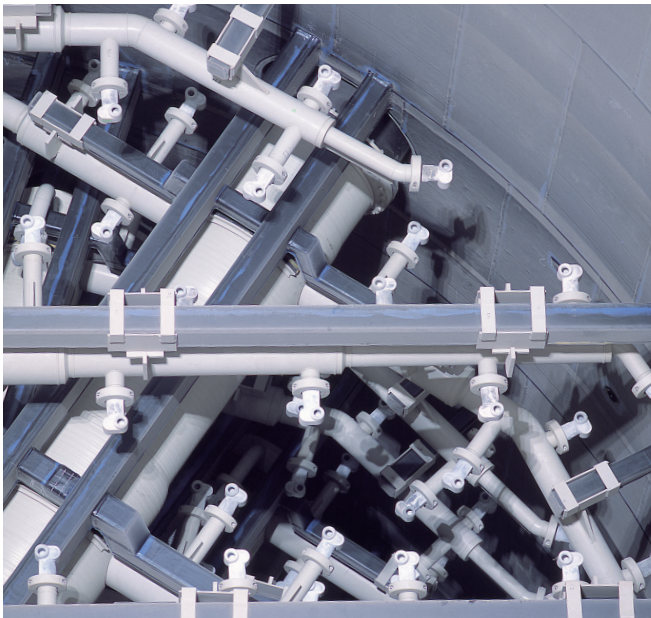
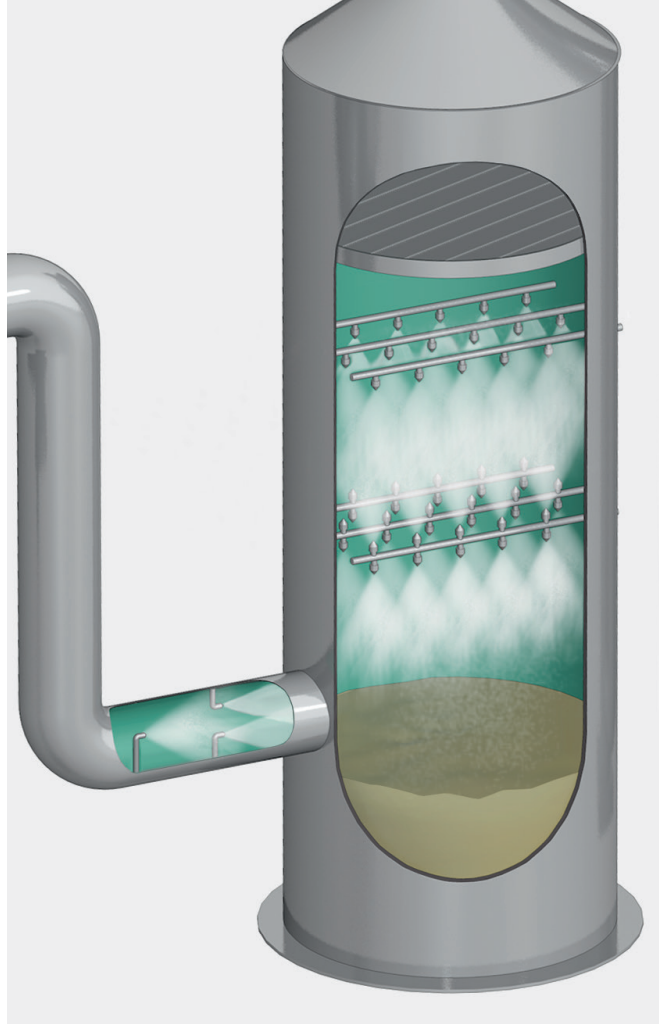


# NOZZLES FOR FLUE-GAS DESULFURIZATION

Flue-gas desulfurization in power plants requires nozzles that guarantee precise long-term operation and are also to withstand extremely aggressive ambient conditions. Lechler has developed atomizing nozzles made of ceramic materials, e.g. from SIC, SISIC or ReSIC, for these applications.

Lechler TwinAbsorb® nozzles ensure efficient flue gas cleaning and reliable SO<sub>2</sub> separation. Their improved efficiency, reduced operating costs as well as low maintenance costs make TwinAbsorb® nozzles the first choice for power plant operators for both process and economic reasons.



