LECHLER

Precision Spray Nozzles for the Chemical Industry

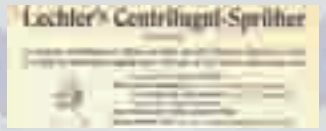
PROCESS OPTIMIZATION WITH NOZZLE TECHNOLOGY

Any company that wants to keep ahead of the competition needs to constantly optimize its production processes. In automated systems, even minor discrepancies can provide optimization opportunities.
Nozzle and spray technology is a good example.
The best results are achieved where nozzle technology is optimally tailored to individual requirements.
This requires a full understanding of the processes involved - especially in the chemical industry.
At Lechler, we have been maintaining this expertise for over 135 years.

As early as when his trading company was founded in 1879, Paul Lechler believed in chemistry. Initially the main focus was on technical products, machine oils and wood preservatives, and in 1905 the company gained exclusive sales rights to the protective coating Inertol®. By 1919 he had added his self-produced protective coatings to this portfolio. In 1961, all chemical products were finally combined in a separate company.

Today Lechler offers a wide product range for the optimization of technical processes. The following pages will provide you with several examples of this.

Throughout our history, chemistry has played a major role in our company. Over the course of many decades, this gave rise to a unique understanding of spraying and atomization processes. We are familiar with a wide range of applications at various pressures, temperatures and atmospheres.

1879	1893	1958	1962
			
Company founded by Paul Lechler	**Patent for liquid atomization**	**Relocation of production from Bad Cannstatt to Feuerbach**	**Sales offices founded in Germany**
Company existence:	14 years	79 years	83 years

Our products are characterised by maximum precision and reproducibility. Today we supply not only a unique selection of readily available standard nozzles, but also have the know-how for making customized products.

We would also be very pleased to advise you in person about how you can make your own processes even more efficient.

The standard

In the Lechler series catalogue "Precision Nozzles and Accessories" you will find an extensive selection of high-quality nozzles that have proven themselves in practical use thousands of times. Thanks to large-volume production, they are readily available at a reasonable price for the various applications in chemical and physics-related technology.

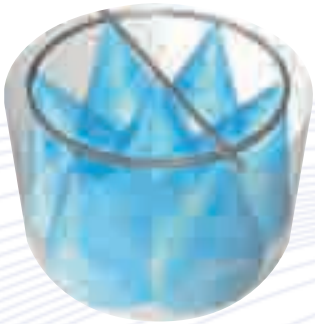
Special solutions

Standard products are often not sufficient for large industrial framework conditions. In this brochure, we present to you additional Lechler nozzles that we make only to order to meet the special needs of the chemicals and petrochemicals industry. If you can't find what you're looking for contact us. We would be happy to examine the possibilities available to us for developing the optimum atomization nozzle to suit your needs – custommade and in close collaboration with you.
Please note the production-related delivery times and costs for the nozzles presented here.

Our competence

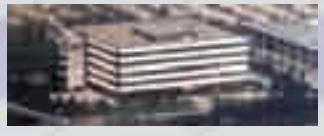
Lechler is a world leader in nozzle and spraying technology.
Our products and solutions are used worldwide in an extremely wide range of sectors – including in the chemical industry.

Our application engineers are familiar with practical use from many successful applications, and are therefore competent partners in the development and realization of exemplary solutions.



This know-how combined with our sophisticated technical achievements in research, design, and production, provides you with the security that is essential in process development today.
Find out for yourself during an obligation-free consultation.

1973



Merging of all sales and administration activities in the new Lechler building in Fellbach

94 years

1988

Founding of the Environmental Technology Division

109 years

1995

Production, sales and administration in Metzingen

116 years

2010

Opening of the new 13,000 m² production hall in Metzingen

131 years

LECHLER NOZZLES ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY

Applications from A to Z

A Absorption, Adsorption, Adiabatic Cooling

B Belt Lubrication & Cooling,

C Cryogenics, Coating, Cleaning in Place (CIP), Conveyor Lubrication, Condensation, Cooling, Centrifuge Cleaning

D Decontamination, Disinfection, Dosing, Dedusting, Degassing, Denitrification, Drying, Droplet Separators

E Emergency Showers, Evaporation Extinguishing equipment

F Flash Evaporation, Filter Cleaning, Fire Protection, Foam Suppression, Flue Gas Desulfurization, Fluidized Bed Technology

G Gas Treatment, Granulation

H High Pressure Cleaning, Humidification

I Impregnation, Injection Cooling

J Jet Cutting

M Mixing Devices

N NOx Removal

O Oven Cooling, Oversaturation

P Pelletizing

Q Quenching

R Rain Curtains, Reactor Cleaning, Retrofitting of Air Cooling Banks

S Spray Drying, Spraying filled and packed Columns, Scrubbers, Steam, Spray Separating Agents

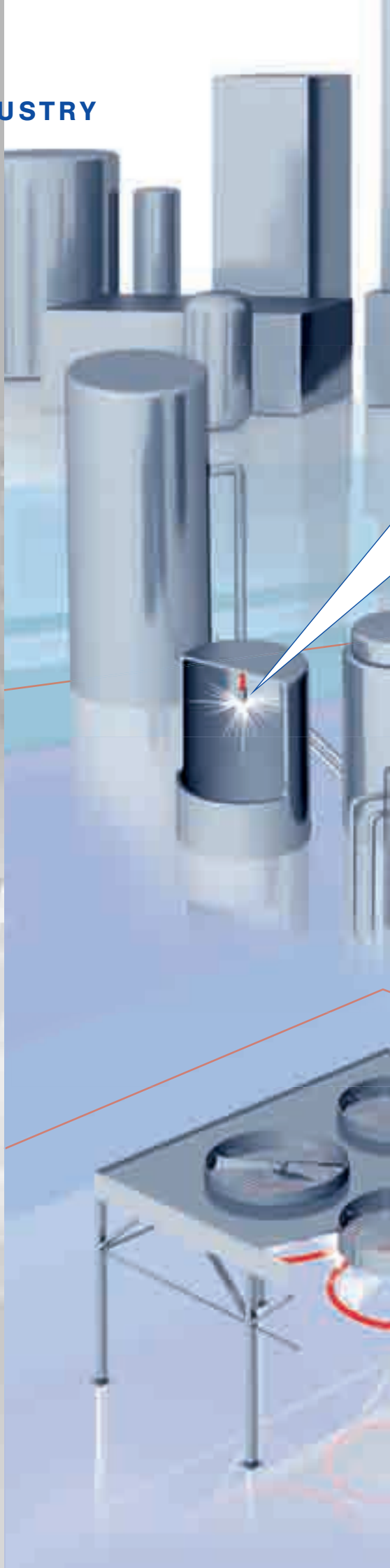
T Tank Cleaning, Temperature Control

V Venturi Scrubbers,

W Water Treatment, Waste Gas Treatment

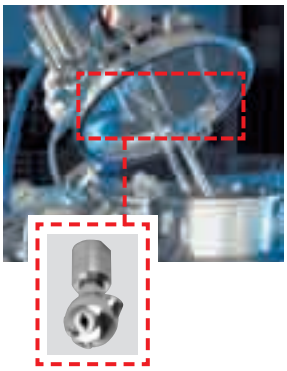
Z Zone Cleaning

If your application is not on the list? Contact us - we'd be happy to advise you!



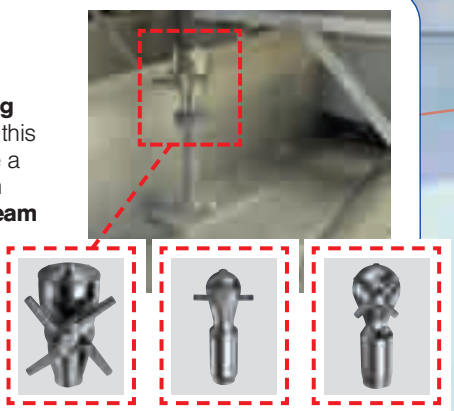
Cleaning containers

Optimum container cleaning requires targeted harmonization with the customized application. Lechler offers a wide range of **rotating nozzles** and will support you in finding the right arrangement.



System and large tank cleaning

High impact tank cleaning machines can be used in this application. These traverse a precisely defined path with **gear-controlled solid stream nozzles**. This gives them a great range.
In smaller containers and systems, the precision jets can remove even persistent dirt.



Nozzles for air cooling and humidification

The thermodynamic processes of evaporation is normally applied in air cooling and humidification. This requires fine droplets that are injected directly into the air / gas flow by **hollow cone or cluster nozzles.** Producing the suitable droplet size and even distribution over the intake channel are particularly important here.

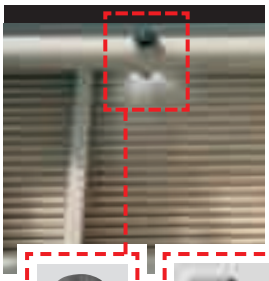
LECHLER NOZZLES ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY

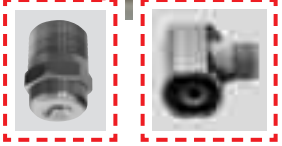
Tank sprinklers and fire protection

For cooling and sprinkling tanks and systems, it is extremely important to spray the entire object with water on all sides or to provide an even water film on the object. The narrowest cross section of the nozzles should be ≥ 6 mm (DIN 14495). **Tongue-type nozzles** and **full cone nozzles** are frequently used.

Droplet separators

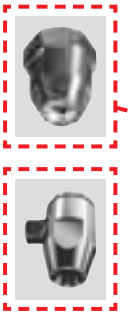
Droplets can be carried along in the gas flow during the absorption process. Lechler **droplet separators** remove droplets from the gas flow in order to prevent downstream measuring devices from being affected. Special **full cone nozzles** are available for cleaning **droplet separators.**





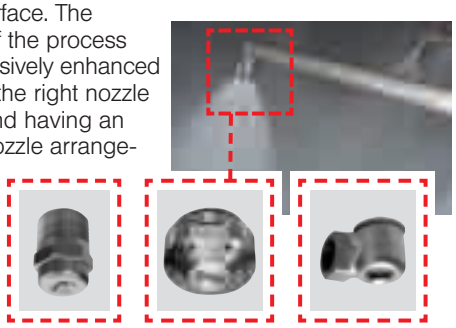
Gas cooling (Quenching)

In gas cooling, a liquid is added via nozzles that, under some circumstances, evaporates completely and thereby absorbs the thermal energy of the gas. Complete evaporation requires very fine droplets which can be produced with **hollow cone** or **twin-fluid nozzles**.



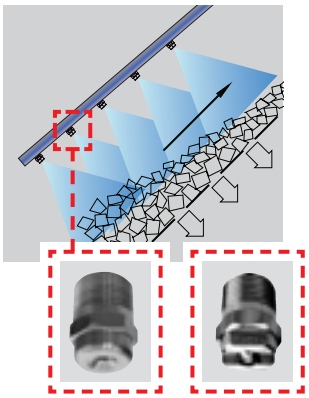
Absorption (Gas washing)

If the waste gas is to undergo absorption, Lechler **full cone, hollow cone**, or **cluster nozzles** are used.
It is of crucial importance here to create a large specific reaction surface. The efficiency of the process can be decisively enhanced by making the right nozzle selection and having an optimum nozzle arrangement.



Material separation in centrifuges

Centrifuges are used to separate materials. **Full cone** and **flat fan nozzles** are used for that in order to spray on water to wash out the material that is to be removed.



WHAT YOU SHOULD KEEP IN MIND WHEN PLANNING

Nozzle selection criteria:

Below we have compiled a list of the most important criteria for selecting your nozzle.

① Atomization methods

Single-fluid nozzles spray small to very large volumes of liquid solely via pressure. This makes them suitable above all for low-viscosity (e.g. water, alcohols) to slightly viscous (e.g. olive oil) fluids and, depending on the jet shape, pressure and flow rate, they produce fine to very coarse droplets. Since only one fluid flow must be handled, single-fluid nozzles are comparatively easy to install and use.

The typical pressures are between 0.5 and 20 bar. In most cases, higher differential pressures than 20 bar are used in single-fluid nozzles only for atomizing viscous products or in cleaning technology.

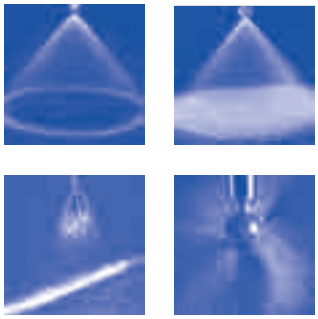


Figure 1: Different spray characters

Twin-fluid nozzles atomize the liquid with the aid of a compressible medium, in most cases compressed air or steam.
They work in the range of very small to medium flow rates and are preferred for particularly fine misting or the atomization of high-viscosity liquids.

A distinction is made between twin-fluid nozzles with internal mixing and those with external mixing. The combining of two different fluid flows makes the installation and operating complexity greater than is the case with comparable single-fluid nozzles.

② Flow rate, spray pattern/angle, spraying behavior

Unless otherwise stated, the flow rate information for our nozzles always refers to water. The conversion of differing liquid densities is explained in our standard catalogue.

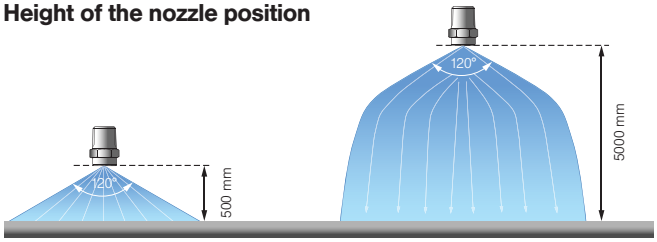
Depending on the version and application, we supply single-fluid nozzles with differently stepped spray angles from 0° (solid stream nozzles) to 360° (tank cleaning nozzles).

The quoted spray angles apply in close vicinity to the nozzle orifice and without external influences. Gravity and air flows influence the spray pattern. Depending on the version, single-fluid nozzles can spray the fluid as a hollow cone, full cone or flat fan.

The **solid stream nozzle** does not spray, but rather produces a closed jet that hits at a concentrated point. The jet only begins to break up after some distance.

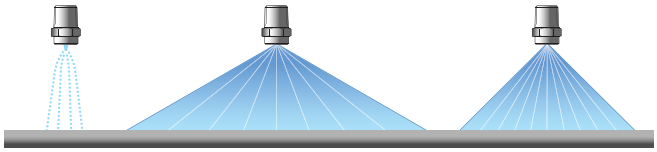
Twin-fluid nozzles have a narrow spray angle of 20° - 40° due to the high speed at which the compressible medium exits. However, as the distance from the nozzle increases, the spray pattern becomes increasingly less sharply delimited. Twin-fluid nozzles normally produce full cone or flat fan spray patterns.

Height of the nozzle position



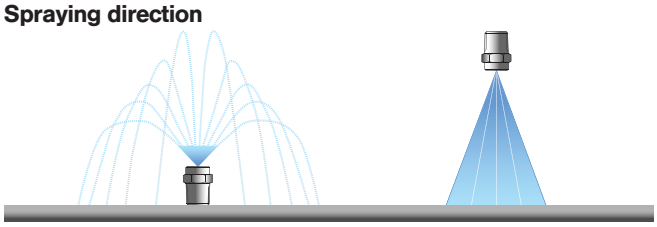
The diagram above illustrates how height influences the spray pattern.

