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

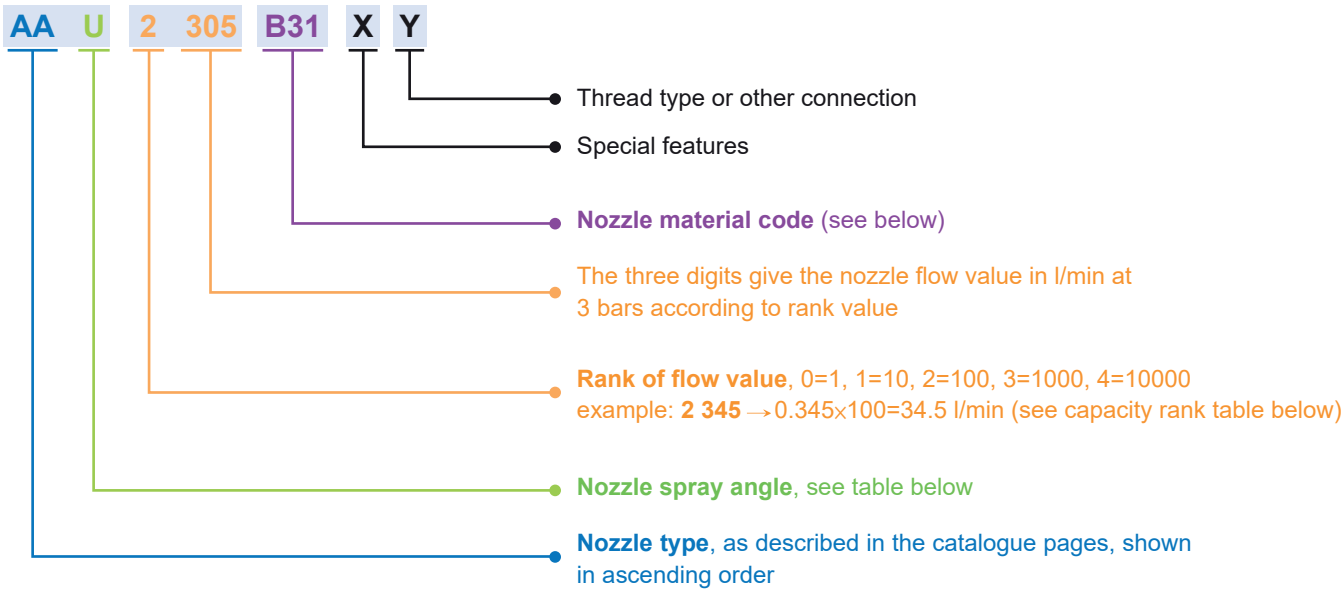
All the contents (texts, images, graphics, layouts, etc.) of this document are property of PNR Italia Srl. Any redistribution or reproduction of part or all of the contents in any form is prohibited.

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°

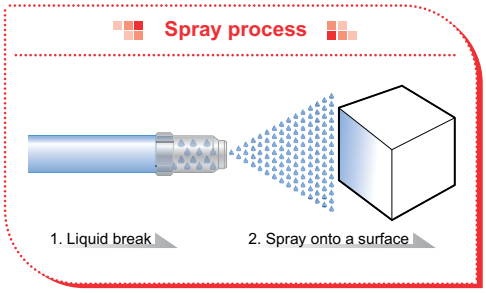
Nozzle material codes

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

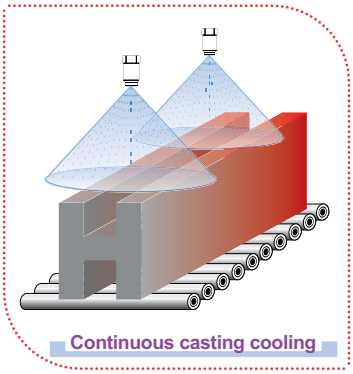
A liquid spraying process can be described as consisting of two phases, namely:
1. breaking of the liquid into separate droplets
2. directing the liquid drops onto a surface or an object, to achieve the desired result.

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.

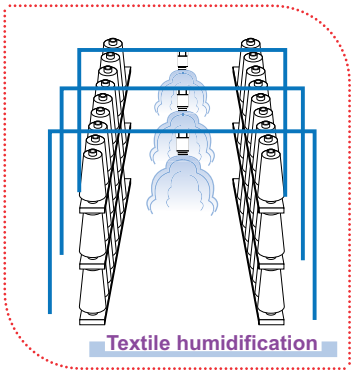


APPLICATIONS

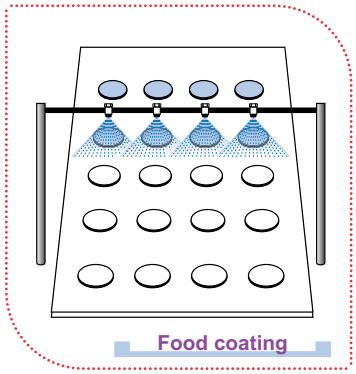
Spraying a liquid through a spray nozzle can serve different purposes, among which the most important are the following:



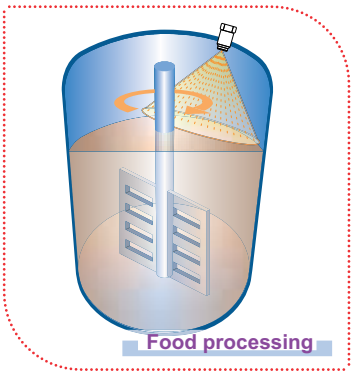
Cooling: heat transfer by spraying liquids onto the products surface for a rapid cooling, such as continuous casting cooling in steelworks.



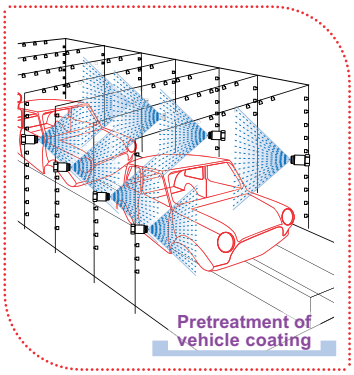
Humidification: spray of very little quantities of liquid onto the products surface into special chambers or rooms to raise relative humidity. A typical application is textiles humidification.



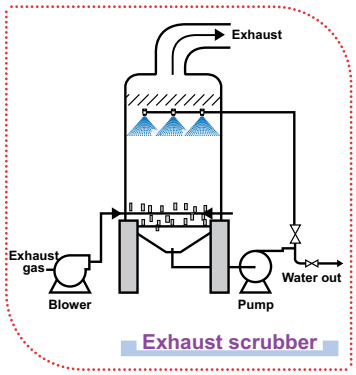
Coating: application of coatings or liquids on the food products surface. For example: oil-spraying on bread.



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

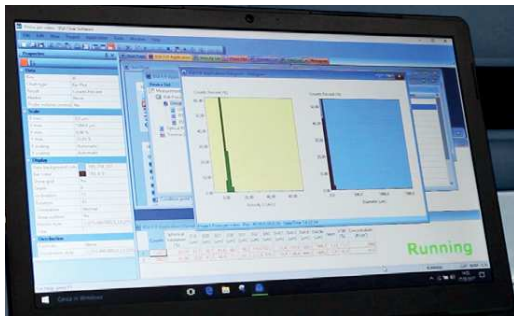
A spray nozzle is a device that turns the pressure energy of a liquid flow into kinetic energy. The nozzle efficiency can be defined as the ratio between the energy available at the nozzle inlet and the energy wich is actually used to increase the liquid speed and create the spray, the difference being 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.