## TwinAbsorb® EV

### Equilateral full cone nozzle

The proven TwinAbsorb® EV equilateral full cone nozzle generates two full cones from only one supply.

#### Advantages

- Finer droplets (SMD d32) due to doubling of the spray cones
- Particularly advantageous not only for high flow rates per nozzle
- Improved mass transfer due to higher relative speeds in relation to the gas flow
- Supports more uniform gas distribution over the scrubber cross-section
- No additional swirl introduced into the gas flow
- Better coverage of the scrubber wall zone
- Reduced losses at the scrubber wall in comparison with hollow cone nozzles
- Reduced torque acting on the pipelines
- Preservation of the positive characteristics of standard tangential flow full cone nozzles:
  - Self-draining
  - Large clear cross-sections
  - Non-clogging design



## TwinAbsorb® EH

### Equilateral hollow cone nozzle

The proven TwinAbsorb® EH equilateral hollow cone nozzle generates two hollow cones from only one supply.

#### Advantages

- Finer droplets (SMD d32) due to doubling of the spray cones
- Particularly advantageous not only for high flow rates per nozzle
- Optimized secondary optimization through doubling of the collision areas
- Highly efficient generation of tiny droplets without additional energy input
- Intensive secondary atomization and therefore increased activated surface for faster mass transfer
- Improved mass transfer due to higher relative speeds in relation to the gas flow
- Increased turbulence in the droplets for more active mass transfer
- No additional swirl introduced into the gas flow
- Improved coverage of the scrubber cross-section
- Reduced torque acting on the pipelines
- Preservation of the positive characteristics of standard hollow cone nozzles:
  - Self-draining
  - Large clear cross-sections
  - Non-clogging design



# NOZZLES FOR FLUE-GAS DESULFURIZATION

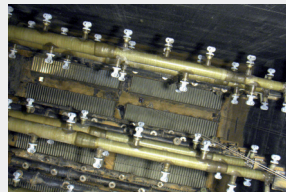
## TwinAbsorb®-V

### Bi-directional double full cone nozzle

The proven TwinAbsorb® V bi-directional full cone nozzle generates two counter-rotating full cones.

#### Advantages

- Improved mass transfer due to higher relative speeds in relation to the gas flow
- No additional swirl introduced into the gas flow
- Increased turbulence in the droplets for more active mass transfer
- Doubling of the hydraulic spray levels in comparison with single-direction nozzles
- Reduced pressure loss when used in counter-current scrubbers
- Increased dwell time of the droplets in the gas flow
- Reduced losses at the scrubber wall in comparison with hollow cone nozzles
- Better coverage of the scrubber wall zone
- Lower wall load in comparison with hollow cone nozzles
- Finer droplets (SMD  $d_{32}$ ) in comparison with single-direction full cone nozzles
- Reduced torque acting on the pipelines
- Preservation of the positive characteristics of standard tangential flow full cone nozzles:
  - Self-draining
  - Large clear cross-sections
  - Non-clogging design



## TwinAbsorb® H

### Bi-directional double hollow cone nozzle

The proven TwinAbsorb® H bi-directional hollow cone nozzle generates two counter-rotating hollow cones.

