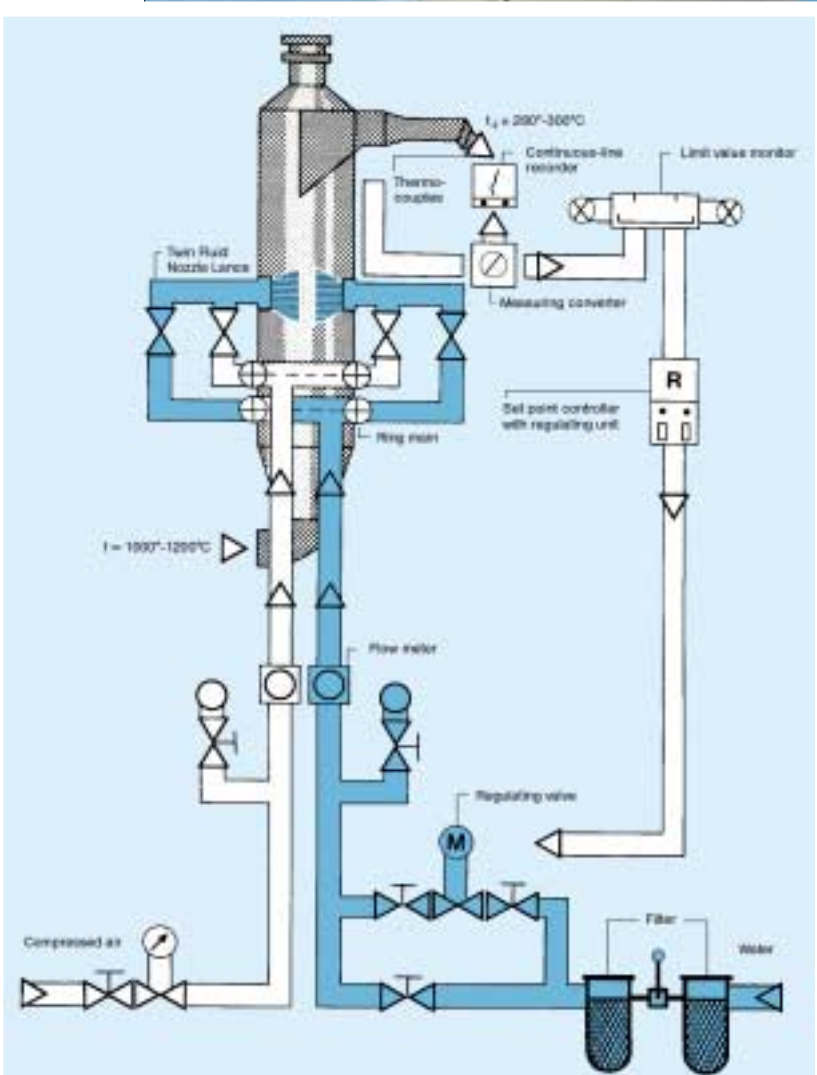




## VarioCool® Gas Conditioning Systems



## Efficient Gas Conditioning made by Lechler

For over 120 years, Lechler has pioneered developments in spray technology for all industries, designing, developing and manufacturing products of outstanding reliability and performance. All accompanied by expert advice based on a thorough knowledge gained through experience in providing both conventional and innovative solutions.

Wherever you are, Lechler seeks to establish a partnership, helping you to enhance product quality through the application of advanced fluids engineering expertise.



From development, through manufacture to installation, Lechler products are subject to continuous quality management. State of the art test and inspection methods, often in excess of our ISO 9001 certification, reliability and longevity of Lechler spray nozzles and systems.



### **VarioCool® system**

Lechler offers you complete gas conditioning systems **VarioCool®**, including nozzle lances, pumps, regulation units and electronic controls. As the only manufacturer worldwide Lechler supplies gas conditioning systems equipped with spillback nozzle lances as well as twin fluid nozzle lances.

The „coupled with the engineers“ experience gained through numerous installations worldwide, enables tailor-made solutions to be designed and implemented.

- Complete system from one source with guarantees on system and process.
- Guarantee on full evaporation.
- Lechler offers spillback and twin fluid lances.
- Extensive engineering support, e.g. gas cooling calculations.
- Modern measuring technology guarantees high product quality.



Pump and regulation unit

#### Applications

Lechler **VarioCool**<sup>®</sup> gas conditioning systems have been used successfully 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.