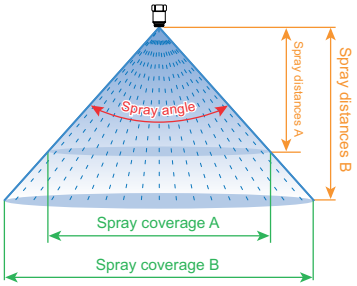
Laser interpherometer test

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)



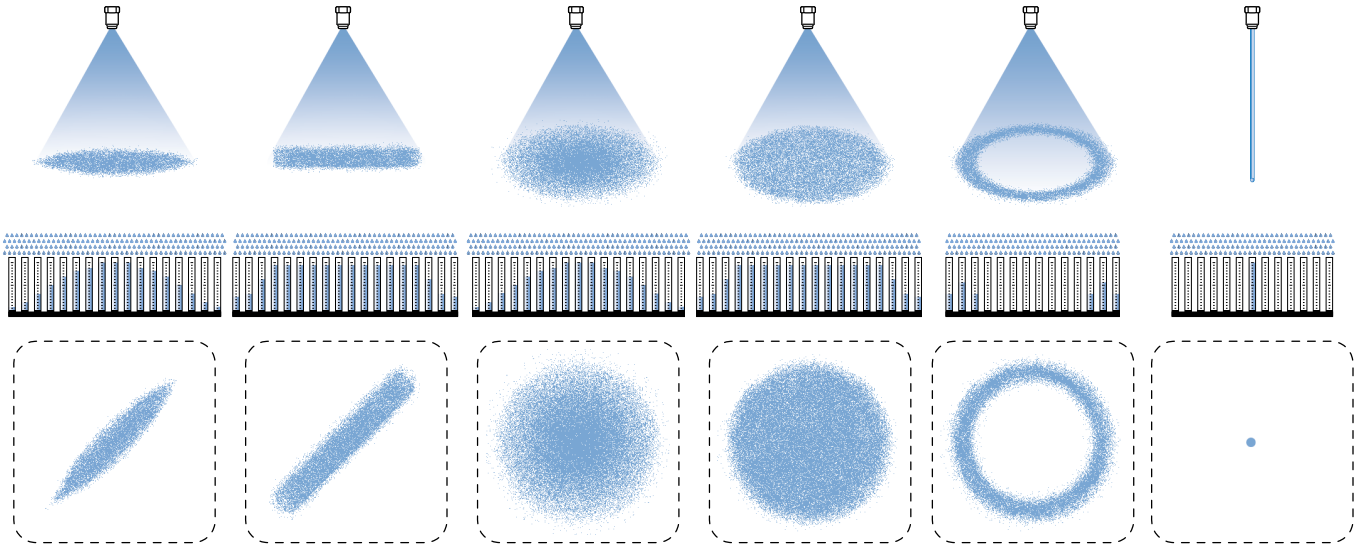
4. IMPACT FORCE

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

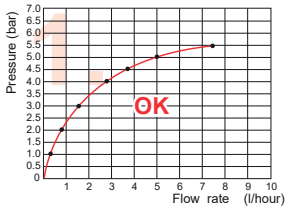
Hollow cone
concave distribution

Straight
single-point distribution

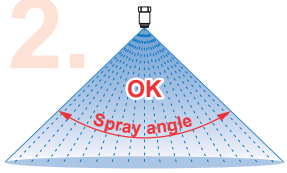
SPRAY NOZZLE

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

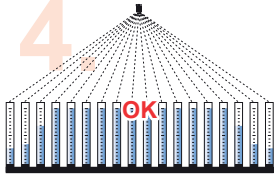


Check if liquid flow and pressure are in direct proportion.

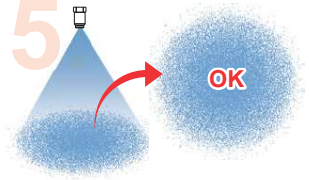


Check if spray angle is as required.

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.

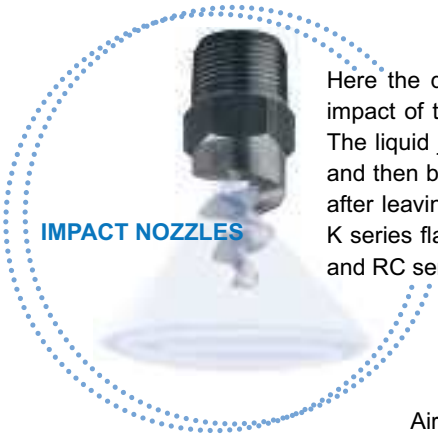
PRESSURE NOZZLES

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

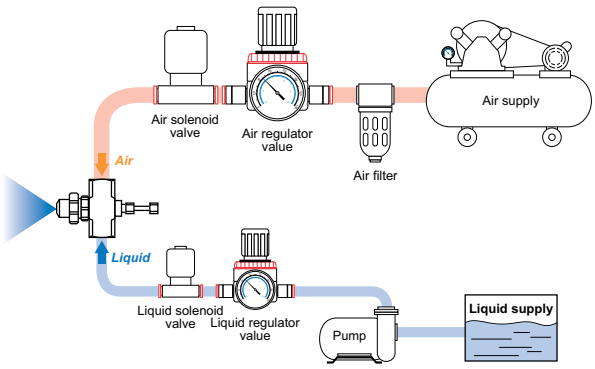


Here the desired spray shape is obtained producing an impact of the liquid jet onto a properly designed surface. The liquid jet is subsequently changed into a fluid lamina and then broken into drops with the desired spray pattern after leaving the nozzle edge. Typical impact nozzles are K series flat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

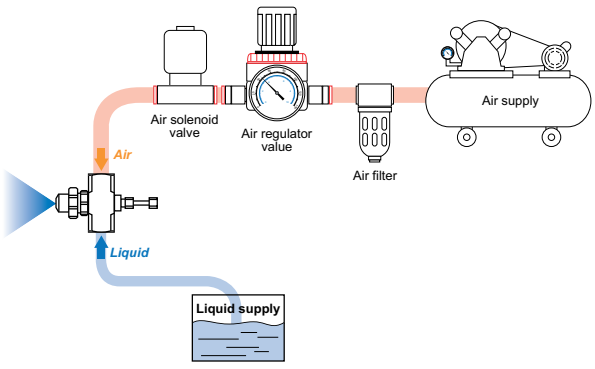
Air-assisted atomizers use their special design and pressurized gas to atomize a liquid and break it into tiny droplets (the smallest average particle size: 10 micron). Please refer to catalogue CTG AZ and contact us.

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)

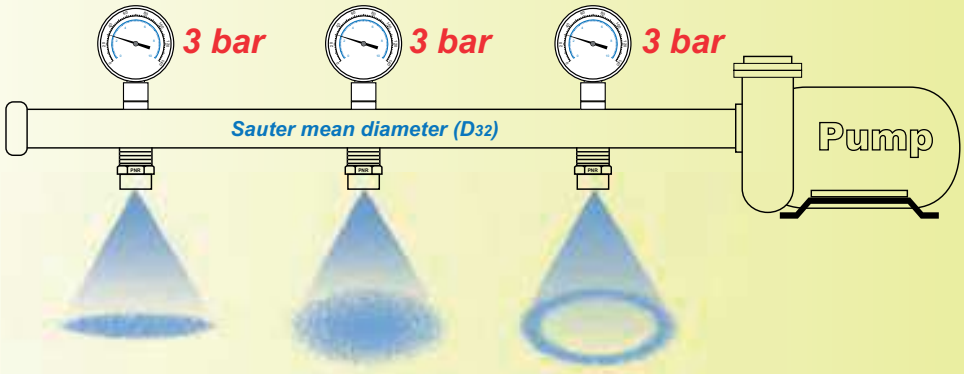
These nozzles use a tangential injection of liquid into a whirling chamber to generate centrifugal forces which break up the liquid vein as soon as it leaves the orifice. Precisely designed orifice profiles, making use of the Coanda effect, provide the ability to obtain very large spray angles.

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.

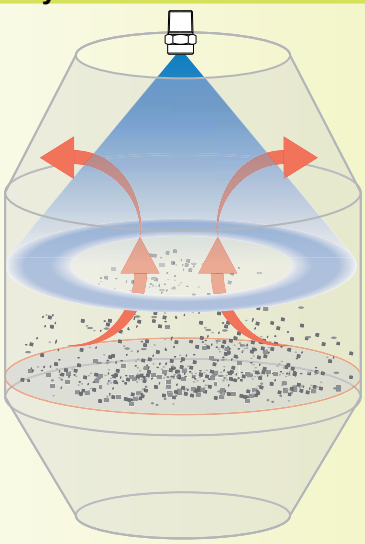
Mist spray

Hollow cone nozzles provide a finely atomized mist and a very uniform hollow cone spray pattern. They are ideal to capture suspended particles and offer higher performances than other nozzles with same operating pressure and capacity. These nozzles are widely used for their efficiency in cooling and cleaning of gases, dust control, absorption processes and air-humidification.



