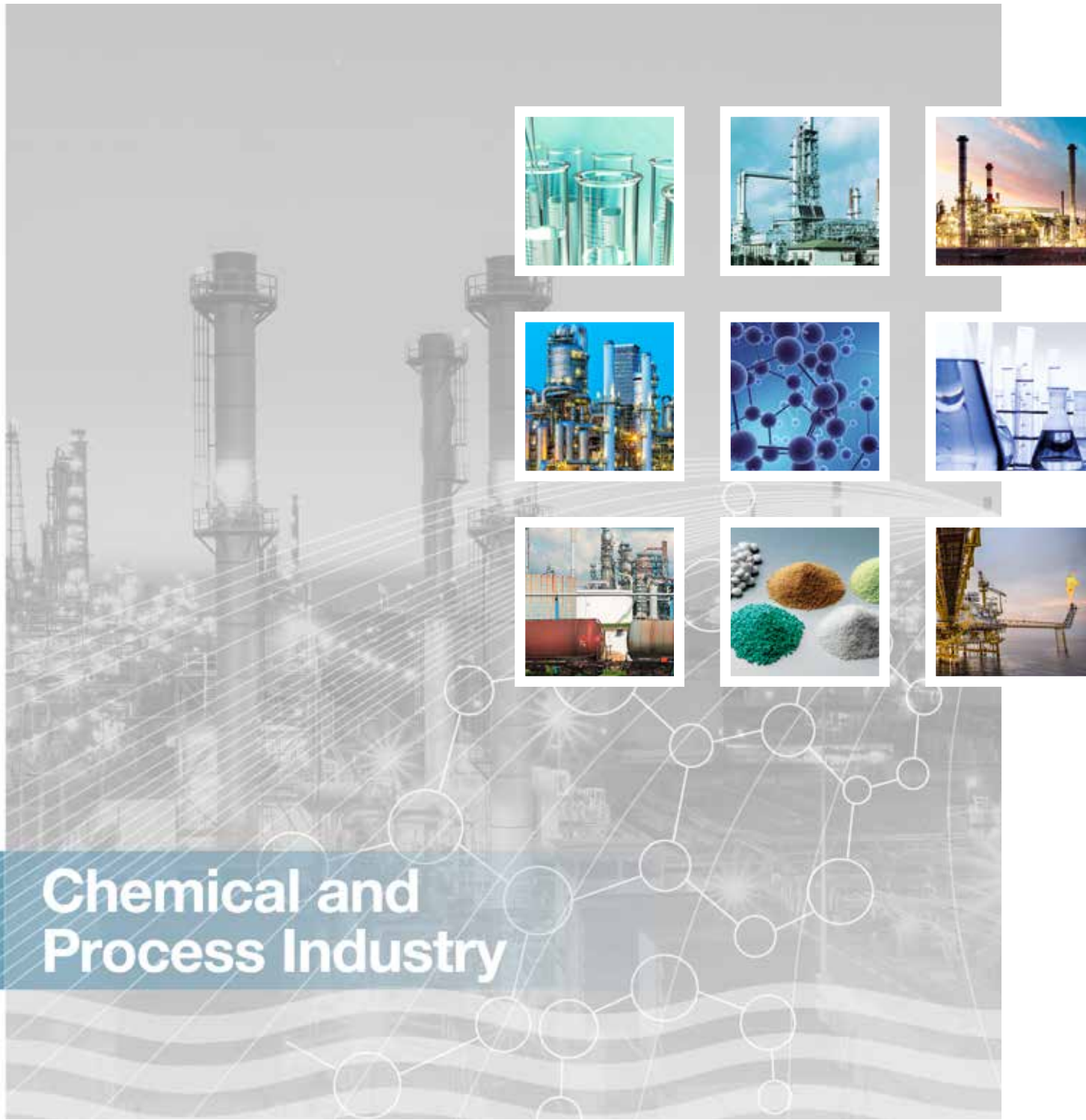
ENGINEERING
YOUR SPRAY SOLUTION

LECHLER

Precision Spray Nozzles and Engineered Solutions for the Chemical Industry



Chemical and Process Industry

PROCESS OPTIMIZATION WITH NOZZLE TECHNOLOGY

On the one hand every company needs to develop and constantly optimize its production processes. In automated systems, even minor discrepancies can provide optimization opportunities. On the other side processes in the chemical industry are extremely complex and mutually dependent, each adjustment extends far beyond its immediate scope. That's why for over 135 years, Lechler provides nozzle and spray technology that always involves the understanding of all the processes involved.

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

But nevertheless, chemistry kept playing a major role in our company. Today Lechler offers a wide product range for the optimization of technical processes. Throughout our history, chemistry has played a major role in our company. Over the course of many decades, this gave rise to a unique understanding of spraying and atomization processes.

Lechler is proud of a long history in the United States

SPRACO A LECHLER COMPANY

Lechler can look back on a long and successful history in the United States. In 1975 Lechler purchased the Spray Engineering Company, manufacturer of Spraco spray products. Recognizing that Spraco is and has been an established name in the spray nozzle business, Lechler continues to make many Spraco products today.

We are familiar with a wide range of applications at various pressures, temperatures and atmospheres. The following pages will provide you with several examples of this.

1879

Company founded by Paul Lechler

1893

Patent for liquid atomization

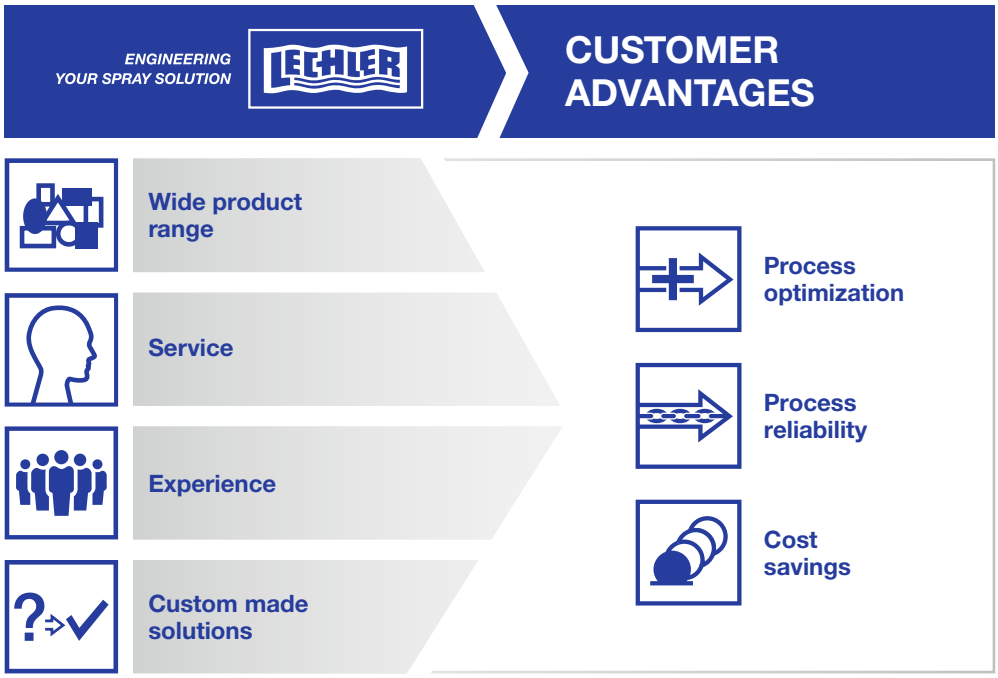
1962

Sales offices set up in Germany

1978

Expansion into the USA, followed by further countries

COMPETENCE – THE ADVANTAGE OF MULTIPLE PERSPECTIVES



Maximum precision and highly reproducible spray patterns – that's what Lechler nozzle and spray solutions stand for. Today we not only supply a unique selection of readily available standard nozzles, but are also prepared, to develop individual solutions customized to your needs. We would also be very pleased to advise you in person about how you can make your own processes even more efficient.

Our competence

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

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

This know-how combined with our sophisticated technical achievements in research, design and production, provides you with the security needed for safe and reliable plant operation.

Take us at our word and let's discuss your process needs in an obligation-free consultation.

1988

Environmental Technologies division founded

1995

Production, sales and administration in Metzingen

2010

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

2016

Opening of the new Development and Technology Center in Metzingen

LECHLER NOZZLES AND ENGINEERED SOLUTIONS – FROM THE WELL TO THE REFINERY

Whether pinpoint precision or broad coverage – spray solutions from Lechler perfectly support your processes at any point. Thanks to our profound process understanding Lechler is far more than just a nozzle manufacturer. In fact, we can help to optimize the efficiency of a large number of your processes. E. g. in the petrochemical industry from the well to the refinery.

Upstream

Applications

- Fire Suppression
- Dust Control
- Truck Cleaning
- Upgrader Froth Control
- Evaporation Ponds
- Waste Water Control
- Heat Exchanger Cooling

Midstream

Applications

- Corrosion Inhibitor Injection
- Bearing Grease Sprays
- Fire Suppression
- Additive Injection
- Storage Tank Cooling
- Hydrogen Scavenger Control
- Biocide Injection
- Glycol Injection
- Tank Cleaning
- Methanol Injection
- Rail Car Washing

Downstream

Applications

- FCC Injectors
- Distillation Sprays
- Defoaming
- Hydrotreater Water Wash
- Packed Tower Cleaning Sprays
- Coker Off Gas Cooling
- Desuperheating
- Water Wash Sprays
- Condenser Spray Cooling
- Amine Scrubber
- Air Pollution Control

LECHLER NOZZLES AND ENGINEERED SOLUTIONS – AT HOME ALONG THE ENTIRE PROCESS LINE

Intense heat, high pressure, corrosive agents – every aspect of our nozzles has to be well defined right from the beginning in order to maintain the ultimate precision. This begins with the internal dimensions and doesn't end at the choice of the material. After the design phase every nozzle is rigorously examined in our test facilities. This way, we can ensure that the spray patterns of our nozzles match perfectly the needs of your processes.

Basic Chemicals

Applications

- Heat Exchanger Sprays
- Desuperheating
- Rapid Quenching Sprays
- Plastic Fiber Cooling
- Granulation
- Pelletizer
- Fractionation

Specialty Chemicals

Applications

- Tank Cleaning
- Heat Exchanger Sprays
- Carbon Products Manufacturing
- Spray Drying
- Rapid Quenching Sprays
- Granulation
- Fire Protection
- Pelletizer
- Sulfuric Acid Regeneration
- Fuel Oil Spray
- Fractionation

Air Pollution Control

Applications

- SO_2 Reduction
- Circulating Dry Scrubber
  - Wet FGD
  - Spray Dry Absorbers
- Gas Cooling Upstream of Baghouses and ESP's
- Wet Scrubbers
- NOx Reduction
  - SCR
  - SNCR

THIS IS WHERE YOU FIND YOUR ANSWER

The variety of different products synthesized and processed by the chemical industry is enormous. The same is true for the involved processes. Most of them are widely used and well understood. Others were specially developed and require extreme ambient conditions, occasionally customized to single reaction vessels.

Lechler supplies you in both areas with state-of-the-art nozzles and spray technologies.

Engineered Solutions

For large industry framework conditions special engineered soultions are necessary. That's why we also present to you additional Lechler customized products and solutions that we make only to order to meet the special needs of the chemical and petrochemical industry, e.g. pump and control skid units, lances, special nozzles, gas cooling and conditioning systems, droplet separators and more. If you can't find what you're looking for, don't hesitate to contact us.

We would be happy to examine the possibilities available to us for developing the optimum atomization nozzle to suit your needs – custom made and in close collaboration with you. Please note the production related delivery times and costs for the nozzles presented here.

- Customized products and solutions
- Tailored to your needs
- Extensive consultation
- Individual design and process support

Precision Spray Nozzles

For most applications, our precision spray nozzles will provide excellent results.

These parts have not only been meticulously designed but also have stood the test of time. Thanks to large-volume production, they are readily available at a reasonable price for the various applications in chemical-related applications. In this brochure you'll find our most commonly used products.

- Thousands of standardized nozzles
- Tried and tested
- Great value for money
- Short delivery time

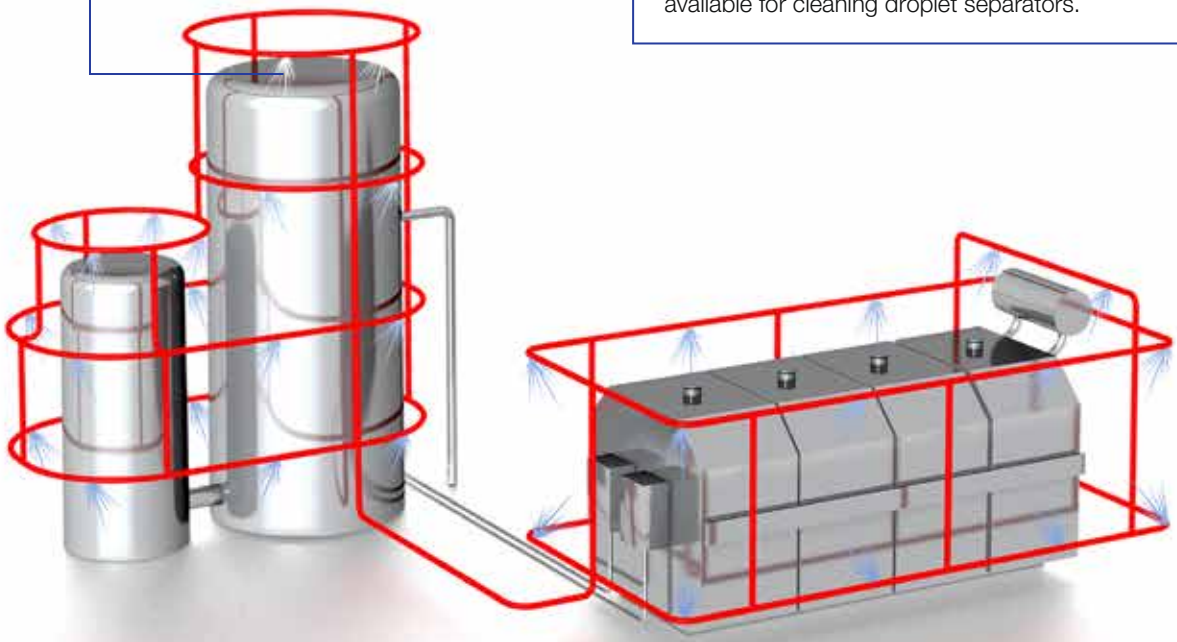
LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY

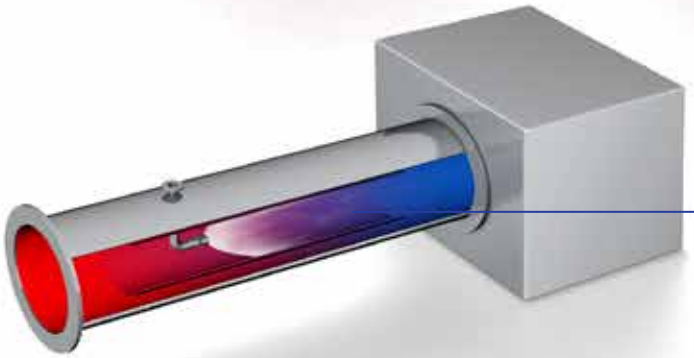
Tank sprinklers and fire protection

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

Droplet separators

Droplets can be carried along in the gas flow. Lechler **droplet separators** 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 droplet separators.



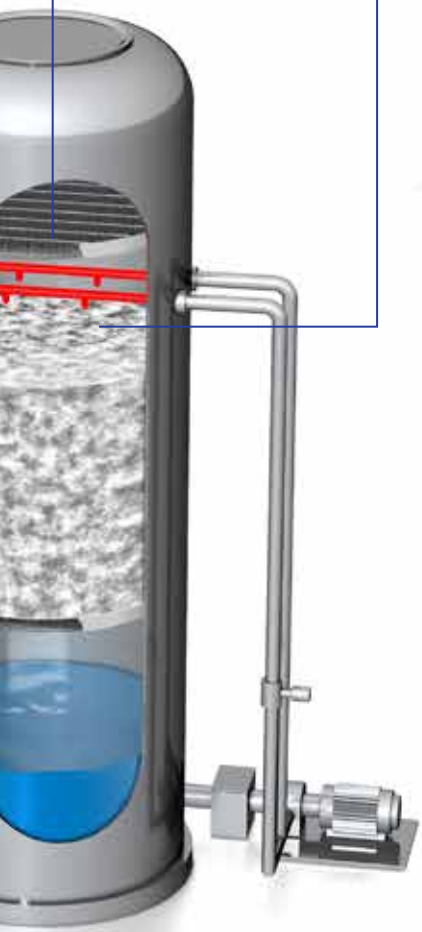


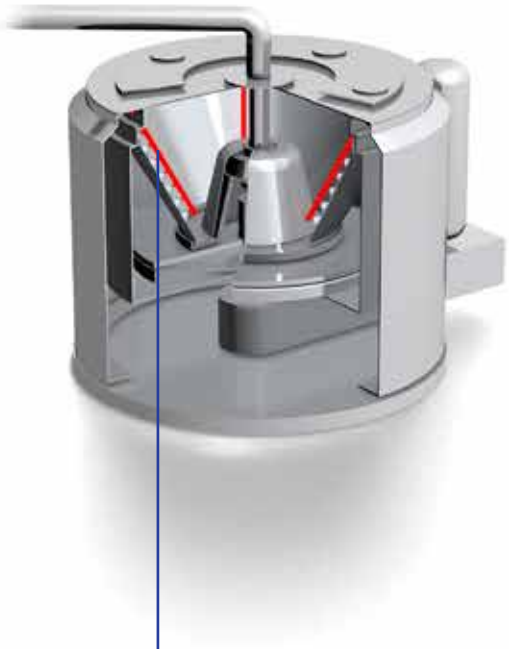
Gas cooling (Quenching)

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

Absorption (Gas washing)

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





Material separation in centrifuges

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

Examples engineered solutions

Droplet separators

- Arrest finest droplets (<10 µm)
- Little pressure loss
- For high flow rates

Nozzle lances and injectors

- Optimal spray placement
- Individual adapted
- Several options

Examples spray nozzle solutions

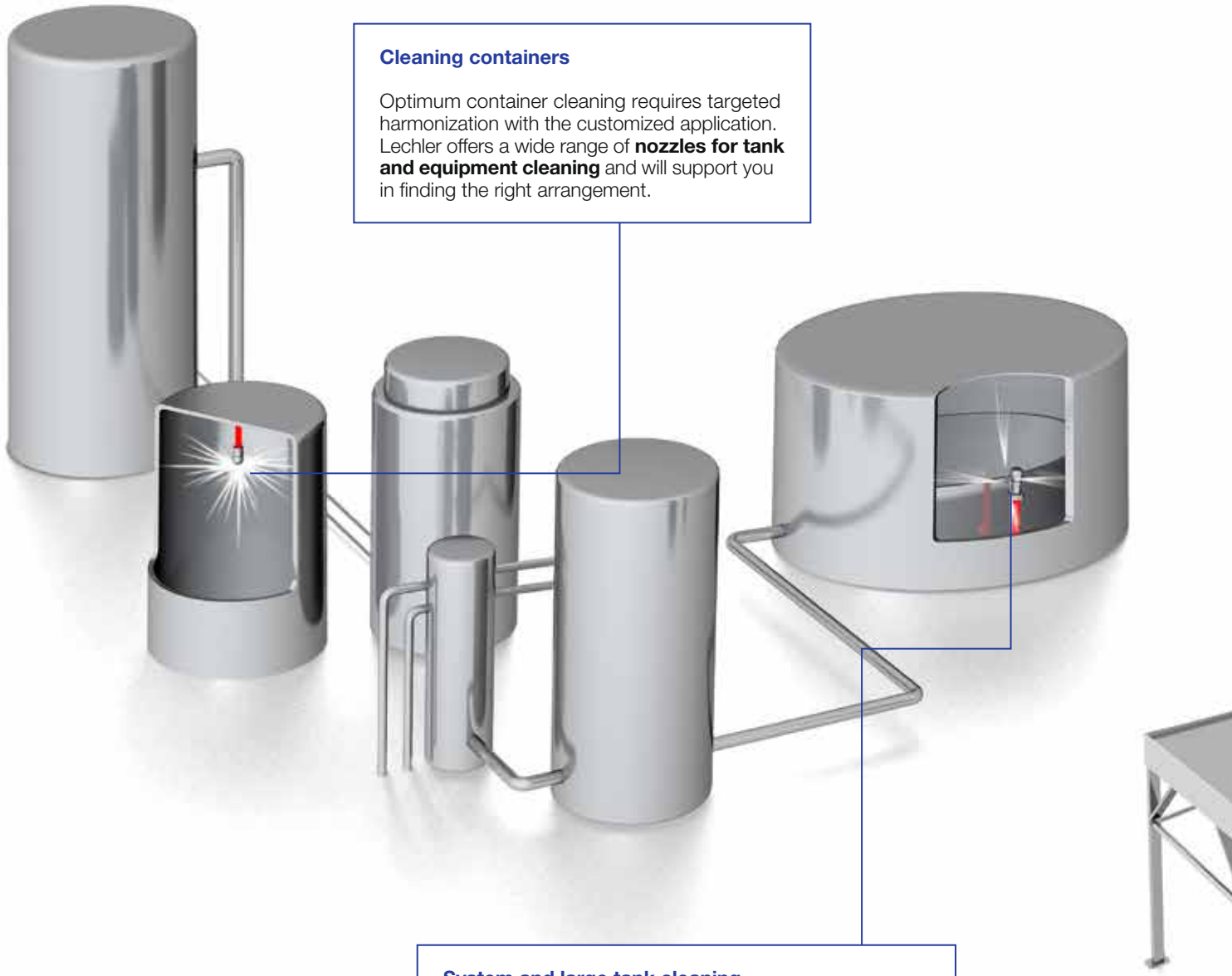
Full cone nozzles – series 490

- Non-clogging design
- Stable spray angle
- Particularly even spray distribution

Twin-fluid nozzles

- Very fine droplets
- Smallest flow rates
- Atomizing viscous liquids

LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY



Cleaning containers

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

System and large tank cleaning

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

Examples engineered solutions

Tank lances

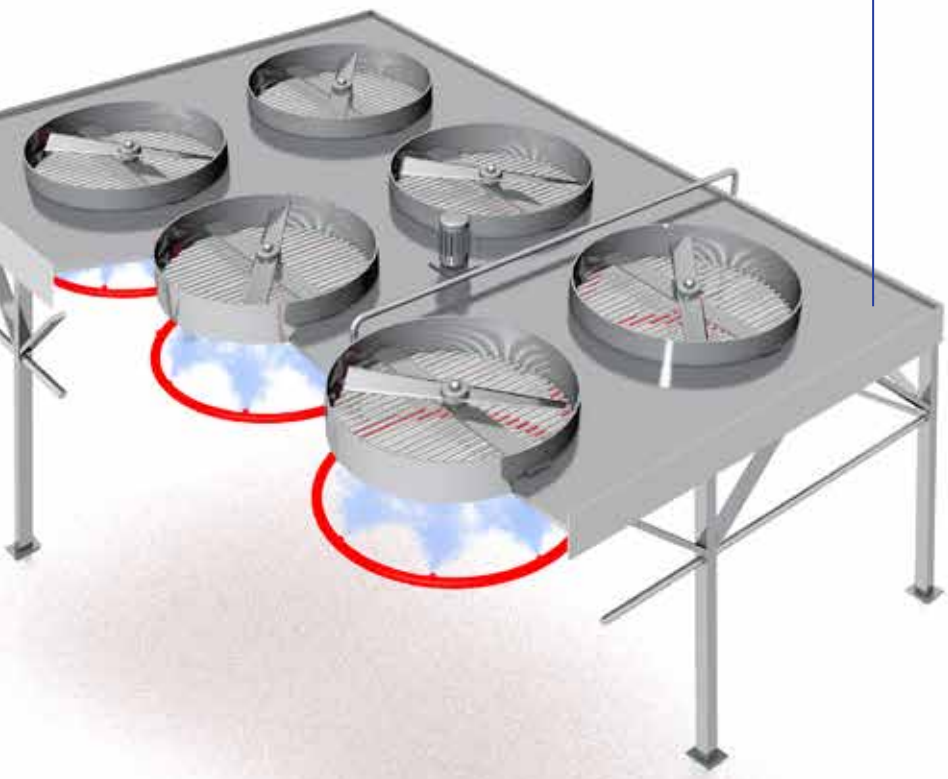
- Fully customized tank lance
- Different materials
- Different connection types

