ENGINEERING
YOUR SPRAY SOLUTION

Nozzles, Nozzle Systems and Mist eliminators for the Shipbuilding Industry

Shipbuilding Industry

LECHLER – YOUR COMPETENT PARTNER FOR NOZZLE AND SEPARATOR TECHNOLOGY

Lechler is Europe's No. 1 and is also one of the leading nozzle providers worldwide. For over 140 years, we have pioneered numerous groundbreaking developments in the field of nozzle and separator technology. We combine comprehensive nozzle engineering expertise with a deep understanding of application-specific requirements to create products that offer outstanding performance and reliability.

There is enormous competition in the shipbuilding industry. In order to survive, it is essential for companies to offer solutions that set them apart from the competition. This is particularly true because the requirements for nozzle and separator solutions in maritime applications are particularly high.

Exceptionally high reliability and ease of maintenance are needed on the high seas. A wide range of applications is expected where the individual solutions can be flexibly adapted to different tasks. Lechler provides support here with mist eliminators and spray technology along with our years of experience.

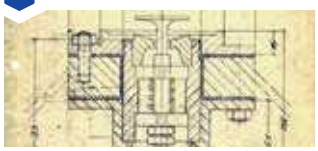
1879

Company founded by Paul Lechler

1893

Patent for liquid atomization

1968



First pop-out deflector-plate nozzle for the German Navy

PROCESS OPTIMIZATION WITH NOZZLE TECHNOLOGY

ENGINEERING YOUR SPRAY SOLUTION

CUSTOMER BENEFITS

- Wide product range
- Service
- Experience
- Custom made solutions

- Process optimization
- Process reliability
- Cost savings

We have over 140 years of knowledge in nozzle and spray technology and 30 years of experience with mist eliminators. We support you with individual, application-oriented and perfectly matched solutions.

Our in-depth application knowledge allows us to develop a comprehensive and efficient solution that is perfectly adapted to your requirements.

Today, Lechler offers a wide product range for maritime use – from tourism and commercial shipping to naval applications. An overview is provided on the following pages.

We will gladly develop the optimum nozzle for your application based on your requirements. Contact us and allow us to advise you without obligation.

CONTENTS

1995

Founding of Sales Office North

2010

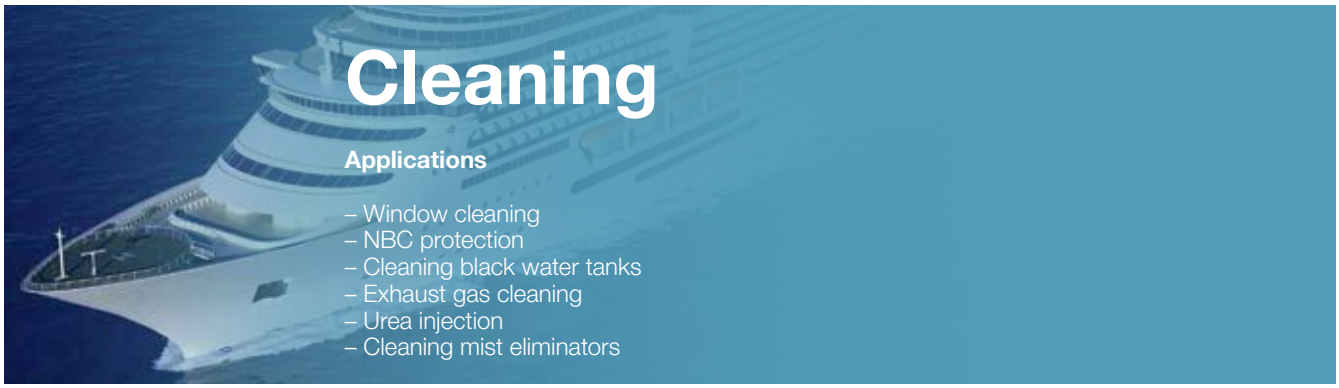
Expansion of production with new 13,000 m² production hall in Metzingen

2016

Opening of the ultra-modern Development and Technology Center in Metzingen

LECHLER NOZZLES AND CUSTOMER-SPECIFIC SYSTEMS FOR SHIPBUILDING

Whether it's commercial shipping, voyages on a cruise ship or military applications – spray solutions from Lechler offer optimum solutions for your applications. Thanks to our expert knowledge and many years of experience, Lechler is much more than just a supplier of nozzles. Working together with you, we are able to optimally design many of your applications and processes for maximum efficiency – e. g. for cleaning, safety and cooling on board.



Cleaning

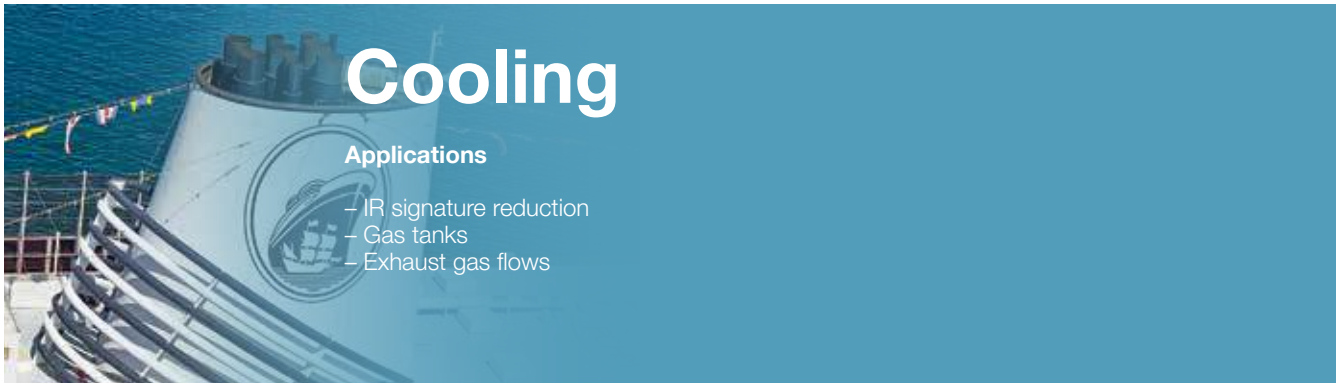
Applications

– Window cleaning
– NBC protection
– Cleaning black water tanks
– Exhaust gas cleaning
– Urea injection
– Cleaning mist eliminators

Fire protection

Applications

– Helicopter landing decks
– Lifeboats
– Ship sides
– Ammunition rooms
– Hatch covers



Cooling

Applications

– IR signature reduction
– Gas tanks
– Exhaust gas flows

APPLICATION OVERVIEW FOR COMMERCIAL SHIPPING

Nozzles for window cleaning

Dirt and salt encrustations can be softened and removed using **flat fan, tongue-type or full cone nozzles**. Large spray angles and lower flow rates are preferred for this, Lechler can meet these requirements with our nozzle range. We recommend nozzles from the **series 632, 652, 686, 684, 490** and **422**. Installation is made easier by a wide range of accessories.

Separators for air intake systems

Lechler **air intake systems** are used for efficient protection against sea water, rain or fog.

Mist eliminators for combustion air

Separator systems for reducing fluid content in combustion air.

Nozzles for hatch covers

Nozzles are used here for cooling and fire protection for the freight or containers with closed hatch covers. We recommend **full cone nozzles** with protection cap of the **series 400/401**.

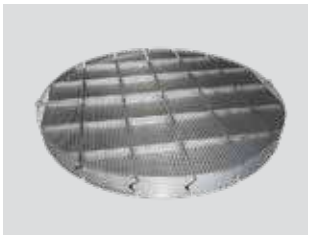
Nozzles for fire protection rain curtains

Lechler **flat fan nozzles** installed in the lashing bridges can help to stop fires spreading and minimize damage to the ship and cargo.

Nozzles and mist eliminators for wet scrubbers

Exhaust gases are desulfurized using **full cone nozzles** and the media salt and fresh water. Nozzles from the **series 403, 405** and **421** are ideally used.

The emission values from the funnel are reduced with highly efficient **mist eliminators**. **Mist eliminators** for vertical gas flow are mainly used here.



Tank cleaning nozzles for gray and black water tanks

Rotating tank cleaning nozzles can be used in these applications. Driven by the medium, these nozzles clean the tank walls in a precisely defined path by means of flat jets or gear-controlled solid streams. **Spray balls** can also be used for small tanks.

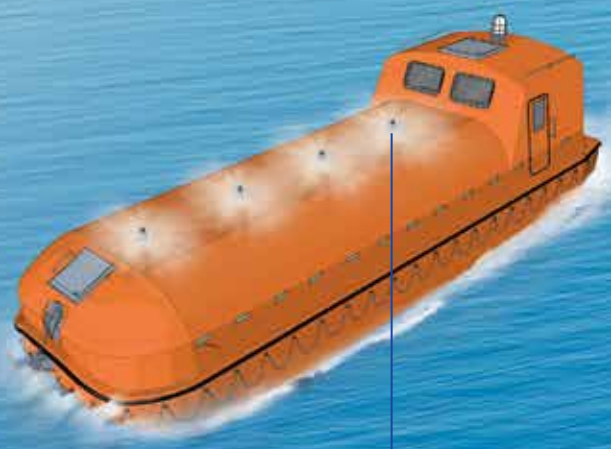
Nozzles for cooling gas tanks

For cooling tanks and installations, it is extremely important to evenly spray the entire object with water from all sides or to ensure a uniform water film on the surface. The smallest nozzle cross section should be ≧ .24 in (DIN 14495). We recommend tangential **full cone nozzles** from the **series 422**.

APPLICATION OVERVIEW FOR COMMERCIAL SHIPPING

Nozzles for helicopter landing decks

Efficient extinguishing by means of **rotating pop-up foam extinguishing nozzles.**
Spray diameters of up to 30 ft and spray heights of up to 16 ft.
In accordance with CAP 437.



Nozzles for fire protection on lifeboats

In this application, the exterior shell on lifeboats is protected against heat and fire. The water film is sprayed backwards so that the shell of the lifeboat is completely wetted and cooled with water. We recommend the **series 500.393, 686** and **490/491**.

Separators for air intake systems

Lechler **air intake systems** are used for efficient protection against sea water, rain or fog.

Ship wall nozzles for fire protection

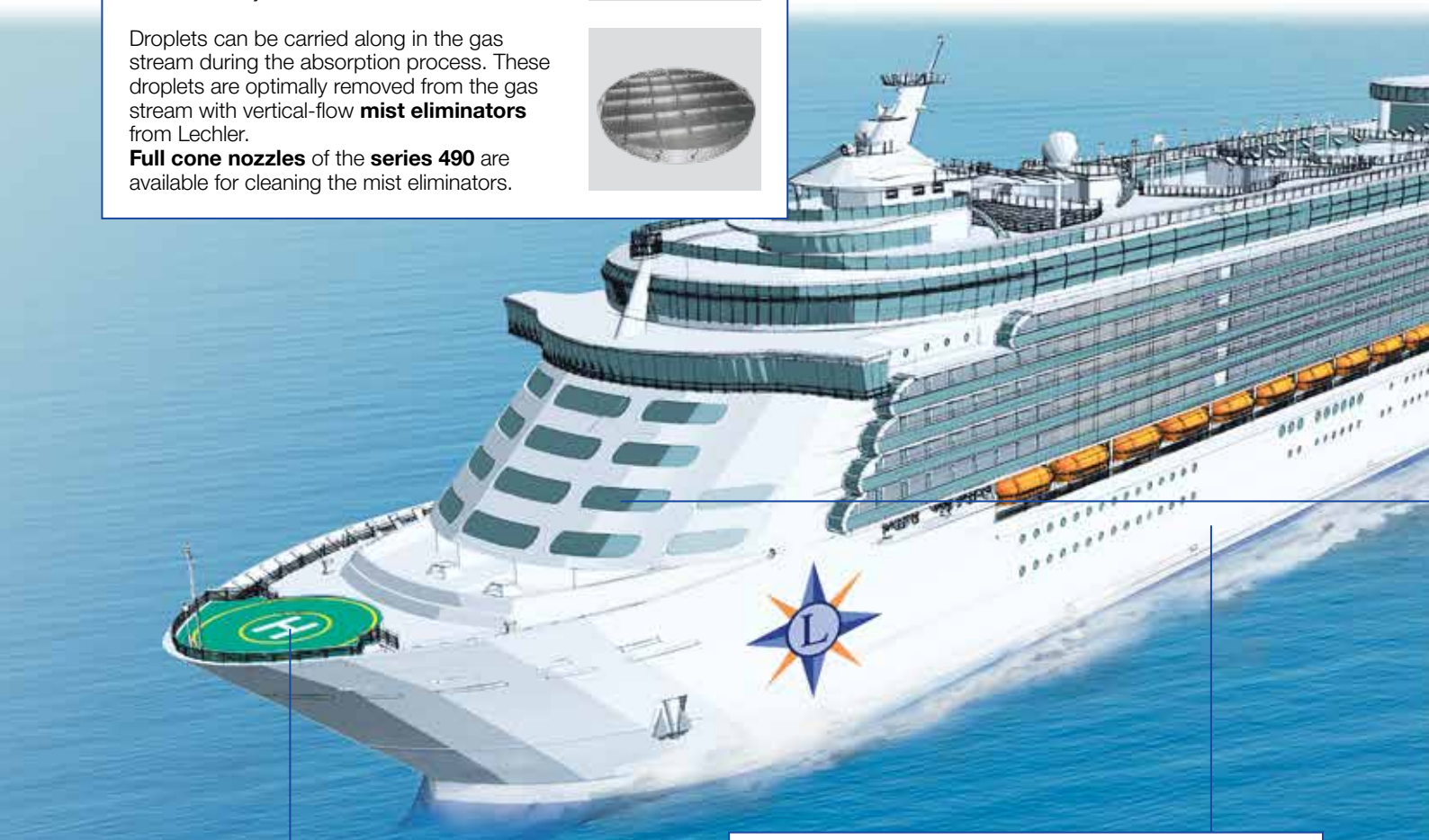
These nozzles were developed especially for seagoing tugs or supply ships, for example, and are used for fire protection on the ship walls during burning oil slicks. The water film runs down and wets the entire wall and protects it against strong heat.

APPLICATION OVERVIEW FOR CRUISE SHIPS AND YACHTS

Nozzles for exhaust gas cleaning (scrubbers) and for cleaning mist eliminators

Exhaust gases are desulfurized using **full cone nozzles** and the media salt and fresh water. Nozzles from the **series 403, 405** and **421** are ideally used.

Droplets can be carried along in the gas stream during the absorption process. These droplets are optimally removed from the gas stream with vertical-flow **mist eliminators** from Lechler.
Full cone nozzles of the **series 490** are available for cleaning the mist eliminators.



Tank cleaning nozzles for gray and black water tanks

Rotating tank cleaning nozzles can be used in these applications. Driven by the medium, these nozzles clean the tank walls in a precisely defined path by means of flat jets or gear-controlled solid streams. Spray balls can also be used for small tanks.

Nozzles for helicopter landing decks

Efficient extinguishing by means of **rotating pop-up foam extinguishing nozzles.** Spray diameters of up to 30 ft and spray heights of up to 16 ft. In accordance with CAP 437.

Cleaning exhaust gas pipes

Deposits in exhaust gas pipes can be removed by means of Lechler **flat fan nozzles** and **rotating cleaners** of the **series 573/583**.

Separators for air intake systems

Lechler **air intake systems** are used for efficient protection against sea water, rain or fog.

Mist eliminators for combustion air

Separator systems for reducing fluid content in combustion air.

Nozzles for window cleaning

Dirt and salt encrustations can be softened and removed by means of **flat fan, tongue-type** or **full cone nozzles**. Large spray angles and lower flow rates are preferred for this, requirements that can be met by our nozzle range. We recommend nozzles from the **series 632, 652, 686, 684, 490** and **422**. Installation is made easier by a wide range of accessories.
We supply special designs with polished surfaces especially for yacht construction.
Ask us for more information.

Nozzles for washing anchor chains

Washing anchor chains requires large-volume nozzles with the highest possible energy density. The **flat fan nozzles** of the **series 616/617** and **full cone nozzles of the series 490/491** are used here.

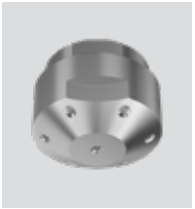
OVERVIEW FOR NAVY APPLICATIONS

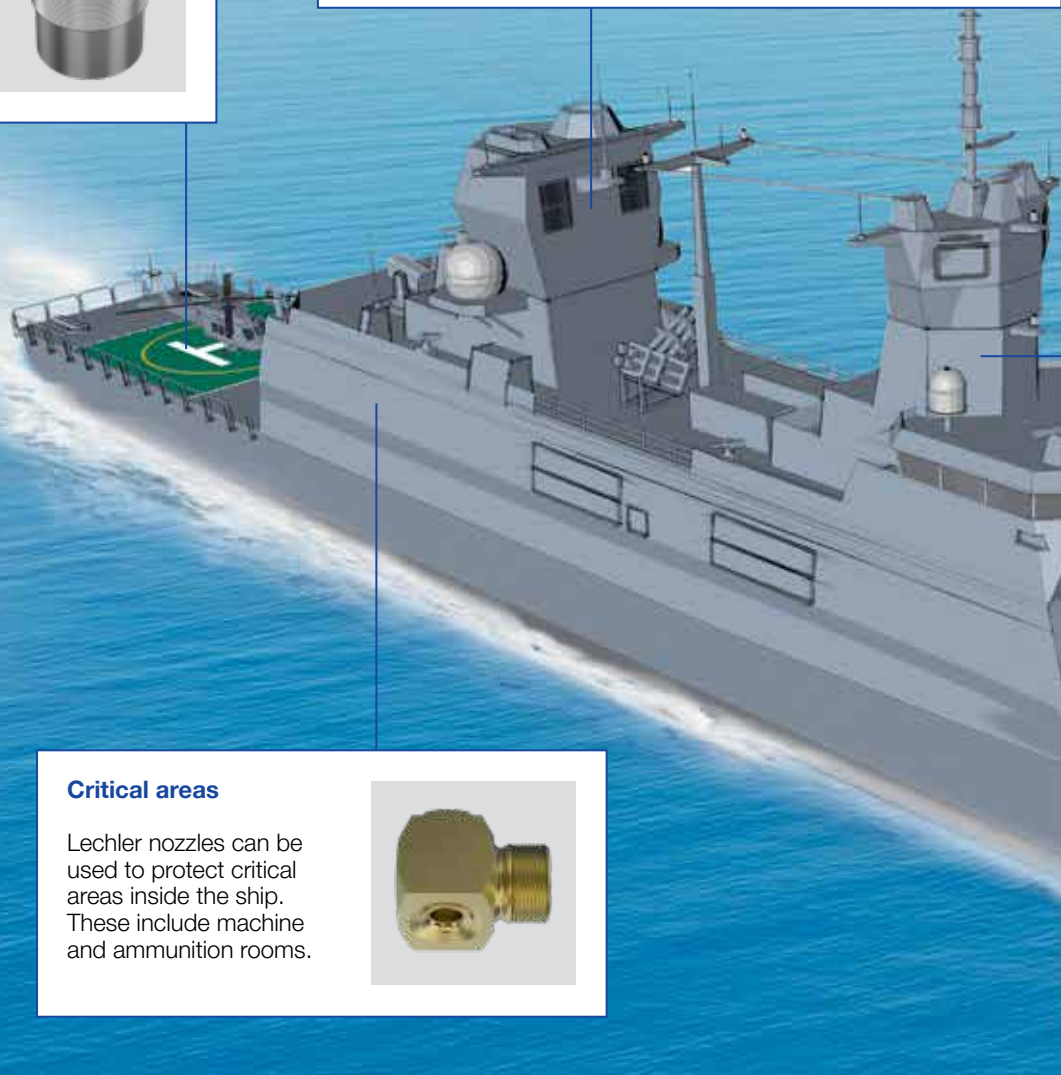
Nozzles for helicopter landing decks

Efficient extinguishing by means of **rotating pop-up foam extinguishing nozzles.** Spray diameters of up to 30 ft and spray heights of up to 16 ft. In accordance with CAP 437.

Gas cooling (quenching)

For gas cooling, a fluid is introduced which ideally completely evaporates and absorbs the thermal energy of the gas.
Very fine droplets are required for complete evaporation, this can be produced with **hollow cone** or **twin-fluid nozzles**.





Critical areas

Lechler nozzles can be used to protect critical areas inside the ship. These include machine and ammunition rooms.

IR signature reduction (exhaust gas stream)

Due to the increasing threat of highly sensitive search sensors, the heat emissions of naval ships must be significantly reduced. Hot exhaust gases can be camouflaged with the Lechler **CamouJet system**. This allows counter-measures to be activated in the required time and with the necessary effect.

IR signature reduction (outer shell/hull)

CamouSpray was specially developed for cooling the ship walls in order to largely minimize heat radiation.

NBC protection (vertical surfaces)

NBC measures are intended to protect the crew against the effects of nuclear (N), biological (B) or chemical (C) contamination. **Flat fan** or **tongue-type nozzles** are used for washing vertical surfaces.

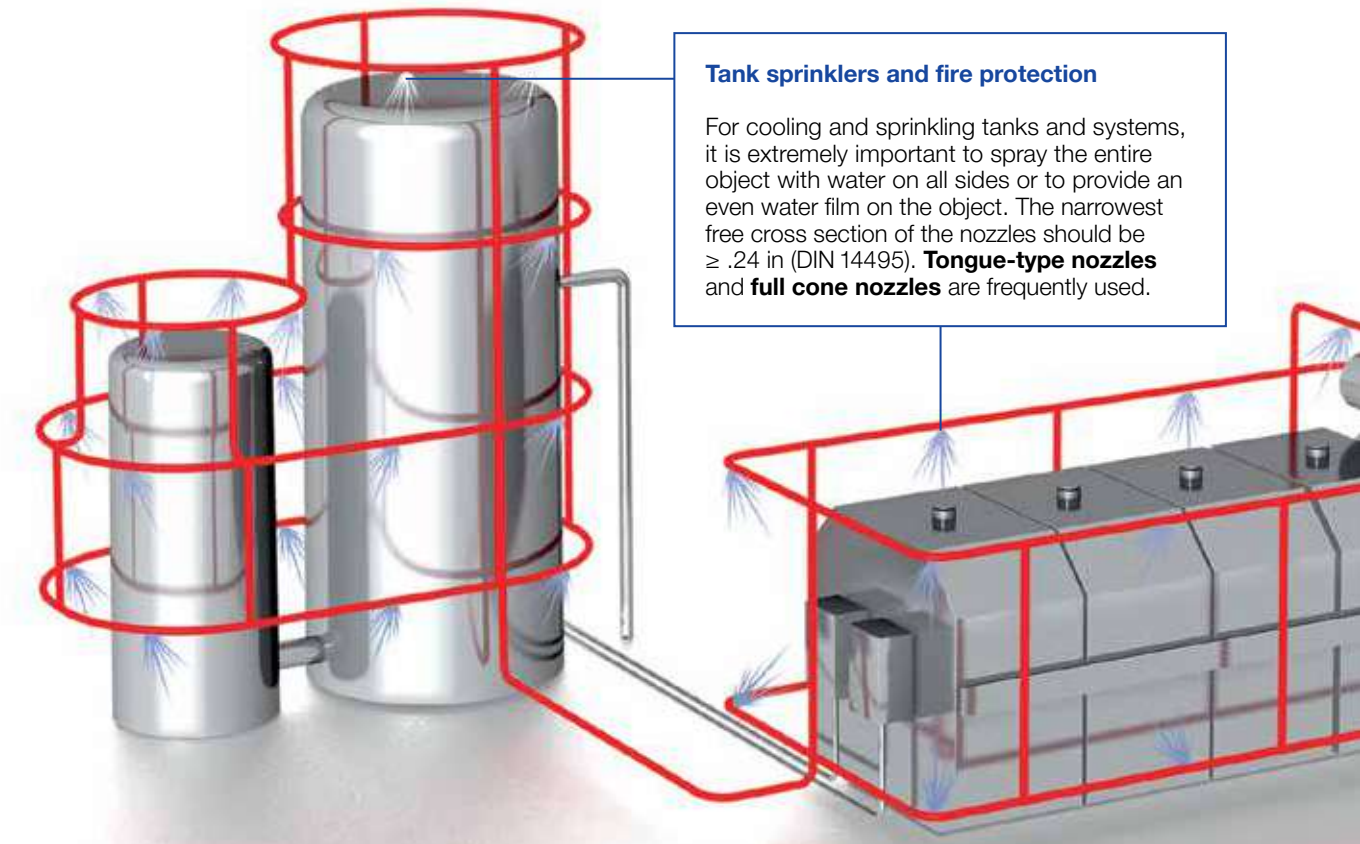
NBC protection (deck)

NBC measures are intended to protect the crew against the effects of nuclear (N), biological (B) or chemical (C) contamination. NBC residue can be flushed from the deck with **pop-out deflection plates** of the **series 571**. The nozzles generate a circular water impact with a diameter of up to 23 ft.

NBC object protection

Individual objects standing on deck such as weapons, radar systems etc. can be optimally cleaned to remove NBC residue using the Lechler object protection nozzles.

LECHLER NOZZLES AND MIST ELIMINATORS ARE CUSTOMER-SPECIFIC SYSTEMS FOR MANY MARITIME APPLICATIONS

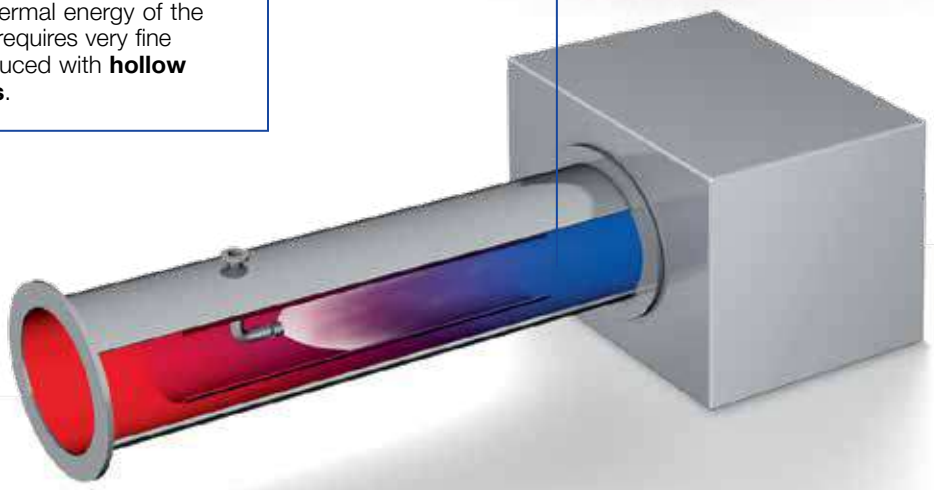


Tank sprinklers and fire protection

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 free cross section of the nozzles should be ≥ .24 in (DIN 14495). **Tongue-type nozzles** and **full cone nozzles** are frequently used.

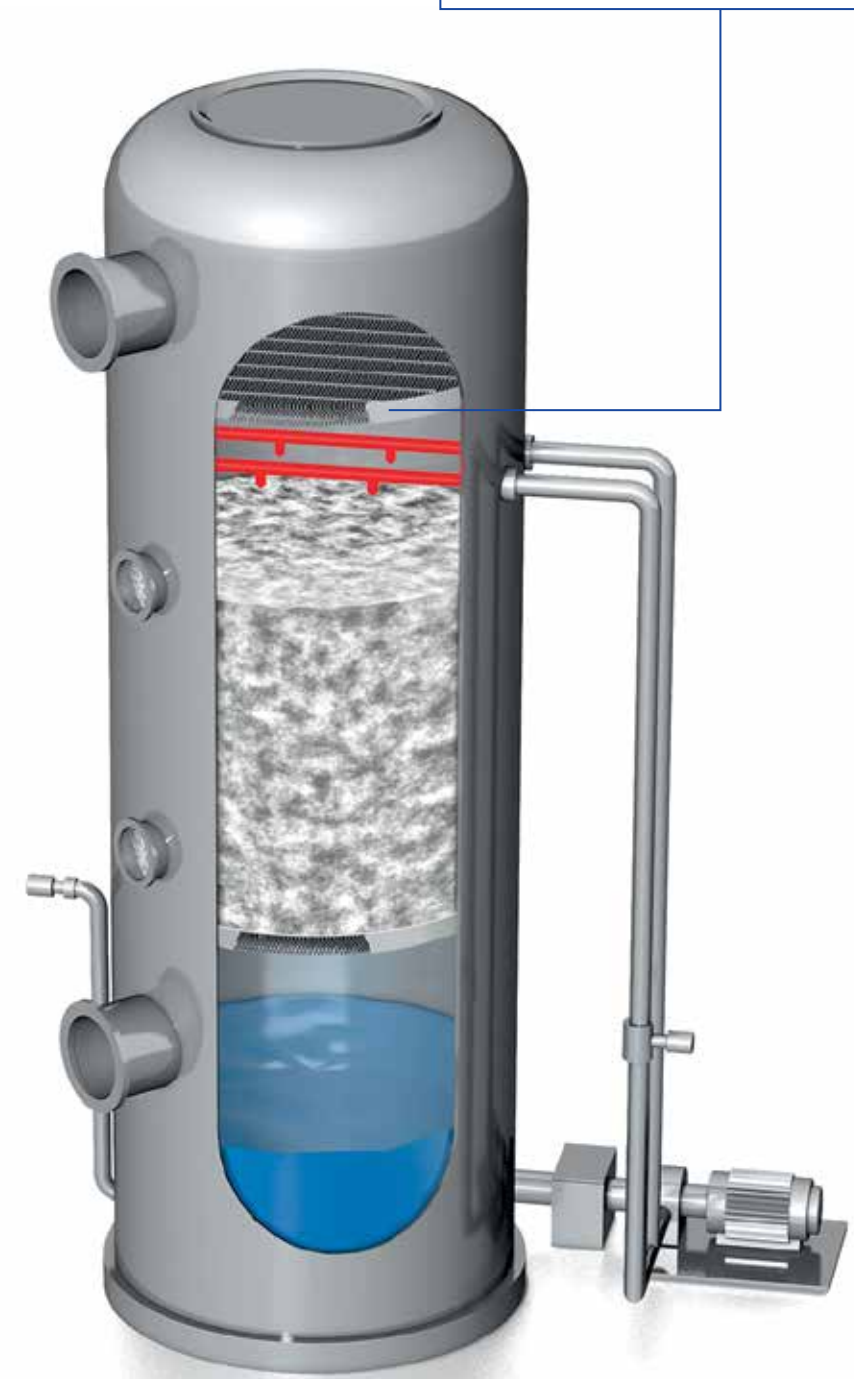
Gas cooling (Quenching)

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**.