FLAT FAN NOZZLE > FULL CONE NOZZLE > HOLLOW CONE NOZZLE

Poor gas scrub efficiency?



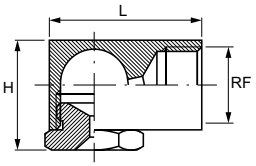
Hollow cone nozzles produce a ring-shaped spray pattern where all the liquid jet is concentrated on the outer edge of the ring. Users may fear that offset nozzles do not catch all suspended particles because air flows through directly from the centre. Hollow cone nozzles are the solution to this problem as their fine mist spray provides a better scrubbing effect.

Accurate offset settings

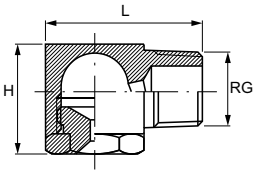
The correct positioning of hollow cone nozzles is of vital importance. There are matrix and offset settings. Please see on page 18 for more information.

PE / PF / PT (HOLLOW CONE NOZZLES)

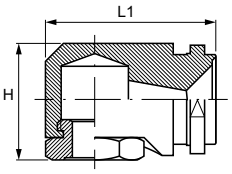
PE (Female)



PF (Male)



PT (QC)



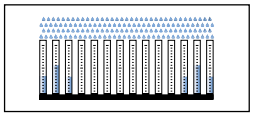
STANDARD ANGLE SPRAY NOZZLES

PE/PF hollow cone nozzles generate a ring-shaped spray pattern with finely atomized droplets and work on the tangential flow principle. Inside these nozzles there is an axial groove that injects the liquid tangentially into the vortex chamber where the strong centrifugal force produces a high rotational velocity and generates a finely atomized liquid flow. As these nozzles have a large inside free passage and no swirl insert, they offer the maximum resistance to clogging. PE/PF nozzles are widely used in many production processes and their variety of spray angles and capacities make them suitable for all kinds of working environments.

- **Thread specification**

Female thread (PE series): BSPT, NPT
Male thread (PF series): BSP, NPT

Spray section



Concave distribution

STANDARD ANGLE SPRAY NOZZLES

	RF RG inch	PEN Female	PFN Male	PTN QC	Code	DE mm	DU mm	Capacity at different pressure values (l/min) (bar) 0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	Dimensions mm H	L	L1
50°	3/8"		•	•	**2180**	5.9	7.9	7.35	8.69	10.4	14.7	18.0	23.2	27.5	32.9	24	34	35
			•	•	**2220**	7.5	7.9	8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2			
			•	•	**2390**	8.7	9.5	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2			

	RF/RG	PES	PFS	PTS	Code	DE	DU	0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	H	L	L1
70°	1/8"		•		**0390**	0.79	1.2	0.16	0.19	0.23	0.32	0.39	0.50	0.60	0.71	19	24	26
			•		**0780**	1.6	1.6	0.32	0.38	0.45	0.64	0.78	1.01	1.19	1.42			
		•	•		**1160**	2.0	2.0	0.65	0.77	0.92	1.31	1.60	2.07	2.44	2.92			
		•	•		**1230**	2.4	2.4	0.94	1.11	1.33	1.88	2.30	2.97	3.51	4.20			
		•	•		**1390**	3.2	3.2	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12			
		•	•		**1630**	4.0	4.0	2.57	3.04	3.64	5.14	6.30	8.13	9.62	11.5			
			•		**1780**	4.4	4.4	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2			
	1/4"		•	•	**0781**	1.6	1.6	0.32	0.38	0.45	0.64	0.78	1.01	1.19	1.42	23	32	32
		•	•	•	**1161**	2.0	2.0	0.65	0.77	0.92	1.31	1.60	2.07	2.44	2.92			
			•	•	**1231**	2.4	2.4	0.94	1.11	1.33	1.88	2.30	2.97	3.51	4.20			
		•	•	•	**1391**	3.6	3.6	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12			
		•	•	•	**1631**	4.0	4.0	2.57	3.04	3.64	5.14	6.30	8.13	9.62	11.5			
			•	•	**1781**	4.8	4.4	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2			
		•	•	•	**2117**	5.9	5.2	4.78	5.65	6.75	9.55	11.7	15.1	17.9	21.4			
	3/8"	•	•		**1392**	3.6	3.2	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12	24	34	35
		•	•		**1632**	4.4	4.0	2.57	3.04	3.64	5.14	6.30	8.13	9.62	11.5			
		•	•		**1782**	5.2	4.4	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2			
		•	•		**2118**	5.9	5.6	4.78	5.65	6.75	9.55	11.7	15.1	17.9	21.4			
		•	•		**2157**	7.1	6.4	6.41	7.58	9.06	12.8	15.7	20.3	24.0	28.7			
		•	•		**2196**	7.5	7.5	8.00	9.47	11.3	16.0	19.6	25.3	29.9	35.8			
			•		**2230**	8.3	7.9	9.39	11.1	13.3	18.8	23.0	29.7	35.1	42.0			
	1/2"	•	•		**2197**	9.5	6.4	8.00	9.47	11.3	16.0	19.6	25.3	29.9	35.8	31	50	50
		•	•		**2231**	9.5	7.5	9.39	11.1	13.3	18.8	23.0	29.7	35.1	42.0			
		•	•	•	**2310**	9.5	9.1	12.7	15.0	17.9	25.3	31.0	40.0	47.4	56.6			
			•	•	**2391**	9.5	11.1	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2			
			•	•	**2470**	9.5	13.1	19.2	22.7	27.1	38.4	47.0	60.7	71.8	85.8			
	3/4"		•		**2311**	12.7	7.9	12.7	15.0	17.9	25.3	31.0	40.0	47.4	56.6	39	55	58
			•		**2392**	12.7	9.5	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2			
			•		**2471**	12.7	11.1	19.2	22.7	27.1	38.4	47.0	60.7	71.8	85.8			
			•		**2550**	12.7	12.7	22.5	26.6	31.8	44.9	55.0	71.0	84.0	100			
		•	•		**2630**	12.7	14.3	25.7	30.4	36.4	51.4	63.0	81.3	96.2	115			
			•		**2700**	12.7	14.7	28.6	33.8	40.4	57.2	70.0	90.4	107	128			
			•		**2780**	12.7	15.9	31.8	37.7	45.0	63.7	78.0	101	119	142			
			•		**2860**	12.7	17.1	35.1	41.5	49.7	70.2	86.0	111	131	157			
			•		**2940**	12.7	18.3	38.4	45.4	54.3	76.8	94.0	121	144	172			

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: PES 1160 B1

PE S 1160 xx

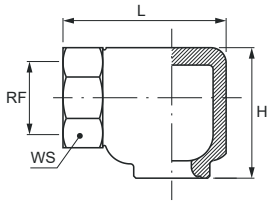
- NOZZLE TYPE: • **PE** - Female • **PF** - Male • **PT** - QC
- SPRAY ANGLE: • **N** - 50° • **S** - 70° • **W** - 120°
- CAPACITY
- MATERIAL: • **B1** - AISI 303 Stainless steel • **B31** - AISI 316L Stainless steel • **T1** - Brass

