



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.

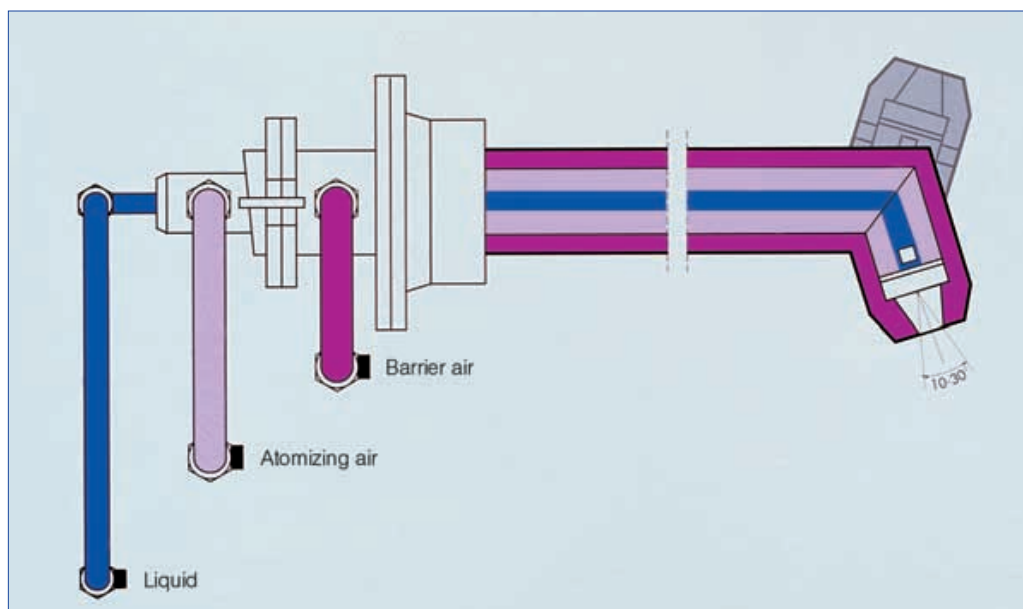
Lechler offers a large variety of nozzles for both principles of atomization. This leaflet presents a first overview of Lechler's designs. Our specialists are always at your disposal in order to solve your very special application problems.

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

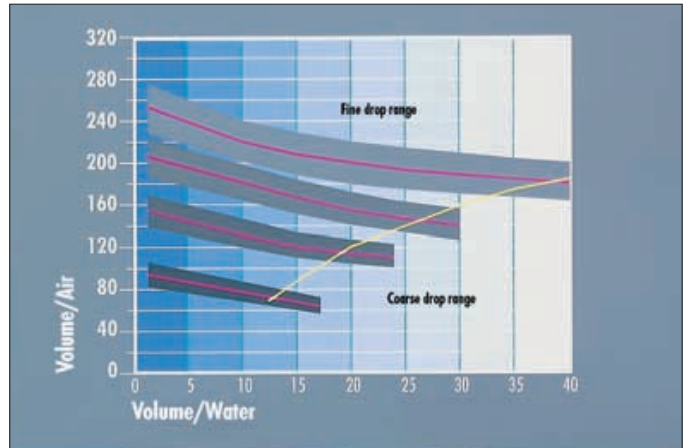
Velocity measurement:
phase Doppler particle analyser

Important terms for the droplet size measurement

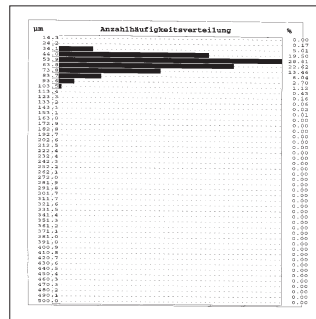
Sauter mean diameter D_{32} :
the Sauter mean diameter characterizes that diameter of a droplet which has the same ratio of volume/surface as the whole spray sample. So the Sauter mean diameter is a measure for the relation of droplet volume to droplet surface and therefore a decisive reference point 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.