#### 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.

#### Measuring technology

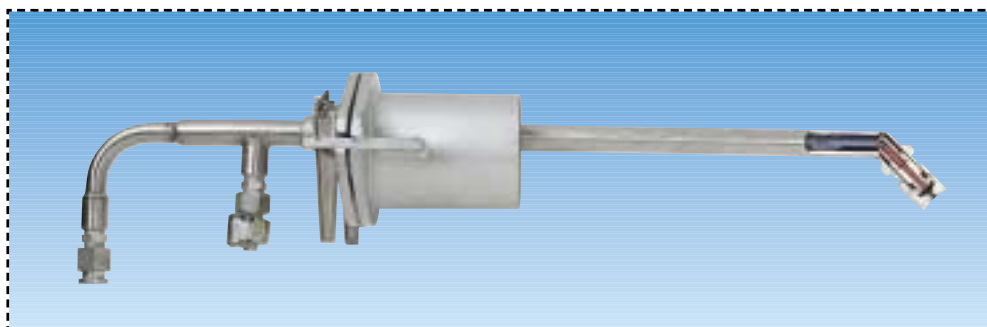
For the design of an engineered system or plant it is necessary to obtain a multitude of nozzle specific data that permits exact statements about flow rate, pressure, spray width, droplet size and droplet velocity. In order to measure these parameters

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.



Computer aided data capture

# VarioCool® Complete Systems for Gas Conditioning



Spillback Nozzle Lance (cut away model)



Spillback Nozzle

Lechler develops and supplies complete pre-assembled pump, regulating and control systems for Spillback and Twinfluid nozzle applications. All Lechler products and third-party equipment is chosen for its durability, ease of maintenance, and proven design for each particular application. The design of the **VarioCool®** systems is adapted to suit all possible functions and mode of operation like start-up, shut-down and normal running mode in a plant with a minimum of maintenance and energy consumption.

### Lechler VarioCool® systems consisting of:

- Lechler Spillback/twin fluid nozzles
- Lechler Spillback/twin fluid lances
- Pre-mounted valve stations
- Temperature control with integrated PLC

In order to adapt the injected flow rate to the special operating conditions and to obtain a save handling different components and equipment are required.

All components must be chosen according to the special requirements of the special operating conditions of the nozzles.

### Valve station

All components will be delivered as a pre-mounted on rack from iron steel which can easily be handled by a lift truck for shipment and installation. Interface for the piping are the flanges of feed and/or return pipe of the valve station.

### The main components are:

Pumps, control valve, filter, flow meter, pressure transmitter/gauges, stop/ball valves, non-return valves, floater valves, electrical temperature controller.

The gas temperature after the quench is measured and registered as an analogue signal at PLC. This actual value is checked against the set point. In case of deviation the control valve will be opened or closed regulating the flow rate injected into the quench until no deviation of the exhaust gas temperature is measured.

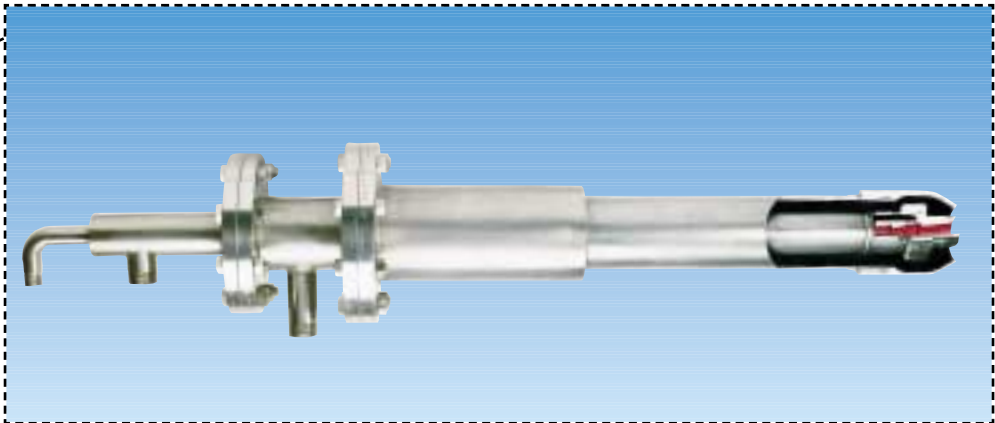
### For an interface to the main control room following signals could be offered:

1. Exhaust gas temperature
2. Exhaust gas inlet temperature
3. Injected water flow rate
4. Collected and /or single failure message