WIDE ANGLE SPRAY NOZZLES

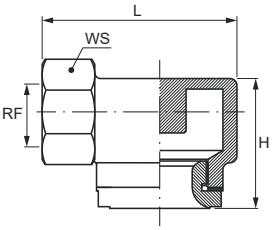
	RF RG inch	PEW Female	PFW Male	PTW QC	Code	DE mm	DU mm	Capacity at different pressure values (l/min) (bar) 0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	Dimensions mm H	L	L1
120°	1/8"	•	•		**0390**	0.79	1.2	0.16	0.19	0.23	0.32	0.39	0.50	0.60	0.71	19	24	26
		•	•		**0780**	1.6	1.6	0.32	0.38	0.45	0.64	0.78	1.01	1.19	1.42			
		•	•		**1200**	2.0	2.8	0.82	0.97	1.15	1.63	2.00	2.58	3.06	3.65			
		•	•		**1230**	2.4	2.8	0.94	1.11	1.33	1.88	2.30	2.97	3.51	4.20			
		•	•		**1270**	2.4	3.2	1.10	1.30	1.56	2.20	2.70	3.49	4.12	4.93			
		•	•		**1320**	2.0	4.4	1.31	1.55	1.85	2.61	3.20	4.13	4.89	5.84			
		•	•		**1390**	3.2	3.2	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12			
		•	•		**1510**	3.2	4.4	2.08	2.46	2.94	4.16	5.10	6.58	7.79	9.31			
		•	•		**1700**	4.0	4.4	2.86	3.38	4.04	5.72	7.00	9.04	10.7	12.8			
	1/4"	•	•	•	**0781**	1.6	1.6	0.32	0.38	0.45	0.64	0.78	1.01	1.19	1.42	23	32	32
		•	•	•	**1130**	1.6	3.2	0.53	0.63	0.75	1.06	1.30	1.68	1.99	2.37			
		•	•	•	**1160**	1.6	4.4	0.65	0.77	0.92	1.31	1.60	2.07	2.44	2.92			
		•	•	•	**1190**	1.6	5.6	0.78	0.92	1.10	1.55	1.90	2.45	2.90	3.47			
		•	•	•	**1271**	2.0	3.2	1.10	1.30	1.56	2.20	2.70	3.49	4.12	4.93			
		•	•	•	**1321**	2.0	4.4	1.31	1.55	1.85	2.61	3.20	4.13	4.89	5.84			
		•	•	•	**1391**	3.6	3.2	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12			
		•	•	•	**1511**	3.6	4.4	2.08	2.46	2.94	4.16	5.10	6.58	7.79	9.31			
		•	•	•	**1600**	3.6	5.6	2.45	2.90	3.46	4.90	6.00	7.75	9.17	11.0			
		•	•	•	**1701**	4.0	4.4	2.86	3.38	4.04	5.72	7.00	9.04	10.7	12.8			
		•	•	•	**1780**	4.8	4.4	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2			
		•	•	•	**1860**	4.0	5.6	3.51	4.15	4.97	7.02	8.60	11.1	13.1	15.7			
		•	•	•	**1940**	4.8	5.6	3.84	4.54	5.43	7.68	9.40	12.1	14.4	17.2			
		•	•	•	**2117**	6.0	5.6	4.78	5.65	6.75	9.55	11.7	15.1	17.9	21.4			
	3/8"	•	•		**1512**	3.6	4.4	2.08	2.46	2.94	4.16	5.10	6.58	7.79	9.31	24	34	35
		•	•		**1601**	3.6	5.6	2.45	2.90	3.46	4.90	6.00	7.75	9.17	11.0			
		•	•		**1702**	4.4	4.4	2.86	3.38	4.04	5.72	7.00	9.04	10.7	12.8			
		•	•		**1781**	5.2	4.4	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2			
		•	•		**1861**	4.4	5.6	3.51	4.15	4.97	7.02	8.60	11.1	13.1	15.7			
		•	•		**1941**	5.2	5.6	3.84	4.54	5.43	7.68	9.40	12.1	14.4	17.2			
		•	•		**2102**	4.4	7.5	4.16	4.93	5.89	8.33	10.2	13.2	15.6	18.6			
		•	•		**2110**	5.2	6.0	4.49	5.31	6.35	8.98	11.0	14.2	16.8	20.1			
		•	•	•	**2118**	6.0	5.6	4.78	5.65	6.75	9.55	11.7	15.1	17.9	21.4			
		•	•	•	**2133**	6.0	6.0	5.43	6.42	7.68	10.9	13.3	17.2	20.3	24.3			
		•	•	•	**2157**	7.1	6.0	6.41	7.58	9.06	12.8	15.7	20.3	24.0	28.7			
		•	•	•	**2172**	6.0	7.9	7.02	8.31	9.93	14.0	17.2	22.2	26.3	31.4			
		•	•	•	**2196**	7.5	7.5	8.00	9.47	11.3	16.0	19.6	25.3	29.9	35.8			
		•	•	•	**2220**	7.5	7.9	8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2			
	1/2"		•	•	**2391**	9.5	11.1	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2	31	50	50
	3/4"		•		**2630**	12.7	14.3	25.7	30.4	36.4	51.4	63.0	81.3	96.2	115	39	55	58

PA / PB (HOLLOW CONE NOZZLES / LARGE CAPACITY)

PA



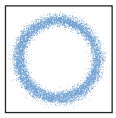
PB



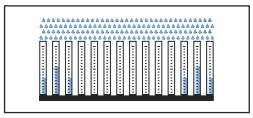
TANGENTIAL NOZZLES

PA/PB tangential nozzles generate a hollow cone spray pattern of finely atomized droplets and work on the tangential flow principle. They are designed with a tangential method of atomization. Inside these nozzles there is an axial groove that injects the liquid tangentially into the vortex chamber where the strong centrifugal force produces a high rotational velocity and generates a finely atomized liquid flow. As these nozzles have a large free passage inside and no swirl insert, they offer the maximum resistance to clogging. PA/PB nozzles are widely used in exhaust scrubbers and are suitable to spray flows with particles.

- **Typical applications**
  Washing: exhaust scrubbers, desulfuration, denitrification
  Cooling: cooling of high temperature gas, product cooling
- **Thread specification**: BSP, NPT (on request)



Spray section



Concave distribution

Code	RF inch	DE mm	DU mm	Capacity at different pressure values (l/min) (bar)									Dimensions mm		
				0.3	0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	H	L	WS
70° PAS 1170 xx	3/8"	3.5	2.0	0.54	0.69	0.82	0.98	1.39	1.70	2.19	2.60	3.10	27	37	22
90° PAU 1390 xx	3/8"	4.0	3.8	1.23	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12			
PAU 1670 xx	1/2"	5.6	5.2	2.12	2.74	3.24	3.87	5.47	6.70	8.65	10.2	12.2	38	46	27
PAU 1850 xx		5.7	6.0	2.69	3.47	4.11	4.91	6.94	8.50	11.0	13.0	15.5			
PAU 2115 xx		6.6	6.9	3.64	4.69	5.56	6.64	9.39	11.5	14.8	17.6	21.0			
PAU 2220 xx	3/4"	8.5	9.0	6.96	8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2	48	60	36
PAU 2320 xx		9.5	11.5	10.1	13.1	15.5	18.5	26.1	32.0	41.3	48.9	58.4			
PAU 2420 xx		9.6	14.0	13.3	17.1	20.3	24.2	34.3	42.0	54.2	64.2	76.7			
PAU 2730 xx	1"	20x10	13.7	23.1	29.8	35.3	42.1	59.6	73.0	94.2	112	133	60	75	46
PAU 2970 xx			16.5	30.7	39.6	46.9	56.0	79.2	97.0	125	148	177			
PAU 3147 xx	1 1/2"	32x16	19.5	46.5	60.0	71.0	84.9	120	147	190	225	268	90	93	60
PAU 3194 xx			22.0	61.3	79.2	93.7	112	158	194	250	296	354			
PAU 3244 xx	2"	35x20	26.5	77.2	99.6	118	141	199	244	315	373	445	127	117	80
PAU 3294 xx			28.5	93.0	120	142	170	240	294	380	449	537			
PAU 3364 xx	2 1/2"	25x40	29.5	115	149	176	210	297	364	470	556	665	156	140	100
PAU 3490 xx			36.5	155	200	237	283	400	490	633	748	895			
PAU 3605 xx			45.0	191	247	292	349	494	605	781	924	1105			
130° PBY 1390 xx	3/8"	3.0	4.5	1.23	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12	27	37	22
PBY 1850 xx		4.4	7.5	2.69	3.47	4.11	4.91	6.94	8.50	11.0	13.0	15.5			
PBY 1980 xx	1/2"	4.0	12.0	3.10	4.00	4.73	5.66	8.00	9.80	12.7	15.0	17.9	35	46	27
PBY 2128 xx		4.7	12.0	4.05	5.23	6.18	7.39	10.5	12.8	16.5	19.6	23.4			
PBY 2208 xx		6.5	12.0	6.58	8.49	10.0	12.0	17.0	20.8	26.9	31.8	38.0			
PBY 2220 xx	3/4"	6.1	15.0	6.96	8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2	50	60	36
PBY 2320 xx		6.5	19.0	10.1	13.1	15.5	18.5	26.1	32.0	41.3	48.9	58.4			
PBY 2420 xx		8.0	19.0	13.3	17.1	20.3	24.2	34.3	42.0	54.2	64.2	76.7			
PBY 2730 xx	1"	13.4	26.0	23.1	29.8	35.3	42.1	59.6	73.0	94.2	112	133	60	93	47
PBY 2970 xx		14.0	26.0	30.7	39.6	46.9	56.0	79.2	97.0	125	148	177			
PBY 3147 xx	1 1/2"	15.0	37.0	46.5	60.0	71.0	84.9	120	147	190	225	268	75	111	60
PBY 3194 xx		19.5	37.0	61.3	79.2	93.7	112	158	194	250	296	354			
PBY 3244 xx	2"	22.0	45.0	77.2	99.6	118	141	199	244	315	373	445	91	140	75
PBY 3294 xx		27.1	45.0	93.0	120	142	170	240	294	380	449	537			
PBY 3364 xx	2 1/2"	25.5	64.0	115	149	176	210	297	364	470	556	665	128	193	90
PBY 3490 xx		33.0	64.0	155	200	237	283	400	490	633	748	895			
PBY 3605 xx		38.0	64.0	191	247	292	349	494	605	781	924	1105			
PBY 3665 xx		43.0	64.0	210	271	321	384	543	665	859	1016	1214			