Mist eliminators

Droplets can be carried along in the gas flow. Lechler **mist eliminators** remove droplets from the gas flow in order to prevent down-stream measuring devices from being affected. Special **full cone nozzles** are available for cleaning mist eliminators.



LECHLER NOZZLES AND MIST ELIMINATORS ARE CUSTOMER-SPECIFIC SYSTEMS FOR MANY MARITIME APPLICATIONS

Cleaning of gray and black water tanks

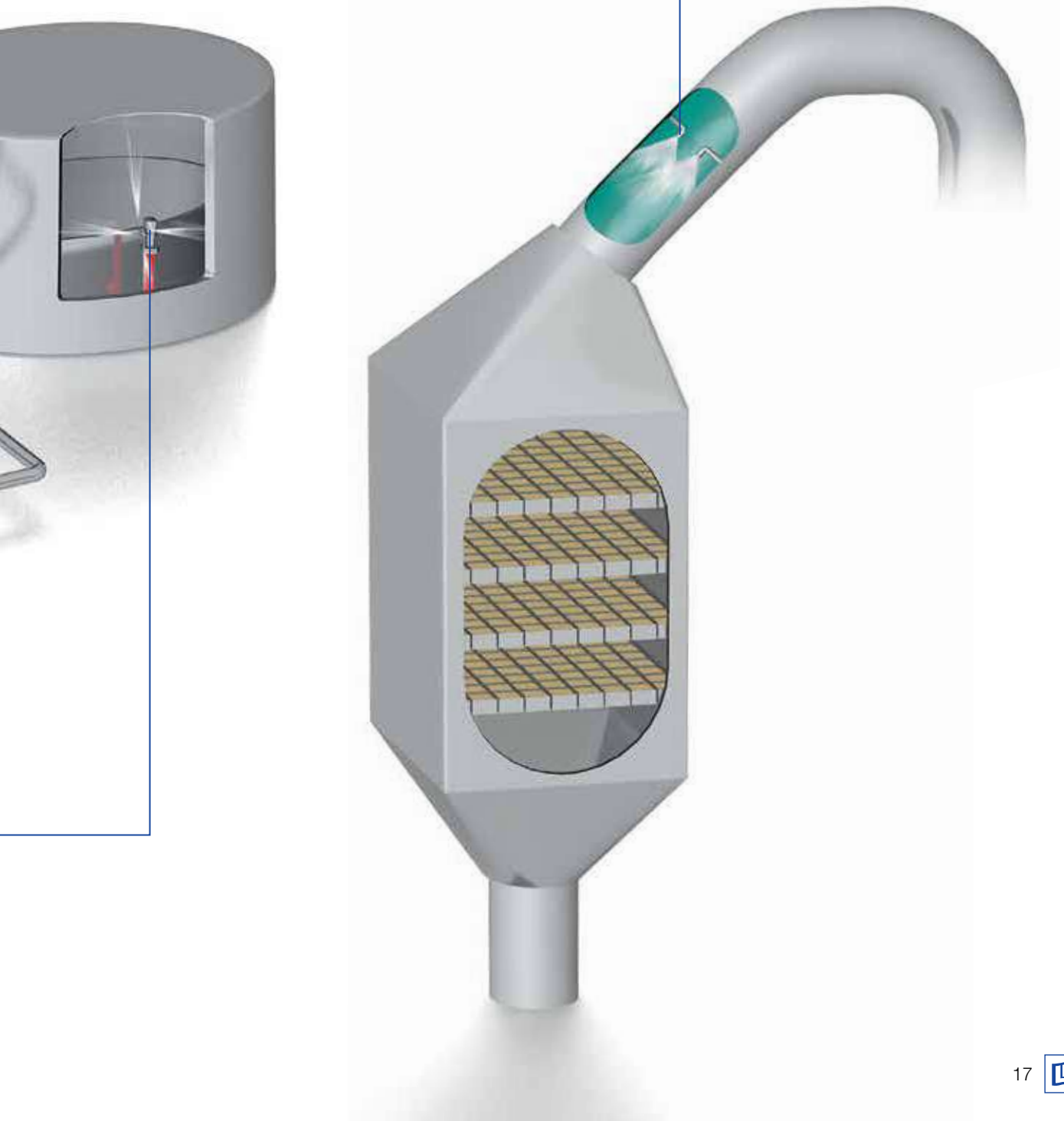
Optimum cleaning of these tanks requires targeted adaptation to the particular application. Lechler offers a wide range of **nozzles for tank and equipment cleaning** and will support you in finding the right arrangement.

Cleaning of large gray and black water tanks

High impact tank cleaning machines can be used in this application. These create 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.

NO_X reduction with SCR

With the selective catalytic reaction (SCR), achieving a high separation efficiency is possible only with the aid of a catalyst. Such a solution requires special precautions to keep the efficiency high and catalyst waste low. The reagent is added immediately before the catalyst using **twin-fluid nozzle lances** in a temperature window appropriate to the reaction.



WHAT YOU SHOULD KEEP IN MIND WHEN PLANNING

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 in ship application are between 0.5 and 8 bar. Higher differential pressures are used for single-fluid nozzles only for cleaning surfaces or generation of ultra-fine droplets in exhaust gas cooling or after treatment.

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/angles and spray 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).

Figure 1: Different spray patterns

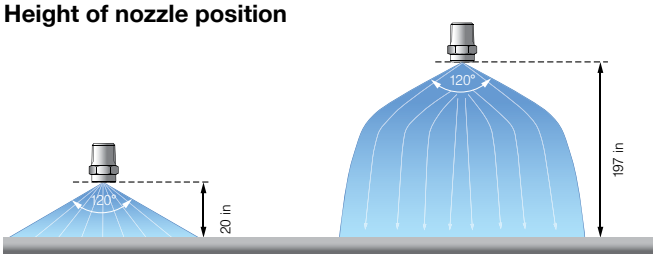
The quoted spray angles apply in close vicinity to the nozzle orifice and without external influences. Gravity and air flows influence the spray pattern. Depending on the version, single-fluid nozzles can spray the fluid as a hollow cone, full cone or flat fan.

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.

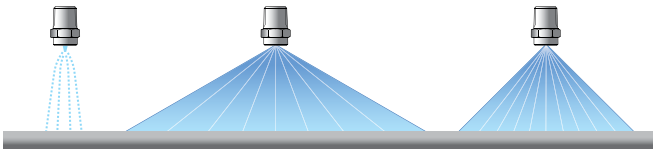
The following parameters influence the spray pattern:

Height of nozzle position



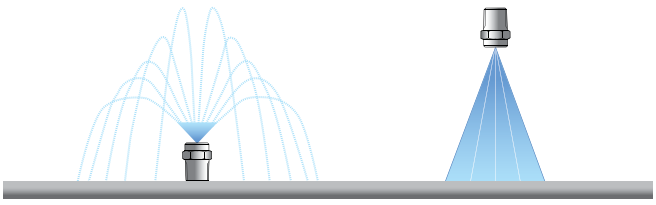
The diagram above illustrates how height influences the spray pattern.

Changing the nozzle pressure



Pressure: very low | Pressure: optimum | Pressure: very high

Spraying direction



Spraying upwards | Spraying downwards

Horizontal spraying

Figure 2: Spray patterns for different operating conditions and installation situations

③ Liquid distribution

Uniform fluid distribution is decisive for cooling and cleaning and for fire protection of surfaces such as superstructures, panoramic windows, helicopter decks and ammunition rooms. For this purpose, several nozzles must be arranged next to each other. The nozzle positioning is variable, depending on task.

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 automatically. This measuring process can also record the liquid distribution of a nozzle over a moving measuring plane. This enables simulation of window cleaning to be simulated.

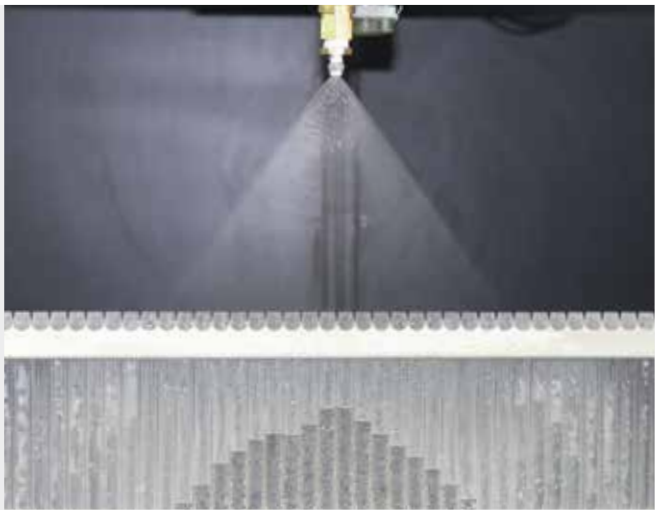


Figure 3: Fluid distribution measurement

④ Drift

When nozzles are located in an open environment, the spray patterns are influenced by the ambient conditions. Air flows such as head wind or natural wind flows in particular can influence the desired spray pattern to a greater or lesser extent. This effect can be reduced by a coarser droplet spectrum. Due to the larger mass of the droplets, these are not deflected as easily by the air flows and follow the required direction better.

This environmental influence must be taken into account especially for targeted applications such as cooling and cleaning objects or superstructures. The influence can also be minimized by differently positioned nozzles.

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.

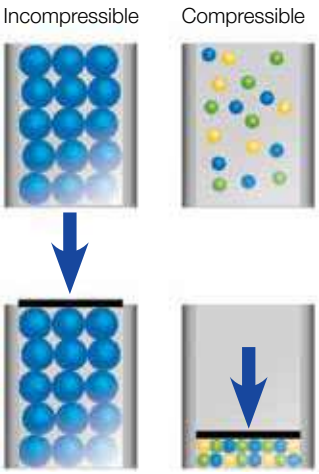


Figure 4: Compressibility behavior (left water, right air)

Gases can be delivered with almost all nozzles with which liquids are also atomized. 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 free cross section. This velocity can increase briefly after the nozzle. The chart below shows the velocity curve in a flow situation.

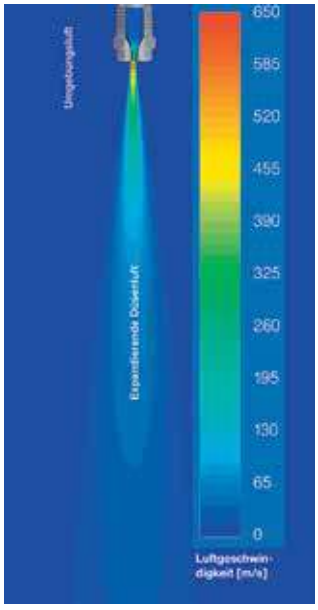


Figure 5: Representation of the speed curve of outflowing air

WHAT YOU SHOULD KEEP IN MIND WHEN PLANNING

⑥ Narrowest free cross section

The risk of a nozzle blocking depends greatly on its narrowest free 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 free 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.

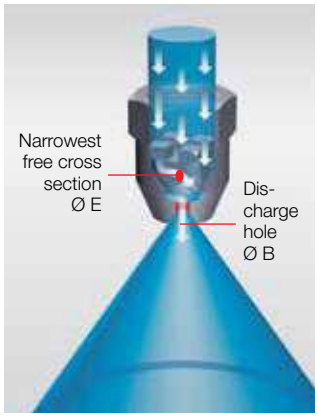


Figure 6: Narrowest free cross section

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 7: 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.

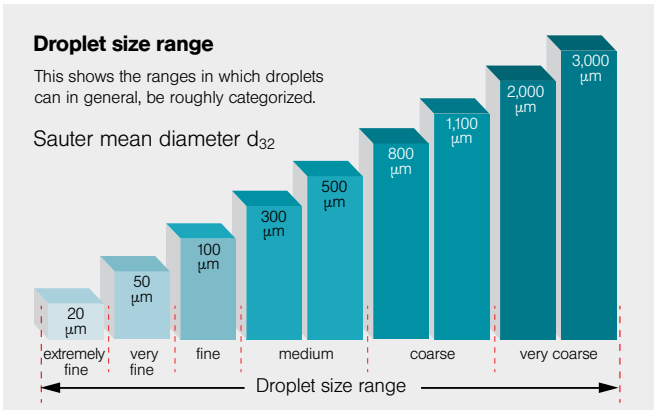


Figure 8: Droplet size definition

⑧ Ambient conditions

The environment being sprayed into is a deciding factor 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.

⑨ Materials

For shipbuilding applications, Lechler especially offers the materials aluminum bronze (DIN 2.0920 (CuAl 8)) and duplex steel 318LN SS and 904L SS. In addition, our standard materials for metal nozzles are brass and the stainless steels 303 SS, 316L SS or 316Ti SS. 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 BSPP, DIN 2999 (BSPT) and NPT.
A distinction is made here between sealing and non-sealing threads. In the case of non-sealing threads, PTFE 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 determined individually.

⑪ Mist eliminators

Mist eliminators have played a vital role as functional elements in process operations and gas scrubbing plants. They are now becoming even more important due to increasingly stringent environmental protection regulations that require a drastic reduction in the residual pollutant content after gas has passed through the scrubbers.

Our mist eliminators are developed in close cooperation with users and institutions.

We have developed mist eliminators that have been used successfully in many different areas in close cooperation with users and institutions. There are no standard solutions for this. Since practically every application has its own requirements, we develop customized droplet separators for the respective task. Our project and process engineers will be glad to advise you on design, planning and execution.

We make use of a very large selection of different profiles and materials for horizontal and vertical flow directions.

In order to design and plan mist eliminators, it is necessary to have precise knowledge of the operating and performance data of the separation systems. State-of-the-art measuring equipment in the new Lechler technical laboratory allows us to validate performance data and simulate specific installation situations.

If the gas flows are heavily laden with dust, deposits or caking can occur under unfavorable conditions which impair the efficiency of the mist eliminators. In order to guarantee availability in continuous operation, it is recommended to install a cleaning system. Cyclical spraying of the mist eliminators with Lechler full cone nozzles has proven effective here.

WHAT YOU SHOULD KEEP IN MIND WHEN PLANNING

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. 9 and 10) 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 result and 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. 11).

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. 12). 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.

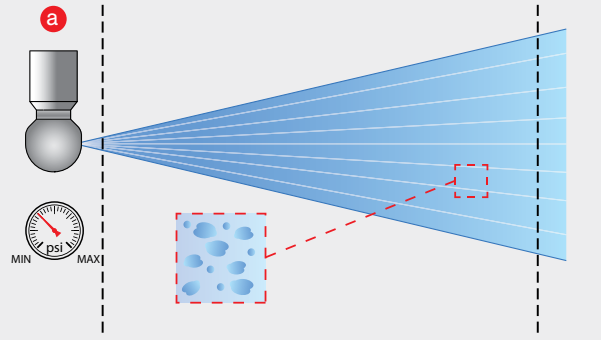


Figure 9: Rotating cleaning nozzles with recommended operating pressure

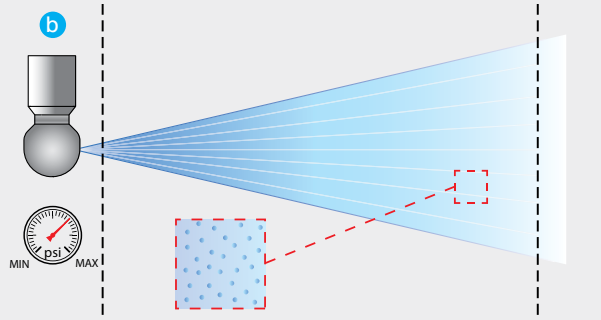
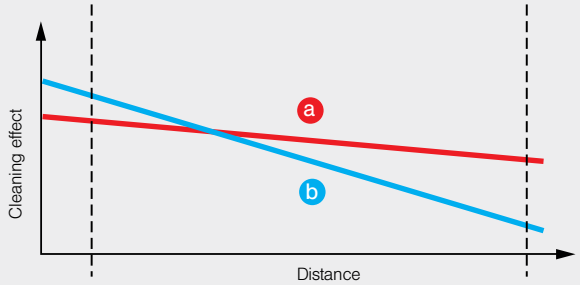


Figure 10: Rotating cleaning nozzles with operating pressure too high



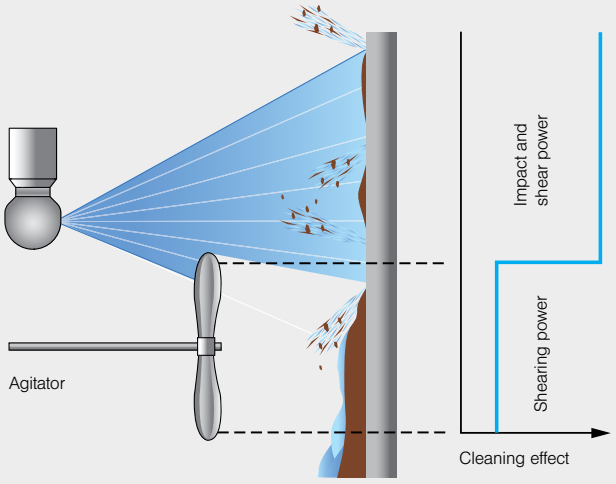


Figure 11: Cleaning mechanisms, impact and shearing power

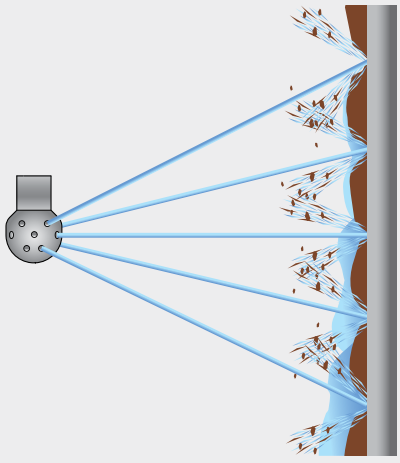


Figure 12: Cleaning with a spray ball

⑬ 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 media

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.

⑭ Approvals

In shipbuilding, approvals from the common certification bodies are often requested for the nozzles. Normally, acceptance of the overall system is required and the nozzle is only part of this. It must therefore be checked exactly in advance whether an individual nozzle acceptance is necessary or whether the nozzle can be accepted as part of the system.

Some nozzles have approvals from the Bundeswehr Technical Center. If necessary, NATO stock numbers can be recoded for Lechler nozzles.

⑮ Export approvals

Please note that nozzles used for military shipping may require export approval. This must be checked in advance.

Figure 13: Chemical attack on a spray ball

THE RIGHT NOZZLE FOR EVERY APPLICATION

Application areas

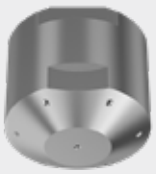
Fire protection

- Hatch cover
- Lifeboat
- Ship wall
- Ammunition room
- Helicopter deck

Chemical, biological, radiological and nuclear (NBC)

- Object protection
- Surface cleaning

Nozzle series

Series	**490/491**	**686**	**571/500.289**	**502/503**
Designation	Axial-flow full cone nozzles	Tongue-type nozzles	Deflector-plate nozzles	Multiple solid stream nozzles
				
Page	42/43	53	67/68	70
Application				

Series	**524/525/500.542**	**400/401**	**500.393**	**500.447**
Designation	Deflector-plate nozzles	Full cone nozzles with protection cap	Deflector-plate nozzles	Pop-up foam extinguishing nozzles
				
Page	45	46	49	49/50
Application				

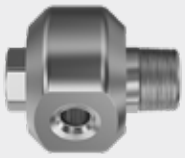
Series	**573/583**	**5B2/5B3**	**170/180**	**76X**
Designation	Rotating cleaners	Static spray balls	Twin-fluid nozzles	Twin-fluid atomizing nozzles
				
Page	61	64/65	27	28/29
Application				

Gas cooling/gas treatment

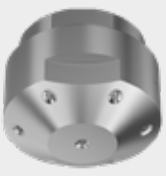
- Urea injection
- Gas tank
- Exhaust gas pipe
- Scrubber

Cleaning

- Windows
- Gray/black water tank
- Anchor chain
- Mist eliminator
- Scrubber (internal cleaning)

422/423	**616/617**	**652**	**632/633**	**684.568**
Tangential full cone nozzles	Flat fan nozzles	Flat fan nozzles for retaining nut	Flat fan nozzles	Tongue-type nozzles
				
44	48	51	52	71

302/304	**600.471/472**	**600.507/600.516**	**600.577**	**5TA/5TB/5TM**
Eccentric hollow cone nozzles	Tongue-type nozzles	Polished tongue-type nozzles	Polished flat fan nozzles	High impact tank cleaning machine
				
73	71	54	55	57/58

214/216	**502/503**	**405**	**403**	**419/421**
Axial-flow hollow cone nozzles	Cluster nozzles	Axial-flow full cone nozzles	Axial-flow full cone nozzles	Axial-flow full cone nozzles
				
31	32	33	34	35/36

COMMERCIAL SHIPPING

With constant growing global trade, maritime trade will also continue to increase. 98 percent of intercontinental trade and 62 percent of internal European trade takes place by means of commercial shipping. A wide range of applications for nozzles in commercial shipping make them an indispensable part of this giant economic sector. Nozzles are used for fire protection in particular, but also for various cleaning tasks such as exhaust gas scrubbing or tank cleaning.

Twin-fluid nozzles for exhaust gas cooling
Series 170/180

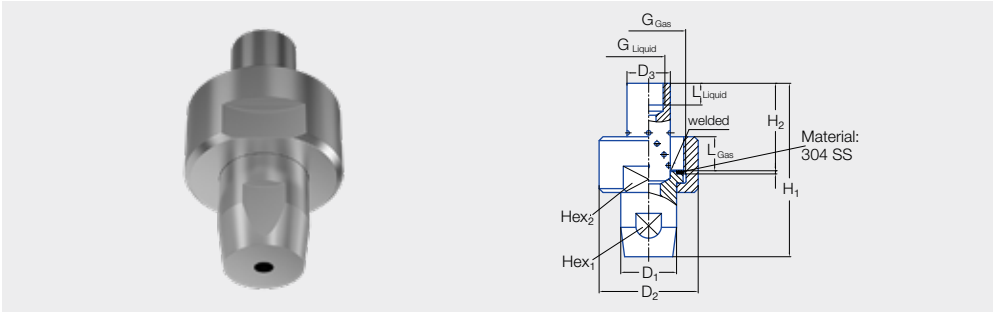
Efficient atomization by mixing liquid medium and gas.

- Internal mixing principle (a mixing chamber inside the nozzle combines a gas and a liquid to produce an intensive two-phase mixture)
- Extremely fine atomization with good control behavior
- Large clear cross sections
- Lower air consumption than for nozzles with external mixing
- Maintenance-free operation

Applications:
Gas cooling, humidification, flue-gas desulfurization, absorption.

The large free cross sections of the nozzle permit maintenance-free operation even for atomization of viscous and abrasive media with high solids load.

Other sizes available on request



Type	Dimensions [in]										
	H_1	H_2	D_1	D_2	D_3	A/F_1	Hex_2	G_{Liquid}	$G_{Gas\ BSPP}$	L_{Liquid}	L_{Gas}
180.641	1.61	-	0.55	1.24	0.45	0.47	24	M8 x 1 A	G 3/4 I	0.31	0.47
170.801	3.19	1.59	1.26	2.27	0.59	1.06	50	3/8 BSPT	G1 1/4 I	0.47	0.51
170.881	3.19	1.59	1.26	2.27	0.59	1.06	50	3/8 BSPT	G1 1/4 I	0.47	0.51
170.961	4.41	2.22	1.42	2.52	1.10	1.26	55	1/2 BSPT	G1 1/2 I	0.55	0.87

Ordering no. / Type	E Ø [in] Air	E Ø [in] Water	Air pressure **p** [psi] 15 **p** water [psi]	15 $\dot{V}$ water [gal/h]	15 $\dot{V}_{n\ air}$ [SCFM]	30 **p** water [psi]	30 $\dot{V}$ water [gal/h]	30 $\dot{V}_{n\ air}$ [SCFM]	45 **p** water [psi]	45 $\dot{V}$ water [gal/h]	45 $\dot{V}_{n\ air}$ [SCFM]	60 **p** water [psi]	60 $\dot{V}$ water [gal/h]	60 $\dot{V}_{n\ air}$ [SCFM]
180.641	.12	.17	11.6	.11	11.8	24.7	.16	18.8	36.3	.21	25.3	45.0	.24	32.4
			13.1	.26	10.6	27.6	.40	16.5	46.4	.80	21.2	66.7	1.1	25.3
			18.9	.66	8.2	39.2	.92	13.5	58.0	1.3	18.8	84.1	1.8	21.2
170.801	.08	.22	10.2	.26	23.5	21.8	.26	34.1	31.9	.32	47.1	46.4	.32	61.8
			13.1	.79	20.6	26.1	1.3	30.6	37.7	1.8	42.4	52.2	2.6	53.6
			14.5	1.3	18.8	29.0	2.6	28.3	43.5	3.7	37.1	58.0	5.3	48.9
170.881	.11	.30	8.7	.26	35.3	21.8	.32	55.9	31.9	.40	76.5	45.0	.48	100.7
			11.6	1.3	32.4	24.7	1.8	53.0	36.3	2.6	69.5	50.8	4.0	90.7
			13.1	2.1	29.4	27.6	3.4	47.1	43.5	5.0	61.8	59.5	7.4	84.2
170.961	.13	.37	8.7	.26	55.3	20.3	.32	91.2	31.9	.40	123.6	43.5	.48	161.9
			11.6	1.3	50	24.7	2.6	76.5	37.7	4.0	105.4	50.8	5.3	129.5
			14.5	3.2	42.4	27.6	5.0	67.7	43.5	6.9	89.5	59.5	10.0	116.5

E = narrowest free cross section
Materials on request

Small spray angle (15°), suitable for small cross sections and horizontal channels

Very large turn down ratio of 20:1 (in some cases up to 40:1)

Adjustment of the droplet spectrum by changing the air/liquid ratio

Very fine droplet spectrum

Clog-resistant thanks to large free cross sections without internal fittings

Typical pressure range Liquid 15–87 psi, atomizing air 15–87 psi,

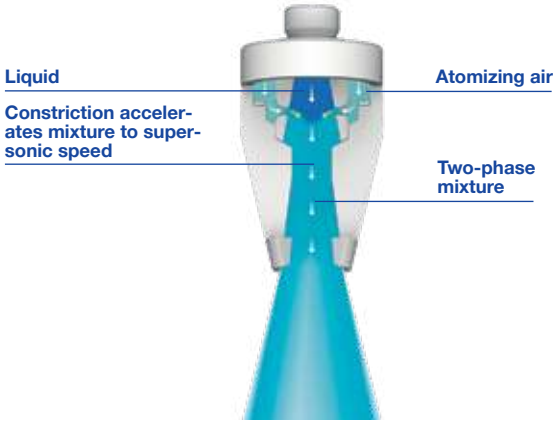


Diagram of the Laval nozzle

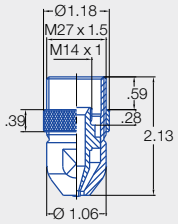
Twin-fluid atomizing nozzles for gas treatment
Series 76X

- Twin-fluid nozzle with external mixing for production of fine droplets
- Modular concept
- Wide range of combination options

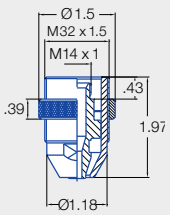
Applications:
Gas treatment, combustion processes.

Material:
Seawater-resistant stainless steels or stainless steels adapted to the combustion process.

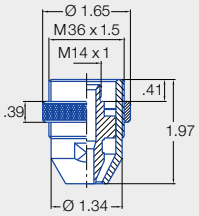
- Solid stream nozzles for high-viscosity suspensions and fluids
- Nozzles with pre-atomization for high atomization efficiency



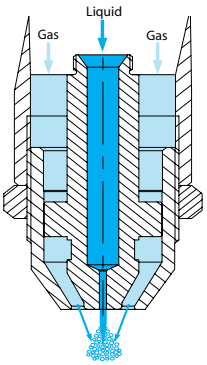
SN 1



SN 2

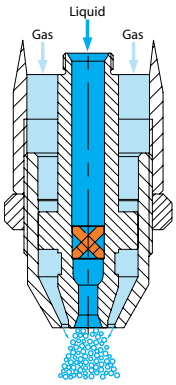


SN 3



Twin-fluid nozzle with external mixing and solid stream orifice

The delivered solid fluid stream is atomized by the gas into small droplets immediately outside the nozzle.