Changing the nozzle pressure



Pressure: Very low | Pressure: Optimum | Pressure: Very high

Spraying direction



Spraying upwards | Spraying downwards

Horizontal spraying

③ Liquid distribution

An even liquid distribution is crucial to processes such as coating. This requires several nozzles to be arranged next to each other. This is because whereas a single nozzle would produce a parabolic liquid distribution, several nozzles arranged next to each other allow an almost even distribution via overlapping.

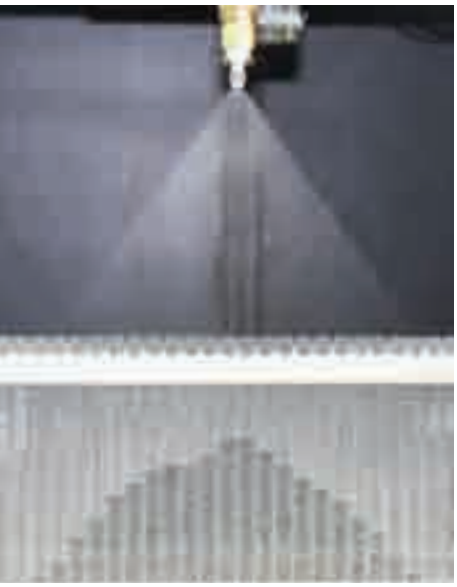


Figure 3: Fluid distribution measurement

Measuring the distribution

The liquid distribution in a plane can be determined with the aid of a combination of Plexiglas cylinders. The filling level of the individual cylinders is determined fully automatically. This measuring process can also record the liquid distribution of a nozzle over a moving measuring plane. This enables conveyor belt spraying to be simulated, for example.

④ Viscosity

Increased viscosity of the fluid can reduce the flow rate, changes the spray pattern (narrower spraying angle) and allows the droplet spectrum to become coarser.

Depending on the fluid properties, it is possible to counteract this to a certain extent by means of higher pressure. For very viscous substances, it is recommended to use twin-fluid nozzles in most cases. It can also be helpful to take account of the fluid's rheology.

Figure 4: Atomization of gelatin with a Lechler ViscoMist twin-fluid nozzle

⑤ Gases

Fundamentally, the delivery of gases (e.g. air) must be regarded in a differed way to that of liquids. Gases are compressible fluids, whereas liquids are incompressible fluids.
Gases can be delivered with almost all nozzles with which liquids are also atomized.

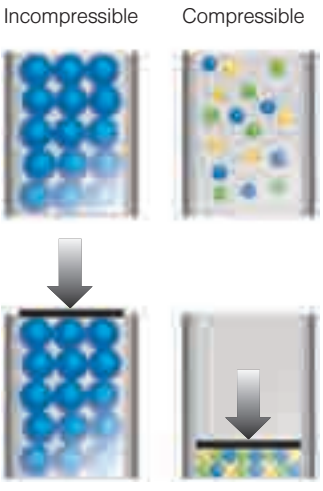


Figure 5: Compressibility behavior. Left water / right air

However, due to the compressibility and lower density, the spray pattern of gases can not be formed in the same manner as liquids.

Under certain conditions (pressure and nozzle geometry), gases tend to significantly increase the sound level. The turbulences that cause the discharge noise are significantly reduced by applying multi-channel nozzles with specially shaped nozzle openings. This nozzle geometry also increases the blowing force while at the same time reducing the air consumption.

In some circumstances, the velocity of gases can be very high. If a certain pressure difference is applied to a nozzle, velocities of around 320 m/s can often arise in the narrowest cross section. This velocity can even increase briefly after the nozzle. The chart below shows the velocity curve in a flow situation.

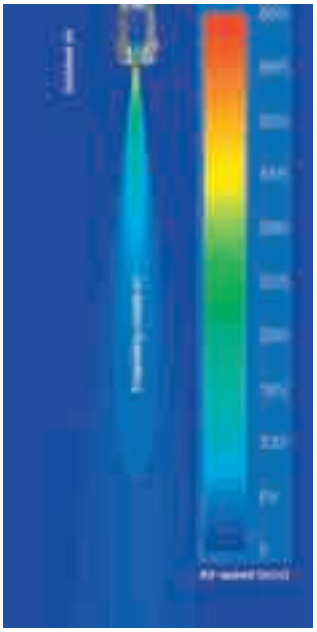


Figure 6: Representation of the speed curve of outflowing air

⑥ Narrowest cross section

The risk of a nozzle blocking depends greatly on its narrowest cross section (Ø E). Experience has shown that for smooth operation, the maximum particle size in the fluid should not exceed one third of the narrowest cross section.

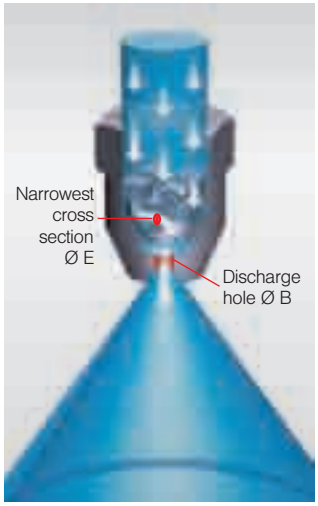


Figure 7: Narrowest cross section

Hollow cone and full cone nozzles with axial flow have an internal swirl. Hollow cone and full cone nozzles with inflow at the side (tangential or eccentric design) do not need a swirl and are, therefore, much less prone to blockages. In the field of flat fan nozzles, our tongue-type nozzles represent a special design that is less susceptible to blockages.

⑦ Droplet sizes

Twin-fluid nozzles can produce very fine to extremely fine droplets. The size depends mainly on the flow rate ratio of the compressible medium used (m^3/h) to the atomized fluid (l/min): The greater the ratio, the finer the atomization.

In the case of **single-fluid nozzles**, however, the decisive factors are pressure, nozzle type and flow rate across the droplet spectrum. Increasing pressure results in finer atomization, but mostly only up to a certain level.

Hollow cone nozzles produce very fine to fine droplets at the same pressure and flow rate. **Full cone nozzles** produce slightly coarser droplet spectrums, and finally **flat fan nozzles** have the coarsest droplet spectrum.

Figure 8: Droplet measurement

The following generally applies: Within a series and at a given pressure, nozzles with a lower flow rate produce finer droplet spectrums than nozzles with a higher flow rate.

⑧ Ambient conditions

The environment being sprayed into is a decisive criterion for which spray angle, pressure, material or droplet size should be selected for the process. If the surrounding gas circulates around a nozzle, this can have a direct influence on the trajectory of the droplets and therefore on the process. Influencing factors in the environment include, for example pressure and temperature, gas type (e.g. air or SO_2), dimensions (e.g. in the case of containers) or other parameters.

Also for example, when cleaning containers it is essential to pay attention as to whether a flammable mixture can form in the tank. If this is the case, Lechler tank cleaners with ATEX approval can be used.

Droplet size range

This shows the ranges in which droplets can in general, be roughly categorized.

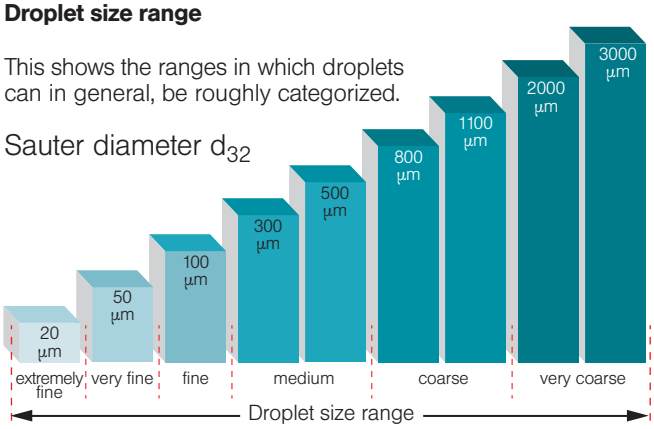


Figure 9: Droplet size definition

⑨ Materials

Our standard materials for metallic nozzles are brass and the stainless steels (AISI 303, 316 L and 316 Ti). Standard nozzles made of plastic are mostly made of PA, PVDF or POM. For special mechanical, thermal or chemical loads, we supply a wide variety of special materials, for example acid-resistant or heat-resistant stainless steels, special alloys, ceramic materials or plastics such as PP, PE1000 or PTFE.

It is also necessary to select the optimum material for the seals. Viton, PTFE, EPDM or EWP are used, depending on the applications. However, sealing materials such as Inconel or Centellen are also used for special cases.

⑩ Connections

Nozzles are mainly manufactured with threads conforming to ISO 228, DIN 2999 (EN 10226-1) and NPT. A distinction is made here between sealing and non-sealing threads. In the case of non-sealing threads, Teflon® strip or a thread paste is used to provide the seal.

Not all nozzles can be connected with a thread. For these we supply flange solutions conforming to DIN 2527, EN 1092-1 and ASME B 16.5. Aseptic clamp connections (Tri-Clamp connections) conforming to DIN 11864-3 are also possible. Whether a connection other than the standard connection is feasible for a nozzle must be be determined individually.

⑪ Material wear

Nozzle wear depends greatly on the conditions of use and on the nozzle material. Normally, the nozzle's fluid discharge opening wears as a result of material abrasion. The following conditions of use can speed up wear:

- Amount and hardness of the particles in the fluid
- Operating the nozzle above the recommended pressure range
- Using aggressive substances

As wear increases, the spray pattern quality becomes continuously worse. In most cases, this can be seen very easily with the naked eye. At the same time, a change occurs in the spraying parameters, for example an increased flow rate.

Wear leads to a worse production result and higher costs. Fig. 10 shows an example of a heavily worn spray ball. For these reasons, regular maintenance intervals and nozzle replacement are particularly important for achieving constant process capability.

Figure 10: Chemical attack on a spray ball

⑫ Mechanical cleaning

Cleaning effects

Rotating cleaning nozzles deliver the greatest possible impact in order to clean the container wall. To achieve this, large droplets must strike at high speed. This even allows the cleaning of persistent dirt that would usually not dissolve. Important influencing variables are the distance between the nozzle and wall, and the operating pressure. Neither must be too great or the fluid will break down into smaller droplets (see Figs. 11 and 12) and the impact will be reduced.

Besides the impact, the fluid running down the container wall also has a significant cleaning effect. If the formed film is thick enough, the resulting shear stresses can remove light to moderate dirt. In that case, unsprayed patches are less of an issue than is the case during impact cleaning (see Fig. 5).

Rotating cleaning nozzles or spray ball?

Due to their simple construction, spray balls are economical and are resistant to faults. Whereas rotating cleaning nozzles spray the entire container wall in a fan-like pattern, the jets from spray balls strike only in concentrated spots. The remaining surface is simply cleaned by the shear stresses of the fluid running off (see Fig. 14). The cleaning process can also take much longer, depending on the type and degree of dirt.

Cost reduction via efficient cleaning processes

This is precisely where our nozzles and rotating cleaning nozzles come into play, having been specially developed for delivering a high mechanical cleaning action. Their greater efficiency helps to permanently reduce on going costs for energy and cleaning agents, and also the duration of cleaning. Consequently a one-off investment in improved nozzle technology pays for itself after only a short time.

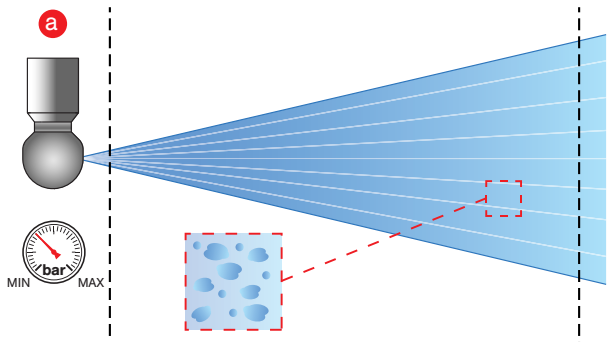


Figure 11: Rotating cleaning nozzles with recommended operating pressure

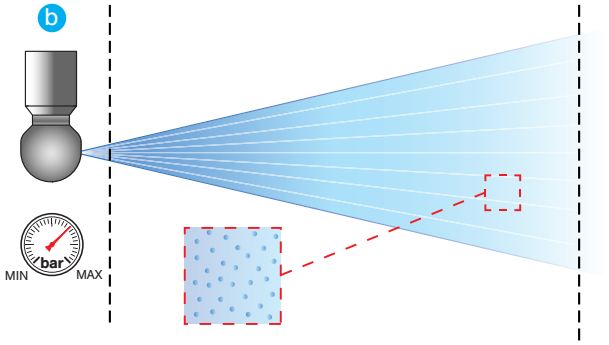
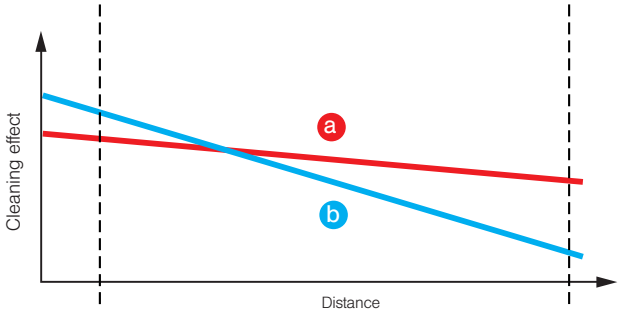


Figure 12: Rotating cleaning nozzles with operating pressure too high



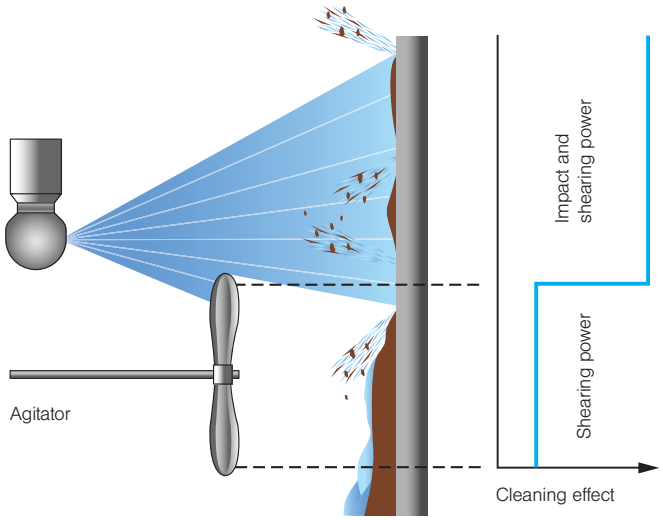


Figure 13: Cleaning mechanisms, impact and shearing power

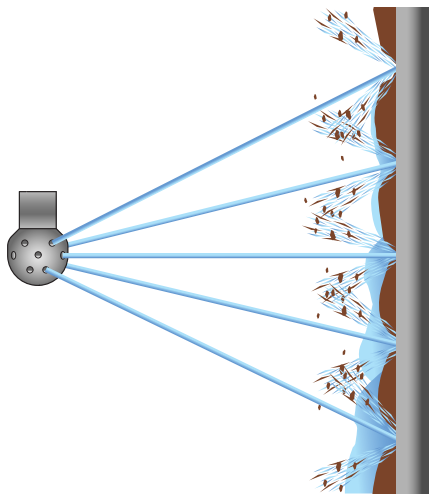


Figure 14: Cleaning with a spray ball

THE RIGHT NOZZLE FOR EVERY APPLICATION – AN OVERVIEW OF THE MOST IMPORTANT SELECTION CRITERIA

Optimum nozzle selection criteria

A wide range of nozzles with different spray patterns is available to you.
The table gives you an overview of the most important criteria that are critical when selecting the nozzles suitable for your particular application.
More detailed technical information and ordering instructions for the correct nozzle series can be found on the quoted pages in this brochure and/or in supplementary information documents on pages 34 and 35.