THREAD SIZE AND MATERIALS

The table on the right side shows thread size and materials

Material	3/8"	1/2"	3/4"	1"	1 1/2"	2"	2 1/2"
B31- AISI 316L SS				•	•	•	•
T1 - Brass	•	•	•	•			

HOW TO MAKE UP THE NOZZLE CODE

EX.: PAS 1170 B31

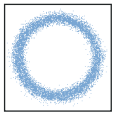
PA S 1170 xx

- NOZZLE TYPE: PA
- SPRAY ANGLE: S
  - S - 70°
  - U - 90°
  - Y - 130°
- CAPACITY: 1170
- MATERIAL: xx
  - B31 - AISI 316L Stainless steel
  - T1 - Brass

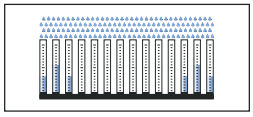
MOULDED PLASTIC NOZZLES

PN/PO series hollow cone nozzles made by plastic moulding, offer a high chemical resistance and low prices. They are tangential nozzles and produce a hollow cone spray of atomized droplets. As they have a large free passage and no swirling vane inside their body, they are highly clog-resistant. PN/PO nozzles are efficient, cost-effective and widely used in many processing lines. Moreover, they can be easily assembled in large quantity onto pipe manifolds.

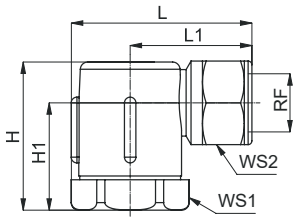
- **Thread specification**
  PO: Male BSPT, NPT
  PN: Female BSP, NPT
  PS: Quick-fit
- **Max operation temperature**:
  100 °C
- **Max operation pressure**:
  10 bar



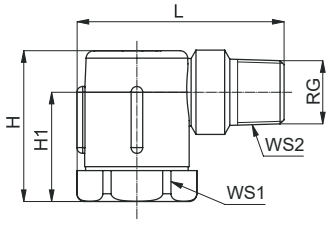
Spray section



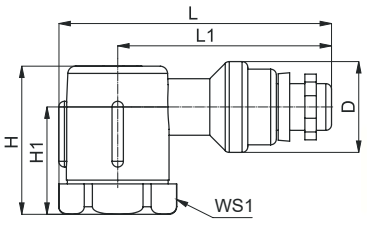
Concave distribution



PN - Female



PO - Male



PS - Quick-fit

Codice	Conn.	L	L1	H	H1	CH1	CH2	D
		mm	mm	mm	mm			mm
PN	3/8" F	47.5	32.0	39.0	28.0	28	22	---
	1/2" F	51.5	36.0	39.0	28.0	28	24	---
PO	3/8" M	53.5	38.0	39.0	28.0	28	---	---
PS	Att. rapido	71.5	56.0	39.0	28.0	28	---	24.0

PNx Female	POx Male	PSx Quick-fit	Code	Thread	Capacity at different pressure values (l/min) (bar)							
					0.5	0.7	1.0	2.0	3.0	5.0	7.0	10
•	•	•	**1170**		0.69	0.82	0.98	1.39	1.70	2.19	2.60	3.10
•	•	•	**1390**		1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12
•	•	•	**1460**		1.88	2.22	2.66	3.76	4.60	5.94	7.03	8.40
•	•	•	**1570**		2.33	2.75	3.29	4.65	5.70	7.36	8.71	10.4
•	•	•	**1670**		2.74	3.24	3.87	5.47	6.70	8.65	10.2	12.2
•	•	•	**1850**	3/8"	3.47	4.11	4.91	6.94	8.50	11.0	13.0	15.5
•	•	•	**1980**	Quick-fit	4.00	4.73	5.66	8.00	9.80	12.7	15.0	17.9
•	•	•	**2115**		4.69	5.56	6.64	9.39	11.5	14.8	17.6	21.0
•	•	•	**2128**		5.23	6.18	7.39	10.5	12.8	16.5	19.6	23.4
•	•	•	**2208**		8.49	10.0	12.0	17.0	20.8	26.9	31.8	38.0
•	•	•	**2220**		8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2
•	•	•	**2319**		13.1	15.5	18.5	26.1	32.0	41.3	48.9	58.4
•			**2129**		5.23	6.18	7.39	10.5	12.8	16.5	19.6	23.4
•			**2209**		8.49	10.0	12.0	17.0	20.8	26.9	31.8	38.0
•			**2221**	1/2"	8.98	10.6	12.7	18.0	22.0	28.4	33.6	40.2
•			**2320**		13.1	15.5	18.5	26.1	32.0	41.3	48.9	58.4
•			**2420**		17.1	20.3	24.2	34.3	42.0	54.2	64.2	76.6

TYPICAL APPLICATIONS

Washing: exhaust scrubbers, parts cleaning, pre-treatment in coating process, dust and foam control, filter spraying
Cooling: wire cooling, plastic pipe cooling
Other applications: humidification systems, etc.

PO MALE THREAD NOZZLES

ZPB fastening clamps in plastic usually connect to nozzles with 3/8" female threads. They are flexible, durable and low cost. Please see more on page 86.

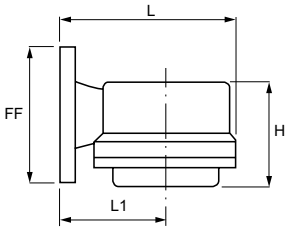
PN (Female) **+ ZPB** Plastic pipe clamp

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: PNS 1170 D6

Px S 1170 xx Y Z

- **Px** — NOZZLE TYPE
  - **PN** - Female
  - **PO** - Male
  - **PS** - Quick-fit
- **S** — ANGLE
  - **Q** - 60°
  - **S** - 70°
  - **T** - 80°
  - **U** - 90°
  - **Y** - 130°
- **1170** — CAPACITY
- **xx** — MATERIAL
  - **D6** - PP, chemicallybonded fiberglass
- **Y** — VERSION
  - **S** - Standard
- **Z** — CONNECT.
  - **B** - BSPT
  - **N** - NPT
  - **G** - BSP
  - **Q** - Quick-fit

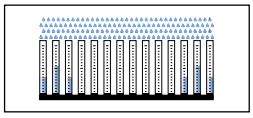


TANGENTIAL NOZZLES / LARGE FLOW RATES

PR nozzles produce a hollow cone spray pattern based on the tangential jet principle generating atomized flows with large flow rates. They have a vaneless and large free inside passage and offer a considerable resistance to clogging and high performances.