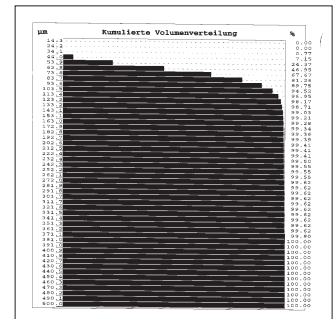
Maximum droplet diameter D_{max} :
the maximum droplet diameter characterizes the biggest droplet diameter that can be found in the spray sample. This value is frequently used to calculate evaporation lengths.



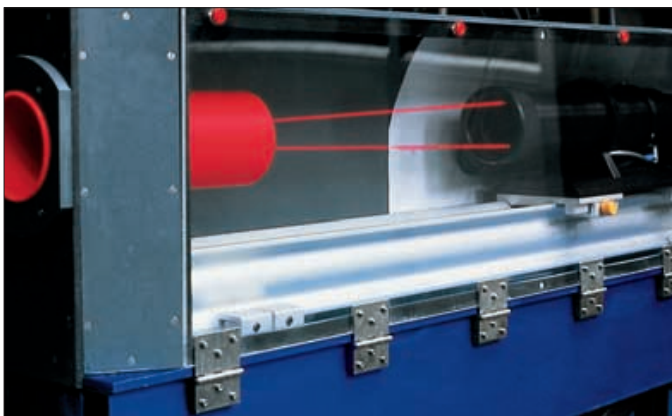
Example for a flow rate diagram of a Lechler Twin Fluid Nozzle Lance



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:

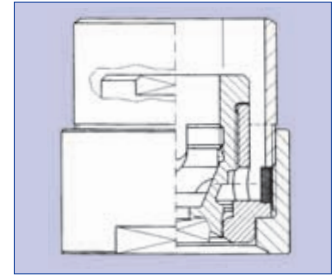
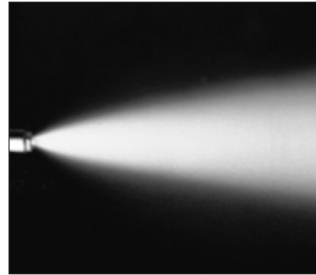
$$\text{air/water ratio } A/W = \frac{\text{Flow Rate Air (m}^3/\text{h at normal conditions)}^1}{\text{Flow Rate Water (l/min)}}$$

¹ To = 273 K (0 °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			
				Liquid pressure p [bar]						Air pressure p [bar]			
Type		Bore diameter	Narrowest cross section	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	10	15	20	25
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				
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				

Further designs on request

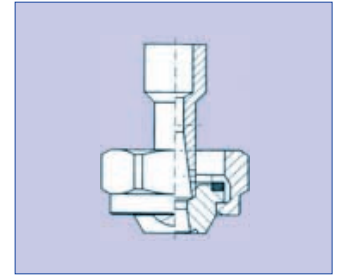
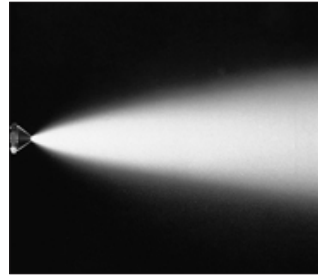
Twin Fluid Nozzles with internal mix model range 170/171/180