### Our engineering package includes:

- Gas cooling calculation
- Nozzle selection
- Lance arrangement
- Lance drawings
- Material selection
- P+I-diagram
- Logical diagram
- Programming of the PLC
- Design of all control equipment





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



Twin Fluid Nozzle

- Dimensioning of pipes
- Dimensioning of water tank
- Drawings and part lists for the supplied equipment
- Documentation in your language

**Possible scope of supply**

- Lechler nozzle lances with accessories like quick couplings and high pressure hoses

- Pre-mounted skid unit with and without PLC
- Water tank
- Ring mains and commissioning on site

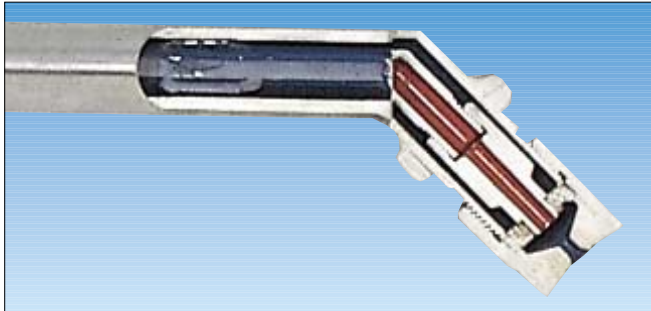
**Your benefit from working with Lechler:**

- ▶ Process guaranties
- ▶ Extensive engineering supply
- ▶ Custom-made solutions
- ▶ Lechler offers spillback **and** twin fluid **VarioCool®** systems
- ▶ Complete system from one source with guaranties
- ▶ World wide network of subsidiaries and associated companies
- ▶ Many references world-wide



Example of pump and regulation unit

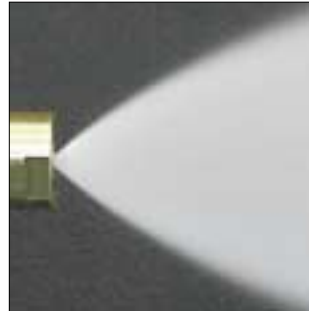
# Spillback Nozzle Lances



Spillback nozzle lance (cut away model)

The Lechler spillback nozzle combines properties which are unknown to "normal" nozzles like full- or hollow cone nozzles. The flowrate of these spillback nozzles can be easily adjusted (within a turndown ratio of up to 12 : 1) without any change of the droplet size or distribution. The spray angle also changes just slightly.

Based on these properties the spillback nozzles were successfully applied in nearly 100 % of all gas cooling towers and applications worldwide in the past decades. As the name already indicates, the nozzle has, apart from the feed flow of 35 bar, a back-flow. By regulating the pressure (and consequently the quantity of water) in the back-flow line the turn down ratio can be realised.



Single nozzle



Cluster head nozzle

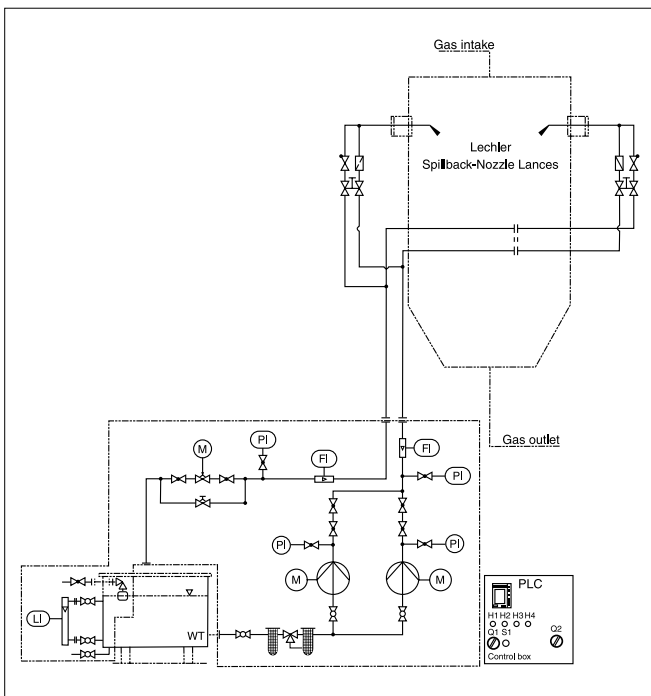
Due to the pressure of 35 bar and the special design of the nozzle the generated droplet distribution is very fine and therefore ideal for gas cooling applications in order to achieve short evaporation distances.