			Twin-fluid nozzles					
			External mixing			Internal mixing	Axial-flow hollow cone nozzles	
								
Series			150	76X 77X	176	170/ 180	212	214 216 218
More detailed information on Page			14	35	35	15	34	16
Flow rate	very low	< 0,1 l/min		●	●	●	●	
	low	0,1 - 1,5 l/min	●	●	●	●		●
	medium	1,5 - 80 l/min	●	●	●	●		●
	high	80 - 1200 l/min						
	very high	> 1250 l/min						
Droplet size	extremely fine	≈ 20 µm	●	●	●	●		
	very fine	≈ 50 µm	●	●	●	●	●	●
	fine	≈ 100 µm	●	●	●	●	●	●
	medium	≈ 300 - 500 µm	●			●		●
	coarse	≈ 800 - 1100 µm						
	very coarse	≈ 2000 - 3000 µm						
Spray angle	small	< 45°	●	●	●	●		
	medium	45 - 80°			●		●	●
	large	80 - 120°						●
	very large	> 120°						
Operating pressure	low	< 10 bar	●	●	●	●	●	●
	medium	10 - 20 bar					●	●
	high	> 20 bar						
Viscosity	low	< 20 mPa·s	●	●	●	●	●	●
	medium	20 - 200 mPa·s	●	●	●	●		
	high	> 200 mPa·s		●	●			
Narrowest cross section	small	< 2 mm	●	●	●	●	●	●
	medium	2 - 8 mm	●	●	●	●		●
	large	> 8 mm				●		

Single-fluid nozzles




Tangential-flow hollow cone nozzles			Axial-flow full cone nozzles						Tangential-flow full cone nozzles	Flat fan nozzles		
												
302	304 306 307	373	490 491	403	405	421	502 503	524 525	422 423	686 687	632 633	616 617
34	34	17	18/19	20	21	22/23	25	26	24	35	35	35
●			●				●		●	●	●	
●	●	●	●		●		●	●	●	●	●	●
		●		●	●	●	●	●	●	●	●	●
				●		●						
●	●		●				●					
●	●	●	●		●		●		●	●	●	●
		●	●	●	●			●	●	●	●	●
						●		●		●		
											●	●
●		●	●	●	●	●	●		●		●	●
●	●	●	●	●	●	●			●	●	●	●
●	●						●	●		●		
●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●		●		●	●	●	●
●	●	●	●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●			●	●	●	●
●			●				●			●	●	●
●	●		●		●		●	●	●	●	●	●
●	●	●		●	●	●		●	●			

● = Possible operating range

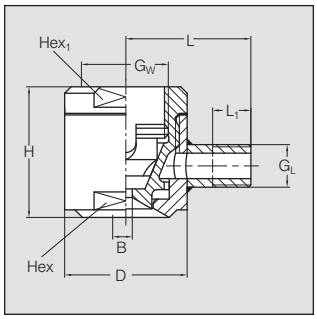
Twin-fluid nozzles

Series 150

Fine liquid atomization by means of air or vapour.

- Liquid, air or vapour are supplied under pressure
- The air or vapour pressure must always be above the liquid pressure
- A higher air-/water ratio leads to finer atomization

Applications:
Chemical process engineering, cooling processes, atomizing viscous liquids.



Type	G_W BSPP	G_L BSPP	H [mm]	D [mm]	L [mm]	L_1 [mm]	Hex [mm]	Hex_1 [mm]	Weight 316 Ti
150. 005. 17 – 150. 013. 17	G 3/8	G 1/4 A	38.0	28.0	32.5	10.0	24.0	24.0	140 g
150. 032. 17	G 1	G 3/8 A	52.0	48.0	49.0	15.0	41.0	41.0	500 g
150. 050. 17 – 150. 063. 17	G 1 1/4	G 1/2 A	75.0	65.0	58.0	15.0	55.0	55.0	1350 g

Spray angle	Ordering no. Type	Mat. no. 17[1] 316 Ti	B Ø [mm]	E Ø [mm]	$\dot{V}$ [l/min] p [bar] 0.3	0.5	0.7	1.0	1.5	2.0	$\dot{V}_n$ [m³/h] Air, Air pressure p [bar] 1.0	2.0	3.0	4.0
20-30°	**150. 005**	○	1.0	1.0	0.15	0.20	0.24	0.28	0.35	0.40	10	15	20	25
	150. 007	○	2.0	2.0	0.39	0.50	0.59	0.71	0.87	1.00	10	15	20	25
	150. 009	○	4.0	2.0	0.97	1.25	1.48	1.77	2.17	2.50	10	15	20	25
	150. 010	○	3.5	2.0	1.55	2.00	2.37	2.83	3.46	4.00	10	15	20	25
	150. 013	○	6.0	2.0	3.10	4.00	4.73	5.66	6.93	8.00	10	15	20	25
	150. 032	○	8.0	2.7	3.10	4.00	4.73	5.66	6.93	8.00	31	47	63	80
	150. 050	○	9.0	4.9	6.20	8.00	9.47	11.31	13.86	16.00	60	90	120	150
	150. 052	○	9.0	4.9	12.20	15.75	18.64	22.27	27.28	31.50	60	90	120	150
	150. 063	○	15.0	4.9	24.40	31.50	37.27	44.55	54.56	63.00	100	150	200	250

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter · E = narrowest free cross section

Example for ordering:	**Type** **150. 005**	**+**	**Material no.** **17**	**=**	**Ordering no.** **150. 005. 17**

Twin-fluid nozzles with internal mixing

Series 170 / 180

Efficient atomization by mixing liquid and gas

- Internal mixing principle (Mixing chamber inside the nozzle combines a gas and a liquid to form an intensive dual-phase mixture)
- Extremely fine atomization with good regulating performance
- Large free cross sections
- Lower air consumption than with nozzles that mix externally
- Maintenance-free operation

Applications:
Gas cooling, air humidification, flue gas desulphurisation, spray drying, absorption

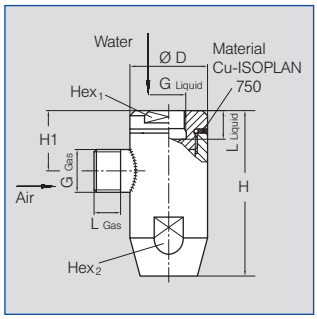
Liquid pressure:
1,0 - 5,0 bar

Air pressure:
1,0 - 5,0 bar

Regulating range up to max.:
1 : 30

Spray angle:
approx. 20°

The nozzle's large free cross sections allow maintenance-free operation even when atomizing viscous and abrasive media with a high solid content.



Typ	Dimensions [mm]									Weight 1.4571/316 Ti
	H	H_1	D	Hex_1	Hex_2	$G_{Liquid\ BSPP}$	$G_{Gas\ BSPP}$	L_{Liquid}	L_{Gas}	
180.641	48	28	25	22	22	G 1/8	G 3/8	7,5	10	140 g
180.721	48	28	25	22	22	G 1/8	G 3/8	7,5	10	140 g
170.801	81	29,5	38	32	32	G 3/8	G 1/2	14	13	540 g
170.881	81	29,5	38	32	32	G 3/8	G 1/2	14	13	565 g
170.961	112	42	52	46	46	G 1/2	G 3/4	18	15	1275 g

Ordering-no.		E Ø mm	E Ø mm	Air pressure **p** [bar]											
				1.0			**2.0**			**3.0**			**4.0**		
Type	Mat. no. **1Y** 316 L	Air	Water	**p** Water [bar]	$\dot{V}$ Water [l/min]	$\dot{V}n$ Air [m^3/h]	**p** Water [bar]	$\dot{V}$ Water [l/min]	$\dot{V}n$ Air [m^3/h]	**p** Water [bar]	$\dot{V}$ Water [l/min]	$\dot{V}n$ Air [m^3/h]	**p** Water [bar]	$\dot{V}$ Water [l/min]	$\dot{V}n$ Air [m^3/h]
180.641	○	3.0	4.2	0.8	0.4	20.0	1.7	0.6	32.0	2.5	0.8	43.0	3.1	0.9	55.0
				0.9	1.0	18.0	1.9	1.5	28.0	3.2	3.0	36.0	4.6	4.0	43.0
				1.3	2.5	14.0	2.7	3.5	23.0	4.0	5.0	32.0	5.8	7.0	37.0
180.721	○	3.7	5.0	0.6	0.5	43.0	1.3	0.7	66.0	2.2	0.9	86.0	3.0	1.1	109.0
				0.8	2.0	37.0	1.7	3.0	55.0	2.7	4.0	74.0	3.7	6.0	86.0
				0.9	3.5	32.0	1.9	5.5	49.0	3.1	7.5	64.0	4.2	9.0	79.0
170.801	○	2.0	5.5	0.7	1.0	40.0	1.5	1.0	58.0	2.2	1.2	80.0	3.2	1.2	105.0
				0.9	3.0	35.0	1.8	5.0	52.0	2.6	7.0	72.0	3.6	10.0	91.0
				1.0	5.0	32.0	2.0	10.0	48.0	3.0	14.0	63.0	4.0	20.0	83.0
170.881	○	2.8	7.6	0.6	1.0	60.0	1.5	1.2	95,.0	2.2	1.5	130.0	3.1	1.8	171.0
				0.8	5.0	55.0	1.7	7.0	90.0	2.5	10.0	118.0	3.5	15,0	154.0
				0.9	8.0	50.0	1.9	13.0	80.0	3.0	19.0	105.0	4.1	28.0	143.0
170.961	○	3.2	9.5	0.6	1.0	94.0	1.4	1.2	155.0	2.2	1.5	210.0	3.0	1.8	275.0
				0.8	5.0	85.0	1.7	10.0	130.0	2.6	15.0	179.0	3.5	20.0	220.0
				1.0	12.0	72.0	1.9	19.0	115.0	3.0	26.0	152.0	4.1	38.0	198.0

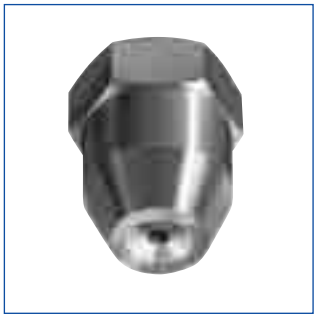
E = narrowest free cross section

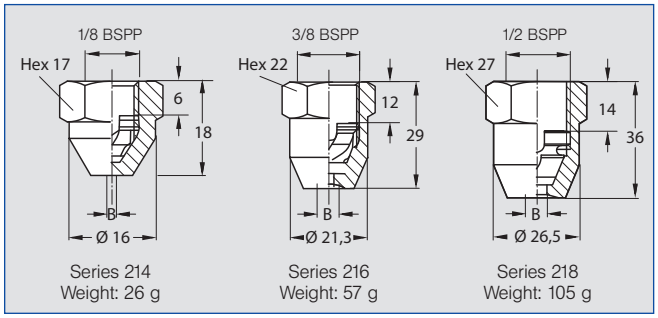
Example for ordering:	**Type** **180. 641**	**+**	**Material no.** **1Y**	**=**	**Ordering no.** **180. 641. 1Y**

Axial-flow hollow cone nozzles

Series 214 / 216 / 218

Fine, uniform hollow cone spray.
Applications:
Cooling and cleaning of air and gas, dust control, spraying onto filters, spray drying, desuperheating.





Spray angle	Ordering no. Type	Mat. no. 17[1] 316 Ti	G BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	20.0	Spray diameter D at p = 3 bar H = 250 mm
60°	214. 184	○	1/8"	0.50	0.50	-	-	0.08	0.10	0.3	0.18	0.25	200
80°	214. 245	○	1/8"	1.00	0.50	-	-	0.16	0.20	0.25	0.36	0.51	450
	214. 305	○	1/8"	1.80	0.50	-	0.23	0.32	0.39	0.51	0.72	1.01	450
60°	216. 324	○	3/8"	1.00	1.00	-	0.28	0.40	0.49	0.63	0.89	1.26	200
	216. 364	○	3/8"	1.40	1.40	-	0.45	0.63	0.77	1.00	1.41	1.99	200
	216. 404	○	3/8"	2.00	2.00	-	0.71	1.00	1.22	1.58	2.24	3.16	200
90°	216. 496	○	3/8"	3.00	2.00	-	1.20	1.70	2.08	2.69	3.80	5.38	500
	216. 566	○	3/8"	4.00	2.00	-	1.77	2.50	3.06	3.95	5.59	7.91	500
	216. 646	○	3/8"	3.50	2.00	2.00	2.83	4.00	4.90	6.32	8.94	12.65	500
	216. 686	○	3/8"	4.00	2.00	2.50	3.54	5.00	6.12	7.91	11.18	15.81	500
	216. 726	○	3/8"	5.00	2.00	3.15	4.45	6.30	7.72	9.96	14.09	19.92	500
	216. 776	○	3/8"	6.00	2.00	4.30	6.00	8.50	10.40	13.40	19.00	26.90	500
	218. 646	○	1/2"	5.00	2.00	2.00	2.83	4.00	4.90	6.32	8.94	12.65	500
	218. 706	○	1/2"	6.50	2.00	2.80	3.96	5.60	6.86	8.85	12.52	17.71	500
	218. 766	○	1/2"	5.00	2.00	4.00	5.66	8.00	9.80	12.65	17.89	25.30	500
	218. 826	○	1/2"	6.50	2.00	5.60	7.92	11.20	13.72	17.71	25.04	35.42	500
	218. 846	○	1/2"	7.50	2.00	6.25	8.84	12.50	15.31	19.76	27.95	39.53	500
	218. 886	○	1/2"	9.00	2.40	8.00	11.31	16.00	19.60	25.30	35.78	50.60	500

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter · E = narrowest free cross section

Example for ordering:	Type	+	Material no.	=	Ordering no.
	214. 184	+	17	=	214. 184. 17

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

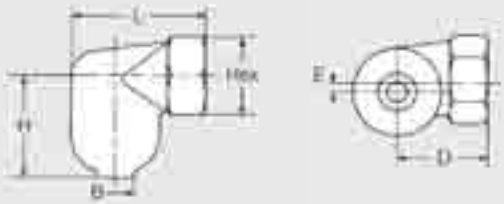
Eccentric hollow cone nozzles

Series 373 „Ramp Bottom“

Fine, uniform hollow cone spray, also at low pressures.
Applications:
cooling and cleaning of gas, water re-cooling, dust control, chemical process engineering.

Sectional view of a series 373 »Ramp Bottom« nozzle

»Ramp Bottom« design offering a longer service life, due to the patented sloping shape of the swirl chamber.

