Flat fan
convex distribution

Flat fan
even distribution

Full cone
convex distribution

Full cone
even distribution

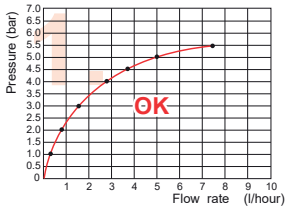
Hollow cone
concave distribution

Straight
single-point distribution

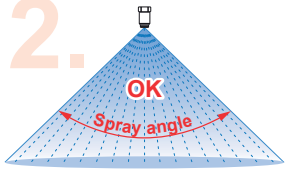
SPRAY NOZZLE

Although nozzles are used to atomize liquids, the atomization precision and effect are deeply influenced by their quality. With our expertise we fully understand our customers needs and expectations and our engineers set high quality control standards not only for the operating precision of our nozzles but also for product inspection. PNR ensures the best atomizing effects and provides capacity and spray angle accuracy with a tolerance of ±10% guarantee. Below highlights of quality inspection.

1. Check if liquid flow and pressure are in direct proportion.
2. Check if spray angle is as required.
3. Check if capacity is as required.
4. Check if distribution is uniform.
5. Check if droplets diameter is uniform

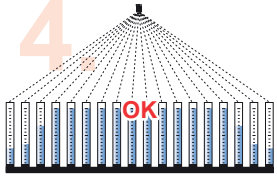


Check if liquid flow and pressure are in direct proportion.

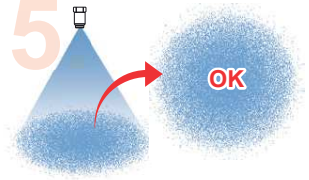


Check if spray angle is as required.

Check if capacity is as required.



Check if distribution is uniform.



Check if droplets diameter is uniform

TECHNIQUES FOR SPRAY PRODUCTION

Many different hydrodynamics techniques can be used to produce a spray and most of them are used today for nozzles to be applied in industrial processes.

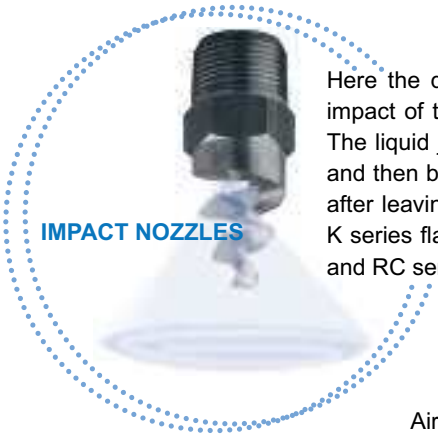
PRESSURE NOZZLES

This is the simplest type of nozzle where an orifice is opened into a chamber where the liquid to be sprayed is fed under pressure.
A spray is produced through the orifice with spray pattern, flow rate and spray angle depending upon the orifice edge profile and the design of the inside pressure chamber. Typical pressure nozzles are J series straight nozzles and F series high pressure flat fan nozzles.

TURBULENCE NOZZLES

Turbulence nozzles use specially shaped vanes which force the pressurized liquid into a whirl chamber producing its high-speed rotation. This breaks up the liquid which exists the nozzle orifice atomized at high-speed. Different nozzle structures and flow rates produce hollow cone, full cone and full square cone spray patterns. Typical turbulence nozzles are RA series hollow cone and D series full cone nozzles.

TECHNIQUES FOR SPRAY PRODUCTION

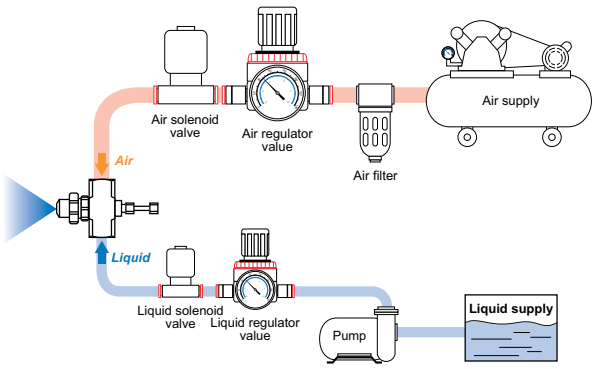


Here the desired spray shape is obtained producing an impact of the liquid jet onto a properly designed surface. The liquid jet is subsequently changed into a fluid lamina and then broken into drops with the desired spray pattern after leaving the nozzle edge. Typical impact nozzles are K series flat fan nozzles, E series spiral full cone nozzles and RC series hollow cone nozzles.