Twin-fluid nozzle with external mixing and pre-atomization

The fluid flows through an internal swirl insert, which causes the fluid to rotate. As a result, a full cone is formed at the orifice consisting of large droplets. These are then atomized into small droplets by the atomizing gas, which emerges from the annular gap. This is more efficient than solid stream atomization because the fluid is already in droplet form and the atomizing gas therefore has a greater attack surface area for the shear forces.

Overview of nozzle sizes

Nozzle/series		Size	Reference air pressure dp [psi]	Air flow rate [SCFM]
Solid stream orifice	**with pre-atomization**			
760.XX0.1Y	**761.XX6**	SN 1	60	15
762.XX0.1Y	**763.XX6**	SN 1	60	27
764.XX0.1Y	**765.XX6**	SN 2	60	65
–	**767.XX6**	SN 3	60	75
766.XX0.1Y	**–**	SN 3	60	106

Twin-fluid atomizing nozzles for lance mounting
Series 76X

Twin-fluid nozzle with external mixing and solid stream orifice

Flow rate								Atomizing air							
No.	Ordering no. / Type	B [in]	Flow Rate gal/min **p** [psi] 15	10	7	4	1	Size	SCFM **p** [psi] 15	30	45	60	75	90	Outside diameter of lance D [in]
1	**760.050**	0.02	0.07	0.04	0.03	0.02	0.01	SN 1	7	11	15	18	22	26	1.18
	760.100	0.04	0.18	0.15	0.12	0.10	0.06								
	760.150	0.06	3.96	0.33	0.28	0.22	0.12								
	760.200	0.08	0.70	0.59	0.50	0.39	0.22								
	760.250	0.10	1.10	0.92	0.78	0.60	0.35								
	760.300	0.12	1.58	1.33	1.12	0.87	0.50								
2	**762.150**	0.06	0.40	0.33	0.28	0.22	0.12	SN 1	14	21	27	34	41	47	1.18
	762.200	0.08	0.70	0.59	0.50	0.39	0.22								
	762.250	0.10	1.10	0.92	0.78	0.60	0.35								
	762.300	0.12	1.58	1.33	1.12	0.87	0.50								
	762.320	0.13	1.80	1.51	1.27	0.99	0.57								
3	**764.300**	0.12	1.58	1.33	1.12	0.87	0.50	SN 2	32	49	65	81	97	113	1.50
	764.500	0.20	4.40	3.68	3.11	2.41	1.39								
4	**766.300**	0.12	1.58	1.33	1.12	0.87	0.50	SN 3	53	79	106	132	159	185	1.65
	766.500	0.20	4.40	3.68	3.11	2.41	1.39								

B = bore diameter
Materials on request

Twin-fluid nozzle with external mixing and pre-atomization

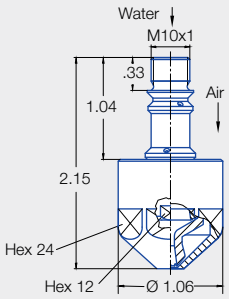
Flow rate										Atomizing air							
No.	Ordering no. / Type	B [in]	E [in]	Flow Rate (Gallons Per Minute) 15 psi	30 psi	45 psi	60 psi	75 psi	90 psi	Size	SCFM **p** [psi] 15	30	45	60	75	90	Outside diameter of lance D [in]
1	**761.446.1Y.00**	0.05	0.04	0.25	0.33	0.39	0.44	0.48	0.51	SN 1	7	11	15	18	22	26	1.18
	761.486.1Y.00	0.06	0.05	0.32	0.42	0.50	0.56	0.61	0.66								
	761.506.1Y.00	0.06	0.05	0.36	0.48	0.56	0.63	0.69	0.74								
	761.526.1Y.00	0.06	0.05	0.40	0.53	0.62	0.70	0.76	0.82								
	761.566.1Y.00	0.07	0.05	0.50	0.66	0.78	0.87	0.95	1.02								
	761.606.1Y.00	0.08	0.06	0.63	0.83	0.98	1.10	1.20	1.29								
2	**763.446.1Y.00**	0.05	0.04	0.25	0.33	0.39	0.44	0.48	0.51	SN 1	14	21	27	34	41	47	1.18
	763.486.1Y.00	0.06	0.05	0.32	0.42	0.50	0.56	0.61	0.66								
	763.506.1Y.00	0.06	0.05	0.36	0.48	0.56	0.63	0.69	0.74								
	763.526.1Y.00	0.06	0.05	0.40	0.53	0.62	0.70	0.76	0.82								
	763.566.1Y.00	0.07	0.05	0.50	0.66	0.78	0.87	0.95	1.02								
	763.606.1Y.00	0.08	0.06	0.63	0.83	0.98	1.10	1.20	1.29								
3	**765.486.1Y.00**	0.06	0.05	0.32	0.42	0.50	0.56	0.61	0.66	SN 2	32	49	65	82	97	113	1.5
	765.646.1Y.00	0.09	0.07	0.80	1.06	1.24	1.39	1.52	1.64								
	765.746.1Y.00	0.13	0.07	1.42	1.88	2.21	2.48	2.71	2.91								
4	**767.646.1Y.00**	0.09	0.07	0.80	1.06	2.49	1.39	1.52	1.64	SN 3	38	57	75	94	113	132	1.65
	767.766.1Y.00	0.13	0.09	1.60	2.11	1.24	2.79	3.05	3.28								
	767.846.1Y.00	0.16	0.13	2.49	3.30	3.88	4.36	4.76	5.12								

B = bore diameter · E = narrowest free cross section
Materials on request

Twin-fluid nozzles for exhaust gas cleaning
Series 1AW

Lechler twin-fluid nozzles for SCR installations operate according to a newly developed, patent pending atomization principle. This enables finest droplet spectra and shortest evaporation distances while also allowing very good controllability of the flow rate.

Applications:
Urea injection, gas cooling.



Spray angle of the individual nozzle
15°
as full cone

Turn-down ratio
of 10:1

Particularly fine droplets thanks to tertiary atomization

Design
as single or cluster nozzle lances

Typical pressure range
Liquid 15-75 psi,
atomizing air
15-75 psi,

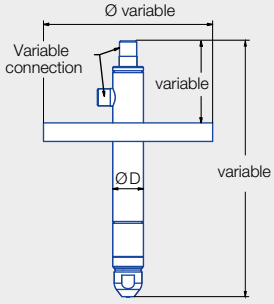
Spray angle	Ordering no. / Type	E Ø [in] Air	E Ø [in] Water	Air pressure **p** [psi] 30 **p** water [psi]	30 $\dot{V}$ water [gal/h]	30 $\dot{V}_{n\ air}$ [SCFM]	45 **p** water [psi]	45 $\dot{V}$ water [gal/h]	45 $\dot{V}_{n\ air}$ [SCFM]
approx. 20°	**1AW.151**	0.03	0.02	29.0	.02	9	58.0	.02	16
				0.4	.04	9	72.5	.03	16
	1AW.231	0.03	0.04	29.0	.04	7	58.0	.05	12
				43.5	.07	7	101.5	.12	11
	1AW.251	0.03	0.90	29.0	.04	8	58.0	.06	14
				72.5	.24	7	116.0	.27	12

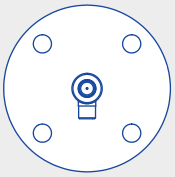
E = narrowest free cross section
Materials on request

Adjustment of the droplet spectrum
by changing the air/ liquid ratio

Twin-fluid atomizing nozzles in lance version
Series 77X/78X/79X

- Twin-fluid nozzle with external mixing for production of fine droplets
- Lance length up to 79 in
- Different standardized apparatus connections:
  – Flange
  – Tri-Clamp
- Other lances on request

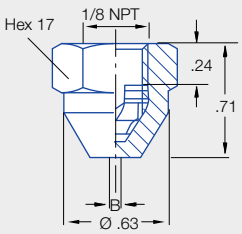




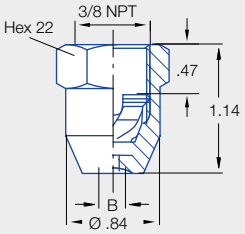
Axial-flow hollow cone nozzles
Series 214/216

Fine, uniform hollow cone spray.

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



Series 214



Series 216

Spray angle	Ordering no. Type	G Male NPT	B Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray diameter D at p = 40 psi H = 10 in
60°	**214.184**	1/8	.020	.019	.01	.02	0.08	.02	.03	.04	.04	8
80°	**214.245**	1/8	.039	.019	.02	.04	0.16	.05	.06	.07	.08	18
	214.305	1/8	.071	.019	.05	.07	0.32	.10	.12	.14	.16	18
60°	**216.324**	3/8	.39	.039	.06	.09	0.40	.12	.15	.18	.20	8
	216.364	3/8	.55	.055	.10	.14	0.63	.20	.24	.28	.31	8
	216.404	3/8	.79	.078	.16	.22	1.00	.31	.38	.44	.49	8
90°	**216.496**	3/8	.118	.078	.26	.37	1.70	.53	.65	.75	.83	20
	216.566	3/8	.158	.078	.39	.55	2.50	.78	.95	1.1	1.2	20
	216.646	3/8	.138	.078	.62	.88	4.00	1.2	1.5	1.8	2.0	20
	216.686	3/8	.158	.078	.78	1.1	5.00	1.6	1.9	2.2	2.5	20
	216.726	3/8	.197	.078	.98	1.4	6.30	2.0	2.4	2.8	3.1	20
	216.776	3/8	.236	.078	1.3	1.9	8.50	2.6	3.2	3.7	4.2	20

B = bore diameter · E = narrowest free cross section
Materials on request

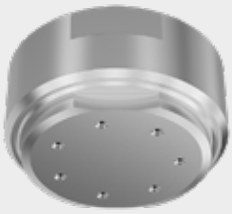
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Cluster head nozzles
Series 502/503

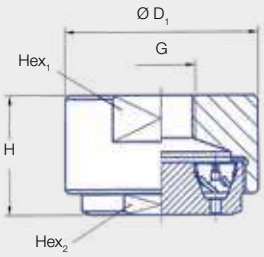
Fine full cone atomization with the aid of several hollow cones spraying into one another.

Applications:
Cooling of gaseous and solid material, desuperheating, chlorine precipitation, absorption as well as for improvement of chemical reaction by enlarging the contact area.

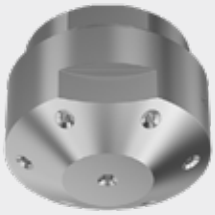
Special versions:
Welded versions for high-temperature applications on request.



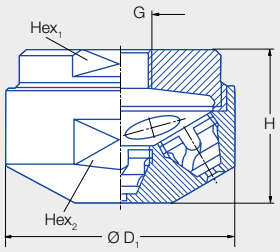
∢ 70°



Dimensions [in]	1/2	3/4
Hex_1	1.8	2.6
Hex_2	1.5	2.2
H	1.0	1.8
D_1	2.0	3.0



∢ 130°

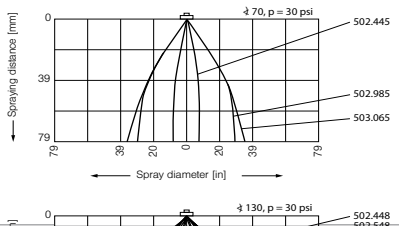


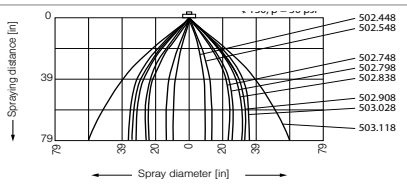
Dimensions [in]	1/2	3/4
Hex_1	1.1	2.0
Hex_2	1.4	2.2
H	1.1	2.1
D_1	1.6	2.4

Spray angle	Ordering no. Type	G Female NPT	B Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	Spray diameter D at p = 30 psi H = 40"	H = 80"
70°	**502.445**	1/2	.039	.020	.19	.27	1.25	.39	1.98	2.80	400	400
	502.985	3/4	.138	.020	4.3	6.1	28.00	8.7	44.30	62.60	1,200	1,500
	503.065	3/4	.197	.039	7.0	9.9	45.00	14.0	71.10	100.60	1,200	1,800
130°	**502.448**	1/2	.039	.020	.19	.27	1.25	.39	1.98	2.80	500	500
	502.548	1/2	.071	.020	.35	.49	2.24	.70	3.54	5.01	700	700
	502.748	3/4	.079	.079	1.2	1.6	7.10	2.2	11.20	15.90	1,100	1,200
	502.838	3/4	.118	.079	1.8	2.6	11.80	3.7	18.70	26.40	1,400	1,600
	502.908	3/4	.158	.079	2.8	3.9	18.00	5.6	28.40	40.20	1,500	1,800
	503.028	3/4	.158	.079	5.5	7.7	35.50	11.0	56.10	79.40	1,600	1,800
	503.118	3/4	.236	.079	9.2	13.1	60.00	18.61	95.00	134.00	2,000	3,000

B = bore diameter · E = narrowest free cross section
Materials on request

Diagram of spray diameter



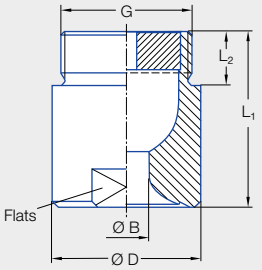


Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

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.



Dimensions (in.)					
G (Male NPT)	L1	L2	D	Flats	Wt. brass (lb.)
1-1/4	1.97	.75	1.93	1-5/8	1.16
1-1/2	2.36	.75	2.32	2	2.02
2	3.07	.94	2.68	2-3/8	3.39

Spray angle	Ordering no. Type	Material no. 316L SS 1Y	Connection Male NPT 1¼"	1½"	2"	Orifice diam. (in.)	Free passage (in.)	Flow Rate (Gallons Per Minute) 5 psi	10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	Spray Diam. D (in.) @ 30 psi H=20"	H=40"
60°	**405. 204**	○	**BP**	-	-	.441	.229	13	17	23	100	27	30	35	22	41
	405. 284	○	-	**BR**	-	.563	.276	21	28	36	160	43	48	57	23	43
	405. 324	○	-	-	**BV**	.646	.296	26	35	46	200	54	60	71	23	43
	405. 364	○	-	-	**BV**	.725	.335	33	43	57	250	67	75	88	23	43
	405. 404	○	-	-	**BV**	.788	.276	41	54	72	315	85	95	111	23	43
90°	**405. 206**	○	**BP**	-	-	.473	.197	13	17	23	100	27	30	35	31	57
	405. 286	○	-	**BR**	-	.599	.244	21	28	36	160	43	48	57	31	61
	405. 326	○	-	-	**BV**	.678	.303	26	35	46	200	54	60	71	33	63
	405. 366	○	-	-	**BV**	.768	.343	33	43	57	250	67	75	88	33	63
	405. 406	○	-	-	**BV**	.867	.374	41	54	72	315	85	95	111	33	63
120°	**405. 208**	○	**BP**	-	-	.500	.197	13	17	23	100	27	30	35	57	102
	405. 288	○	-	**BR**	-	.630	.260	21	28	36	160	43	48	57	59	106
	405. 328	○	-	-	**BV**	.701	.311	26	35	46	200	54	60	71	59	110
	405. 368	○	-	-	**BV**	.792	.347	33	43	57	250	67	75	88	59	110
	405. 408	○	-	-	**BV**	.883	.359	41	54	72	315	85	95	111	59	110

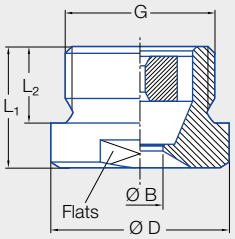
B = bore diameter · E = narrowest free cross section
Materials and higher flow rates on request

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$
(≤ 10 bar)

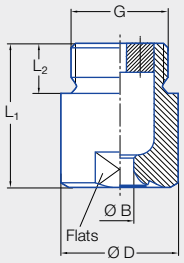
Axial-flow full cone nozzles
Series 403

Very uniform spray pattern.

Applications:
Cooling of gaseous fluids and solids, spraying over packings, scrubbing and washing processes in exhaust gas cleaning installations (SOx reduction).



90°-version



120°-version

90°-version

Dimensions (in.)					
G (Male NPT)	L1	L2	D	Flats	Wt. (lb.)
2-1/2	2.0	1.1	3.3	3.0	2.9
3	2.4	1.2	3.9	3.3	3.7
3-1/2	2.8	1.3	4.6	4.1	8.4

120°-version

Dimensions (in.)					
G (Male NPT)	L1	L2	D	Flats	Wt. (lb.)
2-1/2	4.9	1.1	3.3	3.0	6.6
3	6.0	1.2	3.9	3.3	11.5
3-1/2	6.1	1.3	4.6	4.1	18.5
4	6.5	1.4	5.0	4.3	21.0

Spray angle	Ordering no. Type	Mat. no. 316L SS 1Y	Connection Male NPT 2½"	3"	3½"	4"	Orifice diam. (in.)	Free passage (in.)	Flow Rate (Gallons Per Minute) 5 psi	10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	80 psi	100 psi	Spray Diam. D (in.) @ 30 psi H=20"	H=40"
90°	403. 446	○	BY	-	-	-	.985	.473	52	69	91	400	107	120	141	159	173	35	67
	403. 486	○	BY	-	-	-	1.162	.473	65	86	114	500	134	150	177	198	217	35	67
	403. 526	○	-	MA	-	-	1.000	.544	82	109	143	630	169	189	223	250	273	35	67
	403. 606	○	-	-	MC	-	1.576	.591	131	173	228	1000	269	300	353	396	433	38	69
120°	403. 448	○	BY	-	-	-	1.005	.394	52	69	91	400	107	120	141	159	173	59	112
	403. 488	○	BY	-	-	-	1.162	.433	65	86	114	500	134	150	177	198	217	59	112
	403. 528	○	-	MA	-	-	1.261	.591	82	109	143	630	169	189	223	250	273	59	112
	403. 568	○	-	-	MC	-	1.497	.473	105	138	182	800	215	240	283	317	347	59	112
	403. 608	○	-	-	MC	-	1.655	.473	131	173	228	1000	269	300	353	396	433	59	112
	403. 628	○	-	-	-	ME	1.773	.591	163	216	285	1250	336	375	442	495	542	63	114

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$
(≤ 145 psi)

Axial-flow full cone nozzles
Series 419 »FreeFlow«

FreeFlow

Particularly insensitive to clogging thanks to very large free cross sections.
Stable spray angle.
Uniform spray pattern.

Applications:
Gas washing, spraying over packings, dust control absorption, distillation

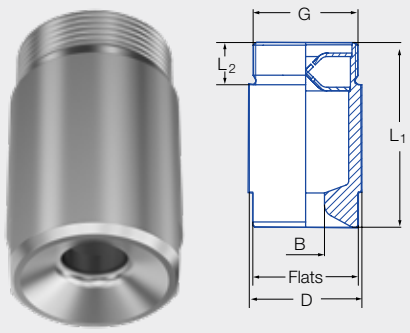


Figure 1

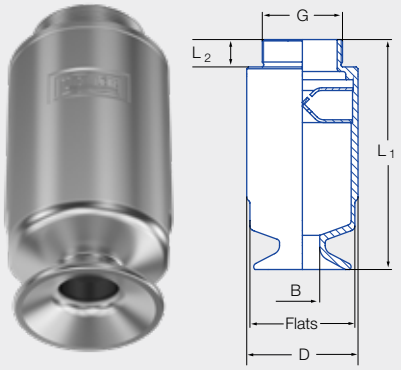


Figure 2

Spray angle	Type	Code	Figure	Dimensions [in] G (Male NPT)	L_1	L_2	D	Flats	Weight (lbs)
90° + 120°	419.3XX	**BV**	1	2	4.13	.94	2.52	2-3/8	2.65
	419.4XX	**BV**	2	2	6.42	1.06	3.15	2-15/16	4.41
	419.51X	**BV**	2	2	7.83	1.06	4.02	3-3/4	8.16
	419.54X	**BY**	2	2 1/2	7.95	1.18	4.02	3-3/4	8.38
	419.57X	**BY**	2	2 1/2	9.09	1.18	4.53	4-1/8	11.46
		MA	2	3	9.17	1.42	4.53	4-1/8	11.46
	419.6XX	**MA**	2	3	9.92	30	4.41	4-9/16	11.90

Spray angle*	Ordering no. Type	Mat.-Nr. 1Y 316L SS	Mat.-Nr. 2P 904 L	Code 1 1/2 Male NPT	Code 2 Male NPT	Code 2 1/2 NPT male	Code 3 NPT male	Code 3 1/2 NPT male	Code 4 NPT male	B Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute) 5 psi	10 psi	15 psi	30 psi	75 psi	Spray Diameter D [in] at p = 15 psi H = 20 in	D = 40 in
90°	**419.366**	○	○	**BR**	**BV**	-	-	-	-	.75	.69	33	43	51	67	97	39	79
	419.396	○	○	**BR**	**BV**	-	-	-	-	.83	.69	39	52	61	80	116	39	79
	419.446	○	○	-	**BV**	**BY**	-	-	-	.94	.81	52	69	81	107	155	39	79
	419.486	○	○	-	**BV**	**BY**	-	-	-	1.14	.81	65	86	101	134	193	39	79
	419.516	○	○	-	**BV**	**BY**	**MA**	**MC**	-	1.15	.95	78	104	122	161	232	39	79
	419.546	○	○	-	**BV**	**BY**	**MA**	**MC**	-	1.30	.95	93	124	144	190	274	39	79
	419.576	○	○	-	-	**BY**	**MA**	-	**ME**	1.38	1.07	111	147	172	228	328	39	79
	419.606	○	○	-	-	-	**MA**	**MC**	-	1.48	1.19	131	172	203	268	386	39	79
	419.626	○	○	-	-	-	**MA**	**MC**	-	1.69	1.19	163	216	254	335	483	39	79
120°	**419.368**	○	○	**BR**	**BV**	-	-	-	-	.83	.69	33	43	51	67	97	67	114
	419.398	○	○	**BR**	**BV**	-	-	-	-	.95	.69	39	52	61	80	116	67	114
	419.448	○	○	-	**BV**	**BY**	-	-	-	.96	.81	52	69	81	107	155	67	114
	419.488	○	○	-	**BV**	**BY**	-	-	-	1.16	.81	65	86	101	134	193	67	114
	419.518	○	○	-	**BV**	**BY**	**MA**	**MC**	-	1.15	.95	78	104	122	161	232	67	114
	419.548	○	○	-	**BV**	**BY**	**MA**	**MC**	-	1.34	.95	93	124	144	190	274	67	114
	419.578	○	○	-	-	**BY**	**MA**	-	**ME**	1.38	1.13	111	147	172	228	328	67	114
	419.608	○	○	-	-	-	**MA**	**MC**	-	1.50	1.27	131	172	203	268	386	67	114
	419.628	○	○	-	-	-	**MA**	**MC**	-	1.71	1.27	163	216	254	335	483	67	114

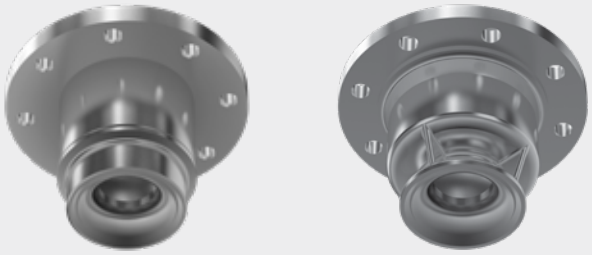
B = Orifice diameter-Ø · E = Free passage · * Spray angle at 15 psi

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	419.366	+	**1Y**	+	**BV**	=	**419.366.1Y.BV**

Axial-flow full cone nozzles
Series 421

Even full cone distribution, high flow rates.

Applications:
Scrubber, 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.				B Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute)					
	Type	Mat. no. 05.84 GG	1Y.84 316L SS	53.00 PP			4 psi	7 psi	14.5 psi	Liters per minute 2 bar	72 psi	145 psi
60°	**421.564**	○	-	○	1.46	0.47	99	121	160	800	305	402
	421.604	○	-	○	1.54	0.55	124	152	200	1000	381	503
	421.624	○	○	○	1.61	0.51	155	190	250	1250	476	629
	421.644	○	○	○	1.93	0.63	198	243	320	1600	610	805
	421.664	○	○	○	2.20	0.63	247	304	400	2000	762	1006
	421.684	○	○	○	2.28	0.83	309	379	501	2500	953	1257
	421.704	○	○	○	2.56	0.94	390	478	631	3150	1201	1584
	421.724	-	○	○	2.83	1.18	495	607	801	4000	1525	2012
	421.744	-	○	○	3.19	1.34	618	759	1001	5000	1906	2514
	421.764	-	○	○	3.46	1.38	779	956	1261	6300	2401	3168
	421.784	-	○	○	3.90	1.54	990	1214	1602	8000	3049	4023
	421.804	-	○	-	4.41	1.65	1237	1517	2002	10000	3811	5029
	421.824	-	○	-	4.92	2.05	1546	1896	2503	12500	4764	6286
90°	**421.566**	○	-	○	1.46	0.59	99	121	160	800	305	402
	421.606	○	-	○	1.54	0.59	124	152	200	1000	381	503
	421.626	○	○	○	1.69	0.75	155	190	250	1250	476	629
	421.646	○	○	○	2.09	0.87	198	243	320	1600	610	805
	421.666	○	○	○	2.20	0.94	247	304	400	2000	762	1006
	421.686	○	○	○	2.32	1.10	309	379	501	2500	953	1257
	421.706	○	○	○	2.60	1.26	390	4790	631	3150	1201	1584
	421.726	-	○	○	2.83	1.38	495	607	801	4000	1525	2012
	421.746	-	○	○	3.19	1.57	618	759	1001	5000	1906	2514
	421.766	-	○	○	3.66	1.54	779	956	1261	6300	2401	3168
	421.786	-	○	○	3.90	1.73	990	1214	1602	8000	3049	4023
	421.806	-	○	○	4.84	2.09	1237	1517	2002	10000	3811	5029
	421.826	-	○	-	4.92	2.13	1543	1896	2502	12500	4764	6286
120°	**421.568**	○	○	○	1.42	0.59	99	121	160	800	305	402
	421.608	○	○	○	1.61	0.59	124	152	200	1000	381	503
	421.628	○	○	○	1.69	0.75	155	190	250	1250	476	629
	421.648	○	○	○	2.09	0.87	198	243	320	1600	610	805
	421.668	○	○	○	2.17	0.94	247	303	400	2000	762	1006
	421.688	○	○	○	2.32	1.10	309	379	501	2500	953	1257
	421.708	○	○	○	2.60	1.26	390	478	631	3150	1201	1584
	421.728	-	○	○	2.83	1.38	495	607	801	4000	1525	2012
	421.748	-	○	○	3.19	1.57	618	759	1001	5000	1906	2514
	421.768	-	○	○	3.46	1.54	779	956	1261	6300	2401	3168
	421.788	-	○	○	3.90	1.73	990	1214	1602	8000	3049	4023
	421.808	-	○	○	4.25	2.09	1237	1517	2002	10000	3811	5029
	421.828	-	○	○	4.76	2.13	1546	1896	253	12500	4764	6286

B = bore diameter · E = narrowest free cross section
* Spray angle at p = 2 bar
Other materials available on request

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$ (≤ 145 psi)

Axial-flow full cone nozzles
Series 421

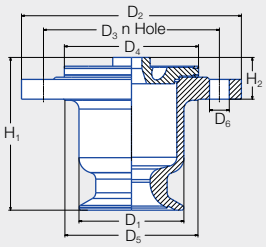


Figure 1

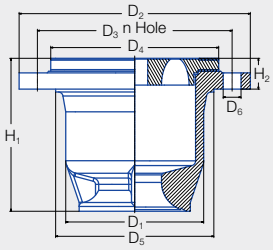


Figure 2

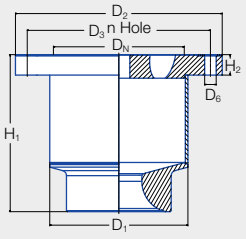


Figure 3

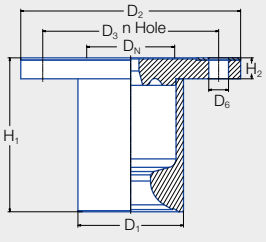


Figure 4

Spray angle	Type	Mat. no.	Fig.	Dimensions [mm]								Flange hole	
				H_1	H_2	D_1	D_2	D_3	D_4	D_5	D_N	Number	D_6
60°-90° 120° 120° 60°-120°	**421.56x/ 421.60x**	05.84 05.84 1Y.84 53.00	1 1 3 4	5.28 5.51 5.51 5.16	1.54 1.54 .75 1.73	3.78 3.78 3.78 3.90	7.87 7.87 7.87 7.87	6.30 6.30 6.30 6.30	4.80 4.80 - -	4.76 4.76 - -	3.15 3.15 3.15 3.15	8 8 8 8	18 18 18 18
60°-120°	**421.62x**	05.84 1Y.84 53.00	1 3 4	6.14 6.14 6.14	1.10 .79 2.09	4.45 4.25 4.61	8.66 8.66 8.66	8.66 8.66 8.66	6.22 - -	5.55 - -	3.94 3.94 3.94	8 8 8	18 18 18
60°-90° 120° 60°-120° 60°-120°	**421.64x/ 421.66x**	05.84 05.84 1Y.84 53.00	2 2 3 4	6.89 6.89 6.89 6.89	4.65 1.14 .75 2.24	5.51 5.51 5.31 5.55	9.84 9.84 9.84 9.84	8.27 8.27 8.27 8.27	7.40 7.40 - -	6.54 6.54 - -	4.92 4.92 4.92 4.92	8 8 8 8	18 18 18 18
60°-120°	**421.68x/ 421.70x**	05.84 1Y.84 53.00	2 3 4	7.32 7.32 7.32	1.50 1.06 2.01	6.69 6.30 6.73	11.22 11.22 11.22	9.45 9.45 9.45	8.15 - -	7.68- -	5.91 5.91 5.91	8 8 8	22 22 23
60°-120°	**421.72x/ 421.74x**	1Y.84 53.00	3 4	9.84 9.84	1.30 1.97	8.43 8.86	13.39 13.39	11.61 11.61	- -	- -	7.87 7.87	8 8	22 23
60°-120°	**421.76x/ 421.78x**	1Y.84 53.00	3 4	11.81 11.81	1.54 2.09	10.39 11.02	15.55 15.55	13.78 13.78	- -	- -	9.84 9.84	12 12	22 23
60°-120°	**421.80x/ 421.82x**	1Y.84 53.00	3 4	14.45 14.45	1.93 2.24	12.40 12.91	17.52 17.52	15.75 15.75	- -	- 14.17	11.81 11.81	12 12	22 23

Other materials available on request

Example for ordering:	**Type**	**+**	**Material no.**	**=**	**Ordering no.**
	421.564	**+**	**05.84**	**=**	**421.564.05.84**

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$
(≤ 145 psi)

Mist eliminator systems on ships

Mist eliminators are used for a wide range of applications on ships. They protect downstream ship installations, reduce the energy requirement and help to ensure compliance with environmental regulations. The possible application areas include air intake systems as protection against rain and splashwater or preparation of combustion air for the engines. Another task is use in wet scrubbing of the exhaust gases in order to reduce the sulfur content. Use on ships therefore places high demands on mist eliminators.