The nozzles are utilised together with lances as single nozzle or as a cluster head (see pictures). Cluster head lances are typically used in larger GCT to get a better distribution of the water and finer droplets.

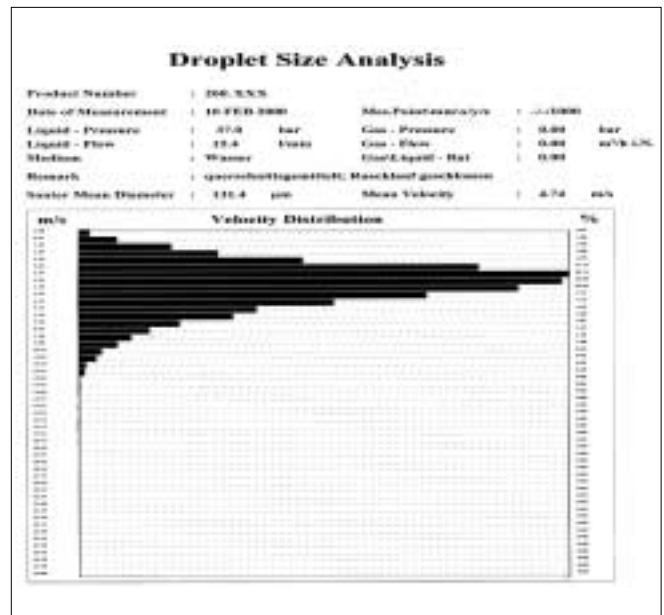
Besides the standard design of the spillback lance, Lechler offers many lances with special features (see page 7).

The standard material of the spillback nozzles is stainless steel.

To meet the demands for an increased running time even when operated with soiled water which causes wear, Lechler designs special spillback nozzles where the main wear parts are made of ceramics and hardened steel.



Example of P-I-diagramm for spillback systems



Example of velocity distribution

# Twin Fluid Nozzle Lances

Twin fluid nozzles were designed to achieve an extreme fine droplet spray. Pressurized gas, most air, is mixed with the water. The energy input from the gas causes a very good atomization of the fluid.

**There are two different designs of these nozzles:**

**External mixing nozzle (KSD-nozzle):**

Water and air are mixed outside the nozzle. These nozzles can be operated with air or steam.

**Internal mixing nozzle (Laval-nozzle):**

Water and air are mixed inside the nozzle. These nozzles have large free orifices and have a turn down ratio of up to 40 : 1. The efficiency in terms of used gas quantity is very good.

The main advantage of the twin fluid nozzles is the property that the droplet distribution/droplet size can be changed by changing the ratio gas/water, even during the operation of the nozzle. This enables the user to adjust the nozzle to changed process data.

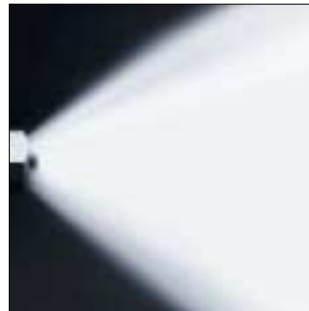
Together with our long experience of designing and manufacturing the necessary lance you get a reliable and proved system component. The nozzles are utilised together with lances. The spray angles are 15 or 60 degree.

**Besides the standard design of the twin fluid and spillback lance, we offer many lances with special features like:**

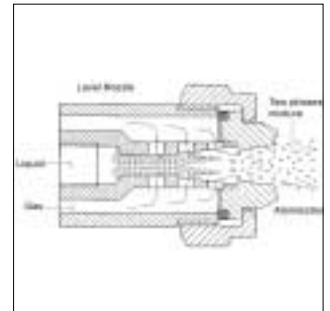
- Protection tube with barrier air for
  - heat protection
  - corrosion protection
  - wear protection
  - no deposit of dust at nozzle
- Adjustable length of the lance
- Fast coupling flange to reduce maintenance time

The lances (and nozzles) can be made of all metals including Hastelloy, Nickel, Inconel, etc.