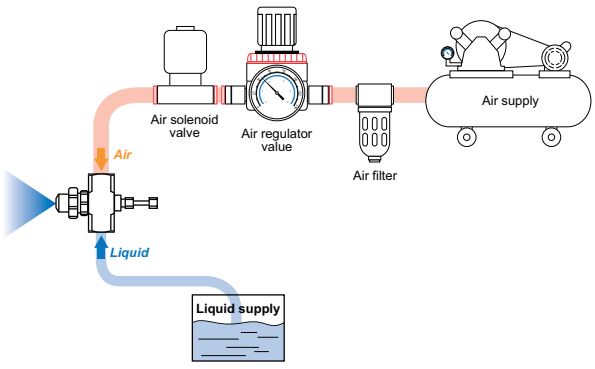
Air-assisted atomizers use their special design and pressurized gas to atomize a liquid and break it into tiny droplets (the smallest average particle size: 10 micron). Please refer to catalogue CTG AZ and contact us.

Air-assisted nozzles - Depending on the liquid supply, these nozzles are of two types: Pressure nozzles and Siphon nozzles.

PRESSURE NOZZLES



SIPHON NOZZLES



Ultrasonic atomizers are sister products of air-assisted atomizers. The front-end has a titanium ultrasonic generator. It uses the energy of the high-speed impact to produce a high-frequency oscillation that micro-atomizes the liquid droplets. The special design produces tiny and uniform droplets (the average smallest particle size: 7 Micron). The advantages are vital to many applications. Ultrasonic atomizers have two phases of atomization. Phase one: liquids mix with pressured air and produce tiny droplets to spray. Phase two: when the atomized droplets hit the ultrasonic generator they get micro-atomized generating smaller droplets. Please contact us for catalogue CTG AZ and more information.

FULL CONE PATTERN

The shape of the tip determines the spray range of full cone nozzles. A typical application of these nozzles is continuous casting cooling when it's necessary to spray the same volume of liquids onto a surface to cool objects.
Our engineers design a series of full cone nozzles to satisfy different needs.
No matter what kind of full cone nozzles they are, they have unique applications.

STANDARD FULL CONE (Turbulence nozzle)

These nozzles use a specially shaped vane placed at the nozzle inlet to give a rotational speed to the fluid flowing through the nozzle.
Because of the rotational speed of the fluid, water exiting the nozzle orifice is subjected to centrifugal force and opens up in the shape of a full cone.
The extent of the angle of the cone is a function of both exit speed (created from the inlet pressure) and the internal design of the nozzle. It can vary in practice from 15° to 120°.

These nozzles can be also produced as square full cone nozzles where the square shape of the pyramidal spray is obtained by a special design of the outlet orifice.
Two important details have to be noted from the system designer when using these type of nozzles:

1. The spray angle is measured on the side of the square section.
2. The square section of the spray rotates within the distance from the nozzle orifice to the target area.

SPIRAL FULL CONE (Impact nozzle)

This is not properly a full cone but rather a continuous liquid curtain evolving with the shape of a spiral inside a conical volume. The disadvantage of a scarcely even distribution is compensated by an exceptionally good resistance to clogging, large orifice and vaneless which make this nozzle the best choice in those applications such as wet scrubber, fire-fighting systems, etc.

MULTIPLE FULL CONE (Turbulence nozzle)

Several nozzles are grouped in a cluster with different spray directions. These nozzles produce large capacity of watermist.
If you need both large capacity and mist, multi-orifice full cone nozzles are the best option.

