# Twin Fluid Nozzle Lances for Gas Conditioning

# Efficient Gas Conditioning with Twin Fluid Nozzle Lances made by Lechler

Lechler with more than 120 years of experience in the field of spraying and atomization technology is your reliable partner for gas conditioning. Thanks to modern measuring methods, highly precise manufacturing technology and up to-date application knowledge we are able to solve your gas conditioning problems.
It is important in many areas of gas conditioning to create very fine droplets and to distribute them evenly in a gas stream. For this reason Lechler has developed special pneumatically controlled liquid atomizing nozzle lances. They are available in a large variety of configurations.
Generally two principles of atomization can be distinguished with pneumatically controlled atomizing nozzles:

**Nozzles with internal mixture:**
Liquid and gas are mixed inside the nozzle.

**Nozzles with external mixture:**
Liquid and gas are mixed outside of the nozzle orifice.

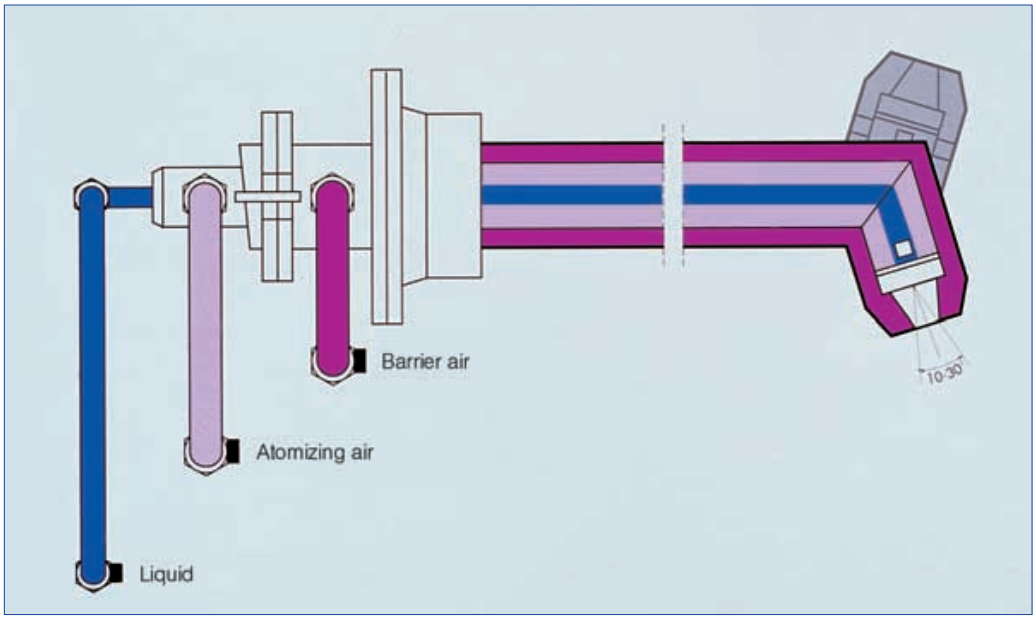
Lechler offers a large variety of nozzles for both principles of atomization. This leaflet presents a first overview of Lechler`s designs. Our specialists are always at your disposal in order to solve your very special application problems.

## Typical examples for Lechler Twin Fluid Nozzle Lances

Lechler Twin Fluid Nozzle Lances have been used successfully for many years in the following processes of gas treatment.

**Cooling / Humidifying (conditioning) in front of ESP**
as an example in waste incinerators, in cement works, in coal fired power stations in front of ESP/baghouse.

**DeNox Process**
In accordance with the SNCR (high temperature DeNox process) or SCR (low temperature DeNox process with catalytic converter) technology e.g. in municipal waste incinerators and power stations.




Schematic sketch of a Lechler Twin Fluid Lance

**Spray dry FGD**
(for drying of reacted limestone slurry), such as in municipal waste incinerator plants.

**Spray adsorption**
as in flue gas desulphurization sections of smaller block type coal fired power stations.

**Atomizing of residues into burning chambers,**
for instance in waste and special waste incinerator plants.

# Modern measuring technology – your guarantee for high product quality

For the design of an engineered system or plant it is necessary to obtain a multitude of nozzle specific data that permits exact statements about flow rate, pressure, spray width, droplet size and droplet velocity. In order to measure these parameters Lechler uses the most modern measuring technology which was partly developed by Lechler. Data from our measuring laboratory is available on request. A further service offered by Lechler is our series of gas cooling calculations.

## Measuring devices

**Liquid pressure:**
electronic pressure sensor

**Flow rate (liquid):**
inductive magnetic flow meter

**Flow rate (air):**
inductive rotameter

**Droplet size:**
phase Doppler particle analyser

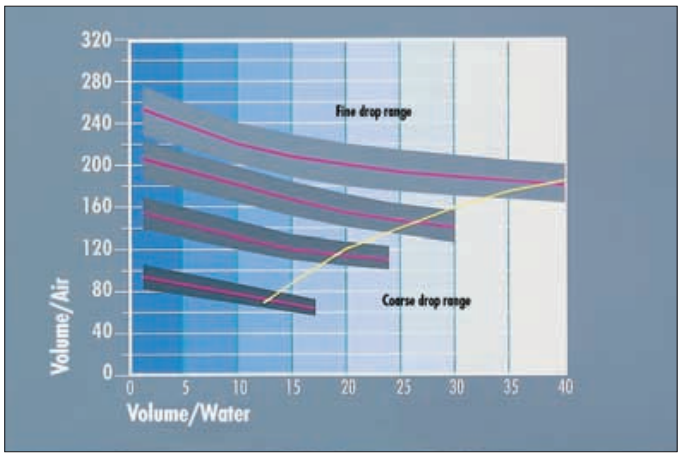
**Velocity measurement:**
phase Doppler particle analyser

## Important terms for the droplet size measurement

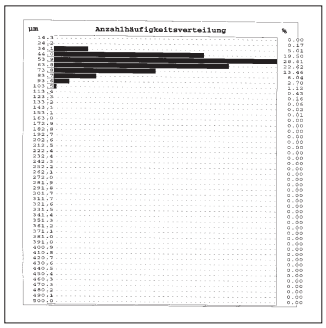
**Sauter mean diameter $D_{32}$:**
the Sauter mean diameter characterizes that diameter of a droplet which has the same ratio of volume/surface as the whole spray sample. So the Sauter mean diameter is a measure for the relation of droplet volume to droplet surface and therefore a decisive reference point in process engineering in order to calculate all surface related processes (heat/substance exchange).