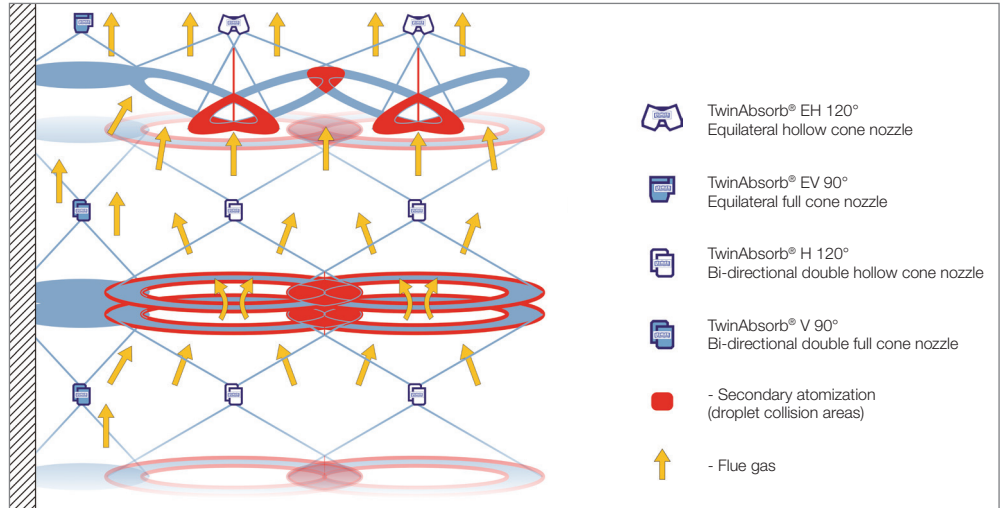
#### Advantages







- Improved mass transfer due to higher relative speeds in relation to the gas flow
- No additional swirl introduced into the gas flow
- Intensive secondary atomization and therefore increased activated surface for faster mass transfer
- Increased turbulence in the droplets for more active mass transfer
- Doubling of the hydraulic spray levels in comparison with single-direction nozzles
- Reduced pressure loss when used in counter-current scrubbers
- Increased dwell time of the droplets in the gas flow
- Supports uniform gas distribution over the scrubber cross-section
- Finer droplets (SMD  $d_{32}$ ) in comparison with single-direction full cone nozzles
- Reduced torque acting on the pipelines
- Preservation of the positive characteristics of standard double hollow cone nozzles:
  - Self-draining
  - Large clear cross-sections
  - Non-clogging design



**Process-oriented nozzle configuration**

- Supports better gas distribution
- Highly efficient secondary atomization
- Improved mass transfer
- Swirl compensation



-  TwinAbsorb® EH 120°  
Equilateral hollow cone nozzle
-  TwinAbsorb® EV 90°  
Equilateral full cone nozzle
-  TwinAbsorb® H 120°  
Bi-directional double hollow cone nozzle
-  TwinAbsorb® V 90°  
Bi-directional double full cone nozzle
-  - Secondary atomization  
(droplet collision areas)
-  - Flue gas

In addition to the TwinAbsorb® series, Lechler also offers a comprehensive range of nozzles for flue gas desulfurization in a wide range of designs and materials that are exactly tailored to your specific application.



**Twin4Absorb**

Twin4Absorb nozzles are a further development of the Twin-Absorb® nozzle series. Four overlapping spray cones generate additional jet collisions and thus a more active reaction surface. Thanks to the enhance spatial distribution, the Twin4Absorb nozzles are ideal for optimizing existing scrubbers.



Nozzles made of SIC



Nozzles made of SISIC



Helix nozzles made of SISIC/ReSIC



Helix nozzles made of Stellite



**Talk to us**

Are you not sure which configuration best meets your requirements? We will gladly advise you. Just give us a call.



# DROPLET SEPARATOR SYSTEMS FOR FLUE-GAS DESULFURIZATION

The introduction of wet flue-gas desulfurization in Germany is inconceivable without Lechler. As a partner to plant builders, we have made a crucial contribution to success in this area with our development work. The result is nozzles made of highly wear-resistant and corrosion-resistant silicon carbide and droplet separator systems that meet the highest process engineering demands.

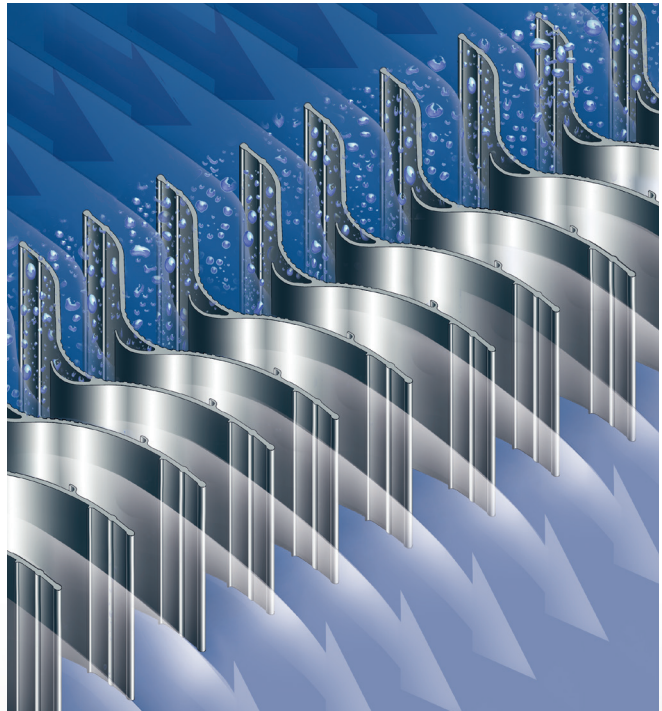
Lechler droplet separators are optimally designed for the droplets produced during scrubbing and thus achieve maximum separation levels.