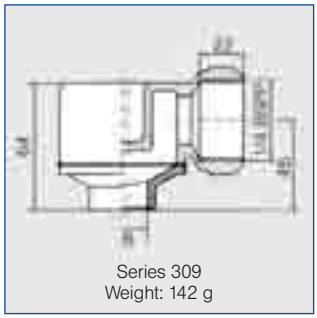


Series 373 „Ramp Bottom“

Dimensions

BSPP	L [mm]	D [mm]	H [mm]	E [mm]	Hex	Weight 316 Ti [g]
1"	67	45	52	6.3	41	285
1 1/4"	77	51	65	7.9	48	570
1 1/2"	97	65	81	7.9	58	900
2"	108	71	94	12.7	67	1250
2 1/2"	134	92	114	20.6	80	2050

Less expensive plastic version, with low requirements on temperature and abrasion resistance.



Series 309
Weight: 142 g

Spray angle	Ordering no. Type	Mat. no. 17 [1] 316 Ti	Code 1" BSPP	1 1/4" BSPP	1 1/2" BSPP	2" BSPP	2 1/2" BSPP	B Ø [mm]	V̇ [l/min] p [bar] 0.3	0.5	1.0	2.0	5.0	10.0	Spray diameter D at p = 2 bar H = 500 mm	H = 1000 mm
70°	373. 115	○	AN	-	-	-	-	11.40	24.40	31.50	44.50	63.00	99.60	141.00	650	1300
80°	373. 175	○	AN	-	-	-	-	12.90	31.00	40.00	56.60	80.00	126.00	179.00	800	1550
	373. 235	○	-	AQ	-	-	-	16.20	45.70	59.00	83.40	118.00	187.00	264.00	700	1350
	373. 285	○	-	AQ	-	-	-	20.50	62.00	80.00	113.00	160.00	253.00	358.00	800	1550
	373. 325	○	-	-	AS	-	-	22.20	77.50	100.00	141.00	200.00	316.00	447.00	800	1550
	373. 365	○	-	-	AS	-	-	23.60	67.90	114.00	161.00	227.00	359.00	508.00	700	1400
	373. 415	○	-	-	-	AW	-	25.60	131.00	169.00	238.00	337.00	533.00	754.00	700	1400
	373. 465	○	-	-	-	AW	-	30.70	182.00	235.00	332.00	469.00	742.00	1049.00	965	1800
	373. 505	○	-	-	-	-	AZ	32.50	209.00	270.00	382.00	540.00	854.00	1207.00	800	1500
	373. 515	○	-	-	-	-	AZ	34.80	233.00	301.00	425.00	601.00	950.00	1344.00	900	1700
	373. 555	○	-	-	-	-	AZ	41.10	290.00	375.00	530.00	750.00	1186.00	1677.00	900	1700

Plastic version:

90°	309. 236. 5E	(Material PVDF)						20.00	45.70	59.00	83.40	118.00	187.00	264.00	850	1500
	309. 286. 5E	(Material PVDF)						24.00	62.00	80.00	113.00	160.00	253.00	358.00	750	1400

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	373. 115	+	17	+	AN	=	373. 115. 17. AN

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter

Axial-flow full cone nozzles

Series 490 / 491

NEW Patent pending

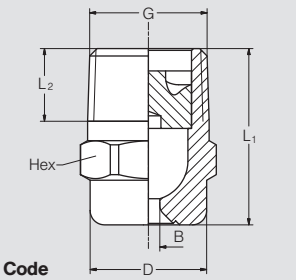
Non-clogging nozzle design. Stable spray angle. Particularly even liquid distribution.
Applications:
Cleaning and washing processes, surface spraying, container cleaning, foam precipitation, degassing of liquids.

Series 490

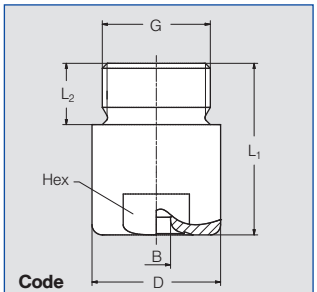
Series 491

Series 490/491 represents a new generation within the axial-flow full cone nozzles product group. These nozzles were developed using state-of-the-art design and simulation methods (CFD).

Nozzles of series 490/491 replace series 460/461 which are still available on request.



Code CA-CG



Code AK-AM

Code	Dimensions [mm] G	L_1	L_2	D	Hex	Weight Brass
CA	1/8 BSPT	18.0	6.5	10.0	11	13 g
CC	1/4 BSPT	22.0	10.0	13.0	14	16 g
CE	3/8 BSPT	24.5	10.0	16.0	17	30 g
CE	3/8 BSPT	30.0	10.0	16.0	17	50 g
CG	1/2 BSPT	32.5	13.0	21.0	22	60 g
CG	1/2 BSPT	43.5	13.0	21.0	22	85 g
AK	3/4 BSPP	42.0	15,0	32.0	27	190 g
AK	3/4 BSPP	50.0	15.0	32.0	27	200 g
AM	1 BSPP	56.0	17.0	40.0	36	350 g

Subject to technical modification.
In a critical installation situation, please ask for the exact dimensions.

Spray angle	Type	Ordering no. Mat. no. 1Y 316 L	30 Brass	Code 1/8 BSPT	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPP	1 BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	7.0	10.0	Spray diameter D at p=2 bar H = 200 mm	H = 500 mm
45°	**490. 403**	○	○	**CA**	-	-	-	-	-	1.25	1.25	0.57	0.76	1.00	1.18	1.44	1.65	1.90	160	400
	490. 523	○	○	**CA**	-	-	-	-	-	1.70	1.70	1.15	1.52	2.00	2.35	2.89	3.30	3.81	160	400
	490. 603	○	○	-	**CC**	**CE***	-	-	-	2.00	2.00	1.81	2.39	3.15	3.70	4.54	5.20	6.00	160	400
	490. 643	-	○	-	-	**CE**	-	-	-	2.45	2.45	2.30	3.03	4.00	4.70	5.77	6.60	7.61	160	400
	490. 683	-	○	-	-	**CE**	-	-	-	2.55	2.55	2.87	3.79	5.00	5.88	7.21	8.25	9.52	160	400
	490. 703	-	○	-	-	**CE**	-	-	-	2.65	2.65	3.22	4.24	5.60	6.59	8.08	9.24	10.66	160	400
	490. 723	○	○	-	-	**CE**	-	-	-	2.85	2.85	3.62	4.77	6.30	7.41	9.09	10.40	11.99	160	400
	490. 783	-	○	-	-	-	**CG**	-	-	3.45	3.45	5.17	6.82	9.00	10.58	12.98	14.85	17.12	160	400
	490. 843	-	○	-	-	-	**CG**	-	-	3.80	3.80	7.18	9.47	12.50	14.70	18.03	20.63	23.80	160	400
60°	**490. 404**	○	○	**CA**	-	-	-	-	-	1.15	1.15	0.57	0.76	1.00	1.18	1.44	1.65	1.90	220	560
	490. 444	○	-	**CA**	-	-	-	-	-	1.25	1.25	0.72	0.95	1.25	1.47	1.80	2.06	2.38	220	560
	490. 484	○	○	**CA**	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	220	560
	490. 524	○	○	**CA**	-	-	-	-	-	1.60	1.60	1.15	1.52	2.00	2.35	2.89	3.30	3.81	220	560
	490. 564	○	○	**CA**	-	-	-	-	-	1.80	1.80	1.44	1.89	2.50	2.94	3.61	4.13	4.76	220	560
	490. 604	○	○	**CA**	**CC**	**CE**	-	-	-	2.05	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	220	560
	490. 644	○	○	-	**CC**	**CE**	-	-	-	2.30	2.30	2.30	3.03	4.00	4.70	5.77	6.60	7.61	220	560
	490. 684	○	○	-	**CC**	**CE**	-	-	-	2.60	2.60	2.87	3.79	5.00	5.88	7.21	8.25	9.52	220	560
	490. 724	○	○	-	**CC**	**CE**	-	-	-	2.95	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	220	560
	490. 764	○	○	-	-	**CE**	-	-	-	3.25	3.25	4.59	6.06	8.00	9.41	11.54	13.20	15.22	220	560
	490. 804	○	○	-	-	**CE**	-	-	-	3.70	3.70	5.74	7.58	10.00	11.76	14.43	16.51	19.04	220	560
	490. 844	○	○	-	-	-	**CG**	-	-	4.05	4.05	7.18	9.47	12.50	14.70	18.03	20.63	23.80	220	560
	490. 884	○	○	-	-	-	**CG**	-	-	4.65	4.65	9.19	12.13	16.00	18.82	23.08	26.41	30.46	220	560
	490. 924	○	○	-	-	-	-	**AK**	-	5.20	5.20	11.49	15.16	20.00	23.52	28.85	33.01	38.07	220	560
	490. 964	○	○	-	-	-	-	**AK**	-	5.80	5.80	14.36	18.95	25.00	29.40	36.07	41.26	47.59	220	560
	491. 044	○	○	-	-	-	-	-	**AM**	7.25	7.25	22.97	30.31	40.00	47.04	57.71	66.02	76.15	220	560
	491. 084	○	○	-	-	-	-	-	**AM**	8.15	8.15	28.72	37.89	50.00	58.80	72.14	82.53	95.18	220	560

*Only available in Material 30 · B = bore diameter · E = narrowest free cross section

Continued on next page.

Conversion formula for the above series: (≤ 10 bar)

$$\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0,4}$$

Axial-flow full cone nozzles

Series 490 / 491

NEW Patent pending

Spray angle	Ordering no. Type	Mat. no. 1Y 316 L	Mat. no. 30 Brass	Code 1/8 BSPT	Code 1/4 BSPT	Code 3/8 BSPT	Code 1/2 BSPT	Code 3/4 BSPP	Code 1 BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	7.0	10.0	Spray diameter D at p=2 bar H = 200 mm	H = 500 mm
90°	490. 406	○	○	CA	-	-	-	-	-	1.20	1.20	0.57	0.76	1.00	1.18	1.44	1.65	1.90	380	860
	490. 446	-	○	CA	-	-	-	-	-	1.30	1.30	0.72	0.95	1.25	1.47	1.80	2.06	2.38	380	860
	490. 486	○	○	CA	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	380	860
	490. 526	○	○	CA	-	-	-	-	-	1.70	1.55	1.15	1.52	2.00	2.35	2.89	3.30	3.81	380	860
	490. 566	○	○	CA	-	-	-	-	-	1.90	1.90	1.44	1.89	2.50	2.94	3.61	4.13	4.76	380	860
	490. 606	○	○	CA	-	CE	-	-	-	2.10	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	380	860
	490. 646	○	○	-	CC	CE	-	-	-	2.40	2.40	2.30	3.03	4.00	4.70	5.77	6.60	7.61	390	960
	490. 686	○	○	-	CC	CE	-	-	-	2.70	2.70	2.87	3.79	5.00	5.88	7.21	8.25	9.52	390	960
	490. 726	○	○	-	CC	CE	-	-	-	3.20	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	390	960
	490. 746	○	○	-	-	CE	-	-	-	3.15	3.15	4.08	5.38	7.10	8.35	10.24	11.72	13.52	390	960
	490. 766	○	○	-	-	CE	-	-	-	3.40	3.40	4.59	6.06	8.00	9.41	11.54	13.20	15.22	390	960
	490. 806	○	○	-	-	CE	-	-	-	3.90	3.90	5.74	7.58	10.00	11.76	14.43	16.51	19.04	390	960
	490. 846	○	○	-	-	CE	-	-	-	4.65	4.00	7.18	9.47	12.50	14.70	18.03	20.63	23.80	390	960
	490. 886	○	○	-	-	-	CG	-	-	5.45	4.50	9.19	12.13	16.00	18.82	23.08	26.41	30.46	390	960
	490. 926	○	○	-	-	-	CG	-	-	5.90	4.50	11.49	15.16	20.00	23.52	28.85	33.01	38.07	390	960
	490. 966	○	○	-	-	-	CG	AK	-	6.55	4.85	14.36	18.95	25.00	29.40	36.07	41.26	47.59	390	960
	491. 006	○	○	-	-	-	CG	AK	-	7.55	5.50	18.09	23.87	31.50	37.05	45.45	51.99	59.97	390	960
	491. 046	○	○	-	-	-	-	AK	-	8.60	6.60	22.97	30.31	40.00	47.04	57.71	66.02	76.15	390	960
	491. 086	○	○	-	-	-	-	AK	AM	9.45	7.25	28.72	37.89	50.00	58.80	72.14	82.53	95.18	390	960
	491. 126	○	○	-	-	-	-	-	AM	10.40	8.00	36.18	47.75	63.00	74.09	90.89	103.98	119.93	390	960
	491. 146	○	-	-	-	-	-	-	AM	11.00	7.50	40.78	53.81	71.00	83.50	102.43	117.19	135.16	390	960
120°	490. 368	○	○	CA	-	-	-	-	-	0.85	0.65	0.36	0.48	0.63	0.74	0.91	1.04	1.20	680	1220
	490. 408	○	○	CA	-	-	-	-	-	1.20	1.20	0.57	0.76	1.00	1.18	1.44	1.65	1.90	680	1220
	490. 448	○	○	CA	-	-	-	-	-	1.30	1.30	0.72	0.95	1.25	1.47	1.80	2.06	2.38	680	1220
	490. 488	○	○	CA	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	680	1220
	490. 528	○	○	CA	-	-	-	-	-	1.70	1.70	1.15	1.52	2.00	2.35	2.89	3.30	3.81	680	1220
	490. 568	○	○	CA	-	-	-	-	-	1.90	1.90	1.44	1.89	2.50	2.94	3.61	4.13	4.76	680	1220
	490. 608	○	○	CA	-	-	-	-	-	2.10	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	680	1220
	490. 648	○	○	-	CC	CE	-	-	-	2.40	2.40	2.30	3.03	4.00	4.70	5.77	6.60	7.61	680	1330
	490. 688	○	○	-	CC	CE	-	-	-	2.75	2.75	2.87	3.79	5.00	5.88	7.21	8.25	9.52	680	1330
	490. 728	○	○	-	CC	CE	-	-	-	3.20	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	680	1330
	490. 748	○	○	-	-	CE	-	-	-	3.20	3.20	4.08	5.38	7.10	8.35	10.24	11.72	13.52	680	1330
	490. 768	○	○	-	-	CE	-	-	-	3.45	3.45	4.59	6.44	8.00	9.41	11.54	13.20	15.22	680	1330
	490. 808	○	○	-	-	CE	-	-	-	3.90	3.90	5.74	7.58	10.00	11.76	14.43	16.51	19.04	680	1330
	490. 848	○	○	-	-	CE	-	-	-	4.70	4.00	7.18	9.47	12.50	14.70	18.03	20.63	23.80	680	1330
	490. 888	○	○	-	-	-	CG	-	-	5.10	4.50	9.19	12.13	16.00	18.82	23.08	26.41	30.46	680	1330
	490. 928	○	○	-	-	-	CG	-	-	5.80	4.75	11.49	15.16	20.00	23.52	28.85	33.01	38.07	680	1330
	490. 968	○	○	-	-	-	CG	AK	-	6.65	4.85	14.36	18.95	25.00	29.40	36.07	41.26	47.59	680	1330
	491. 048	○	○	-	-	-	-	AK	-	9.20	5.85	22.97	30.31	40.00	47.04	57.71	66.02	76.15	680	1330
	491. 128	○	○	-	-	-	-	-	AM	10.80	7.75	36.18	47.75	63.00	74.09	90.89	103.98	119.93	680	1330
	491. 148	○	-	-	-	-	-	-	AM	11.40	7.65	40.78	53.81	71.00	83.50	102.43	117.19	135.16	680	1330

B = bore diameter · E = narrowest free cross section

Other nozzle materials (special alloys, plastics) are available on request.