**Volume diameter $D_{v90}$:**
the volume diameter $D_{v90}$ means that 90 % of the atomized volume is in droplets that are smaller or equal to this value, i. e. only 10 % of the atomized volume has a larger droplet diameter.

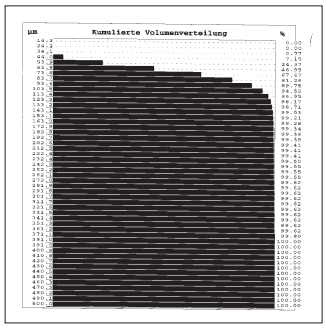
**Maximum droplet diameter $D_{max}$:**
the maximum droplet diameter characterizes the biggest droplet diameter that can be found in the spray sample. This value is frequently used to calculate evaporation lenghts.



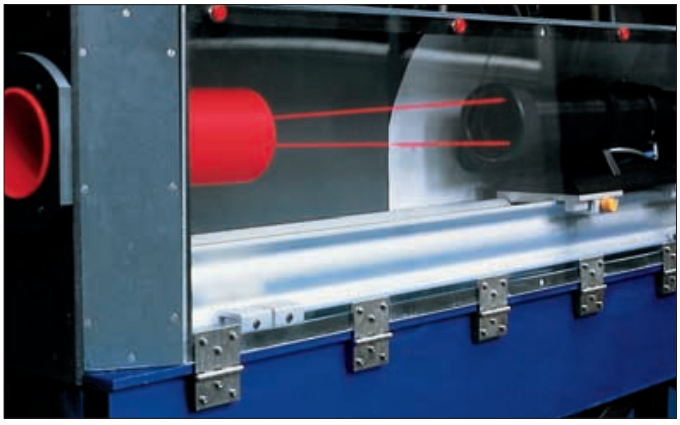
Example for a flow rate diagram of a Lechler Twin Fluid Nozzle Lance



Example for a droplet frequency distribution



Example for cumulated volume distribution


The phase Doppler particle analyser for droplet size measurements


Computer aided data capture

# Twin Fluid Nozzles with external mix model range 150

Twin Fluid Nozzles of the model range 150 create an especially even full cone jet with a spray angle of up to 30°. The gas (air or steam) and the liquid are mixed outside the nozzle body (external mix).

The external mix is especially useful in order to atomize viscous media. Low liquid pressures are typical for this type of construction.

The droplet size is defined by the air/water ratio.

The air/water ratio is defined as follows:

air/water ratio A/W =

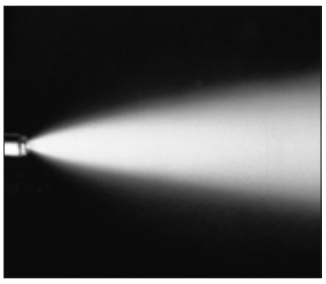
$$\frac{\text{Flow Rate Air (m}^3\text{ / h at normal conditions)}^1}{\text{Flow Rate Water (l / min)}}$$

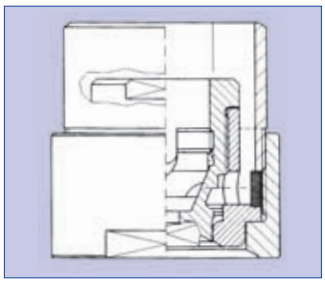
[1] To = 273 K ( O °C )
Po = 1 bar

The higher the air/water ratio is, the smaller the droplets will be. Twin Fluid Nozzles of the model range 150 are available in all types of steel, chrome-nickel alloys and plastic materials (PVC, PVDF, PTFE).

**Advantages:**

- Operation with air or steam
- Good emergency running processes





**Functional data of model range 150**

- Liquid pressure: 0,3 - 10,0 bar ü
- Air pressure: 1,0 - 5,0 bar ü
- Regulating range up to max.: 1 : 5
- Trajectory at 4 bar over pressure: 9 m
- Spray angle: 20°- 30°

| **Product codes for ordering** | | **B ø [mm]** | **E ø [mm]** | **Volume $\dot{V}$** [l/min] Liquid | | | | | | **Volume $\dot{V}_n$** [m³/h] Air | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type** | | **Bore diameter** | **Narrowest cross section** | **Liquid pressure p** [bar] | | | | | | **Air pressure p** [bar] | | | |
| | | | | **0,3** | **0,5** | **0,7** | **1,0** | **1,5** | **2,0** | **1,0** | **2,0** | **3,0** | **4,0** |
| **150.005** | 20 ° | 1,0 | 1,0 | 0,15 | 0,20 | 0,24 | 0,28 | 0,35 | 0,40 | | | | |
| **150.007** | -30 ° | 2,0 | 2,0 | 0,39 | 0,50 | 0,59 | 0,71 | 0,87 | 1,00 | | | | |
| **150.009** | | 4,0 | 2,0 | 0,97 | 1,25 | 1,48 | 1,77 | 2,17 | 2,50 | 10 | 15 | 20 | 25 |
| **150.010** | | 3,5 | 2,0 | 1,55 | 2,00 | 2,37 | 2,83 | 3,46 | 4,00 | | | | |
| **150.013** | | 6,0 | 2,0 | 3,10 | 4,00 | 4,73 | 5,66 | 6,93 | 8,00 | | | | |
| **150.032** | | 8,0 | 2,7 | 3,10 | 4,00 | 4,73 | 5,66 | 6,93 | 8,00 | 31 | 47 | 63 | 80 |
| **150.050** | | 9,0 | 4,9 | 6,20 | 8,00 | 9,47 | 11,31 | 13,86 | 16,00 | 60 | 90 | 120 | 150 |
| **150.052** | | 9,0 | 4,9 | 12,20 | 15,75 | 18,64 | 22,27 | 27,28 | 31,50 | | | | |
| **150.063** | | 15,0 | 4,9 | 24,40 | 31,50 | 37,27 | 44,55 | 54,56 | 63,00 | 100 | 150 | 200 | 250 |