## Task:

- Removal of sulfur compounds
- Protection of downstream installation components
- Reduction of operating costs

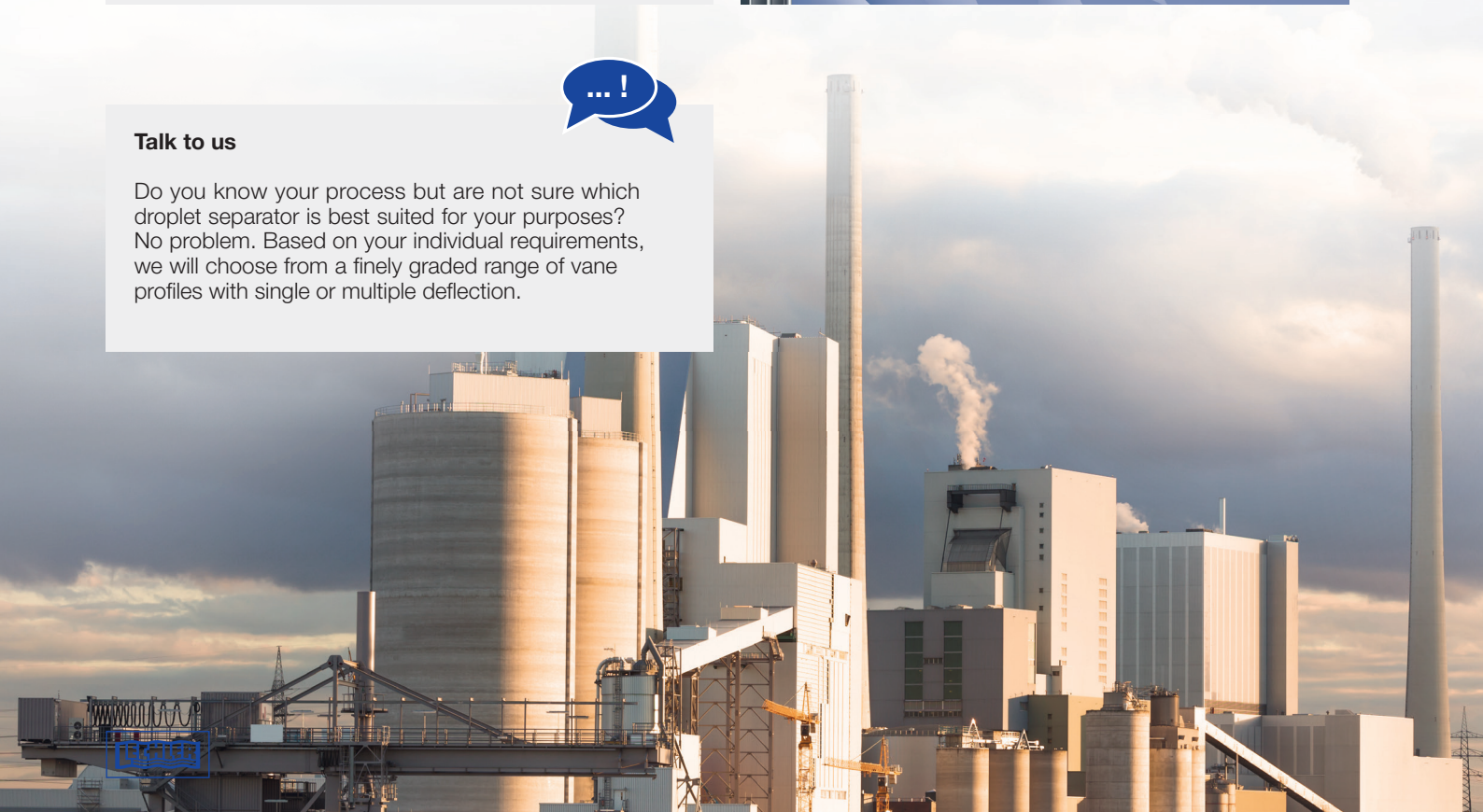
## Advantages:

- Modular system design
- Highest degrees of separation for large liquid quantities
- Separation of small droplets
- Compact design even for high gas speeds
- Low pressure losses
- More uniform flow distribution
- Use also with high solid particle quantities
- Cleaning during ongoing operation
- Delivery of an overall concept
  - Nozzles for desulfurization of flue gases
  - Droplet separator systems
  - Integrated cleaning systems for droplet separators



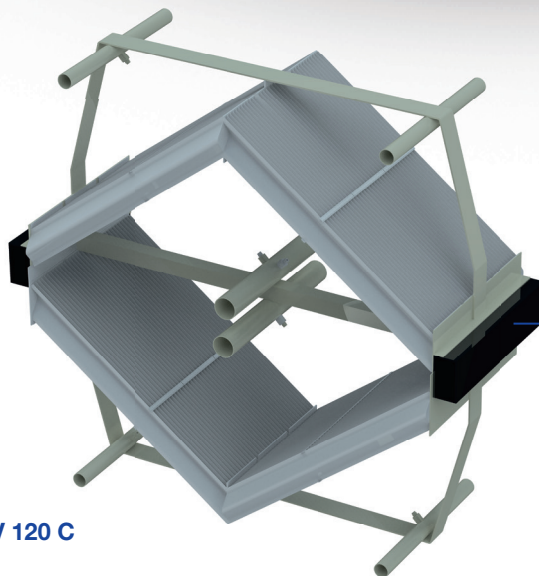
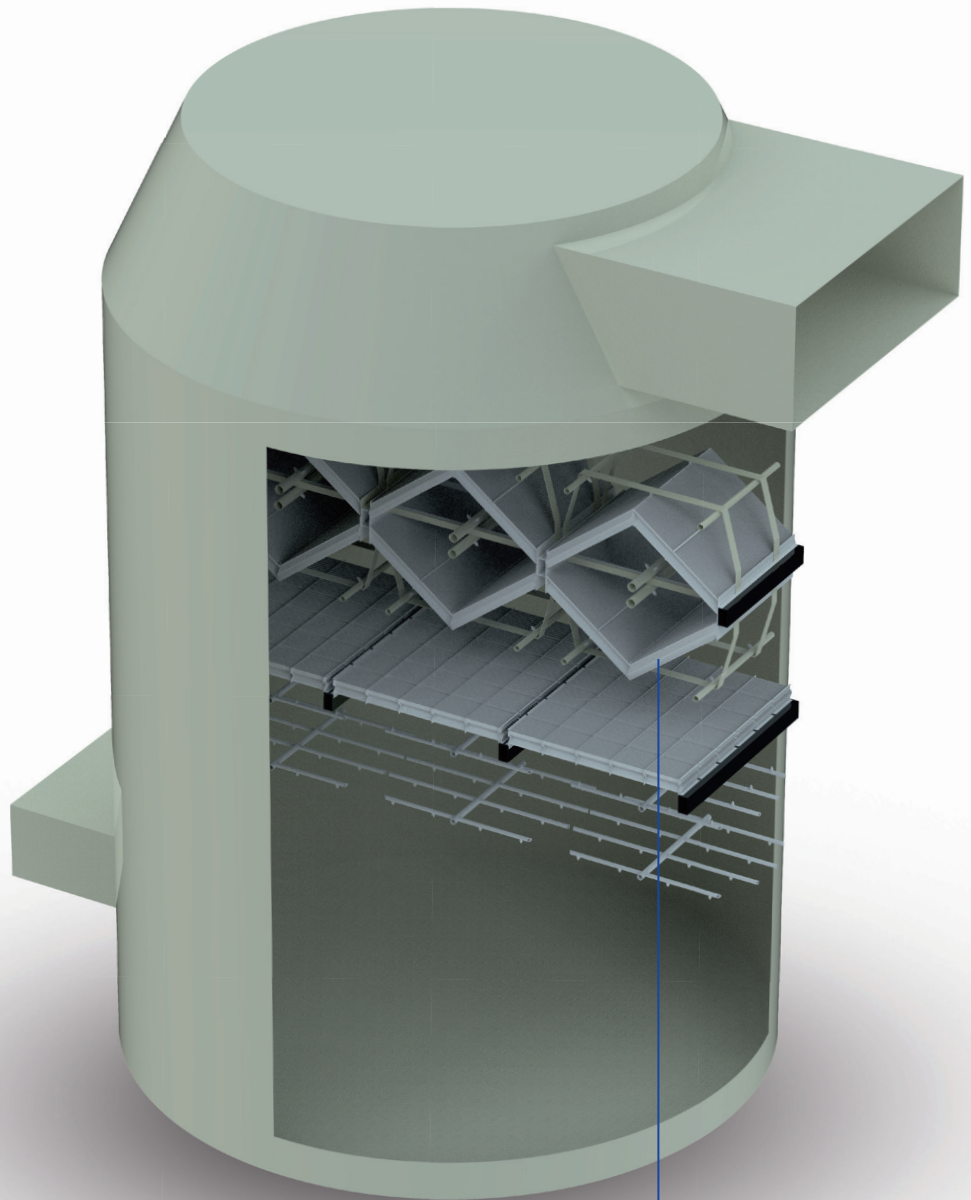
## Talk to us