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	490. 406	+	1Y	+	CA	=	490. 406. 1Y. CA

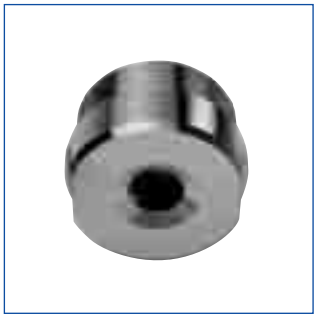
Conversion formula for the above series: (≤ 10 bar)

$$\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0,4}$$

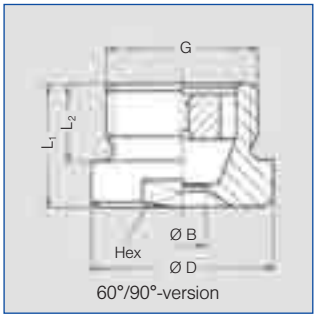
Axial-flow full cone nozzles

Series 403

Very uniform spray pattern.
Applications:
Surface spraying, spraying over packings, chemical process engineering, cooling of gaseous fluids and solids.



Other nozzle sizes and materials are available on request.



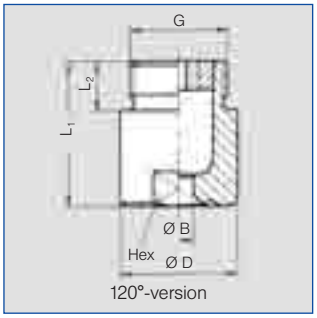
60°/90°-version

60°/90°-version

Dimensions [mm]					
Type	BSPP	L_1	L_2	D	Hex
403.444/403. 446/ 403.484/403. 486	2 1/2"	52	27	83	75
403. 524/403. 526	3"	60	30	98	85
403. 564/403. 604/ 403. 606	3 1/2"	70	32	118	105
403. 624	4"	90	36	128	110

120°-version

Dimensions [mm]					
Type	BSPP	L_1	L_2	D	Hex
403. 448/403. 488	2 1/2"	124	27	83	75
403. 528	3"	153	30	98	85
403. 608	3 1/2"	156	32	118	105
403. 628	4"	165	36	128	110



120°-version

Spray angle	Ordering no. Type	Mat. no. 1Y 316 L	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.3	0.5	1.0	2.0	3.0	5.0	7.0	Spray diameter D at p = 2 bar H = 0.5 m	H = 1 m
60°	403. 444	○	25.00	6.00	187	230	303	400	470	577	660	580	1100
	403. 484	○	29.50	9.00	234	297	379	500	588	721	825	620	1150
	403. 524	○	32.00	8.00	295	362	477	630	741	909	1040	620	1150
	403. 564	○	38.00	14.00	375	459	606	800	941	1154	1320	620	1150
	403. 604	○	41.50	10.00	468	574	758	1000	1176	1443	1651	630	1200
	403. 624	○	48.50	15.00	484	625	887	1250	1531	1977	2339	770	1400
90°	403. 446	○	25.00	12.00	187	230	303	400	470	577	660	900	1700
	403. 486	○	29.50	12.00	234	287	379	500	588	721	825	900	1700
	403. 526	○	32.00	13.80	295	362	477	630	741	909	1040	900	1700
	403. 606	○	40.00	15.00	468	574	758	1000	1176	1443	1651	980	1750
120°	403. 448	○	25.50	10.00	187	230	303	400	470	577	660	1500	2850
	403. 488	○	29.50	11.00	234	287	379	500	588	721	825	1500	2850
	403. 528	○	32.00	15.00	295	362	477	630	741	909	1040	1500	2850
	403. 608	○	42.00	12.00	469	574	759	1000	1176	1443	1651	1550	2850
	403. 628	○	45.00	15.00	585	718	947	1250	1470	1903	2063	1600	2900

B = bore diameter · E = narrowest free cross section

Example for ordering:	Type	+	Material no.	=	Ordering no.
	403. 444	+	1Y	=	403. 444. 1Y

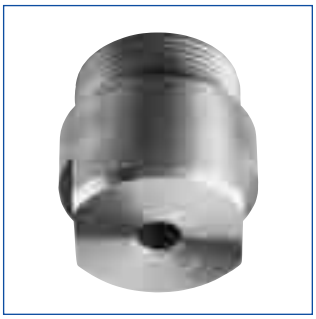
Conversion formula for the above series: (≤ 10 bar)

$$\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0,4}$$

Axial-flow full cone nozzles

Series 405

Very uniform spray pattern.
Applications:
Surface spraying, spraying over packings, cleaning and washing process, chemical process engineering, cooling of gaseous fluids and solids, water treatment.



Other nozzle sizes and materials are available on request.

Dimensions [mm]

BSPP	L_1	L_2	D	Hex
1 1/4 A	50	19	49	41
1 1/2 A	60	19	59	50
2 A	78	24	68	60

Spray angle	Ordering no. Type	Mat. no. 1Y 316 L	Code 1 1/4 BSPP	Code 1 1/2 BSPP	Code 2 BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.3	0.5	1.0	2.0	3.0	5.0	Spray diameter D at p = 2 bar H = 0.5 m	H = 1 m
60°	405. 204	○	AP	-	-	11.20	5.80	47	57	76	100	118	144	560	1040
	405. 284	○	-	AR	-	14.30	7.00	75	92	121	160	188	231	580	1080
	405. 324	○	-	-	AV	16.40	7.50	94	115	152	200	235	289	580	1080
	405. 364	○	-	-	AV	18.40	8.50	117	144	189	250	294	361	580	1080
	405. 404	○	-	-	AV	20.00	7.00	147	181	239	315	370	454	580	1100
90°	405. 206	○	AP	-	-	12.00	5.00	47	57	76	100	118	144	780	1450
	405. 286	○	-	AR	-	15.20	6.20	75	92	121	160	188	231	800	1550
	405. 326	○	-	-	AV	17.20	7.70	94	115	152	200	235	289	850	1600
	405. 366	○	-	-	AV	19.50	8.70	117	144	189	250	294	361	850	1600
	405. 406	○	-	-	AV	22.00	9.50	147	181	239	315	370	454	850	1600
120°	405. 208	○	AP	-	-	12.70	5.00	47	57	76	100	118	144	1450	2600
	405. 288	○	-	AR	-	16.00	6.60	75	92	121	160	188	231	1500	2700
	405. 328	○	-	-	AV	17.80	7.90	94	115	152	200	235	289	1500	2800
	405. 368	○	-	-	AV	20.10	8.80	117	144	189	250	294	361	1500	2800
	405. 408	○	-	-	AV	22.40	9.10	147	181	239	315	370	454	1500	2800

B = bore diameter · E = narrowest free cross section

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	405. 204	+	1Y	+	AP	=	405. 204. 1Y. AP

Conversion formula for the above series: (≤ 10 bar)

$$\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0,4}$$

Axial-flow full cone nozzles

Series 421

Even full cone distribution, high flow rates.
Applications:
For even surface irrigation, cooling and cleaning of gases, water recooling, column irrigation and for improving chemical reactions via surface enlargement.

Other nozzle sizes and materials are available on request.

Spray angle*	Ordering no. Type	Mat. no. 05 GG	17[1] 316 Ti	53 PP	B Ø [mm]	E Ø [mm] Material 17	05 53	V̇ [l/min] p [bar] 0,3	0,5	1,0	2,0	5,0	10,0
60°	421. 564	○	-	○	37	-	12	375	459	606	800	1154	1523
	421. 604	○	-	○	39	-	14	468	574	758	1000	1443	1904
	421. 624	○	○	○	41	13	13	585	718	947	1250	1803	2380
	421. 644	○	○	○	49	16	16	749	919	1213	1600	2308	3046
	421. 664	○	○	○	56	16	16	936	1149	1516	2000	2885	3807
	421. 684	○	○	○	58	21	21	1171	1436	1895	2500	3607	4759
	421. 704	○	○	○	65	24	24	1475	1809	2387	3150	4545	5997
	421. 724	○	○	○	72	28	30	1873	2297	3031	4000	5771	7615
	421. 744	○	○	○	81	32	34	2341	2872	3789	5000	7214	9518
	421. 764	-	○	○	88	38	35	2950	3618	4775	6300	9089	11993
	421. 784	-	○	○	99	43	39	3746	4595	6063	8000	11542	15229
	421. 804	-	○	-	112	46	-	4682	5743	7579	10000	14427	19037
	421. 824	-	○	-	125	52	-	5853	7179	9473	12500	18034	23796
90°	421. 566	○	-	○	37	-	15	375	459	606	800	1154	1523
	421. 606	○	-	○	39	-	14	468	574	758	1000	1443	1904
	421. 626	○	○	○	43	18	18	585	718	947	1250	1803	2380
	421. 646	○	○	○	53	22	22	749	919	1213	1600	2308	3046
	421. 666	○	○	○	56	24	24	936	1149	1516	2000	2885	3807
	421. 686	○	○	○	59	28	28	1171	1436	1895	2500	3607	4759
	421. 706	○	○	○	66	32	32	1475	1809	2387	3150	4545	5997
	421. 726	○	○	○	72	36	36	1873	2297	3031	4000	5771	7615
	421. 746	○	○	○	81	40	40	2341	2872	3789	5000	7214	9518
	421. 766	-	○	○	93	42	39	2950	3618	4775	6300	9089	11993
	421. 786	-	○	○	99	47	44	3746	4595	6063	8000	11542	15229
	421. 806	-	○	○	123	53	52	4682	5743	7579	10000	14427	19037
	421. 826	-	○	-	125	58	-	5853	7179	9473	12500	18034	23796
120°	421. 568	○	○	○	36	15	15	375	459	606	800	1154	1523
	421. 608	○	○	○	40	14	14	468	574	758	1000	1443	1904
	421. 628	○	○	○	43	18	18	585	718	947	1250	1803	2380
	421. 648	○	○	○	53	22	22	749	919	1213	1600	2308	3046
	421. 668	○	○	○	55	24	24	936	1149	1516	2000	2885	3807
	421. 688	○	○	○	59	28	28	1171	1436	1895	2500	3607	4759
	421. 708	○	○	○	66	32	32	1475	1809	2387	3150	4545	5997
	421. 728	○	○	○	72	36	35	1873	2297	3031	4000	5771	7615
	421. 748	○	○	○	81	40	40	2341	2872	3789	5000	7214	9518
	421. 768	-	○	○	88	42	39	2950	3618	4775	6300	9089	11993
	421. 788	-	○	○	99	47	44	3746	4595	6063	8000	11542	15229
	421. 808	-	○	○	108	53	52	4682	5743	7579	10000	14427	19037
	421. 828	-	○	○	121	58	54	5853	7179	9473	12500	18034	23796

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17. · B = bore diameter · E = narrowest free cross section · * Spray angle at p = 2 bar

Axial-flow full cone nozzles

Series 421

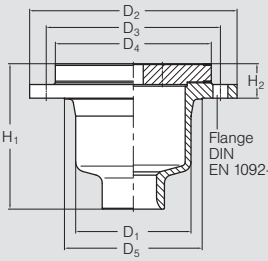


Figure 1

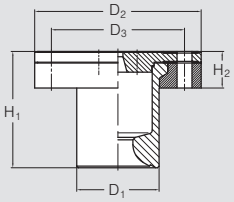


Figure 2

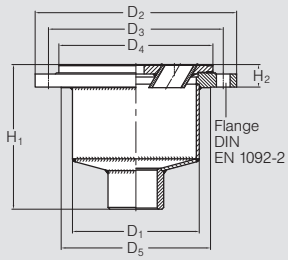


Figure 3

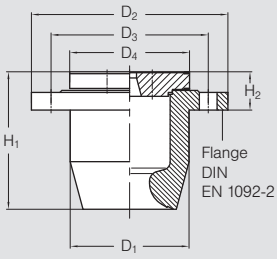


Figure 4

Type	∢	Mat.-no.	Fig.	Dimensions [mm]								Flange hole	
				D_1	D_2	D_3	D_4	D_5	H_1	H_2	D_N	Number	Ø mm
421. 56x/ 421. 60x	60°-120°	05	4	121	200	160	122	-	140	39	80	8	18
		17	1	96	200	160	122	121	140	39	80	8	18
		53	2	99	200	160	-	-	131	44	80	8	18
421. 62x	60°-120°	05	4	141	220	180	158	-	156	28	100	8	18
		17	1	113	220	180	158	141	156	28	100	8	18
		53	2	117	220	180	-	-	157	53	100	8	18
421. 64x/ 421. 66x	60°-120°	05	4	166	250	210	188	-	177	41,5	125	8	18
		17	1	140	250	210	188	166	177	41,5	125	8	18
		53	2	141	250	210	-	-	174	57	125	8	18
421. 68x/ 421. 70x	60°-120°	05	1 or 4*	170	285	240	207	195	188	38	150	8	23
		17	1	170	285	240	207	195	188	38	150	8	23
		53	2	171	285	240	-	-	188	51	150	8	23
421. 72x/ 421. 74x	60°-120°	05	1 or 4*	220	340	295	260	252	250	46	200	8	23
	60°	17	3	214	340	295	260	252	243	35	200	8	23
	90°-120°	17	3	214	340	295	260	252	246	38	200	8	23
	60°-120°	53	2	225	340	295	-	-	252	50	200	8	23
421. 76x/ 421. 78x	60°	17	3	264	395	350	320	309	290	39	250	12	23
	90°-120°	17	3	264	395	350	320	309	291	40	250	12	23
	60°-120°	53	2	280	395	350	-	293	300	53	250	12	23
421. 80x/ 421. 82x	60°	17	3	315	445	400	348	359	355	39	300	12	23
	90°-120°	17	3	315	445	400	348	359	356	40	300	12	23
	60°-120°	53	2	328	445	400	-	360	369	57	300	12	23

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
*available as cast part (Figure 1) or made of solid material (Figure 4)

Example for ordering:	**Type**	**+**	**Material no.**	**=**	**Ordering no.**
	421. 564	**+**	**05**	**=**	**421. 564. 05**

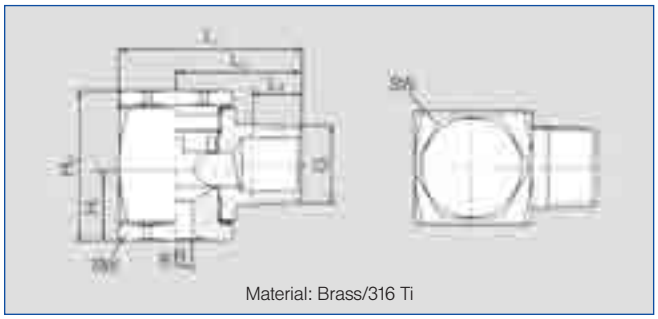
Conversion formula for the above series: (≤ 10 bar)

$$\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0,4}$$

Tangential-flow full cone nozzles

Series 422 / 423

Tangentially arranged liquid supply. Without swirl inserts. Non-clogging. Stable spray angle. Uniform spray.
Applications:
Cleaning and washing process, cooling of gaseous fluids and solids, surface spraying, spraying onto mats in air washers, improving on chemical reactions, continuous casting, foam control.