Further designs on request

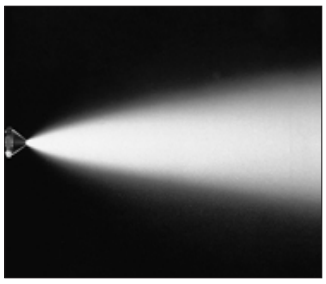
# Twin Fluid Nozzles with internal mix model range 170/171/180

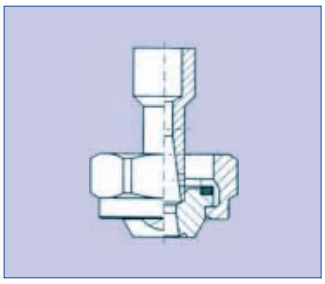
The Lechler Twin Fluid Nozzle range 170/171/180 works as per the supersonic principle. Gas and liquid are mixed in the mixing chamber inside the nozzle (internal mix) and are united to an intensive 2-phase mixture. The further forming of the nozzle geometry has as an effect of accelerating this mixture to supersonic speed. This leads to an extremely fine atomization of the droplets with a good regulating characteristic. For Twin Fluid Nozzles with internal mixture the air/water-ratio plays an important role. **The size of the maximum droplet can be regulated in a big range by variation of the air/water-ratio while the plant is operating.**

The large free cross sections in the nozzle also allow the atomization of viscous liquids and up to a certain extent even abrasive media in maintenance-free use.
Twin Fluid Nozzles of the model range 170/171/180 are available in all types of steel, chrome- nickel alloys, plastic materials (PVC, PVDF, PTFE) and ceramic materials.

**Advantages:**

- Adjustable droplet size
- Wide range of volume rates
- Large free cross sections
- Wear-resistant ceramic inserts





**Functional data of model range 170/171/180**

- Liquid pressure: 1,0 - 5,0 bar ü
- Air pressure: 1,0 - 5,0 bar ü
- Regulating range up to max.: 1 : 30
- Spray angle: 15° and 60° (see p. 8)

| Product codes for ordering (Selection) | E ø [mm] | E ø [mm] | Air pressure p [bar] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1,0 | | | 2,0 | | | 3,0 | | | 4,0 | | |
| Type | Air | Water | p [bar] Water | $\dot{V}$ [l/min] Water | $\dot{V}_n$ [m³/h] Air | p [bar] Water | $\dot{V}$ [l/min] Water | $\dot{V}_n$ [m³/h] Air | p [bar] Water | $\dot{V}$ [l/min] Water | $\dot{V}_n$ [m³/h] Air | p [bar] Water | $\dot{V}$ [l/min] Water | $\dot{V}_n$ [m³/h] Air |
| **170.641** | 3,0 | 4,2 | 0,9 | 0,4 | 24,0 | 1,8 | 0,6 | 37,0 | 2,7 | 0,8 | 50,0 | 3,6 | 0,9 | 68,0 |
| | | | 0,95 | 1,0 | 20,0 | 1,9 | 1,5 | 33,0 | 2,9 | 3,0 | 35,0 | 3,9 | 4,0 | 44,0 |
| | | | 1,0 | 2,5 | 14,0 | 2,0 | 3,5 | 22,0 | 3,1 | 5,0 | 26,0 | 4,1 | 7,0 | 32,0 |
| **170.721** | 3,7 | 5,0 | 0,9 | 0,5 | 34,0 | 1,8 | 0,7 | 50,0 | 2,7 | 0,9 | 69,0 | 3,6 | 1,0 | 88,0 |
| | | | 0,95 | 2,0 | 28,0 | 1,9 | 3,0 | 40,0 | 2,9 | 4,0 | 58,0 | 3,9 | 8,0 | 66,0 |
| | | | 1,0 | 3,5 | 22,0 | 2,0 | 5,5 | 31,0 | 3,1 | 7,5 | 42,0 | 4,2 | 12,0 | 55,0 |
| **170.801** | 2,0 | 5,5 | 0,7 | 1,0 | 40,0 | 1,5 | 1,0 | 58,0 | 2,2 | 1,2 | 80,0 | 3,2 | 1,2 | 105,0 |
| | | | 0,9 | 3,0 | 35,0 | 1,8 | 5,0 | 52,0 | 2,6 | 7,0 | 72,0 | 3,6 | 10,0 | 91,0 |
| | | | 1,0 | 5,0 | 32,0 | 2,0 | 10,0 | 48,0 | 3,0 | 14,0 | 63,0 | 4,0 | 20,0 | 83,0 |
| **170.881** | 2,8 | 7,6 | 0,6 | 1,0 | 60,0 | 1,5 | 1,2 | 95,0 | 2,2 | 1,5 | 130,0 | 3,1 | 1,8 | 171,0 |
| | | | 0,8 | 5,0 | 55,0 | 1,7 | 7,0 | 90,0 | 2,5 | 10,0 | 118,0 | 3,5 | 15,0 | 154,0 |
| | | | 0,9 | 8,0 | 50,0 | 1,9 | 13,0 | 80,0 | 3,0 | 19,0 | 105,0 | 4,1 | 28,0 | 143,0 |
| **170.961** | 3,2 | 9,5 | 0,6 | 1,0 | 94,0 | 1,4 | 1,2 | 155,0 | 2,2 | 1,5 | 210,0 | 3,0 | 1,8 | 275,0 |
| | | | 0,8 | 5,0 | 85,0 | 1,7 | 10,0 | 130,0 | 2,6 | 15,0 | 179,0 | 3,5 | 20,0 | 220,0 |
| | | | 1,0 | 12,0 | 72,0 | 1,9 | 19,0 | 115,0 | 3,0 | 26,0 | 152,0 | 4,1 | 38,0 | 198,0 |