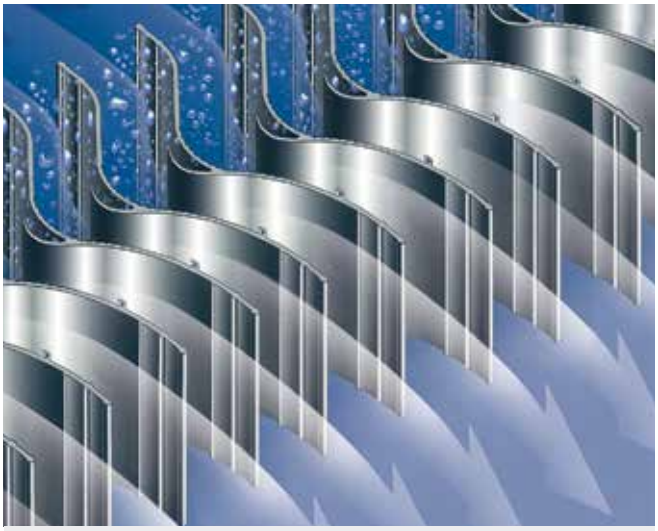
When designing and planning mist eliminators, it is necessary to have precise knowledge of the functional and performance data of the separation system, as well as an in-depth process understanding of the respective application.

Knowledge about droplet formation and droplet movement in a gas flow is essential to ensure fault-free operation of the mist eliminator. For more than 100 years, we have worked on detection, measurement and definition of droplets. It is therefore not a coincidence that Lechler nozzles and Lechler mist eliminators are now considered integral elements in process engineering.

Each installation requires a specific mist eliminator design and construction. Design, construction and selection of the optimum Lechler mist eliminators are based fully on your requirements, specifications and drawings. That is why we do not offer standard solutions, instead we customize systems individually for your specific needs.

In order to guarantee accurate operation, materials must be used that are matched to the relevant variables of the installation in question. For this reason, Lechler offers a wide range of different materials – from stock.

Corresponding to the flow direction, there are Lechler high-performance separators for horizontal and vertical gas flows. The choice of flow direction depends on the individual process or plant design. Lechler offers a suitable solution for all installation situations.



Task of mist eliminator systems on ships:

- Use in wet scrubbers for cleaning the exhaust gases
- Protection off downstream installations
- Reduction of operating costs

Advantages of Lechler mist eliminator systems:

- Modular system design
- Highest degrees of separation for large liquid quantities
- Separation of small droplets
- Compact design even for high gas speeds
- Low pressure losses
- More uniform flow distribution
- Use also with high solid particle quantities
- Cleaning during ongoing operation
- Delivery of an overall concept
  – Nozzles for desulfurization of flue gases
  – Mist eliminator systems
  – Integrated cleaning systems for mist eliminators

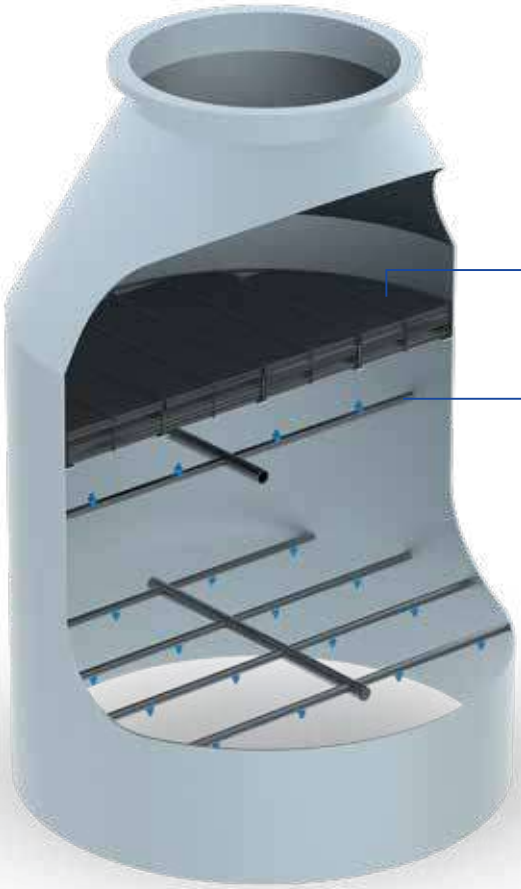
The available materials include:

- Stainless steels in the grades 304 SS, 316L SS, 316Ti SS, 318LN SS, 904L SS, 254SMO SS as well as special alloys such as Hastelloy
- Plastics such as PP, PPTV, PE, PVDF

Talk to us

Do you know your process but are not sure which mist eliminator is best suited for your purposes? No problem. Based on your individual requirements, we will choose from a finely graded range of vane profiles with single or multiple deflection.

Mist eliminator systems in wet scrubbing installations



Mist eliminator for vertical gas flow
Typ LTV400

Cleaning system for mist eliminators

Since the introduction of new limit values for the sulfur content of fuels, retrofitting of a cleaning system for the exhaust gases has become necessary on most ships for operation in protected areas (Emission Control Areas). The Emission Control Areas will be extended to the whole world as from 2020. Vertical-flow separators are used for the wet scrubbers.

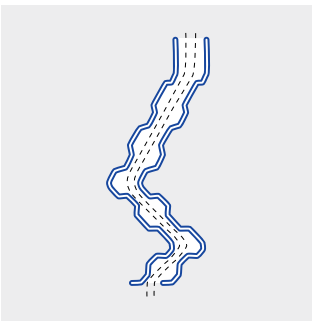
In **vane-type separators with vertical gas flow, the baffle vanes are** arranged horizontally or at a slight horizontal angle. The liquid that is separated at the profile forms a film which drains downwards in the opposite direction to the gas flow. This liquid film interacts with the opposing gas flow. At the bottom end, larger droplets are formed from the liquid film which then fall down.

Reliable operation – even under tough conditions

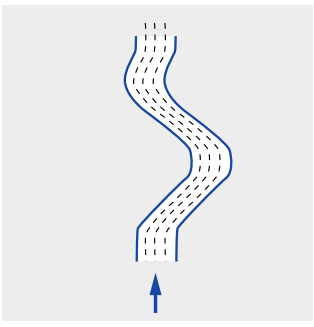
Lechler mist eliminators are characterized by the optimized-flow design. However, if the gas flows are heavily loaded with dust, deposits can occur under unfavorable conditions which impair the efficiency of the mist eliminators. In this case, an additional cleaning system helps to guarantee availability during continuous operation.
An arrangement that performs cyclical washing of the mist eliminators with full-cone nozzles has proven particularly suitable for this. This allows you to increase functional reliability, avoid encrustations and also ensure that your plant operates with optimum efficiency over long periods.

SOX ECAs:

- Baltic Sea
- North Sea/English Channel
- North America
- US Caribbean



Profile geometry LTV 300



Profile geometry LTV 400

Mist eliminators for air intakes

Lechler mist eliminators are available in many sizes and designs.

The one- to multi-stage mist eliminator systems for air intakes developed by Lechler are used in different areas, e. g. in the shipbuilding and offshore industries for protection of ventilation systems against rain, splash water and fog.

The system parts are therefore protected against corrosion and damage and the air quality in air-conditioned areas is also improved.

Only materials that have high resistance to seawater are used here.

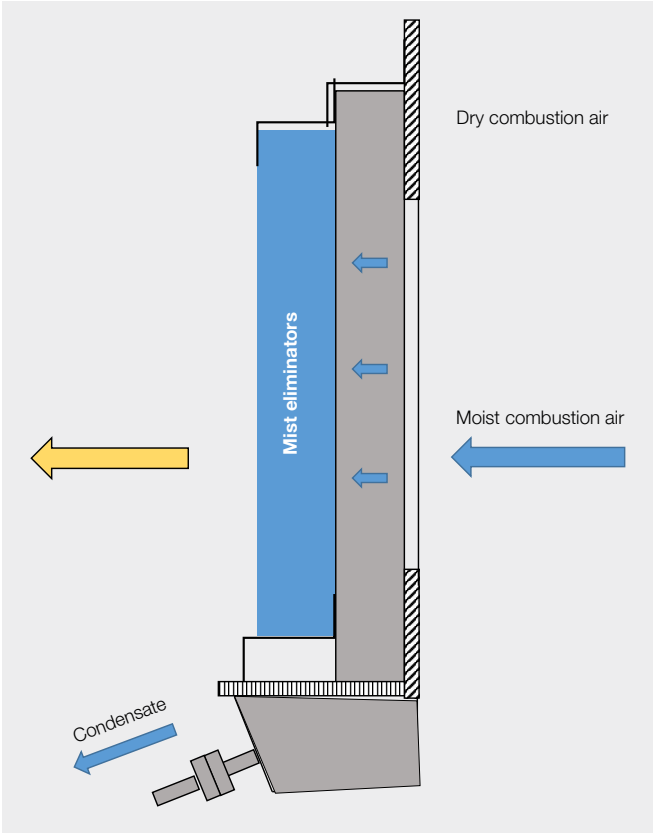
In this case, mist eliminator profiles for horizontal flow are used. Thanks to the large range of different profiles offered by Lechler, it is possible to design a suitable system for every application and all requirements.

The materials can be easily adapted to individual requirements

Mist eliminators for charge air coolers

The intake air for combustion (combustion air) produces up to 200 tonnes of condensation per day in tropical climates.

The quantity of condensed water downstream of the purge air cooler increases dramatically due to the mean effective pressure and consequently the increase in purge air pressure.



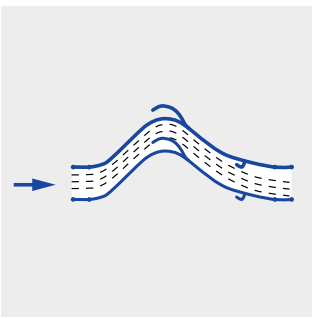
Reliable separation of condensation sustainably extends the service life of the components involved.

Water entering into the combustion chamber is one of the main risk factors for:

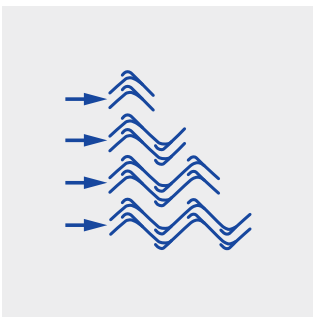
- Problems with piston running
- Damage to the piston rings
- Seizure between the sliding surfaces
- Damage to the surfaces
- Severe mechanical damage to important parts

Condensation of water cannot be avoided in areas with high humidity. Lechler mist eliminators are used to separate the liquid.

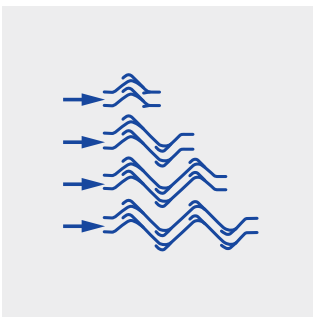
A large range of profiles reliably covers every application.



Profile geometry LTH 100



Profile geometry LTH 500



Profile geometry LTH 600

Axial-flow full cone nozzles
Series 490/491

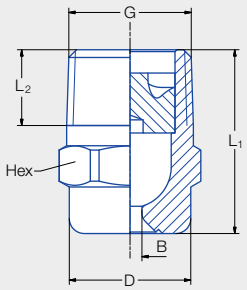
Patented

Non-clogging nozzle design with a very stable spray angle, particularly even liquid distribution and large free cross sections.

Applications:
Cleaning and washing processes, surface spraying, container cleaning, foam precipitation, degassing of liquids.

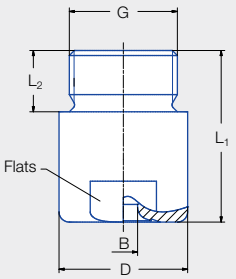
Series 490/491 represents a new generation within the axial-flow full cone nozzles product group. These nozzles were developed using state-of-the-art design and simulation methods (CFD).

Series 490



Code CA-CG

Series 491



Code AK-AM

Conn.	Dimensions (in.) G Male NPT	L_1	L_2	D	Hex	Weight Brass
BA	1/8	0.71	0.26	0.39	7/16	.03
BC	1/4	0.87	0.39	0.51	9/16	.04
BE	3/8	0.96	0.39	0.63	11/16	.07
BE	3/8	1.18	0.39	0.63	11/16	.11
BG	1/2	1.28	0.51	0.83	14/16	.13
BG	1/2	1.71	0.51	0.83	14/16	.19
BK	3/4	1.65	0.59	1.26	1-1/16	.42
BK	3/4	1.97	0.59	1.26	1-1/16	.44
BM	1	2.20	0.67	1.57	1-7/16	.77

Subject to technical modifications. Please enquire about the exact dimensions if the installation situation is critical.

Spray angle	Ordering no. Type	Mat. no. 316 L 1Y	Mat. no. Brass 30	Connection Male NPT 1/8"	1/4"	3/8"	1/2"	3/4"	1"	Orifice diam. (in.)	Free Passage (in.)	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	80 psi	100 psi	150 psi	Spray Diam. D (in.) @ 30 psi H=8"	H=20"
45°	**490. 403**	○	○	**BA**	-	-	-	-	-	.049	.049	.17	.23	1.00	0.27	.30	.35	.40	.43	.51	6	16
	490. 523	○	○	**BA**	-	-	-	-	-	.067	.067	.35	.46	2.00	0.54	.60	.71	.79	.87	1.02	6	16
	490. 603	○	○	-	**BC**	**BE**	-	-	-	.079	.079	.54	.72	3.15	0.84	.95	1.11	1.25	1.37	1.61	6	16
	490. 643	-	○	-	-	**BE**	-	-	-	.096	.098	.69	.91	4.00	1.07	1.20	1.41	1.59	1.73	2.04	6	16
	490. 683	-	○	-	-	**BE**	-	-	-	.100	.100	.86	1.14	5.00	1.34	1.50	1.77	1.98	2.17	2.55	6	16
	490. 703	-	○	-	-	**BE**	-	-	-	.104	.104	.97	1.27	5.60	1.50	1.68	1.98	2.22	2.43	2.85	6	16
	490. 723	○	○	-	-	**BE**	-	-	-	.112	.112	1.09	1.43	6.30	1.69	1.89	2.23	2.50	2.73	3.21	6	16
	490. 783	-	○	-	-	-	**BG**	-	-	.136	.136	1.55	2.05	9.00	2.41	2.70	3.18	3.57	3.90	4.58	6	16
	490. 843	-	○	-	-	-	**BG**	-	-	.150	.150	2.16	2.85	12.50	3.35	3.76	4.42	4.96	5.42	6.37	6	16
60°	**490. 404**	○	○	**BA**	-	-	-	-	-	.045	.045	.17	0.23	1.00	.27	.30	.35	.40	.43	0.51	9	22
	490. 444	○	-	**BA**	-	-	-	-	-	.049	.049	.22	0.29	1.25	.33	.38	.44	.49	.54	0.64	9	22
	490. 484	○	○	**BA**	-	-	-	-	-	.057	.057	.28	0.36	1.60	.43	.48	.57	.63	.69	0.82	9	22
	490. 524	○	○	**BA**	-	-	-	-	-	.063	.063	.35	0.46	2.00	.54	.60	.71	.79	.87	1.02	9	22
	490. 564	○	○	**BA**	-	-	-	-	-	.071	.071	.43	0.57	2.50	.67	.75	.88	.99	1.08	1.27	9	22
	490. 604	○	○	**BA**	**BC**	**BE**	-	-	-	.081	.081	.54	0.72	3.15	.84	.95	1.11	1.25	1.37	1.61	9	22
	490. 644	○	○	-	**BC**	**BE**	-	-	-	.091	.091	.69	0.91	4.00	1.07	1.20	1.41	1.59	1.73	2.04	9	22
	490. 684	○	○	-	**BC**	**BE**	-	-	-	.102	.102	.86	1.14	5.00	1.34	1.50	1.77	1.98	2.17	2.55	9	22
	490. 724	○	○	-	**BC**	**BE**	-	-	-	.112	.110	1.09	1.43	6.30	1.69	1.89	2.23	2.50	2.73	3.21	9	22
	490. 764	○	○	-	-	**BE**	-	-	-	.128	.128	1.38	1.82	8.00	2.14	2.40	2.83	3.17	3.47	4.08	9	22
	490. 804	○	○	-	-	**BE**	-	-	-	.146	.146	1.72	2.28	10.00	2.68	3.00	3.53	3.97	4.34	5.10	9	22
	490. 844	○	○	-	-	-	**BG**	-	-	.159	.159	2.16	2.85	12.50	3.35	3.76	4.42	4.96	5.42	6.37	9	22
	490. 884	○	○	-	-	-	**BG**	-	-	.183	.183	2.76	3.64	16.00	4.28	4.81	5.65	6.34	6.94	8.16	9	22
	490. 924	○	○	-	-	-	-	**BK**	-	.205	.205	3.45	4.56	20.00	5.36	6.01	7.07	7.93	8.67	10.20	9	22
	490. 964	○	○	-	-	-	-	**BK**	-	.228	.228	4.31	5.69	25.00	6.70	7.51	8.83	9.91	10.84	12.74	9	22
	491. 044	○	○	-	-	-	-	-	**BM**	.285	.285	6.90	9.11	40.00	10.71	12.02	14.14	15.86	17.34	20.39	9	22
	491. 084	○	○	-	-	-	-	-	**BM**	.321	.321	8.63	11.38	50.00	13.39	15.02	17.67	19.82	21.67	25.49	9	22

Axial-flow full cone nozzles
Series 490/491

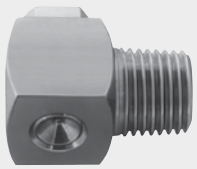
Spray angle	Ordering no. Type	Mat. no. 316 L 1Y	Mat. no. Brass 30	Connection Male NPT 1/8"	1/4"	3/8"	1/2"	3/4"	1"	Orifice diam. (in.)	Free Passage (in.)	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	80 psi	100 psi	150 psi	Spray Diam. D (in.) @ 30 psi H=8"	H=20"
90°	**490. 406**	○	○	**BA**	-	-	-	-	-	.047	.047	.17	.23	1.00	.27	.30	.35	.40	.43	.51	15	34
	490. 446	-	○	**BA**	-	-	-	-	-	.051	.051	.22	.29	1.25	.33	.38	.44	.49	.54	.64	15	34
	490. 486	○	○	**BA**	-	-	-	-	-	.057	.057	0.28	.36	1.60	.43	.48	.57	.63	.69	.82	15	34
	490. 526	○	○	**BA**	-	-	-	-	-	.067	.067	.35	.46	2.00	.54	.60	.71	.79	.87	1.02	15	34
	490. 566	○	○	**BA**	-	-	-	-	-	.075	.075	.43	.57	2.50	.67	.75	.88	.99	1.08	1.27	15	34
	490. 606	○	○	**BA**	-	**BE**	-	-	-	.081	.081	.54	.72	3.15	.84	.95	1.11	1.25	1.37	1.61	15	34
	490. 646	○	○	-	**BC**	**BE**	-	-	-	.094	.094	.69	.91	4.00	1.07	1.20	1.41	1.59	1.73	2.04	15	38
	490. 686	○	○	-	**BC**	**BE**	-	-	-	.106	.106	.86	1.14	5.00	1.34	1.50	1.77	1.98	2.17	2.55	15	38
	490. 726	○	○	-	**BC**	**BE**	-	-	-	.126	.110	1.09	1.43	6.30	1.69	1.89	2.23	2.50	2.73	3.21	15	38
	490. 746	○	○	-	-	**BE**	-	-	-	.124	.124	1.23	1.62	7.10	1.90	2.13	2.51	2.82	3.08	3.62	15	38
	490. 766	○	○	-	-	**BE**	-	-	-	.134	.134	1.38	1.82	8.00	2.14	2.40	2.83	3.17	3.47	4.08	15	38
	490. 806	○	○	-	-	**BE**	-	-	-	.154	.154	1.72	2.28	10.00	2.68	3.00	3.53	3.97	4.34	5.10	15	38
	490. 846	○	○	-	-	**BE**	-	-	-	.183	.157	2.16	2.85	12.50	3.35	3.76	4.42	4.96	5.42	6.37	15	38
	490. 886	○	○	-	-	-	**BG**	-	-	.215	.177	2.76	3.64	16.00	4.28	4.81	5.65	6.34	6.94	8.16	15	38
	490. 926	○	○	-	-	-	**BG**	-	-	.232	.177	3.45	4.56	20.00	5.36	6.01	7.07	7.93	8.67	10.20	15	38
	490. 966	○	○	-	-	-	BG	**BK**	-	.258	.191	4.31	5.69	25.00	6.70	7.51	8.83	9.91	10.84	12.74	15	38
	491. 006	○	○	-	-	-	BG	**BK**	-	.297	.285	5.44	7.17	31.50	8.44	9.47	11.13	12.49	13.66	16.06	15	38
	491. 046	○	○	-	-	-	-	**BK**	-	.339	.315	6.90	9.11	40.00	10.71	12.02	14.14	15.86	17.34	20.39	15	38
	491. 086	○	○	-	-	-	-	BK	**BM**	.372	.285	8.63	11.38	50.00	13.39	15.02	17.67	19.82	21.67	25.49	15	38
	491. 126	○	○	-	-	-	-	-	**BM**	.409	.315	10.87	14.35	63.00	16.87	18.93	22.26	24.98	27.31	32.12	15	38
	491. 146	○	-	-	-	-	-	-	**BM**	.433	.295	12.25	16.17	71.00	19.01	21.33	25.09	28.15	30.78	36.20	15	38
120°	**490. 368**	○	○	**BA**	-	-	-	-	-	.033	.026	.11	.14	.63	.17	.19	.22	.25	.27	.32	27	48
	490. 408	○	○	**BA**	-	-	-	-	-	.047	.047	.17	.23	1.00	.27	.30	.35	.40	.43	.51	27	48
	490. 448	○	○	**BA**	-	-	-	-	-	.051	.051	.22	.29	1.25	.33	.38	.44	.49	.54	.64	27	48
	490. 488	○	○	**BA**	-	-	-	-	-	.057	.057	.28	036	1.60	.43	.48	.57	.63	.69	.82	27	48
	490. 528	○	○	**BA**	-	-	-	-	-	.067	.067	.35	.46	2.00	.54	.60	.71	.79	.87	1.02	27	48
	490. 568	○	○	**BA**	-	-	-	-	-	.075	.075	.43	.57	2.50	.67	.75	.88	.99	1.08	1.27	27	48
	490. 608	○	○	-	-	-	-	-	-	.083	.081	.54	.72	3.15	.84	.95	1.11	1.25	1.37	1.61	27	48
	490. 648	○	○	-	**BC**	**BE**	-	-	-	.094	.094	.69	.91	4.00	1.07	1.20	1.41	1.59	1.73	2.04	27	52
	490. 688	○	○	-	**BC**	**BE**	-	-	-	.108	.108	.86	1.14	5.00	1.34	1.50	1.77	1.98	2.17	2.55	27	52
	490. 728	○	○	-	**BC**	**BE**	-	-	-	.126	.110	1.09	1.43	6.30	1.69	1.89	2.23	2.50	2.73	3.21	27	52
	490. 748	○	○	-	-	**BE**	-	-	-	.126	.126	1.23	1.62	7.10	1.90	2.13	2.51	2.82	3.08	3.62	27	52
	490. 768	○	○	-	-	**BE**	-	-	-	.136	.136	1.38	1.94	8.00	2.14	2.40	2.83	3.17	3.47	4.08	27	52
	490. 808	○	○	-	-	**BE**	-	-	-	.154	.154	1.72	2.28	10.00	2.68	3.00	3.53	3.97	4.34	5.10	27	52
	490. 848	○	○	-	-	BE	-	-	-	.185	.157	2.16	2.85	12.50	3.35	3.76	4.42	4.96	5.42	6.37	27	52
	490. 888	○	○	-	-	-	**BG**	-	-	.201	.177	2.76	3.64	16.00	4.28	4.81	5.65	6.34	6.94	8.16	27	52
	490. 928	○	○	-	-	-	**BG**	-	-	.228	.187	3.45	4.56	20.00	5.36	6.01	7.07	7.93	8.67	10.20	27	52
	490. 968	○	○	-	-	-	BG	**BK**	-	.262	.191	4.31	5.69	25.00	6.70	7.51	8.83	9.91	10.84	12.74	27	52
	491. 048	○	○	-	-	-	-	**BK**	-	.362	.230	6.90	9.11	40.00	10.71	12.02	14.14	15.86	17.34	20.39	27	52
	491. 128	○	○	-	-	-	-	-	**BM**	.425	.305	10.87	14.35	63.00	16.87	18.93	22.26	24.98	27.31	32.12	27	52
	491. 148	○	-	-	-	-	-	-	**BM**	.449	.301	12.25	16.17	71.00	19.01	21.33	25.09	28.15	30.78	36.20	27	52

Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$
(≤ 145 psi)

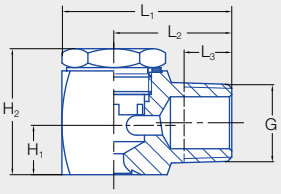
Tangential-flow full cone nozzles
Series 422/423

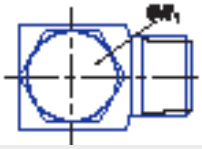
Tangential design has no internal swirl device for maximum clog resistance. Stable spray angle. Uniform spray.

Applications:
Cleaning and washing process, e. g. window cleaning, NBC protection, droplet seperator cleaning, foam recipitation, cooling of gaseous and solids.

