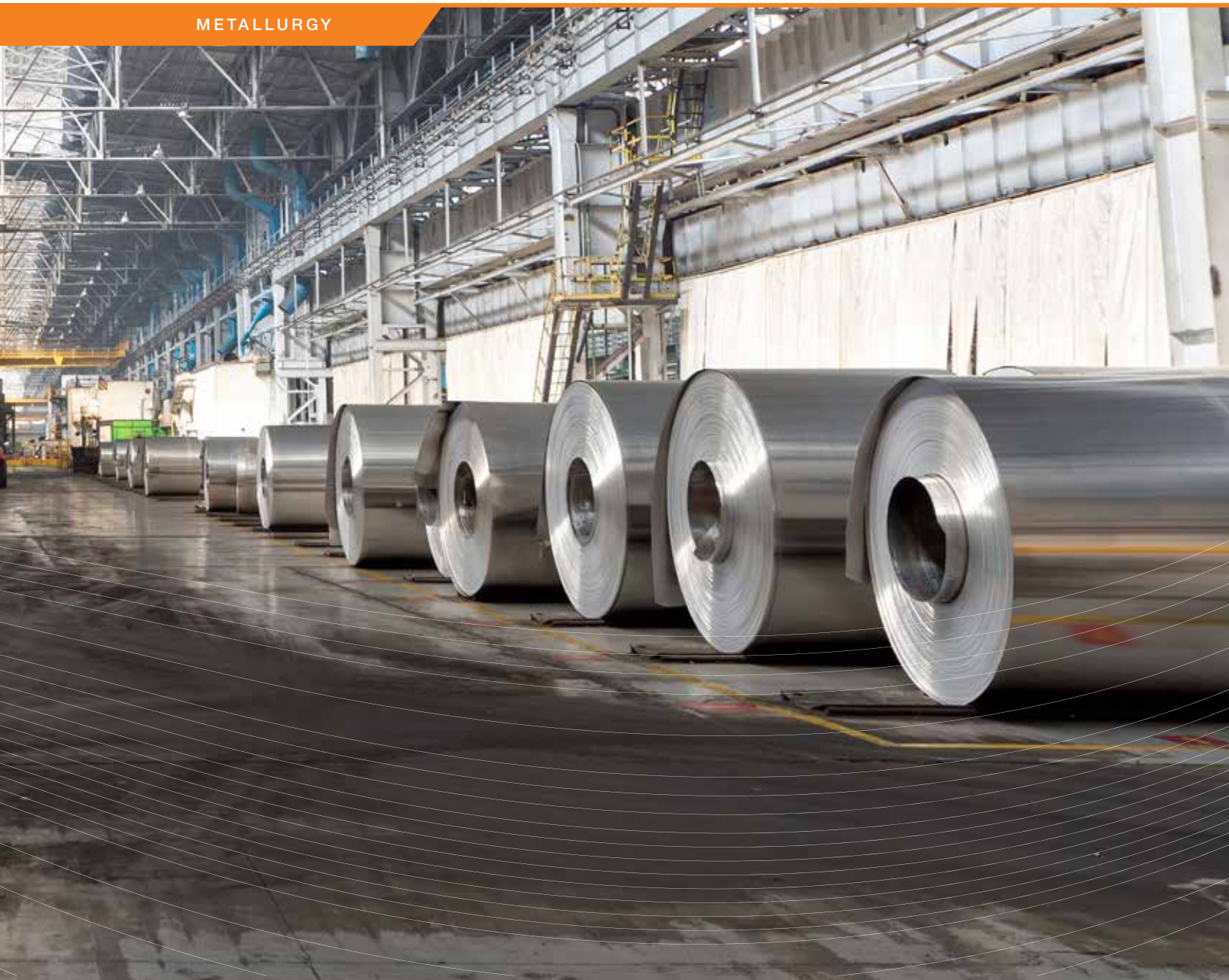
ENGINEERING
YOUR SPRAY SOLUTION

ALUMINIUM INDUSTRY

Nozzles and systems for
the aluminium industry

METALLURGY



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UNSURPASSED NOZZLE KNOW-HOW AND OF THE INDUSTRY

The plant builder's partner

With innovative nozzle solutions, Lechler is always involved in the introduction of new technologies and also in the continuous further development of conventional processes.

A well-founded knowledge of the industry

As an active member of many different national and international associations (VDMA, VDEH, AIST, S.E.A.I. & S.I., ATS and EUnited) and via numerous technical publications, Lechler has become very familiar with the subject matter.

Participation in EU research projects (RFCS) also has increasing Lechler's technological competence as its goal. Of course, you as our client also profit from this. Significant changes to operating conditions with regard to throughput capacity and the product quality demands of modern materials can arise over the course of the very long service lives of metallurgical machinery.
Today the production of a wide range of material qualities also demands a much greater flexibility in the operating procedures and in maintenance. This is where existing plants often reach their limits.

Besides the construction of new plants, one alternative can be the optimization of existing ones. The most common reasons for this are:

- Identifying and remedying quality problems
- Improving ease of maintenance and lowering maintenance costs
- Increasing production speeds
- Changing the product formats and the material qualities (product mix)

In most cases, the decision involves a combination of the above reasons. It is therefore important for your needs to be clearly defined.

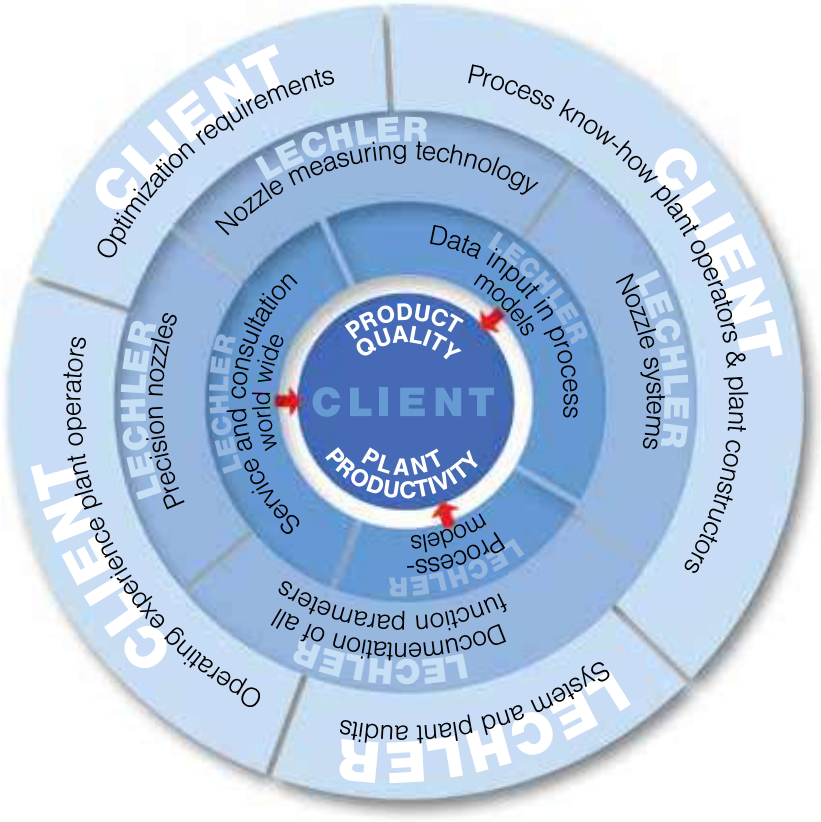
Lechler nozzle configuration

An optimum nozzle configuration is the main prerequisite for fulfilling the production and quality specifications of all plants.

New nozzle solutions open up many different possibilities for saving costs. The optimization of nozzle systems can also make a significant contribution towards increasing production, quality and flexibility.
With the help of Lechler's own PC-based simulation programs, we can analyze the current situation and make optimization suggestions based on state-of-the-art nozzle technolgy.

Lechler system audits

Roll cooling in hot and cold rolling mills (steel, aluminium and non-ferrous)The full optimization potential can often be determined only via a precise study of all the important details. Lechler system audits include an evaluation of the existing production, performance and quality data, along with a carefully documented final report which, in addition to the collected and analyzed data, also contains suggestions for optimizing your system.



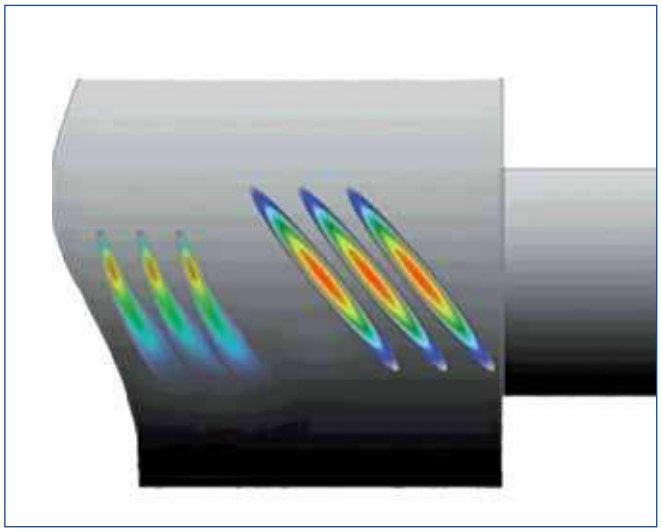
D A WELL-FOUNDED KNOWLEDGE

Lechler supports a long experience of designing and building roll cooling systems with considerable know-how in the operational and process field through our industry experts.

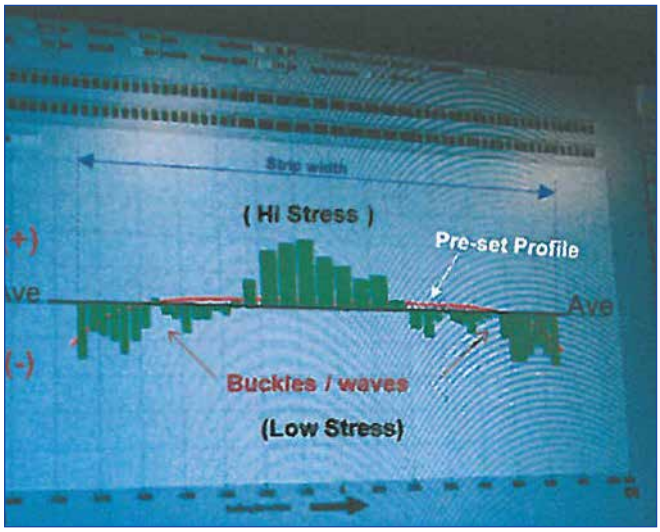
Whereas the principal objectives of the selective roll cooling system is to achieve optimum strip flatness and efficient heat transfer from rolls; ensuring this is achieved by applying minimum coolant is a key engineering and production priority. This results in a consequential reduction in the volume being processed for recovery or disposal of spent coolant which significantly reduces primary operating cost.

Efficient application of the coolant and lubrication media also ensures minimal generation of detritus and particulates in the process further improving service quality and strip brightness.
Lechler systems are "designed in" to the existing mill configurations as an integral part of the rolling process ensuring optimum interaction and integration with the rolling process.

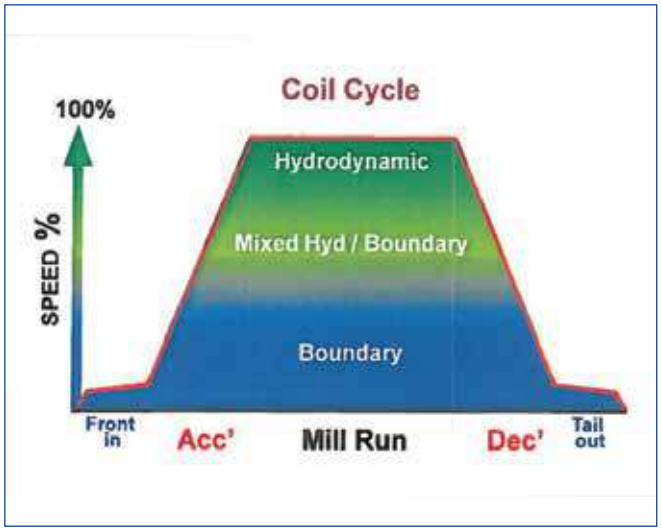
Lechler provides participative contributions to ensuring clients process needs are considered a priority.



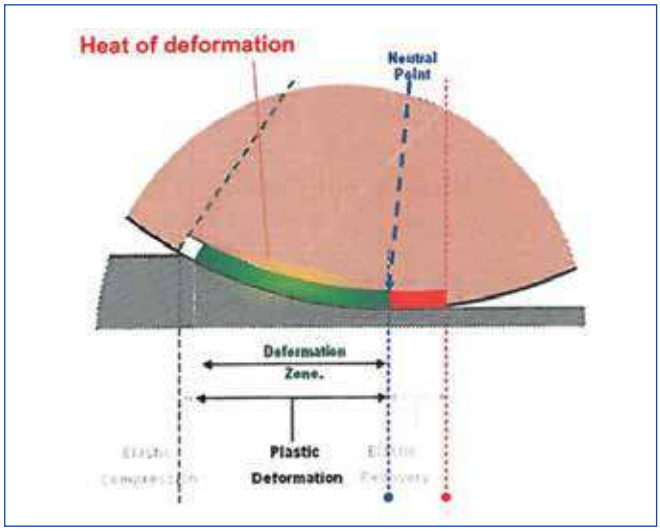
Spray pattern symmetry (non ideal on left, ideal on right)



Flatness display



Lubrication coolant phases



Generation of heat in roll

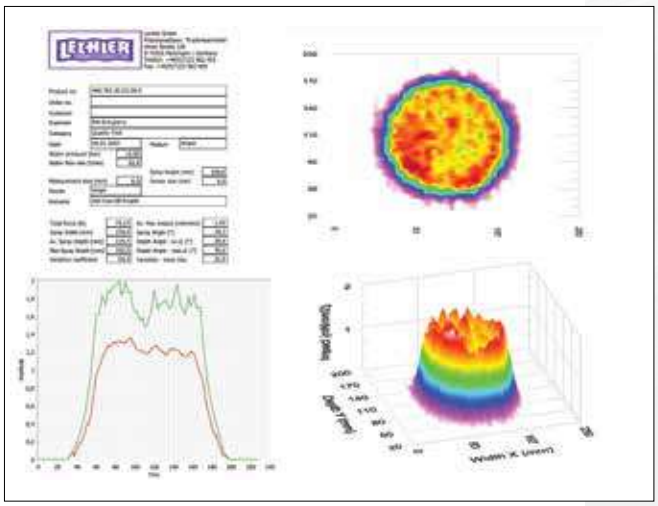
STATE-OF-THE-ART TECHNOLOGY TO ELIMINATE ALL RISKS

Data and facts that you can rely on

There are many reasons for our product's success. A very important one is that based on precise measurements, we are able to make reliable statements about the spray characteristic of a nozzle.
This provides reliable data for development, and also simplifies the evaluation for you with regard to fulfilling the exact purpose in the individual application — even before the nozzle has been integrated into your system. This saves time, reduces costs and ensures planning reliability.

We employ the latest methods to cover the entire measurement spectrum

- Flow rate
- Spray angle
- Spray shape
- Air flow measurement
- Droplet size measurement
- Droplet speed measurement
- 3D spray impact measurement
- Liquid distribution
- Spray videos
- Noise level measurement



Documentation of a spray impact measurement

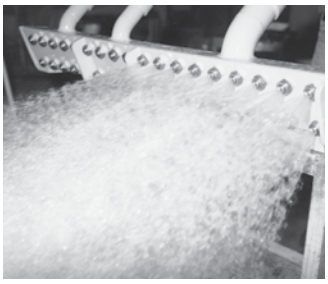
The performance data is determined with state-of-the-art measuring techniques and is documented accurately.

PERFECT TECHNOLOGY FOR ROLL COOLING AND MUCH MORE

- Flat jet nozzles for roll cooling
- Flat jet and tongue nozzles for strip whiping in front of strip thickness gauge measuring units and surface inspection systems
- Nozzles for strip cooling in the run-out roller table
- Anti-peeling and interstand cooling nozzles
- WHISPERBLAST® air nozzles for blowing off strips in front of strip thickness gauges and surface inspection systems
- Studies and nozzle arrangement proposals
- Complete spray headers
- Application systems for the work roll lubrication (LSC)

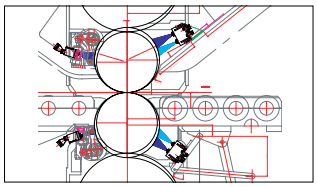
Lechler has a solution for all other nozzle applications in hot rolling

Only the optimal nozzle arrangements in roll cooling, for strip surface quenching (anti-peeling spray) in front of the roll bite or for interstand strip cooling guaranties a long service life of the work rolls and the required strip shape. Systems for strip surface inspection, measurements of strip thickness gauge and shape deliver only reliable data if the strip surface is free of dirt and water. With nozzles from Lechler, very good results can be achieved here too.



Complete roll cooling spray header from Lechler

NOZZLES AND SYSTEMS FOR ECONOMY



Selective roll cooling system, individually planned

Modulax and EVA -nozzle valves for every rolling mill

Modulax-Superior valves

SELECTOSPRAY® an indispensable actuator for shape control. It corrects reliably asymetrical strip shape defects and supports work roll bending

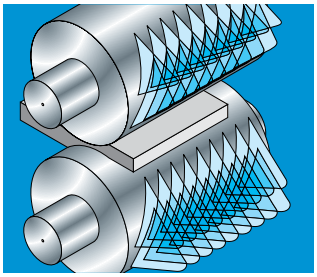
To date, more than 230 Lechler SELECTOSPRAY® roll cooling systems have been installed globally in cold rolling mills for steel, alumi-nium and non-ferrous metals, as well as in aluminium hot rolling mills and foil mills.
Profit from our comprehensive know-how in this specialist area.

SELECTOSPRAY® Nozzle valves

The new MODULAX Superior nozzle valve for electro-pneumatic control sets new standards with regard to operational reliability and plant availability, particularly for steel cold rolling mills and aluminium hot rolling mills. Zonings of 25 mm (Mini-Modulax S) and 50 mm are normal here.

The electrically controlled nozzle valves of the EVA series have proved to be optimally suited to aluminium cold rolling and foil rolling mills (50 mm zone division), as well as for rolling non-ferrous metals. 25 mm zone divisions are possible here too with the Mini EVA valve.

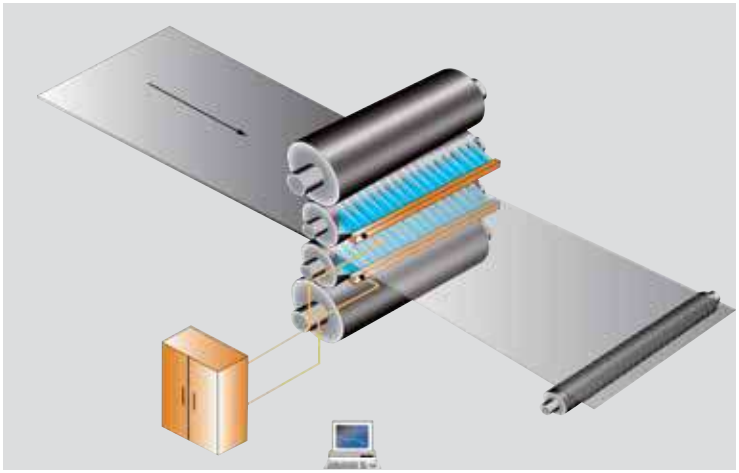
Other valve concepts are available with the DSA series.



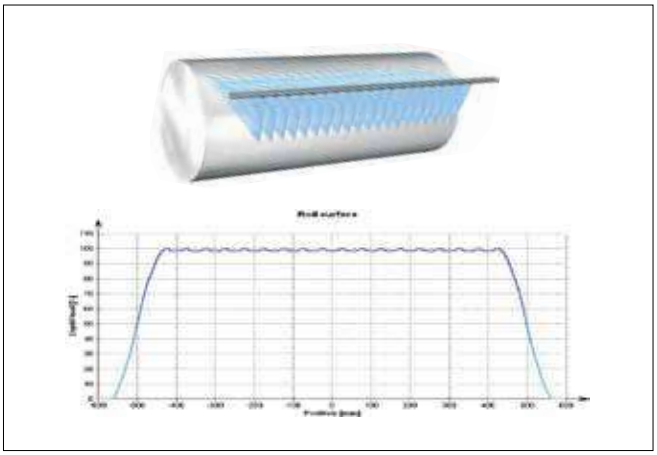
INCREASING QUALITY AND

- Flat jet nozzles for roll cooling
- Flat jet and full-cone nozzles for strip cooling
- Direct application systems for the strip lubrication (LSC)
- Application systems for strip oiling and lubrication (LSC)
- WHISPERBLAST® air nozzles for blowing off strips
- Selective roll cooling systems SELECTOSPRAY® as an actuator for shape control
- Studies and audits of roll cooling in tandem lines
- Nozzle arrangement proposals
- Complete spray headers for optimizing the roll cooling

Electrically controlled SELECTOSPRAY® system with EVA valve technology (25 mm/1", 50 mm/2")



Optimum strip flatness thanks to simulation of the nozzle arrangement

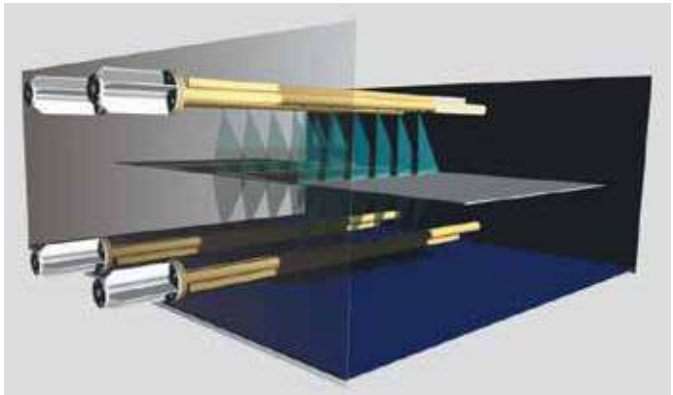


Control cabinet SELECTOSPRAY® system

VARIETY OPENS UP NEW POSSIBILITIES

Lechler is the specialist company for nozzle and spray technology. Make use of the advantages of this wide product range

of various materials such as PVDF, PTFE, polypropylene or stainless steel provide a broad basis for future-orientated and technically perfect solutions. WHISPERBLAST® air nozzles made of stainless steel or plastic are used for blowing off strips or strip edges.