Material: Brass/316 Ti

Other nozzle sizes and materials (special alloys, plastics) are available on request.

Dimensions [mm]							
G	L_1	L_2	L_3	H_1	H_2	SW	Weight
1/4 BSPT	28.0	20.0	10.0	8.0	20.5	12.0	40 g
3/8 BSPT	36.0	25.0	10.0	11.0	26.5	19.0	100 g
1/2 BSPT	48.5	33.5	13.0	20.0	38.5	27.0	235 g
3/4 BSPT	58.0	38.0	14.5	23.5	57.0	36.0	620 g
1 BSPT	76.0	48.5	17.0	27.5	66.0	41.0	1250 g

Spray angle	Ordering no. Type	Mat.-no. 17[1] 316 Ti	Code 1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPT	1 BSPT	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	7.0	10.0	Spray diameter D at p=1-10 bar H = 200 mm	H = 500 mm
60°	422. 644	○	-	CE	-	-	-	3.00	3.00	2.00	2.83	4.00	4.90	6.32	7.48	8.94	225	510
90°	422. 406	○	CC	-	-	-	-	1.50	1.45	0.50	0.71	1.00	1.22	1.58	1.87	2.24	380	860
	422. 486	○	CC	-	-	-	-	1.90	1.80	0.80	1.13	1.60	1.96	2.53	2.99	3.58	380	860
	422. 566	○	CC	-	-	-	-	2.30	2.20	1.25	1.77	2.50	3.06	3.95	4.68	5.59	380	860
	422. 606	○	-	CE	-	-	-	2.60	2.50	1.57	2.23	3.15	3.86	4.98	5.89	7.04	380	860
	422. 646	○	-	CE	-	-	-	3.00	2.90	2.00	2.83	4.00	4.90	6.32	7.48	8.94	390	960
	422. 766	○	-	CE	-	-	-	4.15	4.10	4.00	5.66	8.00	9.80	12.65	14.97	17.89	390	960
	422. 846	○	-	CE	-	-	-	5.20	5.10	6.25	8.84	12.50	15.31	19.76	23.39	27.95	390	960
	422. 886	○	-	CE	-	-	-	5.80	5.70	8.00	11.31	16.00	19.60	25.30	29.93	35.78	390	960
	422. 966	○	-	-	CG	-	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	46.77	55.90	390	960
120°	422. 568	○	CC	-	-	-	-	2.30	2.20	1.25	1.77	2.50	3.06	3.95	4.68	5.59	680	1220
	422. 728	○	-	CE	-	-	-	3.70	3.60	3.15	4.45	6.30	7.72	9.96	11.79	14.09	680	1600
	422. 808	○	-	CE	-	-	-	4.65	4.60	5.00	7.07	10.00	12.25	15.81	18.71	22.36	680	1600
	422. 848	○	-	CE	-	-	-	5.20	5.10	6.25	8.84	12.50	15.31	19.76	23.39	27.95	680	1600
	422. 888	○	-	CE	-	-	-	5.80	5.70	8.00	11.31	16.00	19.60	25.30	29.93	35.78	680	1600
	422. 928	○	-	-	CG	-	-	7.30	7.30	10.00	14.14	20.00	24.49	31.62	37.42	44.72	680	1600
	422. 968	○	-	-	CG	-	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	46.77	55.90	680	1600
	423. 008	○	-	-	CG	-	-	8.70	8.70	15.75	22.27	31.50	38.88	49.81	58.93	70.44	680	1600
	423.128	○	-	-	-	CK	-	12.70	12.30	31.50	44.55	63.00	77.16	99.61	117.86	140.87	680	1600
	423.208	○	-	-	-	-	CM	19.00	16.00	50.00	70.71	100.00	122.47	158.11	187.08	223.61	680	1600

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter · E = narrowest free cross section

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	422. 644	+	17	+	CE	=	422. 644. 17. CE

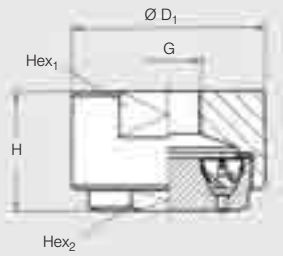
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Cluster head nozzles

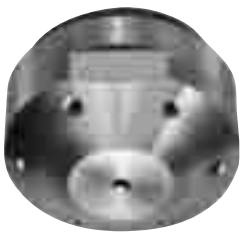
Series 502 / 503

Fine full cone atomization with the aid of several hollow cones spraying into one another.
Applications:
Cooling of gaseous and solid material, desuperheating, chlorine precipitation, absorption as well as for improvement of chemical reaction by enlarging the contact area.

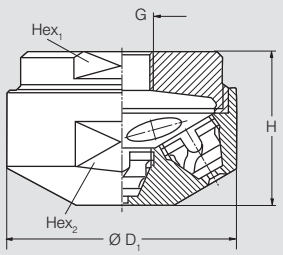
∢ 70°



Dimensions	1/2”	3/4”
Hex_1	46	65
Hex_2	38	55
H	25	46
D_1	50	75
Weight (Brass)	250 g	870 g



∢ 130°



Dimensions	1/2”	3/4”
Hex_1	27	50
Hex_2	36	55
H	28	53
D_1	40	60
Weight (Brass)	150 g	410 g

∢ Spray angle	Ordering no. Type	Mat. no. 17[1] 316 Ti	Mat. no. 30 Brass	G BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	Spray diameter D at p = 2 bar H = 1000 mm	H = 2000 mm
70°	502. 445	○	○	1/2"	1.00	0.50	-	-	1.25	1.53	1.98	2.80	400	400
	502. 545	○	○	1/2"	1.80	0.50	-	1.58	2.24	2.74	3.54	5.01	400	400
	502. 585	○	○	3/4"	1.00	1.00	1.40	1.98	2.80	3.43	4.43	6.30	600	700
	502. 665	○	○	3/4"	1.40	1.40	2.20	3.18	4.50	5.51	7.11	10.10	800	900
	502. 745	○	○	3/4"	2.00	2.00	3.50	5.00	7.10	8.70	11.20	15.90	800	900
	502. 795	○	○	3/4"	2.50	2.00	4.60	6.70	9.50	11.60	15.00	21.20	900	1100
	502. 835	○	○	3/4"	3.00	2.00	6.00	8.30	11.80	14.50	18.70	26.40	1000	1200
	502. 875	○	○	3/4"	3.50	2.00	7.20	10.60	15.00	18.40	23.70	33.50	1100	1300
	502. 905	○	○	3/4"	4.00	2.00	8.80	12.70	18.00	22.05	28.40	40.20	1200	1500
	502. 985	○	○	3/4"	3.50	2.00	14.00	19.80	28.00	34.29	44.30	62.60	1200	1500
	503. 025	○	○	3/4"	4.00	2.00	17.70	25.10	35.50	43.48	56.10	79.40	1200	1600
	503. 065	○	○	3/4"	5.00	2.00	22.10	31.80	45.00	55.11	71.10	100.60	1200	1800
	503. 115	○	○	3/4"	6.00	2.00	30.00	42.00	60.00	72.80	95.00	134.00	1300	2000
130°	502. 448	○	○	1/2"	1.00	0.50	-	-	1.25	1.53	1.98	2.80	500	500
	502. 548	○	○	1/2"	1.80	0.50	-	1.58	2.24	2.74	3.54	5.01	700	700
	502. 588	○	○	3/4"	1.00	1.00	1.40	1.98	2.80	3.43	4.43	6.30	800	900
	502. 668	○	○	3/4"	1.50	1.50	2.20	3.18	4.50	5.51	7.11	10.10	1000	1100
	502. 748	○	○	3/4"	2.00	2.00	3.50	5.00	7.10	8.70	11.20	15.90	1100	1200
	502. 798	○	○	3/4"	2.50	2.00	4.60	6.70	9.50	11.60	15.00	21.20	1200	1300
	502. 838	○	○	3/4"	3.00	2.00	6.00	8.30	11.80	14.50	18.70	26.40	1400	1600
	502. 878	○	○	3/4"	3.50	2.00	7.20	10.60	15.00	18.40	23.70	33.50	1500	1700
	502. 908	○	○	3/4"	4.00	2.00	8.80	12.70	18.00	22.05	28.40	40.20	1500	1800
	502. 988	○	○	3/4"	3.50	2.00	14.00	19.80	28.00	34.29	44.30	62.60	1500	1800
	503. 028	○	○	3/4"	4.00	2.00	17.70	25.10	35.50	43.48	56.10	79.40	1600	1800
	503. 068	○	○	3/4"	5.00	2.00	22.10	31.80	45.00	55.11	71.10	100.60	2000	2500
	503. 118	○	○	3/4"	6.00	2.00	30.00	42.00	60.00	72.80	95.00	134.00	2000	3000

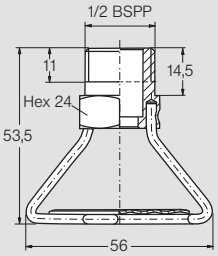
[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter · E = narrowest free cross section

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

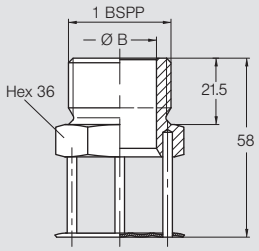
Deflector-plate nozzle

Series 524 / 525

Full cone spray. Non clogging nozzle without swirl insert.
Applications:
Fire fighting and broadcast spraying, wide area spray.



Type 524. 809 – 525. 269



Type 525. 349 – 525. 489

Spray angle	Ordering no. Type	Mat no. 30 Brass	Mat no. 17[1] 316 Ti	B Ø mm	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	Spray diameter D at p = 3 bar approx. H = 1 m	H = 3 m
180°	**524. 809**	○	○	4.00	5.00	7.10	10.00	12.20	15.80	22.40	5.60 m	6.40 m
	524. 939	○	○	5.90	10.60	15.00	21.20	25.90	33.50	47.40	6.00 m	7.00 m
	524. 969	○	○	6.20	12.50	17.70	25.00	30.60	39.50	55.90	8.00 m	9.00 m
	525. 049	○	○	8.00	20.00	28.30	40.00	49.00	63.20	89.40	10.00 m	13.20 m
	525. 109	○	-	9.30	28.00	40.00	56.00	69.00	89.00	125.00	10.20 m	13.40 m
	525. 169	○	-	10.90	40.00	57.00	80.00	98.00	126.00	179.00	10.60 m	13.60 m
	525. 229	○	-	12.20	56.00	79.00	112.00	137.00	177.00	250.00	6.80 m	10.40 m
	525. 269	○	○	12.30	70.00	99.00	140.00	171.00	221.00	313.00	5.20 m	10.20 m
	525. 349	○	○	16.20	112.00	158.40	224.00	274.30	354.20	500.80	4.80 m	9.70 m
	525. 469	○	○	23.80	222.70	315.00	445.50	545.60	704.40	996.20	4.50 m	9.50 m
	525. 489	○	○	25.30	250.00	353.60	500.00	612.40	790.60	1118.00	4.00 m	9.00 m

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
B = bore diameter

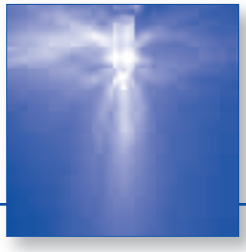
Example for ordering:	Type	+	Material no.	=	Ordering no.
	525.809	+	**30**	=	**525. 809. 30**

Version with dust protection cap on request.

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Rotating cleaning nozzle »MiniSpinner«

Series 5MI



- Inexpensive
- Self rotating
- Efficient slot design

Applications:
Cleaning of
- Plant and equipment
- Tanks
- Machines

Max. tank diameter:
3,0 m

Operating pressure:
1.0 - 2.5 bar

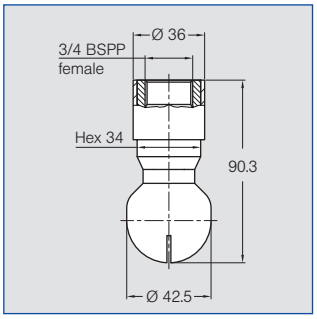
Max. temperature:
140 °C

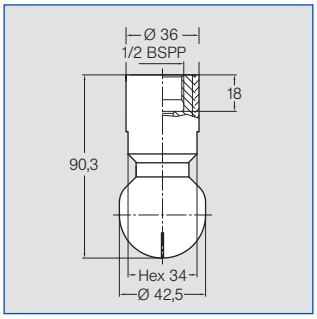
Installation:
Operation in every direction is possible

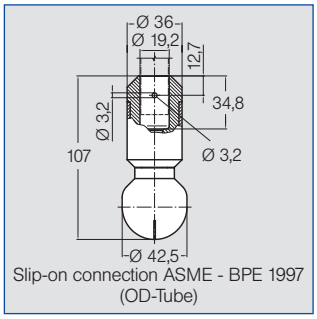
Materials:
1Y: AISI 316 L and 440C
21: Alloy C-22 and C-276

Bearing:
Double ball bearing
1Y: AISI 440C
21: Alloy C-276

Required prefiltration:
Line strainer with a mesh size of 0.1 mm/170 mesh







Slip-on connection ASME - BPE 1997 (OD-Tube)

Spray angle	Type	Ordering number: Mat.-no. 1Y 316 L	Mat.-no. 21 C-22	Connection: 1/2 BSPP*	3/4 BSPP*	3/4" Slip-on	E Ø [mm]	V̇ [l/min] p [bar] (p_max = 5 bar): 1	2	3	at 40 psi [US gal./min]
60°	**5MI.162.1Y**	○	○	**AH**	**-**	**TF07**	2.6	45	63	77	20
180°	**5MI.114.1Y**	○	○	**-**	**AL**	**TF07**	1.0	47	67	82	21
360°	**5MI.054.1Y**	○	○	**-**	**AL**	**TF07**	0.5	21	30	37	9
	5MI.074.1Y	○	○	**-**	**AL**	**TF07**	0.6	35	49	60	15
	5MI.014.1Y	○	○	**-**	**AL**	**TF07**	0.9	49	69	85	21
	5MI.209.1Y	○	○	**-**	**AL**	**TF07**	1.5	71	100	122	31

* NPT on request · More slip-on sizes on request. · Weld-on versions on request
Operation with compressed air only for short-term usage. Operation above the recommended operating pressure means higher wear and smaller droplets. This might have adverse effects on the cleaning result.
Slip-on versions: R-clip made of stainless steel AISI 316 L is included (Ordering number: 095.022.1Y.50.60 (5MI) 095.013.1E.05.59 (5MC)). Depending on diameter of the adapter the flow rate can increase due to leakage between connecting pipe and rotating cleaning nozzle.