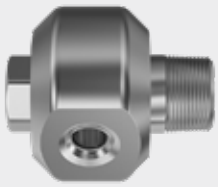


1/4–3/8 version

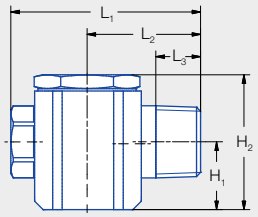


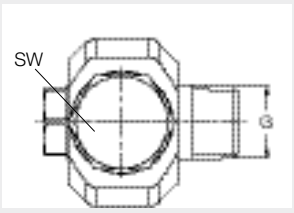


Material: 316L SS/Brass



1/2–1 version





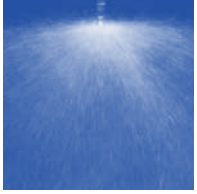
Material: 316L SS/Brass

Dimensions [in]							Weight
G (male NPT)	L_1	L_2	L_3	H_1	H_2	SW	(lb.)
1/4"	1.1	.79	.39	.31	.81	.47	.09
3/8"	1.42	.98	.39	.43	1.04	.75	.22
1/2"	1.91	1.32	.51	.79	1.52	1.06	.52
3/4"	2.28	1.5	.57	.93	2.24	1.42	1.37
1"	2.99	1.91	.67	1.08	2.6	1.61	2.76
1 1/4"	3.7	2.32	.71	1.38	3.23	2.17	5.5
1 1/2"	5.71	3.78	.72	2.4	5.08	3.15	12.4
2"	6.22	3.86	.75	2.72	5.96	3.54	18.35

Spray angle	Ordering no. Type	Mat. no. AISI 316L 1Y	Mat. no. Brass 30	Connection Male NPT 1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	Orifice diam. (in.)	Free passage (in.)	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray Diam. D (in.) @ 40 psi H=8"	H=20"
60°	422. 644	○	○	-	BE	-	-	-	-	-	-	.118	.118	.62	.88	4.0	1.2	1.5	1.8	2.0	9	20
90°	422. 406	○	○	BC	-	-	-	-	-	-	-	.059	.057	.16	.22	1.0	.31	.38	.44	.49	15	34
	422. 486	○	-	BC	-	-	-	-	-	-	-	.075	.071	.25	.35	1.6	.50	.61	.70	.78	15	34
	422. 566	○	○	BC	-	-	-	-	-	-	-	.091	.087	.39	.55	2.5	.78	.95	1.1	1.2	15	34
	422. 606	○	○	-	BE	-	-	-	-	-	-	.102	.099	.49	.69	3.2	.98	1.2	1.4	1.6	15	34
	422. 646	○	○	-	BE	-	-	-	-	-	-	.118	.114	.62	.88	4.0	1.2	1.5	1.8	2.0	15	38
	422. 686	○	○	-	BE	-	-	-	-	-	-	.130	.126	.78	1.1	5.0	1.6	1.9	2.2	2.5	15	38
	422. 726	○	○	-	BE	-	-	-	-	-	-	.146	.142	.98	1.4	6.3	2.0	2.4	2.8	3.1	15	38
	422. 766	○	-	-	BE	-	-	-	-	-	-	.164	.162	1.2	1.8	8.0	2.5	3.0	3.5	3.9	15	38
	422. 806	○	○	-	BE	-	-	-	-	-	-	.183	.181	1.6	2.2	10.0	3.1	3.8	4.4	4.9	15	38
	422. 846	○	○	-	BE	-	-	-	-	-	-	.205	.201	1.9	2.7	12.5	3.9	4.8	5.5	6.1	15	38
	422. 886	○	○	-	BE	-	-	-	-	-	-	.229	.225	2.5	3.5	16.0	5.0	6.1	7.0	7.9	15	38
	422. 926	○	-	-	-	BG	-	-	-	-	-	.288	.288	3.1	4.4	20	6.2	7.6	8.8	9.8	15	38
	422. 966	○	-	-	-	BG	-	-	-	-	-	.315	.315	3.9	5.5	25	7.8	9.5	11.0	12.3	15	38
	423. 006	○	-	-	-	BG	-	-	-	-	-	.343	.343	4.8	6.8	31	9.6	11.8	13.6	15.2	15	38
	423. 046	○	-	-	-	-	BK	-	-	-	-	.426	.402	6.2	8.8	40	12	15	18	20	15	38
	423. 086	○	-	-	-	-	BK	-	-	-	-	.449	.433	7.8	11.0	50	15.5	19.0	22	25	15	38
	423. 126	○	-	-	-	-	BK	-	-	-	-	.500	.485	9.8	13.8	63	19.5	24	28	31	15	38
	423. 146	○	-	-	-	-	-	BM	-	-	-	.552	.532	11.0	15.6	71	22	27	31	35	15	38
	423. 206	○	-	-	-	-	-	BM	-	-	-	.670	.630	15.5	21.9	100	31	38	44	49	15	38
	423. 286	○	-	-	-	-	-	-	BP	-	-	.748	.748	25.0	35.0	160	50	61	71	79	15	38
	423. 366	○	-	-	-	-	-	-	-	BR	-	.875	-	38.0	54.0	246	76	93	107	120	15	38
	423. 406	○	-	-	-	-	-	-	-	-	BV	-	-	49.0	69.0	315	98	120	139	155	15	38
	423. 446	○	-	-	-	-	-	-	-	-	BV	-	-	62.0	88.0	400	124	152	175	196	27	38

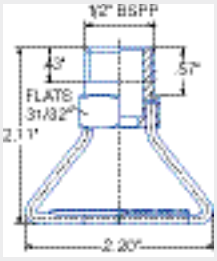
Example for ordering:	Type	+	Code	=	Ordering no.
	422.644	+	BE	=	422.644.30.BE

Deflector-plate nozzle
Series 524/525/500.542



Full cone spray. Non clogging nozzle without swirl insert.

Applications:
Fire fighting and broadcast spraying, wide area spray.



Weight: .15 lb.

Spray angle	Ordering no. Type: Connection: ½" Male BSPP	Material no. 316 SS: 17[1]	Material no. Brass: 30	Orifice diam. (in.)	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	150 psi	Spray Diameter D (ft.) @ 45 psi H=40"	H=120"
180°	**524. 809**	○	○	.158	1.6	2.2	10	3.1	3.8	4.4	4.9	6.0	18	21
	525. 049	○	○	.315	6.2	8.8	40	12.4	15.2	17.6	19.6	24	33	43
	525. 109	-	○	.366	8.8	12.5	57	17.7	22	25	28	34	33	44
	525. 169	-	○	.429	12.6	17.8	81	25	31	36	40	49	35	44
	525. 229	-	○	.481	17.4	25	112	35	43	49	55	67	22	34
	525. 269	○	○	.485	22	31	140	43	53	61	69	84	17	33

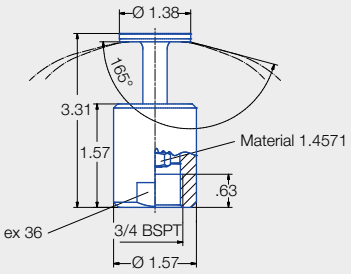
[1] We reserve the right to deliver 316Ti SS or 316L SS under the Material no. 17.
B = bore diameter

Version with dust protection cap on request.

Example of ordering:	Type	+	Material-no.	=	Ordering no.
	524.809	+	**30**	=	**524.809.30**

Deflector-plate nozzle for protection of ship walls against flames and heat, e. g. fire-fighting boats, deep-sea salvage tugs.

The backwards-directed spray jet allows effective cooling of the ship walls and minimizes losses due to wind drift. Thanks to the robust design without moving parts, this nozzle is an inexpensive alternative to pop-out deflector-plate nozzles.



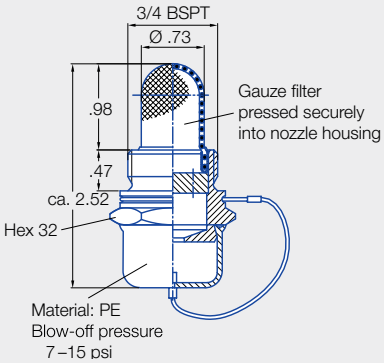
Spray angle	Ordering no. Type	Flow Rate [gal/min] p [psi] 100 psi	Length [in]	Diameter [in]
140°	**500.542**	15.73	3.31	1.57

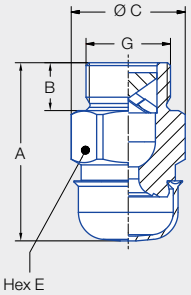
Materials on request

Full cone nozzles with protection cap
Series 400/401

Particularly uniform full cone atomization. The nozzle outlet is protected by a cap against dirt and minor damage. This falls off at a corresponding water pressure and releases the nozzle opening. The protection cap can be optionally secured to prevent loss.

Applications:
Fire protection applications in hatch covers and preventive fire protection in cargo holds.





Flow rates and dimensions

Spray angle	Ordering no.					E Ø [in]	Flow Rate (Gallons Per Minute)			K-factor	Blow-off pressure
	Type	Code					30	liters per minute 2 bar	45		[psi]
		1 BSPP	3/4 BSPP	1 1/4 BSPP	3/4 BSPT						
120°	**400.958.30.00**	○	-	-	-	.27	21.13	80.0	27.90	61.0	7.3-14.5
	400.958.30.01	-	○	-	-	.19	10.57	40.0	14.00	30.0	7.3-14.5
	400.958.30.02	-	-	-	○	.19	8.32	31.5	10.99	24.0	7.3-14.5
	401.024.30.00	-	-	○	-	.20	24.30	92.0	31.96	70.0	4.4-11.6
80°	**400.261.30.04**	-	-	-	○	.24	8.32	31.5	10.99	24.0	7.3-14.5

E = narrowest free cross section · Protection cap material: HD-PE

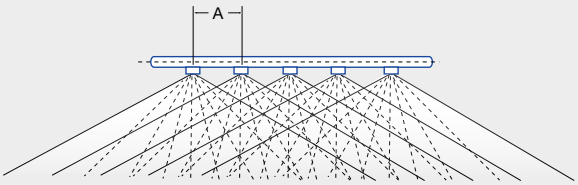
Dimensions [in]				
G	A	B	C	E
1 BSPT	2.54	0.66	1.57	1.42
3/4 BSPT	2.20	0.57	1.32	1.18
3/4 BSPP	2.20	0.59	1.41	1.26
3/4 BSPP	2.52	0.47	1.45	1.26
1 1/4 BSPT	2.64	0.93	2.09	1.81

Rain curtains
Nozzle arrangement

Rain curtains are installed to prevent fires spreading and to divide large spaces into fire sections as well as to shield wall, door and window openings.

Applications:
Rain curtains between containers or bridge and partitioning of hazardous goods.

Nozzle arrangement



Determination of nozzle distance A

Nozzle No.	616.967			617.047			617.127		
Flow pressure before the nozzles (psi)	Water quantity (gal/min) per foot run rain curtain								
	197	164	131	197	164	131	197	164	131
15	0.16	0.18	0.24	0.24	0.29	0.37	0.40	0.48	0.58
30	0.21	0.26	0.34	0.34	0.42	0.53	0.53	0.66	0.85
45	0.26	0.32	0.40	0.42	0.53	0.63	0.69	0.79	1.00
75	0.34	0.42	0.53	0.55	0.66	0.82	0.87	1.06	-
100	0.42	0.50	0.61	0.61	0.79	0.98	1.03	-	-

You can find other spray angles and flow rates in our catalog Edition 112.

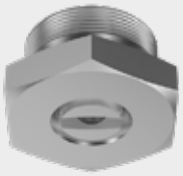
Design data

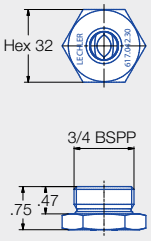
Recommended overall flow rate		Pressure	Pipe cross sections
Room height	Per running meter rain curtain		
Up to 16 ft Each additional m height (up to 26 ft)	approx.11–13 gal/min Additional 3 gal/min	The minimum pressure is 15 psi. 30-45 psi can be considered as the normal pressure. Higher pressures are possible.	The cross section depends on the length and water pressure and also on the type and number of nozzles. A flow velocity of 2–3 m/sec should not be exceeded.

Flat fan nozzles
Series 616/617

Uniform, parabolic distribution of liquid. Increased non-clogging features, more jet power, less fog.

Applications:
Anchor washing, rain curtains, reducing radiated heat.





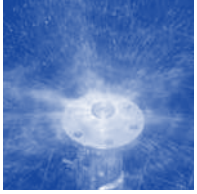
20°–60° | **90°–120°** | **Weight Brass: 75 g**

Spray angle	Ordering no. Type	Mat. no. 16 303 SS	17 [1] 316Ti SS/ 316L SS	30 Brass	A Ø [in]	E Ø [in]	Flow Rate [gal/min] p [psi] 7 psi	15 psi	30 psi	liters per minute 2 bar	45 psi	75 psi	145 psi	Spray width B at p=30 psi H = 10 in	H = 20 in
45°	**616.723**	○	○	○	0.12	0.09	.82	1.20	1.66	6.3	2.07	2.63	3.72	6.89	12.99
	616.763	○	○	○	0.14	0.10	1.04	1.52	2.11	8	2.44	3.34	4.73	6.89	12.99
	616.803	○	○	○	0.16	0.12	1.30	1.90	2.64	10	3.29	4.18	5.91	6.89	13.19
	616.843	○	○	○	0.18	0.13	1.62	2.37	3.30	12.5	4.11	5.22	7.38	7.09	13.19
	616.883	○	○	○	0.20	0.15	2.08	3.04	4.23	16	5.27	6.68	9.45	7.28	13.78
	616.923	○	○	○	0.22	0.17	2.60	3.80	5.28	20	6.58	8.35	11.81	7.48	14.17
	616.963	○	○	○	0.24	0.17	3.24	4.75	6.60	25	8.23	10.44	14.77	7.87	14.76
60°	**616.724**	○	○	○	0.12	0.08	.82	1.20	1.66	6.3	2.07	2.63	3.72	11.61	22.64
	616.764	○	○	○	0.14	0.09	1.04	1.52	2.11	8	2.44	3.34	4.73	11.81	22.83
	616.804	○	○	○	0.16	0.10	1.30	1.90	2.64	10	3.29	4.18	5.91	11.81	22.83
	616.844	○	○	○	0.18	0.12	1.62	2.37	3.30	12.5	4.11	5.22	7.38	11.81	22.83
	616.884	○	○	○	0.20	0.13	2.08	3.04	4.23	16	5.27	6.68	9.45	11.81	22.83
	616.924	○	○	○	0.22	0.16	2.60	3.80	5.28	20	6.58	8.35	11.81	11.81	22.83
	616.964	○	○	○	0.24	0.17	3.24	4.75	6.60	25	8.23	10.44	14.77	11.81	22.83
	617.044	○	-	○	0.31	0.22	5.19	7.60	10.57	40	13.16	16.71	23.63	11.81	22.83
	617.124	-	-	○	0.39	0.29	8.18	11.97	16.64	63	20.73	26.31	37.21	11.81	22.83
90°	**616.726**	○	○	○	0.12	0.07	.82	1.20	1.66	6.3	2.07	2.63	3.72	21.26	39.37
	616.766	○	○	○	0.14	0.07	1.04	1.52	2.11	8	2.63	3.34	4.73	21.65	39.76
	616.806	○	○	○	0.16	0.09	1.30	1.90	2.64	10	3.29	4.18	5.91	21.65	39.76
	616.846	○	○	○	0.18	0.09	1.62	2.37	3.30	12.5	4.11	5.22	7.38	21.65	40.16
	616.886	○	○	○	0.20	0.12	2.08	3.04	4.23	16	5.27	6.68	9.45	21.65	40.16
	616.926	○	○	○	0.22	0.14	2.60	3.80	5.28	20	6.58	8.35	11.81	21.85	40.35
	616.966	○	○	○	0.24	0.15	3.24	4.75	6.60	25	8.23	10.44	14.77	22.05	40.55
120°	**616.727**	○	○	○	0.12	0.06	.82	1.20	1.66	6.3	2.07	2.63	3.72	38.39	69.09
	616.767	○	○	○	0.14	0.07	1.04	1.52	2.11	8	2.63	3.34	4.73	38.19	68.90
	616.807	○	○	○	0.16	0.08	1.30	1.90	2.64	10	3.29	4.18	5.91	37.99	68.50
	616.887	○	○	○	0.18	0.10	2.08	3.04	4.23	16	5.27	6.68	9.45	37.60	68.11
	616.927	○	○	○	0.20	0.11	2.60	3.80	5.28	20	6.58	8.35	11.81	37.40	67.72
	616.967	-	-	○	0.22	0.13	3.24	4.75	6.60	25	8.23	10.44	14.77	37.40	67.72
	617.047	-	-	○	0.24	0.17	5.19	7.60	10.57	40	13.16	16.71	23.63	37.40	67.72

[1] We reserve the right to deliver 316Ti SS or 316L SS under the Material no. 17.
A = equivalent bore diameter · E = narrowest free cross section
Subject to technical modifications.
Other materials on request

Example for ordering:	Type	+	Material-no.	=	Ordering no.
	616.723	+	**16**	=	**616.723.16**

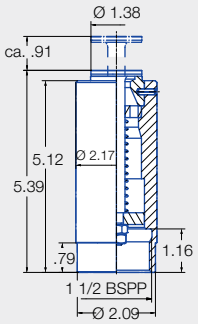
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$



Deflector-plate nozzles
Series 500.393

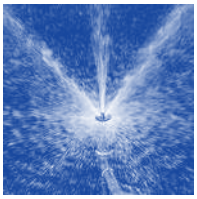
Deflector-plate nozzles for fire protection on lifeboats. The nozzle was designed to protect the outer shell of lifeboats against heat and fire. The water film is sprayed backwards so that the shell of the lifeboat is completely wetted and cooled with water. The nozzle 500.393 eliminates the need for complex piping and a large number of nozzles.

Other spray jet angles available on request.



Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate (Gallons Per Minute) 30 psi	45 psi	60 psi	75 psi	K-factor
180°	**500.393.33.01**	.14	41.21	50.46	58.38	65.25	110

E = narrowest free cross section

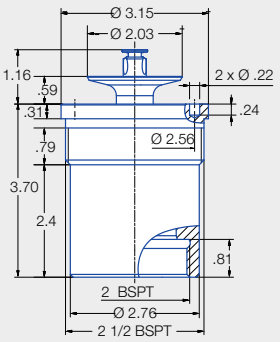


Pop-up foam extinguishing nozzle
Series 500.447.B2.40

The pop-up foam extinguishing nozzle meets customer-specific requirements for fire protection on landing decks. However, rotation of the three central extinguishing jets is omitted on this nozzle. This simplifies the design and makes the nozzle an inexpensive alternative for hangars, for example.

Material:
Seawater-resistant 318LN SS

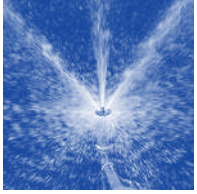
- Spray circle diameter: up to 29.5 ft
- Spray height: up to 16.4 ft
- Recommended operating pressure: 72-116 psi
- Integrated emergency operation characteristics



Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate (Gallons Per Minute) 45	60	75	90	K-factor
180°	**500.447.B2.40**	.14	96.95	108.31	128.12	137.11	183

E = narrowest free cross section

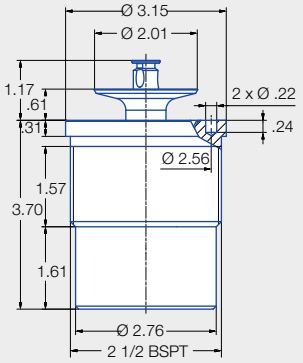
Rotating pop-up foam extinguishing nozzle
Series 500.447.B2



The new rotating foam extinguishing nozzle meets customer-specific requirements for fire protection on landing decks. This development becomes more important due to the fact that crew levels on ships and unmanned offshore platforms are continuously falling.

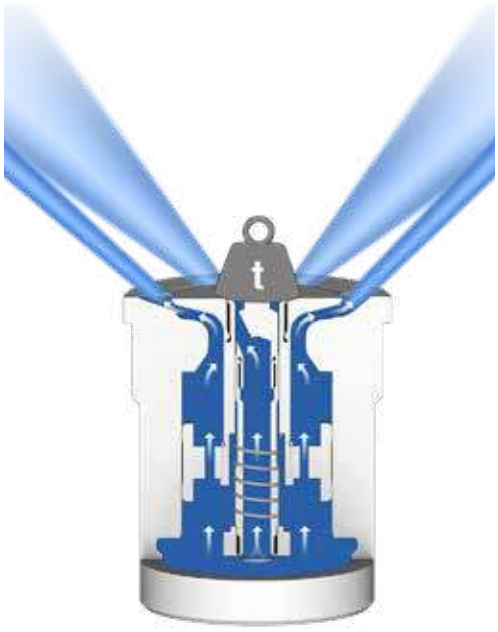
Applications:
Helicopter landing platforms on ships (cargo, passenger, navy, yachts), offshore platforms, hospitals. Aircraft hangars, tank farms, special tank cleaning applications.

Material:
Seawater-resistant stainless steel 918LN SS (spring made of stainless steel 302 SS, bearing made of PTFE)



Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate (Gallons Per Minute) 60	75	100	115	K-factor
180°	**500.447.B2**	.14	96.95	108.31	128.12	137.11	183

E = narrowest free cross section



Operating principle

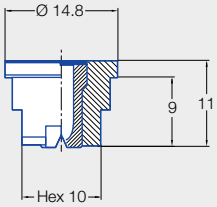
As a result of the fluid pressure, a deflector-plate is lifted and the deck covered with a foam carpet. At the same time, a rotor opens and throws three rotating jets up to five meters high. These rotating jets ensure further coverage in upward direction. If the deflection plate is blocked, the extinguishing water is routed through the openings on the surface. The extinguishing function is therefore preserved.

- Spray circle diameter: up to 29.5 ft
- Spray height: up to 16 ft
- Recommended operating pressure: 72-116 psi
- Integrated emergency operation characteristics

Flat fan nozzles for retaining nut
Series 652

Assembly with retaining nut. Easy nozzle replacement, simple spray alignment. Stable spray angle. Uniform, parabolic fluid distribution. Extremely uniform overall fluid distribution in nozzle group.

Applications:
Window cleaning,
NBC protection.



Weight, brass: .32 lbs

Spray angle	Ordering no. Type	Mat. No. 16 303 SS	17 [1] 316Ti SS/316L SS	30 Brass 2.0401	5E PVDF	A Ø [in]	E Ø [in]	Flow Rate [gal/min] p [psi] 7	15	30	45	75	100	145	Spray width B at p=30 psi H = 10 in	H = 20 in
90°	**652.566**	○	○	○	○	0.08	0.04	0.33	0.47	0.66	0.81	1.04	1.24	1.48	18	32
	652.606	○	○	○	○	0.09	0.05	0.42	0.59	0.83	1.02	1.32	1.56	1.86	18	32
	652.646	○	○	○	○	0.10	0.05	0.53	0.75	1.06	1.29	1.67	1.98	2.36	18	32
	652.676	○	○	○	○	0.11	0.06	0.63	0.89	1.25	1.54	1.98	2.35	2.81	18	32
	652.726	○	○	○	○	0.12	0.07	0.83	1.18	1.66	2.04	2.63	3.11	3.72	18	32
	652.766	○	○	○	-	0.14	0.07	1.06	1.50	2.11	2.59	3.34	3.95	4.73	18	32
	652.806	○	○	○	○	0.16	0.09	1.32	1.87	2.64	3.24	4.18	4.94	5.91	18	32
	652.846	-	-	○	○	0.18	0.09	1.65	2.34	3.30	4.04	5.22	6.15	7.38	18	32
	652.886	○	-	○	○	0.20	0.12	2.11	2.99	4.23	5.18	6.68	7.91	9.45	18	33
120°	**652.567**	○	○	○	○	0.08	0.04	0.33	0.47	0.66	0.81	1.04	1.24	1.48	26	50
	652.607	○	○	○	○	0.09	0.04	0.42	0.59	0.83	1.02	1.32	1.56	1.86	27	51
	652.647	○	○	○	-	0.10	0.05	0.53	0.75	1.06	1.29	1.67	1.98	2.36	27	51
	652.677	○	○	○	-	0.11	0.06	0.63	0.89	1.25	1.54	1.98	2.35	2.81	27	51
	652.727	○	○	○	○	0.12	0.06	0.83	1.18	1.66	2.04	2.63	3.11	3.72	27	52
	652.767	○	○	○	-	0.14	0.07	1.06	1.50	2.11	2.59	3.34	3.95	4.73	28	52
	652.807	○	-	○	-	0.16	0.08	1.32	1.87	2.64	3.24	4.18	4.94	5.91	28	52
	652.847	-	-	-	○	0.18	0.09	1.65	2.34	3.30	4.04	5.22	6.15	7.38	31	58
	652.887	-	-	-	○	0.20	0.10	2.11	2.99	4.23	5.18	6.68	7.91	9.45	31	58

[1] We reserve the right to deliver 316Ti SS or 316L SS under the material no. 17.
A = equivalent bore diameter · E = narrowest free cross section
Subject to technical modifications.

Ordering example:	Type 652.566	+	Material no. 16	=	Ordering no. 652.566.16

You can find other spray angles and flow rates in our catalog Edition 112.

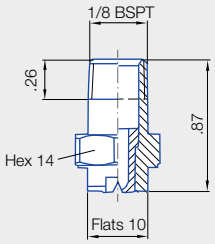
Flat fan nozzles
Series 632/633

Standard cone design, self-sealing thread connection. Stable spray angle. Uniform, parabolical distribution of liquid. Spray pipes equiped with these nozzles show an extremely uniform total distribution of liquid.

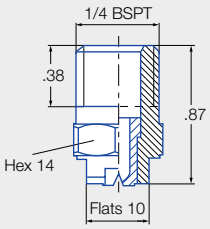
Applications:
Window cleaning, NBC protection.

303 SS/ 316Ti SS/Brass (∢ 20°–75°)

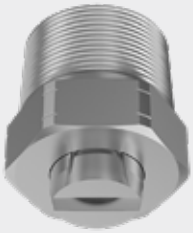
303 SS/ 316Ti SS/Brass (∢ 90°–120°)



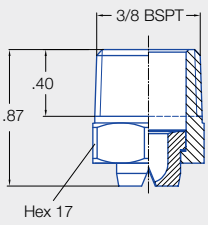
Weight Brass: .04lbs



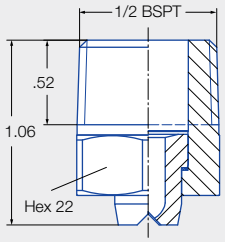
Weight Brass: .04lbs



3/8 or 1/2 version



Weight Brass: .07lbs



Weight Brass: .09lbs

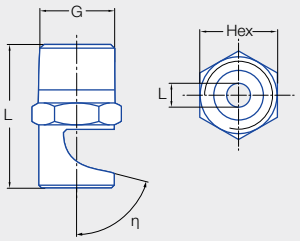
Spray angle	Type	Ordering no.								A Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=30 psi	
		Mat. no.				Code														
		16[1]	17[2]	30	5E	Male NPT														
		303 SS/ 304 SS	316Ti SS/ 316L SS	Brass	PVDF	1/8 NPT	1/4 NPT	3/8 NPT	1/2 NPT			10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	10.0	H = 10"	H = 20"
90°	**632.566**	○	○	○	○	**BA**	**BC**	**-**	**-**	.079	.043	.39	.55	2.5	.78	.95	1.1	1.2	18	33
	632.606	○	○	○	○	**BA**	**BC**	**-**	**-**	.087	.047	.49	.69	3.2	.98	1.2	1.4	1.5	18	34
	632.646	○	○	○	○*	**-**	**BC**	**BE**	**-**	.106	.055	.74	1.0	4.8	1.5	1.8	2.1	2.3	18	34
	632.676	○	○	○	○*	**-**	**BC**	**BE**	**-**	.118	.067	.98	1.4	6.3	2.0	2.4	2.8	3.1	19	35
	632.726	○	○	○	○*	**-**	**BC**	**BE**	**-**	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	19	35
	632.766	○	○	○	○*	**-**	**BC**	**BE**	**-**	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	19	35
	632.806	○	○**	○	○*	**-**	**BC**	**-**	**BG**	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.9	19	36
	632.846	○	○**	○	○*	**-**	**BC**	**-**	**BG**	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	19	35
	632.886	○	○**	○	○*	**-**	**BC**	**-**	**BG**	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.9	19	36
	632.926	○	○	○	-	**-**	**-**	**-**	**BG**	.217	.165	3.1	4.4	20.0	6.2	7.6	8.8	9.8	21	40
	632.966	○	○	○	-	**-**	**-**	**-**	**BG**	.236	.185	3.9	5.5	25.0	7.8	9.5	11.0	12.3	21	40
120°	**632.567**	○	○	○	○*	**BA**	**BC**	**-**	**-**	.079	.035	.39	.55	2.5	.78	.95	1.1	1.2	27	51
	632.607	○	○	○	-	**BA**	**BC**	**-**	**-**	.087	.043	.49	.69	3.2	.98	1.2	1.4	1.5	28	51
	632.647	○	○**	○	○*	**-**	**BC**	**BE**	**-**	.106	.055	.62	.88	4.00	1.2	1.5	1.8	2.0	28	52
	632.677	○	○**	○	○*	**-**	**BC**	**BE**	**-**	.106	.055	.74	1.0	4.8	1.5	1.8	2.1	2.3	28	52
	632.727	○	○**	○	○*	**-**	**BC**	**BE**	**-**	.118	.063	.98	1.4	6.3	2.0	2.4	2.8	3.1	29	54
	632.767	○	○	○	-	**-**	**BC**	**BE**	**-**	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	30	55
	632.807	○	○	○	-	**-**	**BC**	**-**	**BG**	.158	.079	1.6	2.2	10.0	3.1	3.8	4.4	4.9	31	57
	632.847	○	○	-	-	**-**	**BC**	**-**	**BG**	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	31	57
	632.887	○	○	○	-	**-**	**-**	**-**	**BG**	.197	.102	2.5	3.5	16.00	5.0	6.1	7.0	7.9	32	57
	632.927	○	○	○	-	**-**	**-**	**-**	**BG**	.217	.114	3.1	4.4	20.00	6.2	7.6	8.8	9.8	32	57

[1] We reserve the right to deliver 303 SS or 304 SS under the Material no. 16.
[2] We reserve the right to deliver 316Ti SS or 316L SS under the Material no. 17.
A = equivalent bore diameter · E = narrowest free cross section
* Only available with code BC · ** Only available with code BG
Subject to technical modifications.

Tongue-type nozzles
Series 686

Wide flat fan with a short but powerful delimited jet pattern. Particularly clog-proof.

Applications:
Window cleaning,
NBC protection.