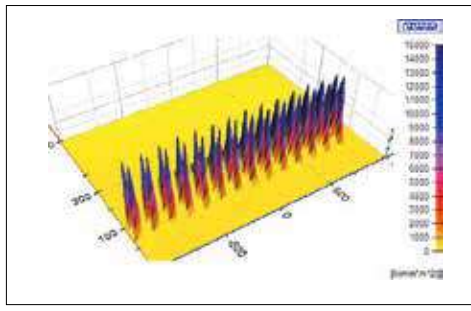


With Lechler nozzles, you can optimally fulfil all typical requirements on pickling, galvanizing and tinning lines, on strip coating lines, and on continuous annealing lines. These include cleaning and rinsing processes, but also the direct application of acids, for example. A wide range of standardised flat jet, tongue and full-cone nozzles made

Special Lechler hollow-cone nozzles made of oxide ceramic, silicon carbide, titanium and palladium-titanium are installed for regenerating acid in picking lines after the spray-roasting process.

Self-cleaning spray pipes (the STAMM® system) allow nozzles and the pipe inner walls to be cleaned in a matter of seconds during operation. This is done either manually or automatically by rotating a cleaning brush inside the spray pipe. This prevents unscheduled and expensive plant shutdowns, and safe-guards the product quality of the strip.

If required, Lechler can also supply complete spray pipes made of polypropylene or PVDF for pickling lines. The optimization of the nozzle arrangement can be incorporated as a task at the same time.



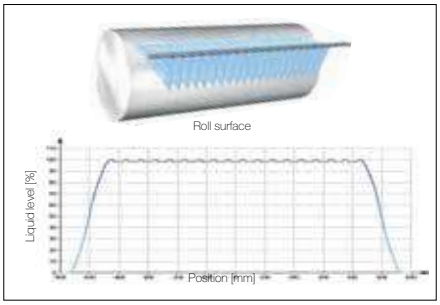
Liquid distribution of a nozzle arrangement

Self-cleaning STAMM® spray pipe system

THERMAL ROLL COOLING STUDIES

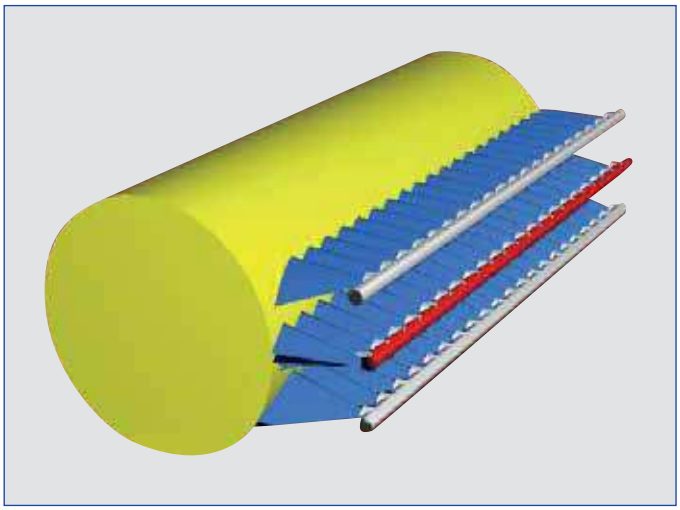
Over the life span of a rolling mill the requirements in terms of product quality and the range of steel grades may change significantly. In particular the capability of the installed roll cooling systems needs to be investigated as one of the key technology area when it comes to process modifications aiming for a higher productivity.

Having engineered and installed more than 350 selective cooling systems in steel, aluminium and non-ferrous rolling mills and having revamped a large number of conventional roll cooling systems in hot and cold rolling mills Lechler has the competence and experience to also help you to optimize your roll cooling system performance. Where the capability of Lechler was limited to the investigation

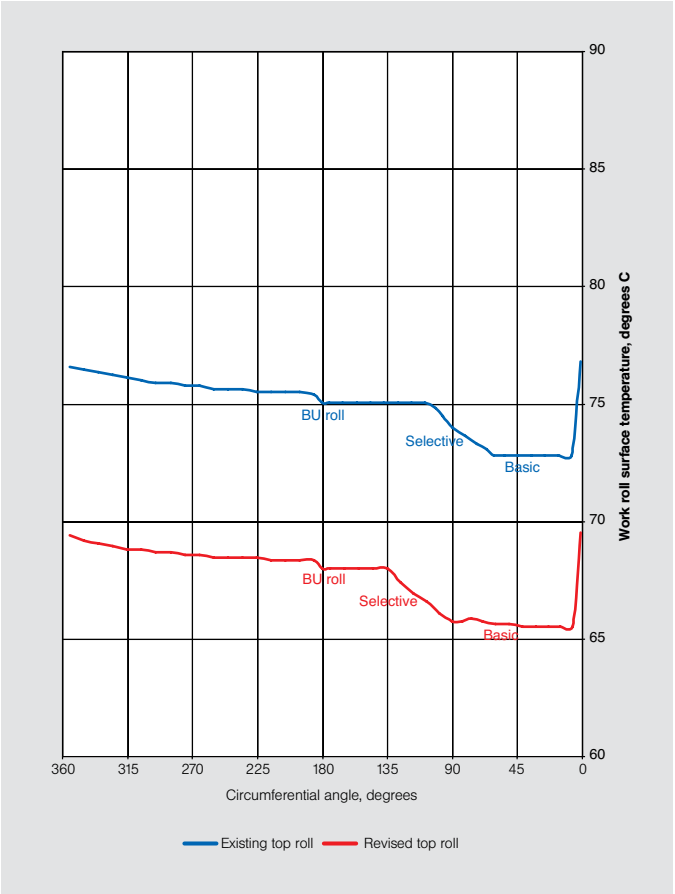


Optimum strip flatness thanks to simulation of the nozzle arrangement

of the coolant volume distribution characteristic, Lechler can now also simulate the thermal cooling effect of the existing work roll sprays with a computer model.



Roll cooling nozzle arrangement



Circumferential work roll temperature profile before (blue) and after (red) optimization

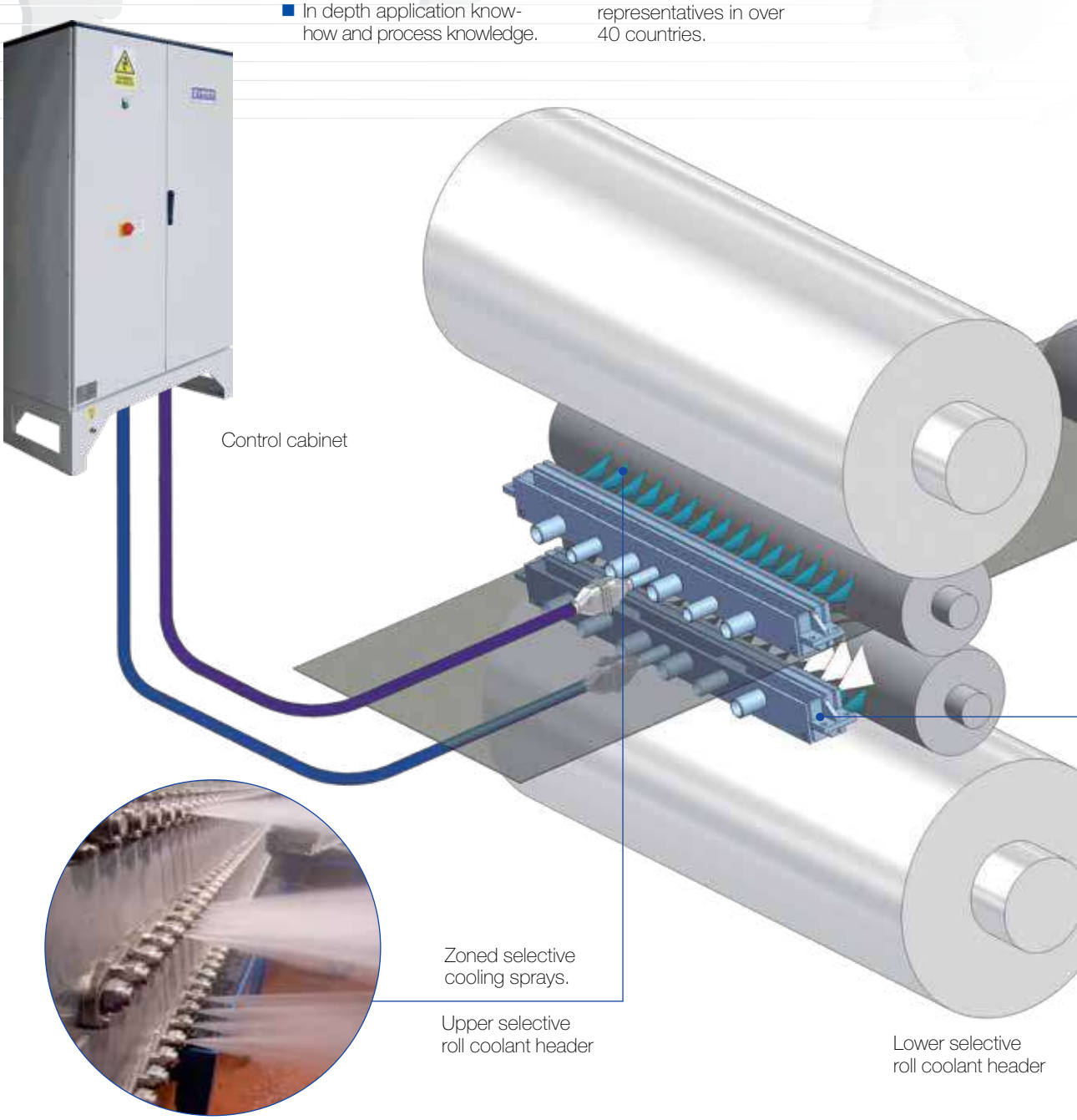
Thermal roll cooling studies help to:

- Improve product quality
- Increase mill speed and productivity
- Experience of 350 Roll cooling systems installed
- Optimized roll cooling headers and nozzles from one source

ROLL COOLING SYSTEMS

The Lechler SELECTOSPRAY® roll cooling system is the industry standard for selective roll cooling in the rolling of flat steel, aluminium and other non-ferrous strip.

- Advanced design and engineering capabilities with more than 400 systems and 1000 headers designed and manufactured.
- In depth application know-how and process knowledge.
- Comprehensive range of high-performance electrical, pneumatic and electro/pneumatic valves.
- In-house design and build of dedicated control cabinets.
- Tailored engineered systems as well as standard configurations.
- Production facilities in Germany, China, England, India, Hungary and the USA. Global network of affiliated sales offices and representatives in over 40 countries.



ADVANCED DESIGN AND ENGINEERING CAPABILITIES

The multi-discipline engineering team at Lechler offer the ability to optimize the roll cooling efficiency by the unique ability to offer a tailored solution to each SRC project.

From initial conceptualization to complete integration into existing or new mill configurations, the approach is the same. No compromise—with an optimized solution to maximize process efficiency.

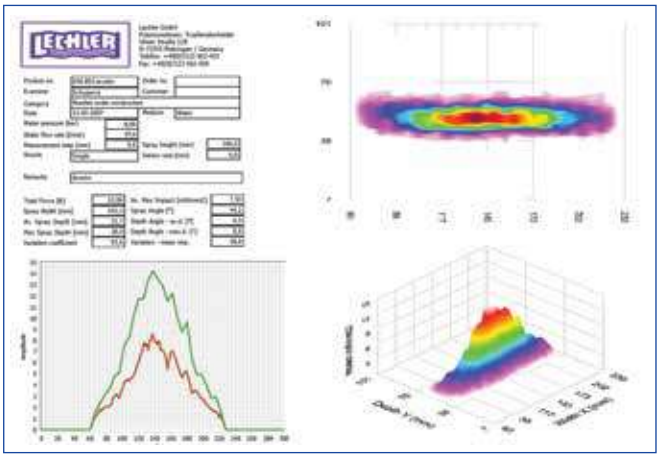
Computational Fluid Dynamics (CFD)
To determine that the internal fluid paths are designed to meet the criteria of near laminar flow.

Finite Element Analysis FEA
To ensure loadings are designed and modelled within acceptable stress and deflection criteria.

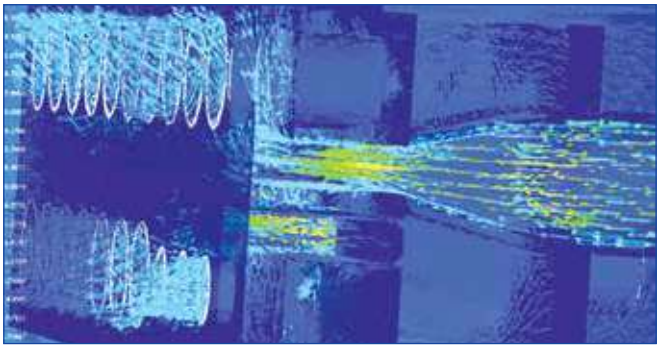
The state of the art tools used to achieve this goal are:

Thermal Modelling to determine the most efficient use of the available coolant.

Spray Simulation utilization of inventor 3-dimensional imaging software to develop symmetrical cooling profiles from the available spray bar position.



Spray impact / pressure analysis



Header internal flow analysis

Proprietary flatness sensor roll.

Constant flow sprays for stable work roll temperature control.

Lechler scope of supply:

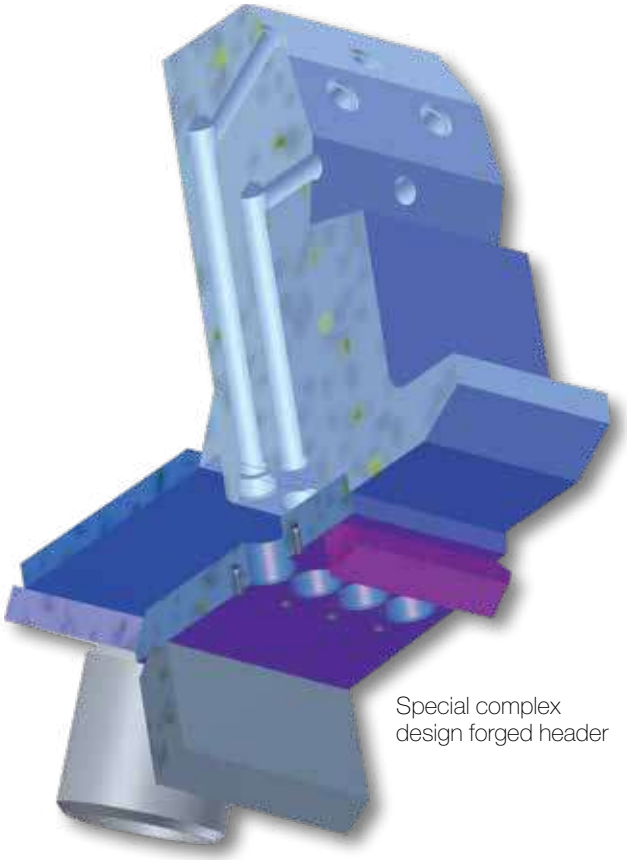
- Selective/non-selective coolant headers
- Control cabinet
- Control connections (electric/pneumatic)
- Spares
- Thermal modelling
- Mill cooling system audits

SELECTOSPRAY® HEADER EVOLUTION

State of the art design and manufacturing has seen Lechler headers develop from a mixture of small fabricated mild steel plates to current industry leading standards for conventional mill configurations using stainless steel plates or heavier stainless steel forgings as a basis of our robust custom built solutions when for example a roll change support rail is required.

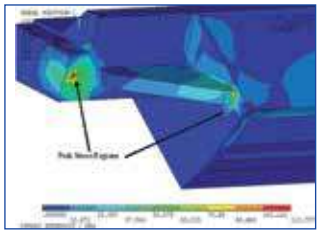
Lechler's header design concepts ensure faster times to market, more competitive pricing whereas development of smaller valves that match the flow of traditional larger valve designs; result in more compact headers, affording the optimising process a further iteration.

Utilizing the Lechler in-house manufacturing and design facilities, the ethos of complete structural integrity is a precursor to creating header designs that have high impact resistance as well as and including such things as integral roll change rails.

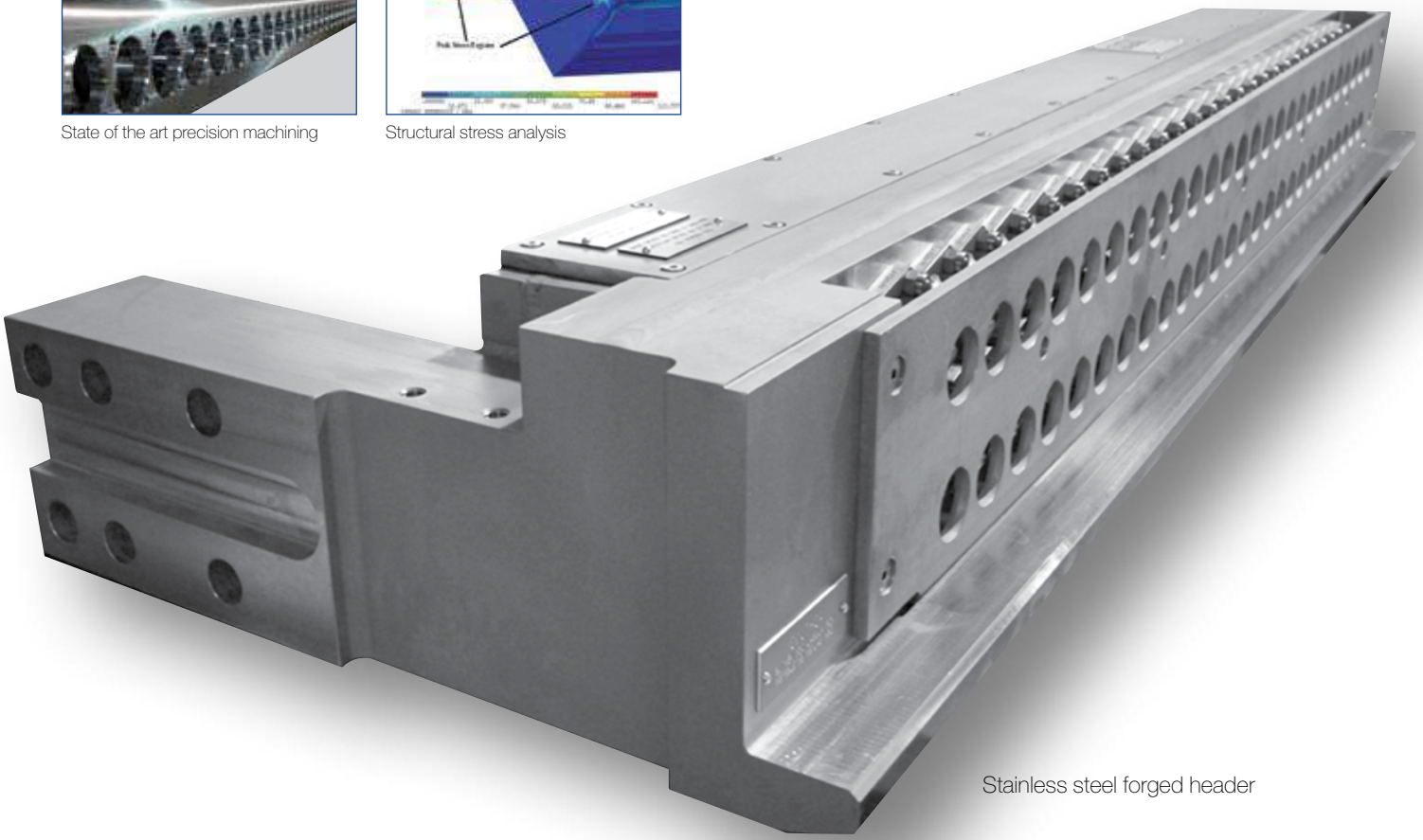


Special complex design forged header

State of the art precision machining



Structural stress analysis



Stainless steel forged header

SELECTOSPRAY® VALVE FAMILY

Selective roll cooling headers are fitted with the appropriate valve type from our family of valves. Valve type and design is carefully selected for optimum performance to give consistent and reliable spray control in each application.