FLAT FAN SPRAY PATTERN

A flat fan spray nozzle serves the purpose of spraying onto a surface or an object moving in a transverse direction with respect to the one of the jet surface, a typical example being the nozzles in a car washing tunnel. The vast majority of flat spray nozzles used in the industry work according to one of the following principles.

IN LINE FLAT FAN (Pressure nozzle)

This is the general purpose flat fan nozzle where the liquid enters the nozzle in line with the axis length and is fed to a pressure chamber from where it is ejected through the nozzle orifice. Flow value and spray angle are determined respectively from the orifice cross section and the orifice edge profile.

IN LINE STRAIGHT JET (Pressure nozzle)

Straight nozzles can be considered as flat fan nozzles as the only difference is the spray angle which is zero degrees in straight nozzles. These nozzles are often used in high-pressure operating environments where the wear resistance of the nozzles is very important. It ensures optimum service life and spray orientation. PNR offers a wide range of material selection.

- 416 hardened stainless steel
- Ruby nozzle + stainless steel body
- Tungsten carbide nozzle tip + stainless steel body

SPOON FLAT FAN (Impact nozzle)

These nozzles feature a flat fan spray. According to the different arc design, these spoon flat fan nozzles can be of two types: high impact with narrow spray angle or low pressure with wide spray angle.

- Under the same operating conditions, narrow angle high impact nozzles produce a higher impact force than standard flat fan nozzles. They are suitable for cleaning environments that need strong impact force.
- Low pressure nozzles with wider spray angle produce a 130° spray angle and a large area of water curtain effect. Low-impact spray nozzles are widely used in various applications such as foam removal, water curtain for gas separation, fruits and vegetables cleaning.

High impact types

Large spray angle

HOLLOW CONE SPRAY PATTERN

A hollow cone spray pattern is made of droplets concentrated on a ring-shaped impact area, with no droplets falling inside the conic volume. Under the same operating conditions, hollow cone nozzles produce a very fine atomized liquid mist and can capture a higher rate of suspended particles than other nozzles. They are widely used in exhaust scrubbers and gas cooling.

HOLLOW CONE (Turbulence nozzle)

These nozzles use a tangential injection of liquid into a whirling chamber to generate centrifugal forces which break up the liquid vein as soon as it leaves the orifice. Precisely designed orifice profiles, making use of the Coanda effect, provide the ability to obtain very large spray angles.

HOLLOW CONE (Deflection nozzle)

A hollow cone can also be obtained taking a liquid flow to change direction onto a properly designed surface in order to break the liquid into droplets and distributes them as a hollow cone spray pattern with clog resistance. This kind of nozzle is mainly used for applications in fire-fighting systems.

FULL CONE NOZZLES

There are two types of full cone nozzles: turbulence nozzles and impact nozzles, distinguishable by their different spray patterns.

Turbulence nozzles use vanes to produce a high-speed rotation and pressurize the liquid flow inside a turbulence chamber. Liquids are atomized by the centrifugal force that produces a solid stream jet with a full cone spray pattern.

Impact nozzles work on the impact principle. Liquids hit their spiral profile, atomize and produce large spray flows with full-cone patterns and desired spray angle. They have no vanes and are virtually clog-free.

To meet the needs of different operating environments, PNR developed a series of vanes, each one with its own technical features. See here below.

VANE

SLOTTED VANE

Slotted vane, so called for its spray section with 6 flows slots on its edge portion and one in the center.
These vanes produce high-speed rotation of pressurized liquids that flow into turbulence chambers where they are atomized. Slotted vanes provide an excellent atomization in a short time. Effective for cost-saving and in case of limited space.

DISC VANE

Innovative design and precise machining, its smooth surface reduces pressure loss and avoids turbulence. It uses 6 peripheral passages to create a swirling motion of the liquid inside the spray chamber.
A set of superficial millings on the lower side of the disc act as a brake on the liquid rotation at the centre creating a full cone jet with an even distribution and finely atomized droplets. No central hole to avoid clogging.