Spray headers

- Fully customized spray headers
- Different materials
- Twin-fluid nozzles possible

Nozzles for air cooling and humidification

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



Examples spray nozzle solutions

High impact tank cleaning machine – series 5TA / 5TB / 5TM

- Powerful solid jets – highest impact
- For persistent soil
- Robust and proven construction

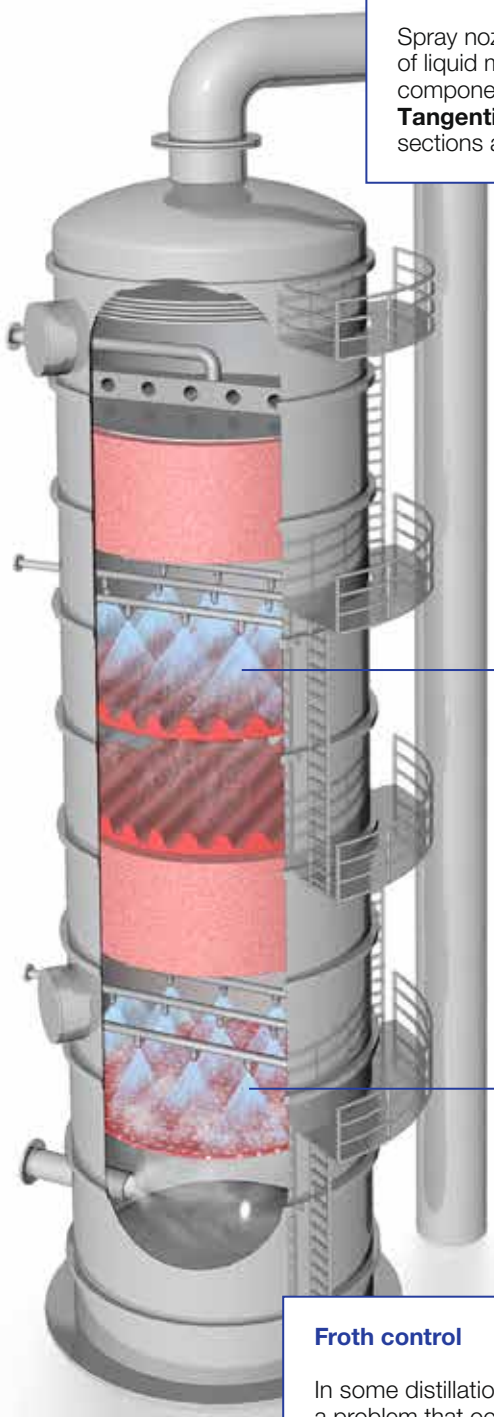
Free spinning tank cleaning nozzles – series 569

- Popular and proven
- Effective flat jets
- ATEX-approved version

Cluster nozzles – series 502 / 503

- Full cone like distribution
- Small droplets

LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY



Distillation / fractionation column

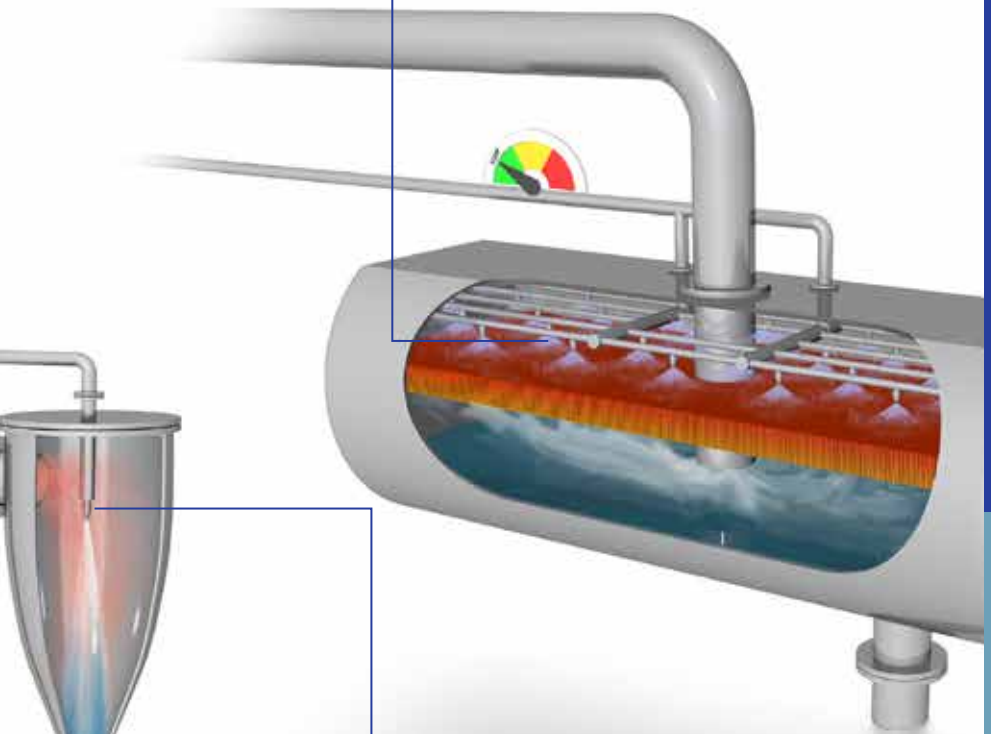
Spray nozzles are an essential item used in distillation of liquid mixtures for separating the mixture into its component parts or fractions, based on the volatilities. **Tangential full cone nozzles** provide large free cross sections and excellent spray distribution for this task.

Froth control

In some distillation processes, frothing can be a problem that occurs throughout. **Full cone nozzles** are used to control the foam because they provide full uniform spray coverage.

Steam condenser sprays

These types of heat exchangers convert steam from its gaseous state to a liquid state by using **full cone nozzles**. These nozzles provide good spray coverage for the large area with the greatest pump efficiency.



Venturi scrubber

Incoming gas is accelerated to a high velocity at the scrubber's throat where it comes into contact with the scrubbing liquid. The liquid is atomized into fine droplets with **hollow cone** or **full cone nozzles**, which entrap the particulate with high collection efficiency.

Examples engineered solutions

Nozzle lances and injectors

- Optimal spray placement
- Individual adapted
- Several options

Pump and control skid units

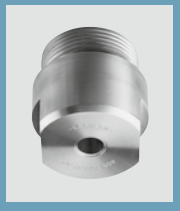
- High-quality components
- Tested quality
- Perfectly tailored solution

Examples spray nozzle solutions

Tangential full cone nozzles – series 422 / 423

- No swirl insert
- Non-clogging
- Stable spray angles

Full cone nozzles – series 403 / 405



- High flow rates
- Even spray distribution
- Big droplets

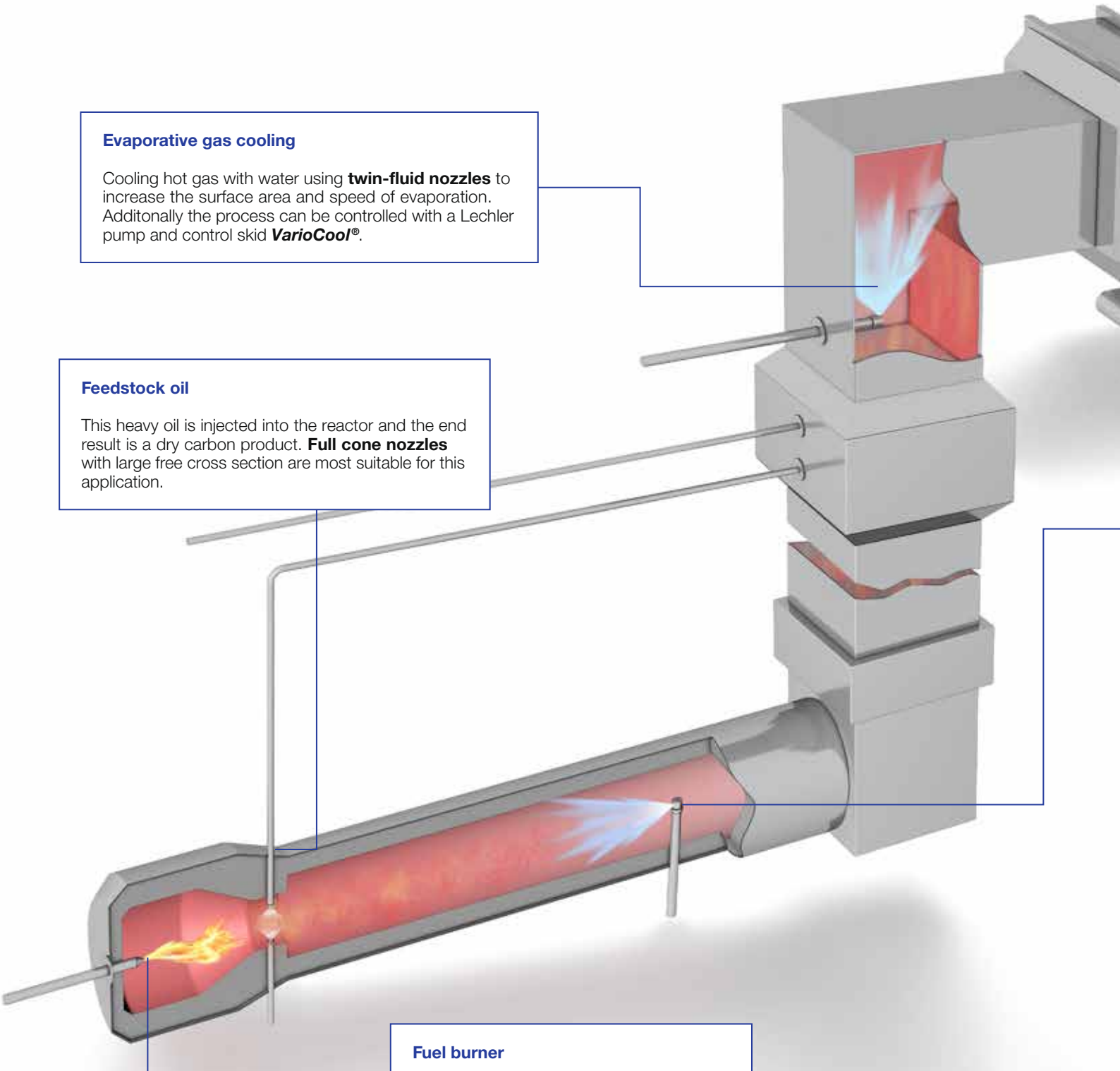
LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY

Evaporative gas cooling

Cooling hot gas with water using **twin-fluid nozzles** to increase the surface area and speed of evaporation. Additonally the process can be controlled with a Lechler pump and control skid ***VarioCool***®.

Feedstock oil

This heavy oil is injected into the reactor and the end result is a dry carbon product. **Full cone nozzles** with large free cross section are most suitable for this application.



Fuel burner

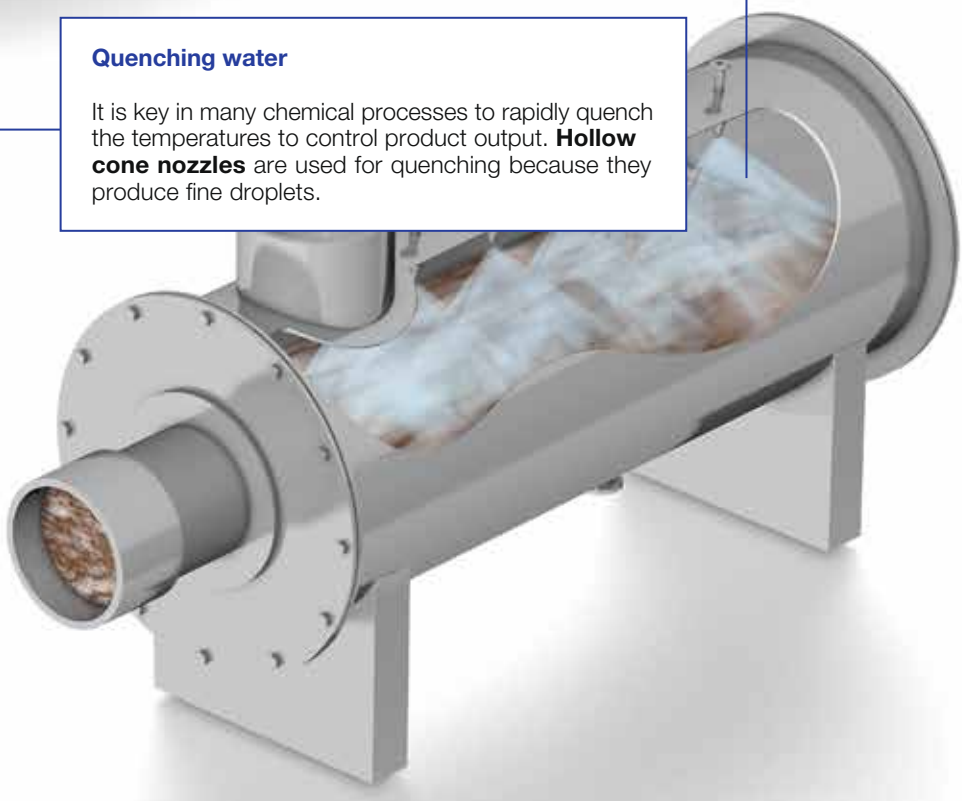
A small **hollow cone nozzle** sprays fuel oil to produce the high temperatures required by the reactor.

Pug mill/pelletizer sprays

A pug mill is a machine in which clay or other materials are mixed into a plastic state or a similar machine for the trituration of ore. In this process **full cone nozzles** are used.

Quenching water

It is key in many chemical processes to rapidly quench the temperatures to control product output. **Hollow cone nozzles** are used for quenching because they produce fine droplets.



Examples engineered solutions

Nozzle lances and injectors

- Optimal spray placement
- Individual adapted
- Several options

Pump and control skid units

- High-quality components
- Tested quality
- Perfectly tailored solution

Examples spray nozzle solutions

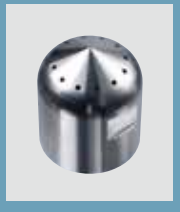
Hollow cone nozzles – series 214 / 216 / 218

- Small droplets
- Low flow rates

Twin-fluid nozzles – series 170 / 180

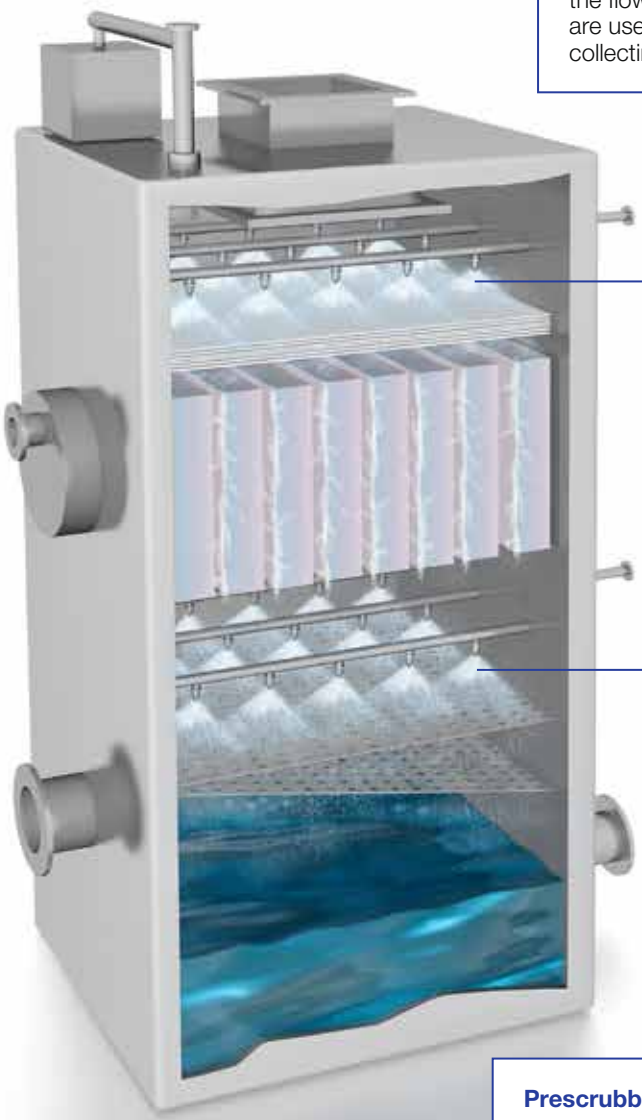
- Efficient atomization
- Extremely fine atomization
- Large free cross sections

Twin-fluid nozzles – VarioJet®



- Internal mixing
- Innovative design
- Very fine droplet spectrum

LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY



Particulate washing

An electrostatic precipitator (ESP) is a filtration device that removes fine particles from a flowing gas using the force of electrostatic charge minimally impeding the flow of gases through the unit. **Full cone nozzles** are used to wash the collected particulate from the collecting tube or plate.

Prescrubbing and gas cooling

At the bottom of the wet ESP, above the gas distribution plates **hollow cone** and **full cone nozzles** are used in the vessel for pre-cleaning, gas cooling, scrubbing and particulate removal.

Water washing of salts

These injectors use **full nozzles**, which are used to scrub salt-forming contaminants from preflash and atmospheric tower overhead systems before they react and cause corrosion.

Examples engineered solutions

Droplet separators

- Arrest finest droplets (<10 µm)
- Little pressure loss
- For high flow rates

Nozzle lances and injectors

- Optimal spray placement
- Individual adapted
- Several options

Spray headers

- Fully customized spray headers
- Different materials
- Twin-fluid nozzles possible

Examples spray nozzle solutions

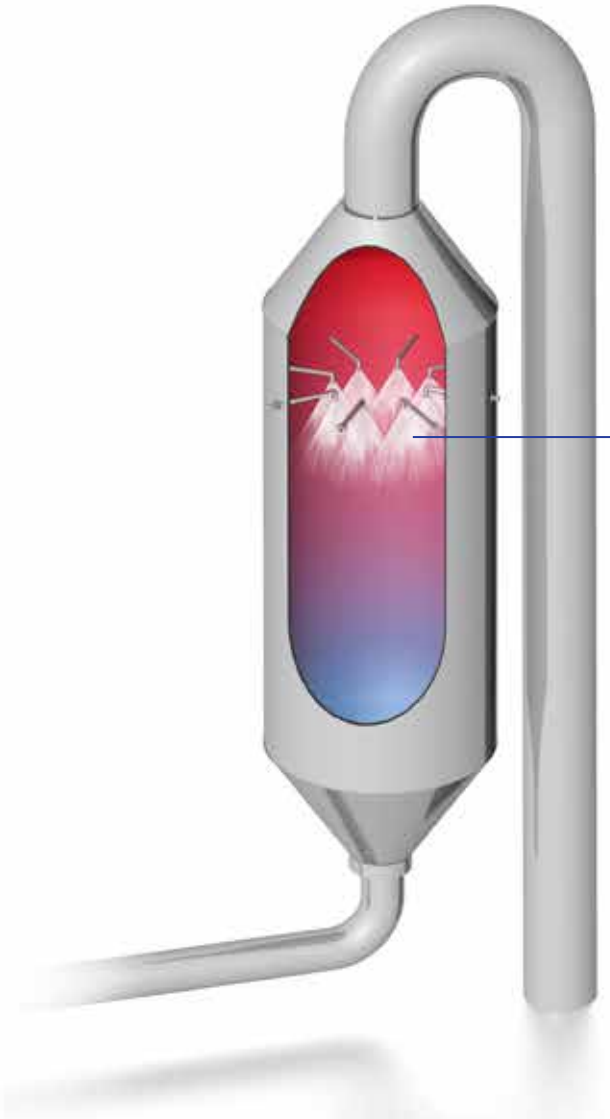
Full cone nozzles – series 490

- Non-clogging design
- Stable spray angle
- Particularly even spray distribution

Hollow cone nozzles – series 214 / 216 / 218

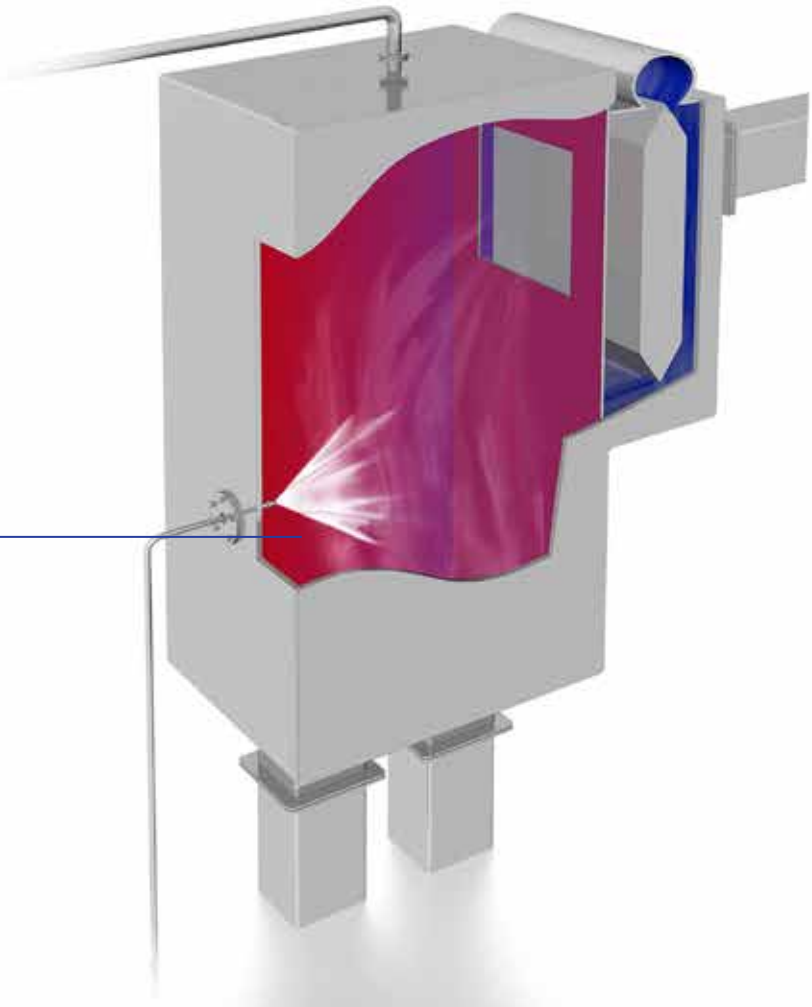
- Small droplets
- Low flow rates

LECHLER NOZZLES AND ENGINEERED SOLUTIONS ARE USED IN MANY FIELDS IN THE CHEMICAL INDUSTRY



Gas cooling tower

Precise cooling and conditioning of hot flue gases create stable outlet conditions for the safe and efficient operation of downstream plant components. Lechler is offering a wide range of **engineered solutions** to controll the outlet conditions of a gas cooling tower.