The proven Lechler valve designs are available in pneumatic and electric versions:

- **Modulax** pneumatically controlled with the solenoid in the control cabinet outside of the mill. Pneumatic valves are primarily used for steel rolling systems.
- **EVA** purely electrically controlled. Electrical valves are used primarily for aluminium rolling systems.

All valve versions offer:

- Very large coolant entry ports.
- Easily removable from the header front and are protected by the header itself.
- All valves carry self-aligning flat jet nozzles.

Valve type	Spacing	Flow (L/M) at 6 bar	Pulse rate (s)
EVA STD	52	159	0.1
mini	26	59	0.1
Modulax STD	52	149	2
mini	26	59	2

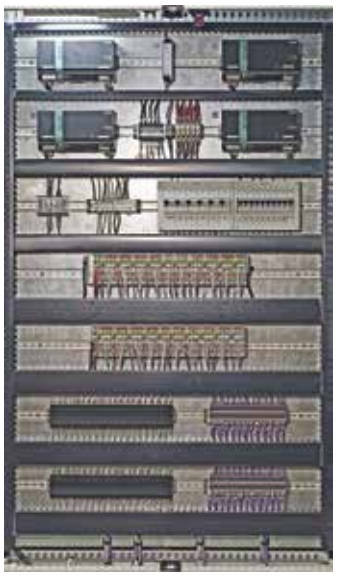
Typical flow rates: Lechler Valves (26/52 mm zones)

SELECTOSPRAY® CONTROL CABINETS

Lechler control cabinets offer the customized control interface to drive pneumatic or electrical SELECTOSPRAY® systems.

We provide control system components that meet the latest industry requirements:

- All cabinets are custom-made in-house by Lechler.
- Use only industry standard parts.
- Hardwired from remote I/O.
- Siemens as standard, Wago I/O unit optional.
- Robust stainless steel hose design with ease of connection.
- Closed loop control by feedback from shape meter or touch screen, push buttons.



SELECTOSPRAY®

Every rolling plant has its own priorities annd not every maintenance measure is necessary in every case. That's why our services come as part of a modular kit from which you can choose the maintenance you really need.

On-site system inspection

During a mill shutdown, our experts carry out a visual assessment together with mechanical, pneumatical and electrical function and spray tests of the selective roll cooling system. Our findings will be summarized in a comprehensive report including results and recommendations.

Unscheduled on-site repair

If need be, we carry out necessary repairs during a mill shutdown provided that the required spare parts are available on site.

Scheduled preventive maintenance and evaluation on site

Our experts carry out regular and scheduled visual assessments and functional tests. They change typical wear parts and any other faulty or worn components or they repair them. Yearly maintenance contracts are the basis for such cooperation and offer you maximum cost transparency.

Off-site refurbishment

Sometimes valved spray headers, control hoses and control cabinets have experienced damage or wear which require maintenance beyond an on-site repair job. In those cases, the equipment can be brought back to the Lechler service center for repair and refurbishment.

Revolving off-site header and hose refurbishment

On-site repair or preventive maintenance of all valves may require a mill shut down longer than desirable. Therefore, Lechler has introduced the system of Revolving Headers.

With one spare header of each type, optimally-refurbished headers are operational in the mill in trouble-free conditions while the additional header is being serviced at Lechler. After a defined operation period, the headers will be changed again. The same can be done for control hoses. Prior to the refurbishment, a repair report together with a quotation is sent to the customer for approval.

Consulting and maintenance

Our experts provide operation and troubleshooting training on site. Consulting regarding the optimal application of the coolant in other mill stands for process improvements can also be given.

Internal evaluation shows severe contamination inside pneumatic chamber header.

Let our team of experts inspect your header system in house with our state of the art equipment and test lab. Our refurbishment program will increase the life of your header system to ensure that it runs properly by providing you with fewer quality issues and increased cost savings.

Our program begins with a complete inspection of your header. We start by removing all pneumatic tubing, soft components, nozzles, and valves. Any missing, broken parts or cracked welds are identified and reported. After the inspection, a thorough acid cleaning of the header, nozzles, valves, and caps is completed. All O-rings, lip seals, and pistons are also replaced to design standards. The final step is a spray test, which searches for positive shutoff, leaks, correct firing sequence, and overall performance.

Refurbishment of hoses is also offered by Lechler in addition to the header system.

SELECTOSPRAY® header after acid cleaning

Spray testing at Lechler

YOUR COMPETITIVE ADVANTAGE

Characteristics	The benefits to you
Tailored Nozzle Design	
■ Custom-designed spray coverage	– Precise spray patterns
■ Optimized coolant usage	– Homogeneous spray pattern – Increased cooling efficiency – Reduced running costs
Pneumatic Operation	
■ Contamination tolerant	– Reduced downtime
■ Fast response 50 ms/m	– Improved product quality – Reduced flatness deviation
■ Low power solenoids	– Reduced running costs
■ High operating temperature (120 °C)	– Can be used for roll conditioning
Easy Access	
■ Removable from the header front	– Quicker valve changes – Reduced maintenance costs
■ Valve alignment not required	– Repeatable spray performance
Compact Dimensions	
■ Low section headers	– Optimized spray position – Increased cooling efficiency
■ Small diameter valves	– Less expensive headers – Can be closely grouped (25 mm)
Reliability	
■ Tested to over 10 million cycles	– Reduced running costs
■ Low-friction seals	– Easy maintenance

Competitive Advantages

- Easy maintenance
- Quick change
- Removable from the front of the header
- No requirement to remove the headers for servicing
- Lower maintenance costs
- Class leading flow rates

Twin Seal Advantages

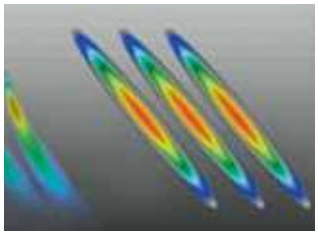
Cabinet Protection

- No coolant damage to:
  - Pneumatic solenoids
  - Nylon control tubes
  - Internal header fittings

- Extended production time between maintenance
- Reduced running costs

Valves removable from the front of the header

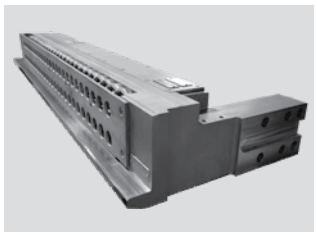
Protection for cabinets and solenoids



Perfect spray geometery (max HTC)

Protection for pneumatic lines and fittings

25mm valve pitch allows for a compact header design



Bespoke header design provides the optimum spray solution

A full range of spares, tools and accessories are available

LECHLER AIR NOZZLES

Leading nozzle technology for compressed air

In many industrial and craft fields, compressed air is an essential aid for drying, cooling, cleaning, transporting, loosening, and mixing. At the same time, the use of compressed air also increases costs and high noise emissions. The critical factor here is the type of nozzle used.

Industries

- Metalworking industry
- Food industry
- Packaging industry
- Electronics industry
- Semiconductor industry
- Plastics industry
- Printing/coating/painting, etc.

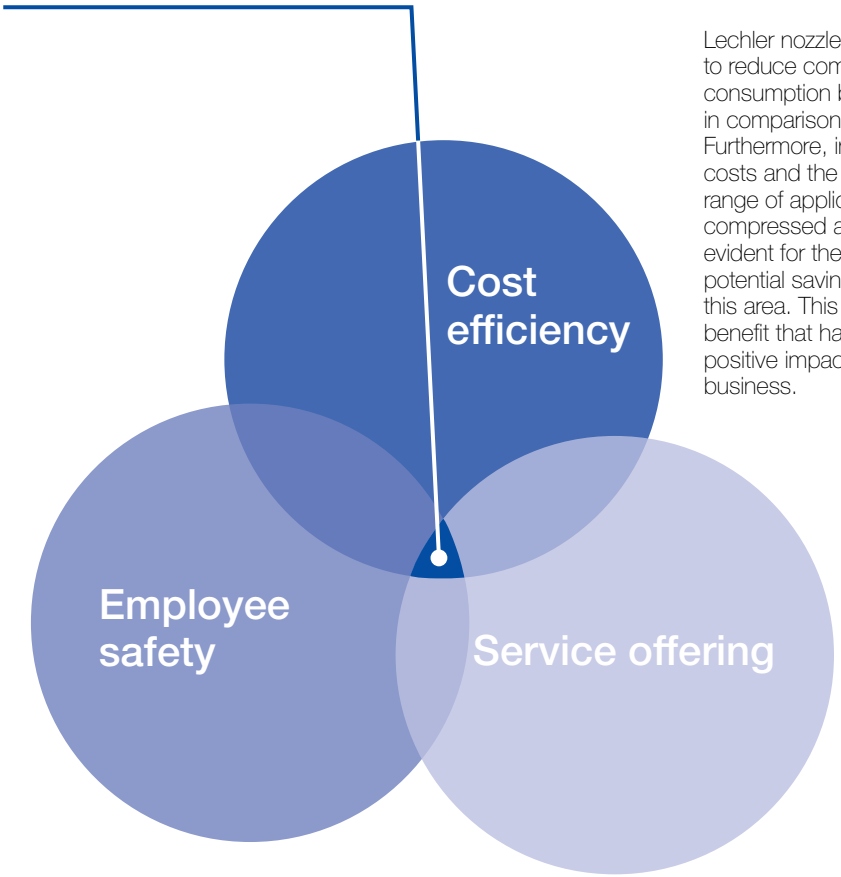
Your competent partner – worldwide

Lechler is headquartered in Metzingen, Germany but is represented all over the world with subsidiaries in the USA, Hungary, England, India, China, France, Belgium, Sweden, Finland, Spain and Italy as well as qualified agents in over 40 countries. We will help you solve your compressed air tasks — wherever you are in the world.

Your advantages

- Reduced noise level
- Lower operating air pressure with same blowing force
- Lower air consumption
- Improved blowing efficiency over larger distances
- Lower operating costs

THREE ADVANTAGES FOR YOU



Cost efficiency

Lechler nozzles make it possible to reduce compressed air consumption by up to 45%, in comparison with open pipes. Furthermore, increasing energy costs and the growing range of applications for compressed air become more evident for the impressive potential savings possible in this area. This is a competitive benefit that has a direct positive impact for your business.

Employee safety

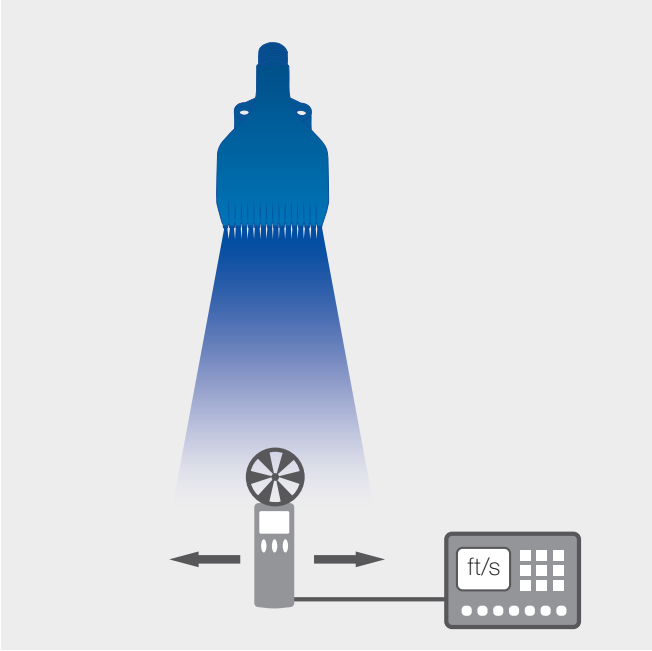
The unique design of our nozzles allows the noise level to be significantly reduced by up to 25 % in comparison with conventional solutions. This also reduces noise-related stress for your employees. Since concentration falls as a result of increased stress, use of low-noise nozzles has a positive effect on production quality.

Service offering

A perfect solution must be optimally tailored to the exact requirements. We will therefore gladly advise you in person about the use of compressed air nozzles and introduce you to new possibilities. Contact us and let us define the best possible solution together for improved quality and optimized process reliability.

MODERN NOZZLE TECHNOLOGY FOR GR
AND LESS NOISE

Spray pattern measurement

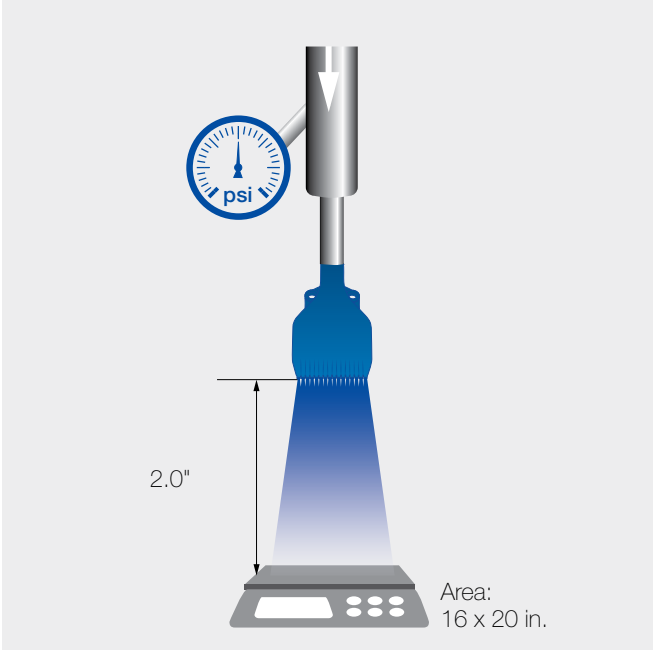


Larger measurable spray pattern

For the spray pattern measurement, the nozzles are clamped in a fixture specially designed for this purpose.
An anemometer (windmeter) moves through the air spray at right angles to the jet direction at previously defined distances and at different pressures. The wind speeds measured here define the spray (as specified on the product pages). An air speed of 2.5 m/s was defined as
the limit value on the basis of experience and flow calculations (CFD).

The compact design and unique form of our air nozzles allow for extremely high speeds at close range
as well as at larger throw distances.

Blowing force

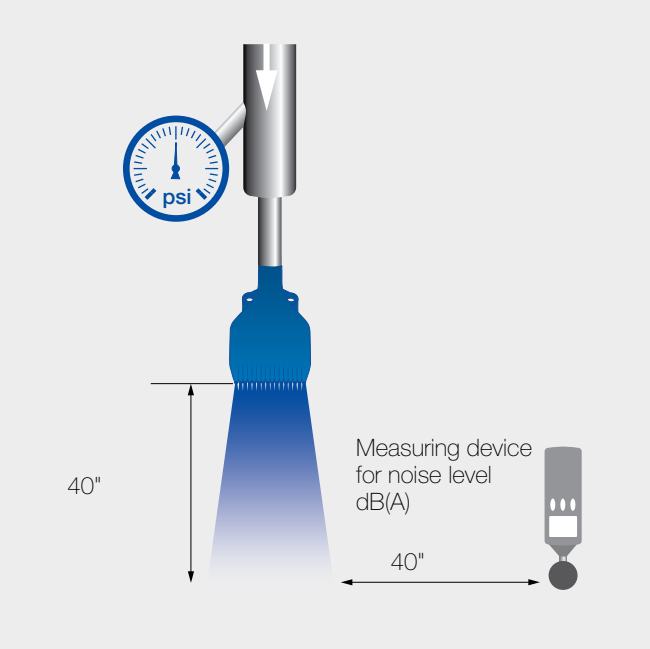


blowing force

In performance, the available blowing force is critical. Our measurements show that Lechler multi-channel nozzles achieve a high blowing force even at large distances.
Thanks to this benefit, our nozzle technology opens up new applications for use with compressed air.
Compared with conventional solutions, the competitive advantage that can be realized with Lechler nozzles is evident again.

EATER EFFICIENCY

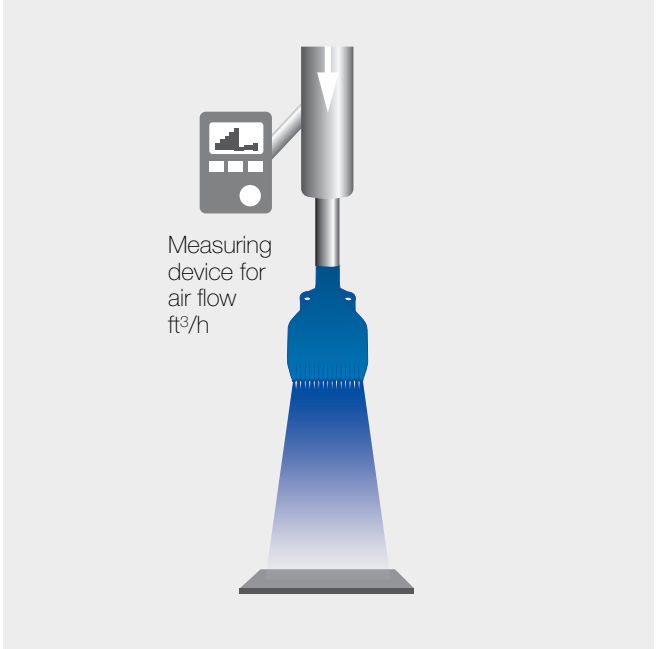
Noise level



Less measurable noise

Conventional air nozzles simply blow air through a hole. The resulting turbulence generates unpleasant, loud hissing noises. Such noises can trigger stress reactions among employees even at relatively low sound pressure levels, thereby impairing both concentration and performance.

Air consumption



Lower measurable air consumption

The generation of compressed air requires energy. Since the energy costs account for an increasingly large share of the overall costs of manufacturing a product, considerable savings can be achieved through the right nozzle selection.

Nozzles from Lechler are designed so that they need less compressed air than conventional nozzles, without compromising performance. As a result, our products help to make production processes more efficient and

Higher measurable

WHAT YOU SHOULD KEEP IN MIND

Difference between blowers and compressors

Jet pattern of air nozzles

Innovative nozzle design

Materials and connections

Gases

Operating medium steam

Cost savings and noise reduction in comparison to an open pipe

Difference between blowers and compressors

If the term BLOWER is used in fan technology, this normally describes equipment that delivers large gas quantities at low pressures. In contrast, a COMPRESSOR delivers low volume flows at high pressures.

Blowers are often used to make extraction and ventilation processes more efficient, e.g. to guarantee the supply of oxygen in combustion processes. In contrast, compressors are frequently used in everyday life. Whether it is inflating car tires or blowing off metal chips on a drill, compressors are used in a host of applications.

Lechler air nozzles make it possible to perform many different blowing-off and cleaning operations easily, efficiently and with low noise.

Spray pattern of air nozzles

Air nozzles are used for concentrated, targeted delivery of air or other gases. The nozzles used are normally flat jet or round jet nozzles. Air is also discharged at a specific angle. However, this is not comparable with that of liquids.

Air expands when it is discharged from the nozzle orifice, which leads to expansion of the jet. The spray angle is normally approx. 20°.

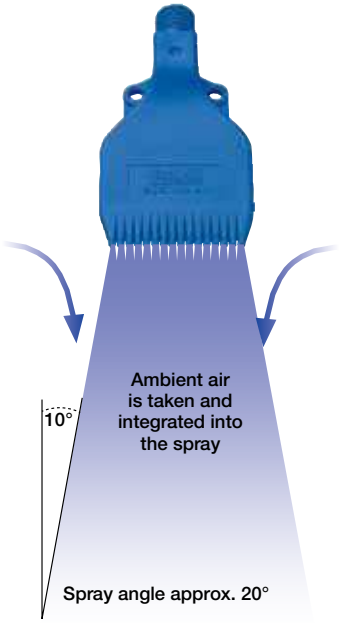


Figure 2: Spray expansion of an air nozzle

Innovative nozzle design

With conventional air nozzles, air is simply blown through a hole. The produced turbulence creates loud hissing noises. With our specially designed multi-channel air nozzles, we are able to focus and reduce this turbulence. The specially shaped orifices guide the supplied air uniformly into arranged air channels to ensure optimum flow behavior. This produces a uniform, aligned and powerful air stream. The decrease in turbulence results in lower noise emissions and also measurably reduces air consumption.

Materials and connections

Our standard materials for metal nozzles are brass and stainless steels: AISI 303, AISI 316L or AISI 316Ti.

Standard nozzles made of plastic are usually made from PP, PVDF or POM.

It is also important to choose the optimum material for seals. Viton, PTFE, EPDM or EWP are used, depending on the application.

Nozzles are manufactured primarily with threads according to ISO 228, DIN EN 10226 and NPT. A distinction is also made between sealing and non-sealing threads. In the case of non-sealing threads, PTFE tape or thread paste is used for sealing.

Lechler nozzles meet many different requirements of international organizations – including food grade compatibility and occupational safety.