X - VANE

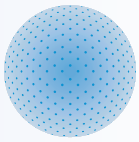
X vanes are widely used, mainly in steelworks. Their simple design is based on two sloping flat surfaces which induce a rotation of the liquid going through the nozzle, and two small slots on each flat part to produce a full-cone spray pattern. All vanes are secured inside the nozzle body to prevent their moving in case of size changes due to high temperatures or sudden vacuum conditions in the feed pipe.

S - TYPE VANE

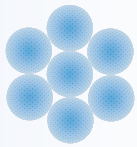
S-type vanes provide a large free passage of liquids through the nozzle, with nearly the same diameter of a spray tip. Therefore they offer the widest possible passage and the highest resistance to clogging among all full-cone spray nozzles with internal vane.

SPIRAL VANE

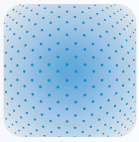
Spiral vane is specific design of spiral full cone nozzles. Liquids hit spiral vane then atomize and extend to the desired spray angle. The specific design greatly increases liquids inlet and outlet diameter. Any foreign matters entering could come out. It avoids clogging and provides larger capacity with the same thread size.



FULL CONE
Round spray



FULL CONE
Cluster spray



FULL CONE
Square pattern

ACCURATE SPRAYS OVERLAPPING

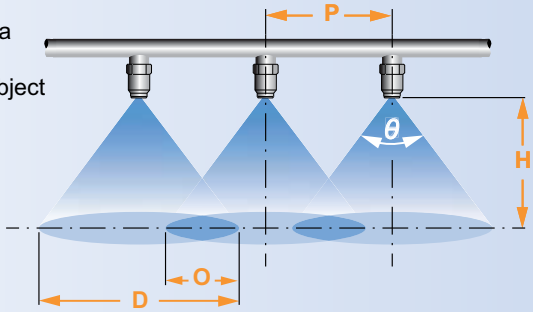
When full and hollow cone nozzles are used simultaneously, it's vital that they cover a uniform spray volume. In general there are two methods to achieve accurate nozzles settings: matrix configuration and offset configuration. See here below.

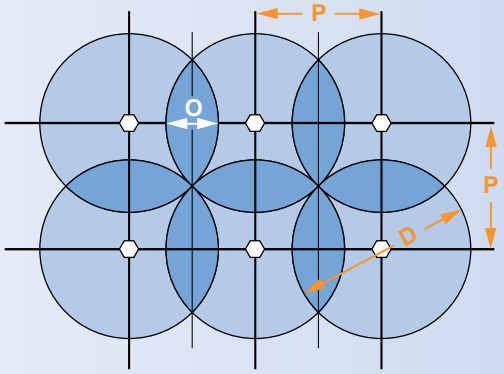
Matrix configuration

O - width of overlapping area
D - diameter of spray range
H - nozzle distance to the object being sprayed
P - nozzle spacing
θ - spray angle

