SPRAY NOZZLES FOR INDUSTRIAL APPLICATIONS

AIR ASSISTED ATOMIZERS

INTRODUCTION

INDEX

INDEX

TECHNICAL PUBLICATIONS

TECHNICAL PUBLICATIONS

PNR manufactures a complete range of spray nozzles for industrial applications, as well as products and systems specially designed for specific industries. Information about our Company and our product range is available through the following publications

SPRAY NOZZLES & ASSEMBLY FITTINGS	CTG GN
INDUSTRIAL TANK WASHING SYSTEMS	CTG LS
AIR ASSISTED ATOMIZERS	CTG AZ
SPRAY ENGINEERING HANDBOOK	CTG SH
STEELWORK NOZZLES	CTG SW
SOLUTIONS FOR THE PULP AND PAPER INDUSTRY	CTG PN

As a result of continuous product improvement our documentation is regularly updated: please visit our website to be always updated.

NOTES

NOTES

Our products are continuously being reviewed and modified to keep up with the latest state of technology. As a result the technical information provided in this catalogue is for guidance only and is not binding. We regret not being able to provide our customers with notification of such changes all of the time. Should you have an application that requires some special features such as specific flow rates or spray angles for example, then please issue a written request before sending your order and we'll do our best to meet your requirements. All information contained in this catalogue, including product data, product codes, diagrams and photographs are the exclusive property of Flowtech. It is forbidden to reproduce any part of this catalogue without having obtained written permission from Flowtech first.

Dimensions in this catalogue are given in millimetres (mm). All threads are made according to the ISO 228 standards (European norms BS 2779 – DIN 259 – UNI 338).
Explanations about the abbreviations used in the catalogue are given on page 25.
All mentioned Trademarks are the property of their respective owners.

Our Company has qualified its quality system with DNV, following ISO 9001/2015 standard.

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL
= ISO 9001:2015 =

INTRODUCTION

AIR ASSISTED ATOMIZING

Several industrial processes need the atomizing of liquids into fine and very fine droplets.
This result might be achieved by means of a purely hydraulic nozzle, with the liquid being fed at high pressure through a very small orifice, but the process would originate two main problems:

A Requiring costly investments and complicated lay-out.
B Originating plugging problems because of the small orifice dimensions.

In the majority of industrial processes a fine liquid atomization is obtained by means of air assisted atomizers, where compressed air supplies the required energy to break the liquid and to throw the droplets at a given distance from the atomizer. An air atomizing system has however two inherent limitations:

A The narrow inside passages require adequate filtering of air and liquid.
B The high speed jet will only produce narrow angle sprays. To overcome this inconvenience multiple orifice atomizers are used to produce a diverging sprays with better droplet distribution.

AIR ASSISTED ATOMIZERS

The first two sections of the Catalog show two types of atomizers largely used in the industry, the third one deals with complete atomizing systems.

ULTRASONIC ATOMIZERS

These devices provide liquid atomization in two steps:

A The liquid is injected into the nozzle center and is first atomized by shear action and then mixed with the high speed air stream leaving the nozzle through the outlet orifice.
B The stream carrying the droplets is taken to impact onto a resonator placed in front of the nozzle orifice, and generates a field of sound waves for additional droplet breakup.

Ultrasonic atomizers produce very fine droplets, in a tight dimensional range, and supply low capacities below 100 liters per hour. Their operation produces a typical noise, the level of which needs to be checked according to the local regulations if some personnel is supposed to work in a nearby area.

CLASSIC ATOMIZERS

These devices produce liquid atomization by simple shear action, providing a high velocity stream to impact onto a liquid flow. In spite of their inherent low efficiency, and because of the low capacities involved, classic atomizers are the most convenient solution for most of the current applications. A wide range of spray patterns, capacities, atomizer types, body options and accessories has been developed to suit many different requirements from the industry.

PNR MATERIAL CODES

Many products in this Catalog are available in different materials, and therefore the product codes carry often two letters (XX) which need to be replaced from the required material code. A list with the most used codes is given in the following.