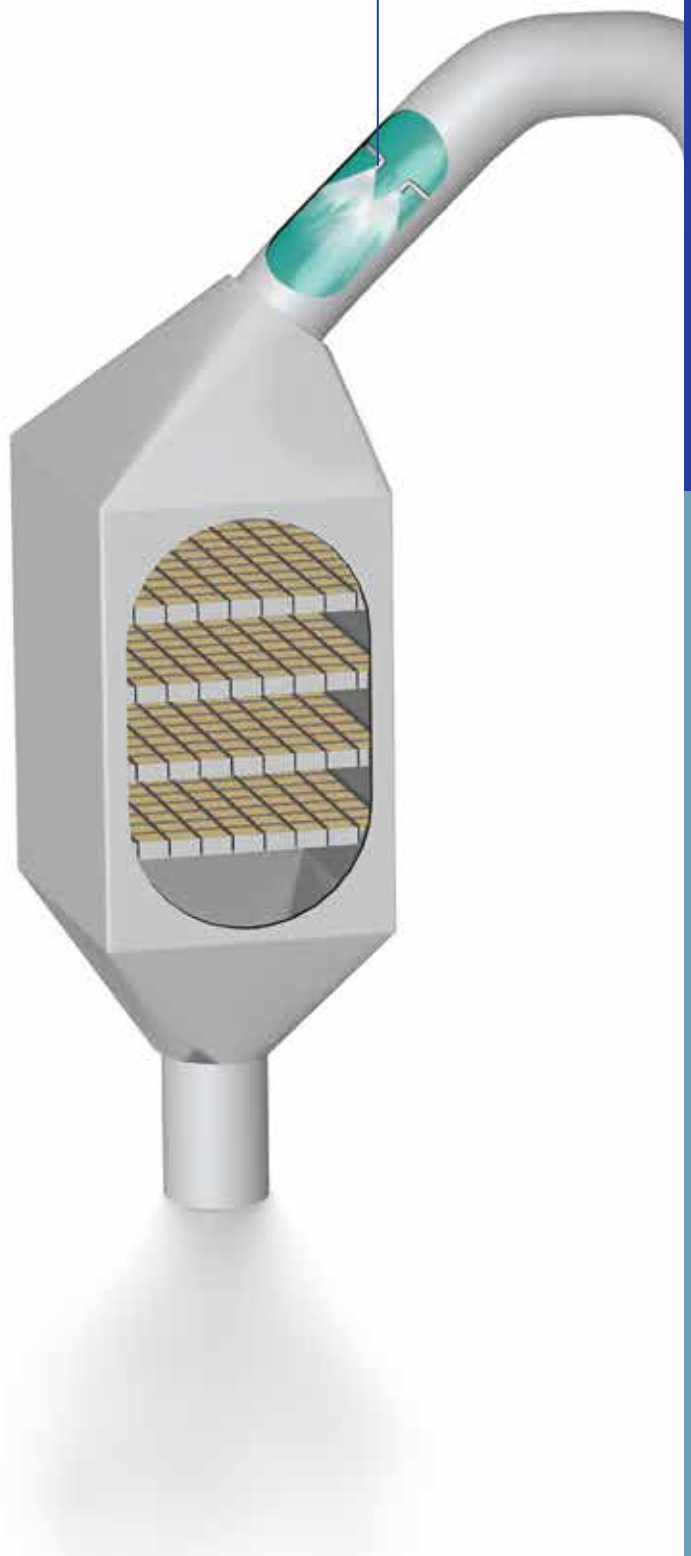


SNCR NOx reduction

The selective non-catalytic reduction (SNCR) is an industrial technique for NOx reduction. **Twin-fluid or flat fan nozzle lances** spray fine droplets of urea or aqueous ammonia directly into a furnace.

NOx 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.



Examples engineered solutions

Nozzle lances and injectors

- Optimal spray placement
- Individual adapted
- Many options

Pump and control skid units

- High-quality components
- Tested quality
- Perfectly tailored solution

Examples spray nozzle solutions

Spillback nozzles

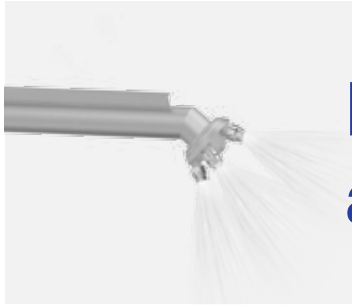
- Fine hollow cone atomization
- Constant pressure
- No compressed air

Twin-fluid nozzles – Laval

- Fine full cone atomization
- Droplet size and spectrum can be adapted
- For high temperatures

ENGINEERED SOLUTIONS FOR PROCESS SOLUTIONS: SOPHISTICATED SOLUTIONS FOR ADVANCED APPLICATIONS

If you are breaking new ground there is no standard solution available. But that's no problem. With our decade-long experience we are able to develop customized nozzles, spray systems and droplet separators on short hand. Let's talk and find your perfect solution.



Nozzle Lances and Injectors

Pump and Control Skids

Droplet Separators

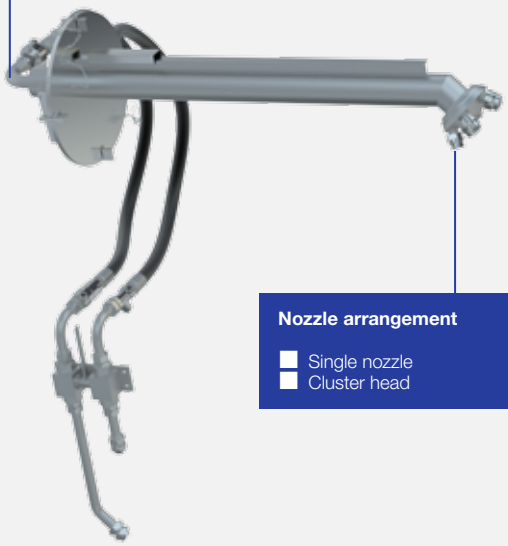
CFD Analysis and Testing Capabilities

NOZZLE LANCES AND INJECTORS FOR HIGHEST SPRAY ACCURACY

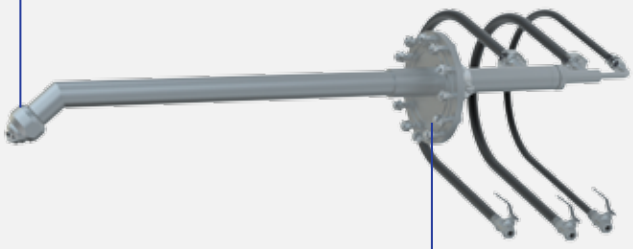
Design features

Connection accessories
- Quick realease coupling
- Conical screw connection
- According to customer requirements

Protection features
- No protection features
- With protection tube and cap
- According to customer requirements



Nozzle arrangement
- Single nozzle
- Cluster head



Flange connections
- Wedge
- Standard flange e.g. DIN, ANSI etc.
- According to customer requirements

Multi nozzle lances
- Number of nozzles according to customer requirements

Lechler nozzle lances ensure optimal spray placement and alignment in flue gas ducts. The choice of nozzles and the consideration of local conditions and process-related matters mean they can be individually adapted to the respective requirements.

The nozzles themselves have a low-maintenance design and can be quickly cleaned or exchanged with minimal effort.

The robust, high-quality stainless steel construction ensures a high degree of functional reliability. Lances are available in a variety of materials to suit specific process requirements.

Lechler nozzle lances are available with many options, including but not limited to:
- Protection tube to increase the service life in case of higher temperatures, high dust loads and aggressive gases, with barrier air as an option.
- Wedge flange, standard flange and special flange in accordance with customer requirements
- Guide rail to facilitate lance installation
- Shifting device to change the insertion length – with or without gastight sealing
- Expansion joint or stuffing box for expansion compensation at high temperatures
- Assembly connecting piece with flange connector for welding onto flue gas duct
- Further special customizations including wear protection, insulation, water cooling or coating
- Pre-assembled accessory kits for process media connections (e.g. quick release couplings, shut-off ball valves, strainers)

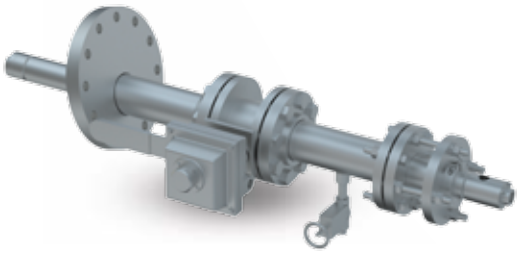
Lechler nozzle lances are manufactured in line with ultramodern production processes and according to the state of the art.

Material

Lances are manufactured from stainless steel (316/316L) as standard, but depending on requirements can also be made of chemical and high-temperature resistant materials.

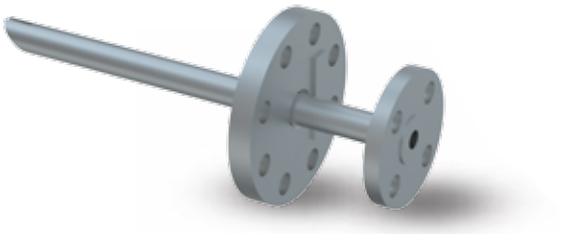
Accessories are available in galvanized steel or stainless steel and the hoses are available in rubber or stainless steel.

Meeting customer requirements

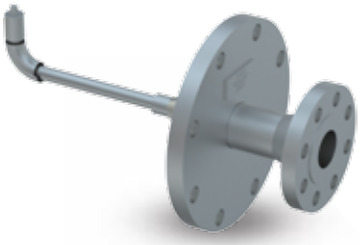


Catalyst retractable lance

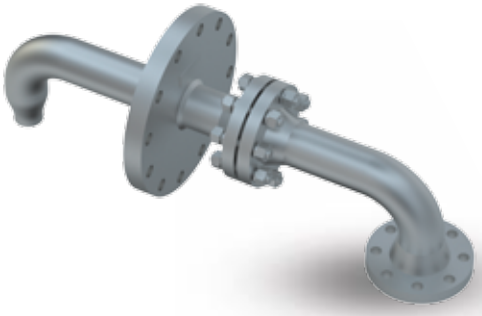
Neutralizer retractable lance



Liquid injection sparger



Water wash injector



Chemical injection quill

Water wash injector

Mounting example

Nozzle lances and injectors
Taylor made solutions

Lance injector type	Material and test requirements and standards	Connection type and features

Hydraulic

Twin-fluid air/liquid

Steam

Material Selection

- Stainless Steel 316L
- Hastelloy
- PP, PVC
- And many more

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

Flange connections

- Wedge
- Standard flange e.g. DIN, ANSI etc.
- Special flange according to customer specification

Additional features

- Shifting device to change the insertion length – with or without gastight sealing
- Expansion joint or stuffing box for expansion compensation at high temperatures
- Pre-assembled accessory kits for process media connections (e.g. quick release couplings, shut-off ball valves, strainers)
- Further special customizations including wear protection, insulation, water cooling or coating
- Assembly connecting piece with flange connector for welding onto flue gas duct
- Guide rail to facilitate lance installation

Injector/lance arrangement

Nozzle type

According to customer requirements

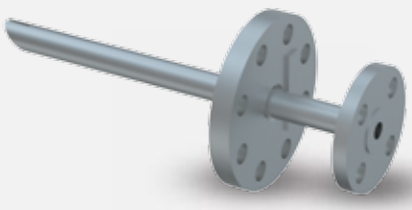
- Spray direction
- Insertion length
- Single nozzle
- Multi-nozzle arrangement
- Cluster head design

Nozzle type selection

- Hydraulic nozzles
- Twin-fluid nozzles

Spargers and Quills

- According to customer requirements



PUMP AND CONTROL SKIDS
A PERFECTLY TAILORED SOLUTION

Our pump and control skid units for regulating the flow rates of water and atomizing air are individual customer-specific solutions. Based on the requirements in each case, our first step is to design an overall concept and select the best components in order to create a perfectly tailored solution.

First-class engineering

To perform our engineering, we determine all relevant parameters and define the plant's design. This includes determining the nominal widths and pressure levels as well as designing the pumps and control valves. We draw up the P&I diagram and make detailed equipment and signal lists as an option. Of course, the project is fully documented to ensure that technology and processes can be quickly traced even after years of use.

High-quality components

An exact knowledge of the characteristic properties of our nozzles is key here. Only a complete system that is coordinated to how the nozzles function and operate will ensure smooth and economical operation of the gas cooling system. Unexpected failures can quickly lead to plant stoppages and costly production outages. This is why we fit our pump and control skid units with high-quality components from well-known manufacturers as standard and the most important functional components are even realized in redundant design.

The components are interconnected with pipes and mounted on a stable base frame with eyelets for crane transportation, at the same time ensuring that all components for operation and maintenance are arranged in an easily accessible manner.

Tested quality

The design (e.g. dimensioning of nominal widths) and production are in line with the latest state of the art and comply with all relevant standards. They are equally subject to the Lechler quality management system certified to DIN EN ISO 9001, as is the final acceptance. Before delivery, the pump and control skid unit undergoes a pressure and tightness test and is checked by our experienced engineers. This will avoid any problems during commissioning.

Control concept from the nozzle specialist

Numerous installations of *VarioCool*® systems, years of commissioning experience, plus expertise in nozzle technology all contribute to the constant improvement and optimization of Lechler control systems. By installing a control solution from Lechler you will benefit considerably from this wealth of experience. The flexible and fully automatic concept can be perfectly adapted to your process. You will have start-up and shut-down scenarios and dynamic process conditions under perfect control with our solution.

Option packages for our *VarioCool*® pump and control skid

Electrical wiring of the components:

Junction box

All components except the pump motors are wired to a junction box within the pump and control skid unit.

This assures that the customer has a central connection point for all electrical components and measuring devices for further processing in the higher-level control.

Control cabinet with complete PLC

All components including the pumps are wired to a control cabinet. The control cabinet is integrated into the base frame of the pump and control skid unit.

The complete injection control is tested in accordance with valid electrical standards and regulations and allows all relevant process parameters to be visualized over a control panel on the control cabinet.

Specific configuration and extensive testing make commissioning much faster. Communication and the exchange of signals (setpoint, plant status, error messages) with the customer's logic system is carried out via PROFIBUS or PROFINET.

The control has several modes of operation such as automatic mode and manual mode for tests during plant downtimes. In the event of faults, our engineers can quickly perform a remote diagnosis via the installed modem without the need for an on-site visit.

Talk to us

Customer requirements are different. Which is why standard solutions do not always make sense. Speak with us and let us work together to find the best solution for your purposes.

DROPLET SEPARATORS
WHEN PERFORMANCE COUNTS

Engineered Solutions

Droplet separators have played a vital role in many process operations and gas washing plants as functional elements that protect downstream installation parts, increase product yield or reduce energy consumption. They are now becoming even more important due to increasingly stringent environmental protection regulations that require a drastic reduction in the residual pollutant content.

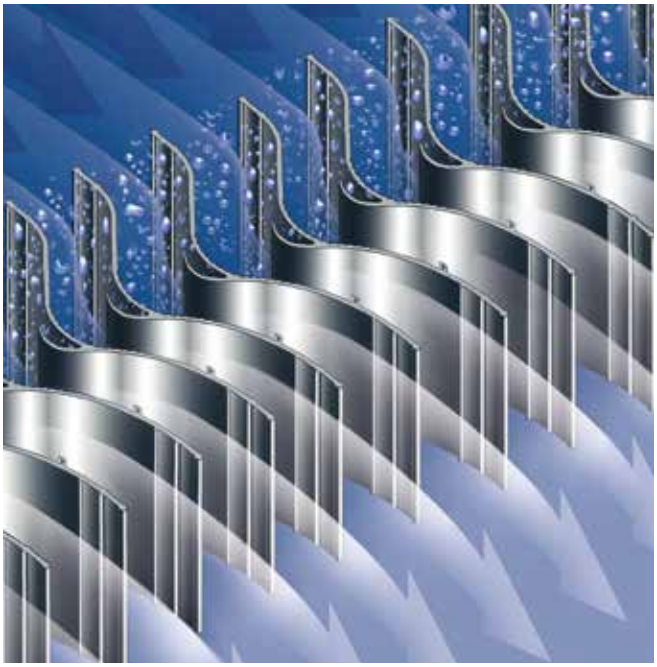
This makes it necessary to use high-performance droplet separators which are capable of separating even the finest droplets with a size of less than 10 microns, while at the same time minimizing pressure losses. This task requires effective separation systems with compact dimensions that can deal with high flow rates.

When designing and planning droplet separators, 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 droplet separator. 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 droplet separators are now considered integral elements in process engineering.

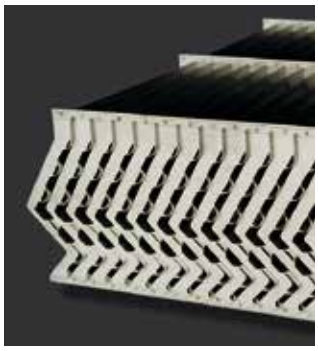
Each installation requires a specific droplet separator design and construction. Design, construction and selection of the optimum Lechler droplet separators are based fully on your requirements, specifications and drawings. That is why we do not offer standard solutions, but customize systems individually 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.



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

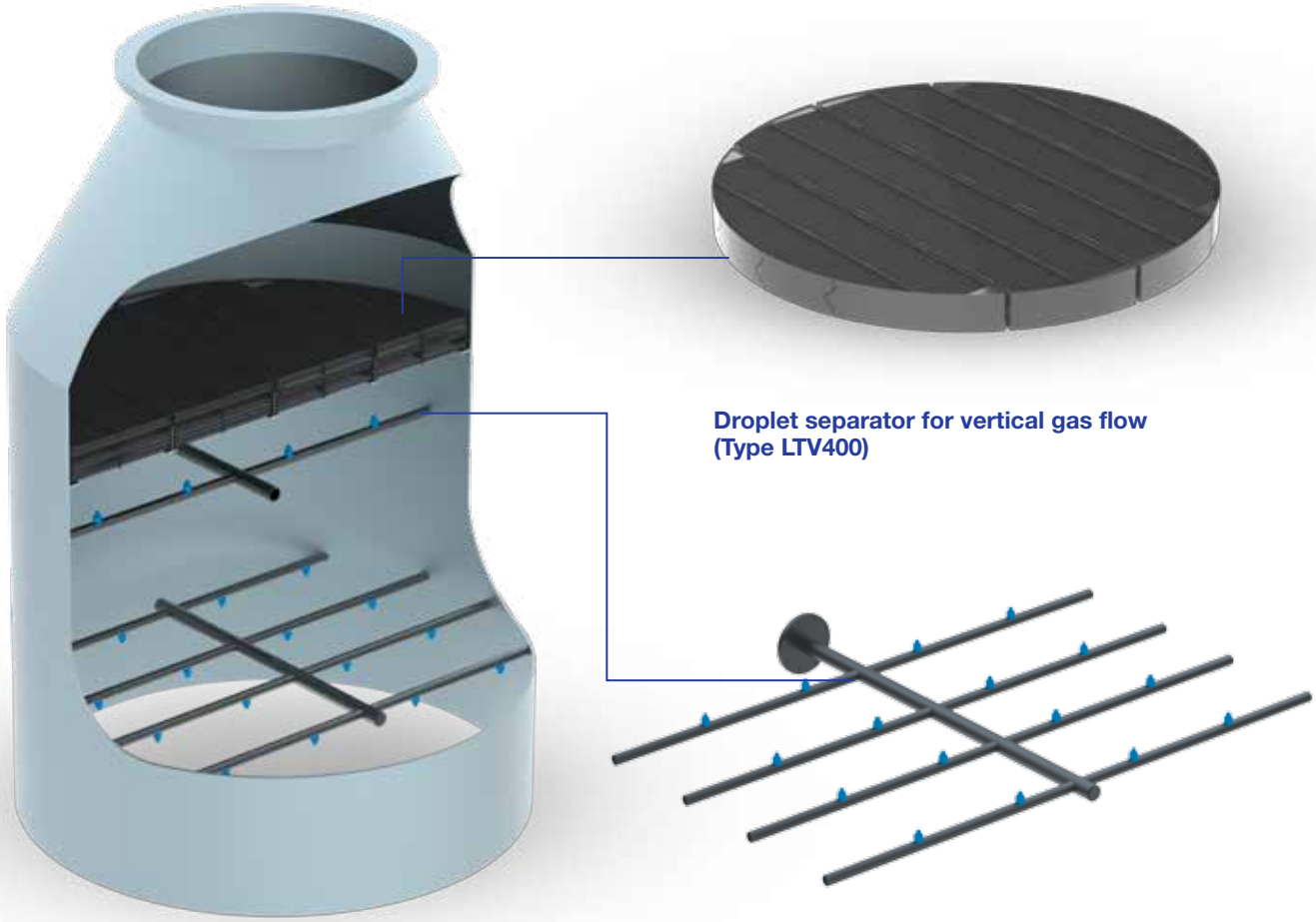


Talk to us

Do you know your process but are not sure which droplet separator 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.

Lechler GmbH
Droplet Separator Division
Charlottenburger Allee 7
52068 Aachen/Germany
Phone: +49 241-463751-40
E-Mail:dropletseparator@lechler.de

Droplet separators
for vertical gas flow



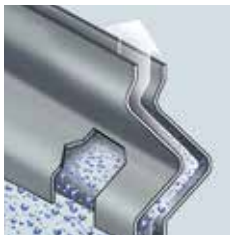
Droplet separator for vertical gas flow (Type LTV400)

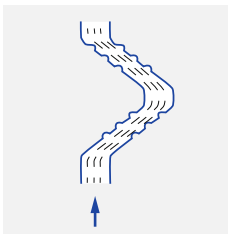
Cleaning system for droplet separators

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.

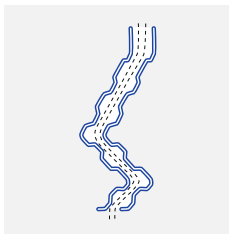
Reliable operation – even under tough conditions

Lechler droplet separators 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 droplet separators. In this case, an additional cleaning system helps to guarantee availability during continuous operation.
An arrangement that performs cyclical washing of the droplet separators 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.