Nozzle spacing(P) = $\frac{D}{\sqrt{2}}$

Overlap(O)= D - P



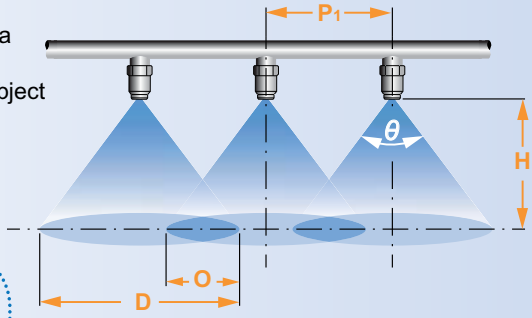


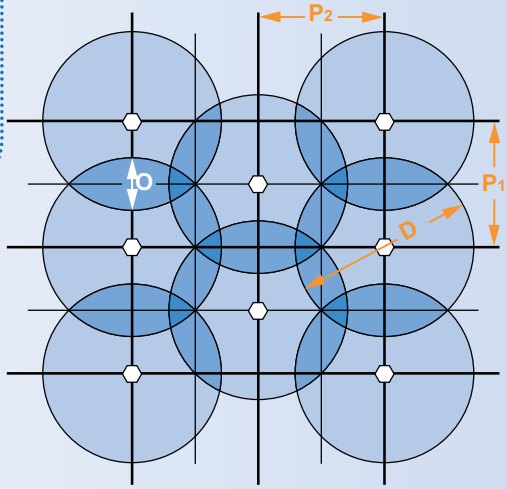
Offset configuration

O - width of overlapping area
D - diameter of spray range
H - nozzle distance to the object being sprayed
P - nozzle spacing
θ - spray angle

Nozzle spacing(P_1)
= $\frac{D}{2} \times \sqrt{3}$
Nozzle spacing(P_2) = $\frac{3}{4}D$

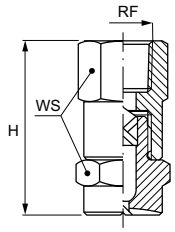
Overlap(O) = D - P_1



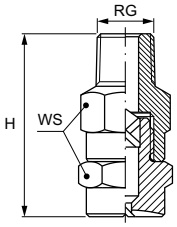


BB / BD (FULL CONE NOZZLES / CLEANABLE)

BB



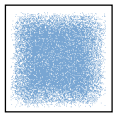
BD



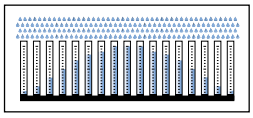
X VANE / SQUARE SPRAY PATTERN / THREE-PIECE DESIGN / EASY CLEAN

BB/BD series full cone nozzles offer a three-piece design made of body, X-vane and connection. BB/BD series nozzles supply a square section spray pattern and are suitable for working environments that strictly require a uniform coverage. The most important feature of BB/BD series nozzle is their X-vane which can be easily disassembled. It is mounted between its body and connection, allowing the narrowest passage to avoid clogging. The best choice to solve clogging problems.

- **Thread specification**
  Male (BSPT, NPT)
  Female (BSP, NPT)



Spray section



Convex distribution

SQUARE SPRAY

BBQ Female	BDQ Male	Code	RF RG	D	D1	Capacity at different pressure values (l/min) (bar)							Spray angle at pressure (°) (bar)		
			inch	mm	mm	0.7	1.0	2.0	3.0	5.0	7.0	10	0.5	1.5	6.0
•	•	**1270**	1/8"	1.8	1.0	1.30	1.56	2.21	2.70	3.49	4.12	4.93	40°	52°	47°
•	•	**1360**		1.9	1.3	1.74	2.08	2.94	3.60	4.65	5.50	6.57	48°	63°	57°
•	•	**1440**		2.1	1.3	2.13	2.54	3.59	4.40	5.68	6.72	8.03	60°	66°	60°
•	•	**1740**	1/4"	2.8	1.6	3.58	4.27	6.04	7.40	9.55	11.3	13.5	62°	67°	61°
•	•	**1890**		3.2	1.6	4.30	5.14	7.27	8.90	11.5	13.6	16.3	70°	75°	68°
•	•	**2110**		3.8	1.6	5.31	6.35	8.98	11.0	14.2	16.8	20.1	78°	82°	75°
•	•	**2133**	3/8"	3.8	2.4	6.42	7.68	10.9	13.3	17.2	20.3	24.3	71°	75°	68°
•	•	**2210**	1/2"	5.6	3.0	10.1	12.1	17.2	21.0	27.1	32.1	38.3	71°	75°	68°
•	•	**2270**		6.4	3.2	13.0	15.6	22.1	27.0	34.9	41.2	49.3	78°	82°	75°

BB/BD series nozzles produce a square spray pattern. The flat spray orientation is set with a 10°-15° offset angle from the main manifold axis to avoid jet overlapping. Therefore the correct alignment of these nozzles is very important and must be done properly. Please refer to the table below.