A1	Mild steel
A2	High speed steel
A8	Zinc plated steel
A9	Nickel plated steel
B1	AISI 303 Stainless steel
B2	AISI 304 Stainless steel
B21	AISI 304 L Stainless stee
B3	AISI 316 Stainless steel
B31	AISI 316 L Stainless steel
B8	AISI 309 Stainless steel
C2	AISI 416, Hardened SS
D1	Polyvinylchloride (PVC)
D2	Polypropylene (PP)

D3	Polyamide (PA)
D5	Polypropylene, w/talcum
D6	Polypropylene, 25% glass fiber
D7	High Density Polyethylene
D8	Polyvinyliden fluoride (PVDF)
E0	EPDM
E1	Ethylenpolytetrafluor. (PTFE)
E3	Acetalic resin (POM)
E31	DELRIN ®
E6	LUCITE ® (PMMA)
E7	Viton
E8	Synthetic rubber (NBR)
H1	Titanium

L1	Monel 400
L2	Incolloy 825
L8	Hastelloy
P6	Acrilyc but. stirene (ABS)
P8	EPDM, 40 Shore
T1	Brass
T2	Chrome plated brass
T3	Copper
T8	Nickel plated brass
T81	ENP Brass
T9	Brass body, Stainless steel set-up
V1	Aluminum
V7	ENP Aluminum

INTRODUCTION

PROPERTIES OF A LIQUID SPRAY

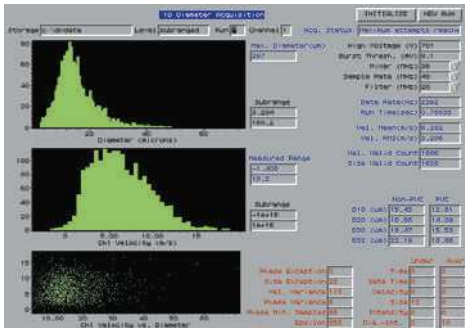
The atomization of a liquid by means of a compressible fluid, like air, steam or a gas, is defined two-phase or twin-fluid or pneumatic atomization. Many industrial processes require using finely atomized droplets and the techniques to produce finely atomized sprays have been largely improved in recent years with new types of atomizers being developed.

In addition more sophisticated process techniques have increased the demand for a precise definition about the characteristics of a given spray for the purpose of getting precisely repeatable results. The most interesting parameters defining a given spray have been defined as in the following, and are now available to the process design engineer.

Arithmetic Mean Diameter AMD (D10)	This is the arithmetic Mean Value as calculated on the diameters from the total number of the drops in the sample spray.
Volume Mean Diameter VMD (D30)	This is the diameter of that drop whose volume is the arithmetic mean from the total number of the drops in the sample spray.
Sauter Mean Diameter SMD (D32)	This is the diameter of that drop whose Volume/Surface ratio is the arithmetic mean from the total number of the drops in the sample spray.

The following Histograms and Diagrams are often used to resume the data referring to the above parameters and give a visual definition of a spray:
- Volume percentage cumulative diagram
- Droplet diameter distribution Histogram
- Droplet velocity distribution Histogram

The dimensional parameters and the above information make it possible to base process calculations on precise data atomization degree, efficiency of heat exchange and spray behavior in a given operation ambient. The knowledge of a value for the Sauter Mean Diameter SMD (D32) in a given spray is of special importance for the calculation of heating exchange in evaporative cooling processes, since it makes it possible to know the value of the total heat exchange surface obtained atomizing a known quantity of liquid.



PNR can supply upon request complete documentation containing test reports about the aforementioned parameters for all PNR catalog and special atomizers.
The Histograms beside show the distribution of droplet diameters (D32) and velocities for one spray ob tained in our laboratory.

The photo beside shows a test performed in our laboratory. A laser Interpherometer is used to measure and record the spray parameters, while fluid flow rates and feed pressures are monitored with high precision instruments.

NOTE

Please note that all capacity values given in this catalog refer to test performed using water and compressed air. Atomizing liquids other than water, or using motive fluids different from compressed air will modify the performance of any atomizer, which have to be assessed through a laboratory test.

ULTRASONIC ATOMIZERS

Ultrasonic atomizers operate on a very sophisticated process which is based on two steps: In the first one tiny water jets are injected into an high speed air flow which provides a first break up and atomization of the fluid.
In the second step the two phase flow, air entraining liquid droplets, goes trough a field of sound waves which produce a further break up and a lower droplet dimension. This is realized through an impact between the two phase flow and a resonator located in front of the nozzle orifice.