- **Flange**
  DIN2633-ND16, JIS
- **Typical applications**
  Desulfurization
  Denitrification
  Exhaust scrubbers
  Coke quenching towers

Spray section



Concave distribution

	Code	DN inch	DE mm	DU mm	Capacity at different pressure values (l/min) (bar)					Dimensions mm			
					0.5	1.0	2.0	3.0	5.0	FF	H	L	L1
130°	**PRY 3612 xx**	3"	31.0	90	250	353	500	612	790	200	157	250	150
	PRY 3685 xx		34.0	90	280	395	559	685	884				
	PRY 3771 xx		36.5	90	315	445	630	771	995				
	PRY 3869 xx		39.5	90	355	502	710	869	1122				
	PRY 3979 xx		40.0	90	400	565	799	979	1264				
	PRY 4110 xx		43.0	90	449	635	898	1100	1420				
	PRY 4122 xx		50.0	90	498	704	996	1220	1575				
	PRY 4153 xx		57.0	90	625	883	1249	1530	1975				
	PRY 4195 xx	4"	60.0	145	796	1126	1592	1950	2517	220	242	355	200
	PRY 4244 xx		70.0	145	996	1409	1992	2440	3150				
	PRY 4306 xx		79.0	145	1249	1767	2498	3060	3950				
	PRY 4385 xx		87.0	145	1572	2223	3144	3850	4970				

HOW TO MAKE UP THE **NOZZLE CODE**

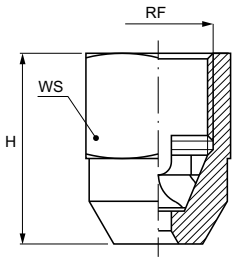
EX.: PRY 3612 B31

PR **Y** **3612** **xx**

- **xx** — MATERIAL
  - **B31** - AISI 316L Stainless steel
  - **G1** - Cast iron
- **3612** — CAPACITY
- **Y** — SPRAY ANGLE
  - **Y** - 130°
- **PR** — NOZZLE TYPE

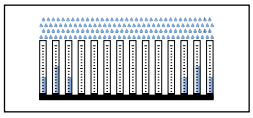
IN LINE SPRAY / INSIDE VANE

RA nozzles are tangential hollow cone nozzles that produce a finely atomized spray in line with the inlet supply pipe. In their body there is a carefully machined swirl vane with two spiral grooves which produce a wide range of capacities, starting from very low values. The strong centrifugal force inside the vortex chamber creates a high speed rotation of the liquid flow producing an atomized mist. For small capacity RA nozzles we suggest to place a suitable filter before their inlet orifice to avoid clogging.



- **Thread specification**: BSP, NPT

Spray section



Concave distribution

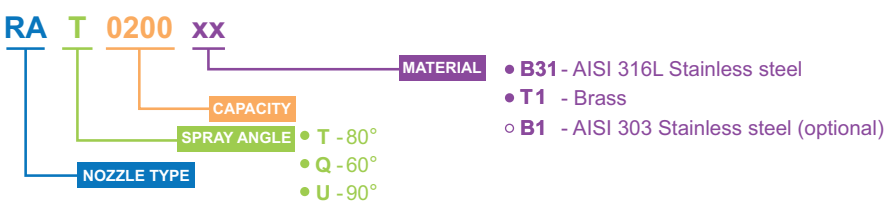
	Code	RF inch	D mm	D1 mm	Capacity at different pressure values (l/min) (bar)								Dimensions mm	
					0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	H	WS
80°	**RAT 0200 xx**	1/8"	1.0	0.5	0.08	0.10	0.12	0.16	0.20	0.26	0.31	0.37	18	17
	RAT 0390 xx		1.7	0.5	0.16	0.19	0.23	0.32	0.39	0.50	0.60	0.71		
60°	**RAQ 0490 xx**	3/8"	1.1	0.6	0.20	0.24	0.28	0.40	0.49	0.63	0.75	0.89	29	22
	RAQ 0770 xx		1.6	0.6	0.31	0.37	0.44	0.63	0.77	0.99	1.18	1.41		
	RAQ 1122 xx		2.0	0.6	0.50	0.59	0.70	1.00	1.22	1.58	1.86	2.23		
90°	**RAU 1208 xx**	3/8"	3.0	1.0	0.85	1.00	1.20	1.70	2.08	2.69	3.18	3.80	29	22
	RAU 1306 xx		4.0	1.6	1.25	1.48	1.77	2.50	3.06	3.95	4.67	5.59		
	RAU 1490 xx		4.2	1.6	2.00	2.37	2.83	4.00	4.90	6.33	7.48	8.95		
	RAU 1612 xx		4.7	1.6	2.50	2.96	3.53	5.00	6.12	7.90	9.35	11.2		
	RAU 1772 xx		5.5	1.6	3.15	3.73	4.46	6.30	7.72	9.97	11.8	14.1		
	RAU 2104 xx		6.3	1.6	4.25	5.02	6.00	8.49	10.4	13.4	15.9	19.0		
	RAU 1491 xx	1/2"	5.0	1.8	2.00	2.37	2.83	4.00	4.90	6.33	7.48	8.95	36	27
	RAU 1551 xx		5.5	1.8	2.25	2.66	3.18	4.50	5.51	7.11	8.42	10.1		
	RAU 1686 xx		6.0	1.8	2.80	3.31	3.96	5.60	6.86	8.86	10.5	12.5		
	RAU 1980 xx		6.3	2.0	4.00	4.73	5.66	8.00	9.80	12.7	15.0	17.9		
	RAU 2137 xx		6.7	2.0	5.59	6.62	7.91	11.2	13.7	17.7	20.9	25.0		
	RAU 2153 xx		7.5	2.0	6.25	7.39	8.83	12.5	15.3	19.8	23.4	27.9		
	RAU 2196 xx		9.0	2.0	8.00	9.47	11.3	16.0	19.6	25.3	29.9	35.8		

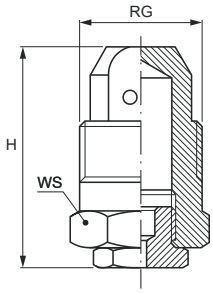
Typical applications

Cooling: gas, products, pipes cooling
Washing: exhaust scrubbers, parts washing
Other applications: dust control, humidification and air refreshing systems

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: RAT 0200 B31

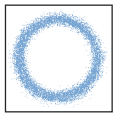




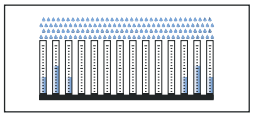
IN LINE SPRAY / VANELESS

These nozzles, designed with no inside whirling vane and a wide unobstructed passage, produce a hollow cone spray pattern, and are highly resistant to clogging. The liquid flow enters at high speed through the top eccentric orifice into the nozzle swirl chamber where the strong centrifugal force generates finely atomized droplets. These nozzles, the ideal choice for dust control applications, are particularly suitable for coal dust suppression and for this reason they are called "miner's nozzles".