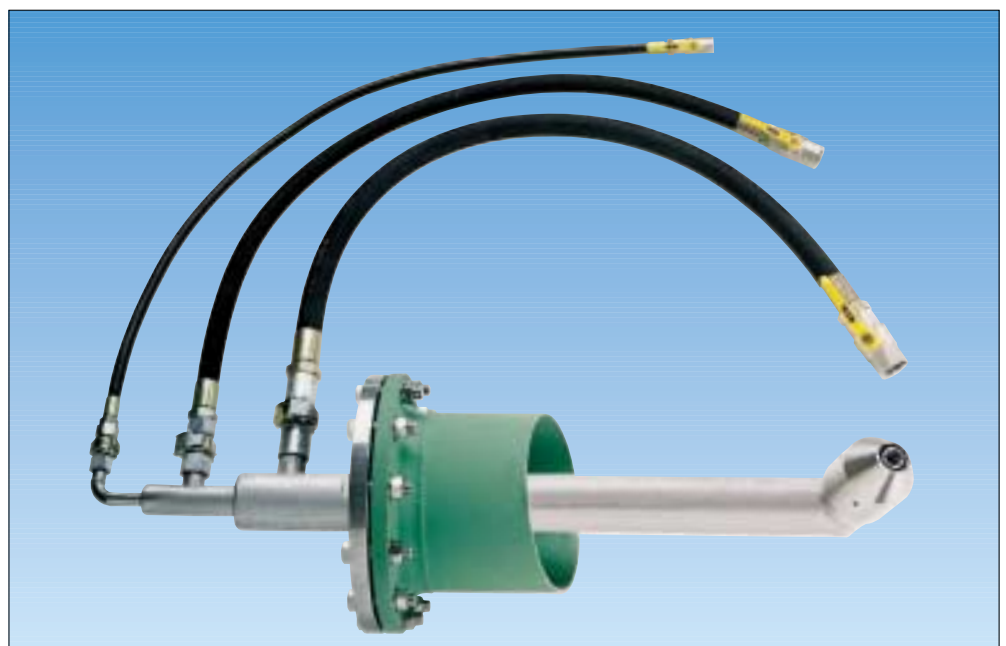
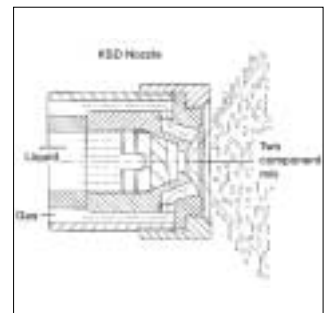
The standard material of the twin fluid nozzles is stainless steel. To meet the demands for an increased running time even when operated with heavily soiled water which causes wear, we designed Laval-nozzles made of solid ceramic.



Laval Nozzle



KSD-Nozzle



Twin Fluid Nozzle Lance with small shield and accessories

# Complete solutions with pump and regulation units and electronic controls

Lechler 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 calculations (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

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.

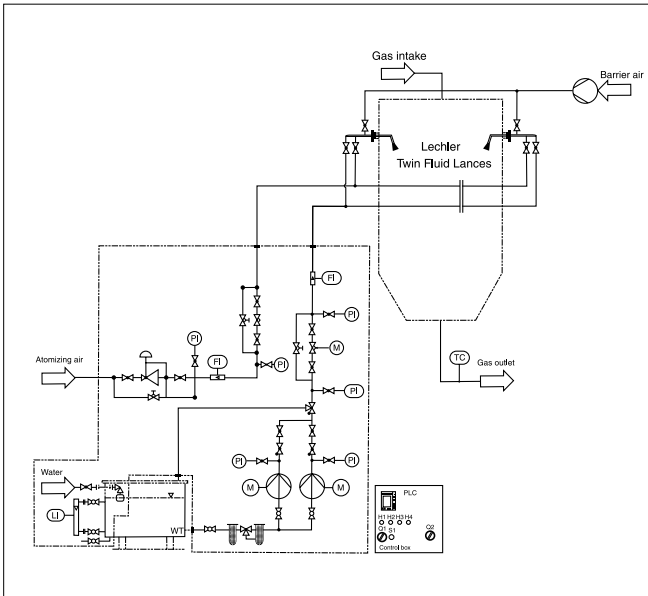
We would be pleased to send you copies of our product- and country-specific reference lists.