Example for ordering:	Type	+ Material no.	+ Connection	= Ordering no.
	5MI.162	**+ 1Y**	**+ AH**	**= 405. 204. 1Y. AH**

Rotating cleaning nozzle »Whirly«

Series 569

- Self rotating
- Powerfull flat jets

Applications:
Cleaning of
- Plant and equipment
- Tanks
- Machines

Max. tank diameter:
Rinsing: 5.0 m
Cleaning: 3.0 m

Operating pressure:
1.0 - 2.5 bar

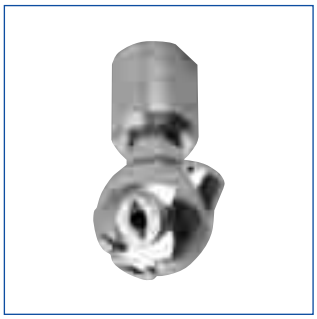
Max. temperature:
140 °C

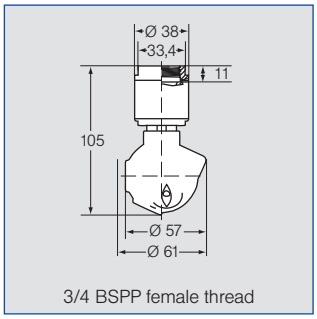
Installation:
Operation in every direction is possible; when installed horizontally rotation starts at 2 bar

Materials:
Stainless steel AISI 316 L, PEEK and Rulon 641

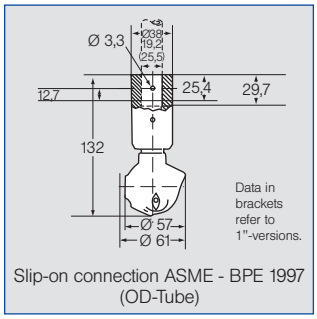
Bearing:
Double ball bearing made of stainless steel

Filtration:
Line strainer with a mesh size of 0.1 mm/170 mesh

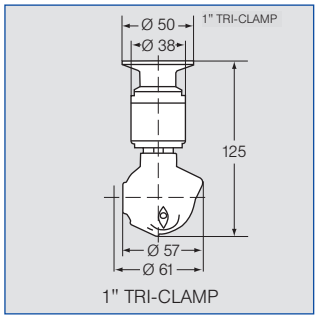




3/4 BSPP female thread



Slip-on connection ASME - BPE 1997 (OD-Tube)



1" TRI-CLAMP

Spray angle	Ordering no. Type	Connection 3/4 BSPP* female	3/4" Slip-on	1" Slip-on	1" Tri-Clamp	E Ø [mm]	V̇ [l/min] p [bar] (p_{max} = 6 bar) 1	2	3	at 40 psi [US gal./min]
270°	**569.055.1Y**	**AL**	**TF07**	**TF10**	**10**	3.6	36	48	62	15
	569.135.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	52	71	87	22
	569.195.1Y	**AL**	**TF07**	**TF10**	**10**	5.6	69	97	119	30
270°	**569.056.1Y**	**AL**	**TF07**	**TF10**	**10**	3.6	36	48	62	15
	569.106.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	41	58	71	18
	569.196.1Y	**AL**	**TF07**	**TF10**	**10**	5.6	69	97	119	30
360°	**569.059.1Y**	**AL**	**TF07**	**TF10**	**10**	3.2	36	48	62	15
	569.139.1Y	**AL**	**TF07**	**TF10**	**10**	3.6	52	71	87	22
	569.199.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	69	97	119	30
	569.279.1Y	**AL**	**TF07**	**TF10**	**10**	7.1	103	145	178	45

E = Narrowest free cross-section · * NPT on request · Weld-on versions on request

Operation with compressed air only for short-term usage. Operation above the recommended operating pressure means higher wear and smaller droplets. This might have adverse effects on the cleaning result.

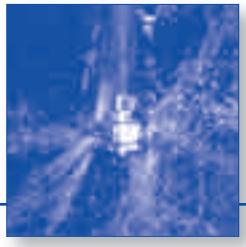
Slip-on versions:
- R-clip made of stainless steel AISI 316 L is included (Ordering number: 095.022.1Y.50.60.E)
- Depending on diameter of the adapter the flow rate can increase due to leakage between connecting pipe and rotating cleaning nozzle.

Example of ordering:	Type	+	Connection	=	Ordering no.
	569.055.1Y.	+	**AL**	=	**569.055.1Y.AL**

Also available with ATEX-approval

Rotation nozzle „Gyro“

Series 577/579



- Self-spinning stainless steel tank cleaning head
- Powered and lubricated by the cleaning fluid
- Flat fan nozzle holes for particularly powerful all-round cleaning
- Large free cross sections, less prone to clogging

Applications:
Cleaning of
- Plant and equipment
- Tanks
- Machines

Max. tank diameter:
6,0 m

Recommended operating pressure:
1-3.5 bar, max. 5 bar

Max. temperature:
90°C

Weight:
NPT 1” 750g
NPT 2” 1800g
NPT 3” 3600g

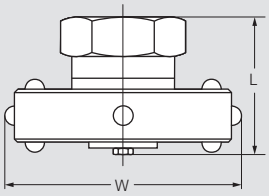
Materials:
17[1]: AISI 316 Ti and PTFE

Bearing:
Slide bearing made of Teflon® (PTFE)

Accessories:
Spare parts set consisting of:
- Top seal
- Bottom seal
- Bolt
- Nut
- Sleeve
- Instructions for use

Required prefiltration:
Line strainer with a mesh size of 0.3 mm/50 mesh

Size	Ordering no.
NPT 1"	057. 701. 55
NPT 2"	057. 702. 55
NPT 3"	057. 703. 55



Spray angle	Ordering no. Type	Connection NPT 1"	Connection NPT 2"	Connection NPT 3"	V̇ [l/min] p [bar] 1	2	3	5	40 psi [US gal/min]	Dimensions Length [mm]	Width [mm]	Effective spray diameter Ø [m]
180°	**577. 283. 17**	**BN**	**-**	**-**	115	163	200	258	50	68.4	118	4
	577. 363. 17	**BN**	**-**	**-**	182	258	316	408	80	68.4	118	4
	577. 404. 17	**-**	**BW**	**-**	228	322	394	509	100	103	151	5
	577. 434. 17	**-**	**BW**	**-**	273	386	473	610	120	103	151	5
	577. 524. 17	**-**	**BW**	**-**	452	639	783	1010	170	103	151	5
	577. 564. 17	**-**	**-**	**MB**	564	798	977	1262	250	116	188	6
	577. 594. 17	**-**	**-**	**MB**	677	958	1173	1515	300	116	188	6
	577. 614. 17	**-**	**-**	**MB**	791	1118	1369	1768	350	116	188	6
180°	**579. 284. 17**	**BN**	**-**	**-**	115	163	200	258	50	68.4	118	4
	579. 364. 17	**BN**	**-**	**-**	182	258	316	408	80	68.4	118	4
	579. 404. 17	**-**	**BW**	**-**	228	322	394	509	100	103	151	5
	579. 434. 17	**-**	**BW**	**-**	273	386	473	610	120	103	151	5
	579. 494. 17	**-**	**BW**	**-**	380	538	659	851	170	103	151	5
	579. 564. 17	**-**	**-**	**MB**	564	798	977	1262	250	116	188	6
	579. 594. 17	**-**	**-**	**MB**	677	958	1173	1515	300	116	188	6
	579. 614. 17	**-**	**-**	**MB**	791	1118	1369	1768	350	116	188	6
270°	**577. 285. 17**	**BN**	**-**	**-**	115	163	200	258	50	68.4	118	4
	577. 365. 17	**BN**	**-**	**-**	182	258	316	408	80	68.4	118	4
	577. 405. 17	**-**	**BW**	**-**	228	322	394	509	100	103	151	5
	577. 435. 17	**-**	**BW**	**-**	273	386	473	610	120	103	151	5
	577. 495. 17	**-**	**BW**	**-**	380	538	659	851	170	103	151	5
	577. 566. 17	**-**	**-**	**MB**	564	798	977	1262	250	116	188	6
	577. 596. 17	**-**	**-**	**MB**	677	958	1173	1515	300	116	188	6
	577. 616. 17	**-**	**-**	**MB**	791	1118	1369	1768	350	116	188	6
360°	**577. 289. 17**	**BN**	**-**	**-**	115	163	200	258	50	68.4	118	4
	577. 369. 17	**BN**	**-**	**-**	182	258	316	408	80	68.4	118	4
	577. 409. 17	**-**	**BW**	**-**	228	322	394	509	100	103	151	5
	577. 439. 17	**-**	**BW**	**-**	273	386	473	610	120	103	151	5
	577. 499. 17	**-**	**BW**	**-**	380	538	659	851	170	103	151	5
	577. 569. 17	**-**	**-**	**MB**	570	806	987	1274	250	116	188	6
	577. 599. 17	**-**	**-**	**MB**	685	969	1187	1532	300	116	188	6
	577. 619. 17	**-**	**-**	**MB**	798	1128	1382	1784	350	116	188	6

[1] We reserve the right to deliver AISI 316 or 316 Ti under the material no. 17.
Please note: Higher pressure generally means higher wear and smaller droplets. This might have adverse effects on the cleaning result. We do not recommend the operation with compressed air.

Example	Type	+	Connection	=	Ordering no.
for ordering:	**577. 283. 17.**	**+**	**BN**	**=**	**577. 283. 17. BN**

Rotating cleaning nozzle »Teflon® Whirly«

Series 573 / 583

Slip-on version certified according to »3-A®«.

- Self rotating
- Rotating solid jets
- Recommended for tanks made of glass and enamel

Applications:
Cleaning of
- Plant and equipment
- Tanks
- Machines

Max. tank diameter:
Rinsing: 5.0 m
Cleaning: 3.0 m

Operating pressure:
1.0 - 2.0 bar

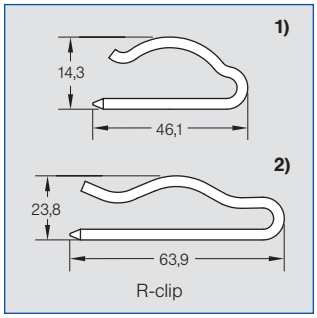
Max. temperature:
95 °C
(Versions for use with higher temperature on request)

Installation:
Operation in every direction is possible

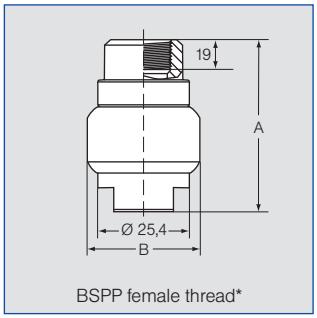
Material:
PTFE (Teflon®)
(Electrically conductive version on request)

Bearing:
Slide bearing made of PTFE

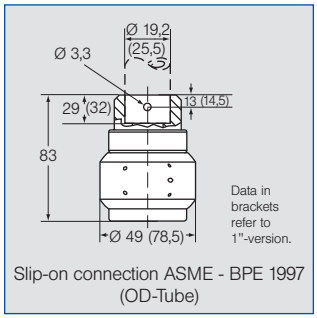
Filtration:
Line strainer with a mesh size of 0.3 mm/50 mesh



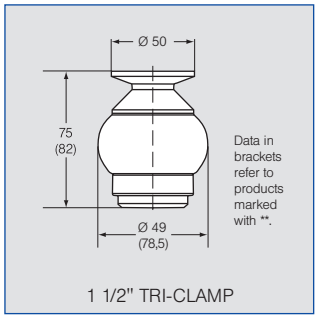
R-clip



BSPP female thread*



Slip-on connection ASME - BPE 1997 (OD-Tube)



1 1/2" TRI-CLAMP

Spray angle	R-clip	Ordering number: Type	Connection: 3/4 BSPP* female	1 BSPP* female	3/4" Slip-on	1" Slip-on	1 1/2" Tri-Clamp	E Ø [mm]	V̇ [l/min] p [bar] (p_{max} = 6 bar): 1	2	3	at 40 psi [US gal./min]	Height A [mm]	Diameter B [mm]
180°	1)	**583.114.55**	**AL**	**-**	**TF07**	**TF10**	**15**	2.1	47	67	82	21	74	49
	1)	**583.264.55**	**AL**	**-**	**TF07**	**TF10**	**15**	3.3	103	145	178	45	74	49
	2)	**583.344.55**	**-**	**AN**	**-**	**TF10**	**15****	7.1	159	225	276	70	100	78.5
180°	1)	**573.114.55**	**AL**	**-**	**TF07**	**TF10**	**15**	2.1	47	67	82	21	74	49
	1)	**573.264.55**	**AL**	**-**	**TF07**	**TF10**	**15**	3.3	103	145	178	45	74	49
	2)	**573.344.55**	**-**	**AN**	**-**	**TF10**	**15****	7.1	159	225	276	70	100	78.5
270°	1)	**583.116.55**	**AL**	**-**	**TF07**	**TF10**	**15**	2.4	47	67	82	21	74	49
	1)	**583.266.55**	**AL**	**-**	**TF07**	**TF10**	**15**	3.4	103	145	178	45	74	49
	2)	**583.346.55**	**-**	**AN**	**-**	**TF10**	**15****	5.9	159	225	276	70	100	78.5
270°	1)	**573.116.55**	**AL**	**-**	**TF07**	**TF10**	**15**	2.4	47	67	82	21	74	49
	1)	**573.266.55**	**AL**	**-**	**TF07**	**TF10**	**15**	3.4	103	145	178	45	74	49
	2)	**573.346.55**	**-**	**AN**	**-**	**TF10**	**15****	5.9	159	225	276	70	100	78.5
360°	1)	**583.209.55**	**AL**	**-**	**TF07**	**TF10**	**15**	3.5	71	100	122	31	74	49
	1)	**583.269.55**	**AL**	**-**	**TF07**	**TF10**	**15**	4.8	103	145	178	45	74	49
	2)	**583.279.55**	**-**	**AN**	**-**	**TF10**	**15****	3.7	106	150	184	47	100	78.5
	2)	**583.349.55**	**-**	**AN**	**-**	**TF10**	**15****	5.6	159	225	276	70	100	78.5

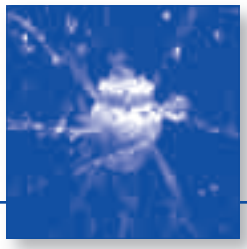
E = Narrowest free cross-section · * NPT on request

Operation with compressed air only for short-term usage. Operation above the recommended operating pressure means higher wear and smaller droplets. This might have adverse effects on the cleaning result. Teflon® is a registered trademark of E. I. Dupont De Nemours and Company.

Slip-on versions:
- R-clip made of stainless steel AISI 316 L is included (Ordering number: R-clip 1: 095.022.1Y.50.88.E, R-clip 2: 095.022.1Y.50.60.E)
- Depending on diameter of the adapter the flow rate can increase due to leakage between connecting pipe and rotating cleaning nozzle.

Example of ordering:	Type	+	Connection	=	Ordering no.
	583.114.55.	+	**AL**	=	**583.114.55.AL**

PTFE Whirling Nozzle – for high temperature applications Series 599



- PTFE whirling nozzle for high temperature applications
- Balanced rotating action
- Gap-free all-around cleaning
- Free spinning, self-lubricating and self-flushing
- All used materials are FDA-conform

Applications:
For rinsing of small and medium-sized vessels and reactors in higher temperature processing environments.