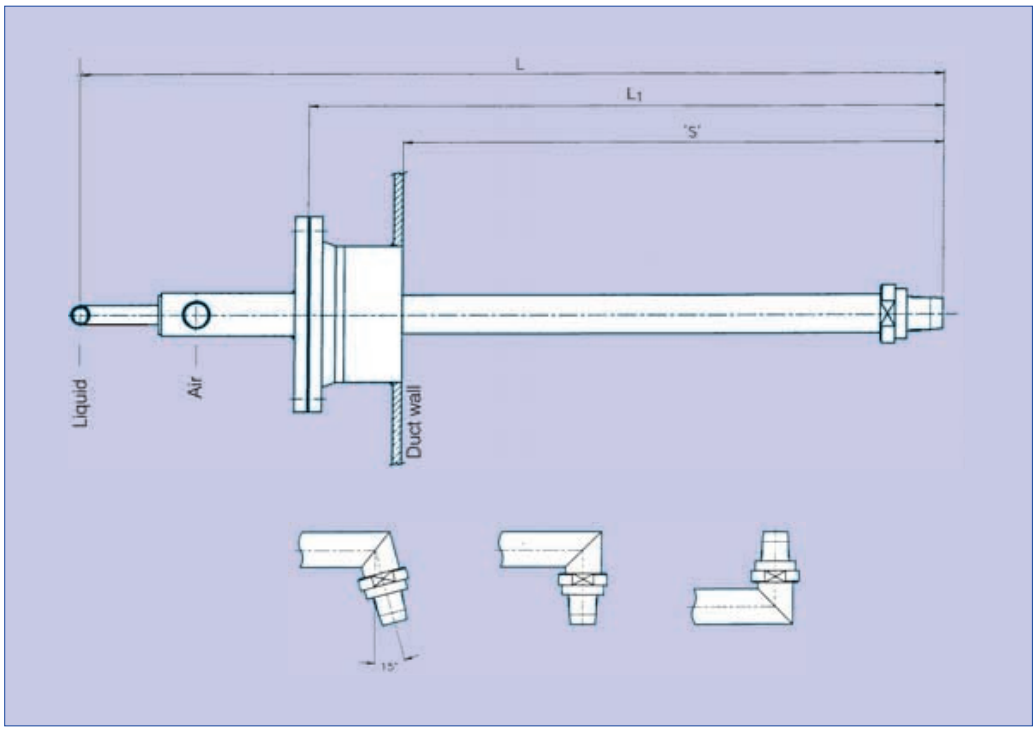
Further designs on request

# Twin Fluid Nozzle Lances
# Examples of configuration

Lechler Twin Fluid Nozzle Lances of this type can be delivered with various spray positions of the nozzles. The compact construction allows easy mounting. The robust construction made from high quality stainless steel provides significant safe operation of the spray lance. Lechler Twin Fluid Nozzle Lances are delivered as a complete spray unit. All components are designed to exactly match each other. This ensures minimum down time when installing and connecting.

**Advantages:**

- Compact construction
- Robust design
- Maintenance friendly construction
- Functional and safe operation

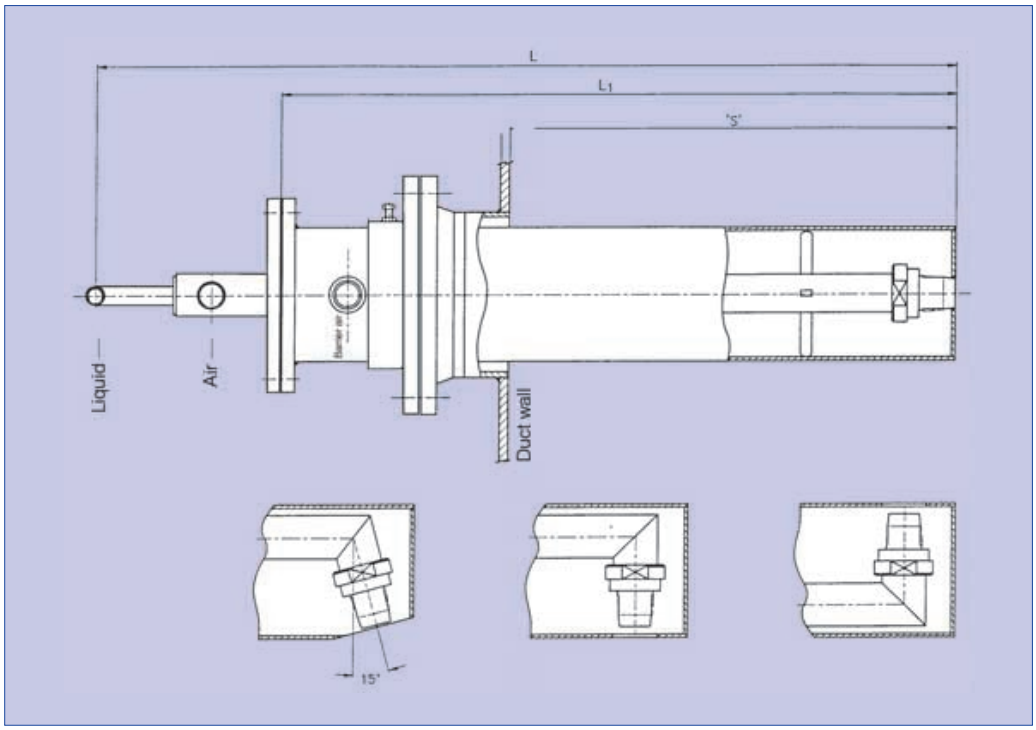



Twin Fluid Nozzle Lance

The Twin Fluid Nozzle Lance, as shown, is a version with a big shield (for instance made from Hastelloy C), barrier air and purge air. This construction is especially suitable for higher gas temperatures and aggressive gases. Twin Fluid Nozzle Lances with heat shield piping can casily be mounted/demounted with the minimum of effort. Thanks to the variable installation depth the spray position is changable and can be adapted to changing process parameters without problem.