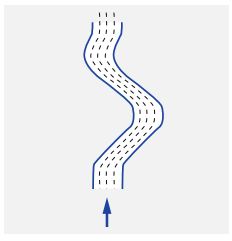




Profile Geometry LTV 271

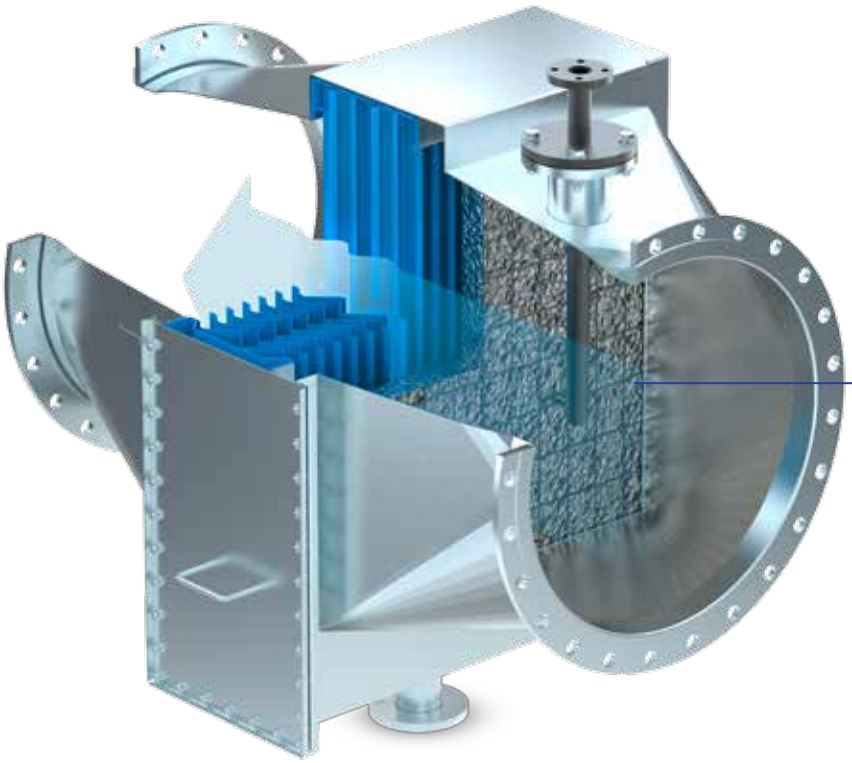


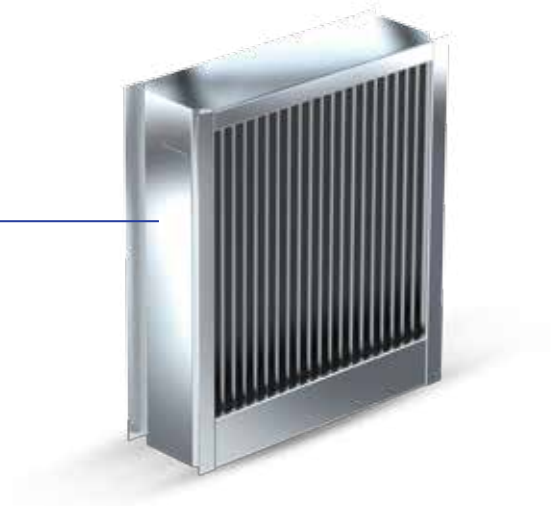
Profile Geometry LTV 300



Profile Geometry LTV 400

Droplet separators
for horizontal gas flow

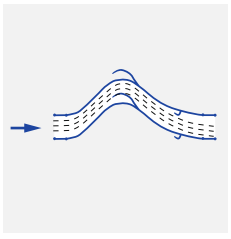




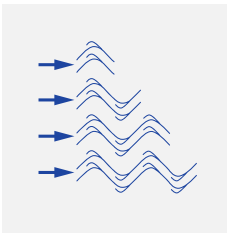
Droplet separator for horizontal gas flow (Type LTH 600)

Housing with droplet separator for horizontal gas flow (Type LTH 600) and agglomerator

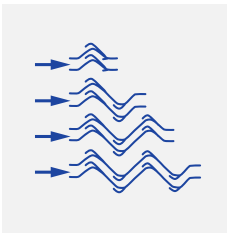
Vane-type separators for horizontal gas flow use different design features for secondary separation than vertical systems. In vane-type separators for horizontal gas flow, the separation vanes are arranged vertically to the gas flow so that the liquid runs down the baffles due to gravity. The creation of flow-calmed zones allows the liquid film to specifically drain in these areas without renewed contact with the gas flow. The fact that liquid run-off is assisted by the forces of gravity results in high-performance separation systems. Depending on the separator design, particularly high flow rates are possible. The flow-optimized shape of the baffle vanes minimizes pressure losses. Based on your individual requirements, it is possible to choose from a finely-graded range of vane profiles with single or multiple deflection.



Profile geometry LTH 100



Profile geometry LTH 500

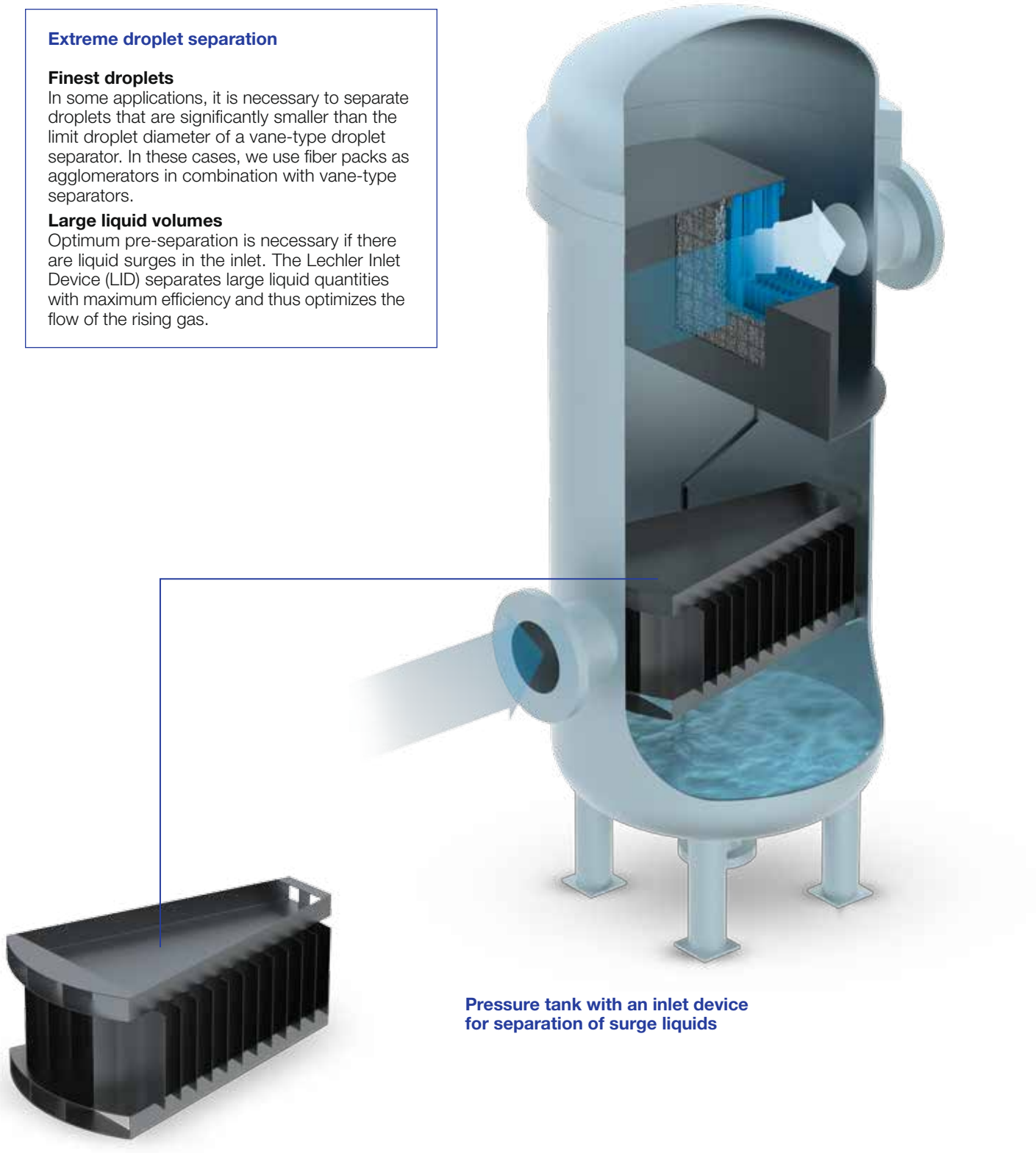


Profile geometry LTH 600

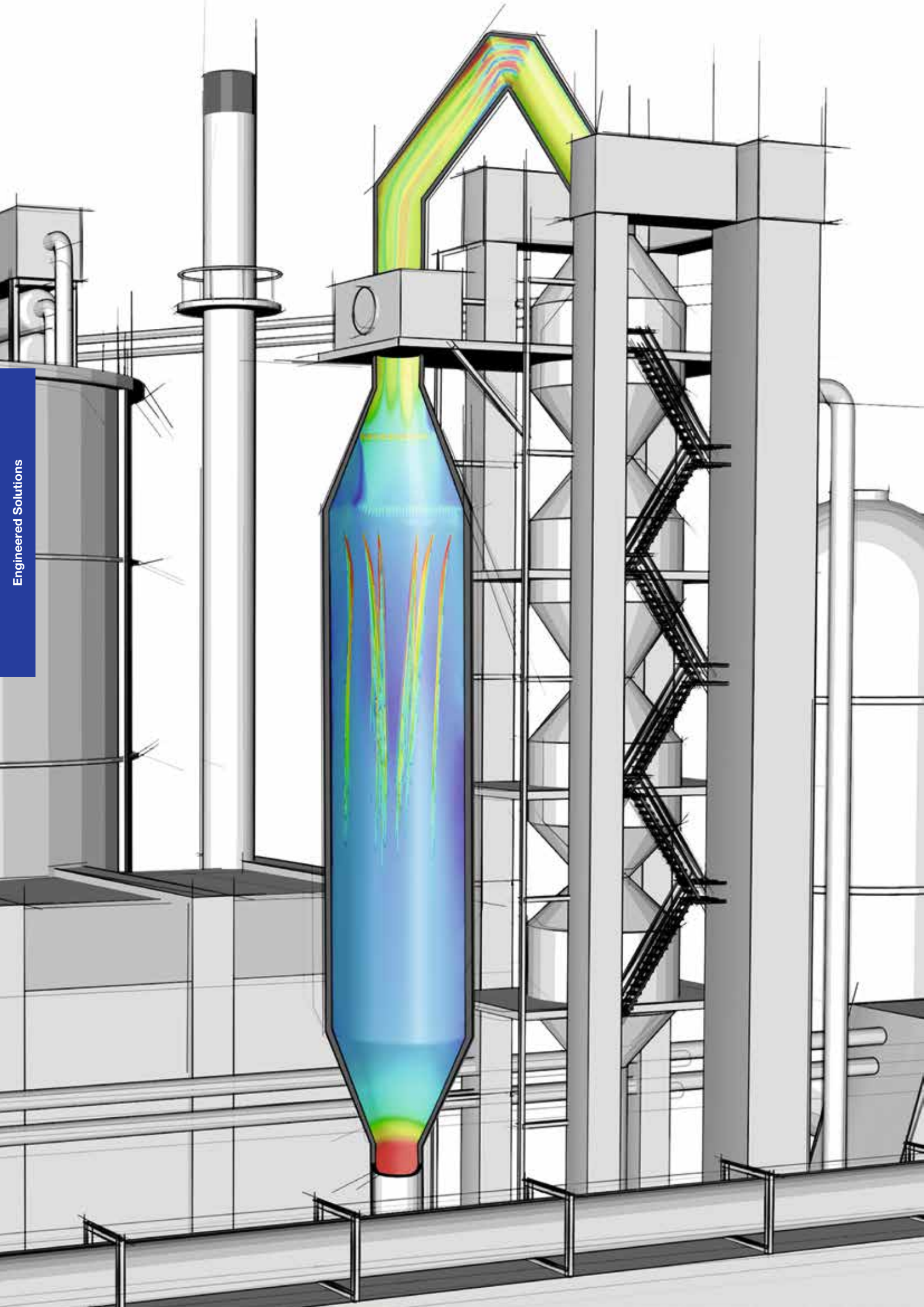
Extreme droplet separation

Finest droplets
In some applications, it is necessary to separate droplets that are significantly smaller than the limit droplet diameter of a vane-type droplet separator. In these cases, we use fiber packs as agglomerators in combination with vane-type separators.

Large liquid volumes
Optimum pre-separation is necessary if there are liquid surges in the inlet. The Lechler Inlet Device (LID) separates large liquid quantities with maximum efficiency and thus optimizes the flow of the rising gas.



Pressure tank with an inlet device for separation of surge liquids



Engineered Solutions

CFD ANALYSIS

Fluid Dynamics simulation as a process optimization tool

For us, perfection is not just a promise, but is based on calculation of computational Fluid Dynamics (CFD).

No matter what the spray application may be, the goal is always to achieve the maximum effect with the minimum possible use of material, spray media and energy. It is therefore essential to have a detailed understanding of how spray mist is formed and propagated.

This is made possible by computer-assisted simulation of the flow processes of one or more media in static and dynamic environments, taking into account heat and mass transfer and almost every physical effect. These simulations incorporate our know-how from many decades of nozzle development.

In the past, Fluid Dynamics was only an internal tool which helped us to develop nozzles faster and with greater precision. The completion of our high performance cluster with a computing performance of around 8.500 GFlops now allows us to offer our know-how as a service.

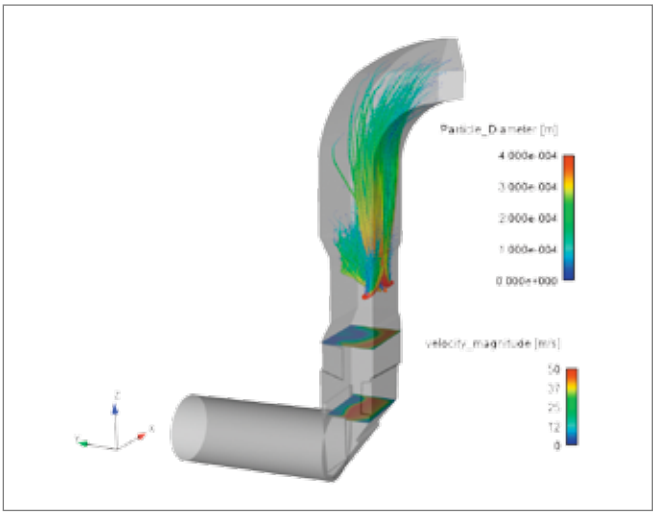
We can simulate nozzle applications and processes individually for your environment and requirements. The aim is to make your spray processes working exactly how you want them to.

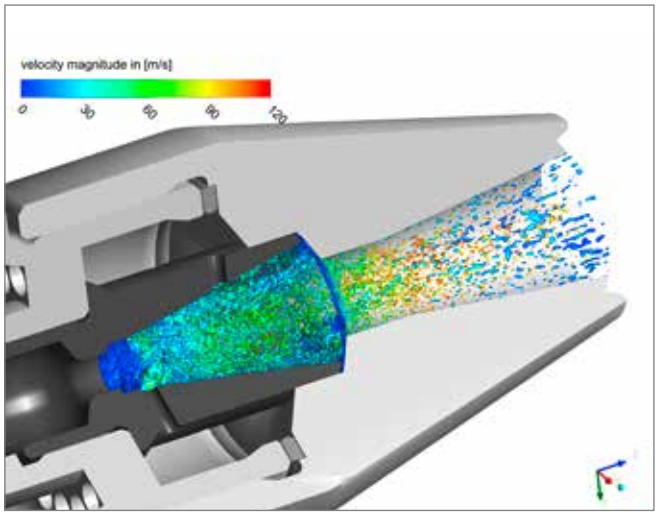
Our services:

- Simple flow field and pressure loss simulations with one or more gas/liquid in containers, pipes and fittings
- Full spray propagation in almost every environment including heat and mass transfer with the surrounding gases
- Calculation of the internal flow field in nozzles and prediction of the spray pattern as well as water distribution and spray characteristic close to the nozzle

Your advantages:

- Maximum efficiency in
  - media consumption for nozzles and applications
  - geometric dimensions of the whole process
- through optimized
  - nozzle selection
  - nozzle operation (for efficient use of pumps, compressors and fans)
  - spray distribution
  - droplet sizes
  - optimized fluid flow upstream and downstream of the spraying process





Engineered Solutions

MEASURING TECHNOLOGY
HOW OUR RESOURCES HELP US ACHIEVE PRECISION

What we are doing before we do it

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.

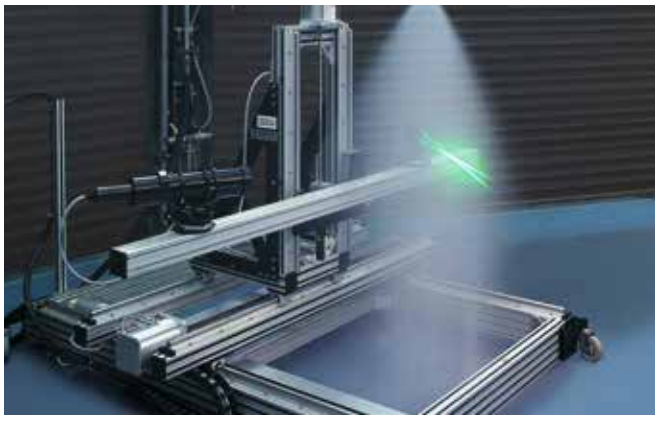
Advanced technology

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.



Our unique selling point: Practice-based knowledge

Since it was founded, Lechler has stood out for its development of new technologies. In 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 to 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.

PRECISION NOZZLES: UTMOST ACCURACY AND MAXIMUM AVAILABILITY FOR STANDARD APPLICATIONS

In the chemical industry there are innumerable applications that require the atomization of liquids of all kinds in different ways. The combination of all these parameters leads to thousands of different nozzles. At Lechler, we have them all. In this brochure, we present you with a selection of our most common nozzles used in chemical applications. If for some reason, you cannot find what you are looking for, please contact our experts to help you with finding the right nozzle for your application.

Spillback nozzles
Atomization without compressed air

Lechler spillback nozzles atomize liquids as a fine hollow cone.

This single-fluid nozzle works according to the pressure atomization principle. The water is sent to the nozzle with an almost constant feed pressure, irrespectively of the atomized flow rate.

The amount injected is steplessly controlled via a valve in the spillback line, whereby part of the flow is taken from the inlet flow rate and carried back to the tank. The maximum atomized flow rate is achieved with the control valve closed.

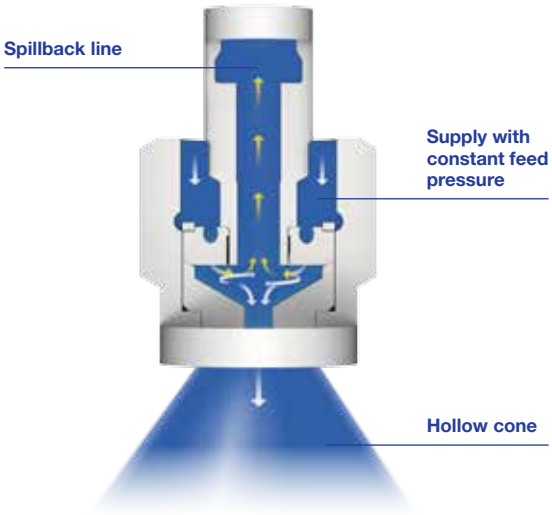
Uniform and fine liquid atomization is achieved across the entire control range.

If the volume to be atomized is distributed over cluster heads with up to six small spillback nozzles, this leads to an improvement in the droplet quality compared to a single nozzle.

Thanks to the cluster heads' total spray angle of about 120°, the distribution of the water volume over the entire channel cross-section improves. The number of lances can be reduced in this way. We also recommend this option when upgrading existing gas cooling towers in particular.

Spray pattern of a single spillback nozzle

Spray pattern of a cluster spillback nozzle lance



Scheme of the spillback nozzle

Use:
- Gas cooling in medium-sized and large gas cooling towers

Properties

Spray angle of the individual nozzles
90° or 60°
as hollow cone

Low operating costs
as no atomizing air required

Execution
as single or cluster nozzle lances possible

High turn-down ratio
of up to 12:1

Even and fine liquid atomization
over the entire control range

Typical pressure range
of 35 bar, g in the supply line at the nozzle

VarioJet® nozzles

Twin-fluid nozzles with low air consumption despite large outlet angle

Lechler *VarioJet*® nozzles atomize according to the principle of internal mixing. With this twin-fluid nozzle, the water is fed in axially via a bore hole.

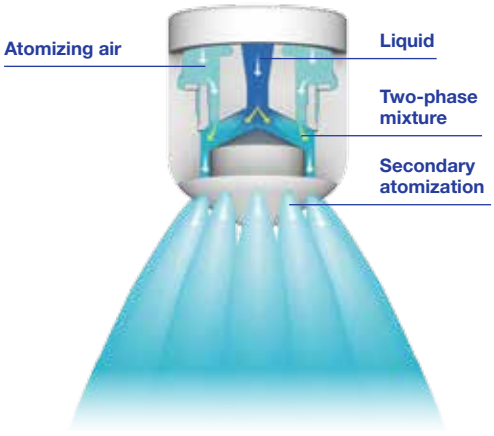
After arriving at the cone tip, the liquid is split up into a thin liquid film. This thin liquid film is split into finest droplets by the atomizing air in the mixing chamber. The resulting two-phase mixture is then atomized a second time when exiting via several bore holes arranged in a circular pattern.

Thanks to the innovative design of the nozzle, a spray with a large outlet angle is achieved. This is characterized by an even liquid distribution as well as a fine droplet spectrum with a low specific air consumption.

The fineness of the droplet spectrum is decisively influenced by the air/liquid ratio and by the pressure level of the two fluids. As a general rule: the higher the air/liquid ratio and the higher the pressure level of atomizing air and liquid is, the finer the droplet spectrum.

The large free cross-sections in the nozzle keep the risk of clogging and the maintenance effort to a minimum.

Spray pattern of the *VarioJet*® nozzle



Scheme of the *VarioJet*® nozzle

Use:
- Gas cooling in gas cooling towers as well as gas-bearing pipes (ducts)

Properties

- **Large spray angle** 60°, 90° for good coverage of the cross-section of the duct
- **Adjustment of the droplet spectrum** by changing the air/fluid ratio
- **Clog-resistant** thanks to large free cross-sections without internal fittings
- **High turn-down ratio** up to 20:1
- **Low air consumption**
- **Typical pressure range** Liquid 1-9 bar, g Atomizing air 1-6 bar, g

Laval nozzles

Twin-fluid nozzles for a wide droplet spectrum in special applications

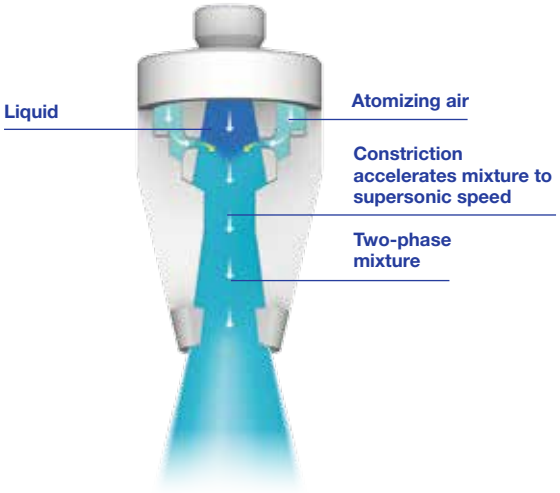
Lechler Laval nozzles atomize liquids as a fine full cone. These twin-fluid nozzles work according to the supersonic principle.

A dual-phase mixture is created from atomizing air and liquid in the mixing chamber inside the nozzle. The shape of the nozzle causes this mixture to be accelerated to supersonic speed, resulting in an extremely fine atomization of the droplets.

By changing the air/liquid ratio, the droplet size and the droplet spectrum can be adapted within a wide range. The large free cross sections of the nozzle also allow atomization of viscous or solids-laden liquids.

Choosing the right material prevents wear even where abrasive media are present, and enables use at high temperatures.

Spray pattern of the Laval nozzle



Scheme of the Laval nozzle

Use:

- Gas cooling in gas-bearing pipes (ducts) and medium-sized and small gas cooling towers
- Injection of solids-laden water
- Introduction of lime water in the desulfurisation process
- Injection of aqueous ammonia or urea solution for the DeNOx process (SNCR/SCR)
- Chemical process engineering (spray dryers etc.)

Properties

Small spray angle
15°, suitable for small cross-sections and horizontal ducts

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

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

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

Very fine droplet spectrum

Typical pressure range
Liquid 1-6 bar, g
Atomizing air 1-6 bar, g

Twin-fluid nozzles with internal mixing
Series 170 / 180

Efficient atomization by mixing liquid and gas.