Ultrasonic atomizers can only be manufactured with high precision machining operations but offer the following remarkable advantages.

A
The droplets in the atomized jet show low values for the Sauter Mean Diameter, and in addition a rather narrow range of individual droplet diameter: in other words the drops are very small and with little difference in diameter between the smallest and the biggest droplet. This means the spray is made by droplets very small and very similar in size, which is very important in all evaporative processes like for example air humidification: it is rather easy then to obtain values for the evaporation time and evaporation length of a given spray.

B
The noticeable variations in local air pressure all around the resonator, associated to the sound waves, eliminate the danger of dust and foreign particles build-up in the vicinity of the nozzle orifice, thus avoiding a decay in the atomizer performance.

The system will then be very reliable and require limited or null maintenance.

Ultrasonic atomizers

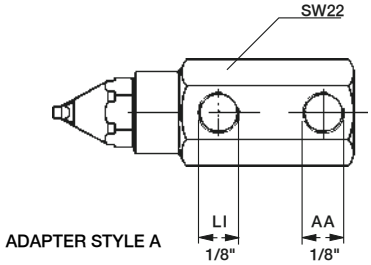
Page 4

Atomizing carts

Page 5

ULTRASONIC ATOMIZERS

ATOMIZERS AND FITTINGS



ADAPTER STYLE A

Ultrasonic atomizers produce the finest sprays available with air assistance for industrial processes, with a narrow angle full cone jet. Water and air do not mix in a confined volume before leaving the nozzle and therefore their feed pressures can be adjusted independently without influencing each other: this allows for a very wide regulation range on the liquid capacity and makes it easier to reach the desired operating conditions.

Please note that the code given in the table only refers to the atomizing head and must be completed with the identification for one of the four connection adapters available, as shown below in the page.
The drawing beside shows an atomizing head assembled onto one A type adapter.

Materials	Atomizing head	B1 AISI 303 Stainless steel
	Adapter	B1 AISI 303 Stainless steel
		T1 Brass

WM = Water capacity ((l/min)
AH = Air capacity (Nmc/ora)

IDENTIFICATION CODES

ATOMIZING HEAD
The codes given in the table refer to the atomizing head only, and can be used to order the head as a separate part.

ADAPTERS
Can be ordered separately using the codes below, please replace
XX = B1 for AISI 303
XX = T1 for brass

COMPLETE ATOMIZERS
To identify a complete atomizer, please add to the head code the three suffix letters describing the potential adapter style and its material, according to the information below.

MAD 0801 B1 X Y Z

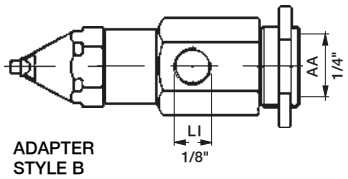
Adapter material
A = T1 Brass
B = B1 AISI 303