- **Thread specification**: BSPT, NPT



Spray section



Concave distribution

	Code	RG	D Orifice	D1 Inlet	Capacity at different pressure values (l/min) (bar)								Dimensions mm	
		inch	mm	mm	0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	H	WS
60°	**RBQ 1160 xx**	3/8"	2.0	2.0	0.65	0.77	0.92	1.31	1.60	2.07	2.44	2.92	31	17
	RBQ 1230 xx		2.4	2.4	0.94	1.11	1.33	1.88	2.30	2.97	3.51	4.20		
	RBQ 1390 xx		3.2	2.3	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12		
	RBQ 1630 xx		3.9	3.8	2.57	3.04	3.64	5.14	6.30	8.13	9.62	11.5		
	RBQ 2110 xx		4.4	*4.0	4.49	5.31	6.35	8.98	11.0	14.2	16.8	20.1		
70°	**RBS 1391 xx**	1/2"	3.5	3.0	1.59	1.88	2.25	3.18	3.90	5.03	5.96	7.12	37	22
	RBS 1631 xx		4.0	4.0	2.57	3.04	3.64	5.14	6.30	8.13	9.62	11.5		
	RBS 1781 xx		4.5	2.9	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2		
	RBS 2117 xx		5.1	*3.4	4.82	5.70	6.81	9.63	11.8	15.2	18.0	21.5		
	RBS 2157 xx		7.0	*3.6	6.45	7.63	9.12	12.9	15.8	20.4	24.1	28.8		
	RBS 2196 xx		7.3	*4.8	7.96	9.42	11.3	15.9	19.5	25.2	29.8	35.6		
	RBS 1782 xx	3/4"	4.7	4.5	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2	43	32
	RBS 2118 xx		5.9	4.8	4.82	5.70	6.81	9.63	11.8	15.2	18.0	21.5		
	RBS 2197 xx		7.0	6.5	7.96	9.42	11.3	15.9	19.5	25.2	29.8	35.6		
	RBS 2390 xx		9.3	*6.0	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2		
80°	**RBT 2310 xx**	1 1/2"	10.0	*7.0	12.7	15.0	17.9	25.3	31.0	40.0	47.4	56.6	69	50
	RBT 2550 xx		12.9	*8.5	22.5	26.6	31.8	44.9	55.0	71.0	84.0	100		
	RBT 2630 xx		15.0	*8.5	25.7	30.4	36.4	51.4	63.0	81.3	96.2	115		
	RBT 2700 xx		14.6	*9.0	28.6	33.8	40.4	57.2	70.0	90.4	107	128		
	RBT 2940 xx		19.8	*10.0	38.4	45.4	54.3	76.8	94.0	121	144	172		

**** Double inlet orifice***

Typical applications

Cooling: gas cooling, product cooling, pipe cooling
Washing: exhaust scrubbers, product cleaning
Other applications: dust control, humidification systems, sterilization

HOW TO MAKE UP THE **NOZZLE CODE**

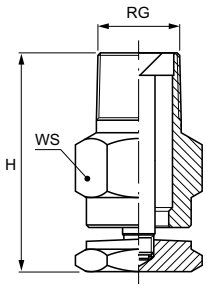
EX.: RBQ 1160 B1

RB **Q** **1160** **xx**

- NOZZLE TYPE: RB
- SPRAY ANGLE: Q -60° / S -70° / T -80°
- CAPACITY: 1160
- MATERIAL: xx
  - ● **B1** - AISI 303 Stainless steel
  - ● **T1** - Brass
  - ○ **B31** - AISI 316L Stainless steel (optional)

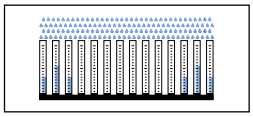
IN LINE SPRAY

RC type deflected nozzles produce a ring-shaped hollow cone spray pattern, in line with the nozzle inlet supply pipe. The water flow hits the deflection cap fixed onto the nozzle outlet orifice producing small droplets, very wide spray angles and uniform distribution. The deflection cap determines the various deflection angles. This nozzles are highly efficient and clog resistant.



■ **Thread specification**: BSPT, NPT

Spray section



Concave distribution

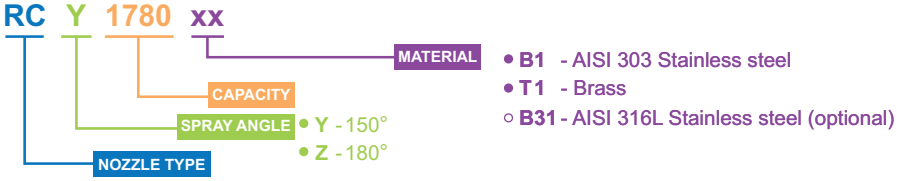
	RG inch		Code	Capacity at different pressure values (l/min) (bar)								Dimensions mm	
	1/4"	3/8"		0.5	0.7	1.0	2.0	3.0	5.0	7.0	10	H	WS
150°	•		RCY 1780 xx	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2	33	17
	•		RCY 2117 xx	4.82	5.70	6.81	9.63	11.8	15.2	18.0	21.5		
	•		RCY 2157 xx	6.41	7.58	9.06	12.8	15.7	20.3	24.0	28.7		
	•		RCY 2196 xx	7.96	9.42	11.3	15.9	19.5	25.2	29.8	35.6		
		•	RCY 2230 xx	9.39	11.1	13.3	18.8	23.0	29.7	35.1	42.0	44	22
		•	RCY 2270 xx	11.0	13.0	15.6	22.0	27.0	34.9	41.2	49.3		
		•	RCY 2310 xx	12.7	15.0	17.9	25.3	31.0	40.0	47.4	56.6		
		•	RCY 2350 xx	14.3	16.9	20.2	28.6	35.0	45.2	53.5	63.9		
		•	RCY 2390 xx	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2		
180°	•		RCZ 1780 xx	3.18	3.77	4.50	6.37	7.80	10.1	11.9	14.2	33	17
	•		RCZ 2117 xx	4.82	5.70	6.81	9.63	11.8	15.2	18.0	21.5		
	•		RCZ 2157 xx	6.41	7.58	9.06	12.8	15.7	20.3	24.0	28.7		
	•		RCZ 2196 xx	7.96	9.42	11.3	15.9	19.5	25.2	29.8	35.6		
		•	RCZ 2230 xx	9.39	11.1	13.3	18.8	23.0	29.7	35.1	42.0	44	22
		•	RCZ 2270 xx	11.0	13.0	15.6	22.0	27.0	34.9	41.2	49.3		
		•	RCZ 2310 xx	12.7	15.0	17.9	25.3	31.0	40.0	47.4	56.6		
		•	RCZ 2350 xx	14.3	16.9	20.2	28.6	35.0	45.2	53.5	63.9		
		•	RCZ 2390 xx	15.9	18.8	22.5	31.8	39.0	50.3	59.6	71.2		

Typical applications

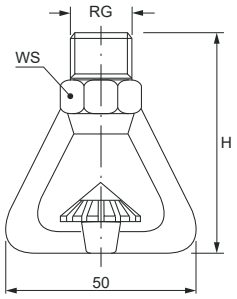
Washing: exhaust scrubbers, small tanks, pipes interiors
Other applications: pipes coating, dust control, fire protection

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: RCY 1780 B1



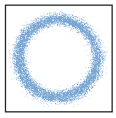
RO (HOLLOW CONE NOZZLES / DEFLECTED SPRAY)



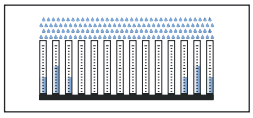
DEFLECTED SPRAY

RO hollow cone deflected spray nozzles are specially designed for fire-fighting engineering. They produce an excellent water atomization and their deflected jet assures a wide spray coverage. The spray pattern is formed by the liquid flowing from the nozzle orifice over the surface of the below deflector with a special slotted design. All RO nozzles are certified by the EU fire regulations.

- **Thread specification**: BSPT, NPT
- **Typical applications**
  Fire-fighting: fire extinguishing, cooling
  Other applications: tank cleaning, exhaust scrubbers