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

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

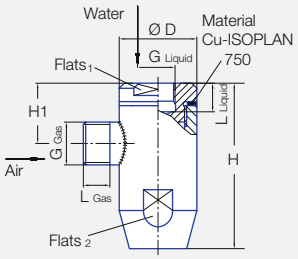
Liquid pressure:
1.0 - 5.0 bar

Air pressure:
1.0 - 5.0 bar

Regulating range up to max.:
1 : 30

Spray angle:
approx. 20°

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



Type	Dimensions [mm]									Weight 316 SS
	H	H_1	D	$Flats_1$	$Flats_2$	$G_{Liquid\ BSPP}$	$G_{Gas\ BSPP}$	L_{Liquid}	L_{Gas}	
180.641	48	28	25	22	22	G 1/8	G 3/8	7,5	10	140 g
180.721	81	29.5	38	32	32	G 3/8	G 1/2	14	13	540 g
170.801	81	29.5	38	32	32	G 3/8	G 1/2	14	13	540 g
170.881	81	29.5	38	32	32	G 3/8	G 1/2	14	13	540 g
170.961	112	42	52	46	46	G 1/2	G 3/4	18	15	1275 g

Ordering no.		E Ø [mm]	E Ø [mm]	Air pressure **p** [bar]											
				1.0			**2.0**			**3.0**			**4.0**		
Type	Mat. no. **1Y** 316L SS	Air	Water	**p** Water [bar]	**V** Water [l/min]	$\dot{V}_n$ Air [m³/h]	**p** Water [bar]	**V** Water [l/min]	$\dot{V}_n$ Air [m³/h]	**p** Water [bar]	**V** Water [l/min]	$\dot{V}_n$ Air [m³/h]	**p** Water [bar]	**V** Water [l/min]	$\dot{V}_n$ Air [m³/h]
180.641	○	3.0	4.2	0.8 0.9 1.3	0.4 1.0 2.5	20.0 18.0 14.0	1.7 1.9 2.7	0.6 1.5 3.5	32.0 28.0 23.0	2.5 3.2 4.0	0.8 3.0 5.0	43.0 36.0 32.0	3.1 4.6 5.8	0.9 4.0 7.0	55.0 43.0 37.0
180.721	○	3.7	5.0	0.6 0.8 0.9	0.5 2.0 3.5	43.0 37.0 32.0	1.3 1.7 1.9	0.7 3.0 5.5	66.0 55.0 49.0	2.2 2.7 3.1	0.9 4.0 7.5	86.0 74.0 64.0	3.0 3.7 4.2	1.1 6.0 9.0	109.0 86.0 79.0
170.801	○	2.0	5.5	0.7 0.9 1.0	1.0 3.0 5.0	40.0 35.0 32.0	1.5 1.8 2.0	1.0 5.0 10.0	58.0 52.0 48.0	2.2 2.6 3.0	1.2 7.0 14.0	80.0 72.0 63.0	3.2 3.6 4.0	1.2 10.0 20.0	105.0 91.0 83.0
170.881	○	2.8	7.6	0.6 0.8 0.9	1.0 5.0 8.0	60.0 55.0 50.0	1.5 1.7 1.9	1.2 7.0 13.0	95,.0 90.0 80.0	2.2 2.5 3.0	1.5 10.0 19.0	130.0 118.0 105.0	3.1 3.5 4.1	1.8 15,0 28.0	171.0 154.0 143.0
170.961	○	3.2	9.5	0.6 0.8 1.0	1.0 5.0 12.0	94.0 85.0 72.0	1.4 1.7 1.9	1.2 10.0 19.0	155.0 130.0 115.0	2.2 2.6 3.0	1.5 15.0 26.0	210.0 179.0 152.0	3.0 3.5 4.1	1.8 20.0 38.0	275.0 220.0 198.0

E = narrowest free cross section

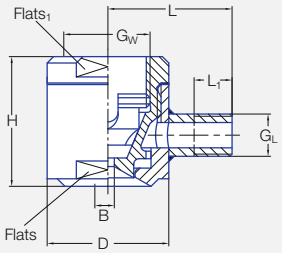
Example	**Type**	**+**	**Material no.**	**=**	**Ordering no.**
for ordering:	**180.641**	**+**	**1Y**	**=**	**180.641.1Y**

Twin-fluid nozzles
Series 150

Fine liquid atomization by means of air or vapour.

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

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



Type	G_W BSPP	G_L BSPP	H [mm]	D [mm]	L [mm]	L_1 [mm]	Flats [mm]	$Flats_1$ [mm]	Weight 316Ti SS
150.005.17 – 150.013.17	G 3/8	G 1/4 A	38.0	28.0	32.5	10.0	24.0	24.0	140 g
150.032.17	G 1	G 3/8 A	52.0	48.0	49.0	15.0	41.0	41.0	500 g
150.050.17 – 150.063.17	G 1 1/4	G 1/2 A	75.0	65.0	58.0	15.0	55.0	55.0	1350 g

Spray angle	Ordering no.		B Ø [mm]	E Ø [mm]	$\dot{V}$ [l/min]						V_n [m³/h] Air			
	Type	Mat. no. **17**[1] 316Ti SS			**p** [bar]						Air pressure **p [bar]**			
					0.3	0.5	0.7	1.0	1.5	2.0	1.0	2.0	3.0	4.0
20-30°	**150.005**	○	1.0	1.0	0.15	0.20	0.24	0.28	0.35	0.40	10	15	20	25
	150.007	○	2.0	2.0	0.39	0.50	0.59	0.71	0.87	1.00	10	15	20	25
	150.009	○	4.0	2.0	0.97	1.25	1.48	1.77	2.17	2.50	10	15	20	25
	150.010	○	3.5	2.0	1.55	2.00	2.37	2.83	3.46	4.00	10	15	20	25
	150.013	○	6.0	2.0	3.10	4.00	4.73	5.66	6.93	8.00	10	15	20	25
	150.032	○	8.0	2.7	3.10	4.00	4.73	5.66	6.93	8.00	31	47	63	80
	150.050	○	9.0	4.9	6.20	8.00	9.47	11.31	13.86	16.00	60	90	120	150
	150.052	○	9.0	4.9	12.20	15.75	18.64	22.27	27.28	31.50	60	90	120	150
	150.063	○	15.0	4.9	24.40	31.50	37.27	44.55	54.56	63.00	100	150	200	250

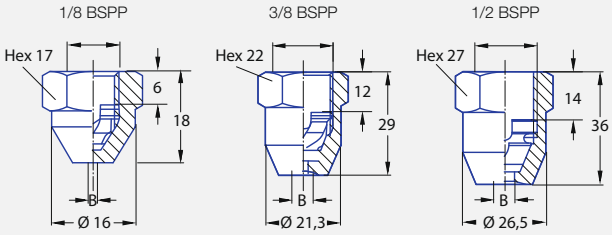
[1] We reserve the right to deliver 316Ti SS or 316L SS under the material no. 17.
B = bore diameter · E = narrowest free cross section

Example for ordering:	**Type**	**+**	**Material no.**	**=**	**Ordering no.**
	150.005	**+**	**17**	**=**	**150.005.17**

Axial-flow hollow cone nozzles
Series 214 / 216 / 218

Fine, uniform hollow cone spray.

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



Series 214
Weight: 26 g

Series 216
Weight: 57 g

Series 218
Weight: 105 g

Spray angle	Ordering no. Type	Mat. no. 17[1] 316Ti SS	G BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	20.0	Spray diameter D at p = 3 bar H = 250 mm
60°	**214.184**	○	1/8	0.50	0.50	-	-	0.08	0.10	0.13	0.18	0.25	200
80°	**214.245**	○	1/8	1.00	0.50	-	-	0.16	0.20	0.25	0.36	0.51	450
	214.305	○	1/8	1.80	0.50	-	0.23	0.32	0.39	0.51	0.72	1.01	450
60°	**216.324**	○	3/8	1.00	1.00	-	0.28	0.40	0.49	0.63	0.89	1.26	200
	216.364	○	3/8	1.40	1.40	-	0.45	0.63	0.77	1.00	1.41	1.99	200
	216.404	○	3/8	2.00	2.00	-	0.71	1.00	1.22	1.58	2.24	3.16	200
90°	**216.496**	○	3/8	3.00	2.00	-	1.20	1.70	2.08	2.69	3.80	5.38	500
	216.566	○	3/8	4.00	2.00	-	1.77	2.50	3.06	3.95	5.59	7.91	500
	216.646	○	3/8	3.50	2.00	2.00	2.83	4.00	4.90	6.32	8.94	12.65	500
	216.686	○	3/8	4.00	2.00	2.50	3.54	5.00	6.12	7.91	11.18	15.81	500
	216.726	○	3/8	5.00	2.00	3.15	4.45	6.30	7.72	9.96	14.09	19.92	500
	216.776	○	3/8	6.00	2.00	4.30	6.00	8.50	10.40	13.40	19.00	26.90	500
	218.646	○	1/2	5.00	2.00	2.00	2.83	4.00	4.90	6.32	8.94	12.65	500
	218.706	○	1/2	6.50	2.00	2.80	3.96	5.60	6.86	8.85	12.52	17.71	500
	218.766	○	1/2	5.00	2.00	4.00	5.66	8.00	9.80	12.65	17.89	25.30	500
	218.826	○	1/2	6.50	2.00	5.60	7.92	11.20	13.72	17.71	25.04	35.42	500
	218.846	○	1/2	7.50	2.00	6.25	8.84	12.50	15.31	19.76	27.95	39.53	500
	218.886	○	1/2	9.00	2.40	8.00	11.31	16.00	19.60	25.30	35.78	50.60	500

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

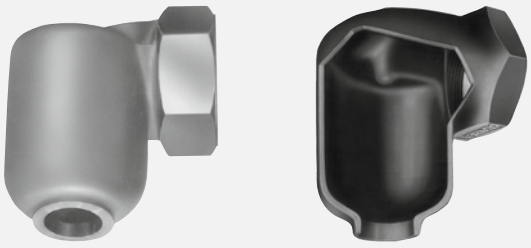
Example for ordering	Type	+	Material no.	=	Ordering no.
	214.184	+	**17**	=	**214.184.17**

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

Eccentric hollow cone nozzles
Series 373 »Ramp Bottom«

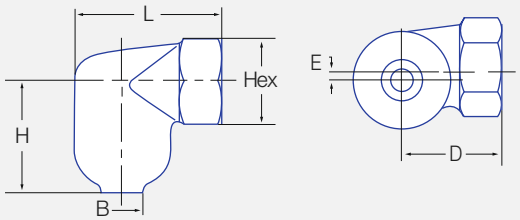
Fine, uniform hollow cone spray, also at low pressures.

Applications:
cooling and cleaning of gas, water re-cooling, dust control, chemical process engineering.



Sectional view of a series 373 »Ramp Bottom« nozzle

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

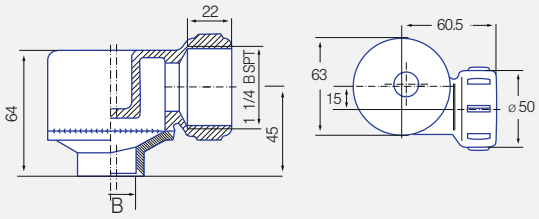


Series 373 »Ramp Bottom«

Dimensions [mm]

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

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



Series 309
Weight: 142 g

Spray angle	Ordering no. Type	Mat. no. 17 316 SS	Code 1 BSPP	1 1/4 BSPP	1 1/2 BSPP	2 BSPP	2 1/2 BSPP	B Ø [mm]	V̇ [l/min] p [bar] 0.3	0.5	1.0	2.0	5.0	10.0	Spray diameter D at p = 2 bar H = 500 mm	H = 1000 mm
70°	**373.115**	○	**AN**	-	-	-	-	11.40	24.40	31.50	44.50	63.00	99.60	141.00	650	1300
80°	**373.175**	○	**AN**	-	-	-	-	12.90	31.00	40.00	56.60	80.00	126.00	179.00	800	1550
	373.235	○	-	**AQ**	-	-	-	16.20	45.70	59.00	83.40	118.00	187.00	264.00	700	1350
	373.285	○	-	**AQ**	-	-	-	20.50	62.00	80.00	113.00	160.00	253.00	358.00	800	1550
	373.325	○	-	-	**AS**	-	-	22.20	77.50	100.00	141.00	200.00	316.00	447.00	800	1550
	373.365	○	-	-	**AS**	-	-	23.60	67.90	114.00	161.00	227.00	359.00	508.00	700	1400
	373.415	○	-	-	-	**AW**	-	25.60	131.00	169.00	238.00	337.00	533.00	754.00	700	1400
	373.465	○	-	-	-	**AW**	-	30.70	182.00	235.00	332.00	469.00	742.00	1049.00	965	1800
	373.505	○	-	-	-	-	**AZ**	32.50	209.00	270.00	382.00	540.00	854.00	1207.00	800	1500
	373.515	○	-	-	-	-	**AZ**	34.80	233.00	301.00	425.00	601.00	950.00	1344.00	900	1700
	373.555	○	-	-	-	-	**AZ**	41.10	290.00	375.00	530.00	750.00	1186.00	1677.00	900	1700

Plastic version:

90°	**309.236.5E**	**(Material PVDF)**						20.00	45.70	59.00	83.40	118.00	187.00	264.00	850	1500
	309.286.5E	**(Material PVDF)**						24.00	62.00	80.00	113.00	160.00	253.00	358.00	750	1400

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

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	373.115	+	**17**	+	**AN**	=	**373.115.17.AN**

Axial-flow full cone nozzles
Series 490 / 491

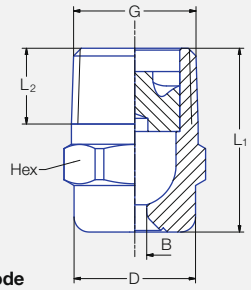
NEW Patent pending

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

Series 491



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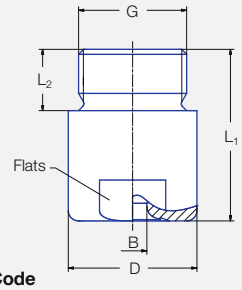


Code AK-AM

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

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

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

Spray angle	Ordering no.									B Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray diameter D at p = 2 bar	
	Type	Mat. no.		Code								p [bar]								
		1Y 316L SS	30 Brass	1/8 BSPT	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPP	1 BSPP			0.5	1.0	2.0	3.0	5.0	7.0	10.0	H = 200 mm	H = 500 mm
45°	**490.403**	○	○	**CA**	-	-	-	-	-	1.25	1.25	0.57	0.76	1.00	1.18	1.44	1.65	1.90	160	400
	490.523	○	○	**CA**	-	-	-	-	-	1.70	1.70	1.15	1.52	2.00	2.35	2.89	3.30	3.81	160	400
	490.603	○	○	-	**CC**	**CE***	-	-	-	2.00	2.00	1.81	2.39	3.15	3.70	4.54	5.20	6.00	160	400
	490.643	○	○	-	**CC**	**CE***	-	-	-	2.45	2.45	2.30	3.03	4.00	4.70	5.77	6.60	7.61	160	400
	490.683	-	○	-	-	**CE**	-	-	-	2.55	2.55	2.87	3.79	5.00	5.88	7.21	8.25	9.52	160	400
	490.703	-	○	-	-	**CE**	-	-	-	2.65	2.65	3.22	4.24	5.60	6.59	8.08	9.24	10.66	160	400
	490.723	○	○	-	-	**CE**	-	-	-	2.85	2.85	3.62	4.77	6.30	7.41	9.09	10.40	11.99	160	400
	490.783	-	○	-	-	-	**CG**	-	-	3.45	3.45	5.17	6.82	9.00	10.58	12.98	14.85	17.12	160	400
	490.843	-	○	-	-	-	**CG**	-	-	3.80	3.80	7.18	9.47	12.50	14.70	18.03	20.63	23.80	160	400
60°	**490.404**	○	○	**CA**	-	-	-	-	-	1.15	1.15	0.57	0.76	1.00	1.18	1.44	1.65	1.90	220	560
	490.444	○	-	**CA**	-	-	-	-	-	1.25	1.25	0.72	0.95	1.25	1.47	1.80	2.06	2.38	220	560
	490.484	○	○	**CA**	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	220	560
	490.524	○	○	**CA**	-	-	-	-	-	1.60	1.60	1.15	1.52	2.00	2.35	2.89	3.30	3.81	220	560
	490.564	○	○	**CA**	-	-	-	-	-	1.80	1.80	1.44	1.89	2.50	2.94	3.61	4.13	4.76	220	560
	490.604	○	○	**CA**	**CC**	**CE**	-	-	-	2.05	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	220	560

*Only available in material 30 · B = Bore diameter · E = Narrowest free cross section

Continued on next page.

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 490 / 491

NEW Patent pending

Spray angle	Ordering no.									B Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray diameter D at p = 2 bar	
	Type	Mat. no.		Code								p [bar]								
		1Y 316L SS	30 Brass	1/8 BSPT	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPP	1 BSPP			0.5	1.0	2.0	3.0	5.0	7.0	10.0	H = 200 mm	H = 500 mm
60°	**490.644**	○	○	-	**CC**	**CE**	-	-	-	2.30	2.30	2.30	3.03	4.00	4.70	5.77	6.60	7.61	220	560
	490.684	○	○	-	**CC**	**CE**	-	-	-	2.60	2.60	2.87	3.79	5.00	5.88	7.21	8.25	9.52	220	560
	490.724	○	○	-	**CC**	**CE**	-	-	-	2.95	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	220	560
	490.764	○	○	-	-	**CE**	-	-	-	3.25	3.25	4.59	6.06	8.00	9.41	11.54	13.20	15.22	220	560
	490.804	○	○	-	-	**CE**	-	-	-	3.70	3.70	5.74	7.58	10.00	11.76	14.43	16.51	19.04	220	560
	490.844	○	○	-	-	-	**CG**	-	-	4.05	4.05	7.18	9.47	12.50	14.70	18.03	20.63	23.80	220	560
	490.884	○	○	-	-	-	**CG**	-	-	4.65	4.65	9.19	12.13	16.00	18.82	23.08	26.41	30.46	220	560
	490.924	○	○	-	-	-	-	**AK**	-	5.20	5.20	11.49	15.16	20.00	23.52	28.85	33.01	38.07	220	560
	490.964	○	○	-	-	-	-	**AK**	-	5.80	5.80	14.36	18.95	25.00	29.40	36.07	41.26	47.59	220	560
	491.044	○	○	-	-	-	-	-	**AM**	7.25	7.25	22.97	30.31	40.00	47.04	57.71	66.02	76.15	220	560
	491.084	○	○	-	-	-	-	-	**AM**	8.15	8.15	28.72	37.89	50.00	58.80	72.14	82.53	95.18	220	560
90°	**490.406**	○	○	**CA**	-	-	-	-	-	1.20	1.20	0.57	0.76	1.00	1.18	1.44	1.65	1.90	380	860
	490.446	-	○	**CA**	-	-	-	-	-	1.30	1.30	0.72	0.95	1.25	1.47	1.80	2.06	2.38	380	860
	490.486	○	○	**CA**	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	380	860
	490.526	○	○	**CA**	-	-	-	-	-	1.70	1.55	1.15	1.52	2.00	2.35	2.89	3.30	3.81	380	860
	490.566	○	○	**CA**	-	-	-	-	-	1.90	1.90	1.44	1.89	2.50	2.94	3.61	4.13	4.76	380	860
	490.606	○	○	**CA**	-	**CE**	-	-	-	2.10	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	380	860
	490.646	○	○	-	**CC**	**CE**	-	-	-	2.40	2.40	2.30	3.03	4.00	4.70	5.77	6.60	7.61	390	960
	490.686	○	○	-	**CC**	**CE**	-	-	-	2.70	2.70	2.87	3.79	5.00	5.88	7.21	8.25	9.52	390	960
	490.726	○	○	-	**CC**	**CE**	-	-	-	3.20	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	390	960
	490.746	○	○	-	-	**CE**	-	-	-	3.15	3.15	4.08	5.38	7.10	8.35	10.24	11.72	13.52	390	960
	490.766	○	○	-	-	**CE**	-	-	-	3.40	3.40	4.59	6.06	8.00	9.41	11.54	13.20	15.22	390	960
	490.806	○	○	-	-	**CE**	-	-	-	3.90	3.90	5.74	7.58	10.00	11.76	14.43	16.51	19.04	390	960
	490.846	○	○	-	-	**CE**	-	-	-	4.65	4.00	7.18	9.47	12.50	14.70	18.03	20.63	23.80	390	960
	490.886	○	○	-	-	-	**CG**	-	-	5.45	4.50	9.19	12.13	16.00	18.82	23.08	26.41	30.46	390	960
	490.926	○	○	-	-	-	**CG**	-	-	5.90	4.50	11.49	15.16	20.00	23.52	28.85	33.01	38.07	390	960
	490.966	○	○	-	-	-	CG	**AK**	-	6.55	4.85	14.36	18.95	25.00	29.40	36.07	41.26	47.59	390	960
	491.006	○	○	-	-	-	-	**AK**	-	7.55	5.50	18.09	23.87	31.50	37.05	45.45	51.99	59.97	390	960
	491.046	○	○	-	-	-	-	**AK**	-	8.60	6.60	22.97	30.31	40.00	47.04	57.71	66.02	76.15	390	960
	491.086	○	○	-	-	-	-	-	**AM**	9.45	7.25	28.72	37.89	50.00	58.80	72.14	82.53	95.18	390	960
	491.126	○	○	-	-	-	-	-	**AM**	10.40	8.00	36.18	47.75	63.00	74.09	90.89	103.98	119.93	390	960
	491.146	○	-	-	-	-	-	-	**AM**	11.00	7.50	40.78	53.81	71.00	83.50	102.43	117.19	135.16	390	960
120°	**490.368**	○	○	**CA**	-	-	-	-	-	0.85	0.65	0.36	0.48	0.63	0.74	0.91	1.04	1.20	680	1220
	490.408	○	○	**CA**	-	-	-	-	-	1.20	1.20	0.57	0.76	1.00	1.18	1.44	1.65	1.90	680	1220
	490.448	○	○	**CA**	-	-	-	-	-	1.30	1.30	0.72	0.95	1.25	1.47	1.80	2.06	2.38	680	1220
	490.488	○	○	**CA**	-	-	-	-	-	1.45	1.45	0.92	1.21	1.60	1.88	2.31	2.64	3.05	680	1220
	490.528	○	○	**CA**	-	-	-	-	-	1.70	1.70	1.15	1.52	2.00	2.35	2.89	3.30	3.81	680	1220
	490.568	○	○	**CA**	-	-	-	-	-	1.90	1.90	1.44	1.89	2.50	2.94	3.61	4.13	4.76	680	1220
	490.608	○	○	**CA**	-	-	-	-	-	2.10	2.05	1.81	2.39	3.15	3.70	4.54	5.20	6.00	680	1220
	490.648	○	○	-	**CC**	**CE**	-	-	-	2.40	2.40	2.30	3.03	4.00	4.70	5.77	6.60	7.61	680	1330
	490.688	○	○	-	**CC**	**CE**	-	-	-	2.75	2.75	2.87	3.79	5.00	5.88	7.21	8.25	9.52	680	1330
	490.728	○	○	-	**CC**	**CE**	-	-	-	3.20	2.80	3.62	4.77	6.30	7.41	9.09	10.40	11.99	680	1330
	490.748	○	○	-	-	**CE**	-	-	-	3.20	3.20	4.08	5.38	7.10	8.35	10.24	11.72	13.52	680	1330
	490.768	○	○	-	-	**CE**	-	-	-	3.45	3.45	4.59	6.44	8.00	9.41	11.54	13.20	15.22	680	1330
	490.808	○	○	-	-	**CE**	-	-	-	3.90	3.90	5.74	7.58	10.00	11.76	14.43	16.51	19.04	680	1330
	490.848	○	○	-	-	CE	-	-	-	4.70	4.00	7.18	9.47	12.50	14.70	18.03	20.63	23.80	680	1330
	490.888	○	○	-	-	-	**CG**	-	-	5.10	4.50	9.19	12.13	16.00	18.82	23.08	26.41	30.46	680	1330
	490.928	○	○	-	-	-	**CG**	-	-	5.80	4.75	11.49	15.16	20.00	23.52	28.85	33.01	38.07	680	1330
	490.968	○	○	-	-	-	CG	**AK**	-	6.65	4.85	14.36	18.95	25.00	29.40	36.07	41.26	47.59	680	1330
	491.048	○	○	-	-	-	-	**AK**	-	9.20	5.85	22.97	30.31	40.00	47.04	57.71	66.02	76.15	680	1330
	491.128	○	○	-	-	-	-	-	**AM**	10.80	7.75	36.18	47.75	63.00	74.09	90.89	103.98	119.93	680	1330
	491.148	○	-	-	-	-	-	-	**AM**	11.40	7.65	40.78	53.81	71.00	83.50	102.43	117.19	135.16	680	1330

B = Bore diameter · E = Narrowest free cross section

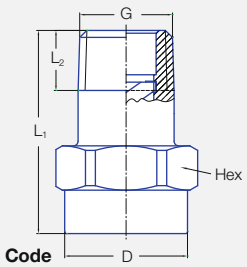
Other nozzle materials (special alloys, plastics) are available on request.