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		
			Water [bar]	Water [l/min]	Air [m³/h]	Water [bar]	Water [l/min]	Air [m³/h]	Water [bar]	Water [l/min]	Air [m³/h]	Water [bar]	Water [l/min]	Air [m³/h]
	Air	Water	p	v̇	ṽn	p	v̇	ṽn	p	v̇	ṽn	p	v̇	ṽn
170.641	3,0	4,2	0,9 0,95 1,0	0,4 1,0 2,5	24,0 20,0 14,0	1,8 1,9 2,0	0,6 1,5 3,5	37,0 33,0 22,0	2,7 2,9 3,1	0,8 3,0 5,0	50,0 35,0 26,0	3,6 3,9 4,1	0,9 4,0 7,0	68,0 44,0 32,0
170.721	3,7	5,0	0,9 0,95 1,0	0,5 2,0 3,5	34,0 28,0 22,0	1,8 1,9 2,0	0,7 3,0 5,5	50,0 40,0 31,0	2,7 2,9 3,1	0,9 4,0 7,5	69,0 58,0 42,0	3,6 3,9 4,2	1,0 8,0 12,0	88,0 66,0 55,0
170.801	2,0	5,5	0,7 0,9 1,0	1,0 3,0 5,0	40,0 35,0 32,0	1,5 1,8 2,0	1,0 5,0 10,0	58,0 52,0 48,0	2,2 2,6 3,0	1,2 7,0 14,0	80,0 72,0 63,0	3,2 3,6 4,0	1,2 10,0 20,0	105,0 91,0 83,0
170.881	2,8	7,6	0,6 0,8 0,9	1,0 5,0 8,0	60,0 55,0 50,0	1,5 1,7 1,9	1,2 7,0 13,0	95,0 90,0 80,0	2,2 2,5 3,0	1,5 10,0 19,0	130,0 118,0 105,0	3,1 3,5 4,1	1,8 15,0 28,0	171,0 154,0 143,0
170.961	3,2	9,5	0,6 0,8 1,0	1,0 5,0 12,0	94,0 85,0 72,0	1,4 1,7 1,9	1,2 10,0 19,0	155,0 130,0 115,0	2,2 2,6 3,0	1,5 15,0 26,0	210,0 179,0 152,0	3,0 3,5 4,1	1,8 20,0 38,0	275,0 220,0 198,0

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.

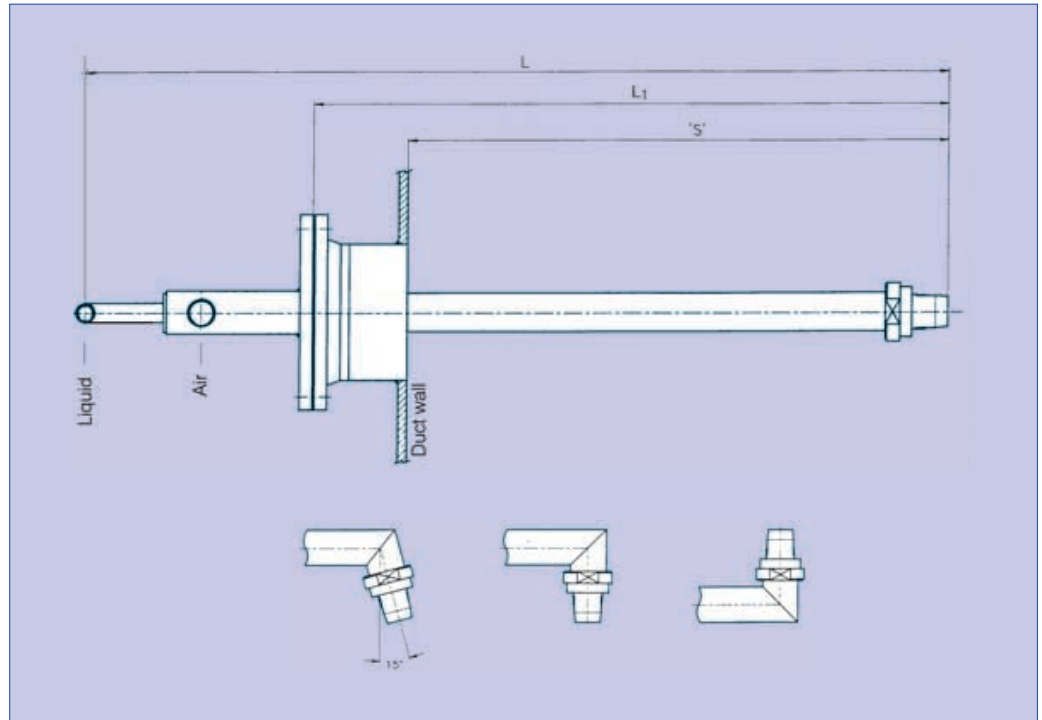
Advantages:

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

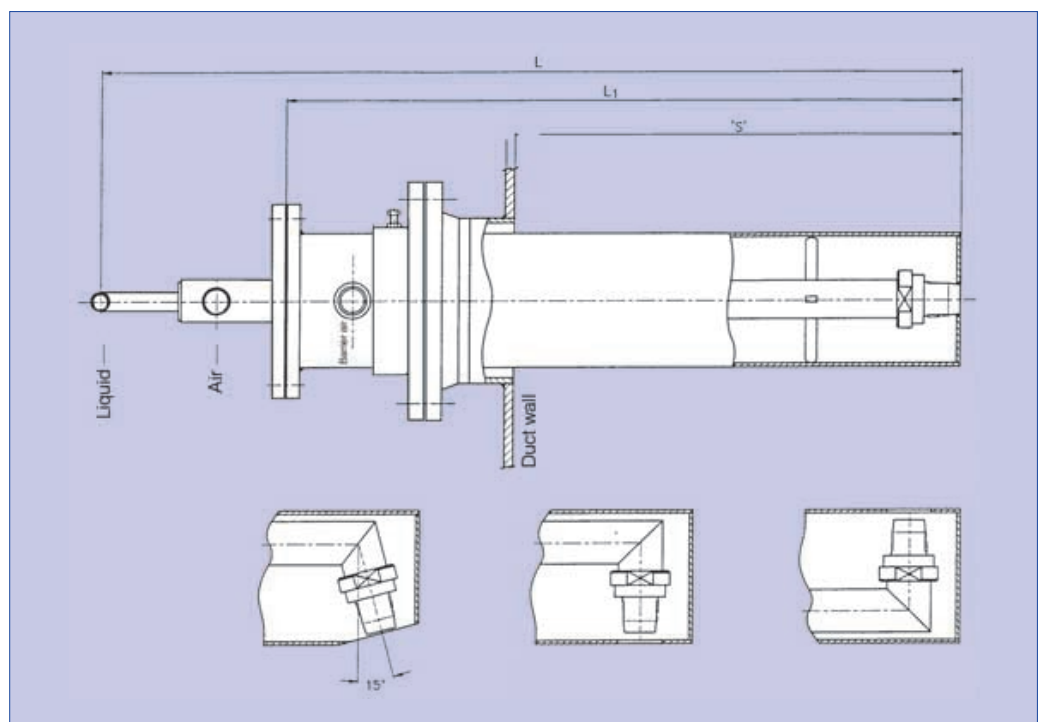
The Twin Fluid Nozzle Lance, as shown, is a version with a big shield (for instance made from Hastelloy C), barrier air and purge air. This construction is especially suitable for higher gas temperatures and aggressive gases. Twin Fluid Nozzle Lances with heat shield piping can easily be mounted/dismounted 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



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.

Advantages:

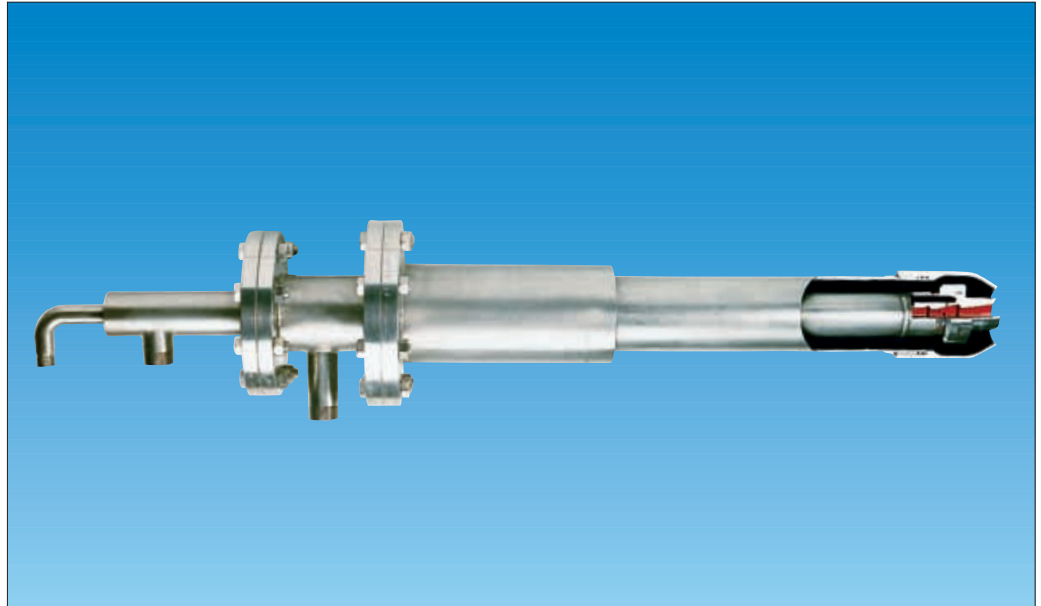
- Robust and compact design
- High safety in operation