Weight Brass: .04lbs

Spray angle	Deflector angle	Type	Ordering no. Material no. 316 SS 17	Brass 30	PVDF 5E	Connection Male NPT 1/8"	1/4"	3/8"	1/2"	Orifice diam. (in.)	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	80 psi	100 psi	Spray Width B (in.) @ 30 psi H=10"
90°	75°	**686. 366**	-	○	-	**BA**	-	-	-	.031	.10	.14	.63	.17	.20	.24	.28	.31	20
	75°	**686. 406**	-	○	-	**BA**	-	-	-	.039	.16	.22	1.0	.27	.31	.38	.44	.49	21
	40°	**686. 686**	-	○	-	-	**BC**	-	-	.094	.78	1.1	5.0	1.3	1.6	1.9	2.2	2.5	21
	40°	**686. 726**	-	○	-	**BA**	-	-	-	.106	.98	1.4	6.3	1.7	2.0	2.4	2.8	3.1	21
	40°	**686. 806**	-	○	-	-	**BC**	-	-	.133	1.6	2.2	10.0	2.7	3.1	3.8	4.4	4.9	21
	40°	**686. 886**	○	-	-	-	**BC**	-	-	.165	2.5	3.5	16.0	4.3	5.0	6.1	7.0	7.8	21
	40°	**686. 926**	○	-	-	-	-	**BE**	-	.185	3.1	4.4	20	5.4	6.2	7.6	8.8	9.8	21
140°	75°	**686. 368**	○	○	-	**BA**	-	-	-	.032	.10	.14	.63	.17	.20	.24	.28	.31	54
		686. 408	○	○	-	**BA**	-	-	-	.039	.16	.22	1.0	.27	.31	.38	.44	.49	54
		686. 448	○	○	-	**BA**	**BC**	-	-	.047	.19	.27	1.3	.35	.39	.48	.55	.61	54
		686. 488	○	○	-	**BA**	**BC**	-	-	.051	.25	.35	1.6	.43	.50	.61	.70	.78	54
		686. 528	○	○	-	**BA**	**BC**	-	-	.059	.31	.44	2.0	.54	.62	.76	.88	.98	54
		686. 568	○	○	○	**BA**	**BC***	-	-	.067	.39	.55	2.5	.67	.78	.95	1.1	1.2	54
		686. 608	○	○	-	**BA**	**BC**	-	-	.075	.49	.69	3.2	.86	.98	1.2	1.4	1.5	54
		686. 648	○	○	-	-	**BC**	-	-	.087	.62	.88	4.0	1.1	1.2	1.5	1.8	2.0	54
		686. 688	○	○	-	**BA**	**BC**	-	-	.095	.78	1.1	5.0	1.4	1.6	1.9	2.2	2.5	54
		686. 728	-	○	-	**BA**	**BC**	-	-	.106	.98	1.4	6.3	1.7	2.0	2.4	2.8	3.1	54
		686. 768	○	○	-	**BA***	**BC**	-	-	.118	1.2	1.8	8.0	2.2	2.5	3.0	3.5	3.9	54
		686. 808	○	○	-	**BA**	**BC**	-	-	.134	1.6	2.2	10.0	2.7	3.1	3.8	4.4	4.9	54
		686. 828	○	○	-	**BA**	**BC**	-	-	.142	1.7	2.5	11.2	3.0	3.5	4.3	4.9	5.5	54
		686. 848	○	○	-	**BA***	**BC**	-	-	150	1.9	2.7	12.5	3.4	3.9	4.8	5.5	6.1	54
		686. 868	○	○	-	-	**BC**	-	-	.158	2.2	3.1	14.0	3.8	4.3	5.3	6.1	6.9	54
		686. 888	○	○	-	-	**BC**	-	-	165	2.5	3.5	16.0	4.3	5.0	6.1	7.0	7.8	54
		686. 908	○	○	-	-	**BC**	-	-	.177	2.8	3.9	18.0	4.8	5.6	6.8	7.9	8.8	54
		686. 928	○	-	-	-	-	**BE**	-	.185	3.1	4.4	20	5.4	6.2	7.6	8.8	9.8	54
		686. 968	○	○	-	-	-	**BE**	**BG**	.209	3.9	5.5	25	6.7	7.8	9.5	11.0	12.3	54
		686. 988	○	○	-	-	-	**BE**	**BG**	.221	4.3	6.1	28	7.5	8.7	10.6	12.3	13.7	54

B = bore diameter
Can also be used for air or saturated steam.
*Only available with code BA
Materials on request

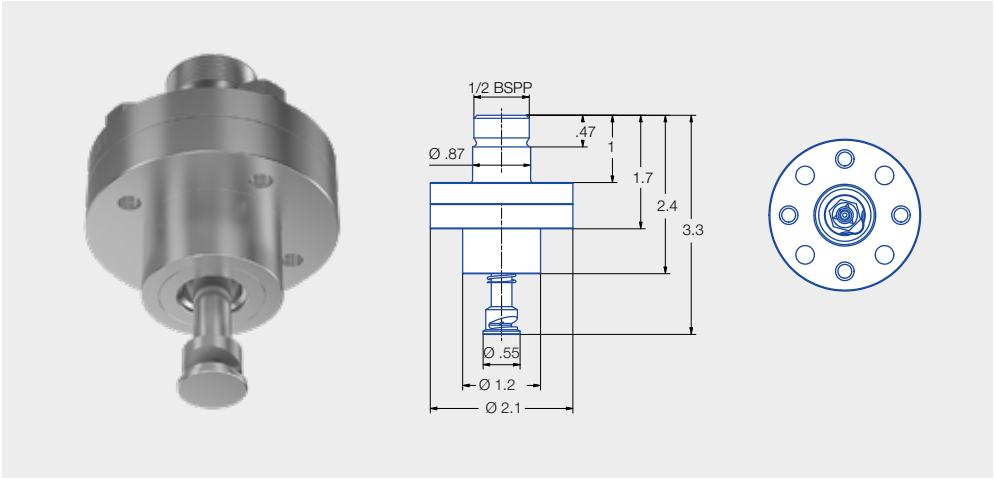
Example of ordering:	**Type**	**+**	**Material no.**	**+**	**Code**	**=**	**Ordering no.**
	686.686	**+**	**16**	**+**	**BC**	**=**	**686.686.16.BC**

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

Polished tongue-type nozzles
Series 600.507/600.516

Pop-up tongue-type nozzles guarantee an inconspicuous appearance combined with a high degree of functionality. Thanks to rear-side mounting, no protruding components interfere with the visual appearance or restrict the field of view.

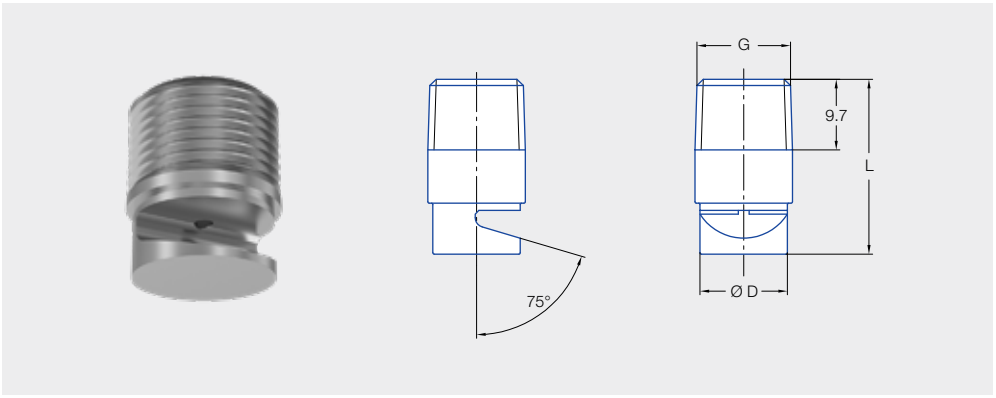
Applications:
Window cleaning, preferably in yacht construction. Cleaning of surfaces that are difficult to access by spray pattern directed backwards.



Spray angle	Ordering no.	Mat. No.	Flow Rate (Gallons Per Minute)
	Type	17 316Ti SS	**p** [psi] 75 psi
140°	**600.507**	○	.85

Other materials on request

Aesthetic design with a high quality appearance is important in yacht construction. Rough surfaces and edges have been eliminated to ensure a perfect look. The clog-resistant design and wide spray angle are combined with a powerful, intensive jet to permit spraying of large window surfaces.



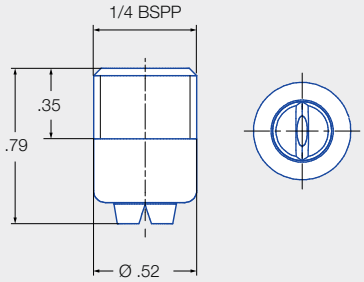
Spray angle	Ordering no.	Mat. No.	Flow Rate (Gallons Per Minute)	Length [in]	Diameter [in]	Thread
	Type	17 316Ti SS	30 psi	L	D	G
140°	**600.516.17.10.00.0**	○	0.66	0.63	.47	G 1/4
	600.516.17.11.00.0	○	0.83	0.63	.47	G 1/4
	600.516.17.12.00.0	○	0.53	0.63	.47	G 1/4
	600.516.17.21.00.0	○	0.83	0.94	.47	G 1/4
	600.516.17.22.00.0	○	0.53	0.94	.47	G 1/4
	600.516.17.24.00.0	○	2.11	0.94	.47	G 1/4
	600.516.17.25.00.0	○	2.64	0.94	.47	G 1/4
	600.516.17.26.00.0	○	1.32	0.94	.47	G 1/4

All flow rates and spray angels in accordance with page 48 possible on request
Other materials on request

Polished flat fan nozzles
Series 600.577

These compact flat fan nozzles are ideal for a concealed installation. There are no rough surfaces or edges in order to guarantee an optimum aesthetic design.

Applications:
Window cleaning, preferably in yacht construction.



Spray angle	Ordering no.	Mat. No.	Flow Rate (Gallons Per Minute)	Length [in]	Diameter [in]	Thread BSPP
	Type	**17** 316Ti SS	30 psi			
45°	**600.577.17.11**	○	1.06	.79	.48	G 1/4 A
120°	**600.577.17.10**	○	1.06	.79	.52	G 1/4 A
140°	**600.577.17.00**	○	1.25	.79	.48	G 1/4 A

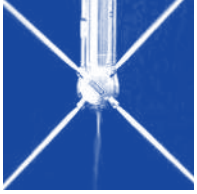
All flow rates in accordance with page 48 possible on request
Other materials on request

Polished ball joints for window cleaning

	Ordering no.	Material	Thread size 1 BSPT	Thread size 2 BSPT	Length	Diameter
	**092.023.17.01.00**	316Ti SS	1/4 male thread	1/4 female thread	1.65 in	1.18 in
	**092.023.17.02.00**	316Ti SS	1/4 female thread	1/4 female thread	1.65 in	1.18 in
	**092.023.17.03.00**	316Ti SS	1/4 male thread	1/4 female thread	2.36 in	1.18 in
	**092.023.17.05.00**	316Ti SS	3/8 female thread	1/4 female thread	1.65 in	1.18 in
	**092.023.17.08.00**	316Ti SS	1/4 male thread	1/4 female thread	3.15 in	1.18 in

Other versions possible on request

High impact tank cleaning machine »IntenseClean Hygienic« Series 5TA/5TB



- Gear-controlled
- Particularly powerful solid jets
- Operating pressures up to 217 and 362psi possible

Applications:
Cleaning tanks/gray and black water tanks.

Materials:
316L SS, 632 SS,
PEEK, PTFE,
Zirconium oxide, EPDM

Max. temperature:
203°F, 266°F (Environment)

Recommended operating pressure:
29-145 psi

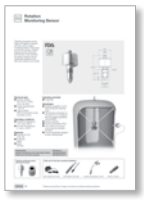
Installation:
Operation in every direction possible

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

Bearing:
Ball bearing

Weight:
5TA: 2 lbs
5TB: 8.8 lbs

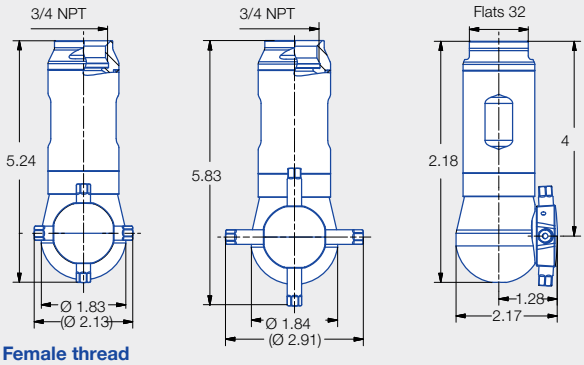
Rotation monitoring sensor:



Sensor compatible, please ask for more information.

ATEX version on request

5TA



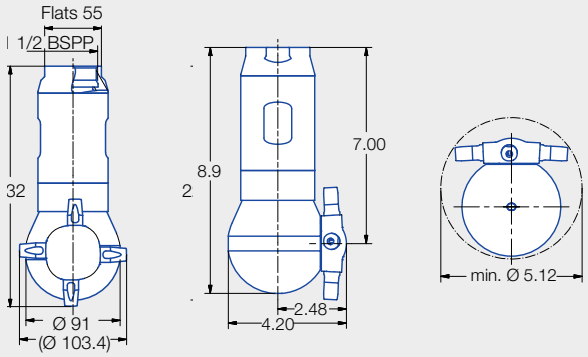
Female thread 5TA.403.1Y.AL and 5TA.404.1Y.AL | **Female thread 5TA.405.1Y.AL** | **Female thread**

Spray angle	Ordering no.	Free Passage (in.)	Number, Ø Nozzles [in]	Flow Rate (Gallons Per Minute) liters per minute 2 bar	30 psi	40 psi	75 psi	145 psi	Max Pressure (psi)	Max. tank diameter [ft]
360°	**5TA. 403. 1Y. BL**	.059	4 x .12	25	7	8	11	15	217	39
	5TA. 404. 1Y. BL	.059	4 x .16	42	11	13	18	25	217	41
	5TA. 405. 1Y. BL	.059	4 x .20	50	13	16	21	30	217	43

E = narrowest free cross section · Slip-on connection on request

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

5TB



Female thread

Spray Angle	Ordering no.	Free Passage (in.)	Number, Ø of nozzles (in)	Flow Rate (Gallons Per Minute) liters per minute 2 bar	30 psi	40 psi	75 psi	145 psi	Max. tank Ø (ft.)	Max. pressure (psi)
360°	**5TB. 406. 1Y. BS**	.236	4 x .24	107.0	28.7	33.2	45.4	63.1	42	362
	5TB. 407. 1Y. BS	.236	4 x .28	135.0	36.2	41.8	57.2	79.6	46	362
	5TB. 408. 1Y. BS	.236	4 x .32	165.0	44.3	51.2	70.1	97.5	46	362

E = narrowest free cross section · Slip-on connection on request

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

High impact tank cleaning machine
Series 5TM

- Gear driven
- Very powerful solid jets
- Popular and proven design

Applications:
Cleaning tanks/gray and black water tanks.

Materials:
316L SS, 304 SS, PTFE, PEEK

Max. temperature:
140°F/60°C

Recommended operating pressure:
75 psi

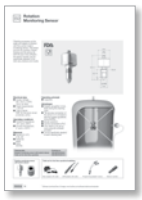
Installation:
Operation in every direction possible

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

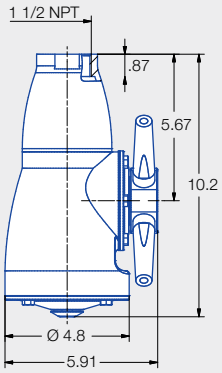
Bearing:
Ball bearing

Weight:
17 lbs

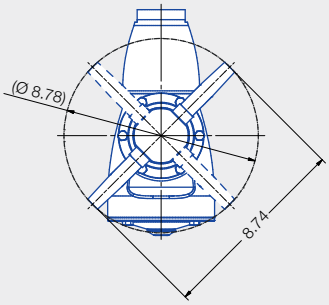
Rotation monitoring sensor:



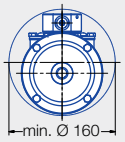
Sensor compatible, please ask for more information.

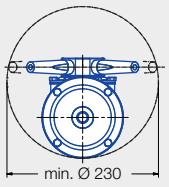


Female thread



5TM.2XX.1Y.AS (2 nozzles)





5TM.4XX.1Y.AS (4 nozzles)

Ordering no.				Free Passage (in.)	No. of Nozzles x Diameter	Operating Pressure				Max. tank diameter [ft]
Type	Connection					40 psi	60 psi	80 psi	100 psi	
	1 1/2" Male NPT	1 1/2" Female NPT	1 1/2" CL150 Flange							
5TM. 208. 1Y	**BR**	**BS**	**015**	.314	2 x 8mm	40 gpm	49 gpm	56 gpm	59 gpm	79
5TM. 209. 1Y	**BR**	**BS**	**015**	.354	2 x 9mm	45 gpm	54 gpm	60 gpm	65 gpm	79
5TM. 210. 1Y	**BR**	**BS**	**015**	.394	2 x 10mm	50 gpm	62 gpm	69 gpm	72 gpm	79
5TM. 211. 1Y	**BR**	**BS**	**015**	.433	2 x 11mm	57 gpm	68 gpm	78 gpm	80 gpm	75
5TM. 406. 1Y	**BR**	**BS**	**015**	.236	4 x 6mm	43 gpm	53 gpm	61 gpm	69 gpm	59
5TM. 407. 1Y	**BR**	**BS**	**015**	.276	4 x 7mm	**	70 gpm	78 gpm	82 gpm	66
5TM. 408. 1Y	**BR**	**BS**	**015**	.315	4 x 8mm	62 gpm	74 gpm	84 gpm	92 gpm	72
5TM. 409. 1Y	**BR**	**BS**	**015**	.354	4 x 9mm	74 gpm	88 gpm	98 gpm	106 gpm	75
5TM. 410. 1Y	**BR**	**BS**	**015**	.394	4 x 10mm	80 gpm	95 gpm	107 gpm	110 gpm	75

E = narrowest free cross section

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

Rotating cleaning nozzle »XactClean® HP«
Series 5S2/5S3

- Controlled rotation
- Powerful flat fan nozzles
- Very efficient tank cleaning nozzle

Applications:
Cleaning tanks/gray and black water tanks.

Materials:
316L SS,
316 SS,
632 SS,
PEEK, PTFE,
Zirconium oxide, EPDM

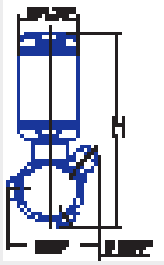
Max. temperature:
203 °F/ 95 °C

Recommended operating pressure:
5 bar

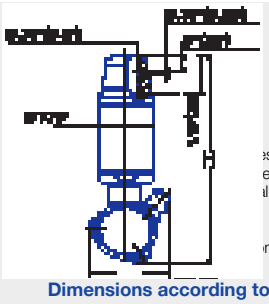
Installation:
Operation in every direction is possible

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

Bearing:
Double ball bearing



Female thread



Dimensions according to ASME-BPE (OD-tube)

Spray angle	Ordering no. Type	Connection ⅜" Female NPT	½" Female NPT	¾" Female NPT	1" Female NPT	½" OD Slip-on	¾" OD Slip-on	Free Passage Ø (in.)	Flow Rate (Gallons Per Minute) liters per minute 2 bar	30 psi	40 psi	75 psi	145 psi	Max. tank diameter [ft]
180°	**5S2.953.1Y**	**BF**	**BH**	**-**	**-**	**TF05 (T5)**	**-**	.08	25	6.6	7.8	10.6	15.1	11.5
	5S3.053.1Y	**-**	**BH**	**-**	**-**	**-**	**TF07 (T7)**	.08	41	10.8	12.8	17.2	24.3	13
	5S3.113.1Y	**-**	**BH**	**BL**	**-**	**-**	**TF07 (T7)**	.08	60	15.9	18.4	24.8	35.1	20
	5S3.183.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	89	23.5	27.7	37.3	52.6	23
	5S3.233.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	111	29.3	34.3	46.2	65.5	25
	5S3.263.1Y	**-**	**-**	**BL**	**BN**	**-**	**TF07 (T7)**	.08	135	35.7	41.8	56.3	79.5	26
180°	**5S2.954.1Y**	**BF**	**BH**	**-**	**-**	**TF05 (T5)**	**-**	.08	25	6.6	7.8	10.6	15.1	11.5
	5S3.054.1Y	**-**	**BH**	**-**	**-**	**-**	**TF07 (T7)**	.08	41	10.8	12.8	17.2	24.3	13
	5S3.114.1Y	**-**	**BH**	**BL**	**-**	**-**	**TF07 (T7)**	.08	60	15.9	18.4	24.8	35.1	20
	5S3.184.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	89	23.5	27.7	37.3	52.6	23
	5S3.234.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	111	29.3	34.3	46.2	65.5	25
	5S3.264.1Y	**-**	**-**	**BL**	**BN**	**-**	**TF07 (T7)**	.08	135	35.7	41.8	56.3	79.5	26
270°	**5S2.955.1Y**	**BF**	**BH**	**-**	**-**	**TF05 (T5)**	**-**	.08	25	6.6	7.8	10.6	15.1	11.5
	5S3.055.1Y	**-**	**BH**	**-**	**-**	**-**	**TF07 (T7)**	.08	41	10.8	12.8	17.2	24.3	13
	5S3.115.1Y	**-**	**BH**	**BL**	**-**	**-**	**TF07 (T7)**	.08	60	15.9	18.4	24.8	35.1	20
	5S3.185.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	89	23.5	27.7	37.3	52.6	23
	5S3.235.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	111	29.3	34.3	46.2	65.5	25
	5S3.265.1Y	**-**	**-**	**BL**	**BN**	**-**	**TF07 (T7)**	.08	135	35.7	41.8	56.3	79.5	26
270°	**5S2.956.1Y**	**BF**	**BH**	**-**	**-**	**TF05 (T5)**	**-**	.08	25	6.6	7.8	10.6	15.1	11.5
	5S3.056.1Y	**-**	**BH**	**-**	**-**	**-**	**TF07 (T7)**	.08	41	10.8	12.8	17.2	24.3	13
	5S3.116.1Y	**-**	**BH**	**BL**	**-**	**-**	**TF07 (T7)**	.08	60	15.9	18.4	24.8	35.1	20
	5S3.186.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	89	23.5	27.7	37.3	52.6	23
	5S3.236.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	111	29.3	34.3	46.2	65.5	25
	5S3.266.1Y	**-**	**-**	**BL**	**BN**	**-**	**TF07 (T7)**	.08	135	35.7	41.8	56.3	79.5	26
360°	**5S2.959.1Y**	**BF**	**BH**	**-**	**-**	**TF05 (T5)**	**-**	.07	25	6.6	7.8	10.6	15.1	11.5
	5S3.059.1Y	**-**	**BH**	**-**	**-**	**-**	**TF07 (T7)**	.08	41	10.8	12.8	17.2	24.3	13
	5S3.119.1Y	**-**	**BH**	**BL**	**-**	**-**	**TF07 (T7)**	.08	60	15.9	18.4	24.8	35.1	20
	5S3.189.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	89	23.5	27.7	37.3	52.6	23
	5S3.239.1Y	**-**	**-**	**BL**	**-**	**-**	**TF07 (T7)**	.08	111	29.3	34.3	46.2	65.5	25
	5S3.269.1Y	**-**	**-**	**BL**	**BN**	**-**	**TF07 (T7)**	.08	135	35.7	41.8	56.3	79.5	26

E = narrowest free cross section · NPT on request

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

Nozzle dimensions [in]

Connection	Max. Height [H]
BF	5.83
BH	5.87
BL	5.47
BN	5.47
TF05 (T5)	5.91
TF07 (T7)	6.46

ATEX version on request

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

Slip-on information:
– R-clip made of 316L SS is included (Ordering number: 095.022.1Y.50.60.E (TF07), 095.013.1E.05.59.0 (TF05)).
– 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	+	Material no.	=	Ordering no.
	5S2.953.1Y	+	**BF**	=	**5S2.953.1Y.BF**

Rotating cleaning nozzle »XactClean® HP+« Series 5S5

- Controlled rotation
- Powerful flat fan nozzles
- Very efficient tank cleaning nozzle, especially for larger tanks

Materials:
316L SS,
316 SS, PEEK, EPDM

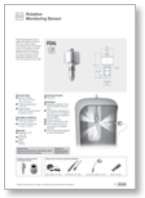
Max. temperature:
203°F/ 95°C

Recommended operating pressure:
45 psi

Installation:
Operation in every direction is possible

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

Bearing:
Double ball bearing

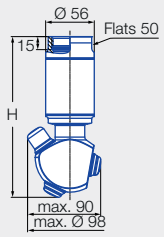


Rotation monitoring sensor
Sensor compatible, please ask for more information.

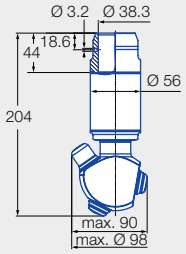
The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

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

Slip-on information:
– R-clip made of 316L SS is included (Ordering number: 095.013.1Y.06.45.0).
– Depending on diameter of the adapter the flow rate can increase due to leakage between connecting pipe and rotating cleaning nozzle.



Female thread



Dimensions slip-on connection according to ASME-BPE (OD-tube)

Nozzle dimensions [in]

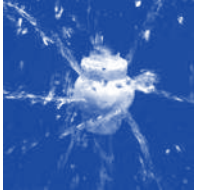
Connection	Max. Height [H]
BN	7.28
BQ	7.28
BS	7.36

Spray angle	Ordering no.					Free passage Ø [in]	Flow Rate (Gallons Per Minute)				Max. tank diameter [ft]
	Type	Connection					2 bar	30 psi	40 psi	75 psi	
		1 NPT	1 1/4 NPT	1 1/2 NPT	1 1/2" Slip-on						
180°	**5S5.293.1Y**	**BN**	**-**	**-**	**TF15**	.12	165	44.3	51.2	70.1	29.5
	5S5.323.1Y	**BN**	**BQ**	**-**	**TF15**	.12	200	53.7	62.0	84.9	30.2
	5S5.363.1Y	**-**	**BQ**	**BS**	**TF15**	.12	250	67.2	77.5	106.1	30.8
180°	**5S5.294.1Y**	**BN**	**-**	**-**	**TF15**	.12	165	44.3	51.2	70.1	29.5
	5S5.324.1Y	**BN**	**BQ**	**-**	**TF15**	.12	200	53.7	62.0	84.9	30.2
	5S5.364.1Y	**-**	**BQ**	**BS**	**TF15**	.12	250	67.2	77.5	106.1	30.8
270°	**5S5.295.1Y**	**BN**	**-**	**-**	**TF15**	.12	165	44.3	51.2	70.1	29.5
	5S5.325.1Y	**BN**	**BQ**	**-**	**TF15**	.12	200	53.7	62.0	84.9	30.2
	5S5.365.1Y	**-**	**BQ**	**BS**	**TF15**	.12	250	67.2	77.5	106.1	30.8
270°	**5S5.296.1Y**	**BN**	**-**	**-**	**TF15**	.12	165	44.3	51.2	70.1	29.5
	5S5.326.1Y	**BN**	**BQ**	**-**	**TF15**	.12	200	53.7	62.0	84.9	30.2
	5S5.366.1Y	**-**	**BQ**	**BS**	**TF15**	.12	250	67.2	77.5	106.1	30.8
360°	**5S5.299.1Y**	**BN**	**-**	**-**	**TF15**	.12	165	44.3	51.2	70.1	29.5
	5S5.329.1Y	**BN**	**BQ**	**-**	**TF15**	.12	200	53.7	62.0	84.9	30.2
	5S5.369.1Y	**-**	**BQ**	**BS**	**TF15**	.12	250	67.2	77.5	106.1	30.8
	5S5.399.1Y	**-**	**BQ**	**BS**	**TF15**	.12	300	80.6	93	127.3	31.5

E = narrowest free cross section · NPT on request

Example of ordering:	Type	+	Material no.	=	Ordering no.
	5S5.293.1Y	+	**BN**	=	**5S5.293.1Y.BN**

Rotating cleaning nozzle »PTFE Whirly«
Series 573/583



- Self rotating
- Rotating solid jets
- Recommended for tanks made of glass and enamel
- 3A® version available

Applications:
Cleaning tanks/gray and black water tanks. Internal cleaning of contaminated pipes, e. g. exhaust gas pipes.

Materials:
PTFE

Max. temperature:
200 °F

Recommended operating pressure:
30 psi

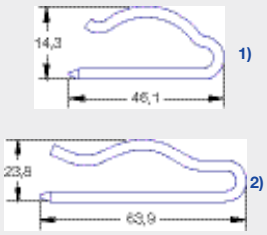
Installation:
Operation in every direction is possible

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

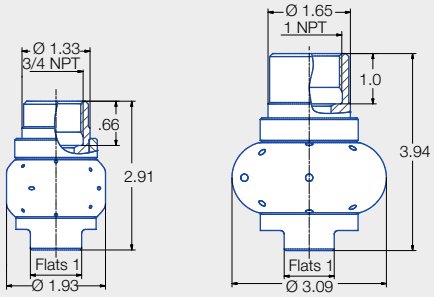
Bearing:
Slide bearing made of PTFE

Data in brackets refer to 1"-version marked with *

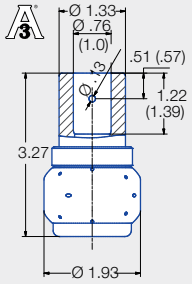
1" Slip-on
TF10*



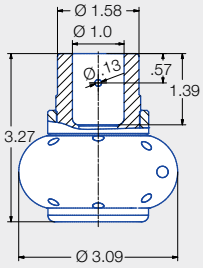
R-clip



Female thread | **Female thread**



3/4" and 1" Slip-on connection (3A-approved) Dimensions according to ASME-BPE (OD-tube)



1" Slip-on connection (3A-approved) Dimensions according to ASME-BPE (OD-tube)

Spray Angle	Ordering no. Type	Connection ¾" Female NPT	1" Female NPT	Sanitary Pin ¾" Slip-on	Sanitary Pin 1" Slip-on	1" 1½" Tri-Clamp	Free Passage Ø (in.)	Flow Rate (Gallons Per Minute) 20 psi	liters per minute 2 bar	40 psi	60 psi	Tri-Clamp Drawing Reference	Max. tank diameter [ft]
270° up	**583. 116. 55**	**BL**	**-**	**TF07**	**-**	**15**	.081	16	67	21	25	1	8.2
	583. 266. 55	**BL**	**-**	**TF07**	**-**	**15**	.133	32	145	45	55	1	9.2
270° down	**573. 266. 55**	**BL**	**-**	**TF07**	**-**	**15**	.133	32	145	45	55	1	9.2
360°	**583. 119. 55**	**BL**	**-**	**TF07**	**-**	**15**	.056	13	58	18	22	1	7.9
	583. 209. 55	**BL**	**-**	**TF07**	**-**	**15**	.136	22	100	31	38	1	8.2
	583. 269. 55	**BL**	**-**	**TF07**	**-**	**15**	.187	32	145	45	55	1	9.2
	583. 279. 55	**-**	**BN**	**-**	**TF10**	**15**	.146	33	150	47	58	2	9.8
	583. 349. 55	**-**	**BN**	**-**	**TF10**	**15**	.219	50	226	70	86	2	10.5

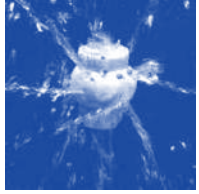
The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

Information on operation:
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 information:
– R-clip made of 316L SS 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.