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	490.644	+	**1Y**	+	**CC**	=	**490.644.1Y.CC**

Axial-flow full cone nozzles
Series 460 / 461

Very uniform spray pattern.

Applications:
Cleaning and washing process, cooling of gaseous fluids and solids, surface spraying, spraying onto mats in air washers, improving of chemical reactions.



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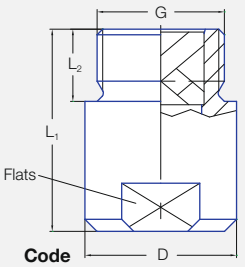

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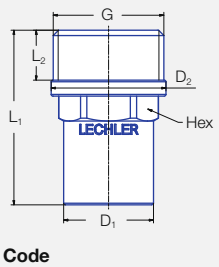


Code AM

Code	Dimensions [mm]					
	G	L_1	L_2	D_1	D_2	Hex/Flats
CA	1/8 BSPT	22.0	6.5	13.0	-	14
CC	1/4 BSPT	22.0	9.7	13.0	-	14
CE	3/8 BSPT	30.0	10.0	17.0	-	17
CG	1/2 BSPT	43.5	13.2	22.0	-	22
AK	3/4 BSPP	42.0	15.0	31.5	-	27
AM	1 BSPP	52.5	15.0	27.0	34.5	27

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

Spray angle	Ordering no.								B Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray diameter D at p = 2 bar	
	Type	Mat. no.	Code								p [bar]								
		5E																	
		PVDF	1/8 BSPT	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPP	1 BSPP			0.5	1.0	2.0	3.0	5.0	7.0	10.0	H = 200 mm	H = 500 mm
60°	**460.524**	○	**CA**	-	-	-	-	-	1.60	1.60	1.00	1.41	2.00	2.45	2.83	3.16	4.47	220	560
	460.644	○	-	**CC**	-	-	-	-	2.40	1.90	2.30	3.03	4.00	4.70	5.77	6.60	7.61	220	560
	460.724	○	-	**CC**	-	-	-	-	2.80	2.10	3.15	4.45	6.30	7.72	8.91	9.96	14.09	220	560
	460.964	○	-	-	-	-	**AK**	-	5.80	4.90	14.36	18.95	25.00	29.40	36.07	41.26	47.59	220	560
90°	**460.326**	○	**CA**	-	-	-	-	-	0.80	0.55	0.23	0.30	0.40	0.47	0.58	0.66	0.76	380	860
	460.406	○	**CA**	-	-	-	-	-	1.20	0.85	0.57	0.76	1.00	1.18	1.44	1.65	1.90	380	860
	460.486	○	**CA**	-	-	-	-	-	1.45	1.20	0.92	1.21	1.60	1.88	2.31	2.64	3.05	380	860
	460.526	○	**CA**	-	-	-	-	-	1.65	1.30	1.15	1.52	2.00	2.35	2.89	3.30	3.81	380	860
	460.606	○	**CA**	-	**CE**	-	-	-	2.05	1.45	1.81	2.39	3.15	3.70	4.54	5.20	6.00	380	860
	460.646	○	-	**CC**	-	-	-	-	2.30	1.80	2.30	3.03	4.00	4.70	5.77	6.60	7.61	390	960
	460.726	○	-	-	**CE**	-	-	-	2.95	2.00	3.62	4.77	6.30	7.41	9.09	10.40	11.99	390	960
	460.746	○	-	-	**CE**	-	-	-	3.30	1.90	4.08	5.38	7.10	8.35	10.24	11.72	13.52	390	960
	460.766	○	-	-	**CE**	-	-	-	3.30	2.40	4.59	6.06	8.00	9.41	11.54	13.20	15.22	390	960
	460.806	○	-	-	**CE**	-	-	-	3.70	2.70	5.74	7.58	10.00	11.76	14.43	16.51	19.04	390	960
	460.846	○	-	-	**CE**	-	-	-	4.05	3.20	7.18	9.47	12.50	14.70	18.03	20.63	23.80	390	960
	460.886	○	-	-	**CE**	**CG**	-	-	4.70	3.10	9.19	12.13	16.00	18.82	23.08	26.41	30.46	390	960
	460.926	○	-	-	-	**CG**	-	-	5.10	2.80	10.00	14.14	20.00	24.49	28.28	31.62	44.72	390	960
	460.966	○	-	-	-	**CG**	-	-	5.80	3.80	14.36	18.95	25.00	29.40	36.07	41.26	47.59	390	960
	461.006	○	-	-	-	**CG**	-	-	6.40	3.80	18.09	23.87	31.50	37.05	45.45	51.99	59.97	390	960
	461.046	○	-	-	-	-	**CK***	-	7.20	5.30	22.97	30.31	40.00	47.04	57.71	66.02	76.15	390	960
	461.086	○	-	-	-	-	-	**AM**	8.40	5.00	25.00	35.36	50.00	61.24	70.71	79.06	111.80	390	860

B = Bore diameter · E = Narrowest free cross section
* connection 3/4 BSPT

Continued on next page.

Example for ordering:	Type	+	Material no.	+	Code	=	Ordering no.
	460.524	+	**5E**	+	**CA**	=	**460.524.5E.CA**

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 460 / 461

Spray angle	Ordering no.								B Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray diameter D at p = 2 bar	
	Type	Mat. no.	Code								p [bar]								
		5E PVDF	1/8 BSPT	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPP	1 BSPP			0.5	1.0	2.0	3.0	5.0	7.0	10.0	H = 200 mm	H = 500 mm
120°	**460.368**	○	**CA**	-	-	-	-	-	0.95	0.45	0.32	0.45	0.63	0.77	0.89	1.00	1.41	680	1220
	460.408	○	**CA**	-	-	-	-	-	1.20	0.85	0.57	0.76	1.00	1.18	1.44	1.65	1.90	680	1220
	460.488	○	**CA**	-	-	-	-	-	1.50	1.00	0.92	1.21	1.60	1.88	2.31	2.64	3.05	680	1220
	460.528	○	**CA**	-	-	-	-	-	1.65	1.20	1.15	1.52	2.00	2.35	2.89	3.30	3.81	680	1220
	460.608	○	**CA**	-	-	-	-	-	2.10	1.40	1.81	2.39	3.15	3.70	4.54	5.20	6.00	680	1220
	460.648	○	-	**CC**	**CE**	-	-	-	2.45	1.60	2.30	3.03	4.00	4.70	5.77	6.60	7.61	680	1330
	460.728	○	-	-	**CE**	-	-	-	3.10	1.90	3.62	4.77	6.30	7.41	9.09	10.40	11.99	680	1330
	460.748	○	-	-	**CE**	-	-	-	3.30	1.90	4.08	5.38	7.10	8.35	10.24	11.72	13.52	680	1330
	460.768	○	-	-	**CE**	-	-	-	3.50	1.90	4.59	6.44	8.00	9.41	11.54	13.20	15.22	680	1330
	460.808	○	-	-	**CE**	-	-	-	3.80	2.40	5.74	7.58	10.00	11.76	14.43	16.51	19.04	680	1330
	460.848	○	-	-	**CE**	-	-	-	4.20	2.70	7.18	9.47	12.50	14.70	18.03	20.63	23.80	680	1330
	460.888	○	-	-	-	**CG**	-	-	4.60	3.10	9.19	12.13	16.00	18.82	23.08	26.41	30.46	680	1330
	460.968	○	-	-	-	**CG**	-	-	5.90	4.10	14.36	18.95	25.00	29.40	36.07	41.26	47.59	680	1330
	461.048	⊗	-	-	-	-	**CK***	-	7.60	4.90	22.97	30.31	40.00	47.04	57.71	66.02	76.15	680	1330

B = Bore diameter · E = Narrowest free cross section
⊗ Material PP (material no. 53)
*Connection 3/4 BSPT

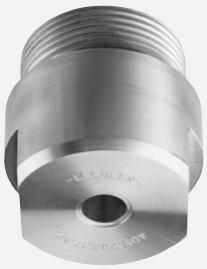
Example for ordering:	**Type**	**460.368**	**+**	**Material no.**	**+**	**Code**	**=**	**Ordering no.**
			+	**5E**	**+**	**CA**	**=**	**460.368.5E.CA**

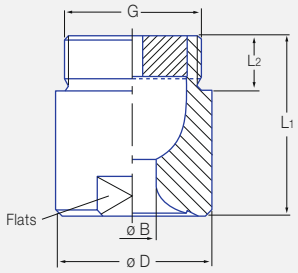
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \left(\frac{p_2}{p_1}\right)^{0.4}$ (≤ 10 bar)

Axial-flow full cone nozzles
Series 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 [mm]					Weight 316L SS
G	L_1	L_2	D	Flats	
1 1/4 BSPP	50	19	49	41	525 g
1 1/2 BSPP	60	19	59	50	920 g
2 BSPP	78	24	68	60	1550 g

Other nozzle sizes and materials are available on request.

Spray angle	Ordering no. Type	Mat. no. 1Y 316L SS	Code 1 1/4 BSPP	Code 1 1/2 BSPP	Code 2 BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.3	0.5	1.0	2.0	3.0	5.0	Spray diameter D at p = 2 bar H = 0.5 m	H = 1 m
60°	**405.204**	○	**AP**	-	-	11.20	5.80	47	57	76	100	118	144	560	1040
	405.284	○	-	**AR**	-	14.30	7.00	75	92	121	160	188	231	580	1080
	405.324	○	-	-	**AV**	16.40	7.50	94	115	152	200	235	289	580	1080
	405.364	○	-	-	**AV**	18.40	8.50	117	144	189	250	294	361	580	1080
	405.404	○	-	-	**AV**	20.00	7.00	147	181	239	315	370	454	580	1100
90°	**405.206**	○	**AP**	-	-	12.00	5.00	47	57	76	100	118	144	780	1450
	405.286	○	-	**AR**	-	15.20	6.20	75	92	121	160	188	231	800	1550
	405.326	○	-	-	**AV**	17.20	7.70	94	115	152	200	235	289	850	1600
	405.366	○	-	-	**AV**	19.50	8.70	117	144	189	250	294	361	850	1600
	405.406	○	-	-	**AV**	22.00	9.50	147	181	239	315	370	454	850	1600
120°	**405.208**	○	**AP**	-	-	12.70	5.00	47	57	76	100	118	144	1450	2600
	405.288	○	-	**AR**	-	16.00	6.60	75	92	121	160	188	231	1500	2700
	405.328	○	-	-	**AV**	17.80	7.90	94	115	152	200	235	289	1500	2800
	405.368	○	-	-	**AV**	20.10	8.80	117	144	189	250	294	361	1500	2800
	405.408	○	-	-	**AV**	22.40	9.10	147	181	239	315	370	454	1500	2800

B = bore diameter · E = narrowest free cross section

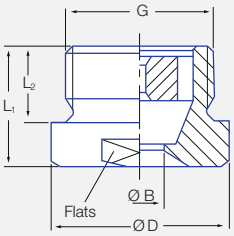
Example for ordering:	Type	+	Material-no.	+	Code	=	Ordering no.
	405.204	+	**1Y**		**AP**	=	**405.204.1Y.AP**

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

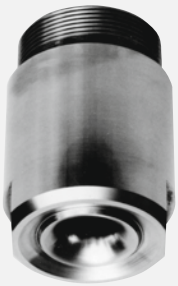
Axial-flow full cone nozzles
Series 403

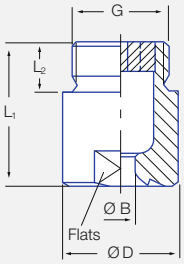
Very uniform spray pattern.

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



60°/ 90°-version





120°-version

Other nozzle sizes and materials are available on request.

60°/ 90°-version

Dimensions [mm]						Weight
Type	BSPP	L_1	L_2	D	Flats	
403.444/403.446 403.484/403.486	2 1/2	52	27	83	75	1300 g
403.524/403. 526	3	60	30	98	85	2000 g
403.564/403.604/403.606	3 1/2	70	32	118	105	3600 g
403.624	4	90	36	128	110	5500 g

120°-version

Dimensions [mm]						Weight
Type	BSPP	L_1	L_2	D	Flats	
403.448/403.488	2 1/2	124	27	83	75	3200 g
403.528	3	153	30	98	85	5400 g
403.608	3 1/2	156	32	118	105	8300 g
403.628	4	165	36	128	110	9600 g

Spray angle	Ordering no.		B Ø [mm]	E Ø [mm]	V̇ [l/min]							Spray diameter D at p = 2 bar	
	Type	Mat. no. 1Y 316L SS			p [bar]							H = 0.5 m	H = 1 m
					0.3	0.5	1.0	2.0	3.0	5.0	7.0		
60°	**403.444**	○	25.00	6.00	187	230	303	400	470	577	660	580	1100
	403.484	○	29.50	9.00	234	297	379	500	588	721	825	620	1150
	403.524	○	32.00	8.00	295	362	477	630	741	909	1040	620	1150
	403.564	○	38.00	14.00	375	459	606	800	941	1154	1320	620	1150
	403.604	○	41.50	10.00	468	574	758	1000	1176	1443	1651	630	1200
	403.624	○	48.50	15.00	484	625	887	1250	1531	1977	2339	770	1400
90°	**403.446**	○	25.00	12.00	187	230	303	400	470	577	660	900	1700
	403.486	○	29.50	12.00	234	287	379	500	588	721	825	900	1700
	403.526	○	32.00	13.80	295	362	477	630	741	909	1040	900	1700
	403.606	○	40.00	15.00	468	574	758	1000	1176	1443	1651	980	1750
120°	**403.448**	○	25.50	10.00	187	230	303	400	470	577	660	1500	2850
	403.488	○	29.50	11.00	234	287	379	500	588	721	825	1500	2850
	403.528	○	32.00	15.00	295	362	477	630	741	909	1040	1500	2850
	403.608	○	42.00	12.00	469	574	758	1000	1176	1443	1651	1500	2850
	403.628	○	45.00	15.00	585	718	947	1250	1470	1903	2063	1600	2900

B = bore diameter · E = narrowest free cross section

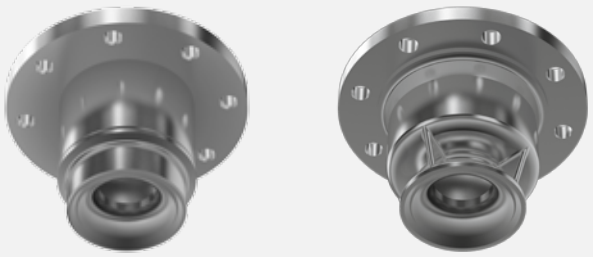
Example for ordering:	Type	+	Material no.	=	Ordering no.
	403.444	+	1Y	=	430.444.1Y

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 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 [mm]	E Ø [mm]	V̇ [l/min]					
	Type	Mat. no. 05.84 GG	Mat. no. 1Y.84 316L SS	Mat. no. 53.00 PP			p [bar] (p_{max} = 10 bar) 0.3	0.5	1.0	2.0	5.0	10.0
60°	**421.564**	○	-	○	37	12	375	459	606	800	1154	1523
	421.604	○	-	○	39	14	468	574	758	1000	1443	1904
	421.624	○	○	○	41	13	585	718	947	1250	1803	2380
	421.644	○	○	○	49	16	749	919	1213	1600	2308	3046
	421.664	○	○	○	56	16	936	1149	1516	2000	2885	3807
	421.684	○	○	○	58	21	1171	1436	1895	2500	3607	4759
	421.704	○	○	○	65	24	1475	1809	2387	3150	4545	5997
	421.724	-	○	○	72	30	1873	2297	3031	4000	5771	7615
	421.744	-	○	○	81	34	2341	2872	3789	5000	7214	9518
	421.764	-	○	○	88	35	2950	3618	4775	6300	9089	11993
	421.784	-	○	○	99	39	3746	4595	6063	8000	11542	15229
	421.804	-	○	-	112	42	4682	5743	7579	10000	14427	19037
	421.824	-	○	-	125	52	5853	7179	9473	12500	18034	23796
90°	**421.566**	○	-	○	37	15	375	459	606	800	1154	1523
	421.606	○	-	○	39	15	468	574	758	1000	1443	1904
	421.626	○	○	○	43	19	585	718	947	1250	1803	2380
	421.646	○	○	○	53	22	749	919	1213	1600	2308	3046
	421.666	○	○	○	56	24	936	1149	1516	2000	2885	3807
	421.686	○	○	○	59	28	1171	1436	1895	2500	3607	4759
	421.706	○	○	○	66	32	1475	1809	2387	3150	4545	5997
	421.726	-	○	○	72	35	1873	2297	3031	4000	5771	7615
	421.746	-	○	○	81	40	2341	2872	3789	5000	7214	9518
	421.766	-	○	○	93	39	2950	3618	4775	6300	9089	11993
	421.786	-	○	○	99	44	3746	4595	6063	8000	11542	15229
	421.806	-	○	○	123	53	4682	5743	7579	10000	14427	19037
	421.826	-	○	-	125	54	5853	7179	9473	12500	18034	23796
120°	**421.568**	○	○	○	36	15	375	459	606	800	1154	1523
	421.608	○	○	○	41	15	468	574	758	1000	1443	1904
	421.628	○	○	○	43	19	585	718	947	1250	1803	2380
	421.648	○	○	○	53	22	749	919	1213	1600	2308	3046
	421.668	○	○	○	55	24	936	1149	1516	2000	2885	3807
	421.688	○	○	○	59	28	1171	1436	1895	2500	3607	4759
	421.708	○	○	○	66	32	1475	1809	2387	3150	4545	5997
	421.728	-	○	○	72	35	1873	2297	3031	4000	5771	7615
	421.748	-	○	○	81	40	2341	2872	3789	5000	7214	9518
	421.768	-	○	○	88	39	2950	3618	4775	6300	9089	11993
	421.788	-	○	○	99	44	3746	4595	6063	8000	11542	15229
	421.808	-	○	○	108	53	4682	5743	7579	10000	14427	19037
	421.828	-	○	○	121	54	5853	7179	9473	12500	18034	23796

B = bore diameter · E = narrowest free cross section
* Spray angle at p = 2 bar

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 421

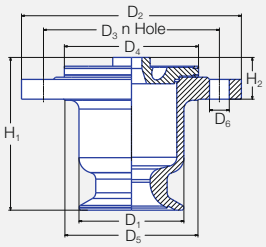


Figure 1

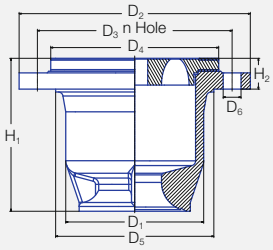


Figure 2

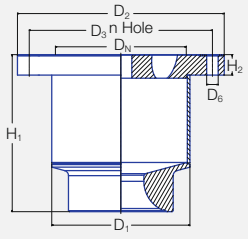


Figure 3

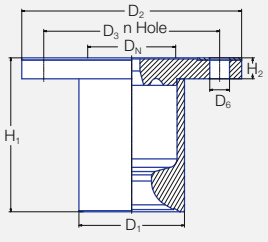


Figure 4

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°	**421.56x/**	05.84	1	134	39	96	200	160	122	121	80	8	18
120°	**421.60x**	05.84	1	140	39	96	200	160	122	121	80	8	18
120°		1Y.84	3	140	19	96	200	160	-	-	80	8	18
60°-120°		53.00	4	131	44	99	200	160	-	-	80	8	18
60°-120°	**421.62x**	05.84	1	156	28	113	220	180	158	141	100	8	18
		1Y.84	3	156	20	108	220	180	-	-	100	8	18
		53.00	4	156	53	117	220	180	-	-	100	8	18
60°-90°	**421.64x/**	05.84	2	175	42	140	250	210	188	166	125	8	18
120°	**421.66x**	05.84	2	175	29	140	250	210	188	166	125	8	18
60°-120°		1Y.84	3	175	19	135	250	210	-	-	125	8	18
60°-120°		53.00	4	175	57	141	250	210	-	-	125	8	18
60°-120°	**421.68x/**	05.84	2	186	38	170	285	240	207	195	150	8	22
	421.70x	1Y.84	3	186	27	160	285	240	-	-	150	8	22
		53.00	4	186	51	171	285	240	-	-	150	8	23
60°-120°	**421.72x/**	1Y.84	3	250	33	214	340	295	-	-	200	8	22
	421.74x	53.00	4	250	50	225	340	295	-	-	200	8	23
60°-120°	**421.76x/**	1Y.84	3	300	39	264	395	350	-	-	250	12	22
	421.78x	53.00	4	300	53	280	395	350	-	-	250	12	23
60°-120°	**421.80x/**	1Y.84	3	367	49	315	445	400	-	-	300	12	22
	421.82x	53.00	4	367	57	328	445	400	-	360	300	12	23

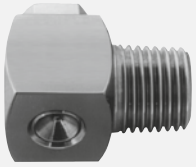
Example for ordering:	Type	+	Material no.	=	Ordering no.
	421.564	+	**05.84**	=	**421.564.05.84**

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

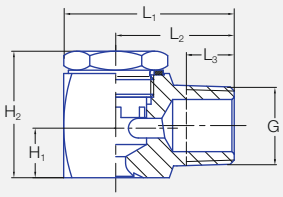
Tangential-flow full cone nozzles
Series 422 / 423

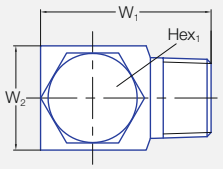
Tangentially arranged liquid supply. Without swirl inserts. Non-clogging. Stable spray angle. Uniform spray.

Applications:
Cleaning and washing process, cooling of gaseous fluids and solids, surface spraying, spraying onto mats in air washers, improving of chemical reactions, continuous casting, foam control.