Adapter style
A = XMA 0103 xx
B = XMA 0101 xx
C = XMA 0102 xx
D = XMA 0100 xx

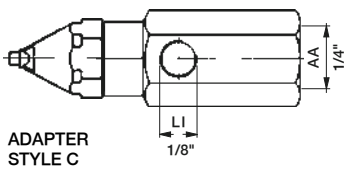
Connection
G = BSP F
N = NPT F

	Code		Air pressure (bar) 0,5 WM	0,5 AH	0,7 WM	0,7 AH	1,0 WM	1,0 AH	2,0 WM	2,0 AH	3,0 WM	3,0 AH
25°	MAD 0331 B1	2	0,10	3,1	0,12	3,0	0,15	3,1	0,27	2,7	-	-
		3	0,05	3,7	0,10	3,1	0,12	3,6	0,20	3,7	0,32	2,9
		4	0,02	4,7	0,05	4,8	0,08	4,4	0,18	4,4	0,25	4,2
		5	-	-	0,02	5,3	0,05	5,3	0,13	5,5	0,22	5,2
		6	-	-	-	-	0,02	6,1	0,12	6,0	0,18	5,8
	MAD 0801 B1	2	0,23	2,7	0,28	2,9	0,37	2,7	0,72	2,2	-	-
		3	0,22	3,6	0,27	3,6	0,32	3,5	0,52	3,2	0,82	2,7
		4	0,18	4,5	0,22	4,4	0,28	4,6	0,45	4,6	0,62	4,7
		5	0,12	5,4	0,18	5,3	0,25	5,6	0,40	5,4	0,53	5,4
		6	0,07	6,2	0,13	6,3	0,22	6,2	0,35	6,3	0,50	6,2
	MAD 1131 B1	2	0,50	7,3	0,60	6,6	0,73	6,9	1,15	5,6	-	-
		3	0,40	9,7	0,50	9,5	0,65	9,4	0,96	9,3	1,35	7,9
		4	0,27	11,6	0,37	11,9	0,55	11,8	0,93	12,1	1,20	11,5
		5	0,13	13,9	0,23	13,8	0,38	14,0	0,87	14,1	1,15	13,8
		6	0,07	18,6	0,13	18,7	0,27	8,7	0,72	18,9	1,10	19,0
40°	MAL 0800 B1	2	0,18	2,7	0,23	2,7	0,32	2,9	0,73	2,1	-	-
		3	0,15	3,7	0,18	3,9	0,25	3,5	0,50	3,7	0,85	2,6
		4	0,10	4,5	0,17	4,6	0,22	4,9	0,33	4,8	0,53	4,4
		5	0,03	5,4	0,10	5,6	0,18	5,4	0,30	5,4	0,45	5,3
		6	-	-	0,03	6,2	0,12	6,3	0,27	6,2	0,38	6,3
	MAL 1130 B1	2	0,46	7,3	0,52	7,2	0,68	6,8	1,13	5,7	-	-
		3	0,38	9,5	0,47	9,7	0,65	10,2	0,95	9,4	1,27	7,7
		4	0,23	11,8	0,35	11,8	0,50	11,9	0,88	12,1	1,15	11,8
		5	0,13	13,5	0,23	13,9	0,37	14,0	0,82	14,1	1,10	14,2
		6	0,07	16,0	0,13	16,2	0,27	16,2	0,63	16,2	1,03	16,3
	MAL 1300 B1	2	0,95	14,6	1,12	16,5	1,40	16,3	2,42	10,4	-	-
		3	0,80	19,3	1,00	20,0	1,26	22,2	1,90	19,2	2,87	14,5
		4	0,60	24,7	0,80	24,7	1,08	25,0	1,80	25,0	2,40	23,2
		5	0,42	29,9	0,60	30,3	0,90	30,4	1,70	30,5	2,27	29,9
		6	0,23	35,6	0,40	36,0	0,67	35,6	1,55	36,2	2,15	35,2

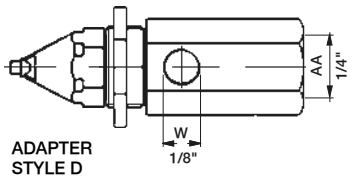
Liquid pressure (bar)



ADAPTER STYLE B



ADAPTER STYLE C



ADAPTER STYLE D

LOCKNUT FITS BOTH FRONT AND REAR THREADED BODIES.

B and D adapter style allow for mounting the atomizer through a wall or the side of a duct.
In this case do not forget to order the **VAM 2002 xxA** locknut, which fits both, to hold the adapter in place.

ATOMIZING CARTS

ATOMIZING CARTS

This type of atomizing cart makes it possible to atomize into the air of confined rooms liquids without requiring an operator to be present, the typical example being spraying disinfectants in hospital rooms.
These devices combine the ease of mobility with long operation times and can be efficiently operated by all kind of personnel after a very simple training.

The solution to be atomized is contained into the stainless steel tank, where it is put under pressure by means of the same compressed air used for the atomization process and which must be available on the spot.
Up to three atomizers for a maximum capacity of 7,2 l/min can be assembled onto the cart, each of them mounted on a swivel head for efficient ambient saturation. Ease of mobility is assured from two rubber lined wheels and a convenient handle.

The device can be operated with simple manual controls, or from a PLC unit which allows for setting an operation time and a start delay for allowing the operator to leave the room before atomizing starts.

Weight with manual control 13 kg (empty)
Tank volume 19 liters

Atomizing carts are designed on customer requirements, therefore no standard range coding is available. A certificate according to EUROPEAN 97/23/CE (PED) norm is released for each tank.