E = narrowest free cross section · NPT on request
* see drawing 3 for details

Example of ordering:	Type	+	Connection	=	Ordering no.
	583.116.55.	+	BL	=	583.116.55.BL



Rotating cleaners made of PTFE for use at high temperatures
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.

Materials:
PTFE
Rings: Hastelloy®

Max. temperature:
274°F/ 134°C

Max. tank diameter:
Rinsing: 16 ft
Cleaning: 10 ft

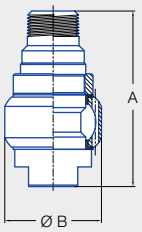
Recommended operating pressure:
15-40 psi

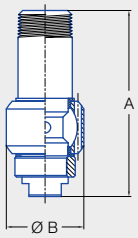
Installation:
Operation in every direction is possible

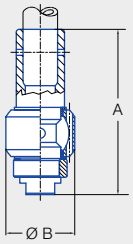
599.133.55.BK

599.170.55.BK

599.174.J7.TF07







Spray angle	Ordering no. Type	Connection 3/4" NPT	Connection 3/4" slip-on	Flow Rate (Gallons Per Minute) 20 psi	liters per minute 2bar	40 psi	60 psi	A Length [in]	B Ø [in]	Weight [lb]
360°	**599.133.55**	**BK**	**-**	22	100	31	38	3.5	2.0	.35
	599.170.55	**BK**	**-**	19	84	26	32	3.6	1.5	.25
	599.174.J7	**-**	**TF07**	19	84	26	32	3.6	1.5	.25

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 of ordering:	Type	+	Connection	=	Ordering no.
	599.133.55.	+	BK	=	599.133.55.BK

Static spray balls
Series 540/541

- Compact design
- Effective solid jets
- Also to use with saturated steam

Applications:
Cleaning tanks/gray and black water tanks.

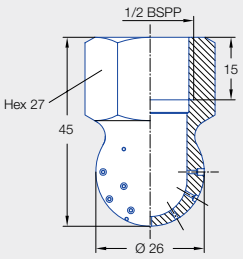
Materials:
303 SS

Max. temperature:
400°F/ 200°C

Recommended operating pressure:
45 psi

Installation:
Operation in every direction possible

For additional spray balls please refer to our brochure "Precision Spray Nozzles for Tank and Equipment Cleaning"



Spray angle	Ordering no.	Free Passage (in.)	Flow Rate (Gallons Per Minute)				Max. tank diameter [ft]
			20 psi	liters per minute 2 bar	40 psi	60 psi	
240°	**540. 909. 16. BH**	.031	4.0	18	5.6	6.8	21
	540. 989. 16. BH	.039	6.1	28	8.7	10.6	23
	541. 109. 16. BH	.059	13	57	18	22	25
	541. 189. 16. BH	.079	20	90	28	34	27
	541. 239. 16. BH	.090	26	118	37	45	31

E = narrowest free cross section · NPT on request

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

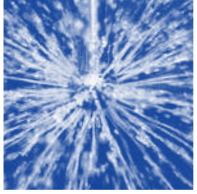
In most applications, static spray balls do not deliver the same cleaning power as rotating nozzles, anyway they do have advantages that make them indispensable for certain tasks:

– No moving parts
– Self-draining
– Easy to inspect
– Proven use in hygienically sensitive environments

Should a rotating nozzle stop turning for some reason, parts of the tank may remain uncleaned. This cannot happen with spray balls. However, gaps can occur in the spray pattern if individual openings are blocked with soil.

Compared to rotating nozzles, static spray balls usually need two to three times the amount of liquid.

Static Spray Balls »RinseClean«
Series 5B2/5B3



- Popular spray ball design
- Powerful solid streams

Applications:
Cleaning tanks/gray and black water tanks.

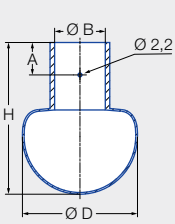
Material:
316L SS,
R-clip: 316L SS

Max. temperature:
392 °F / 200 °C

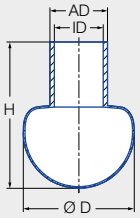
Recommended operating pressure:
30 psi

Installation:
Operation in every direction is possible

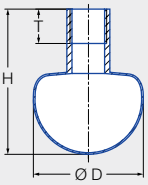
For additional spray balls please refer to our brochure "Precision Spray Nozzles for Tank and Equipment Cleaning"



Dimensions slip-on connection according to DIN 10357



Weld-on connection



Thread connection

Slip-on connection according to DIN EN 10357 series B (replaces DIN 11850 series 1)

Spray angle	Ordering no. Type	E Ø [in]	Flow Rate (Gallons per minute) 20 psi	40 psi	liters per minute 2 bar	60 psi	Dimensions [in] Ø D	Height H	Con-nection B	Distance to bore hole A	R-clip	Max. tank diameter [ft]
360°	**5B2.879.1Y.D0.80.0**	.03	3.4	4.7	15	5.6	.79	1.46	0.32	.35	1	7
	5B3.089.1Y.D1.20.0	.04	10.9	15.5	50	18.6	1.10	1.65	0.48	.35	1	7
	5B3.139.1Y.D1.20.0	.06	14.3	20.2	65	24.8	1.10	1.65	0.48	.35	1	8
	5B3.209.1Y.D1.80.0	.06	22.0	31.0	100	38.2	1.10	1.65	0.72	.35	2	8
	5B3.309.1Y.D2.20.0	.07	39.0	55.8	180	68.6	2.52	3.31	0.87	.71	2	12
	5B3.379.1Y.D2.80.0	.08	57.1	80.7	260	98.7	2.52	3.31	1.11	.71	3	17
	5B3.389.1Y.D4.00.0	.08	61.4	86.9	280	106.4	2.52	3.31	1.59	.71	4	17
	5B3.409.1Y.D3.40.0	.09	70.1	99.3	320	121.6	2.52	3.31	1.35	.71	4	17
	5B3.449.1Y.D2.80.0	.12	89.9	127.2	410	155.7	2.52	3.31	1.11	.71	3	18
	5B3.489.1Y.D3.40.0	.11	112.0	158.2	510	193.9	2.52	3.31	1.35	.71	4	18
	5B3.499.1Y.D4.00.0	.11	118.5	167.5	540	205.1	2.52	3.31	1.59	.71	4	18
	5B3.539.1Y.D5.20.0	.13	147.0	207.8	670	254.7	3.54	4.37	2.06	.98	5	18
180°	**5B3.083.1Y.D1.80.0**	.05	10.9	15.5	50	18.9	1.10	1.65	0.72	.35	2	7
	5B3.253.1Y.D2.20.0	.07	28.5	40.3	130	49.3	2.52	3.31	0.87	.71	2	10
	5B3.323.1Y.D2.80.0	.09	43.7	62.0	200	76.0	2.52	3.31	1.11	.71	3	11
	5B3.463.1Y.D5.20.0	.13	100.8	142.7	460	174.7	3.54	4.37	2.06	.98	5	18
180°	**5B3.114.1Y.D1.80.0**	.06	13.0	18.6	60	22.9	1.10	1.65	0.72	.35	2	7
	5B3.274.1Y.D2.20.0	.09	32.9	46.5	150	57.1	2.52	3.31	0.87	.71	2	10
	5B3.394.1Y.D2.80.0	.12	63.6	90.0	290	110.1	2.52	3.31	1.11	.71	3	16
	5B3.444.1Y.D5.20.0	.13	87.8	124.1	400	152.0	3.54	4.37	2.06	.98	5	17

Slip-on connection according to DIN EN 10357 series A (replaces DIN 11850 series 2)

Spray angle	Ordering no. Type	E Ø [in]	Flow Rate (Gallons per minute) 20 psi	40 psi	liters per minute 2 bar	60 psi	Dimensions [in] Ø D	Height H	Con-nection B	Distance to bore hole A	R-clip	Max. tank diameter [ft]
360°	**5B3.149.1Y.D2.90.0**	.04	15.5	21.7	70	15.4	2.52	3.31	1.15	.71	3	8
	5B3.299.1Y.D2.90.0	.06	36.3	51.2	165	36.2	2.52	3.31	1.15	.71	3	10
	5B3.359.1Y.D2.90.0	.07	50.6	71.3	230	50.5	2.52	3.31	1.15	.71	3	16
	5B3.399.1Y.D2.90.0	.09	65.8	93.1	300	65.7	2.52	3.31	1.15	.71	3	17
	5B3.429.1Y.D2.90.0	.10	79.1	111.7	360	78.9	2.52	3.31	1.15	.71	3	17
	5B3.539.1Y.D5.30.0	.13	147.0	207.8	670	147.0	3.54	4.37	2.10	.98	5	18

Static Spray Balls »RinseClean«
Series 5B2/5B3

Slip-on connection according to DIN EN 10357 series D (ASME BPE 1997, OD tube compatible)

Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate (Gallons per minute) 20 psi	40 psi	liters per minute 2 bar	60 psi	Dimensions [in] Ø D	Height H	Con-nection B	Distance to bore hole A	R-clip	Max. tank diameter [ft]
360°	**5B3.089.1Y.A1.00.0**	.04	10.9	15.5	50	10.9	1.10	1.65	0.39	.35	1	7
	5B3.209.1Y.A1.90.0	.06	22.0	31.0	100	22.0	1.10	1.65	0.76	.35	2	8
	5B3.309.1Y.A1.90.0	.07	39.4	55.8	180	39.6	2.52	3.31	0.76	.71	2	11
	5B3.379.1Y.A2.60.0	.08	57.1	80.7	260	56.9	2.52	3.31	1.01	.71	3	17
	5B3.449.1Y.A3.80.0	.12	89.9	127.2	410	89.9	2.52	3.31	1.51	.71	4	18
	5B3.539.1Y.A5.10.0	.13	147.0	207.8	670	147.0	3.54	4.37	2.01	.98	5	18

Threaded connection

Spray angle	Ordering no. / Type	Con-nection NPT	E Ø [in]	Flow Rate (Gallons per minute) 20 psi	40 psi	liters per minute 2 bar	60 psi	Dimensions [in] Ø D	Height H	Screw-in length T	Max. tank diameter [ft]
360°	**5B2.879.1Y.BA.00.0**	1/8 A	.03	3.4	4.7	15	5.6	.79	1.5	.31	7
	5B3.309.1Y.BH.00.0	1/2"	.07	39.4	55.8	180	68.6	2.5	3.3	.55	11
	5B3.379.1Y.BN.00.0	1"	.08	57.1	80.7	260	98.7	2.5	3.3	.71	17
	5B3.539.1Y.BW.00.0	2"	.12	147.0	207.8	670	254.7	3.5	4.4	.94	18

Welded connection according to ISO 2037

Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate (Gallons per minute) 20 psi	40 psi	liters per minute 2 bar	60 psi	Dimensions [in] OD = outside diameter ID = inside diameter Ø D	Height H	Dimensions of the connection piece	Max. tank diameter [ft]
360°	**5B2.879.1Y.W1.20.0**	.03	3.4	4.7	15	5.6	.79	1.5	OD .47 ID.39	7
	5B3.089.1Y.W1.20.0	.04	10.9	15.5	50	18.9	1.1	1.7	OD .47 ID.39	7
	5B3.209.1Y.W1.70.0	.06	22	31.0	100	38.2	1.1	1.7	OD .68 ID.60	8
	5B3.309.1Y.W2.50.0	.07	39.4	55.8	180	68.6	2.5	3.3	OD .98 ID .89	11
	5B3.379.1Y.W2.50.0	.08	57.1	80.7	260	98.7	2.5	3.3	OD .98 ID .89	17
	5B3.449.1Y.W3.80.0	.12	90	127.2	410	155.7	2.5	3.3	OD 1.5 ID 1.4	18

E = narrowest free cross section

Slip-on information

- R-clip made of 316L SS is included. (Ordering no.: See table on page 64).
- Depending on diameter of adapter, the flow rate can increase due to leakage between connecting pipe and static spray ball.

The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

In most applications, spray balls do not deliver the same cleaning power as rotating nozzles, although they do have advantages that make them indispensable for certain tasks:

– No moving parts
– Self-draining
– Easy to inspect
– Proven use in hygienically sensitive environments

Should a rotating cleaner stop turning for some reason, parts of the tank may remain uncleaned. This cannot happen with spray balls. However, gaps can occur in the spray pattern if individual openings are blocked with dirt.

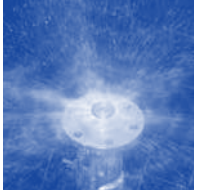
Compared to rotating cleaners, spray balls usually need two to three times the amount of fluid.

NAVY

Safety at sea is a basic prerequisite for free trade routes. This includes everything from precise mapping and identification of navigation channels to protection against crime, terrorism, piracy and armed conflicts. There is a great global interest in a functioning, open world trade system, free transport routes and free trade in maritime transport.

Lechler nozzles are used on naval ships in a wide range of applications and therefore support safety and security on the high seas. On deck, they are used for camouflage, cleaning the deck surfaces or extinguishing fires by means of foam. Inside the ship, nozzle are used for protection of critical areas or support gas cooling.

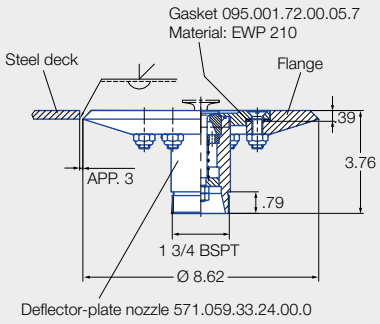
Deflector-plate nozzles
Series 571



Applications:
Cleaning deck surfaces in the event of NBC contamination.

- Uniform, flat and coarse-droplet spray circle
- Low wind susceptibility, large-area fluid impact
- Recessed installation

Other housing versions possible on request.



Deflector-plate nozzle 571.059.33.24.00.0

Spray angle	Ordering no. / Type	E Ø [in]	Flow Rate p [psi] gal/min					Flow Rate p [psi] SCFM				
			75	90	100	120	130	75	90	100	120	130
180°	**571.059**	.08	17.62	18.94	20.68	22.01	23.33	2.35	2.53	2.77	2.94	3.12
	571.179	.11	34.79	38.30	40.95	44.04	46.68	4.65	5.12	5.47	5.89	6.24

Standard material: Lock nuts = 316Ti SS · Spring: 1.4300 · All other components: 2.0920 (aluminum bronze)
Flange not included in the scope of delivery. Available on request.

NATO/BW number available on request.

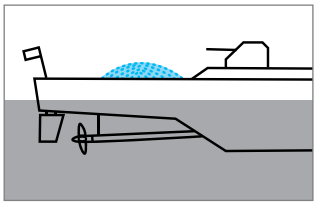
Design recommendations

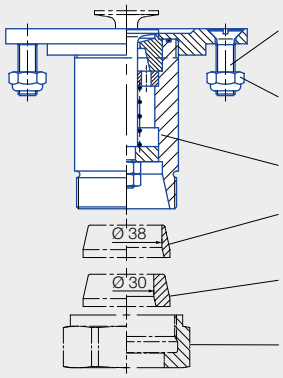
Spray water quantity:
Approx. 1 SCFM (1.32 gal/min) is calculated per tonne displacement. According to the construction specifications of the German Armed Forces for naval ships, 0.14 SCFM (1.06 gal/min) is required per m^2 of deck area.

However, it was possible to prove in tests that .66–.79 gal/min is sufficient for coverage of the deck surfaces due to the low spray losses of the Lechler nozzles used when combined.

Spray diameter

Pressure	Type 571.059.33.24 Ø [ft]	Type 571.179.33.24 Ø [ft]
75	23	24
90	24	24
100	21	23
120	21	23
130	21	23

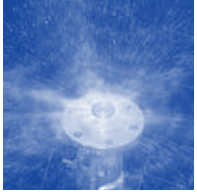

Spray circle diameter at 116 psi (according to BWB)
Type 571.059: approx. 20 ft
Type 571.179: approx. 23 ft



Countersunk screw ordering no.: 6 ea.	**095.012.1C.00.35.0** **M10 x 35 DIN 963** Material: 1.4301
Countersunk screw ordering no.: 6 ea.	**095.011.1C.00.14.0** **M10 DIN 985** Material: 1.4301
Nozzle ordering no.:	**571.XXX.33.24**
Brazed conical nipple ordering no.:	**095.016.3F.01.30.0** **A38 DIN 86148** Material: 2.0872
Brazed conical nipple ordering no.:	**095.016.3F.04.10.0** **A30 DIN 86148** Material: 2.0872
Union nut Hex 60 ordering no.:	**095.011.3E.00.12.0** Material: 2.0966

Other connection flanges and mounting types on request.

Deflector-plate nozzles
Series 571/500.289

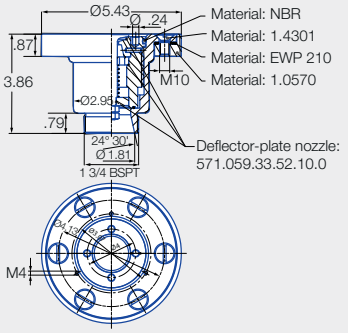


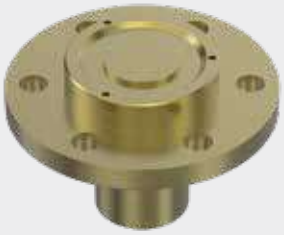
Applications:
Cleaning deck surfaces in the event of NBC contamination.

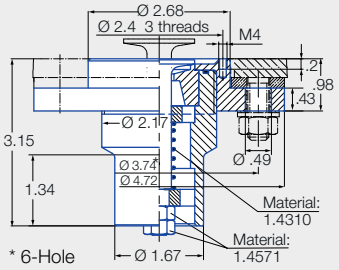
■ **Series 571**
Modular-design deflector-plate nozzle where the nozzle is guided. This allows simple mounting/ disassembly, e. g. for cleaning purposes or in areas with high mechanical loads (e. g. in the area of the guns).

■ **Series 500.289**
Deflector-plate nozzle for mounting using stud bolts and clamp couplings (e. g. Straub Grip-L) from the inside of the ship.

■ **Recessed installation**

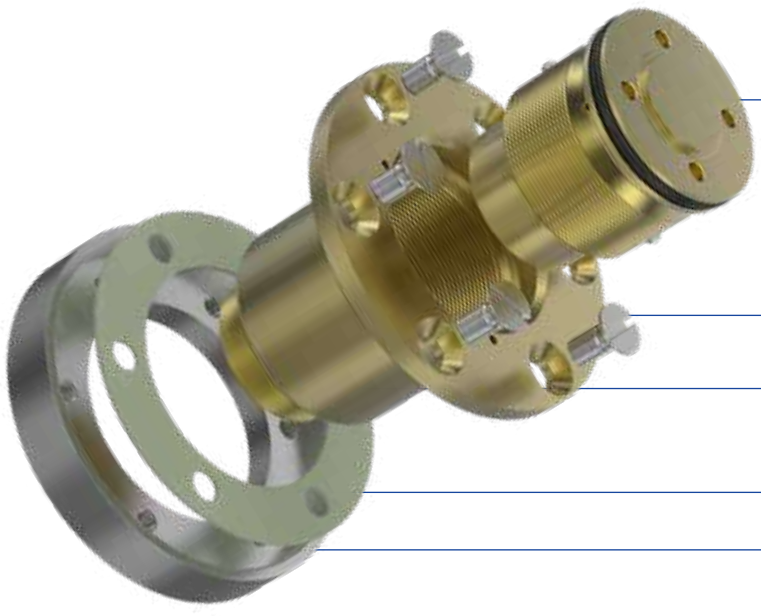




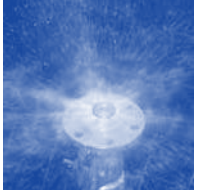


Spray angle	Ordering no. / Type	E Ø [in]	V̇ p [psi] gal/min					V̇ p [psi] SCFM				
			75	90	100	120	130	75	90	100	120	130
180°	**571.059.33.52**	0.08	17.62	18.94	20.68	22.01	23.33	2	3	3	3	3
	571.179.33.52	0.11	34.79	38.30	40.95	44.04	46.68	5	5	5	6	6
	500.289.33.00	0.08	17.62	18.94	20.68	22.01	23.33	2	3	3	3	3

Standard material: Lock nuts = 316Ti SS · Spring: 301 SS · All other components: AlBz8 (aluminum bronze)



CamouTech system
Series 500.286/600



The CamouTech system was developed especially to reduce the IR signature (e. g. heating up due to the sun). Thanks to large-area spraying of the ship surfaces, these are cooled so that they are almost at the ambient temperature. An additional benefit is active protection against NBC contamination.

The Lechler CamouTech system consists of two components:

■ CamouSpray

The ship's hull and all superstructures are sprayed using the CamouSpray system. The nozzles recessed in the ship wall do not offer any radar signature and are extended only in operation when the corresponding water pressure is present. The resulted coarse-droplet water film has low susceptibility to wind drift which cools the outer shell efficiently.

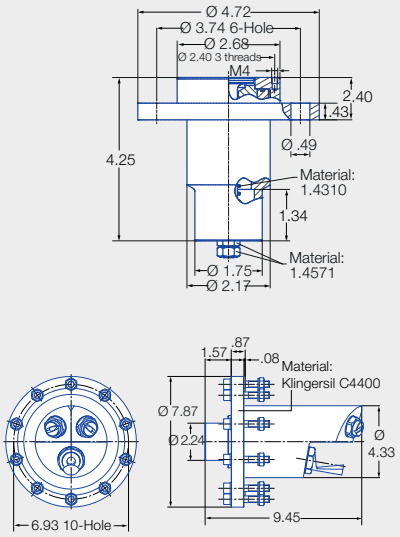
■ CamouJet

The CamouJet system is used for shielding hot exhaust gases that are discharged above the water line at the rear of the ship. This system consists of three spray heads that are arranged around the exhaust pipe and enclose and cool the exhaust gas stream.

Please contact us for further information.

CamouSpray single nozzle

CamouJet single nozzle



CamouSpray single nozzle

Spray angle	Ordering no. / Type	Flow Rate p [psi] gal/min 60	p [psi] gal/min 75	p [psi] gal/min 100	p [psi] gal/min 120
180°	**500.286.33.05**	7.93	8.88	10.57	11.23

CamouJet single nozzle

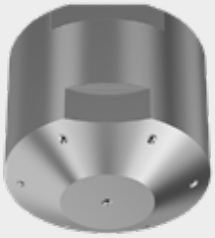
Ordering no. / Type	Flow Rate p [psi] gal/min 120	p [psi] in SCFM 120	Position
600.469.17	124.16	7.45	Port
600.470.17	124.16	5.89	Starboard
600.468.17	98.01	22.3	Midships

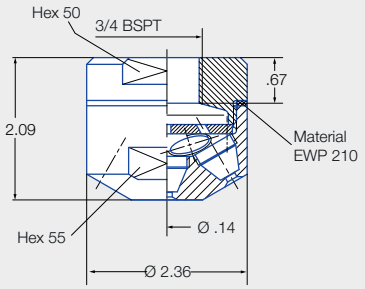
Multiple solid stream nozzles
Series 502/503

- Multiple solid stream nozzles with coarse droplets
- Low wind susceptibility
- Large-area impact

Applications:
Cleaning NBC contamination on superstructures and objects. The nozzles are also part of the CamouSpray system for cooling superstructures and objects in order to reduce the IR signature. Fire protection, protection against radiation heat.

NATO/BW number available on request.

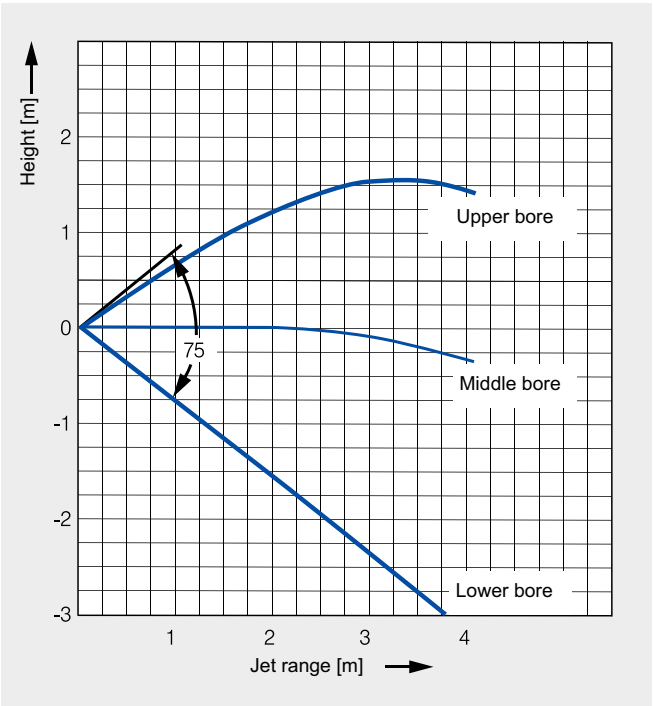


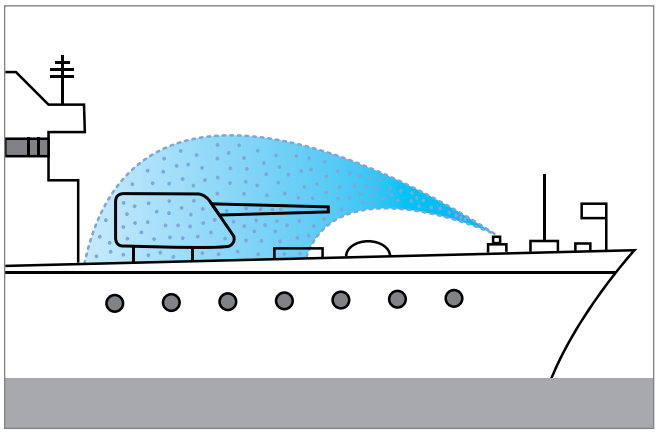


Spray angle	Ordering no.			B Ø [in]	E Ø [in]	Flow Rate									
	Type	Material no.	Code			p [psi] gal/min					p [psi] SCFM				
		316Ti SS	3/4 BSPT			75	90	100	120	130	75	90	100	120	130
180°	**502.885**	**17**	**06**	0.07	0.11	6.60	7.13	7.93	8.45	8.98	1	1	1	1	1
	502.915	**17**	**06**	0.08	0.11	7.93	8.72	9.51	10.04	10.57	1	1	1	1	1
	503.005	**17**	**06**	0.11	0.16	13.21	14.53	15.59	16.64	17.70	2	2	2	2	2
	503.035	**17**	**06**	0.14	0.11	15.85	17.17	18.49	19.81	21.13	2	2	2	3	3

Spray jet characteristic

Nozzle installed horizontally
Range approx. 13 ft





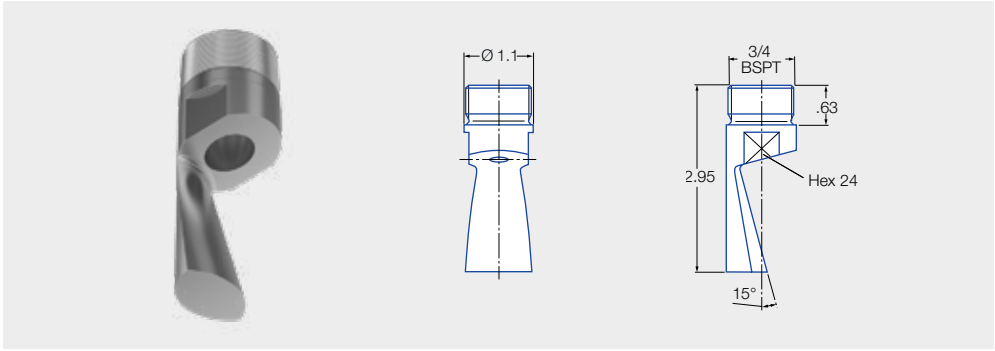
Ordering example:	Type	+	Material no.	+	Code	=	Ordering no.
	502.885	+	**17**	+	**06**	=	**502.885.17.06**

Tongue-type nozzle
Series 600.471/472

- Flat fan tongue-type nozzle for NBC protection with convex geometry. A tunnel-shaped spray pattern is produced by the special shape of the tongue.
- Clog-resistant

Applications:
Cleaning NBC contamination on superstructures and objects, rocket launchers and guns.