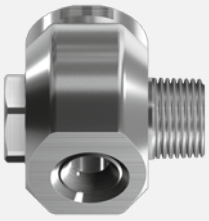


1/4 – 3/8 version

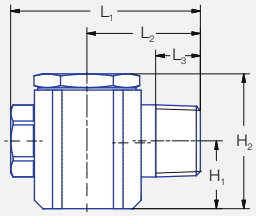


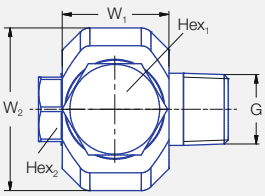


Material: 316L SS



1/2 - 1 version





Material: 316L SS

G	Dimensions [mm] L_1	L_2	L_3	H_1	H_2	W_1	W_2	Hex_1	Hex_2	Weight 316L SS
1/4 BSPT	28.0	20.0	9.7	8.0	21.0	15.6	16.0	11	-	44 g
3/8 BSPT	36.0	25.0	10.1	11.0	26.7	23.2	22.0	19	-	101 g
1/2 BSPT	56.0	33.5	13.2	20.0	40.0	32.0	48.0	27	19	310 g
3/4 BSPT	65.5	38.5	14.5	23.5	57.0	40.0	63.0	36	27	830 g
1 BSPT	85.0	48.5	16.8	27.3	66.0	55.0	78.0	41	36	1581 g

Spray angle	Ordering no. Type	Mat-no. 1Y 316L SS	Code 1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPT	1 BSPT	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	7.0	10.0	Spray diameter D at p = 2 bar H = 200 mm	H = 500 mm
60°	**422.644**	○	-	**CE**	-	-	-	3.00	3.00	2.00	2.83	4.00	4.90	6.32	7.48	8.94	225	510
90°	**422.406**	○	**CC**	-	-	-	-	1.40	1.40	0.50	0.71	1.00	1.22	1.58	1.87	2.24	380	860
	422.486	○	**CC**	-	-	-	-	1.85	1.85	0.80	1.13	1.60	1.96	2.53	2.99	3.58	380	860
	422.566	○	**CC**	-	-	-	-	2.25	2.25	1.25	1.77	2.50	3.06	3.95	4.68	5.59	380	860
	422.606	○	-	**CE**	-	-	-	2.55	2.55	1.57	2.23	3.15	3.86	4.98	5.89	7.04	380	860
	422.646	○	-	**CE**	-	-	-	2.90	2.90	2.00	2.83	4.00	4.90	6.32	7.48	8.94	390	960
	422.766	○	-	**CE**	-	-	-	4.15	4.15	4.00	5.66	8.00	9.80	12.65	14.97	17.89	390	960
	422.846	○	-	**CE**	-	-	-	5.30	5.30	6.25	8.84	12.50	15.31	19.76	23.39	27.95	390	960
	422.886	○	-	**CE**	-	-	-	5.85	6.00	8.00	11.31	16.00	19.60	25.30	29.93	35.78	390	960
	422.966	○	-	-	**CG**	-	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	46.77	55.90	390	960
120°	**422.568**	○	**CC**	-	-	-	-	2.45	2.40	1.25	1.77	2.50	3.06	3.95	4.68	5.59	680	1220
	422.728	○	-	**CE**	-	-	-	4.00	3.90	3.15	4.45	6.30	7.72	9.96	11.79	14.09	680	1600
	422.808	○	-	**CE**	-	-	-	4.90	4.90	5.00	7.07	10.00	12.25	15.81	18.71	22.36	680	1600
	422.848	○	-	**CE**	-	-	-	5.30	5.30	6.25	8.84	12.50	15.31	19.76	23.39	27.95	680	1600
	422.888	○	-	**CE**	-	-	-	6.60	6.00	8.00	11.31	16.00	19.60	25.30	29.93	35.78	680	1600
	422.928	○	-	-	**CG**	-	-	7.30	7.30	10.00	14.14	20.00	24.49	31.62	37.42	44.72	680	1600
	422.968	○	-	-	**CG**	-	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	46.77	55.90	680	1600
	423.008	○	-	-	**CG**	-	-	8.70	8.70	15.75	22.27	31.50	38.88	49.81	58.93	70.44	680	1600
	423.128	○	-	-	-	**CK**	-	12.70	12.30	31.50	44.55	63.00	77.16	99.61	117.86	140.87	680	1600
	423.208	○	-	-	-	-	**CM**	17.00	16.00	50.00	70.71	100.00	122.47	158.11	187.08	223.61	680	1600

B = Bore diameter · E = Narrowest free cross section

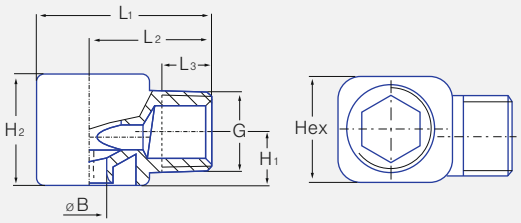
Example for ordering:	Type	+	Material-no.	+	Code	=	Ordering no.
	422.644	+	**1Y**	+	**CE**	=	**422.644.1Y.CE**

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

Tangential-flow full cone nozzles
Plastic version
Series 422 / 423

Tangentially arranged liquid supply. Without swirl inserts. Non-clogging. Stable spray angle. Uniform spray.

Applications:
Cleaning and washing processes, surface spraying, bottle cleaning, keg cleaning, sausage showers, foam control, degassing, pasteurization.



Material: PVDF

Dimensions [mm]							Weight
G	L_1	L_2	L_3	H_1	H_2	Hex	
1/4 BSPT	28.0	20.0	9.8	8.0	16.0	16.0	7 g
3/8 BSPT	36.0	25.0	10.1	11.2	23.0	22.0	16 g
1/2 BSPT	49.5	33.5	13.2	19.2	38.0	32.0	40 g
3/4 BSPT	58.5	38.5	18.5	24.5	50.0	41.0	50 g

Spray angle	Ordering no.						B Ø [mm]	E Ø [mm]	V̇ [l/min]						Spray diameter D at p = 1-10 bar	
	Type	Mat. no.	Code						p [bar]							
		5E PVDF	1/4 BSPT	3/8 BSPT	1/2 BSPT	3/4 BSPT			0.5	1.0	2.0	3.0	5.0	10.0	H = 200 mm	H = 500 mm
60°	**422.724**	○	-	**CE**	-	-	3.60	3.60	3.15	4.45	6.30	7.72	9.96	14.09	225	510
90°	**422.406**	○	**CC**	-	-	-	1.50	1.45	0.50	0.71	1.00	1.22	1.58	2.24	380	860
	422.566	○	**CC**	-	-	-	2.30	2.20	1.25	1.77	2.50	3.06	3.95	5.59	380	860
	422.606	○	-	**CE**	-	-	2.60	2.50	1.57	2.23	3.15	3.86	4.98	7.04	380	860
	422.646	○	-	**CE**	-	-	3.00	2.90	2.00	2.83	4.00	4.90	6.32	8.94	390	960
	422.726	○	-	**CE**	-	-	3.70	3.60	3.15	4.45	6.30	7.72	9.96	14.09	390	960
	422.806	○	-	**CE**	-	-	4.65	4.60	5.00	7.07	10.00	12.25	15.81	22.36	390	960
	422.846	○	-	**CE**	-	-	5.20	5.10	6.25	8.84	12.50	15.31	19.76	27.95	390	960
	422.886	○	-	**CE**	-	-	5.80	5.70	8.00	11.31	16.00	19.60	25.30	35.78	390	960
	422.926	○	-	-	**CG**	-	7.30	7.30	10.00	14.14	20.00	24.49	31.62	44.72	390	960
	422.966	○	-	-	**CG**	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	55.90	390	960
	423.006	○	-	-	**CG**	-	8.70	8.70	15.75	22.27	31.50	38.58	49.81	70.44	390	960
	423.126	○	-	-	-	**CK**	12.00	12.00	31.50	44.55	63.00	77.16	99.61	140.87	390	960
120°	**422.408**	○	**CC**	-	-	-	1.50	1.45	0.50	0.71	1.00	1.22	1.58	2.24	680	1220
	422.448	○	**CC**	-	-	-	1.65	1.60	0.62	0.88	1.25	1.53	1.98	2.80	680	1220
	422.488	○	**CC**	-	-	-	1.90	1.80	0.80	1.13	1.60	1.96	2.53	3.58	680	1220
	422.568	○	**CC**	-	-	-	2.30	2.20	1.25	1.77	2.50	3.06	3.95	5.59	680	1220
	422.728	○	-	**CE**	-	-	3.70	3.60	3.15	4.45	6.30	7.72	9.96	14.09	680	1600
	422.888	○	-	**CE**	-	-	5.80	5.70	8.00	11.31	16.00	19.60	25.30	35.78	680	1600
	422.968	○	-	-	**CG**	-	8.00	8.00	12.50	17.68	25.00	30.62	39.53	55.90	680	1600
	423.008	○	-	-	**CG**	-	8.70	8.70	15.75	22.27	31.50	38.58	49.81	70.44	680	1600
	423.128	○	-	-	-	**CK**	12.70	12.30	31.50	44.55	63.00	77.16	99.61	140.87	680	1600

B = bore diameter · E = narrowest free cross section

Example of ordering:	Type	+	Material-no.	+	Code	=	Ordering no.
	422.724	+	**5E**	+	**CE**	=	**422.724.5E.CE**

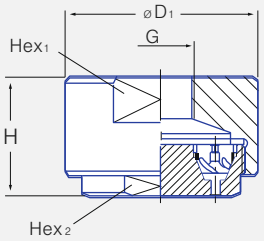
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Cluster head nozzles
Series 502 / 503

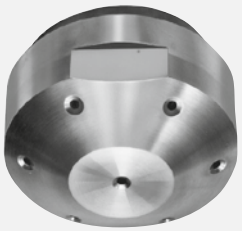
Fine full cone atomization with the aid of several hollow cones spraying into one another.

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

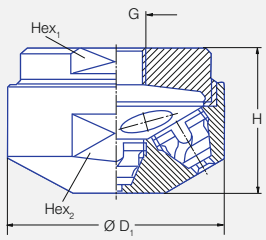
∢70°



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



∢130°



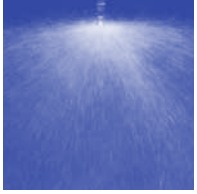
Dimensions [mm]		
	1/2	3/4
Hex_1	27	50
Hex_2	36	55
H	28	53
D_1	40	60
Weight (Brass)	150 g	410 g

Spray angle	Ordering no. Type	Mat. no. 17[1] 316Ti SS	G BSPP	B Ø [mm]	E Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	Spray diameter D at p = 2 bar H = 1000 mm	H = 2000 mm
70°	**502.445**	○	1/2	1.00	0.50	-	-	1.25	1.53	1.98	2.80	400	400
	502.545	○	1/2	1.80	0.50	-	1.58	2.24	2.74	3.54	5.01	400	400
	502.585	○	3/4	1.00	1.00	1.40	1.98	2.80	3.43	4.43	6.30	600	700
	502.665	○	3/4	1.40	1.40	2.20	3.18	4.50	5.51	7.11	10.10	800	900
	502.745	○	3/4	2.00	2.00	3.50	5.00	7.10	8.70	11.20	15.90	800	900
	502.795	○	3/4	2.50	2.00	4.60	6.70	9.50	11.60	15.00	21.20	900	1100
	502.835	○	3/4	3.00	2.00	6.00	8.30	11.80	14.50	18.70	26.40	1000	1200
	502.875	○	3/4	3.50	2.00	7.20	10.60	15.00	18.40	23.70	33.50	1100	1300
	502.905	○	3/4	4.00	2.00	8.80	12.70	18.00	22.05	28.40	40.20	1200	1500
	502.985	○	3/4	3.50	2.00	14.00	19.80	28.00	34.29	44.30	62.60	1200	1500
	503.025	○	3/4	4.00	2.00	17.70	25.10	35.50	43.48	56.10	79.40	1200	1600
	503.065	○	3/4	5.00	2.00	22.10	31.80	45.00	55.11	71.10	100.60	1200	1800
	503.115	○	3/4	6.00	2.00	30.00	42.00	60.00	72.80	95.00	134.00	1300	2000
130°	**502.448**	○	1/2	1.00	0.50	-	-	1.25	1.53	1.98	2.80	500	500
	502.548	○	1/2	1.80	0.50	-	1.58	2.24	2.74	3.54	5.01	700	700
	502.588	○	3/4	1.00	1.00	1.40	1.98	2.80	3.43	4.43	6.30	800	900
	502.668	○	3/4	1.50	1.50	2.20	3.18	4.50	5.51	7.11	10.10	1000	1100
	502.748	○	3/4	2.00	2.00	3.50	5.00	7.10	8.70	11.20	15.90	1100	1200
	502.798	○	3/4	2.50	2.00	4.60	6.70	9.50	11.60	15.00	21.20	1200	1300
	502.838	○	3/4	3.00	2.00	6.00	8.30	11.80	14.50	18.70	26.40	1400	1600
	502.878	○	3/4	3.50	2.00	7.20	10.60	15.00	18.40	23.70	33.50	1500	1700
	502.908	○	3/4	4.00	2.00	8.80	12.70	18.00	22.05	28.40	40.20	1500	1800
	502.988	○	3/4	3.50	2.00	14.00	19.80	28.00	34.29	44.30	62.60	1500	1800
	503.028	○	3/4	4.00	2.00	17.70	25.10	35.50	43.48	56.10	79.40	1600	1800
	503.068	○	3/4	5.00	2.00	22.10	31.80	45.00	55.11	71.10	100.60	2000	2500
	503.118	○	3/4	6.00	2.00	30.00	42.00	60.00	72.80	95.00	134.00	2000	3000

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

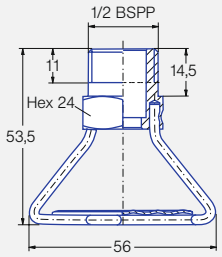
Conversion formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Deflector-plate nozzle
Series 524 / 525

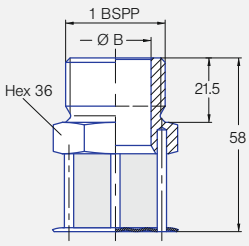


Full cone spray. Non clogging nozzle without swirl insert.

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



Type 524.809 – 525.269



Type 525.349 – 525.489

Spray angle	Ordering no. Type	Mat. no. 30 Brass	Mat. no. 17[1] 316Ti SS	B Ø [mm]	V̇ [l/min] p [bar] 0.5	1.0	2.0	3.0	5.0	10.0	Spray diameter D at p=3 bar approx. H = 1 m	H = 3 m
180°	**524.809**	○	○	4.00	5.00	7.10	10.00	12.20	15.80	22.40	5.60 m	6.40 m
	524.939	○	○	5.90	10.60	15.00	21.20	25.90	33.50	47.40	6.00 m	7.00 m
	524.969	○	○	6.20	12.50	17.70	25.00	30.60	39.50	55.90	8.00 m	9.00 m
	525.049	○	○	8.00	20.00	28.30	40.00	49.00	63.20	89.40	10.00 m	13.20 m
	525.109	○	-	9.30	28.00	40.00	56.00	69.00	89.00	125.00	10.20 m	13.40 m
	525.169	○	-	10.90	40.00	57.00	80.00	98.00	126.00	179.00	10.60 m	13.60 m
	525.229	○	-	12.20	56.00	79.00	112.00	137.00	177.00	250.00	6.80 m	10.40 m
	525.269	○	○	12.30	70.00	99.00	140.00	171.00	221.00	313.00	5.20 m	10.20 m
	525.349	○	○	16.20	112.00	158.40	224.00	274.30	354.20	500.80	4.80 m	9.70 m
	525.469	○	○	23.80	222.70	315.00	445.50	545.60	704.40	996.20	4.50 m	9.50 m
	525.489	○	○	25.30	250.00	353.60	500.00	612.40	790.60	1118.00	4.00 m	9.00 m

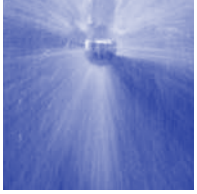
[1] We reserve the right to deliver 316Ti SS or 316L SS under the material no. 17.
B = Bore diameter

Version with dust protection cap on request.

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

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

Rotating cleaning nozzle »MiniSpinner«
Series 5MI



- Entirely made from stainless steel/Hastelloy
- Self-rotating
- Efficient slot design
- Modern double ball bearing

Materials:
316L SS, 440C SS,
Hastelloy C22,
Hastelloy C276

Max. temperature:
140 °C

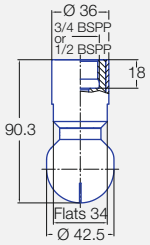
Recommended operating pressure:
2 bar

Installation:
Operation in every direction is possible

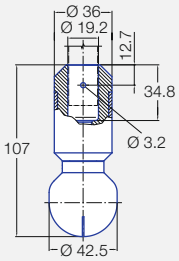
Filtration:
Line strainer with a mesh size of 0.1 mm/170 mesh

Bearing:
Double ball bearing made of 440C SS
Double ball bearing made of C276

ATEX version on request



Female thread



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

Spray angle	Type	Ordering no. Mat. no. 1Y 316L SS	Mat. no. 21 Hastelloy C22	Connection 1/2 BSPP	Connection 3/4 BSPP	Connection 3/4" Slip-on	E Ø [mm]	V̇ [l/min] p [bar] (p_{max} = 5 bar) 1	2	3	at 40 psi [US gal./min]	Max. tank diameter [m]
60°	**5MI.162**	○	○	**AH**	**-**	**TF07**	2.6	45	63	77	20	-
180°	**5MI.113**	○	○	**-**	**AL**	**TF07**	1.0	47	67	82	21	2.6
180°	**5MI.114**	○	○	**-**	**AL**	**TF07**	1.0	47	67	82	21	2.6
360°	**5MI.054**	○	○	**-**	**AL**	**TF07**	0.5	21	30	37	9	1.8
	5MI.074	○	○	**-**	**AL**	**TF07**	0.6	35	49	60	15	2.1
	5MI.014	○	○	**-**	**AL**	**TF07**	0.9	49	69	85	21	2.3
	5MI.209	○	○	**-**	**AL**	**TF07**	1.5	71	100	122	31	2.6

E = Narrowest free cross-section
NPT, more slip-on sizes and weld-on versions on request

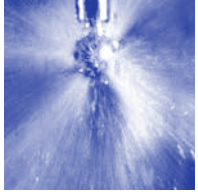
The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

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 is included. Mat. no. 1Y: R-clip made of stainless steel 316L SS (Ordering no. 095.022.1Y.50.60).
Mat. no. 21: R-clip made of Hastelloy C22 (Ordering no. 095.022.21.50.60)
- 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.	+	Connection	=	Ordering no.
	5MI.162.	+	**1Y**	+	**AH**	=	**5MI.162.1Y.AH**

Rotating cleaning nozzle »Whirly«
Series 569



- Popular and proven design
- Powerful flat jets
- Wide range of flow rates

Materials:
316L SS, PEEK, Rulon 641

Max. temperature:
140 °C

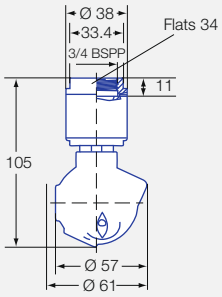
Recommended operating pressure:
2 bar

Installation:
Operation in every direction is possible; in horizontal installation position no rotating until 2 bar

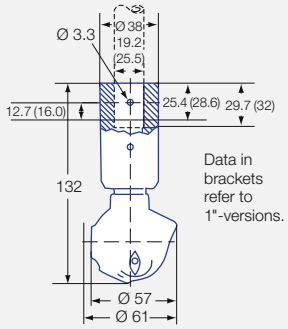
Filtration:
Line strainer with a mesh size of 0.1 mm/170 mesh

Bearing:
Double ball bearing made of stainless steel

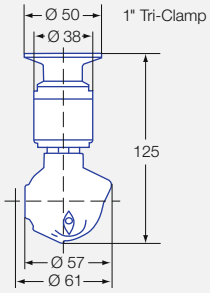
ATEX version on request



Female thread



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



Tri-Clamp

Spray angle	Ordering no. Type	Connection 3/4 BSPP female	3/4" Slip-on	1" Slip-on	1" Tri-Clamp	E Ø [mm]	V̇ [l/min] p [bar] (p$_{max}$ = 6 bar) 1	2	3	at 40 psi [US gal./min]	Max. tank diameter [m]
270°	**569.055.1Y**	**AL**	**TF07**	**TF10**	**10**	3.6	36	48	62	15	1.8
	569.135.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	52	71	87	22	2.1
	569.195.1Y	**AL**	**TF07**	**TF10**	**10**	5.6	69	97	119	30	2.6
270°	**569.056.1Y**	**AL**	**TF07**	**TF10**	**10**	3.6	36	48	62	15	1.8
	569.106.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	41	58	71	18	2.1
	569.196.1Y	**AL**	**TF07**	**TF10**	**10**	5.6	69	97	119	30	2.6
360°	**569.059.1Y**	**AL**	**TF07**	**TF10**	**10**	3.2	36	48	62	15	1.8
	569.139.1Y	**AL**	**TF07**	**TF10**	**10**	3.6	52	71	87	22	2.1
	569.199.1Y	**AL**	**TF07**	**TF10**	**10**	4.8	69	97	119	30	2.6
	569.279.1Y	**AL**	**TF07**	**TF10**	**10**	7.1	103	145	178	45	3.0

E = Narrowest free cross-section · NPT on request

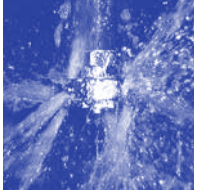
The maximum tank diameter shown above applies for the recommended operating pressure and is indicative only. The cleaning result is also affected by the type of soiling.

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 stainless steel 316L SS is included (Ordering no.: 095.022.1Y.50.60.E).
- Depending on diameter of the adapter the flow rate can increase due to leakage between connecting pipe and rotating cleaning nozzle.

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

Rotating cleaning nozzle »Gyro«
Series 577



- Self rotating
- Effective flat jet nozzles
- Large free cross sections, less prone to clogging

Max. tank diameter:
5.5 m

Materials:
316L SS, PTFE

Max. temperature:
90 °C

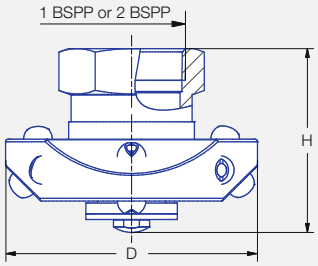
Recommended operating pressure:
3 bar

Installation:
Vertically facing downward

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

Bearing:
Slide bearing made of PTFE

Accessories:
Spare parts set consisting of: top seal, bottom seal, bolt, nut, sleeve, instructions for use



Female thread

Spray angle	Ordering no.			$\dot{V}$ [l/min]					Dimensions	
	Type	Connection		**p** [bar] (p_{max} = 5 bar)						
		1 BSPP	2 BSPP	1	2	3	5	at 40 psi [US gal./ min]	Height H [mm]	Diameter D [mm]
180°	**577.283.1Y**	**AN**	**-**	115	163	200	258	50	72	118
	577.363.1Y	**AN**	**-**	182	258	316	408	80	72	118
	577.403.1Y	**-**	**AW**	228	322	394	509	100	103	156
	577.433.1Y	**-**	**AW**	273	386	473	610	120	103	156
	577.523.1Y	**-**	**AW**	452	639	783	1010	170	103	156
180°	**577.284.1Y**	**AN**	**-**	115	163	200	258	50	72	118
	577.364.1Y	**AN**	**-**	182	258	316	408	80	72	118
	577.404.1Y	**-**	**AW**	228	322	394	509	100	103	156
	577.434.1Y	**-**	**AW**	273	386	473	610	120	103	156
	577.494.1Y	**-**	**AW**	380	538	659	851	170	103	156
270°	**577.285.1Y**	**AN**	**-**	115	163	200	258	50	72	118
	577.365.1Y	**AN**	**-**	182	258	316	408	80	72	118
	577.405.1Y	**-**	**AW**	228	322	394	509	100	103	156
	577.435.1Y	**-**	**AW**	273	386	473	610	120	103	156
	577.495.1Y	**-**	**AW**	380	538	659	851	170	103	156
360°	**577.289.1Y**	**AN**	**-**	115	163	200	258	50	72	118
	577.369.1Y	**AN**	**-**	182	258	316	408	80	72	118
	577.409.1Y	**-**	**AW**	228	322	394	509	100	103	156
	577.439.1Y	**-**	**AW**	273	386	473	610	120	103	156
	577.499.1Y	**-**	**AW**	380	538	659	851	170	103	156

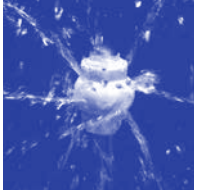
NPT on request

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.