**Advantages:**

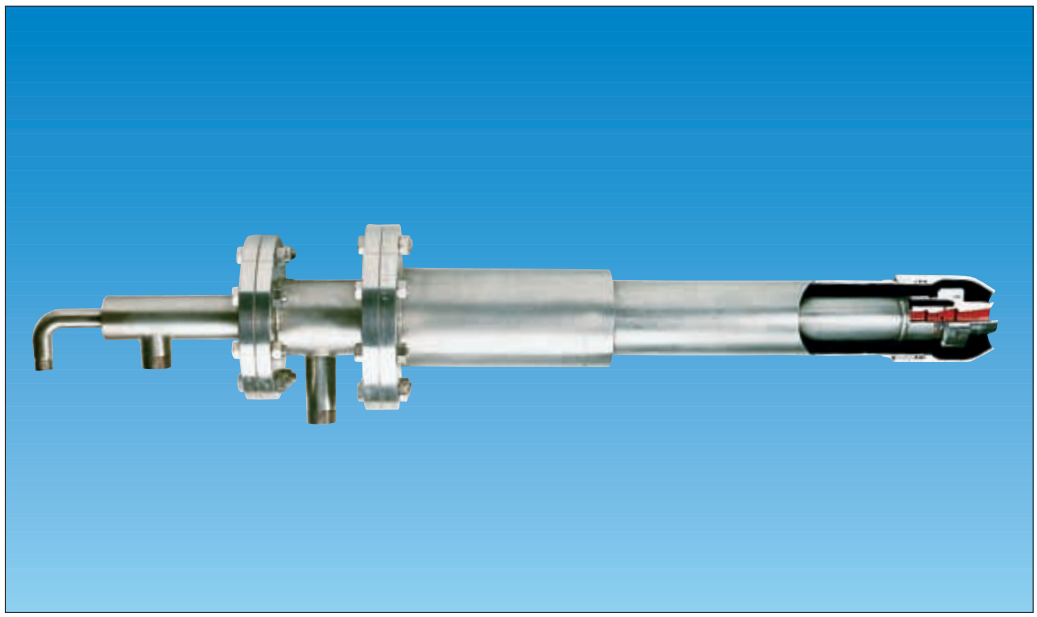
- Robust design
- Maintenance friendly design
- Functional and safe operation for variable installation depth




Twin Fluid Nozzle Lance with big shield and barrier air

# Twin Fluid Nozzle Lances
# Examples of configuration

The nozzle lance illustrated is designed with a **compact** shield. This shield reduces the flow resistance in the gas duct compared with the lance itself. At high gas velocity in particular, this results in an improved process result. The air barrier protects the nozzle from clogging and protects the interior nozzle lance against corrosion and overheating. The conical design of the front barrier air cap effectively ensures that the nozzle is evenly surrounded by an air barrier. This guarantees reliable, low-maintenance operation. The front barrier air cap can be quickly dismantled in order to inspect the nozzle.



Twin Fluid Nozzle Lance with small shield and barrier air (cut away model)

### Advantages:

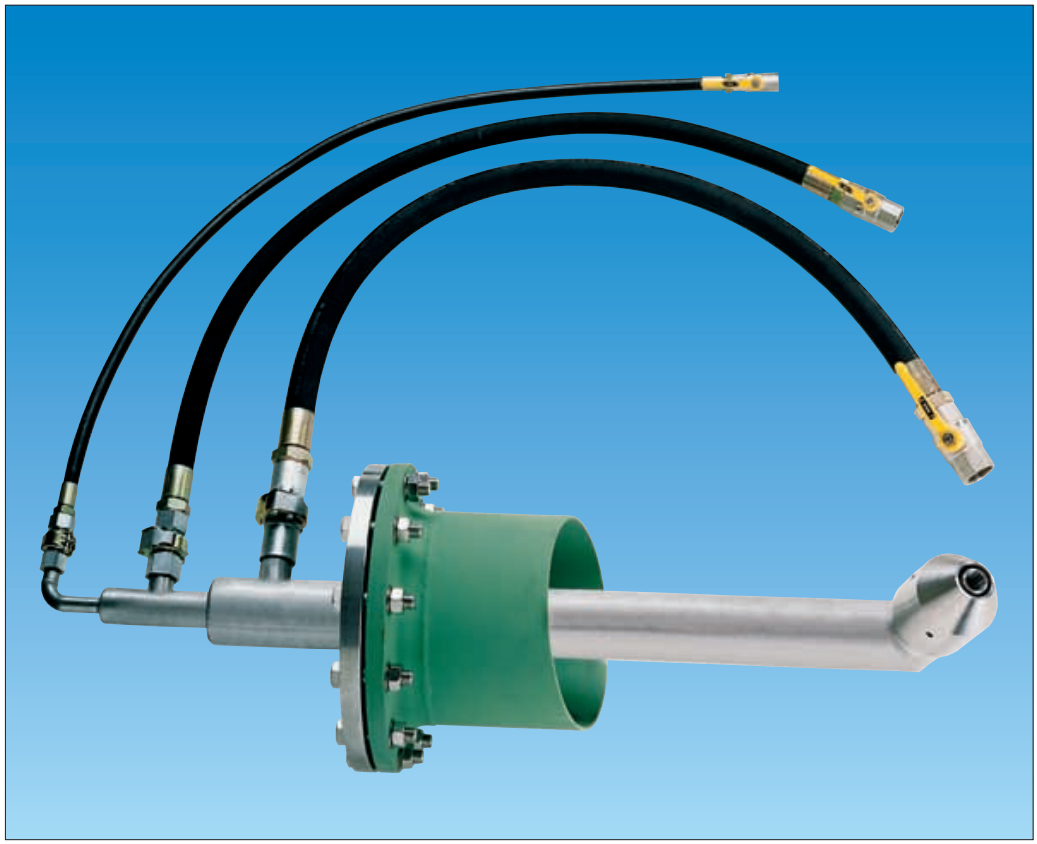
- Robust and compact design
- High safety in operation

### Materials:

The standard material is stainless steel 316/1.4571. High alloy steels, such as chrome-nickel steels (Hastelloy) are also available for special processes. Lances made from plastic materials, such as PVC, PVDF, PTFE and temperature resistant FRP have proved to be highly efficiant for some special applications.

### Standard delivery scope:

- Pressure resistant and flexible hoses
- Shut off valve
- Mounting devices, coupling devices
- Special accessories up to complete spraying systems including control units (see page 11).



Twin Fluid Nozzle Lance with small shield and accessories

# Example of a Twin Fluid Nozzle Lance with a multiple nozzle head

Twin Fluid Nozzle Lances with multiple spray heads are used where relatively large cooling water quantities need to be finely atomized. These nozzle lances allow a large spray angle of up to 90° and create very fine and small droplets even at a high liquid flow rate. Each multiple nozzle head can be supplied with 3, 4 or 6 nozzles.