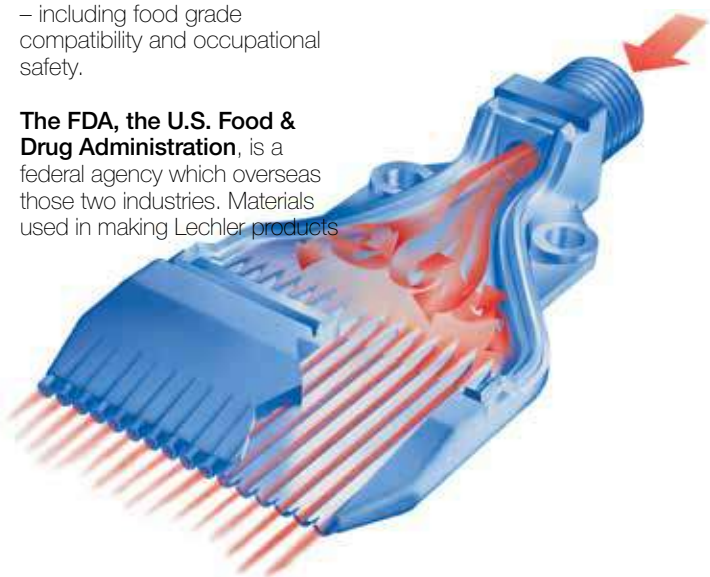
The FDA, the U.S. Food & Drug Administration, is a federal agency which overseas those two industries. Materials used in making Lechler products are compliant with the requirements of FDA regulation 21 CFR for use in food applications.

The regulation (EC) No. 1935/ 2004 of the European Parliament regulates general safety requirements to all food and beverage contact materials.

Within this regulation, it is additionally stipulated that plastics must comply with (EU) 10/2011.

The Occupational Safety and Health Administration (OSHA) is a US federal authority for prevention of accidents at work.

The respective logo on the product pages indicates which requirements are met.



Gases

The output of gases (i.e. air) is fundamentally different to the output of liquids. Gases are compressible fluids, whereas liquids are considered as incompressible fluids.

Gases can be supplied with practically all nozzles that can also be used for atomizing liquids. However, due to the compressibility and lower density of gases, gas sprays cannot be formed in the same way as with liquids. Gases tend to generate a significantly increased noise level under certain conditions (pressure and nozzle design).

The development of multi-channel nozzles with specially shaped nozzle orifices makes it possible to considerably reduce the turbulence in the nozzle that causes noise. In addition, this nozzle design increases blowing force
while at the same time reducing air consumption.

The speeds of gases can be very high under certain conditions. If a specific pressure difference is applied to a nozzle, speeds of approx. 1050 ft/s can often occur in the smallest cross section. This speed can even increase shortly after the gas leaves the nozzle. The illustration below shows the speed characteristic in a flow simulation.

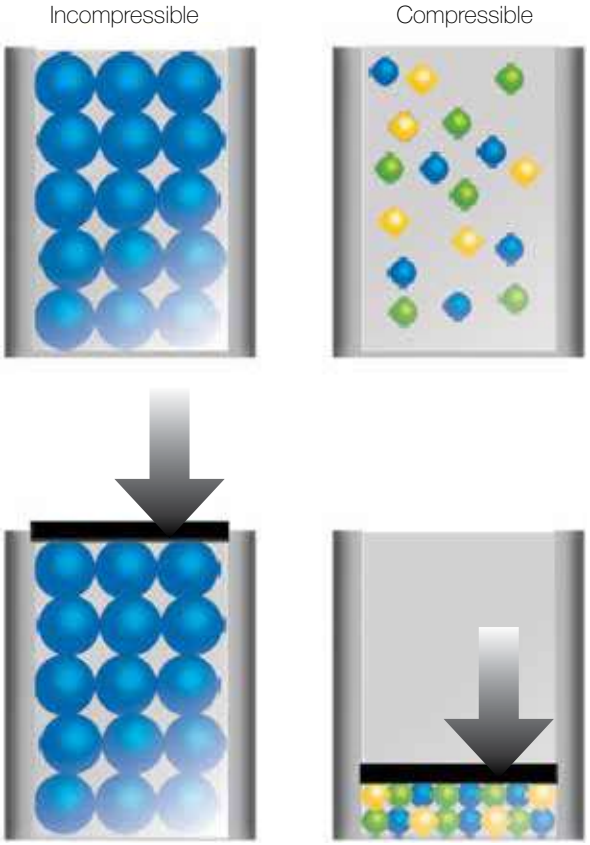


Figure 3: Compressibility behavior: Left water / right air

Operating medium steam

In general, steam must be considered as a gas. However, in certain cases, it must be treated differently to (i.e. air), especially with regards to flow characteristics. Since water is actually liquid under normal conditions, it changes its state of aggregation only subject to certain prerequisites; this means that the flow and thermodynamic properties of steam differ from those of gases. For example, the throughput of steam is always specified as a mass flow in practice. In contrast, gas throughputs are often specified as volume flows. However, one of the most important properties of steam is its density, (i.e.) maintenance of its gaseous state. If steam is pressurized, it can quickly lose its gaseous state at a given temperature and change to liquid state. This can already take place at moderate pressures and temperatures. Particular attention must be paid to this and other physical-chemical properties if it is desired to use steam as a medium for nozzles.

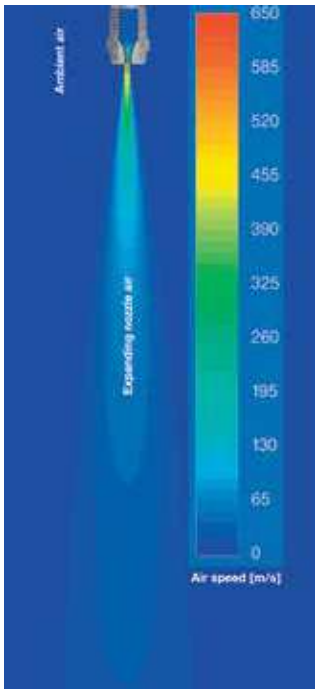


Figure 4: Representation of the speed curve of outflowing air

Cost savings and noise reduction in comparison to an open pipe

The use of compressed air has long been standard in companies. Whether for blowing off debris, sorting out defective parts or simply for drying products after washing. Companies frequently use simple pipes for this purpose. These can be purchased inexpensively and individually shaped and aligned for the specific application.

However, this may appear to be an inexpensive solution but usually is very uneconomical in the long run. Thanks to their unique design, the air consumption and noise level of Lechler air nozzles are significantly lower than for comparable open pipes with equivalent bore diameter. The use of Lechler air nozzles is not only a cost savings but it also protects the health and safety of your employees.

STAMM® SHOWER HEADERS

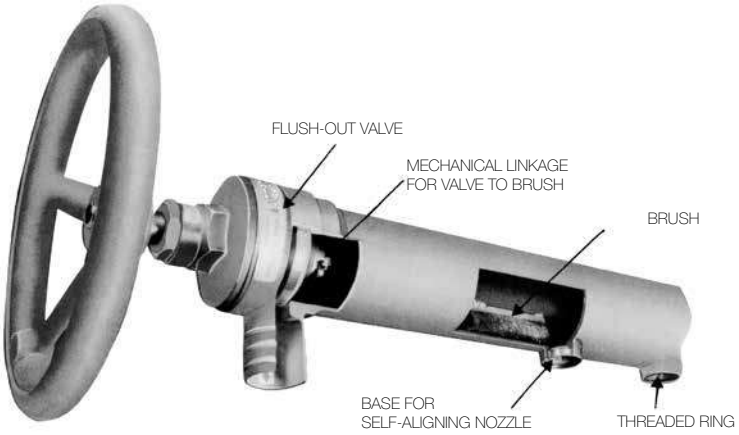
Engineered and manufactured by Lechler Inc. in the USA under license by the STAMM® Company in Germany, these shower headers with built-in cleaning device are recognized worldwide as the original "brush and flush" shower system.

Shower pipe and nozzles remain clog-free due to the unique flush system design.
A simple turn of the handwheel sweeps contaminants away from the nozzle orifices and directs the debris down the flush-out valve. Since these showers eliminate costly down time for cleaning, they are especially cost-effective in applications subject to high fluid contamination.
Some features of the self-cleaning shower system are:

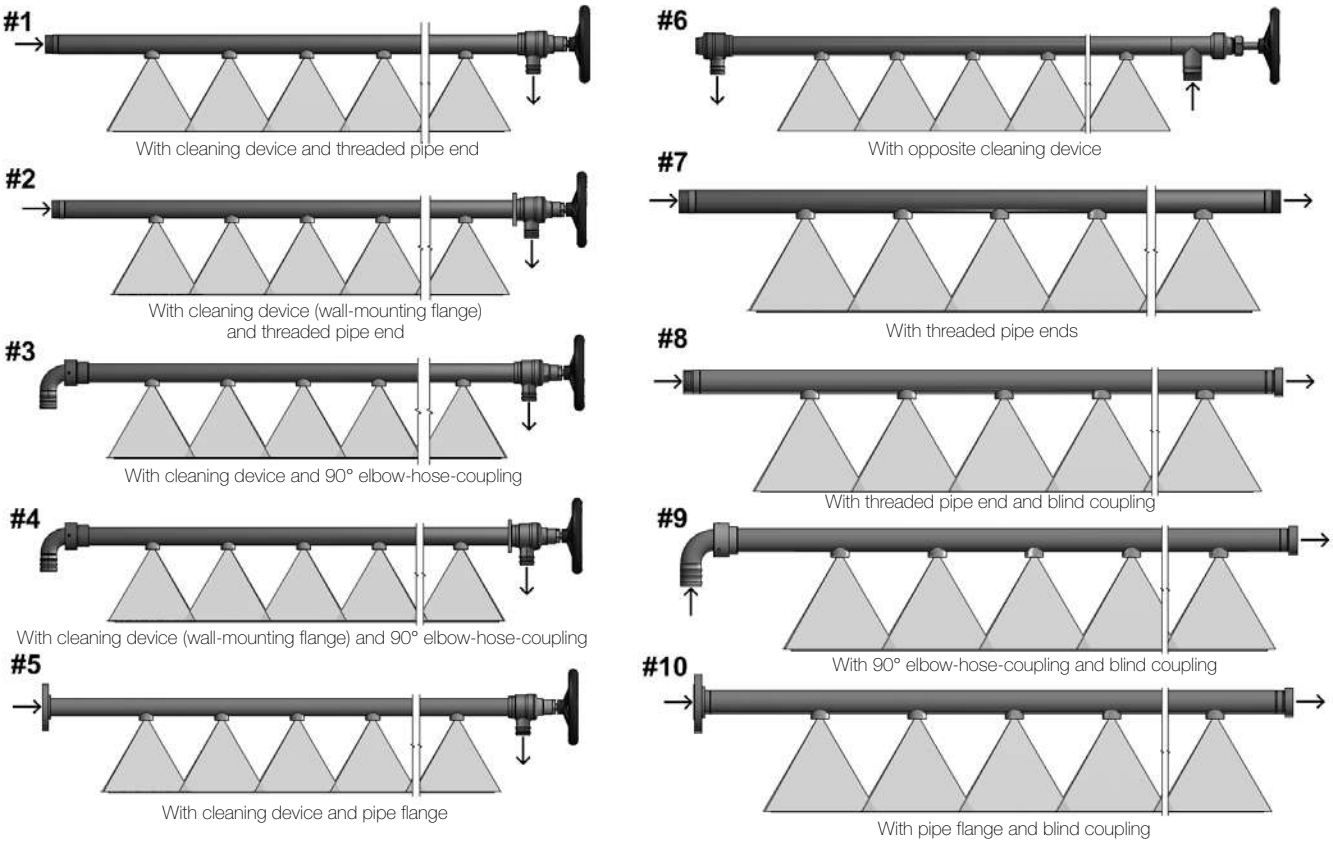
- Header pipe available in sizes from 1 1/2" to 6" in diameter.
- Contaminants flushed via special valve, preventing them from clogging orifices or reaching showered surface.
- System accommodates wide range of flow rates.
- Stainless steel construction throughout.
- Highly efficient, interchangeable nozzles are self-aligning.
- Systems are tailored to your specific application.

Refer to the next page for a selection of nozzles specifically designed for use in STAMM® showers.

Typical applications:
- Cleaning of wires and felts
- Humidification
- Knock-off
- Lubrication



Standard shower models (Other configurations also available; note that models #7–10 have no cleaning device)

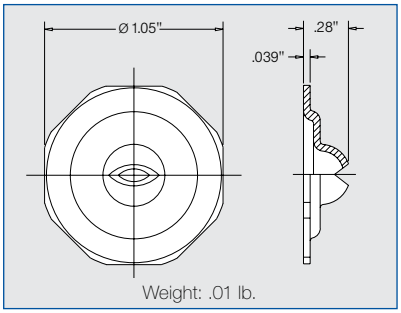


SERIES 626 / 5SW

Designed specifically for STAMM® shower headers, these nozzles can serve as replacements or to change the flow rate of an existing unit. Self aligning when used with STAMM® or Lechler bases. 317 LN stainless steel construction for long service life. Available in 60°, 30°, and 15° flat fans or 0° solid stream ("needle jet") versions.

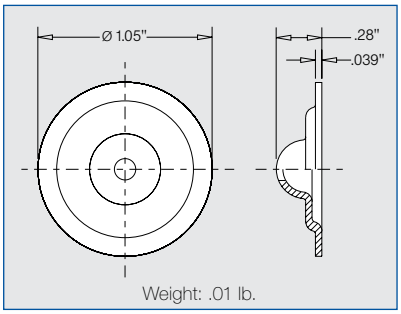
Applications:
- For use on STAMM® showers
- Paper production
- Belt filter press cleaning in wastewater treatment

∢ 15°–60°



Weight: .01 lb.

∢ 0°



Weight: .01 lb.

Notes: Also available upon request are: (1) nozzles with other flow rates and (2) solid stream nozzles (0°) with a ruby tip orifice. The number in the Equiv. Orifice Diam. column represents the Nozzle # and spray angle stamped on each nozzle; e.g., the nozzle stamped 1.0 / 60 refers to 626.364.1F.37. Lechler has blank shower nozzles with no orifices which can be used on STAMM® showers when a particular nozzle opening needs to be blocked. The part number for this blank nozzle is **006.261.1F.00**.

Spray angle ∢	Ordering no.	Equiv. Orifice Diam. (mm)	Flow Rate (Gallons Per Minute) 40 psi	60 psi	100 psi	150 psi	250 psi	500 psi	1000 psi
60°	**626. 364. 1F. 37**	1.0	.20	.24	.31	.38	.49	.69	.98
	626. 404. 1F. 37	1.2	.31	.38	.49	.60	.77	1.1	1.6
	626. 464. 1F. 37	1.5	.50	.61	.79	.96	1.2	1.8	2.5
	626. 564. 1F. 37	2.0	.77	.95	1.2	1.5	1.9	2.7	3.9
	626. 644. 1F. 37	2.5	1.2	1.5	2.0	2.4	3.1	4.4	6.2
	626. 724. 1F. 37	3.0	2.0	2.4	3.1	3.8	4.9	6.9	9.8
	626. 804. 1F. 37	4.0	3.1	3.8	4.9	6.0	7.8	11.0	15.5
	626. 884. 1F. 37	5.0	4.9	6.0	7.8	9.6	12.3	17.4	25
	626. 964. 1F. 37	6.0	7.8	9.5	12.3	15.0	19.4	27	39
	627. 004. 1F. 37	7.0	9.8	12.0	15.5	18.9	24	35	49
	627. 044. 1F. 37	8.0	12.4	15.2	19.6	24	31	44	62
30°	**626. 362. 1F. 37**	1.0	.20	.24	.31	.38	.49	.69	.98
	626. 482. 1F. 37	1.5	.50	.61	.79	.96	1.2	1.8	2.5
	626. 562. 1F. 37	2.0	.77	.95	1.2	1.5	1.9	2.7	3.9
	626. 642. 1F. 37	2.5	1.2	1.5	2.0	2.4	3.1	4.4	6.2
	626. 722. 1F. 37	3.0	2.0	2.4	3.1	3.8	4.9	6.9	9.8
	626. 802. 1F. 37	4.0	3.1	3.8	4.9	6.0	7.8	11.0	15.5
	626. 882. 1F. 37	5.0	4.9	6.0	7.8	9.6	12.3	17.4	25
15°	**626. 361. 1F. 37**	1.0	.20	.24	.31	.38	.49	.69	.98
	626. 561. 1F. 37	2.0	.77	.95	1.2	1.5	1.9	2.7	3.9
	626. 721. 1F. 37	3.0	2.0	2.4	3.1	3.8	4.9	6.9	9.8
0°	**5SW. 300. 1F. 00**	0.7	.09	.11	.14	.17	.22	.31	.44
	5SW. 320. 1F. 00	0.8	.13	.15	.20	.24	.32	.45	.63
	5SW. 340. 1F. 00	0.9	.15	.19	.25	.30	.39	.55	.77
	5SW. 360. 1F. 00	1.0	.20	.24	.31	.38	.49	.69	.98
	5SW. 390. 1F. 00	1.2	.31	.38	.49	.60	.77	1.1	1.6
	5SW. 460. 1F. 00	1.5	.50	.61	.79	.96	1.2	1.8	2.5
	5SW. 540. 1F. 00	2.0	.77	.95	1.2	1.5	1.9	2.7	3.9
	5SW. 620. 1F. 00	2.5	1.2	1.5	2.0	2.4	3.1	4.4	6.2
	5SW. 680. 1F. 00	3.0	2.0	2.4	3.1	3.8	4.9	6.9	9.8
	5SW. 780. 1F. 00	4.0	3.1	3.8	4.9	6.0	7.8	11.0	15.5
	5SW. 860. 1F. 00	5.0	4.9	6.0	7.8	9.6	12.3	17.4	25

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan nozzles

Series 632 / 633

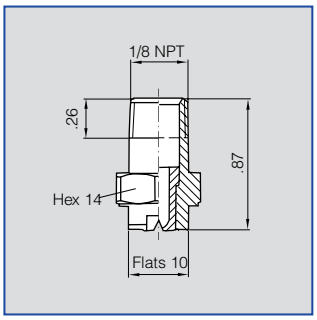
Standard design with high-precision spray angle, exact flow rate, and extremely narrow spray depth, achieved through close manufacturing tolerances. Parabolic distribution of liquid ensures that spray pipes equipped with these nozzles show an extremely uniform total liquid distribution. Conical, self-sealing thread connection. The design of spray headers is very easy due to the thread connection of the nozzles. The entire product range is available at short notice, due to the modular design.

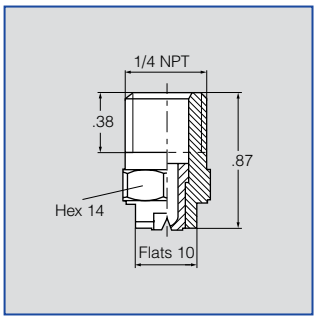
Applications:
Cleaning, pickling, coating, surface treatment, rinsing.

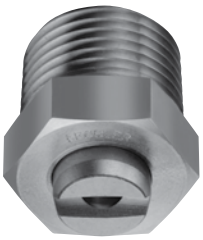
Mat. no. 17 (∢ 20°-75°)

Mat. no. 17 (∢ 90°-120°)

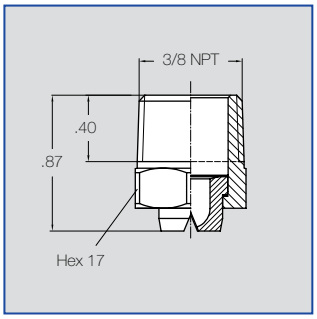
Mat no. 5E

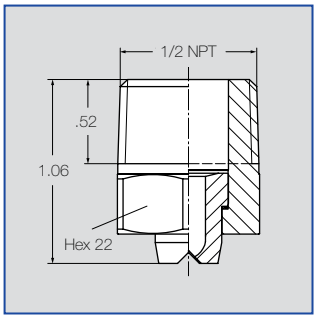






3/8" or 1/2" version





Spray angle	Ordering no.							Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=30 psi	
	Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Connection Male NPT		3/8"				10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	H=10"	H=20"
20°	**632. 441**	○	○	**BA**	**BC**	-	-	.053	.043	.19*	.27	1.3	.39	.48	.55	.61	3	6
	632. 481	○	○	**BA**	**BC**	-	-	.059	.047	.25*	.35	1.6	.50	.61	.70	.78	3	6
30°	**632. 482**	○	○	**BA**	**BC**	-	-	.059	.043	.25*	.35	1.6	.50	.61	.70	.78	5	9
	632. 562	○	○	**BA**	**BC**	-	-	.079	.059	.39	.55	2.5	.78	.95	1.1	1.2	5	9
	632. 642	○	-	-	**BC**	-	-	.099	.071	.62	.88	4.0	1.2	1.5	1.8	2.0	5	9
	632. 722	○	-	-	**BC**	-	-	.118	.095	.98	1.4	6.3	2.0	2.4	2.8	3.1	5	9
	632. 762	○	-	-	**BC**	-	-	.138	.106	1.1	1.5	8.0	2.6	3.3	4.0	4.7	5	10
	632. 802	○	-	-	**BC**	-	-	.158	.122	1.6	2.2	10.0	3.1	3.8	4.4	4.9	5	10

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.
*differing spray pattern
Subject to technical modifications.