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.

Example for Ordering:	Type	+	Connection	=	Ordering no.
	577.283.1Y.	+	**AN**	=	**577.283.1Y.AN**

Rotating cleaning nozzle »Teflon® Whirly«
Series 573 / 583



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

Materials:
PTFE (Teflon®)

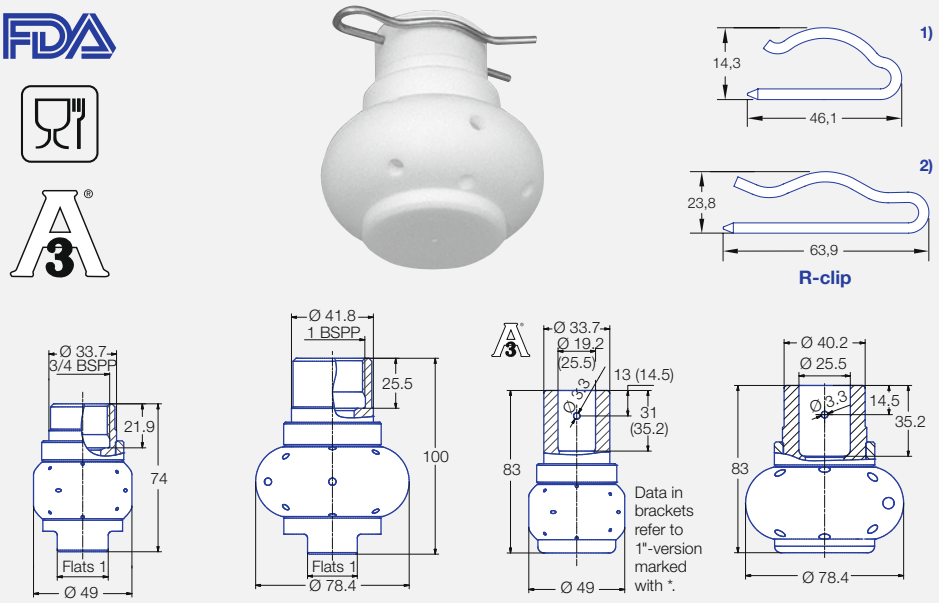
Max. temperature:
95 °C
(Versions for use with higher temperature (130 °C) on request)

Recommended operating pressure:
2 bar

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



Spray angle	R-clip	Ordering no. Type	Connection 3/4 BSPP	1 BSPP	3/4" Slip-on	1" Slip-on	E Ø [mm]	V̇ [l/min] p [bar] (p_{max} = 6 bar) 1	2	3	at 40 psi [US gal./min]	Max. tank diameter [m]
180°	1)	**583.114.55**	**AL**	**-**	**TF07**	**TF10***	2.1	47	67	82	21	2.5
	1)	**583.264.55**	**AL**	**-**	**TF07**	**TF10***	3.3	103	145	178	45	2.8
	2)	**583.344.55**	**-**	**AN**	**-**	**TF10**	7.1	159	225	276	70	3.2
180°	1)	**573.114.55**	**AL**	**-**	**TF07**	**TF10***	2.1	47	67	82	21	2.5
	1)	**573.264.55**	**AL**	**-**	**TF07**	**TF10***	3.3	103	145	178	45	2.8
	2)	**573.344.55**	**-**	**AN**	**-**	**TF10**	7.1	159	225	276	70	3.2
270°	1)	**583.116.55**	**AL**	**-**	**TF07**	**TF10***	2.4	47	67	82	21	2.5
	1)	**583.266.55**	**AL**	**-**	**TF07**	**TF10***	3.4	103	145	178	45	2.8
	2)	**583.346.55**	**-**	**AN**	**-**	**TF10**	5.9	159	225	276	70	3.2
270°	1)	**573.116.55**	**AL**	**-**	**TF07**	**TF10***	2.4	47	67	82	21	2.5
	1)	**573.266.55**	**AL**	**-**	**TF07**	**TF10***	3.4	103	145	178	45	2.8
	2)	**573.346.55**	**-**	**AN**	**-**	**TF10**	5.9	159	225	276	70	3.2
360°	1)	**583.119.55**	**AL**	**-**	**TF07**	**TF10***	1.8	41	58	71	18	2.4
	1)	**583.209.55**	**AL**	**-**	**TF07**	**TF10***	3.5	71	100	122	31	2.5
	1)	**583.269.55**	**AL**	**-**	**TF07**	**TF10***	4.8	103	145	178	45	2.8
	2)	**583.279.55**	**-**	**AN**	**-**	**TF10**	3.7	106	150	184	47	3.0
	2)	**583.349.55**	**-**	**AN**	**-**	**TF10**	5.6	159	225	276	70	3.2

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.

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

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

Slip-on information:
- R-clip made of stainless steel 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.

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

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

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

Max. temperature:
95 °C

Recommended operating pressure:
5 bar

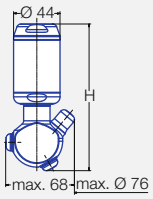
Installation:
Operation in every direction is possible

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

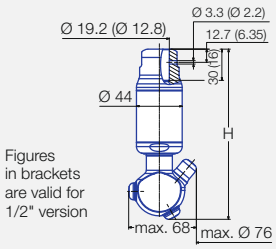
Bearing:
Double ball bearing

Rotation monitoring sensor:

Sensor compatible, please ask for more information.



Female thread



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

Nozzle dimensions [mm]

Connection	Max. Height H [mm]
AF	146
AH	149
AL	139
AN	139
TF05	148
TF07	164

ATEX version on request

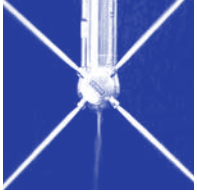
Spray angle	Type	Ordering no. Connection 3/8 BSPP female	1/2 BSPP female	3/4 BSPP female	1 BSPP female	1/2" Slip-on	3/4" Slip-on	E Ø [mm]	V̇ [l/min] p [bar] (p_{max} = 15 bar) 2	5	10	at 40 psi [US gal./min]	Max. tank diameter [m]
270°	**5S2.955.1Y**	**AF**	**AH**	**-**	**-**	**TF05**	**-**	2.0	25	40	57	7.8	3.5
	5S3.055.1Y	**-**	**AH**	**-**	**-**	**-**	**TF07**	2.0	41	65	92	12.8	4.0
	5S3.115.1Y	**-**	**AH**	**AL**	**-**	**-**	**TF07**	2.0	60	94	133	18.4	6.0
	5S3.185.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	89	141	199	27.7	7.0
	5S3.235.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	111	175	248	34.3	7.5
	5S3.265.1Y	**-**	**-**	**AL**	**AN**	**-**	**TF07**	2.0	135	213	301	41.8	8.0
270°	**5S2.956.1Y**	**AF**	**AH**	**-**	**-**	**TF05**	**-**	2.0	25	40	57	7.8	3.5
	5S3.056.1Y	**-**	**AH**	**-**	**-**	**-**	**TF07**	2.0	41	65	92	12.8	4.0
	5S3.116.1Y	**-**	**AH**	**AL**	**-**	**-**	**TF07**	2.0	60	94	133	18.4	6.0
	5S3.186.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	89	141	199	27.7	7.0
	5S3.236.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	111	175	248	34.3	7.5
	5S3.266.1Y	**-**	**-**	**AL**	**AN**	**-**	**TF07**	2.0	135	213	301	41.8	8.0
360°	**5S2.959.1Y**	**AF**	**AH**	**-**	**-**	**TF05**	**-**	1.7	25	40	57	7.8	3.5
	5S3.059.1Y	**-**	**AH**	**-**	**-**	**-**	**TF07**	2.0	41	65	92	12.8	4.0
	5S3.119.1Y	**-**	**AH**	**AL**	**-**	**-**	**TF07**	2.0	60	94	133	18.4	6.0
	5S3.189.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	89	141	199	27.7	7.0
	5S3.239.1Y	**-**	**-**	**AL**	**-**	**-**	**TF07**	2.0	111	175	248	34.3	7.5
	5S3.269.1Y	**-**	**-**	**AL**	**AN**	**-**	**TF07**	2.0	135	213	301	41.8	8.0

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.

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 stainless steel 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.



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

- Gear-controlled
- Particularly powerful solid jets
- Operating pressures up to 15 and 25 bar possible

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

Max. temperature:
95 °C

Recommended operating pressure:
5 bar

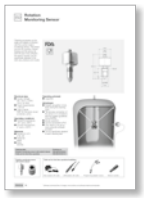
Installation:
Operation in every direction possible

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

Bearing:
Ball bearing

Weight:
5TA: 0.9 kg
5TB: 4.0 kg

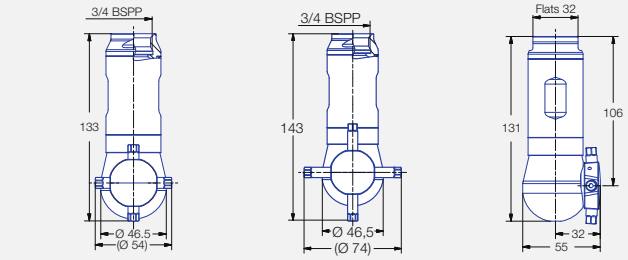
Rotation monitoring sensor:



Sensor compatible, please ask for more information.

ATEX version on request

5TA



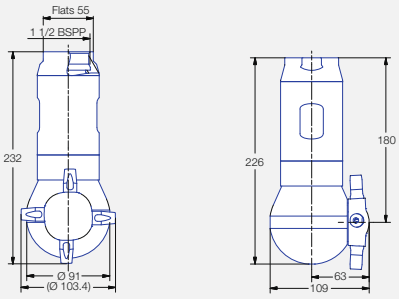
Female thread 5TA.403.1Y.AL and 5TA.404.1Y.AL | **Female thread 5TA.405.1Y.AL** | **Female thread**

Spray angle	Ordering no. Type	E Ø [mm]	Number. Ø Nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 15 bar) 2	5	10	at 40 psi [US gal./ min]	Max. tank diameter [m]
360°	**5TA.403.1Y.AL**	1.5	4 x 3.0	25	40	56	7.8	12.0
	5TA.404.1Y.AL	1.5	4 x 4.0	35	55	78	10.9	12.5
	5TA.405.1Y.AL	1.5	4 x 5.0	50	79	112	15.5	13.0

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



Spray angle	Ordering no. Type	E Ø [mm]	Number, Ø Nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 25 bar) 2	5	10	at 40 psi [US gal./ min]	Max. tank diameter [m]
360°	**5TB.406.1Y.AS**	6.0	4 x 6.0	107	169	239	33.1	14.0
	5TB.407.1Y.AS	6.0	4 x 7.0	135	213	302	41.9	14.0
	5TB.408.1Y.AS	6.0	4 x 8.0	165	261	369	51.2	15.0

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.

High impact tank cleaning machine »IntenseClean« Series 5TM

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

Materials*:
316L SS, PTFE, carbon fibre

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

Recommended operating pressure:
5 bar

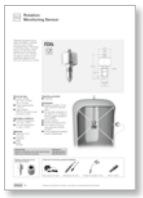
Installation:
Operation in every direction possible

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

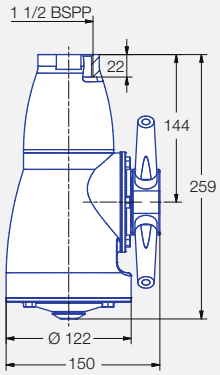
Bearing:
Ball bearing

Weight:
7.5 kg

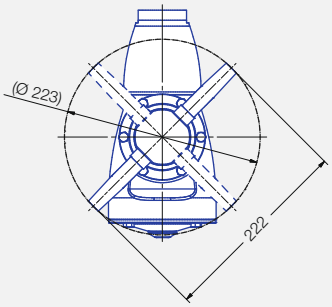
Rotation monitoring sensor:



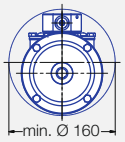
Sensor compatible, please ask for more information.

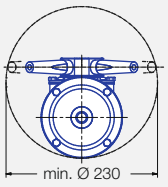


Female thread



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





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

Spray angle	Ordering no.	E Ø [mm]	Number, Ø Nozzles [mm]	V̇ [l/min] p [bar] (p_{max} = 7 bar) 2	3	5	at 40 psi [US gal./ min]	Max. tank diameter [m]
360°	**5TM.208.1Y.AS**	8	2 x 8.0	125	153	198	39	24.0
	5TM.210.1Y.AS	10	2 x 10.0	160	196	253	50	24.0
	5TM.406.1Y.AS	6	4 x 6.0	140	171	221	43	18.0
	5TM.407.1Y.AS	7	4 x 7.0	170	208	269	53	20.0
	5TM.408.1Y.AS	8	4 x 8.0	200	245	316	62	22.0
	5TM.410.1Y.AS	10	4 x 10.0	260	318	411	81	23.0

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.

* The mentioned materials refer to the main components of the tank cleaning machine. A detailed list of all contained materials is available on request.

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 to 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

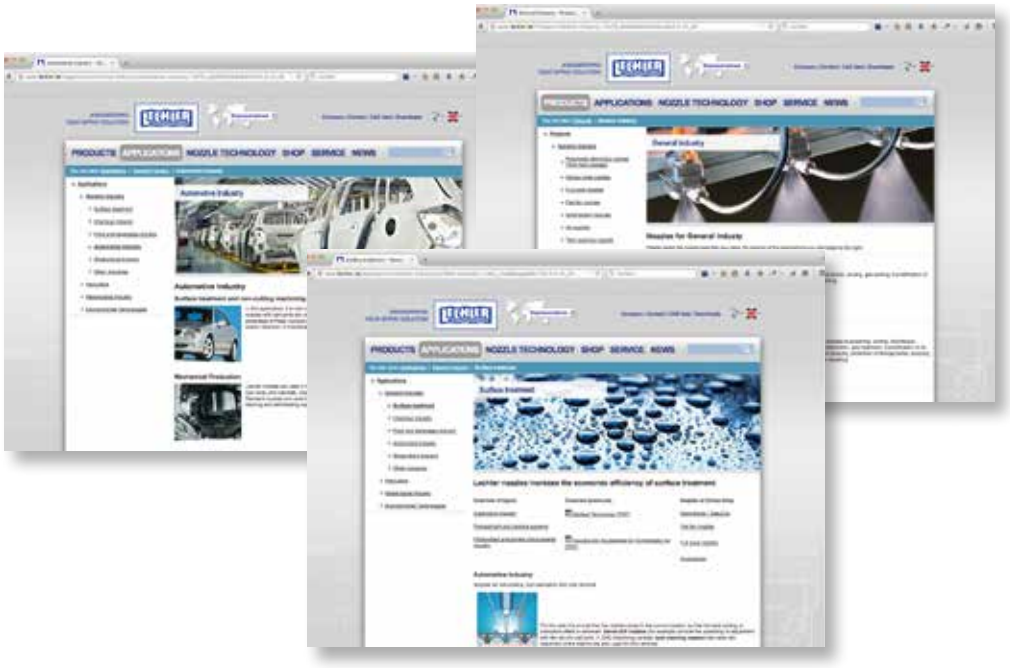
Talk to us

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.

FULL INFORMATION IS JUST A CLICK AWAY: THE LECHLER WEBSITE

Our website contains further information on our products as well as useful resources.

www.lechler.com



3D DESIGN DATA FOR YOUR WORK

So you can work on your designs with reliable data from the outset, free 3D data on Lechler nozzles and accessories are available to you online.

http://lechler.partcommunity.com

Your advantages:

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- Simple, fast product selection
- Preview function with product photo and 3D graphics
- All popular 3D formats available
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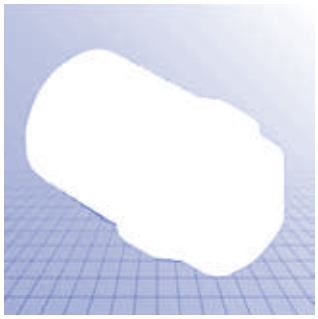


LECHLER INDUSTRY APP

Android (Google)

iOS (Apple)

NEW

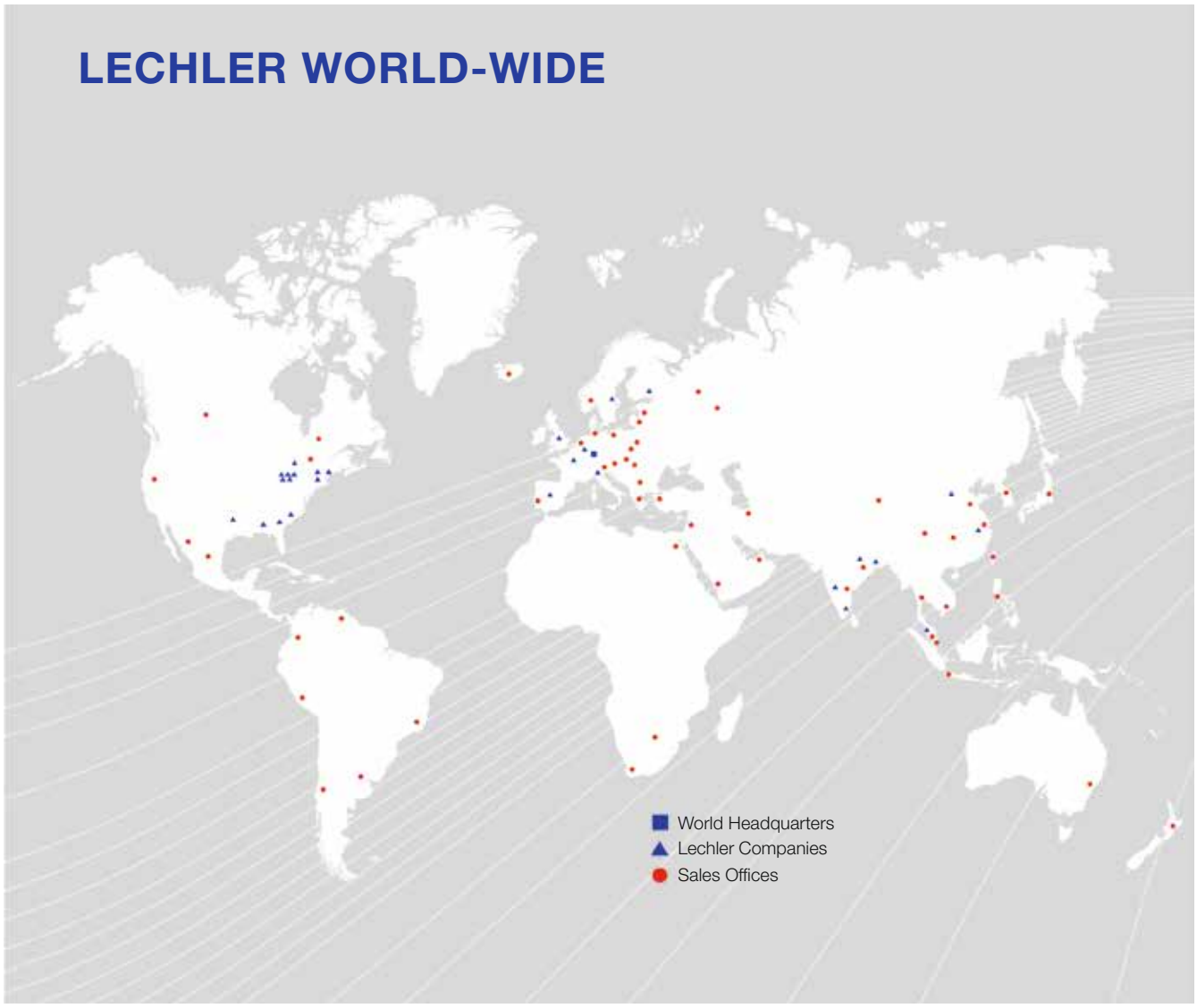
All important calculation and conversion programs for nozzle technology combined in one App.

- Unit converter for pressure, volume and flow rate
- Pressure/flow rate calculator for single-fluid nozzles incl. axial-flow full cone nozzles
- Calculation of pipe diameters

FOR YOUR NOTES

ENGINEERING
YOUR SPRAY SOLUTION

LECHLER WORLD-WIDE



Lechler GmbH · Precision Nozzles · Nozzle Systems
P.O. Box 13 23 · 72544 Metzingen, Germany · Phone: +49 7123 962-0 · Fax: +49 7123 962-301 · info@lechler.de · www.lechler.com

ASEAN: Lechler Spray Technology Sdn. Bhd. · No. 23, Jalan Teknologi 3/3A · Taman Sains Selangor 1 · Kota Damansara, PJU 5 · 47810 Petaling Jaya · Malaysia · info@lechler.com.my
Belgium: Lechler S.A./N.V. · Avenue Mercator, 6 · 1300 Wavre · Phone: +32 10 225022 · Fax: +32 10 243901 · info@lechler.be
China: Lechler Intl. Trad. Co. Ltd. · Beijing · Rm. 418 Landmark Tower · No. 8 Dong San Huan Bei Lu · Phone: +86 10 84537968, Fax: +86 10 84537458 · info@lechler.com.cn
Finland: Lechler Oy · Jäspilänkatu 18 · 04250 Kerava · Phone: +358 207 856880 · Fax: +358 207 856881 · info@lechler.fi
France: Lechler France, S.A. · Bât. CAP2 · 66-72, Rue Marceau · 93558 Montreuil · Phone: +33 1 49882600 · Fax: +33 1 49882609 · info@lechler.fr
Great Britain: Lechler Ltd. · 1 Fell Street, Newhall · Sheffield, S9 2TP · Phone: +44 114 2492020 · Fax: +44 114 2493600 · info@lechler.com
India: Lechler (India) Pvt. Ltd. · Plot B-2 · Main Road · Wagle Industrial Estate · Thane (W) - 400604 · Phone: +91 22 40634444 · Fax: +91 22 40634498 · lechler@lechlerindia.com
Italy: Lechler Spray Technology S.r.l. · Via Don Dossetti, 2 · 20080 Carpiano (Mi) · Phone: +39 02 98859027 · Fax: +39 02 9815647 · info@lechleritalia.com
Spain: Lechler S.A. · Avda. Pirineos 7 · Oficina B7, Edificio Inbisa I · 28700 San Sebastián de los Reyes, Madrid · Phone: +34 91 6586346 · Fax: +34 91 6586347 · info@lechler.es
Sweden: Lechler AB · Kungsängsvägen 31 B · 753 23 Uppsala · Phone: +46 18 167030 · Fax: +46 18 167031 · info@lechler.se
USA: Lechler Inc. · 445 Kautz Road · St. Charles, IL. 60174 · Phone: +1 630 3776611 · Fax: +1 630 3776657 · info@lechlerUSA.com

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