Materials:

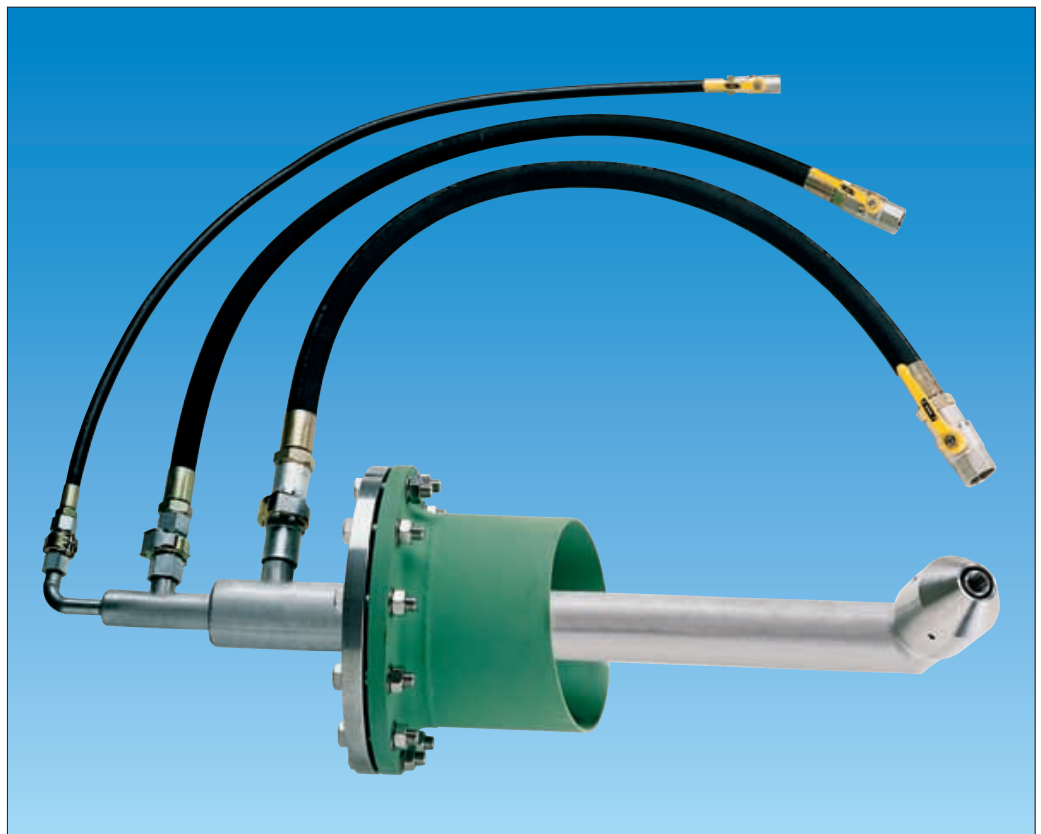
The standard material is stainless steel 316/1.4571. High alloy steels, such as chrome-nickel steels (Hastelloy) are also available for special processes. Lances made from plastic materials, such as PVC, PVDF, PTFE and temperature resistant FRP have proved to be highly efficient for some special applications.