Continued on next page.

Example of ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	632. 441	+	**17**	+	**BC**	=	**632. 441. 17. BC**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan nozzles

Series 632 / 633

Spray angle	Ordering no.							Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=psi	
	Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Connection Male NPT ⅛1/8"	1/4"	3/8"	1/2"			10 psi	20 psi	2 bar (liters per minute)	40 psi	60 psi	80 psi	100 psi	H=10"	H=20"
45°	**632. 483**	○	○	**BA**	**BC**	-	-	.059	.043	.25*	.35	1.6	.50	.61	.70	.78	7	13
	632. 563	○	○	**BA**	**BC**	-	-	.079	.055	.39	.55	2.5	.78	.95	1.1	1.2	7	14
	632. 643	○	○	**BA**	**BC**	-	-	.098	.071	.53	.75	4.0	1.3	1.7	2.0	2.4	8	15
	632. 673	○	-	-	**BC**	**BE**	-	.106	.083	.74	1.0	4.8	1.5	1.8	2.1	2.3	8	15
	632. 723	○	-	-	**BC**	**BE**	-	.118	.095	.98	1.4	6.3	2.0	2.4	2.8	3.1	8	15
	632. 763	○	-	-	**BC**	**BE**	-	.138	.102	1.1	1.5	8.0	2.6	3.3	4.0	4.7	8	15
	632. 803	○	-	-	**BC**	**BE**	**BG**	.158	.118	1.6	2.2	10.0	3.1	3.8	4.4	4.9	8	15
	632. 843	○***	-	-	**BC**	-	**BG**	.177	.138	1.9	2.7	12.5	3.9	4.8	5.5	6.1	8	15
	632. 883	○	-	-	-	-	**BG**	.197	.157	2.5	3.5	16.0	5.0	6.1	7.0	7.9	9	17
	632. 923	○	-	-	-	-	**BG**	.217	.165	3.1	4.4	20.0	6.2	7.6	8.8	9.8	9	17
	632. 963	○	-	-	-	-	**BG**	.236	.185	3.9	5.5	25.0	7.8	9.5	11.0	12.3	9	17
60°	**632. 484**	○	○	**BA**	**BC**	-	-	.059	.039	0.2*	0.4	1.6	0.5	0.6	0.7	0.8	10	20
	632. 514	○	○	**BA**	**BC**	-	-	.065	.043	0.3*	0.4	1.9	0.6	0.7	0.8	0.9	11	20
	632. 564	○	○	**BA**	**BC**	-	-	.079	.051	0.4	0.5	2.5	0.8	1.0	1.1	1.2	11	21
	632. 604	○	○	**BA**	**BC**	-	-	.087	.059	0.5	0.7	3.2	1.0	1.2	1.4	1.6	11	22
	632. 644	○	○**	-	**BC**	**BE**	-	.099	.063	0.6	0.9	4.0	1.2	1.5	1.8	2.0	12	22
	632. 674	○	○**	-	**BC**	**BE**	-	.106	.071	0.7	1.1	4.8	1.5	1.8	2.1	2.4	12	23
	632. 724	○	○**	-	**BC**	**BE**	-	.118	.083	1.0	1.4	6.3	2.0	2.4	2.8	3.1	12	23
	632. 764	○	-	-	**BC**	**BE**	-	.138	.091	1.2	1.8	8.0	2.5	3.0	3.5	3.9	12	23
	632. 804	○***	○**	-	**BC**	-	**BG**	.158	.102	1.6	2.2	10.0	3.1	3.8	4.4	4.9	12	23
	632. 844	○***	○**	-	**BC**	-	**BG**	.177	.118	1.9	2.7	12.5	3.9	4.8	5.5	6.1	12	23
	632. 884	○***	○**	-	**BC**	-	**BG**	.197	.134	2.5	3.5	16.0	5.0	6.1	7.0	7.8	12	22
	632. 924	○	-	-	-	-	**BG**	.217	.165	3.1	4.4	20.0	6.2	7.6	8.8	9.8	13	25
	632. 964	○	-	-	-	-	**BG**	.236	.185	3.9	5.5	25.0	7.8	9.5	11.0	12.3	13	25
	633. 004	○	-	-	-	-	**BG**	.276	.205	4.9	6.9	31.5	9.8	12.0	13.8	15.5	13	25
	633. 044	○	-	-	-	-	**BG**	.315	.217	6.2	8.8	40.0	12.4	15.2	17.6	19.6	13	25
	633. 084	○	-	-	-	-	**BG**	.354	.268	7.8	11.0	50.0	15.5	19.0	21.9	24.5	13	25
90°	**632. 566**	○	○	**BA**	**BC**	-	-	.079	.043	0.4	0.5	2.5	0.8	1.0	1.1	1.2	18	33
	632. 606	○	○	**BA**	**BC**	-	-	.087	.047	0.5	0.7	3.2	1.0	1.2	1.4	1.6	18	34
	632. 646	○	○**	-	**BC**	**BE**	-	.098	.051	0.6	0.9	4.0	1.2	1.5	1.8	2.0	18	34
	632. 676	○	○**	-	**BC**	**BE**	-	.106	.055	0.7	1.1	4.8	1.5	1.8	2.1	2.4	18	34
	632. 726	○	○**	-	**BC**	**BE**	-	.118	.067	1.0	1.4	6.3	2.0	2.4	2.8	3.1	18	34
	632. 766	○	○**	-	**BC**	**BE**	-	.138	.075	1.2	1.8	8.00	2.5	3.0	3.5	3.9	19	35
	632. 806	○***	○**	-	**BC**	-	**BG**	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	19	35
	632. 846	○***	○**	-	**BC**	-	**BG**	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	19	35
	632. 886	○***	○**	-	**BC**	-	**BG**	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.8	19	36
	632. 926	○	-	-	-	-	**BG**	.217	.165	3.1	4.4	20.0	6.2	7.6	8.8	9.8	21	40
	632. 966	○	-	-	-	-	**BG**	.236	.185	3.9	5.5	25.0	7.8	9.5	11.0	12.3	21	40

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Continued on next page.

*differing spray pattern
**only available with code BC
***only available with code BG
Subject to technical modifications.

Example of ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	632. 483	+	**17**	+	**BA**	=	**632. 483. 17. BA**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan nozzles

Series 632 / 633

Spray angle	Ordering no.							Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=30 psi	
	Type	Mat. no. 17[1] AISI 316Ti / AISI 316L	Mat. no. 5E PVDF	Connection Male NPT ⅛1/8"	1/4"	⅜3/8"	½1/2"			10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	H=10"	H=20"
120°	**632.607**	○	-	**BA**	**BC**	-	-	.087	.043	.49	.69	3.2	.98	1.2	1.4	1.5	27	51
	632.647	○***	○**	-	**BC**	**BE**	-	.099	.051	.62	.88	4.0	1.2	1.5	1.8	2.0	27	51
	632.677	○***	○**	-	**BC**	**BE**	-	.106	.055	.74	1.0	4.8	1.5	1.8	2.1	2.3	28	52
	632.727	○***	○**	-	**BC**	**BE**	-	.118	.063	.98	1.4	6.3	2.0	2.4	2.8	3.1	29	54
	632.767	○	-	-	**BC**	**BE**	-	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	30	55
	632.807	○	-	-	**BC**	-	**BG**	.158	.079	1.6	2.2	10.0	3.1	3.8	4.4	4.9	31	57
	632.847	○	-	-	**BC**	-	**BG**	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	31	57
	632.887	○	-	-	-	-	**BG**	.197	.102	2.5	3.5	16.	5.0	6.1	7.0	7.9	31	57
	632.927	○	-	-	-	-	**BG**	.217	.114	3.1	4.4	20.0	6.2	7.6	8.8	9.8	31	57

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

*differing spray pattern
**only available with conn. BC
***only available with conn. BG
Subject to technical modifications.

Example of ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	632. 607	+	**17**	+	**BA**	=	**632. 607. 17. BA**

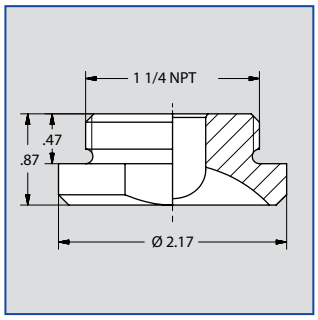
Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

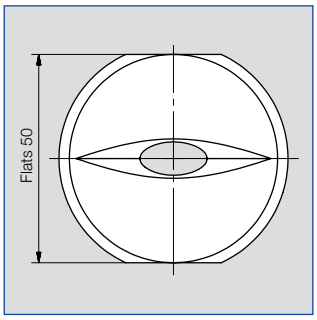
Flat fan nozzles

Series 621

Parabolic distribution of liquid.

Applications:
Cleaning, pickling, surface treatment, rinsing.





Spray angle	Ordering no. Type	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
20°	**621. 121**	○	.315	.256	9.8	13.8	63	19.5	23.9	27.6	30.9	5	8
45°	**621. 123**	○	.394	.287	9.8	13.8	63	19.5	23.9	27.6	30.9	10	19
	621. 203	○	.472	.386	15.5	21.9	100	31.0	38.0	43.9	49.1	10	19
	621. 243	○	.524	.402	19.4	27.4	125	38.8	47.5	54.9	61.3	10	19
	621. 263	○	.559	.417	21.7	30.7	140	43.4	53.2	61.4	68.7	10	19
	621. 283	○	.591	.453	24.8	35.1	160	49.6	60.8	70.2	78.5	10	19
	621. 343	○	.709	.567	34.8	49.1	224	69.5	85.1	98.3	109.9	10	19
60°	**621. 124**	○	.394	.291	9.8	13.8	63	19.5	23.9	27.6	30.9	13	25
	621. 204	○	.472	.374	15.5	21.9	100	31.0	38.0	43.9	49.1	13	25
	621. 284	○	.591	.370	24.8	35.1	160	49.6	60.8	70.2	78.5	13	25
90°	**621. 126**	○	.394	.256	9.8	13.8	63	19.5	23.9	27.6	30.9	21	40
	621. 206	○	.472	.343	15.5	21.9	100	31.0	38.0	43.9	49.1	21	40
	621. 286	○	.591	.470	24.8	35.1	160	49.6	60.8	70.2	78.5	21	40

incl. gasket 062.140.72.00 (Material: EWP 210)

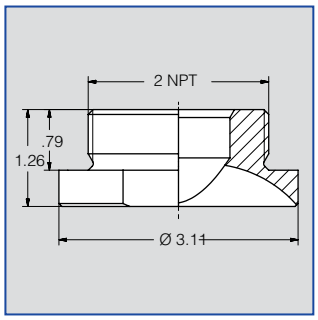
Example of ordering:	**Type** **621. 121**	**+**	**Material no.** **5E**	**=**	**Ordering no.** **621. 121. 5E**

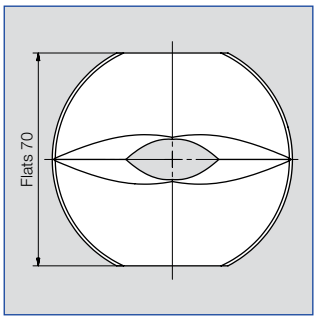
Flat fan nozzles

Series 625

Parabolic distribution of liquid. Headers, equipped with these nozzles, show a highly uniform total distribution of liquids, even at different installation heights and centers.

Applications:
Cleaning, pickling, surface treatment, rinsing.





Spray angle	Ordering no. Type	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
20°	**625. 301**	○	.630	.520	23.8	33.5	180	58.1	75.3	89.0	106.2	5	8
	625. 321	○	.669	.559	26.4	37.2	200	64.7	83.5	98.8	118.1	5	8
	625. 361	○	.748	.642	33.0	46.8	250	80.8	104.3	123.6	147.7	5	8
	625. 421	○	.886	.756	48.3	68.2	365	118.1	152.4	180.4	215.6	5	8
	625. 451	○	.965	.823	56.3	79.5	425	137.6	177.5	210.0	251.0	5	8
60°	**625. 404**	○	.827	.520	41.7	58.9	315	102.0	131.6	155.6	186.0	13	25
	625. 454	○	.965	.638	56.3	79.5	425	137.6	177.5	210.0	251.0	13	25
120°	**625. 367**	○	.748	.591	33.0	46.8	250	80.8	104.3	123.6	147.7	32	57
	625. 407	○	.827	.709	41.7	58.9	315	102.0	131.6	155.6	186.0	32	57
	625. 427	○	.886	.709	48.3	68.2	365	118.1	152.4	180.4	215.6	32	57

Incl. gasket 062.540.72.00 (Material: EWP 210)

Example of ordering:	Type	+	Material no.	=	Ordering no.
	625. 301	+	**5E**	=	**625. 301. 5E**

Flat fan nozzles for retaining nut

Series 652

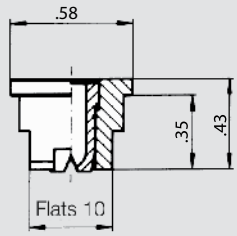
Assembly with retaining nut. Easy nozzle changing, simple jet alignment. Parabolic distribution of liquid. Spray pipes equipped with these nozzles show an extremely uniform total liquid distribution.

Applications:
Cleaning, surface treatment, pickling, rinsing.

Mat. no. 17
(∢ 20°-60°)

Mat. no. 17
(∢ 90°-120°)

PVDF



Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
20°	**652. 441**	○	○	.053	.043	.19*	.27	1.3	.39	.48	.55	.61	3	5
	652. 481	○	○	.059	.047	.25	.35	1.6	.50	.61	.70	.78	3	5
30°	**652. 482**	○	○	.059	.043	.25*	.35	1.6	.50	.61	.70	.78	5	9
	652. 562	○	○	.079	.059	.39	.55	2.5	.78	.95	1.1	1.2	5	9
	652. 642	○	-	.099	.071	.62	.88	4.0	1.2	1.5	1.8	2.0	5	9
	652. 722	○	-	.118	.095	.98	1.4	6.3	2.0	2.4	2.8	3.1	5.	9
	652. 762	○	-	.138	.106	1.2	1.8	8.0	2.5	3.0	3.5	3.9	5	9
	652. 802	○	-	.158	.122	1.6	2.2	10.0	3.1	3.8	4.4	4.9	5	9
45°	**652. 483**	○	○	.059	.043	.25*	.35	1.6	.50	.61	.70	.78	7	13
	652. 563	○	○	.079	.055	.39	.55	2.5	.78	.95	1.1	1.2	7	13
	652. 643	○	○	.099	.071	.62	.88	4.0	1.2	1.5	1.8	2.0	7	14
	652. 723	○	-	.118	.095	.98	1.4	6.3	2.0	2.4	2.8	3.1	7	14
	652. 763	○	-	.138	.102	1.2	1.8	8.0	2.5	3.0	3.5	3.9	7	14
	652. 803	○	-	.158	.118	1.6	2.2	10.0	3.1	3.8	4.4	4.9	8	14
60°	**652. 484**	○	○	.059	.039	.25*	.35	1.6	.50	.61	.70	.78	11	21
	652. 514	○	○	.065	.43	.29	.42	1.9	.59	.72	.83	.93	11	21
	652. 564	○	○	.079	.051	.39	.55	2.5	.78	.95	1.1	1.2	11	21
	652. 604	○	○	.087	.059	.49	.69	3.2	.98	1.2	1.4	1.5	11	20
	652. 644	○	○	.099	.063	.62	.88	4.0	1.2	1.5	1.8	2.0	11	20
	652. 674	○	○	.106	.071	.74	1.0	4.8	1.5	1.8	2.1	2.3	11	20
	652. 724	○	○	.118	.083	.98	1.4	6.3	2.0	2.4	2.8	3.1	11	20
	652. 764	○	-	.138	.091	1.2	1.8	8.0	2.5	3.0	3.5	3.9	11	20
	652. 804	○	○	.158	.102	1.6	2.2	10.0	3.1	3.8	4.4	4.9	11	20
	652. 844	-	○	.177	.118	1.9	2.7	12.5	3.9	4.8	5.5	6.1	11	20
90°	**652. 566**	○	○	.079	.043	.39	.55	2.5	.78	.95	1.1	1.2	18	22
	652. 606	○	○	.087	.047	.49	.69	3.2	.98	1.2	1.4	1.5	18	32
	652. 646	○	○	.099	.051	.62	.88	4.0	1.2	1.5	1.8	2.0	18	32
	652. 676	○	○	.106	.055	.74	1.0	4.8	1.5	1.8	2.1	2.3	18	32
	652. 726	○	○	.118	.067	.98	1.4	6.3	2.0	2.4	2.8	3.1	18	32
	652. 766	○	-	.138	.075	1.2	1.8	8.0	2.5	3.0	3.5	3.9	18	32
	652. 806	○	○	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	18	32
	652. 846	-	○	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	18	32
	652. 886	-	○	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.8	18	33
120°	**652. 607**	○	○	.087	.043	.49	.69	3.2	.98	1.2	1.4	1.5	27	51
	652. 647	○	-	.099	.051	.62	.88	4.0	1.2	1.5	1.8	2.0	27	51
	652. 677	○	-	.106	.055	.74	1.0	4.8	1.5	1.8	2.1	2.3	27	51
	652. 727	○	○	.118	.063	.98	1.4	6.3	2.0	2.4	2.8	3.1	27	52
	652. 767	○	-	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	28	52
	652. 847	-	○	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	31	57
	652. 887	-	○	.197	.102	2.5	3.5	16.0	5.0	6.1	7.0	7.8	31	57

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.A · *differing spray pattern

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Example of ordering:	Type	+	Material no.	= Ordering no.
	652. 441	+	17	= 652. 441. 17

Flat fan dovetail nozzles

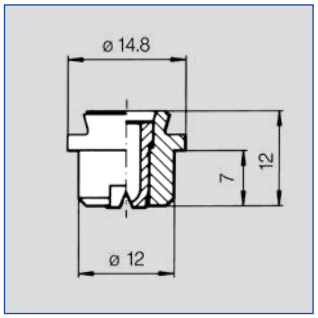
Series 660

Assembly with retaining nut. Automatic jet alignment due to dovetail guide. Stable spray angle. Parabolic distribution of liquid. Spray pipes with these nozzles show an extremely uniform total liquid distribution.

Applications:
Cleaning, pickling, coating, rinsing.

Mat. no. 17

Mat. no. 5E



Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
45°	**660. 443**	○	○	.053	.039	0.2	0.3	1.25	0.4	0.5	0.5	0.6	7	13
	660. 483	○	○	.059	.043	0.2	0.4	1.6	0.5	0.6	0.7	0.8	7	13
	660. 513	○	○	.065	.047	0.3	0.4	1.90	0.6	0.7	0.8	0.9	7	14
	660 .563	○	○	.079	.055	0.4	0.5	2.5	0.8	1.0	1.1	1.2	7	14
	660. 603	○	○	.087	.063	0.5	0.7	3.15	1.0	1.2	1.4	1.5	7	14
	660. 643	○	○	.099	.071	0.6	0.9	4.0	1.2	1.5	1.8	2.0	7	14
	660. 673	○	○	.106	.079	0.7	1.0	4.75	1.5	1.8	2.1	2.3	7	14
	660. 723	○	○	.118	.094	1.0	1.4	6.30	2.0	2.4	2.8	3.1	7	14
	660. 763	○	○	.138	.102	1.2	1.8	8.00	2.5	3.0	3.5	3.9	7	14
	660. 803	○	○	.157	.118	1.6	2.2	10.00	3.1	3.8	4.4	4.9	7	14
	660. 843	○	○	.177	.134	1.9	2.7	12.50	3.9	4.8	5.5	6.1	7	14
	660. 883	○	○	.197	.150	2.5	3.5	16.00	5.0	6.1	7.0	7.8	7	14
	660. 923	○	○	.217	.165	3.1	4.4	20.00	6.2	7.6	8.8	9.8	7	14
60°	**660. 484**	○	○	.059	.039	0.2	0.4	1.6	0.5	0.6	0.7	0.8	11	21
	660. 514	○	○	.065	.043	0.3	0.4	1.9	0.6	0.7	0.8	0.9	11	21
	660. 564	○	○	.079	.051	0.4	0.5	2.5	0.8	1.0	1.1	1.2	11	21
	660. 604	○	○	.087	.059	0.5	0.7	3.2	1.0	1.2	1.4	1.6	11	21
	660. 644	○	○	.099	.063	0.6	0.9	4.0	1.2	1.5	1.8	2.0	11	21
	660. 674	○	○	.106	.071	0.7	1.0	4.75	1.5	1.8	2.1	2.3	11	21
	660. 724	○	○	.118	.083	1.0	1.4	6.3	2.0	2.4	2.8	3.1	11	20
	660. 764	○	○	.138	.091	1.2	1.8	8.00	2.5	3.0	3.5	3.9	11	20
	660. 804	○	○	.158	.102	1.6	2.2	10.0	3.1	3.8	4.4	4.9	11	20
	660. 844	○	○	.177	.118	1.9	2.7	12.50	3.9	4.8	5.5	6.1	11	20
	660. 884	○	○	.197	.134	2.5	3.5	16.00	5.0	6.1	7.0	7.8	11	20
	660. 924	○	○	.217	.161	3.1	4.4	20.00	6.2	7.6	8.8	9.8	11	20
75°	**660. 565**	○	○	.079	.043	0.4	0.5	2.50	0.8	1.0	1.1	1.2	14	25
	660. 645	○	○	.098	.051	0.6	0.9	4.00	1.2	1.5	1.8	2.0	14	25
	660. 725	○	○	.118	.067	1.0	1.4	6.30	2.0	2.4	2.8	3.1	14	25
	660. 765	○	○	.138	.075	1.2	1.8	8.00	2.5	3.0	3.5	3.9	14	25
	660. 805	○	○	.157	.094	1.6	2.2	10.00	3.1	3.8	4.4	4.9	14	25
	660. 845	○	○	.177	.102	1.9	2.7	12.50	3.9	4.8	5.5	6.1	14	25
	660. 885	○	○	.197	.122	2.5	3.5	16.00	5.0	6.1	7.0	7.8	14	25
	660. 925	○	○	.217	.142	3.1	4.4	20.00	6.2	7.6	8.8	9.8	14	25

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Continued on next page.