Nipple

X-Type vane

Nozzle tip

DIMENSIONS AND WEIGHTS

Nozzle type	RF inch	H mm	WS mm	W kg
BB Female	1/8"	30	14	0.03
	1/4"	37	17	0.04
	3/8"	46	19	0.07
	1/2"	57	25	0.20

Nozzle type	RG inch	H mm	WS mm	W kg
BD Male	1/8"	32	14	0.02
	1/4"	39	17	0.04
	3/8"	47	19	0.07
	1/2"	57	25	0.20

Typical applications

Washing: exhaust scrubbers, parts cleaning, pre-treatment for coating processes
Cooling: exhaust gas cooling, tank cooling
Coating: oil coating, spray of chemicals
Other applications: dust control, leak test

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: BBQ 1270 B1

BB **Q** **1270** **xx**

- NOZZLE TYPE: BB
- SPRAY ANGLE: Q - 60°
- CAPACITY: 1270
- MATERIAL:
  - • **B1** - AISI 303 Stainless steel
  - • **B31** - AISI 316L Stainless steel
  - ○ **T1** - Brass (optional)

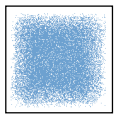
X-VANE / SQUARE SPRAY PATTERN / TWO-PIECE DESIGN

BF/BH type nozzles have a simple two-piece design producing a square section spray pattern. They are the convenient choice where the coverage of a surface is required to be as even as possible. Their X-vane ensures uniform spray distribution and resistance to clogging, also when working with large capacities. The sides of the square spray section are not aligned with the grooves of the nozzle orifice and the offset angle is between 10° and 15° depending on working pressure and distance from the impact surface. Therefore, utmost attention must be paid during the nozzles overlay setting. They must be carefully aligned and adjusted according to the operating situation.

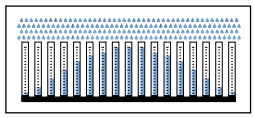
- **Thread specification**
  Male (BSPT, NPT)
  Female (BSP, NPT)

BH

BF



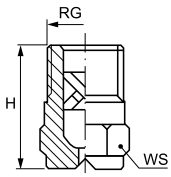
Spray section

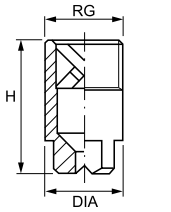


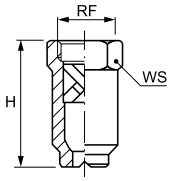
Convex distribution

Standard spray angle

BFS Female	BHQ Male	Code	RF RG	D	D1	Capacity at different pressure values (l/min) (bar)						
			inch	mm	mm	0.7	1.0	2.0	3.0	5.0	7.0	10
	•	1270	1/8"	1.7	1.3	1.30	1.56	2.21	2.70	3.49	4.12	4.93
	•	1350		1.9	1.3	1.69	2.02	2.86	3.50	4.52	5.35	6.39
	•	1440		2.2	1.3	2.13	2.54	3.59	4.40	5.68	6.72	8.03
	•	1740	1/4"	2.8	1.6	3.58	4.27	6.04	7.40	9.55	11.3	13.5
	•	1890		3.2	1.6	4.30	5.14	7.27	8.90	11.5	13.6	16.3
	•	2107		3.8	1.6	5.17	6.18	8.74	10.7	13.8	16.3	19.5
	•	2133	3/8"	4.0	2.4	6.42	7.68	10.9	13.3	17.2	20.3	24.3
	•	2210	1/2"	5.5	3.2	10.1	12.1	17.1	21.0	27.1	32.1	38.3
	•	2270		6.4	3.2	13.0	15.6	22.1	27.0	34.9	41.2	49.3
	•	2370	3/4"	6.7	4.4	17.9	21.4	30.2	37.0	47.8	56.5	67.6
•		2780	1"	1.9	1.3	37.7	45.0	63.7	78.0	101	119	142
•		3131	1¼"	2.4	1.3	63.3	75.6	107	131	169	200	239
•		3170	1½"	2.8	1.6	82.1	98.1	139	170	219	260	310
•		3215	2"	3.2	1.6	104	124	176	215	278	328	393
•		3265		3.8	1.6	128	153	216	265	342	405	484
•		3355		1.6	1.3	171	205	290	355	458	542	648
•		3360	2½"	1.9	1.3	174	208	294	360	465	550	657
•		3435		2.4	1.3	210	251	355	435	562	664	794
•		3700		2.8	1.6	338	404	572	700	904	1069	1278
•		4220	5"	1.9	1.3	1063	1270	1796	2200	2840	3361	4017
•		4420	6"	2.4	1.3	2029	2425	3429	4200	5422	6416	7668