Max. tank diameter:
Rinsing: 5 m
Cleaning: 3 m

Recommended operating pressure:
1-2 bar, max. 6 bar

Installation:
Operation in every direction is possible

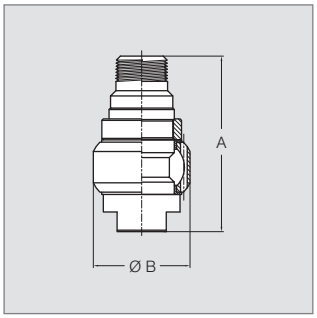
Max. temperature:
130°C

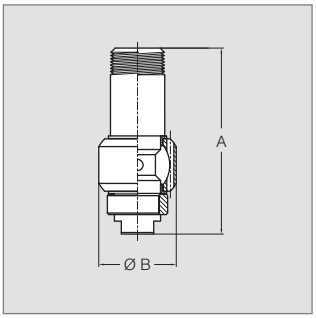
Materials:
- PTFE
- Rings: Hastelloy®

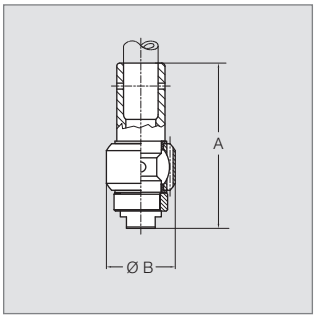
599. 133. 55. BK

599. 170. 55. BK

599. 174. J7. TF07







Strahlwinkel	Ordering no. Type	Connection 3/4" male NPT	Connection 3/4" female tube	V̇ [l/min] p [bar] 1	2	3	40 psi [US gal./min]	A Length [mm]	B Ø [mm]	Weight [g]
360°	**599. 133. 55**	**BK**	**-**	71	100	122	31	89	51	160
	599. 170. 55	**BK**	**-**	61	84	103	26	91	38	115
	599. 174. J7	**-**	**TF07**	61	84	103	26	91	38	115

Please note: Higher pressure generally means higher wear and smaller droplets. This might have adverse effects on the cleaning result. We do not recommend the operation with compressed air.

Example for ordering:	**Type** **599. 133. 55.**	**+**	**Connection** **BK**	**=**	**Ordering no.** **599. 133. 55. BK**

High impact tank cleaning machine

Series 5TA / 5TB

- Gear-controlled
- Particularly powerful solid jets
- Two different sizes for a variety of container sizes
- Operating pressures up to 15 and 25 bar possible

Applications:
Cleaning of
- Systems
- Machines
- Tankers
- Large tanks

Max. tank diameter:
See table

Operating pressure:
2,0 - 10,0 bar

Temperature:
95 °C, 130 °C (Environment)

Installation:
Operation in any installation position

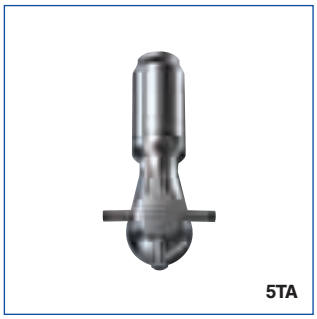
Materials:
AISI 316 L, PEEK, PTFE, EPDM, Zirconium oxide

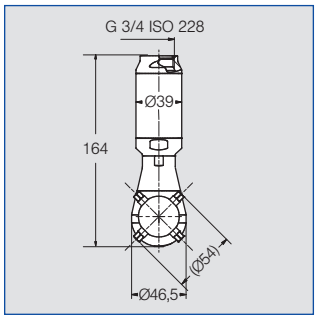
Weight:
5TA approx. 0,9 kg
5TB approx. 4,0 kg

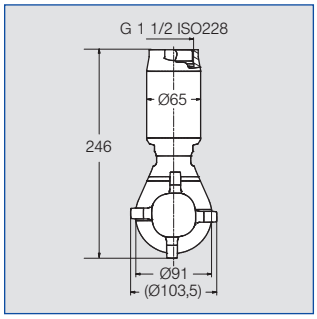
Bearing:
Ball bearing

Required prefiltration:
Line filter with 0.2 mm/ 80 mesh

Rotation monitoring sensor:
This series is qualified for rotation monitoring with the Lechler sensor.







The new Lechler rotating jet cleaner enables containers and systems to be cleaned very efficiently. Thanks to the powerful solid jets, it also performs even the most difficult cleaning tasks.
Its high-quality and hygienic design makes it especially well suited for use in the chemicals and pharmaceuticals industry.

Spray angle	Ordering number / Type	E Ø [mm]	Number, Ø nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 15 bar) 2	5	10	40 psi [US gal./min]	Max. tank-diameter (at 5 bar) [m]
360°	**5TA.403.1Y.AL**	1.5	4 x 3.0	25	40	56	7.8	8.0
	5TA.404.1Y.AL	1.5	4 x 4.0	42	66	93	12.9	11.0
	5TA.405.1Y.AL	1.5	4 x 5.0	50	79	112	15.5	12.0

Spray angle	Ordering number / Type	E Ø [mm]	Number, Ø nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 25 bar) 2	5	10	40 psi [US gal./min]	Max. tank-diameter (at 5 bar) [m]
360°	**5TB.406.1Y.AS**	6.0	4 x 6.0	107	169	239	33,1	13,0
	5TB.407.1Y.AS	6.0	4 x 7.0	135	213	302	41,9	14,0
	5TB.408.1Y.AS	6.0	4 x 8.0	165	261	369	51,2	14,0

E = Narrowest free cross-section

Rotation monitoring:
Please request detailed information.

High impact tank cleaning machine

Series 5TM

- Gear driven
- Very powerfull solid jets

Applications:
Cleaning of
- Plant and equipment
- Tanks
- Machines
- Road tankers
- Large vessels

Max. tank diameter:
Rinsing: 24.0 m
Cleaning: 15.0 m

Operating pressure:
2.0 - 5.0 bar

Max. temperature:
60 °C
(Version for higher temperatures on request)

Installation:
Operation in every direction is possible

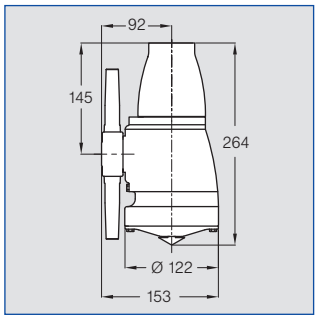
Materials:
Stainless steel AISI 316 L,
Gear components made of PTFE and carbon fibre

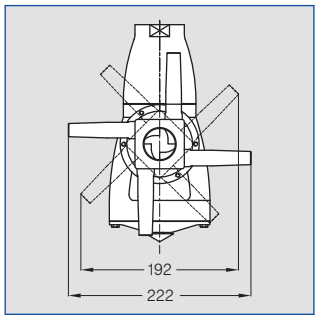
Weight:
approx. 7.5 kg

Bearing:
Ball and slide bearings

Required prefiltration:
Line strainer with a mesh size of 0.2 mm/80 mesh

Rotation monitoring sensor:
This series is qualified for rotation monitoring with the Lechler sensor.





Spray angle	Ordering number	Connection BSPP female	E Ø [mm]	Number, Ø Nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 7 bar) 2	3	5	at 40 psi [US gal./ min]
360°	**5TM.208.1Y.AS**	1 1/2	8	2 x 8.0	125	153	198	39
	5TM.210.1Y.AS	1 1/2	10	2 x 10.0	160	196	253	50
	5TM.406.1Y.AS	1 1/2	6	4 x 6.0	140	171	221	43
	5TM.407.1Y.AS	1 1/2	7	4 x 7.0	170	208	269	53
	5TM.408.1Y.AS	1 1/2	8	4 x 8.0	200	245	316	62
	5TM.410.1Y.AS	1 1/2	10	4 x 10.0	260	318	411	81

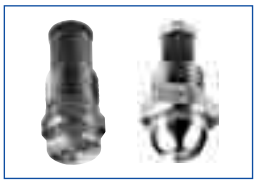
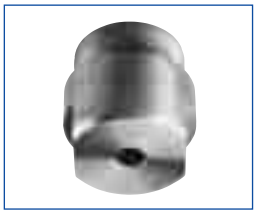
E = Narrowest free cross-section

The cycle time takes between 7 and 41 min depending on type and pressure.

Rotation monitoring sensor
Please ask for more information.

YOU WILL FIND OTHER NOZZLES FOR USE IN THE CHEMICAL INDUSTRY IN OUR INDUSTRY CATALOGUE ...

Over the years, our catalogue for precision nozzles and accessories has become an indemand nozzle technology handbook. It contains valuable tools and comprehensive technical information on Lechler products. Many of them have for a long time also been used in the chemical industry to solve a very wide range of tasks.

Axial-flow hollow cone nozzles	**Series**	∢	$\dot{V}$ [l/min] at **p** = 2 bar	Connection	Application/ Design	**Catalogue page**
	**212**	60° 80°	0.015 – 0.46 (bei p = 7 bar)	1/4 BSPT 1/4 BSPP	Disinfection, humidification of air, spraying over germinating boxes, product dampening, humidification of textiles, oil spraying, absorption. **Extremely fine, fog-like hollow cone spray.**	**2.5**
Eccentric hollow cone nozzles	**Series**	∢	$\dot{V}$ [l/min] at **p** = 2 bar	Connection	Application/ Design	**Catalogue page**
	**302**	60° 80° 90° 130°	0.40 – 25.00	3/8 BSPP	Humidification of air in air washers, dust control, spraying onto filters, foam control, cooling. **Non-clogging nozzle design, without swirl insert.**	**2.8** **2.9**
	**304** **306** **307**	90° 130°	5.60 – 33.50	1/2 BSPP 3/4 BSPP	Fire fighting, protection of storage tanks, foam control. **Non-clogging nozzle design, without swirl insert.**	**2.12**
Full cone nozzles	**Series**	∢	**V** [l/min] at **p** = 2 bar	Connection	Application/ Design	**Catalogue page**
	**460** **461**	45° 60° 90° 120°	0.40 – 71.00	1/8 BSPT 1/4 BSPT 3/8 BSPT 1/2 BSPT 3/4 BSPP 1 BSPP	Cleaning and washing process, cooling of gaseous fluids and solids, surface spraying, spraying onto mats in air washers, improving on chemical reactions. **Large free cross-sections, due to optimized x-style swirl insert.**	**3.5**
	**405**	60° 90° 120°	100.00 – 315.00	1 1/4 BSPP 1 1/2 BSPP 2 BSPP	Surface spraying, spraying over packings, cleaning and washing process, chemical process engineering, cooling of gaseous fluids and solids, water treatment. **Uniform full cone spray.**	**3.7**

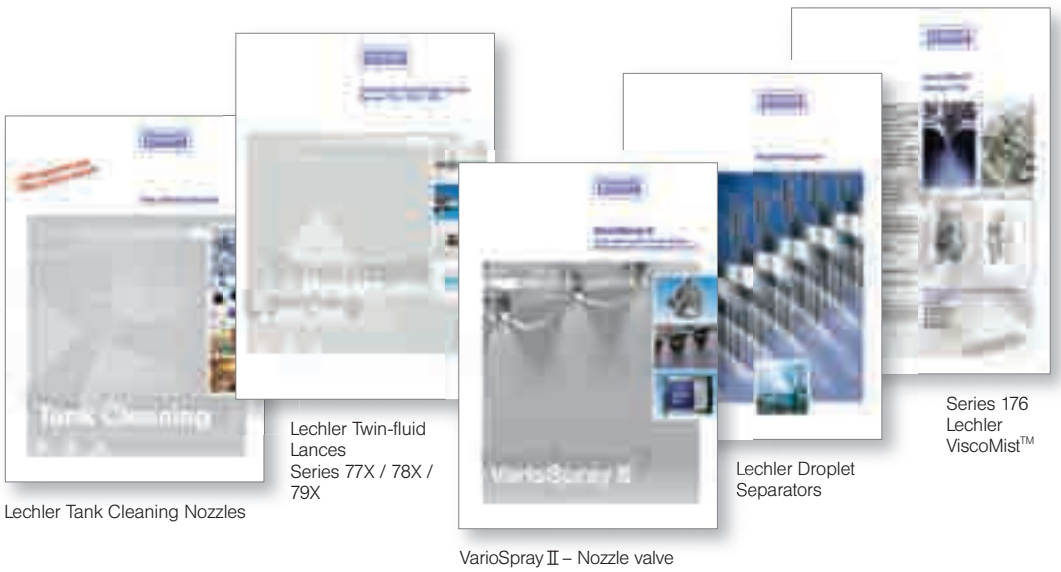
Full cone nozzles	Series	∢	**V** [l/min] at **p** = 2 bar	Connection	Application/ Design	Catalogue page
	**422** **423**	60° 90° 120°	1.00 – 100.00	1/4 BSPT 3/8 BSPT 1/2 BSPT 3/4 BSPT 1 BSPT	Cleaning and washing process, cooling of gaseous fluids and solids, surface spraying, spraying onto mats in air washers, improving on chemical reactions, continuous casting. **Without swirl inserts, non-clogging.**	**3.10** **3.11**

Flat fan nozzles	Series	∢	**V** [l/min] at **p** = 2 bar	Connection	Application/ Design	Catalogue page
	**632** **633**	20° 30° 45° 60° 75° 90° 120°	0.05 – 49.96	1/8 BSPP 1/4 BSPP 3/8 BSPP 1/2 BSPP	Spray cleaning, surface treatment, filter cleaning, belt cleaning, lubricating, coating. **Standard design with conical, self sealing thread.**	**4.8**
	**616** **617**	20° 30° 45° 60° 90° 120°	6.30 – 63.00	3/4 BSPP	Cleaning installations, rain curtains, spray pipes, foam spraying. **Non-clogging nozzle design.**	**4.15**
	**686**	90° 140°	0.50 – 28.00	1/8" BSPT 1/4" BSPT 3/8" BSPT 1/2" BSPT	Foam control for cleaning and washing process, fire prevention. **Particularly clog proof.**	**4.31**

... AND IN DIFFERENT SPECIAL BROCHURES

We have collated information about special nozzles in their own brochures covering various subject areas that are also of particular interest to the chemical industry.

All documents can be downloaded from our website at **www.lechler.com**.
We would also be happy to send you the brochures.



Lechler Tank Cleaning Nozzles

Lechler Twin-fluid Lances Series 77X / 78X / 79X

VarioSpray II – Nozzle valve system for the variable atomization of very small liquid volumes

Lechler Droplet Separators

Series 176 Lechler ViscoMist™

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ON THE INTERNET, YOU CAN FIND EVEN MORE INFORMATION AND SUPPORT FOR YOUR WORK AT: www.lechler.com

You can also find on the Internet additional information about our entire range of services, work aids, our global presence and much more besides – we look forward to your visit.

AND AT http://lechler.partcommunity.com THERE'S 3D DESIGN DATA

3D data on Lechler nozzles and accessories is available to you free of charge for your development and design work. Profit from these advantages:

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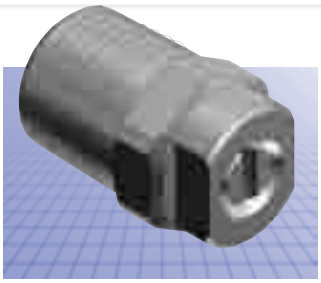

With this service, Lechler once again proves its competence and its high standards as a technology leader.

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Lechler world-wide

Edition 07/14 · EN · 1.000 · M-2014-3550-061 · www.dgm-walliser.de · S · Subject to technical modification.