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan dovetail nozzles

Series 660

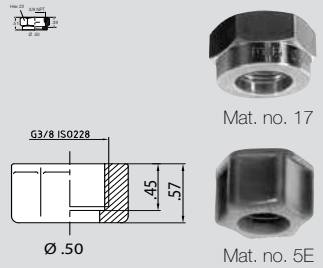
Spray angle	Ordering no.			Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=30 psi	
	Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF			10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	H=10"	H=20"
90°	**660. 566**	○	○	.079	.043	0.4	0.5	2.5	0.8	1.0	1.1	1.2	20	36
	660. 606	○	○	.087	.047	0.5	0.7	3.2	1.0	1.2	1.4	1.6	20	36
	660. 646	○	○	.099	.051	0.6	0.9	4.0	1.2	1.5	1.8	2.0	19	36
	660. 674	○	○	.106	.142	0.7	1.0	4.75	1.5	1.8	2.1	2.3	19	36
	660. 726	○	○	.118	.067	1.0	1.4	6.3	2.0	2.4	2.8	3.1	19	35
	660. 766	○	○	.138	.075	1.2	1.8	8.00	2.5	3.0	3.5	3.9	19	34
	660. 806	○	○	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	19	34
	660. 846	○	○	.177	.094	1.9	2.7	12.5	3.9	4.8	5.5	6.1	19	19
	660. 886	○	○	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.8	19	19
	660. 926	○	○	.217	.142	3.1	4.4	20.0	6.2	7.6	8.8	9.8	19	19
120°	**660. 607**	○	○	.087	.043	0.5	0.7	3.2	1.0	1.2	1.4	1.6	27	51
	660. 647	○	○	.099	.051	0.6	0.9	4.0	1.2	1.5	1.8	2.0	28	51
	660. 677	○	○	.106	.055	0.7	1.1	4.8	1.5	1.8	2.1	2.4	29	52
	660. 727	○	○	.118	.063	1.0	1.4	6.4	2.0	2.4	2.8	3.1	29	52
	660. 767	○	○	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	31	52
	660. 807	○	○	.158	.079	1.6	2.2	10.0	3.1	3.8	4.4	4.9	31	53
	660. 847	○	○	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	31	52
	660. 887	○	○	.197	.102	2.5	3.5	16.0	5.0	6.1	7.0	7.8	31	52
	660. 927	○	○	.197	.102	3.1	4.4	20.0	6.2	7.6	8.8	9.8	31	52

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Example of ordering:	Type	+	Material no.	=	Ordering no.
	660. 566	+	**17**	=	**660. 566. 17**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

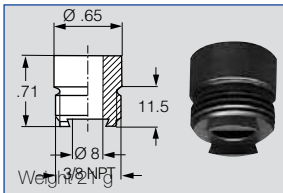
Flat fan dovetail nozzles
Accessories
Series 660



Mat. no. 17

Mat. no. 5E

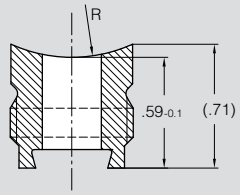
Retaining nut:
065.200.17[1]
(AISI 316Ti/AISI 316L)
065.200.5E (PVDF)



Weight 21 g

Welding nipple: **066.011.17**[1]
(AISI 316Ti/AISI 316L)
066.011.5E (PVDF)
066.011.53 (PP)
Other lengths on request.

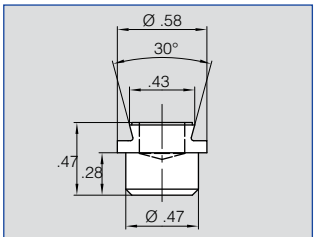
Nipple with radius



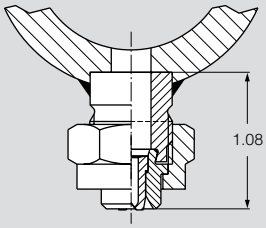
Welding nipple: **066.017.17**[1]
(AISI 316Ti/AISI 316L)

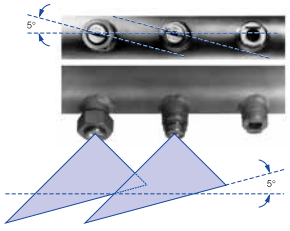
Standard radiuses for welding nipples (others on request)

Ordering no.	Radius
066.017.17.10	10
066.017.17.13	12.5
066.017.17.16	16
066.017.17.20	20
066.017.17.25	25
066.017.17.31	31



Blind Tips: **006.600.17**[1]
(AISI 316Ti/AISI 316L)
006.600.5E (PVDF)

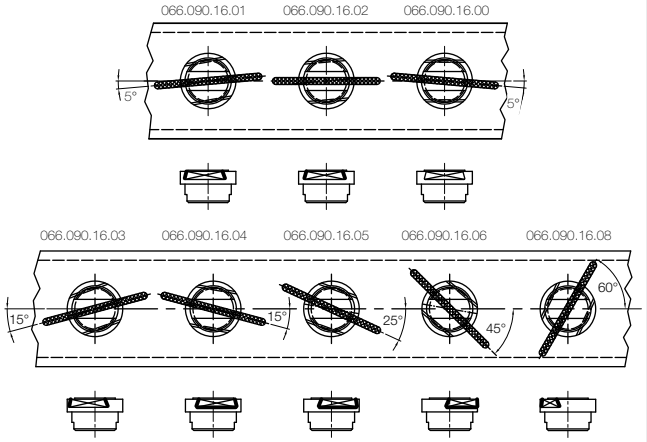




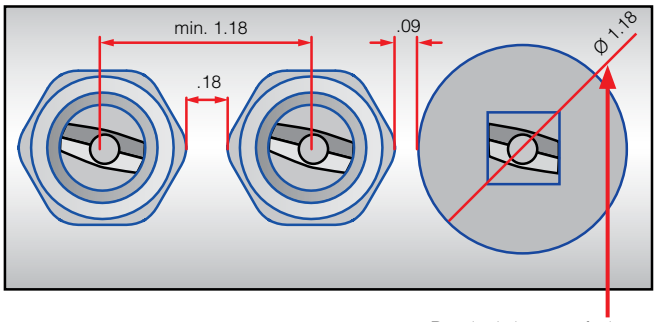
Other offset angles
are available on request

Alignment Tips

Material AISI 303



Minimum pitch for series 660



Required clearance for box nut

Front view of nozzle arrangement

3D View of nozzle arrangement

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

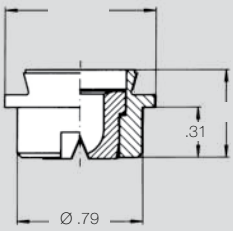
Flat fan dovetail nozzles

Series 664 / 665

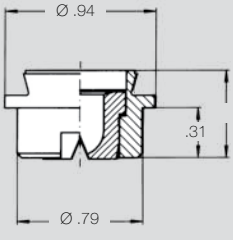
Assembly with retaining nut. Automatic jet alignment due to dovetail guide. Stable spray angle. Parabolic distribution of liquid. Spray pipes with these nozzles show an extremely uniform total liquid distribution.

Applications:
Cleaning, pickling, coating, rinsing.

Mat. no. 17



Mat. no. 5E



Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Mat. no. 53 PP	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
45°	**664. 723**	○	○	○	.118	.095	.98	1.4	6.3	2.0	2.4	2.8	3.1	10	19
	664. 763	○	○	○	.138	.102	1.2	1.8	8.0	2.5	3.	3.5	3.9	10	19
	664. 803	○	○	○	.158	.118	1.6	2.2	10.0	3.1	3.8	4.4	4.9	10	19
	664. 843	○	○	○	.177	.134	1.9	2.7	12.5	3.9	4.8	5.5	6.1	10	19
	664. 883	○	○	○	.197	.150	2.5	3.5	16.0	5.0	6.1	7.0	7.8	10	20
	664. 923	○	○	○	.217	.165	3.1	4.4	20	6.2	7.6	8.8	9.8	11	20
	664. 943	○	○	○	.224	.169	3.5	4.9	22.4	7	8.5	9.8	11	8	16
	664. 963	○	○	○	.236	.043	3.9	5.5	25.0	7.8	9.5	11.0	12.3	11	20
	664. 983	○	○	○	.248	.185	4.3	6.1	28	8.7	10.6	12.3	13.7	18	16
	665. 003	○	○	○	.260	.205	4.9	6.9	31.5	9.8	12	13.8	15.5	18	16
	665. 013	○	○	○	.268	.205	4.4	6.3	33.5	10.8	14.0	16.6	19.8	8	16
	665. 043	○	○	○	.315	.232	6.2	8.8	40.0	12.4	15.2	17.6	19.6	11	20
	665. 063	○	○	○	.343	.244	7	9.9	45	14	17.1	19.8	22.1	8	16
	665. 083	○	○	○	.354	.260	7.8	11	50	15.5	19	22	24.5	8	16
	665. 123	○	○	○	.394	.291	9.8	13.8	63	19.6	23.9	27.7	31	8	16
	665. 163	○	○	○	.425	.331	12.4	17.6	80	24.8	30.4	35.1	39.3	8	16
	665. 183	○	○	○	.445	.362	14	19.8	90	28	34.2	39.5	44.2	8	16
	665. 203	○	○	○	.472	.386	15.5	21.9	100	31	38	43.9	49.1	8	16
60°	**664. 724**	○	○	○	.118	.083	.98	1.4	6.3	2.0	2.4	2.8	3.1	12	22
	664. 764	○	○	○	.138	.091	1.2	1.8	8.0	2.5	3.0	3.5	3.9	12	22
	664. 804	○	○	○	.158	.102	1.6	2.2	10.0	3.1	3.8	4.4	4.9	12	22
	664. 844	○	○	○	.177	.118	1.9	2.7	12.5	3.9	4.8	5.5	6.1	12	22
	664. 884	○	○	○	.197	.134	2.5	3.5	16.0	5.0	6.1	7.0	7.8	12	22
	664. 924	○	○	○	.217	.162	3.1	4.4	20	6.2	7.6	8.8	9.8	12	23
	664. 944	○	○	○	.224	.165	3.5	4.9	22.4	7	8.5	9.8	11	12	23
	664. 964	○	○	○	.236	.165	4.3	6.1	28	8.7	10.6	12.3	13.7	12	23
	664. 984	○	○	○	.248	.177	3.7	5.2	28.0	9.1	11.7	13.8	16.5	12	23

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Continued on next page.

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan dovetail nozzles

Series 664 / 665

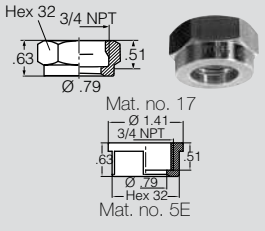
Spray angle	Ordering no.				Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray width B at p=30 psi	
	Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Mat. no. 53 PP			10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	H=10"	H=20"
60°	**665. 004**	○	○	○	.260	.189	4.9	6.9	31.5	9.8	12	13.8	15.5	12	23
	665. 014	○	○	○	.268	.193	5.2	7.4	33.5	10.4	12.7	14.7	16.4	12	23
	665. 044	○	○	○	.315	.217	6.2	8.8	40.0	12.4	15.2	17.6	19.6	12	23
	665. 064	○	○	○	.343	.228	7	9.9	45	14	17.1	19.8	22.1	12	23
	665. 084	○	○	○	.355	.244	7.8	11.0	50.0	15.5	19.0	21.9	24.5	13	23
	665. 124	○	○	○	.394	.292	9.8	13.8	63.0	19.5	23.9	27.6	30.9	13	24
	665. 164	○	○	○	.425	.327	12.4	17.6	80	24.8	30.4	35.1	39.3	13	24
	665. 184	○	○	○	.445	.350	14	19.8	90	28	34.2	39.5	44.2	13	24
	665. 204	○	○	○	.472	.374	15.5	21.9	100	31	38	43.9	49.1	13	24
75°	**664. 725**	○	○	○	.118	.075	0.98	1.4	6.3	2	2.4	2.8	3.1	14	25
	664. 765	○	○	○	.138	.083	1.2	1.8	8	2.5	3	3.5	4	14	25
	664. 805	○	○	○	.157	.102	1.6	2.2	10	3.1	3.8	4.4	4.9	14	25
	664. 845	○	○	○	.177	.118	1.9	2.7	12.5	3.9	4.8	5.5	6.1	14	25
	664. 885	○	○	○	.197	.130	2.5	3.5	16	5	6.1	7	7.9	14	25
	664. 925	○	○	○	.217	.150	3.1	4.4	20	6.2	7.6	8.8	9.8	14	25
	664. 965	○	○	○	.236	.161	3.9	5.5	25	7.8	9.5	11	12.3	14	25
	665. 005	○	○	○	.260	.169	4.9	6.9	31.5	9.8	12	13.8	15.5	14	25
	665. 015	○	○	○	.268	.181	5.2	7.4	33.5	10.4	12.7	14.7	16.4	14	25
	665. 045	○	○	○	.315	.209	6.2	8.8	40	12.4	15.2	17.6	19.6	14	25
	665. 085	○	○	○	.354	.240	7.8	11	50	15.5	19	22	24.5	14	25
	665. 125	○	○	○	.394	.268	9.8	13.8	63	19.6	23.9	27.7	31	14	25
90°	**664. 726**	○	○	○	.118	.067	0.98	1.4	6.3	2	2.4	2.8	3.1	17	31
	664. 766	○	○	○	.138	.075	1.2	1.8	8	2.5	3	3.5	4	17	31
	664. 806	○	○	○	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	17	31
	664. 846	○	○	○	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	17	31
	664. 886	○	○	○	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.8	17	31
	664. 926	○	○	○	.217	.142	3.1	4.4	20.0	6.2	7.6	8.8	9.8	17	31
	664. 966	○	○	○	.236	.154	3.9	5.5	25.0	7.8	9.5	11.0	12.3	17	31
	665. 046	○	○	○	.315	.193	6.2	8.8	40.0	12.4	15.2	17.6	19.6	17	31
	665. 126	○	○	○	.394	.252	9.8	13.8	63.0	19.5	23.9	27.6	30.9	17	31
120°	**664.727**	○	○	○	.118	.063	.98	1.4	6.3	2.0	2.4	2.8	3.1	49	85
	664.767	○	○	○	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	49	85
	664.807	○	○	○	.158	.079	1.6	2.2	10.0	3.1	3.8	4.4	4.9	49	85
	664.847	○	○	○	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	49	85
	664.887	○	○	○	.197	.102	2.5	3.5	16	5	6.1	7	7.9	49	85
	664.927	○	○	○	.217	.114	3.1	4.4	20	6.2	7.6	8.8	9.8	49	85
	664.967	○	○	○	.236	.126	3.9	5.5	25.0	7.8	9.5	11.0	12.3	49	85
	665.047	○	○	○	.236	.126	6.2	8.8	40	12.4	15.2	17.6	19.6	49	85
	665.127	○	○	○	.394	.224	9.8	13.8	63	19.6	23.9	27.7	31	49	85

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

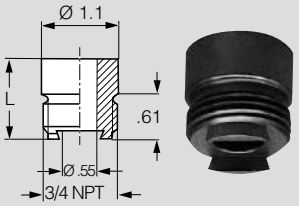
Example of ordering:	Type	+	Material no.	=	Ordering no.
	665. 004	+	**17**	=	**665. 004. 17**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan dovetail nozzles
Accessories
Series 664 / 665

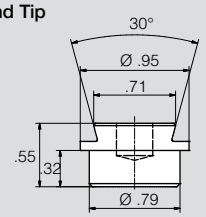


Retaining nut:
065.600.17[1]
(AISI 316Ti/AISI 316L)
065.600.5E (PVDF)



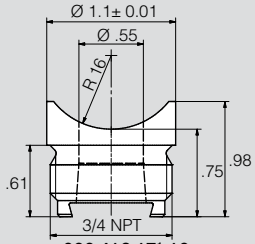
Welding nipple:
066.410.17[1]
(AISI 316Ti/AISI 316L):
L= 27 mm
066.410.5E (PVDF):
L= 27 mm
066.411.17[1]
(AISI 316Ti/AISI 316L):
L= 60 mm
066.411.17[1]**.04**
(AISI 316Ti/AISI 316L):
L= 110 mm
Other lengths on request.

Blind Tip

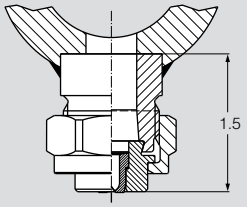


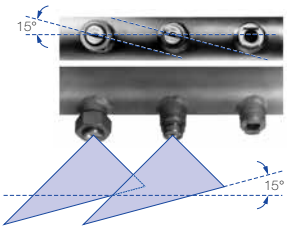
Blind Tip:
006.642.17[1]
(AISI 316Ti/AISI 316L)
006.642.5E (PVDF)