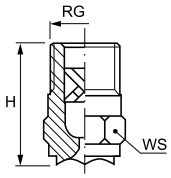


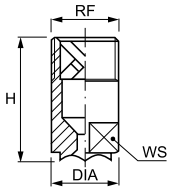


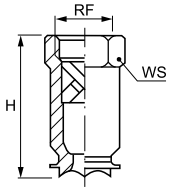


Wide spray angle

BFW Female	BHW Male	Code	RF RG	D	D1	Capacity (l/min) at different pressure values (bar)						
				mm	mm	0.7	1.0	2.0	3.0	5.0	7.0	10
	•	2100	1/4"	3.2	1.6	4.83	5.77	8.16	10.0	12.9	15.3	18.3
	•	2122	3/8"	3.9	1.6	5.89	7.04	9.96	12.2	15.8	18.6	22.3
	•	2144		4.0	2.4	6.96	8.31	11.8	14.4	18.6	22.0	26.3
	•	2172		4.6	2.4	8.31	9.93	14.0	17.2	22.2	26.3	31.4
	•	2194		5.4	2.4	9.37	11.2	15.8	19.4	25.0	29.6	35.4
	•	2220	1/2"	4.8	3.0	10.6	12.7	18.0	22.0	28.4	33.6	40.2
	•	2250		5.1	3.0	12.1	14.4	20.4	25.0	32.3	38.2	45.6
	•	2290		5.7	3.0	14.0	16.7	23.7	29.0	37.4	44.3	52.9
	•	2320		7.0	3.0	15.5	18.5	26.1	32.0	41.3	48.9	58.4
	•	2360		8.0	3.0	17.4	20.8	29.4	36.0	46.5	55.0	65.7
•	•	2500	3/4"	8.5	4.5	24.2	28.9	40.8	50.0	64.6	76.4	91.3
•	•	2930	1"	11.6	5.6	44.9	53.7	75.9	93.0	120	142	170
•		3134	1¼"	14.5	6.0	64.7	77.4	109	134	173	205	245
•		3200	1½"	18.2	9.0	96.6	115	163	200	258	306	365
•		3395	2"	24.0	11.1	191	228	323	395	510	603	721
•		3590	2½"	26.0	14.3	285	341	482	590	762	901	1077
•		3800	3"	31.5	17.5	386	462	653	800	1033	1222	1461







Dimensions and weights

Size	inch	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1¼"	1½"	2"	2½"	3"	5"	6"
H	mm	22	23	30	39	55	70	88	102	138	175	187	311	366
WS	mm	12	14	17	21	27	32	40	50	60	85	100	170	200
DIA	mm					32	38							
W	kg	0.01	0.02	0.03	0.04	0.20	0.35	0.55	0.80	1.6	2.0	7.8	18	25
Manufacture		Machine						Casting						

HOW TO MAKE UP THE NOZZLE CODE

EX.: BFS 2780 B1

BF S 2780 xx

- BF — NOZZLE TYPE
- S — SPRAY ANGLE: • Q - 60° • U - 90° • S - 70° • W - 120°
- 2780 — CAPACITY
- xx — MATERIAL:
  - B1 - AISI 303 Stainless steel
  - B31 - AISI 316L Stainless steel
  - T1 - Brass
  - D1 - PVC
  - E1 - PTFE