Spray section



Concave distribution

	Code	RG inch	D mm	Capacity at different pressure values (l/min) (bar)						WS mm	H mm
				1.0	3.0	5.0	6.0	7.0	10.0		
130°	ROY D005 xx yy	1/2"	3.0	4.80	8.10	10.3	11.3	12.2	14.5	25	65
	ROY D006 xx yy		3.5	6.70	11.5	14.9	16.4	17.6	20.5		
	ROY D009 xx yy		4.0	9.00	15.6	20.0	22.0	24.0	29.0		
	ROY D011 xx yy		4.5	11.5	19.8	25.0	28.0	30.0	36.0		
	ROY D016 xx yy		5.0	15.8	27.0	35.0	39.0	42.0	50.0		
	ROY D018 xx yy		5.5	18.0	30.0	40.0	44.0	48.0	57.0		
	ROY D023 xx yy		6.0	23.0	39.0	50.0	55.0	60.0	71.0		
	ROY D027 xx yy		6.5	27.0	47.0	61.0	66.0	72.0	86.0		
	ROY D032 xx yy		7.0	31.0	55.0	72.0	77.0	84.0	91.0		
	ROY D041 xx yy		8.0	41.0	70.0	92.0	103	112	130		
	ROY D052 xx yy		9.0	52.0	91.0	117	129	140	165		
	ROY D064 xx yy		10.0	64.0	110	139	152	165	200		
	ROY D095 xx yy		12.0	95.0	164	214	236	255	290		
	ROY D103 xx yy		13.0	103	178	230	252	272	325		
130°	ROY E005 xx yy	3/4"	3.0	4.80	8.10	10.3	11.3	12.2	14.5	27	65
	ROY E006 xx yy		3.5	6.70	11.5	14.9	16.4	17.6	20.5		
	ROY E009 xx yy		4.0	9.00	15.6	20.0	22.0	24.0	29.0		
	ROY E011 xx yy		4.5	11.5	19.8	25.0	28.0	30.0	36.0		
	ROY E016 xx yy		5.0	15.8	27.0	35.0	39.0	42.0	50.0		
	ROY E018 xx yy		5.5	18.0	30.0	40.0	44.0	48.0	57.0		
	ROY E023 xx yy		6.0	23.0	39.0	50.0	55.0	60.0	71.0		
	ROY E027 xx yy		6.5	27.0	47.0	61.0	66.0	72.0	86.0		
	ROY E032 xx yy		7.0	31.0	55.0	72.0	77.0	84.0	91.0		
	ROY E041 xx yy		8.0	41.0	70.0	92.0	103	112	130		
	ROY E052 xx yy		9.0	52.0	91.0	117	129	140	165		
	ROY E064 xx yy		10.0	64.0	110	139	152	165	200		
	ROY E095 xx yy		12.0	95.0	164	214	236	255	290		
	ROY E103 xx yy		13.0	103	178	230	252	272	325		

COMPLETE NOZZLE CODE

Code	Thread	Filter	
		Copper	None
FB	BSPT	•	
FN	NPT	•	
SB	BSPT		•
SN	NPT		•

HOW TO MAKE UP THE **NOZZLE CODE**

EX.: ROY D018 B31FB

RO Y D 123 xx yy

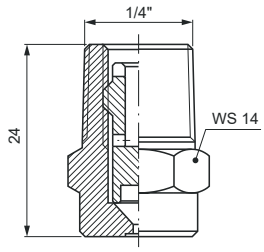
- COMPLETE NOZZLE CODE
- MATERIAL
  - **B31** - AISI 316L Stainless steel
  - **T1** - Brass
  - **T8** - Brass, nickel plated
  - **T81** - Brass, electroless nickel plated
- CAPACITY
- THRAD • D - 1/2" • E - 3/4"
- ANGLE • Y - 130°
- NOZZLE TYPE

HYDRAULIC ATOMIZERS

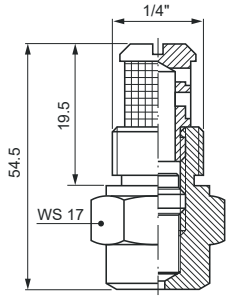
RX/RZ series hydraulic nozzles deliver a very finely atomized hollow cone spray, even at low pressure values. They contain a precisely machined insert with narrow passages that can be easily disassembled for cleaning in case of obstruction. Clogging can be avoided placing a fine mesh strainer on the main manifold or using an individual filter.

RW hydraulic atomizers works in the same way, but the tip is locked with a welded nipple ZAA and a locknut VAA. The capacities of RW tip are the same of RX nozzle. To have the complete product code, just change “RX” with “RW”.

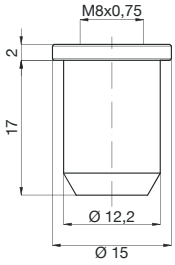
- **Connection**:
  BSPT (RX), BSP (RZ), NPT (RX, RZ), tip with nipple and locknut (RW)
- **Typical applications**
  dust control, humidification, deodorant spray, disinfectant liquid spray, exhaust scrubbers



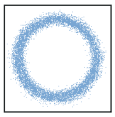
RX



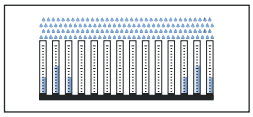
RZ (+VEF)



RW



Spray section



Concave distribution

	Code	D	Capacity (l/hour) at different pressure values (bar)									
		mm	1.5	2.0	3.0	4.0	5.0	6.0	10	15	20	50
80°	**RXT 0060 xx**	0.50	2.55	2.94	3.60	4.16	4.65	5.09	6.57	8.05	9.30	14.7
	RXT 0100 xx	0.50	4.24	4.90	6.00	6.93	7.75	8.49	11.0	13.4	15.5	24.5
	RXT 0130 xx	0.70	5.52	6.37	7.80	9.01	10.1	11.0	14.2	17.4	20.1	31.8
	RXT 0190 xx	0.70	8.06	9.31	11.4	13.2	14.7	16.1	20.8	25.5	29.4	46.5
	RXT 0250 xx	1.00	10.6	12.2	15.0	17.3	19.4	21.2	27.4	33.5	38.7	61.2
	RXT 0380 xx	1.00	16.1	18.6	22.8	26.3	29.4	32.2	41.6	51.0	58.9	93.1
	RXT 0510 xx	1.50	21.6	25.0	30.6	35.3	39.5	43.3	55.9	68.4	79.0	125
	RXT 0650 xx	1.60	27.6	31.8	39.0	45.0	50.3	55.2	71.2	87.2	101	159
	RXT 0780 xx	1.90	33.1	38.2	46.8	54.0	60.4	66.2	85.4	105	121	191
	RXT 0910 xx	1.90	38.6	44.6	54.6	63.0	70.5	77.2	99.7	122	141	223
	RXT 1116 xx	1.90	49.2	56.8	69.6	80.4	89.9	98.4	127	156	180	284
	RXT 1143 xx	1.90	60.7	70.1	85.8	99.1	111	121	157	192	222	350
	RXT 1166 xx	2.20	70.4	81.3	99.6	115	129	141	182	223	257	407

	Code	D	Capacity (l/min) at different pressure values (bar)									
		mm	1.5	2.0	3.0	4.0	5.0	6.0	10	15	20	50
60°	**RZQ 0080 xx**	0.45	0.06	0.07	0.08	0.09	0.10	0.11	0.15	0.18	0.21	0.33
	RZQ 0120 xx	0.55	0.08	0.10	0.12	0.14	0.15	0.17	0.22	0.27	0.31	0.49
	RZQ 0250 xx	0.80	0.18	0.20	0.25	0.29	0.32	0.35	0.46	0.56	0.65	1.02
	RZQ 0390 xx	1.00	0.28	0.32	0.39	0.45	0.50	0.55	0.71	0.87	1.01	1.59
	RZQ 0560 xx	1.20	0.40	0.46	0.56	0.65	0.72	0.79	1.02	1.25	1.45	2.29
	RZQ 0780 xx	1.40	0.55	0.64	0.78	0.90	1.01	1.10	1.42	1.74	2.01	3.18
	RZQ 1100 xx	1.60	0.71	0.82	1.00	1.15	1.29	1.41	1.83	2.24	2.58	4.08
	RZQ 1140 xx	1.90	0.99	1.14	1.40	1.62	1.81	1.98	2.56	3.13	3.61	5.72
	RZQ 1170 xx	2.10	1.20	1.39	1.70	1.96	2.19	2.40	3.10	3.80	4.39	6.94
	RZQ 1200 xx	2.30	1.41	1.63	2.00	2.31	2.58	2.83	3.65	4.47	5.16	8.16

VEF THREADED FILTERS

We suggest to use a VEF threaded filter to protect the nozzle against clogging.

ADDITIONAL SPRAY ANGLES

The spray angle of the RZQ nozzles is 60° with orifice dimensions larger than 1.0 mm. Please see additional angles in the table below.

RZF	RZM	RZQ	RZU
30°	45°	60°	90°

HOW TO MAKE UP THE NOZZLE CODE

EX.: RXT 0060 B1

Rx T 0060 xx

- **MATERIAL**
  - **B1** - AISI 303 Stainless steel
  - **B31** - AISI 316L Stainless steel
  - **T1** - Brass
- **CAPACITY**
- **SPRAY ANGLE**
  - **T** - 80° (RW, RX)
  - **Q** - 60° (RZ)
- **NOZZLE TYPE**
  - **RW**
  - **RX**
  - **RZ**