Nipple with radius

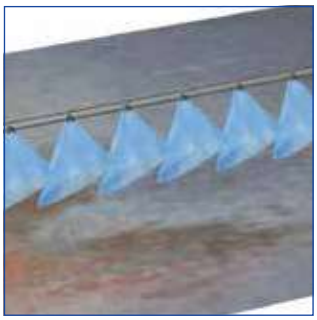


066.412.17[1]**.16**



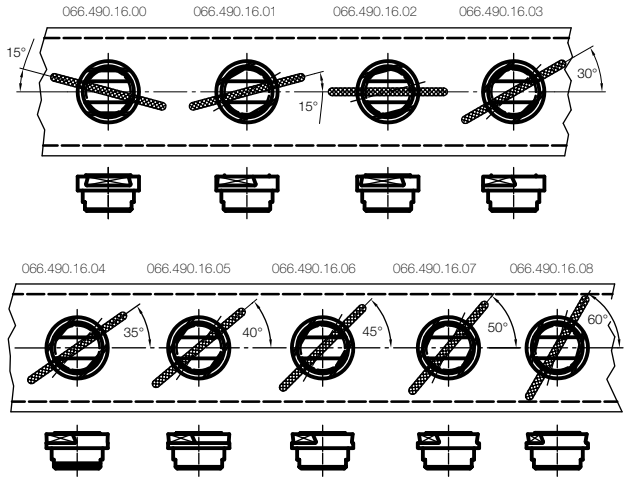


Other offset angles
are available on request

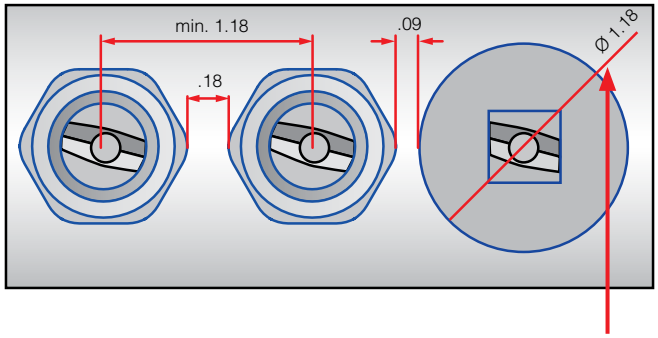


Alignment Tips

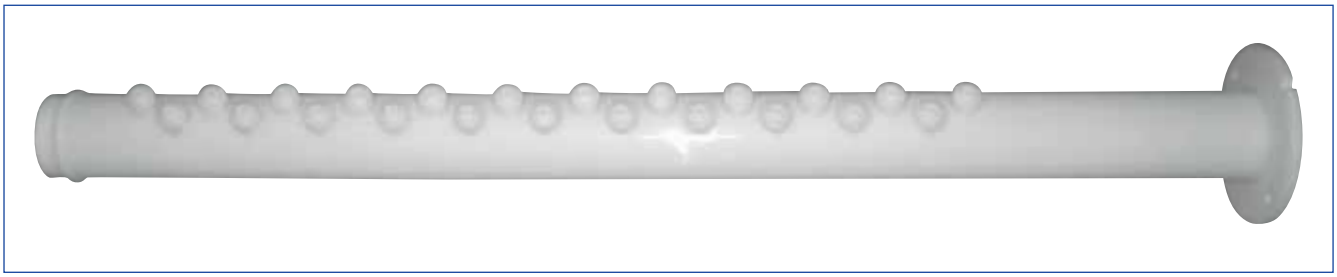
Material AISI 303



Minimum pitch for series 664/665



Required clearance for box nut



Spray header for pickling line with nozzles series 664/665

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Flat fan dovetail nozzles

Series 664 / 665

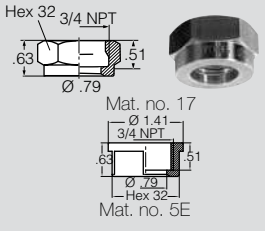
Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	5E PVDF	53 PP	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	Spray width B at p=30 psi H=10"	H=20"
60°	**665. 004**	○	○	○	.260	.189	4.9	6.9	31.5	9.8	12	13.8	15.5	12	23
	665. 014	○	○	○	.268	.193	5.2	7.4	33.5	10.4	12.7	14.7	16.4	12	23
	665. 044	○	○	○	.315	.217	6.2	8.8	40.0	12.4	15.2	17.6	19.6	12	23
	665. 064	○	○	○	.343	.228	7	9.9	45	14	17.1	19.8	22.1	12	23
	665. 084	○	○	○	.355	.244	7.8	11.0	50.0	15.5	19.0	21.9	24.5	13	23
	665. 124	○	○	○	.394	.292	9.8	13.8	63.0	19.5	23.9	27.6	30.9	13	24
	665. 164	○	○	○	.425	.327	12.4	17.6	80	24.8	30.4	35.1	39.3	13	24
	665. 184	○	○	○	.445	.350	14	19.8	90	28	34.2	39.5	44.2	13	24
	665. 204	○	○	○	.472	.374	15.5	21.9	100	31	38	43.9	49.1	13	24
75°	**664. 725**	○	○	○	.118	.075	0.98	1.4	6.3	2	2.4	2.8	3.1	14	25
	664. 765	○	○	○	.138	.083	1.2	1.8	8	2.5	3	3.5	4	14	25
	664. 805	○	○	○	.157	.102	1.6	2.2	10	3.1	3.8	4.4	4.9	14	25
	664. 845	○	○	○	.177	.118	1.9	2.7	12.5	3.9	4.8	5.5	6.1	14	25
	664. 885	○	○	○	.197	.130	2.5	3.5	16	5	6.1	7	7.9	14	25
	664. 925	○	○	○	.217	.150	3.1	4.4	20	6.2	7.6	8.8	9.8	14	25
	664. 965	○	○	○	.236	.161	3.9	5.5	25	7.8	9.5	11	12.3	14	25
	665. 005	○	○	○	.260	.169	4.9	6.9	31.5	9.8	12	13.8	15.5	14	25
	665. 015	○	○	○	.268	.181	5.2	7.4	33.5	10.4	12.7	14.7	16.4	14	25
	665. 045	○	○	○	.315	.209	6.2	8.8	40	12.4	15.2	17.6	19.6	14	25
	665. 085	○	○	○	.354	.240	7.8	11	50	15.5	19	22	24.5	14	25
	665. 125	○	○	○	.394	.268	9.8	13.8	63	19.6	23.9	27.7	31	14	25
90°	**664. 726**	○	○	○	.118	.067	0.98	1.4	6.3	2	2.4	2.8	3.1	17	31
	664. 766	○	○	○	.138	.075	1.2	1.8	8	2.5	3	3.5	4	17	31
	664. 806	○	○	○	.158	.095	1.6	2.2	10.0	3.1	3.8	4.4	4.9	17	31
	664. 846	○	○	○	.177	.095	1.9	2.7	12.5	3.9	4.8	5.5	6.1	17	31
	664. 886	○	○	○	.197	.122	2.5	3.5	16.0	5.0	6.1	7.0	7.8	17	31
	664. 926	○	○	○	.217	.142	3.1	4.4	20.0	6.2	7.6	8.8	9.8	17	31
	664. 966	○	○	○	.236	.154	3.9	5.5	25.0	7.8	9.5	11.0	12.3	17	31
	665. 046	○	○	○	.315	.193	6.2	8.8	40.0	12.4	15.2	17.6	19.6	17	31
	665. 126	○	○	○	.394	.252	9.8	13.8	63.0	19.5	23.9	27.6	30.9	17	31
120°	**664.727**	○	○	○	.118	.063	.98	1.4	6.3	2.0	2.4	2.8	3.1	49	85
	664.767	○	○	○	.138	.067	1.2	1.8	8.0	2.5	3.0	3.5	3.9	49	85
	664.807	○	○	○	.158	.079	1.6	2.2	10.0	3.1	3.8	4.4	4.9	49	85
	664.847	○	○	○	.177	.091	1.9	2.7	12.5	3.9	4.8	5.5	6.1	49	85
	664.887	○	○	○	.197	.102	2.5	3.5	16	5	6.1	7	7.9	49	85
	664.927	○	○	○	.217	.114	3.1	4.4	20	6.2	7.6	8.8	9.8	49	85
	664.967	○	○	○	.236	.126	3.9	5.5	25.0	7.8	9.5	11.0	12.3	49	85
	665.047	○	○	○	.236	.126	6.2	8.8	40	12.4	15.2	17.6	19.6	49	85
	665.127	○	○	○	.394	.224	9.8	13.8	63	19.6	23.9	27.7	31	49	85

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

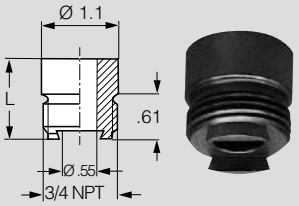
Example of ordering:	Type	+	Material no.	=	Ordering no.
	665. 004	+	**17**	=	**665. 004. 17**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan dovetail nozzles
Accessories
Series 664 / 665

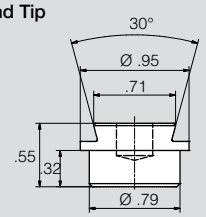


Retaining nut:
065.600.17[1]
(AISI 316Ti/AISI 316L)
065.600.5E (PVDF)



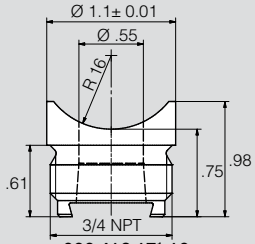
Welding nipple:
066.410.17[1]
(AISI 316Ti/AISI 316L):
L= 27 mm
066.410.5E (PVDF):
L= 27 mm
066.411.17[1]
(AISI 316Ti/AISI 316L):
L= 60 mm
066.411.17[1]**.04**
(AISI 316Ti/AISI 316L):
L= 110 mm
Other lengths on request.

Blind Tip

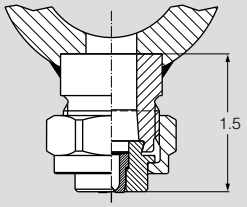


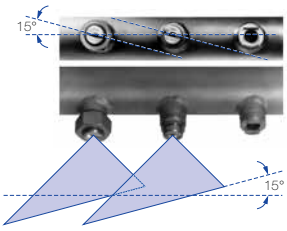
Blind Tip:
006.642.17[1]
(AISI 316Ti/AISI 316L)
006.642.5E (PVDF)

Nipple with radius

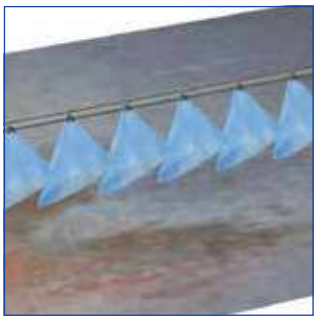


066.412.17[1]**.16**



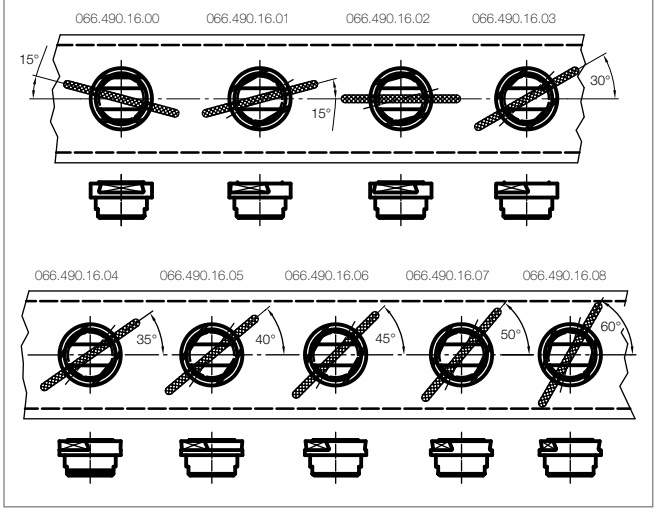


Other offset angles
are available on request

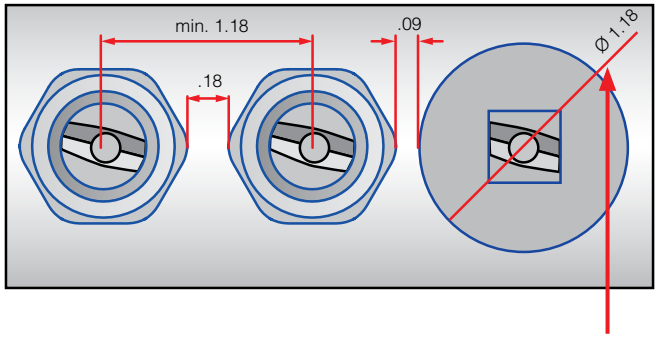


Alignment Tips

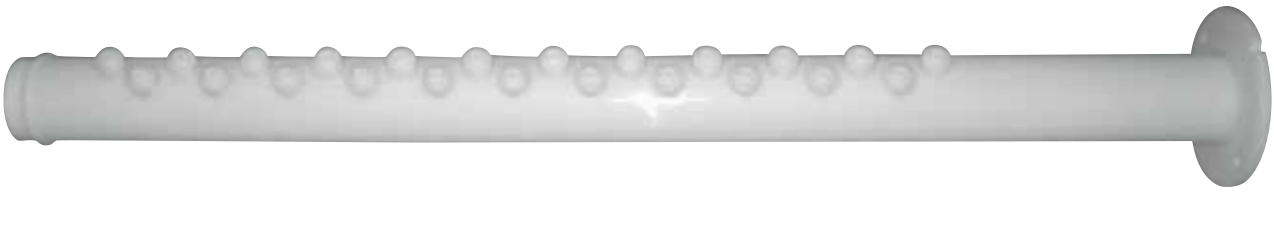
Material AISI 303



Minimum pitch for series 664/665



Required clearance for box nut



Spray header for pickling line with nozzles series 664/665

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Flat fan dovetail nozzles

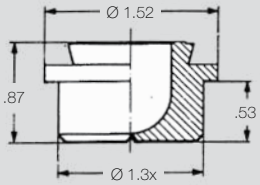
Series 669

Spray pipes with these nozzles show an extremely uniform total liquid distribution.

Applications:
Cleaning, pickling, coating, rinsing.

Mat. no. 17


Mat. no. 5E



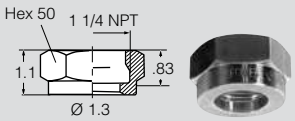
Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	60 psi	80 psi	100 psi	145 psi	Spray width B at p=30 psi H=10"	H=20"
20°	**669. 041**	○	○	.315	.256	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	5	8
	669. 121	○	○	.394	.327	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	5	8
	669. 201	○	○	.472	.417	15.5	21.9	100.0	31.0	38.0	43.9	49.1	59.1	5	8
	669. 281	○	○	.591	.512	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	5	8
30°	**669. 042**	○	○	.315	.252	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	6	12
	669. 122	○	○	.394	.323	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	6	12
	669. 202	○	○	.472	.409	15.5	21.9	100.0	31.0	38.0	43.9	49.1	59.1	6	12
	669. 282	○	○	.591	.476	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	6	12
45°	**669. 043**	○	○	.315	.232	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	10	19
	669. 123	○	○	.394	.287	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	10	19
	669. 163	○	○	.425	.331	15.5	21.9	80.0	31.0	38.0	43.9	49.1	59.1	10	19
	669. 203	○	○	.472	.386	24.8	35.1	100.0	49.6	60.8	70.2	78.5	94.5	10	19
	669. 243	○	○	.528	.402	19.4	27.4	125.0	38.8	47.5	54.9	61.3	73.8	10	19
	669. 263	○	○	.559	.417	21.7	30.7	140.0	43.4	53.2	61.4	68.7	82.7	10	19
	669. 283	○	○	.591	.453	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	10	19
	669. 343	○	○	.709	.567	34.8	49.1	224.0	69.5	85.1	98.3	109.9	132.3	10	19
60°	**669. 044**	○	○	.315	.217	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	13	25
	669. 124	○	○	.394	.291	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	13	25
	669. 204	○	○	.472	.374	15.5	21.9	100.0	31.0	38.0	43.9	49.1	59.1	13	25
	669. 284	○	○	.591	.370	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	13	25
90°	**669. 046**	○	○	.315	.193	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	21	40
	669. 126	○	○	.394	.256	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	21	40
	669. 206	○	○	.472	.343	15.5	21.9	100.0	31.0	38.0	43.9	49.1	59.1	21	40
	669. 286	○	○	.591	.372	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	21	40
120°	**669. 047**	○	○	.315	.173	6.2	8.8	40.0	12.4	15.2	17.6	19.6	23.6	31	57
	669. 127	○	○	.394	.232	9.8	13.8	63.0	19.5	23.9	27.6	30.9	37.2	31	57
	669. 207	○	○	.472	.299	15.5	21.9	100.0	31.0	38.0	43.9	49.1	59.1	31	57
	669. 287	○	○	.591	.348	24.8	35.1	160.0	49.6	60.8	70.2	78.5	94.5	31	57

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

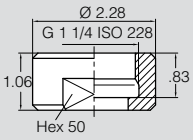
Example of ordering:	Type	+	Material no.	=	Ordering no.
	669.041	+	**17**	=	**669.041.17**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Flat fan dovetail nozzles
Accessories
Series 669

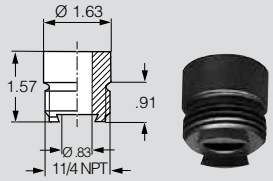


Mat. no. 17



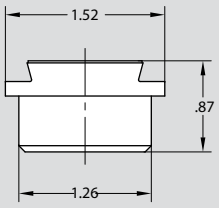
Mat. no. 5E

Retaining nut:
066.900.17[1] (AISI 316Ti/AISI 316L)
066.900.5E (PVDF)

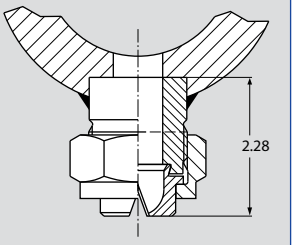


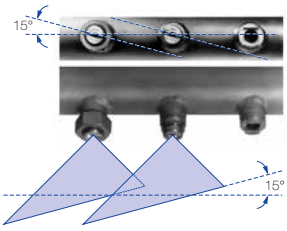
Welding nipple: **066.910.17**[1] (AISI 316Ti/AISI 316L)
066.910.5E (PVDF)

Blind Tip



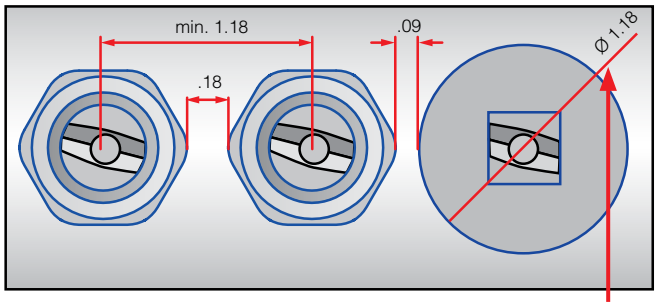
006.690.00



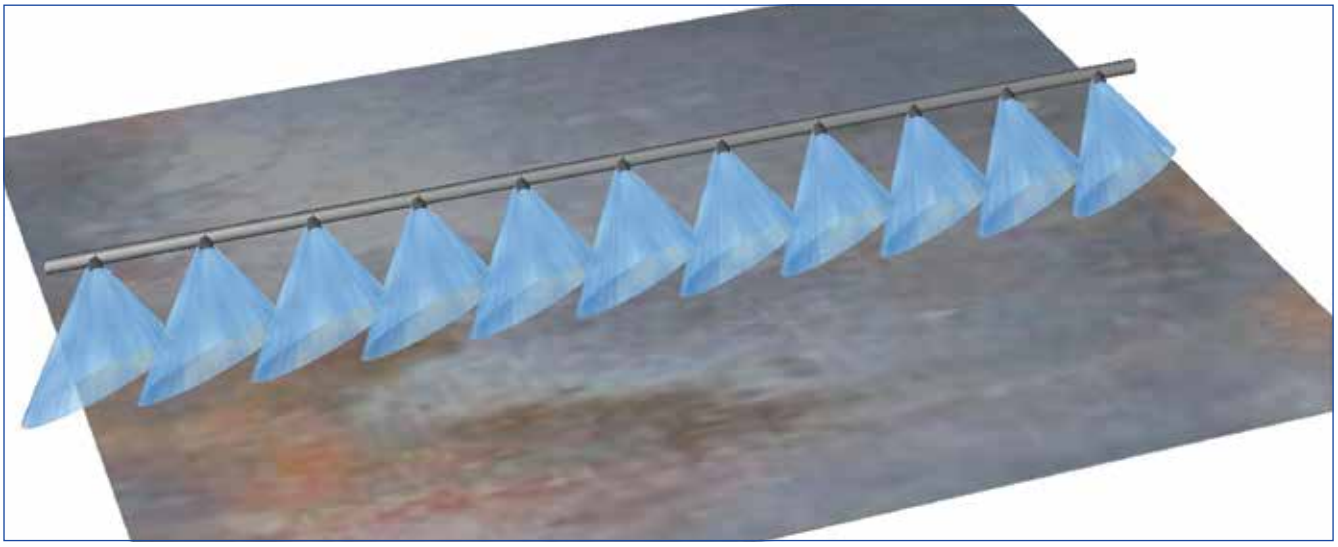


Other offset angles
are available on request

Minimum pitch for series 669



Required clearance for box nut



[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Tongue-type nozzles

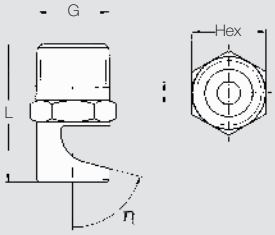
Series 686

Wide flat fan with a sharply delimited jet pattern. Non-clogging.

Applications:
Cleaning, pickling, rinsing, requiring powerful and concentrated water jets.