### Advantage:

- Wide spray angle
- High liquid flow rate per lance
- Small droplet sizes
- Compact and robust construction
- Maintenance friendly design
- Functional and safe design

### Materials:

The Standard material is stainless steel 316/1.4571. High alloy steels, such as chrome-nickel steels (Hastelloy) are also available for special processes. Lances made from plastic materials, such as PVC, PVDF, PTFE and temperature resistant FRP have proved to be highly efficient for some special applications.

### Standard delivery scope:

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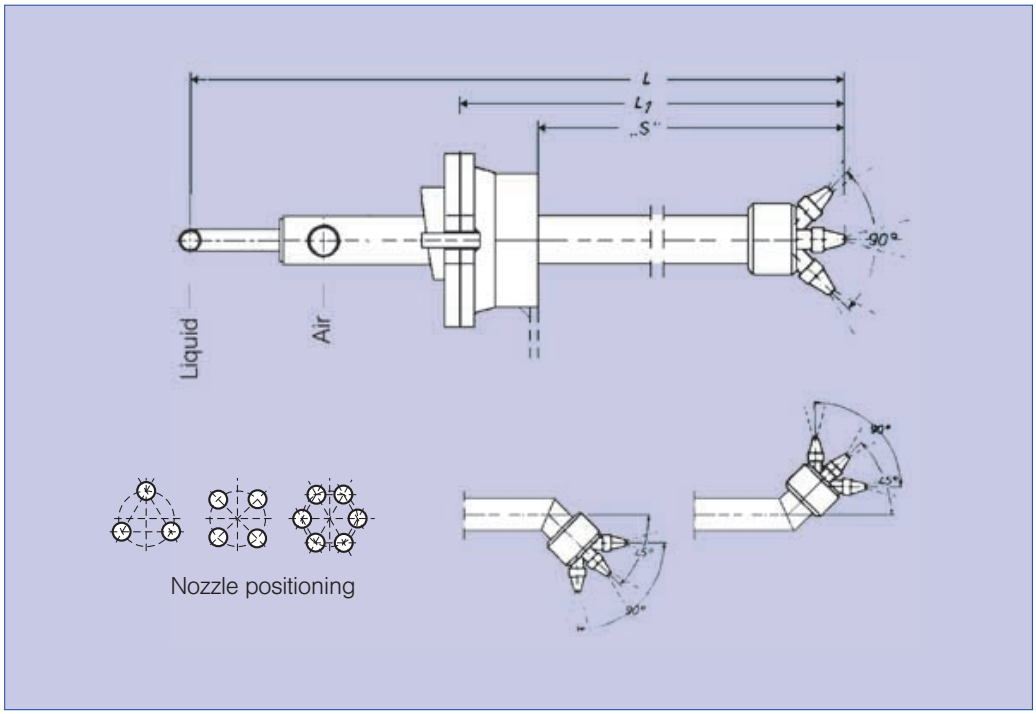
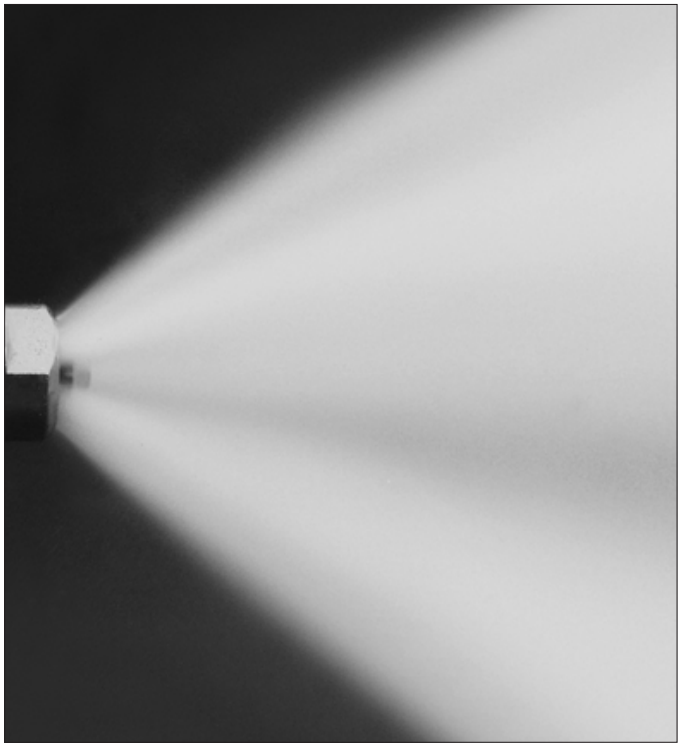



Twin Fluid Nozzle Lance with a multiple nozzle head



Spray pattern of a multiple supersonic nozzle with 60° spray angle

# Questionnaire for calculation of your gas cooling requirements

Dear customer,

to comment on your gas cooling problem, we would require all data known to you and indispensable for computing. The more precise your indications are, the more reliable our calculations can be (given without any process commitment).
Please complete this technical questionnaire.

Company:..... Date:.....

Address:..... Complement:.....

..... Department:.....

..... Phone/Fax:.....

## 1. Gas data

- Gas flow rate under normal conditions*, wet gas min..... max..... $m^3$/h i. N.

  Composition of gas (HCl, HF, etc.) .....
- Cooling limit temperature (dew point) .....°C relative incoming humidity.....%
- Inlet temperature of gas min..... max.....°C
- Outlet temperature of gas min..... max.....°C
- System pressure (in the reaction area).....bar

## 2. Conditions on site

- Are gas cooling tower dimensions fixed? ☐ Yes Ø..... dimensions .....

  ☐ No Favorite-Ø..... dimensions .....
- Available reaction distance..... m. ☐ Reaction distance to be determined.
- Direction of gas ☐ ⇓ ☐ ⇑ ☐ ⇒
- Dust content in gas..... $mg/m^3$ i. N.
- Nozzle type: ☐ Single fluid ☐ Twinfluid ☐ Both types possible
- Complete evaporation required? ☐ Yes ☐ No
- Is water injection system always in operation? ☐ Yes ☐ No

  In case the operation is interrupted, running time .....%

## 3. Coolant data

- Coolant water max. over pressure .....bar ..... Content of solids.....