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 barrier air (cut away model)



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:

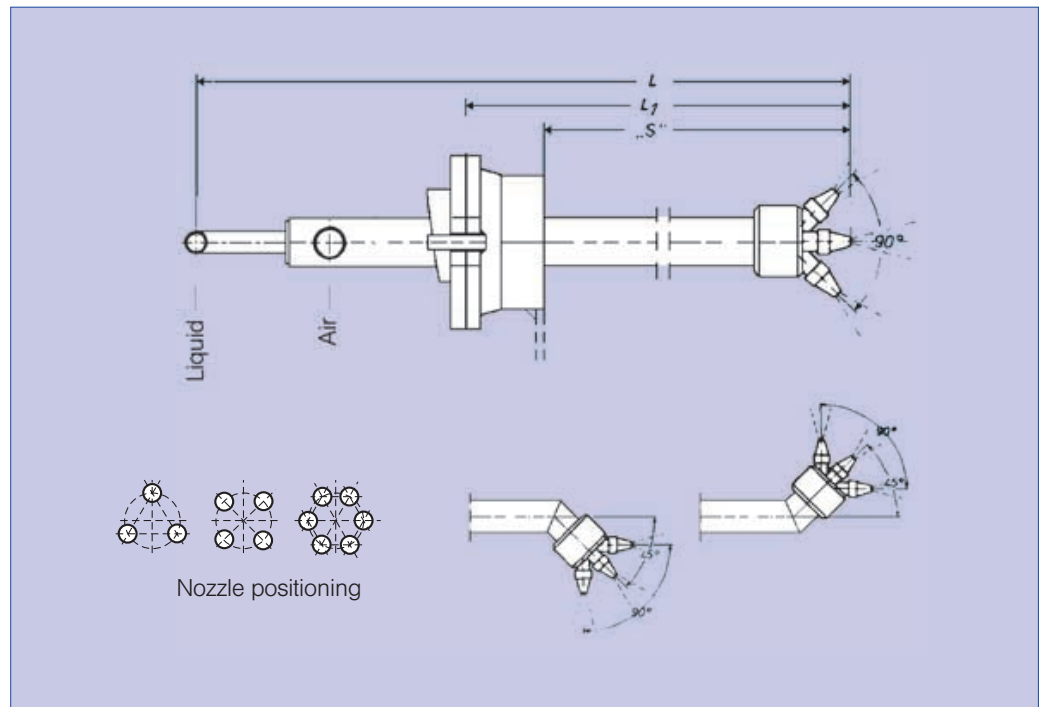
- Wide spray angle
- High liquid flow rate per lance
- Small droplet sizes
- Compact and robust construction
- Maintenance friendly design
- Functional and safe design

Materials:

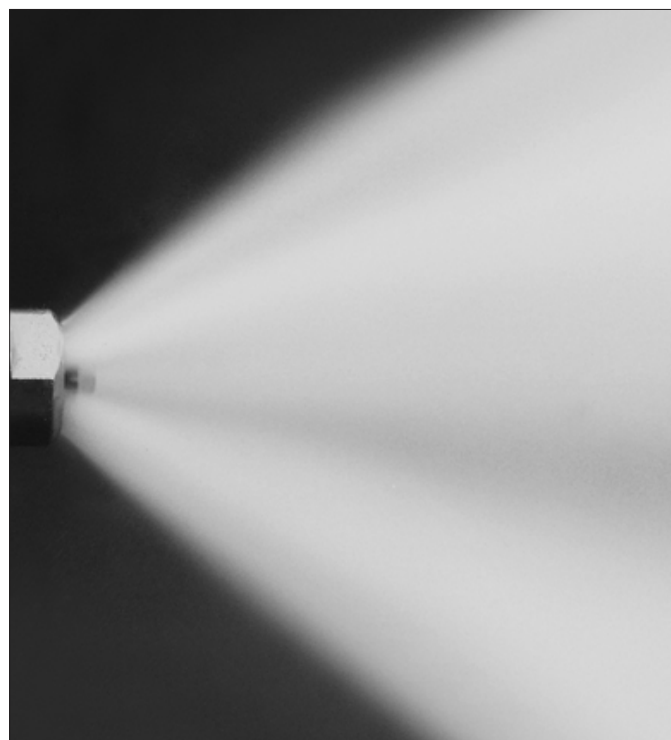
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Standard delivery scope:

- 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 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.....m³/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/m³ 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 %

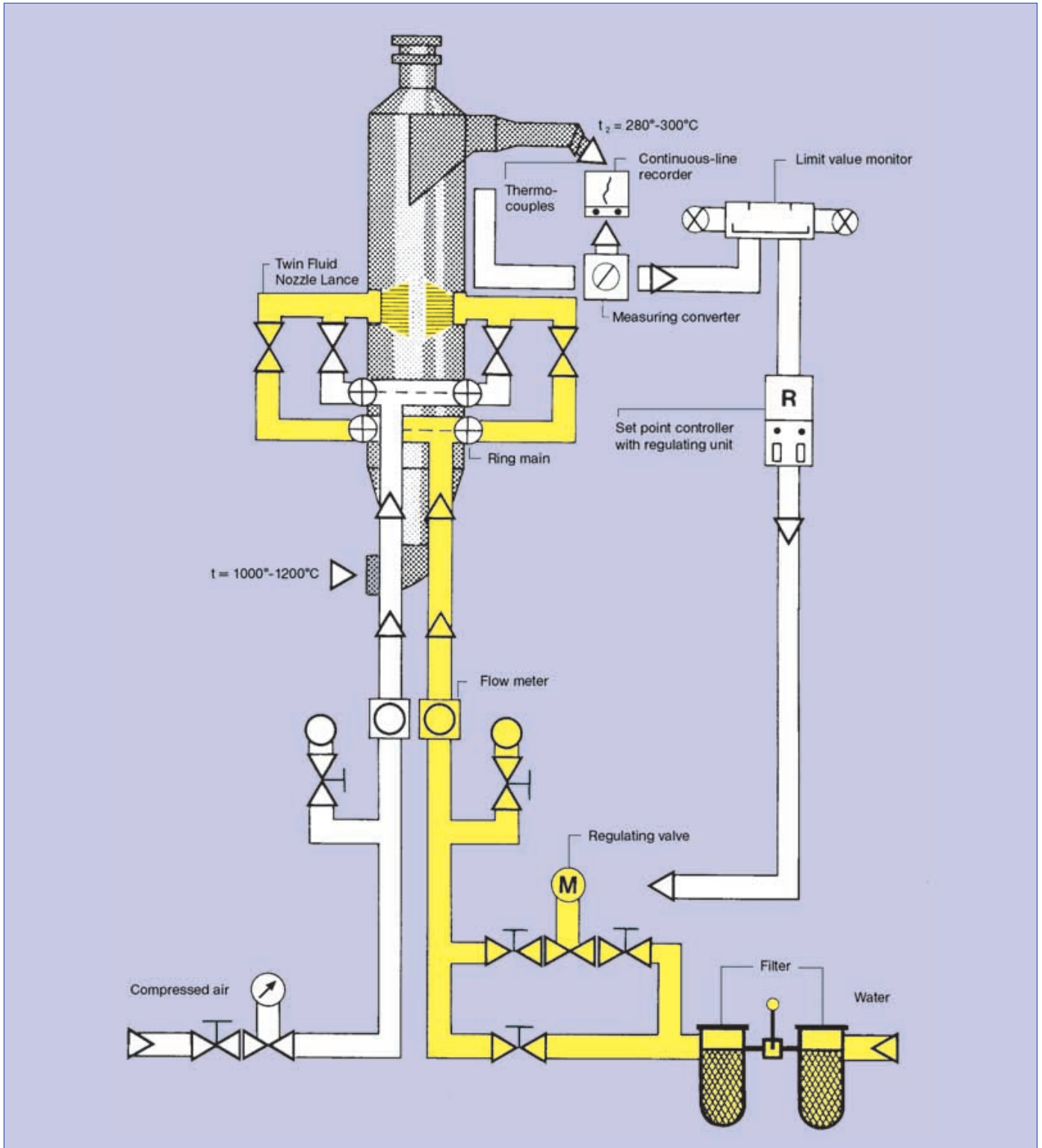
3. Coolant data

- 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

* T₀ = 273 K (0°C), P₀ = 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 inter-connecting 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 mini-

mum 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



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