Mat. no. 17
(∢ 140°)

Mat. no. 5E
(∢ 140°)



Schematic design
for ∢ 140°

Spray angle	η	Ordering no.							Orifice diameter [in]	Flow Rate (Gallons Per Minute)			Dimensions								Spray width B at p=30 psi
		Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Code G Connection Male NPT	1/4"		1/2"		14.5	2.0	72.5	L [in] R 1/8	L [in] R 1/4	L [in] R 3/8	L [in] R 1/2	Hex [in] R 1/8	Hex [in] R 1/4	Hex [in] R 3/8	Hex [in] R 1/2	H=10"
90°	40°	**686. 646**	○	-	**BA**	-	-	-	.087	.75	4.0	1.7	.97	-	-	-	.43	-	-	-	21
		686. 686	○	-	**BA**	**BC**	-	-	.094	.94	5.0	2.1	.98	1.6	-	-	.43	.55	-	-	21
		686. 726	○	-	-	**BC**	-	-	.106	1.2	6.3	2.6	-	1.2	-	-	-	.55	-	-	21
		686. 766	○	-	-	**BC**	-	-	.118	1.5	8.0	3.3	-	1.3	-	-	-	.55	-	-	21
		686. 806	○	○	-	**BC**	-	-	.134	1.9	10.0	4.2	-	1.3	-	-	-	.55	-	-	21
		686. 846	○	-	-	**BC**	**BE**	-	.150	2.3	12.5	5.2	-	1.3	1.3	-	-	.55	.67	-	21
		686. 846	-	○	-	**BC**	-	-	.150	2.3	12.5	5.2	-	1.3	-	-	-	.55	-	-	21
		686. 886	○	-	-	**BC**	-	-	.165	3.0	16.0	6.7	-	1.4	-	-	-	.67	-	-	21
		686. 926	○	-	-	-	**BE**	-	.185	3.7	20.0	8.4	-	-	1.5	-	-	-	.67	-	21
		686. 926	-	○	-	-	**BE**	**BG**	.185	3.7	20.0	8.4	-	-	1.5	1.7	-	-	.67	.87	21
		686. 966	-	○	-	-	-	**BG**	.209	4.7	25.0	10.4	-	-	-	1.81	-	-	-	.87	21
		686. 966	○	-	-		**BE**	**BG**	.209	4.7	25.0	10.4	-	-	1.6	1.8	-	-	.67	.87	21
		686. 986	○	-	-	-	-	**BG**	.220	5.2	28.0	11.7	-	-	-	1.8	-	-	-	.87	21
140°	75°	**686. 648**	○	-	-	**BC**	-	-	.087	.75	4.0	1.7	-	.95	-	-	-	.55	-	-	54
		686. 688	○	-	**BA**	**BC**	-	-	.094	.94	5.0	2.1	.91	1.1	-	-	.43	.55	-	-	54
		686. 728	○	-	**BA**	**BC**	-	-	.106	1.2	6.3	2.6	.91	1.1	-	-	.43	.55	-	-	54
		686. 728	-	○	-	**BC**	-	-	.106	1.2	6.30	2.6	-	1.1	-	-	-	.55	-	-	54
		686. 768	○	-	**BA**	**BC**	-	-	.118	1.5	8.00	3.3	.91	1.1	-	-	.43	.55	-	-	54
		686. 808	○	-	**BA**	**BC**	-	-	.134	1.9	10.0	4.2	.91	1.1	-	-	.43	.55	-	-	54
		686. 808	-	○	-	**BC**	-	-	.134	1.9	10.0	4.2	-	1.1	-	-	-	.55	-	-	54
		686. 828	○	-	**BA**	**BC**	-	-	.142	2.1	11.2	4.7	.91	1.1	-	-	.43	.55	-	-	54
		686. 848	○	-	**BA**	**BC**	-	-	.150	2.3	12.5	5.2	.91	1.1	-	-	.43	.55	-	-	54
		686. 848	-	○	-	**BC**	-	-	.150	2.3	12.5	5.2	-	1.1	-	-	-	.55	-	-	54
		686. 868	-	○	-	**BC**	-	-	.157	2.6	14.0	5.9	-	1.1	-	-	-	.55	-	-	54
		686. 888	○	○	-	**BC**	-	-	.165	3.0	16.0	6.7	-	1.1	-	-	-	.55	-	-	54
		686. 908	○	-	-	**BC**	**BE**	-	.177	3.4	18.0	7.5	-	1.1	1.2	-	-	.55	.67	-	54
		686. 928	○	○	-	-	**BE**	-	.185	3.7	20.0	8.35	-	-	1.2	-	-	-	.67	-	54
		686. 948	○	-	-	-	**BE**	-	.193	4.2	22.4	9.36	-	-	1.3	-	-	-	.67	-	54
		686. 968	○	-	-	-	**BE**	**BG**	.209	4.7	25.0	10.44	-	-	1.3	1.5	-	-	.67	.87	54
		686. 988	○	-	-	-	**BE**	**BG**	.220	5.2	28.0	11.69	-	-	1.3	1.5	-	-	.67	.87	54

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Other types on request.

Example of ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	686. 646	+	**17**	+	**BA**	=	**686. 646. 17. BA**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Tongue-type nozzles

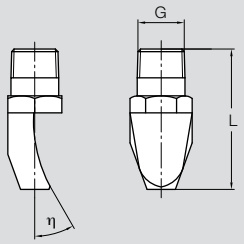
Series 688 / 689

Hard, sharp flat fan, narrowly delimited jet pattern. Non-clogging.

Applications:
Cleaning, pickling, rinsing, cross spray, requiring powerful and concentrated water jets.

Mat. no. 17
(≮ 45°)

Mat. no. 5E
(≮ 45°)



Spray angle	η	Ordering no.					Orifice diameter [in]	Flow Rate (Gallons Per Minute)			Dimensions						Spray width B at p=30 psi	
			Mat. no.		Connection						L [in]			Hex [in]				
		Type	17[1] AISI 316Ti/ AISI 316L	5E PVDF	Male NPT ⅜3/8"	Male NPT ¾3/4"		10 psi	2 liters per minute bar	80 psi	R 3/8	R 1/2	R 3/4	R 3/8	R 1/2	R 3/4	H=10"	H=20"
15°	9°	**689. 001**	○	-	-	**BK**	.236	5.88	31.50	13.16	-	-	5.55	-	-	1.06	3	5
	9°	**689. 121**	○	-	-	**BK**	.339	11.77	63.00	26.31	-	-	168	-	-	1.06	3	5
45°	35°	**688. 763**	○	-	**BE**	-	.118	1.50	8.00	3.34	1.65	-	-	.75	-	-	9	17
	29°	**688. 923**	○	-	**BE**	-	.189	3.74	20.00	8.35	2.30	-	-	.87	-	-	9	17
	35°	**689. 003**	○	-	**BE**	**BK**	.236	5.88	31.50	13.16	2.56	-	2.89	.96	-	1.06	10	19

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

Other types on request.

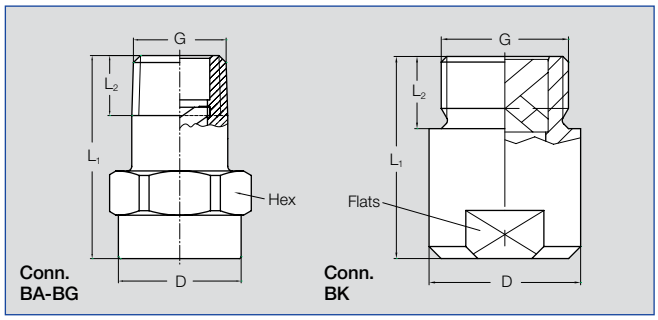
Example of ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	688. 763	+	**17**	+	**BE**	=	**688. 763. 17. BE**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Axial-flow full cone nozzles
PVDF version
Series 460 / 461

Very uniform spray pattern. Large free cross-sections, due to optimized x-style swirl insert.

Applications:
Pickling, Surface treatment, rinsing, acid fume scrubbing.



Code	Dimensions [mm]				
	Male NPT G	L_1	L_2	D	Hex/Flats
BA	1/8 NPT	.87	.26	.51	14
BC	1/4 NPT	.87	.38	.51	14
BE	3/8 NPT	1.18	.39	.67	17
BG	1/2 NPT	1.71	.52	.87	22
BK	3/4 NPT	1.65	.59	1.24	27

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

Spray angle	Ordering no.							Orifice diameter [in]	Free passage [in]	Flow Rate (Gallons Per Minute)							Spray diameter D at p = 30 psi	
	Type	Mat. no. 5E	Connection Male NPT															
		PVDF	1/8"	1/4"	3/8"	1/2"	3/4"			10 psi	20 psi	liters per minute 2 bar	30 psi	40 psi	60 psi	80 psi	100 psi	150 psi	H=8"	H=20"
60°	**460. 644**	○	-	**BC**	-	-	-	.095	.075	.69	.91	4.0	1.1	1.2	1.4	1.6	1.7	2.0	9	22
	460. 964	○	-	-	-	-	**BK**	.229	.193	4.3	5.7	25	6.7	7.5	8.8	9.9	10.8	12.7	9	22
90°	**460. 326**	○	**BA**	-	-	-	-	.032	.022	.07	.09	0.4	.11	.12	.14	.16	.17	.20	15	34
	460. 406	○	**BA**	-	-	-	-	.047	.033	.17	.23	1.0	.27	.30	.35	.40	.43	.51	15	34
	460. 486	○	**BA**	-	-	-	-	.057	.047	.28	.36	1.6	.43	.48	.57	.63	.69	.82	15	34
	460. 526	○	**BA**	-	-	-	-	.065	.051	.35	.46	2.0	.54	.60	.71	.79	.87	1.0	15	34
	460. 606	○	**BA**	-	**BE**	-	-	.081	.057	.54	.72	3.2	.84	.95	1.1	1.2	1.4	1.6	15	34
	460. 646	○	-	**BC**	-	-	-	.091	.071	.69	.91	4.0	1.1	1.2	1.4	1.6	1.7	2.0	15	38
	460. 726	○	-	-	**BE**	-	-	.116	.079	1.1	1.4	6.3	1.7	1.9	2.2	2.5	2.7	3.2	15	38
	460. 746	○	-	-	**BE**	-	-	.130	.075	1.2	1.6	7.1	1.9	2.1	2.5	2.8	3.1	3.6	15	38
	460. 766	○	-	-	**BE**	-	-	.130	.095	1.4	1.8	8.0	2.1	2.4	2.8	3.2	3.5	4.1	15	38
	460. 806	○	-	-	**BE**	-	-	.146	.106	1.7	2.3	10.0	2.7	3.0	3.5	4.0	4.3	5.1	15	38
	460. 846	○	-	-	**BE**	-	-	.160	.126	2.2	2.8	12.5	3.3	3.8	4.4	5.0	5.4	6.4	15	38
	460. 886	○	-	-	-	**BG**	-	.185	.122	2.8	3.6	16.0	4.3	4.8	5.7	6.3	6.9	8.2	15	38
	460. 966	○	-	-	-	**BG**	-	.229	.150	4.3	5.7	25	6.7	7.5	8.8	9.9	10.8	12.7	15	38
	461. 006	○	-	-	-	**BG**	-	.252	.150	5.4	7.2	32	8.4	9.5	11.1	12.5	13.7	16.1	15	38
	461. 046	⊗	-	-	-	-	**BK**	.284	.209	6.9	9.1	40	10.7	12.0	14.1	15.9	17.3	20	15	38

Continued on next page.

⊗ material PP (material no. 53), connection 3/4 NPT (Conn. BK)

Example for ordering:	Type	+ Material no.	+ Conn.	= Ordering no.
	460. 644	+ **5E**	+ **BC**	= **460. 644. 5E. BC**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Axial-flow full cone nozzles
PVDF version
Series 460 / 461

Spray angle	Ordering no. Type	Mat. no. 5E PVDF	Connection Male NPT 1/8"⅛	1/4"	⅜3/8"	1/2"½	Orifice diameter [in]	Free passage [in]	Flow Rate (Gallons Per Minute) 10 psi	20 psi	liters per minute 2 bar	40 psi	80 psi	100 psi	150 psi	Spray diameter D at p = 30 psi H=8"	H=20"
120°	**460. 408**	○	**BA**	-	-	-	.047	.033	.17	.23	1.0	.30	.40	.43	.51	27	52
	460. 488	○	**BA**	-	-	-	.059	.039	.28	.36	1.6	.48	.63	.69	.82	27	52
	460. 528	○	**BA**	-	-	-	.065	.047	.35	.46	2.0	.60	.79	.87	1.0	27	52
	460. 608	○	**BA**	-	-	-	.083	.055	.54	.72	3.5	.95	1.2	1.4	1.6	27	52
	460. 648	○	-	**BC**	-	-	.096	.063	.69	.91	4.0	1.2	1.6	1.7	2.0	27	52
	460. 728	○	-	-	**BE**	-	.122	.075	1.1	1.4	6.3	1.9	2.5	2.7	3.2	27	52
	460. 748	○	-	-	**BE**	-	.130	.075	1.2	1.6	7.1	2.1	2.8	3.1	3.6	27	52
	460. 768	○	-	-	**BE**	-	.138	.075	1.4	1.8	8.0	2.4	3.2	3.5	4.1	27	52
	460. 808	○	-	-	**BE**	-	.150	.094	1.7	2.3	10.0	3.0	4.0	4.3	5.1	27	52
	460. 848	○	-	-	**BE**	-	.165	.106	2.2	2.8	12.5	3.8	5.0	5.4	6.4	27	52
	460. 888	○	-	-	-	**BG**	.181	.122	2.8	3.6	16.0	4.8	6.3	6.9	8.2	27	52
	460. 968	○	-	-	-	**BG**	.232	.161	4.3	5.7	25.0	7.5	9.9	10.8	12.7	27	52
	461. 048	⊗	-	-	-	-	.299	.193	6.9	9.1	40.0	12.0	15.9	17.3	20	27	52

⊗ material PP (material no. 53), connection 3/4 NPT (Conn. BK)

Example for ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	460. 408	+	**5E**	+	**BA**	=	**460. 408. 5E. BA**

Conversion formula for the above series: $V_2 = V_1 \sqrt{\frac{P_2}{P_1}}$

Multi-channel flat fan nozzles for air Whisperblast®
Series 600.130 / 600.493 / 600.562

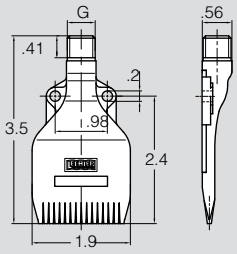
Highly efficient air stream, acting upon areas.
Reduced noise levels.
Low air consumption.

Applications:
Blowing off and blowing out, cleaning, drying, cooling, conveying with air.

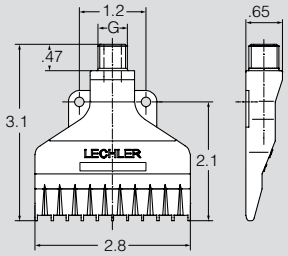
600.130.S2
(PP colorless)

600.493.1Y
(Stainless steel AISI 316L)

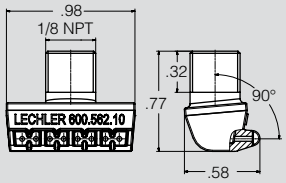
600.562.1Y.10
(Stainless steel AISI 316L)



Weight: .03 lb · Tmax: 140 °F

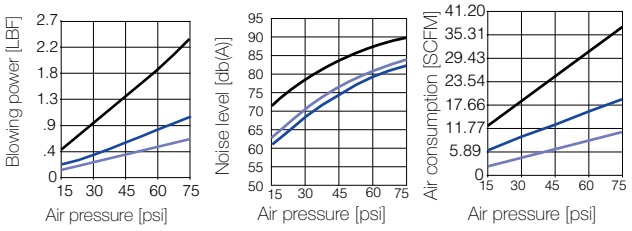


Weight: .28 lb · Tmax: 1022 °F



Weight: .04 lb · Tmax: 356 °F

Technical data



Ordering no.					
Type	Mat. no.		Connection		
	1Y Stainless steel	S2 PP colorless	1/8 BSPP	1/4 BSPP	1/4 NPT
600.130	-	○	-	**AC**	**BC**
600.493	○	-	-	**AC**	**BC**
600.562.1Y.10	○	-	○	-	-

Example for ordering:	Type	+	Material no.	+	Conn.	=	Ordering no.
	600. 130	+	**S2**	+	**BC**	=	**600. 130. S2. BC**

Flat fan nozzles for air or saturated steam

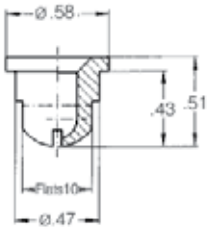
Series 679

Particularly wide-angle, powerful air jet. Assembling with retaining nut. Easy nozzle changing. Simple jet alignment.

Applications:
Blowing off liquids, cooling, reheating, drying.

Mat. no. 17

Mat. no. 5E

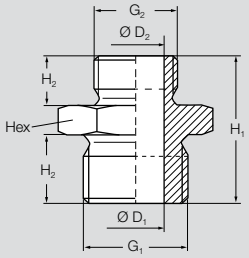


Spray angle	Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Equivalent Orifice diam. [in]	V_n L = Air [SCFM] MS = Saturated Steam [lb/h] p [psi] 0.5 L	0.5 S	2.0 L	2.0 S	5.0 L	5.0 S	10.0 L	10.0 S
ca. 70°	**679. 085**	○	○	.051	1.2	3.5	2.4	6.8	2.8	6.1	8.7	13.5
	679. 117	○	○	.059	1.2	3.8	2.5	7.3	2.9	6.5	9.1	14.3
	679. 165	○	○	.071	1.5	4.4	3.0	9.0	3.6	8.0	11.1	17.6
	679. 255	○	○	.083	2.1	6.2	4.3	12.6	5.0	11.2	15.7	24.7
	679. 365	○	○	.110	3.7	11.0	7.5	22.1	8.8	19.6	27.4	43.2
	679. 415	○	○	.142	6.0	17.6	11.9	35.3	14.1	31.4	43.9	69.2
	679. 495	○	○	.169	9.2	27.3	18.3	54.7	21.6	48.5	67.1	106.9

A = Equivalent bore diameter

Example of ordering:	Type	+	Material no.	=	Ordering no.
	679. 085	+	**17**	=	**679. 085. 17**

Double nipple

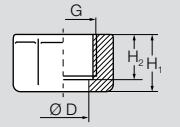


Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Dimensions [mm] G_1 NPT	G_2 NPT	H_1	H_2	D_1	D_2	Hex	Weight
065. 215	○	○	3/8 A	1/4 A	.98	.40	.40	.28	22	.063 lb
065. 211	○	○	3/8 A	3/8 A	.98	.40	.45	-	22	.052 lb

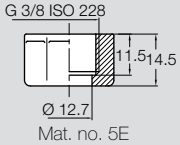
Nuts

Mat. no. 17

Mat. no. 5E



Mat. no. 17



Mat. no. 5E

Ordering no. Type	Mat. no. 17[1] AISI 316Ti/ AISI 316L	Mat. no. 5E PVDF	Dimensions [mm] G NPT	H_1	H_2	D	Hex	Weight
065. 200	○	-	3/8	.512	.394	.504	22	.052 lb
065. 200	-	○	3/8	.571	.453	.504	22	.052 lb

[1] We reserve the right to deliver AISI 316Ti or AISI 316L under the material no. 17.

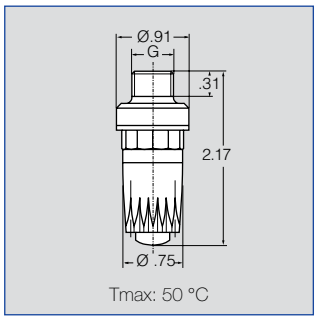
Multi-channel round jet nozzles for air

Series 600.326

Powerful air jet, producing punctiform impact patterns. Low noise level. Low air consumption.

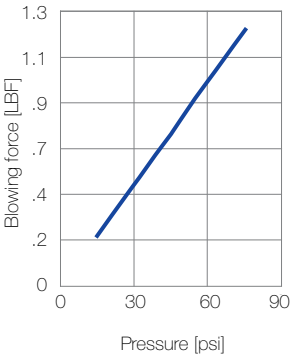
Applications:
Targeted blowing out and blowing off with compressed air.

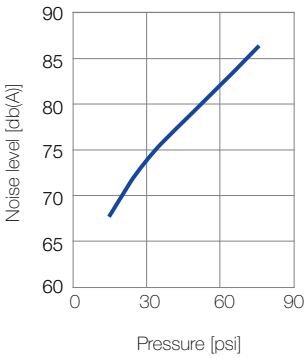
600.326.5K (ABS)

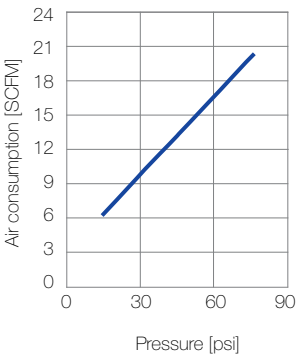


Tmax: 50 °C

Technical data







Ordering no.		Connection thread
Type	Conn.	
600. 326. 5K (Material: ABS)	**AC**	1/4" Male BSPP
	AA	1/8" Male BSPP
	BA	1/8" Male NPT
	BC	1/4" Male NPT
	HG	M12 x 1.25

Example of ordering:	**Type**	**+**	**Conn.**	**=**	**Ordering no.**
	600. 326. 5K	**+**	**BC**	**=**	**600. 326. 5K. BC**

Tangential Nozzles

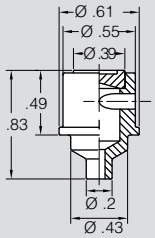
Series 300.185

Very homogeneous and stable hollow cone spray pattern. Not prone to clogging due to tangential design.

Applications:
Acid regeneration.

Material: Aluminium oxide

Material: Silicon carbide



Typical dimensions
(details on request)

For the acid regeneration a very precise spray pattern even at low flow rates is required.

The nozzles are fitted in a plate with multiple borings allowing the flow to pass through to the nozzles and to position them correctly.

Special materials such as sintered silicon carbide or aluminium oxide are used for the nozzles to prolong the life-time in this demanding atmosphere.

Please contact Lechler for available flow rates and spray angles.

Schematic view of reactor

ALUMINIUM
SPRAY APPLICATIONS
WE HAVE THE WORLD COVERED

Headquarters
Production
Sales

Subsidiary
Sales office/sales representative

Full range from one source

Precise spray applications play a crucial part in many areas of steel production and non-ferrous metallurgy: from cooling in continuous casting processes and roller cooling through to descaling and strip treatment. Lechler offers special nozzles made of a wide range of different materials to cover all applications. The focus is always on achieving the optimum result with the lowest possible consumption of energy and spray media – thus also significantly reducing the overall carbon footprint.

Global representation

We are at home right at the heart of Europe. In Metzingen, Germany, we have developed unique expertise in planning, calculation and realization of metallurgical spray applications. From here, we support you with our highly qualified experts and sales partners all over the world.

We do not just see ourselves as a supplier, however. Because we also support you in process optimization on-site. Thanks to our international network of production locations, subsidiaries and sales offices/sales representatives, we can always guarantee fast part availability and short distances for service work. Contact us and experience this for yourself. We look forward to hearing from you.

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Subject to technical modifications and mistakes.