  Inlet temperature .....°C
- Medium (Twin fluid nozzles)

Air Over pressure.....bar

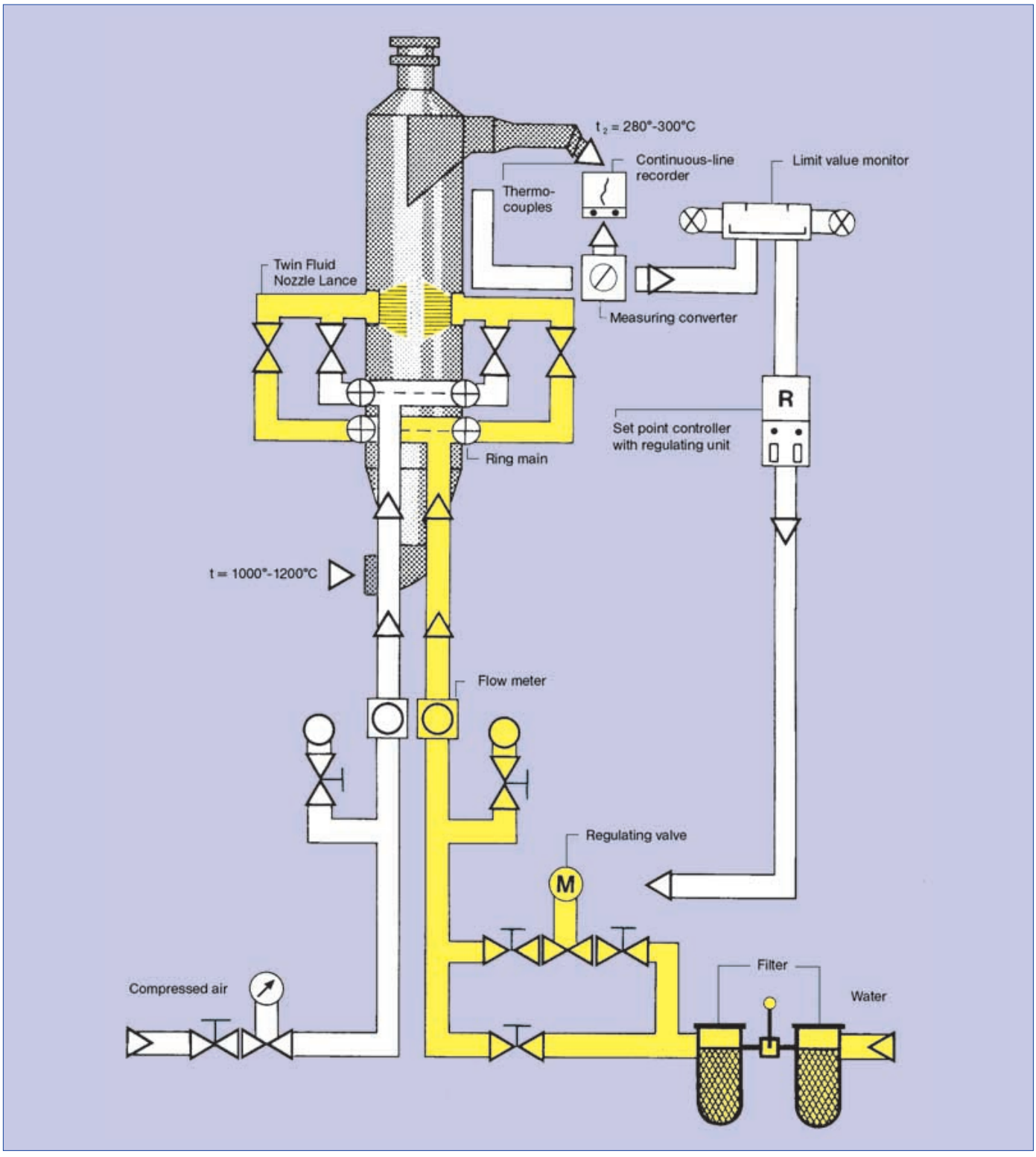
Steam Over pressure.....bar

Temperature .....°C

* $T_0 = 273$ K (0°C), $P_0 = 1$ bar

**Please send this questionnaire together with a short description to Fax-No.: ++49 (0) 71 23 - 9 62 301**

# Typical installation of Twin Fluid Nozzle Lances including control unit



# Lechler complete solutions with pump, regulation units and electronic controls

Lechler also supplies complete, pre-assembled pump and regulator stations. The design of these stations is adapted to suit the function and mode of operation of the nozzle lances. The control valve, for example, is designed to match the special operating characteristics (required control range) of the installation. The choice of materials used for the components is determined by the medium to be sprayed.

### Our range of engineering services includes:

- Gas cooling computations (evaporation distance and water quantity)
- Selection of nozzle (type, number and size)
- Design of pump, control valves, etc.
- Detail designs of air, water and barrier air pipe lines
- Designing flow sheets
- Designing drawings for nozzle lances, pump- and regulation units
- Documentation

### The pump and regulation units can be equipped with the following components:

- Filters
- Contact pressure gauges
- Pressure gauges
- Pumps
- Control valves
- Flowmeters
- Non-return valves
- Overflow valves

etc.

The measuring and monitoring instruments for the unit (flow measurements, pressure monitoring) are established in cooperation with the customer. The correct choice of instrumentation ensures that the required operational reliability and safety are achieved.
The components and interconnecting pipework are mounted on a stable rack. Pressure- and function-test and pre-commissioning at Lechler factory enables us to put the system into operation in a minimum of time after shipping the compact unit on site.
In order to offer complete solutions, we can also supply the PLC required for temperature control. The switching cabinet can be integrated onto the valve rack.

### Our complete engineering package includes:

- Designing the control system
- Flow charts
- Preparing the program for the PLC
- CAD circuit diagrams
- Documentation

Example for pump and regulation unit

Our complete system solution offers you a prefabricated installation tailored to your needs.
Large numbers of complete systems of this type have been built and installed for a range of applications throughout the world and have proved their worth in continuous operation.