## 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



Example of pump and regulation unit



Example of P-H diagram for twin fluid system



Spillback system with integrated PLC



Duct cooling with twin fluid nozzle lances



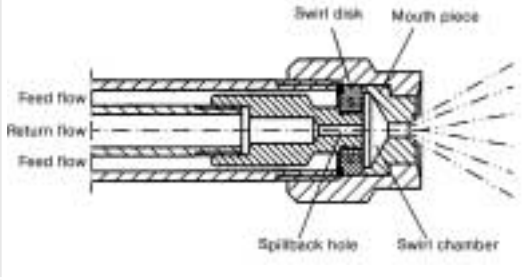
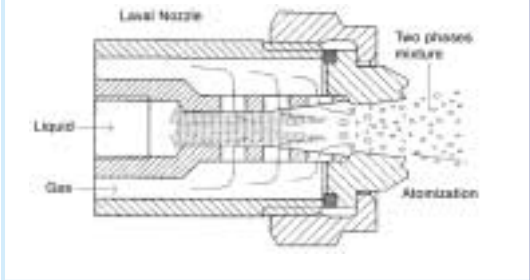
Pump arrangement on a unit



Inside view gas cooling tower

## Comparison between Spillback and Twin Fluid Nozzles

### Types of Lechler Nozzles

Nozzle type	Spillback Nozzle	Twin Fluid Nozzle, type Laval
		
<b>Media</b>	1 media: liquid	2 media: liquid, gas
<b>Principle of atomisation</b>	high pressure	2-phase mixture
<b>Velocity of droplets</b>	up to 30 m/s	up to 150 m/s
<b>Turn down ratio</b>	approx. 14:1 (max.)	approx. 40:1 (max.)
<b>Spray angle</b>	30°, 45°, 60° and 90°	15° and 60°
<b>Flow rate range per nozzle</b>	From 3,3 l/min up to 495 l/min at 35 bar, return line closed	From 0,01 l/min up to 190 l/min
<b>Control of the flow rate</b>	feed pressure of the pump, pressure drop in the return line	feed pressure of the pump for liquid and gas
<b>Standard material</b>	SS 316, ceramic (other materials on request)	SS 316, ceramic (other materials on request)
<b>Typical applications</b>	Gas conditioning tower, clinker cooling	Duct cooling, DeNOx, gas conditioning tower
<b>Advantages</b>	Low investment and running cost, worldwide most applied nozzle for gas cooling	Large free passages, droplet size adjustable from extremely fine to coarse

# Questionnaire for calculation of your gas conditioning requirements



Please reply to Lechler (Fax or e-mail see following page)

Dear customer,

to comment on your gas conditioning 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.

Company:..... Date:.....  
 Address:..... Complement:.....  
 ..... Department:.....  
 ..... Phone/Fax:.....  
 ..... Projekt no.:.....

## 1. Gas data

■ Gas flow rate (under standard conditions,\* humid)

Gas flow [Nm <sup>3</sup> /h*, humid]	t inlet [°C]		t outlet [°C]	
max.:	min.:	max.:		
nominal:	min.:	max.:	min.:	max.:
min.:	min.:	max.:		

If there are other design cases, please note separately

Gas composition [Vol. %]	H <sub>2</sub> O	CO <sub>2</sub>	O <sub>2</sub>	N <sub>2</sub>			

- Other components of gas (HCl, HF, etc.)..... [mg/Nm<sup>3</sup>\*, humid]
- Critical cooling limit temperature (dew point)  Yes, at ..... °C
- System pressure (in the reaction area) ..... bar (g)

## 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<sup>3</sup> 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 Inlet temperature ..... °C  
 (max. over pressure ..... bar)..... Content of solids.....
- Medium (Twin fluid nozzles)
- Air Over pressure..... bar (g)
- Steam Over pressure..... bar (g)  
 Temperature ..... °C

## 4. If available, please attach

- Process flow sheet
- Sketch/drawing of GCT

\* T<sub>0</sub> = 273 K (0°C), P<sub>0</sub> = 1 bar

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**E-Mail: [info@lechler.de](mailto:info@lechler.de)**  
**Internet: [www.lechler.de](http://www.lechler.de)**



Lechler is your competent partner when it comes to exhaust-air cleaning and gas conditioning plants. Know-how from over 120 years of experience is available to all companies which manufacture or operate such plants.

Don't settle for less than the best when it comes to protecting the environment. Consult with the specialists from Lechler for the best application of nozzles, nozzle lances or droplet separators. A series of brochures is available to provide you with an initial insight. These brochures contain the comprehensive data and performance specifications which you will require in planning and maintaining your plant.

**I am interested in Lechler's components for effective environmental protection. Please send me the marked information.**

Company \_\_\_\_\_

Department \_\_\_\_\_

Name \_\_\_\_\_

Function \_\_\_\_\_

Street/P.O. Box \_\_\_\_\_

Post code/Town \_\_\_\_\_

Telephone \_\_\_\_\_

Telefax \_\_\_\_\_

- Twin Fluid Nozzle Lances**
- Spillback Nozzle Lances**
- Nozzles for flue-gas desulphuration**

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