The nozzles are also part of the CamouSpray system for cooling superstructures and objects in order to reduce the IR signature.



Spray angle	Ordering no.	Material no.	Connection	Flow Rate (gal/min)	Length [in]	Diameter [in]
	Type	17 316Ti SS		120 [psi]	L	D
30°	**600.471.17.00**	○	3/4 BSPP	10.57	2.95	1.10
45°	**600.471.17.01**	○	3/4 BSPP	26.42	2.95	1.10
	600.471.17.11	○	3/4 NPT	26.42	2.95	1.10
	600.472.17.30	○	3/4 BSPT	81.37	2.95	1.06

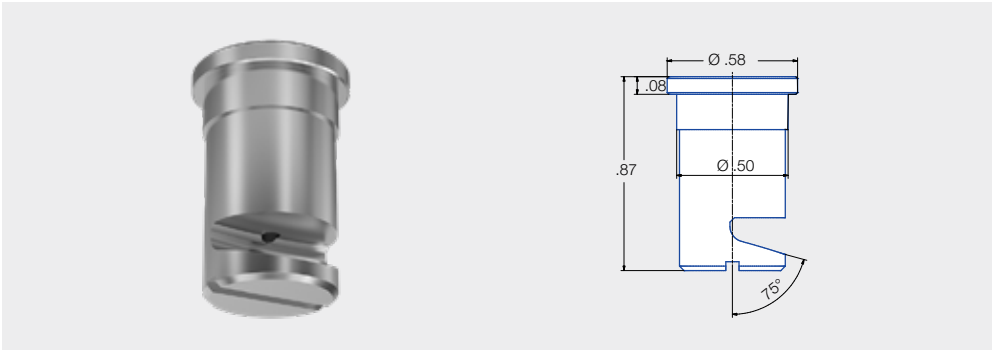
Tongue-type nozzle
Series 684.568

- Wide flat jet with a short powerful spray pattern
- Clog-resistant

Application:
Cleaning NBC contamination on superstructures.

These nozzles are also part of the CamouSpray system.

NATO/BW number available on request.



Spray angle	Ordering no.		E Ø [in]	Flow Rate (Gallons Per Minute)										Spray width B at p = 30 psi
	Type	Material no.		**p** [psi] gal/min					**p** [psi] SCFM					
		316Ti SS		75	90	100	120	130	75	90	100	120	130	250 in
140°	**684.568**	**17**	.07	1.04	1.14	1.24	1.32	1.40	.14	.15	.16	.18	.19	10

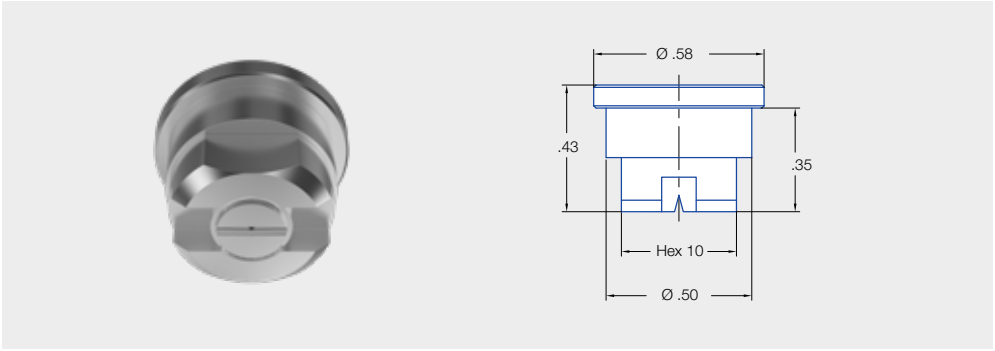
Flat fan nozzle
Series 652.567

■ Uniform flat jet

Applications:
Cleaning NBC contamination on ship superstructures. Guide value for nozzle arrangement: per 3 m² – 1 nozzle 652.567.

These nozzles are also part of the CamouSpray system.

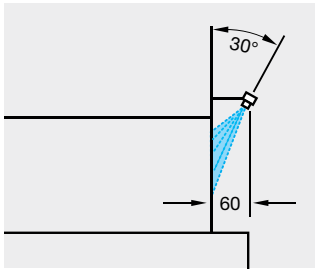
NATO/BW number available on request.

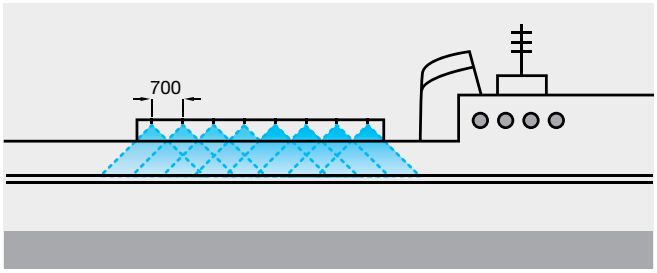


Spray angle	Ordering no.		A Ø [in]	E Ø [in]	Flow Rate (Gallons Per Minute)										Spray width B at p = 30 psi	
	Type	Material no.			**p** [psi] gal/min					**p** [psi] SCFM						
		316Ti SS			75	90	100	120	130	75	90	100	120	130	10 [in]	20 [in]
120°	**652.567**	**17**	.08	.04	1.04	1.14	1.24	1.32	1.40	.14	.15	.16	.18	.19	26	50

A = equivalent bore diameter · E = narrowest free cross section

Nozzle arrangement





The following nozzles can be alternatively used for this application:

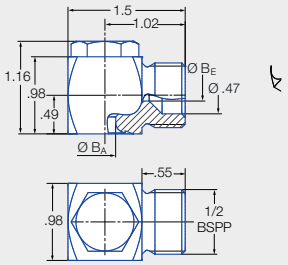
Tongue-type nozzles: Page 53/71
CamouSpray: Page 68/69

Eccentric hollow cone nozzles
Series 302/304
Protection against fire or radiation heat

- Uniform hollow cone atomization
- Clogging-resistant nozzle without swirl inserts

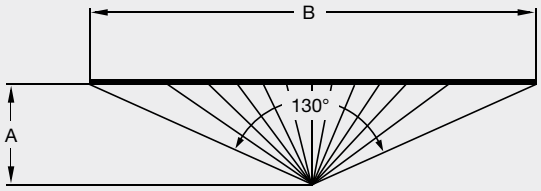
Applications:
Sprinkling ammunition rooms on defense ships, fire protection/protection, protection against radiation heat.

NATO/BW number available on request.

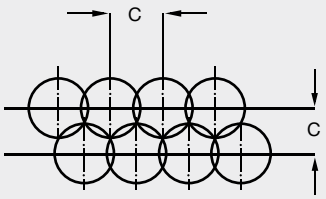


Spray angle	Ordering no.						B_A Ø [in]	B_E Ø [in]		
	Type	Material no.			Code				**p** [psi] gal/min	**p** [psi] SCFM
		2.0402	2.0966	2.0920	1/2 BSPP	3/8 BSPP			120	120
130°	**302.628**	**30**	**3E**	**33**	**-**	**02**	.20	.13	1.85	.24
	304.688	**30**	**3E**	**33**	**02**	**-**	.24	.15	2.64	.35
	304.758	**30**	**3E**	**33**	**02**	**-**	.30	.17	3.96	.53

Spray widths



Nozzle arrangement



Example: A = 11.81 in, B = 45.28 in, C = 31.50 in

Spray diameter B [in]	**Spray height [in]**
17.72	3.94
33.46	7.87
45.28	11.81
57.09	15.75

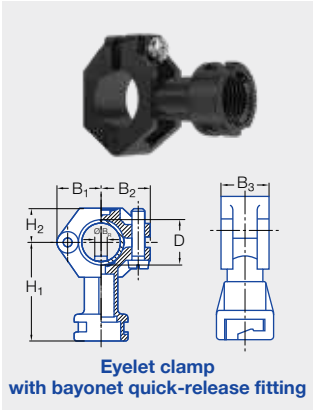
The construction specifications require the following impact density of the German Armed Forces for naval ships for wall and ceiling surfaces: 1 SCFM (15 l/min) per m^2.

Ordering	Type	+	Material no.	+	Code	=	Ordering no.
example:	**302.628**	**+**	**30**	**+**	**02**	**=**	**302.628.30.02**

Accessories

	Description	Ordering no.	Material	Thread size BSPT	Thread size BSPT	Length (in)	Diameter (in)
	Ball joint	**092.050.17.AK**	303 SS	3/4 male thread	3/4 female thread	3.35	2.01
	Ball joint	**092.055.17.AK**	303 SS	3/4 male thread	3/4 male thread	3.66	2.01
	Ball joint	**092.050.17.AL**	303 SS	3/4 female thread	3/4 female thread	3.15	2.01
	Angle 45°	**095.016.17.12.46.0**	316Ti SS	3/4 male thread	3/4 male thread	3.66	2.01
	Nipple	**065.611.17**	316Ti SS	3/4 male thread	3/4 male thread	1.38	1.45
	Nipple	**065.610.17**	316Ti SS	3/4 male thread	–	.87	1.06
	Gauze filter	**065.256.56**	POM	–	–	.84	.58
	Nipple	**065.211.17**	316Ti SS	3/8 male thread	3/8 male thread	.98	.98
	Retaining nut	**065.200.17**	316Ti SS	3/8 female thread	–	.98	.51
	Gasket	**065.240.72**	EWP 210 asbestos free	–	–	–	–

Bayonet quick release system

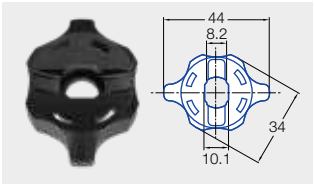


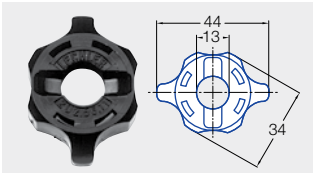
Eyelet clamp with bayonet quick-release fitting

For series	Ordering no.	Material no. 51 Polyamide	53 Polypropylene	5E PVDF	56 POM	Code	Screw (material)	Pipe Ø	D Ø [in]	Dimensions [in] H_1	H_2	$B_{R\,Ø}$ *	$B^*_{Ø}$	B_1	B_2	B_3	Weight (lbs)
302 Bayonet/ 422 Bayonet/2TR/ 468/548/646/ 652/679/684	**090.003**	○	○	○	-	**KA**	303 SS	1/2"	.79–.87	1.95	0.65	0.24	.24–.25	0.83	0.94	18.5	.05
	090.013	○	○	○	-	**KA**		3/4"	.98–1.08	2.07	0.69	0.30	.31	0.96	1.04	22.0	.06
	090.023	○	○	○	-	**KA**		1"	1.26–1.36	2.24	0.83	0.42	.43	1.18	1.22	22.0	.07

* B_R Ø = spigot diameter · ** B Ø = recommended bore diameter.

Bayonet quick release nuts incl. gasket 065.242.73 (material: rubber)



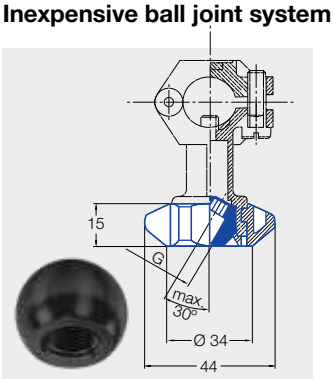


For series	Ordering no.	Material	Colour
652/ 679	**065.202.5E.00**	PVDF	blue
2TR/468/548 684	**065.202.56.11**	POM	black
	065.202.53.11	Polypropylene	gray

Note: Pay attention to the material combination when using bayonet eyelet clamps in combination with bayonet quick-release nuts. Stiffness may result if different materials are used.

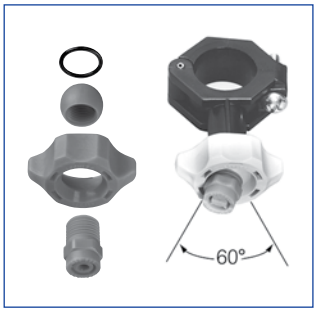
Ball joint for bayonet quick-release system

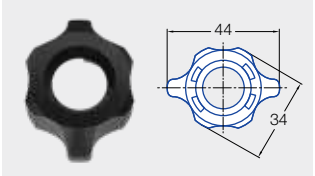
Inexpensive ball joint system for nozzles with 1/8 and 1/4 external threads.



Ball piece for eyelet clamp with bayonet quick-release fitting

For series	Ordering no. Type	Mat. No. 5E PVDF	Code 1/8 BSPT	Code 1/4 BSPT	Colour
All nozzles with 1/8 or 1/4 external thread.	**092.150**	○	**AB**	**AD**	blue





Bayonet quick-release nut for ball piece
incl. O-ring 095.015.7C.04.16.0 (Material: 72 NBR 872)

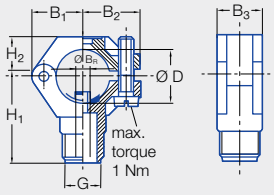
For series	Ordering no.	Material	Colour
For ball piece	**092.150.5E.00**	PVDF	blue

Ordering example:	Type	+	Material no.	=	Ordering no.
	090.003	+	**51**	=	**090.003.51**

Pressure/temperature ranges

T	P_{max}
149 °F	145 psi
176 °F	120 psi
212 °F	60 psi

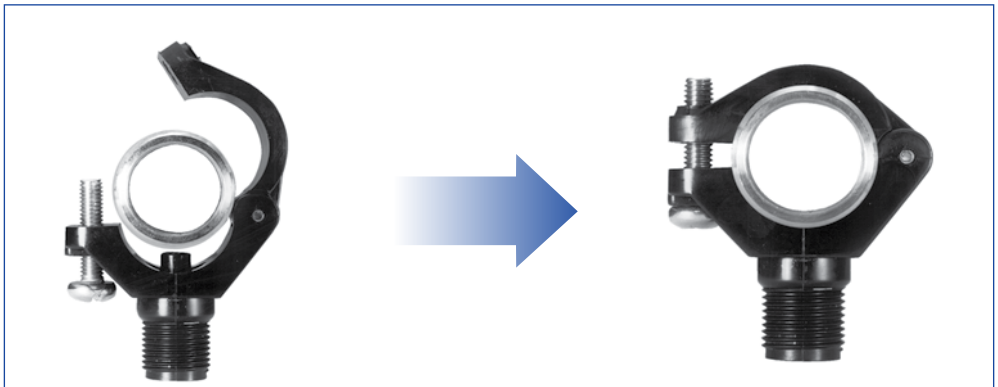
Eyelet clamps/retaining nuts



Eyelet clamps for retaining nut

For series	Ordering no. Type	Mat. no. 5E PVDF	Screw	Dimensions [in] BSPP	Pipe Ø	D Ø	B_R* Ø	B** Ø	B_1	B_2	B_3	H_1	H_2	Weight (Polyamide) (lbs)
2TR/216/302/308/350 468/548/679/684/652	**090.053**	○	Material 303 SS	3/8	3/8"	.65-.71	0.24	.24-.25	0.75	0.87	0.73	1.36	0.57	.04
	090.003	○		3/8	1/2"	.79-.87	0.24	.24-.25	0.83	0.94	0.73	1.44	0.65	.04
	090.013	○		3/8	3/4"	.98-1.08	0.30	.31	0.96	1.04	0.87	1.56	0.69	.06
	090.023	○		3/8	1"	1.26-1.36	0.42	.43	1.18	1.22	0.87	1.73	0.83	.07
	090.033	○		3/8	1 1/4"	1.57-1.69	0.50	.50	1.34	1.40	0.98	1.89	0.98	.08

* B_R Ø = spigot diameter · ** B Ø = recommended bore diameter.



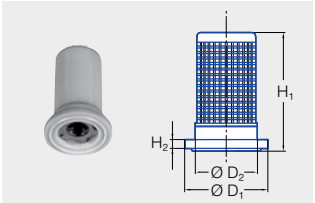
Retaining nuts

For series	Ordering no. Type	Material no. 16 303 SS	17[1] 316Ti SS/ 316L SS	1Y 316L SS	30 Brass	56 POM	5E PVDF	Dimensions [in] BSPP	H_1	H_2	D Ø	Hex	Weight (Brass)(lbs)
2TR/468/ 548/652/660/ 679/684	**065.200**	○	○	-	○	-	-	3/8	.57	.40	.50	.87	.06
	065.200	-	-	-	-	○	○	3/8	.57	.40	.50	.87	.06
	069.000	○	-	○	○	-	-	UNF 11/16	.57	.40	.50	.87	.06
656/657 664/665	**065.600**	○	○	-	○	-	○	3/4	.63	.51	.79	1.26	.13

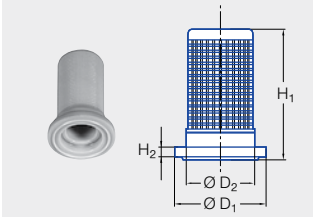
[1] We reserve the right to supply the material 316Ti SS or 316L SS for Material no. 17.

Ordering example:	Type	+	Material no.	=	Ordering no.
	065.200	+	16	=	065.200.16

Ball non-return valves/Gauze filters/Strainers



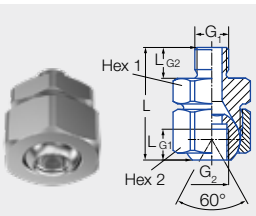
Ball non-return valve with integrated gauze filter p_{max} = 20 bar



Gauze filter

For nozzle size	Ordering no. Type	Mat. No. 56 POM	Colour	Opening pressure [psi]	Closing pressure [psi]	Mesh size [in]	Dimensions [in] H_1	H_2	D_1	D_2	Weight (lbs)
xxx.48x-xxx.56x	**065.266** Ball 1.4021 Spring 1.4310	○	red	5.8-7.3	5.1-6.5	.03	.85	.08	.58	.43	.004
xxx.48x-xxx.56x	**065.256**	○	red	-	-	.03	.85	.08	.58	.43	.004

Compact ball joints for restricted installation space

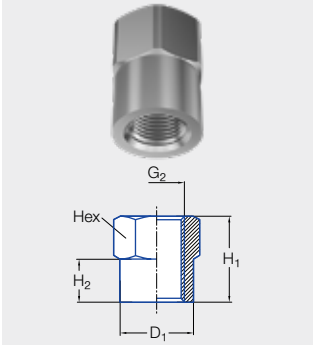


Ball joint with threaded connection

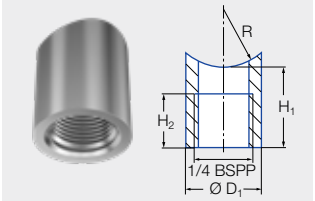
For series	Ordering no. Type	16 303 SS	30 Brass	Code	Dimensions [in] D_1	D_2	G_1 BSPP	G_2 BSPP	L_{G1}	L_{G2}	L	A/F_1	A/F_2	A/F_3	Weight (brass) (lbs)
All nozzles with 1/8" external thread	**092.010**	○	○	**BA**	-	-	1/8	1/8	.31	.31	1.15	.87	.94	-	.15
All nozzles with 1/4" external thread	**092.024**	○	○	**BC**	-	-	1/4	1/4	.47	.47	1.73	1.06	1.06	-	.31
All nozzles with 3/8" external thread	**092.030**	○	○	**BE**	-	-	3/8	3/8	.47	.47	1.73	1.06	1.18	-	.35

Ordering example:	Type	+	Material no.	+	Code	=	Ordering no.
	092.010	+	16	+	BA	=	092.010.16.BA

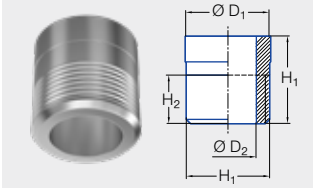
Accessories
Sockets/nipples



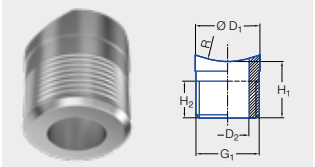
Sockets



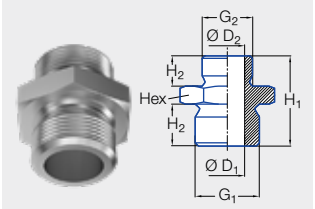
Sockets with radius
(R = 10/13/16/20/25 or 31 mm)



Nipples



Nipples with radius
(R = 10/13/16/20/25 or 31 mm)



Double nipples

For series	Type	Ordering no. Material no. 02 Steel	1Y 316L SS	17 316Ti SS	30 Brass	53 Polypro-pylene	Dimensions [in] G_1 BSPP	G_2 BSPP	H_1	H_2	D_1	D_2	A/F	Weight (brass) (lbs)
All nozzles with 1/8 external thread	**040.270**	-	○	-	○	-	-	1/8	.79	.39	.54	-	.55	.055
All nozzles with 1/4 external thread	**061.220**	-	○	-	○	-	-	1/4	.79	.39	.66	-	.67	.055
All nozzles with 3/8 external thread	**040.271**	-	○	-	○	-	-	3/8	.79	.39	.85	-	.87	.055
	040.271	-	-	-	-	○		3/8	.79	.39	.96	-	.87	.055
All nozzles with 1/4 external thread	**040.228. xx.yy***	-	○	-	-	-	-	1/4	.71	.08	.67	-	-	.035
2TR/216/302 308/350/548/ 468/679 /684/652	**065.210**	○	-	○	○	○	3/8	-	.71	.39	.68	.45	-	.044
306/307 502/503 656/657	**065.610**	○	-	○	-	○	3/4	-	1.06	.55	1.10	.71	-	.134
2TR/216/302/308/350 548/468/679/684/652	**065.217.xx.yy***	-	-	○	-	-	3/8	-	.59	.39	.68	.45	-	.044
216/302/308 350/548/468 679/684/652	**065.215**[1]	-	-	○	○	-	3/8	1/4	.98	.39	.39	.28	.87	.066
	065.211	-	-	○	○	-	3/8	3/8	.98	.39	.45	-	.87	.055
656/657	**065.611**	-	-	○	○	-	3/4	3/4	1.38	.55	.71	-	1.26	.198

* Replace **xx** by the Material no. and **yy** by the radius R
[1] Not to be used with non-return valve or gauze filter.

Ordering example:	Type	+	Material no.	=	Ordering no.
	040.270	+	1Y	=	040.270.1Y

QUALITY WITH A SYSTEM

Lechler products are used in a wide variety of sectors and applications. Which is why the products' requirements are often very specific to certain applications. We define the term "quality" as the extent to which our products fulfill our customer's individual requirements.

In order to do this we have been certified with internationally renowned certificates.

Certifications and Quality

- ISO 9001-2008 Certification
- DIN EN 10204 Inspection Certificate
- Classification according to Pressure Equipment Directive 2014/68/EU
- Declaration of Incorporation of partly completed machinery according to 2006/42/EC
- Declaration of Conformity of machinery according to 2006/42/EC
- ASME qualified welding procedure specifications
- Welding procedure specification DIN EN ISO 15609

Code Compliance

- ASME B31.1 Power Piping Code
- Metallic industrial piping: DIN EN 13480
- Unfired pressure vessels: DIN EN 13445
- ASME B31.3 Process Piping Code
- Welder Performance Qualification Records per ASME BPVC Section IX
- Qualification test of welders: DIN EN 287

Testing

- ANSI and ASTM testing
- Non-destructive testing – Penetrant testing: DIN EN ISO 3452
- Hardness
- Hydrostatic pressure test: Pressure Equipment Directive 2014/68/EU, DIN EN 13480-5 and DIN EN 13445-5
- Spray and flow testing
- Phase Doppler Anemometry (PDA) measurement system
- Magnetic particle inspection: DIN EN ISO 17638
- Positive Material Identification

Talk to us

Your requirements are the first step towards a solution. We are more than happy to help you solve your individual tasks. Tell us your objectives and we will take care of the solution. If the solution is not yet available, we will tailormake one for you. That is our promise.

MEASURING TECHNOLOGY
HOW OUR RESOURCES HELP US ACHIEVE PRECISION

The basis for precision nozzle development

At Lechler, exact measurements have long been the basis for clearly defined spray characteristics. The data obtained in our laboratories form the foundation for any development and make it easier for our customers to choose nozzles for specific applications. This saves time, lowers costs and provides planning security.

Advanced technology

We have further expanded our research capacities by opening our own Development and Technology Center.

A highlight here is a laser-assisted phase doppler anemometer. As one of the most modern optical measuring procedures, it measures the velocity and the diameter of spherical droplets simultaneously and without contact. Using the data obtained, spectra can be reliably derived for particle size distributions and velocities.

Measurements range from tiny water droplets in the micrometer region to very large droplets of around 8 millimeters. These are performed with a high temporal and spatial resolution.

Individual positions in the spray can be automatically approached and measured with extremely high accuracy – in x, y and z directions.

International cooperation

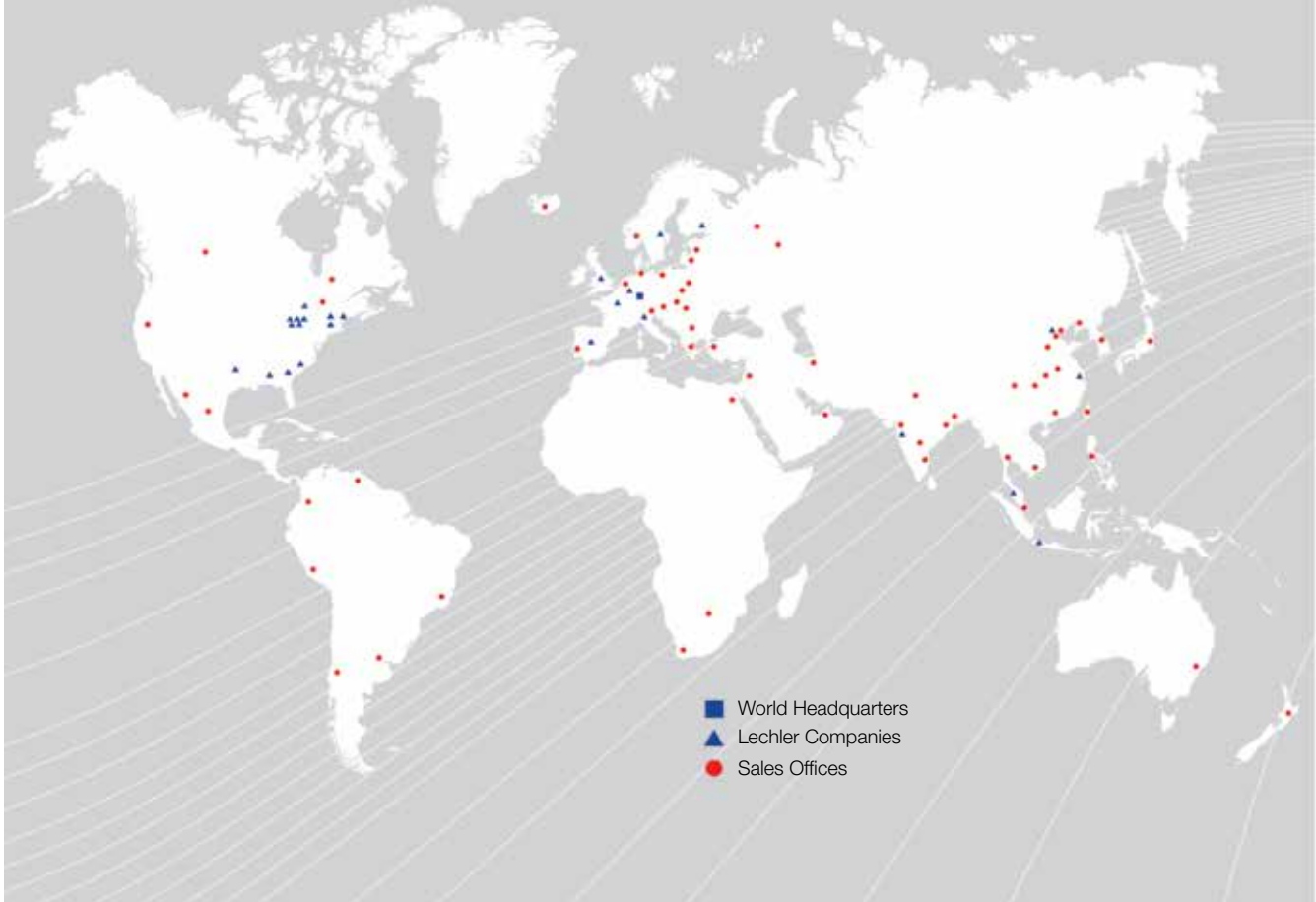
We at Lechler value the importance of international cooperation. Because that is exactly what opens up new perspectives on a problem. In addition, cooperation offers us the possibility of testing nozzles in very special test environments and of discovering new use scenarios in this way.

Our unique selling point: Practice-based knowledge

Since it was founded, Lechler has stood out for its development of new technologies. For more than a century we have successfully filed a large number of patents. Starting with the “Centrifugal Sprayer” from 1893 and going up to state-of-the-art technologies of the 21st Century. We will continue this proud tradition into the future, and our new technical center will be key in doing so. After seven years of construction, the Lechler Development and Technology Center was opened in the summer of 2016. Since then it has offered everything nozzle developers dream of on a surface of over 600 m^2. In addition to extensive measuring facilities, state-of-the-art test benches with a wide range of pump performances are available to measure and investigate sprays, from microfine mist to fuller sprays with varying jetting characteristics.

ENGINEERING
YOUR SPRAY SOLUTION

LECHLER WORLDWIDE



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