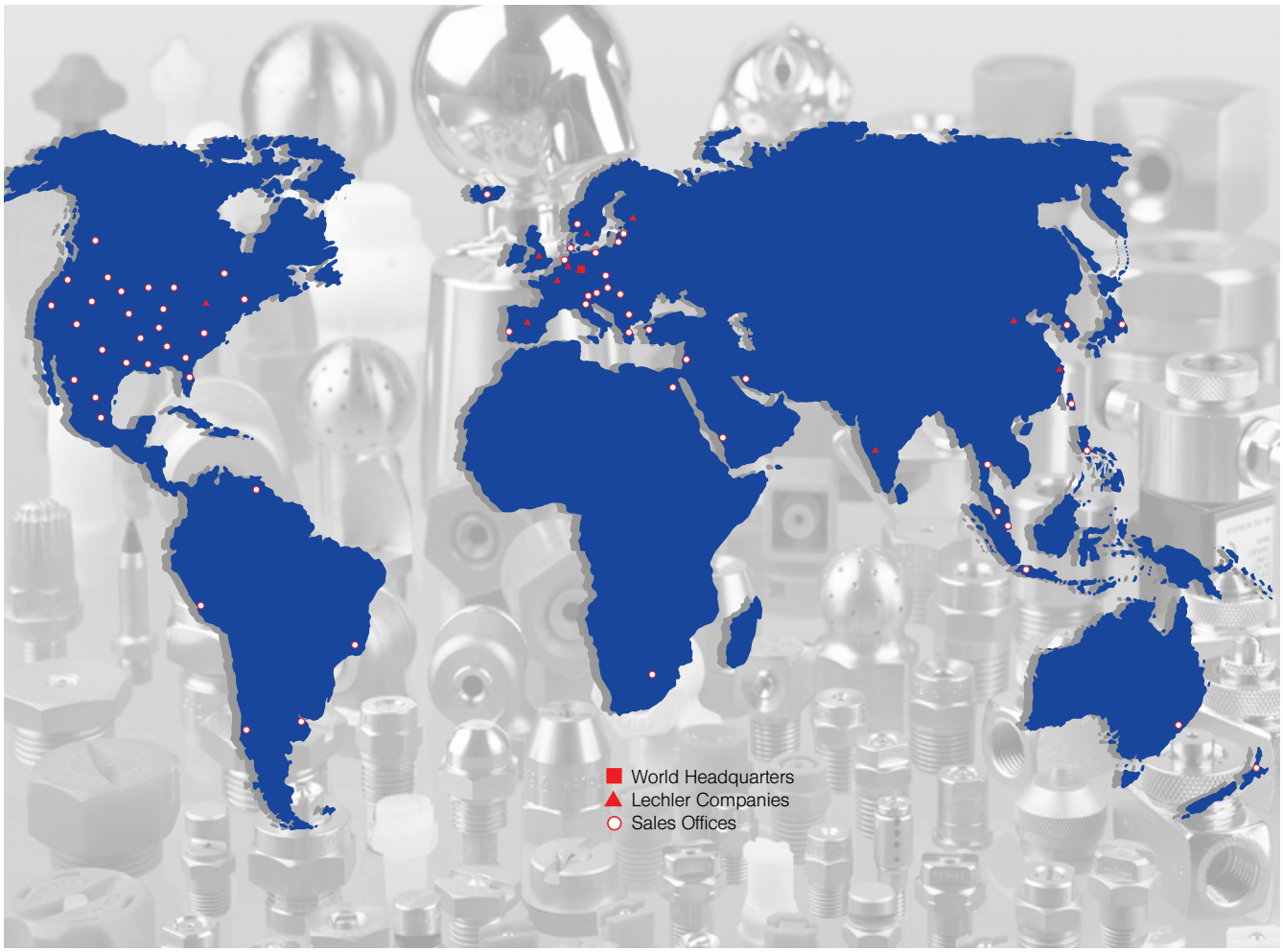
We would be pleased to send you copies of our product- and country-specific reference lists.

### Advantages:

- Complete solution from a single source including process guarantees
- No interfaces
- Systems adapted to suit operational requirements
- Minimal installation and commissioning times
- Compact units

**Lechler GmbH**
**Precision Nozzles · Droplet Separators**
**P.O. Box 13 23**
**72544 Metzingen / Germany**
**Phone +49 (0 ) 71 23 - 962 - 0**
**Fax +49 (0 ) 71 23 - 962 - 333**

**E-mail: info@ lechler.de**
**Internet: www.lechler.com**




**Belgium:** Lechler S.A./N.V. · Avenue Mercatorlaan, 6 · 1300 Wavre · Phone: (10) 225022 · Fax: (10) 243901 · info@lechler.be
**China:** Lechler Intl. Trad. Co., Ltd. · Beijing Office · Rm.1812 CTS Plaza · No.2 Bei San Huan Dong Lu · Phone: (86) 1064661986, Fax: (86) 1064660196 · info@lechler.com.cn
**Finland:** Lechler Oy · Kalliotie 2 · 04360 Tuusula · Phone: (358) 98709844 · Fax: (358) 98709847 · info@lechler.fi
**France:** Lechler France, S.A. · Bât. CAP2 B51 · 66-72, Rue Marceau · 93558 Montreuil cedex · Phone: (1) 49882600 · Fax: (1) 49882609 · info@lechler.fr
**Great Britain:** Lechler Ltd. · 1 Fell Street, Newhall · Sheffield, S9 2TP · Phone: (0114) 2492020 · Fax: (0114) 2493600 · info@lechler.com
**India:** Lechler (India) Pvt. Ltd. · Plot B-2 · Main Road · Wagle Industrial Estate · Thane (W) - 400604 · Phone: (22) 25811196 · Fax: (22) 25821262 · lechler@lechlerindia.com
**Sweden:** Lechler AB · Box 158 · 68324 Hagfors · Phone: (46) 56325570 · Fax: (46) 56325571 · info@lechler.se
**Spain:** Lechler S.A. · Avda. Pirineos 7 · Oficina B7, Edificio Inbisa I · 28700 San Sebastián de los Reyes, Madrid · Phone: (34) 916586346 · Fax: (34) 916586347 · info@lechler.es
**USA:** Lechler Inc. · 445 Kautz Road · St. Charles, IL 60174 · Phone: (630) 377-6611 · Fax: (630) 377-6657 · GeneralMgr@lechlerUSA.com

**Edition 05/06** · GB · 1.000 · LEC06063 · www.walliser-partner.de · S · Subject to technical modifications.