Do you know your process but are not sure which droplet separator is best suited for your purposes? No problem. Based on your individual requirements, we will choose from a finely graded range of vane profiles with single or multiple deflection.



In order to design and plan droplet separators, it is necessary to be familiar with the operating and performance data of the separation systems. An in-depth technical understanding of the processes in each application is also required. Know-how about droplet formation and droplet movement in a gas flow is essential to ensure fault-free operation of a droplet separator. For more than 100 years now, we have worked on detection, measurement and definition of droplets. It is therefore not by chance that Lechler nozzles and Lechler droplet separators are now considered integral elements in process engineering.

Corresponding to the flow direction, Lechler high-performance separators are differentiated based on horizontal and vertical gas flow. Separators are also realized for oblique gas flow under certain conditions. The choice of flow direction depends on the individual process or plant design. Lechler offers a suitable solution for all installation situations.



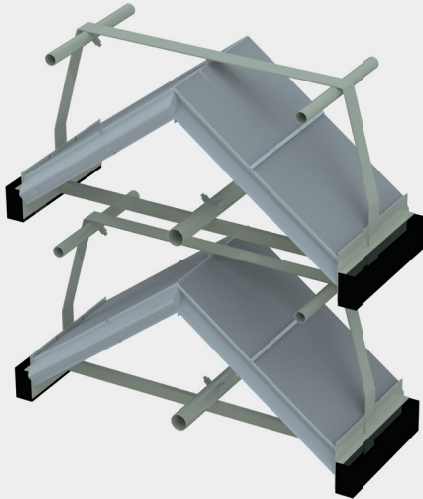
LTV 120 C

# DROPLET SEPARATOR SYSTEMS FOR FLUE-GAS DESULFURIZATION

The LTV 120 droplet separator for vertical gas flows is available in different designs and also with multiple stages. Integrated cleaning systems with highly efficient Lechler cleaning nozzles permit continuous operation and reduce the risk of clogging. The angled installation position allows reliable removal of the separated liquid even at high gas speeds.

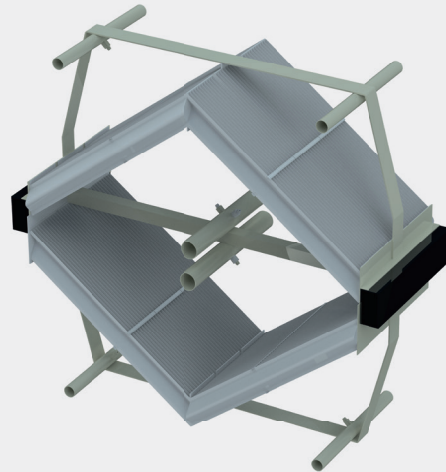
## LTV 120 AA

2-stage droplet separator system with integrated cleaning system for installation on two levels.



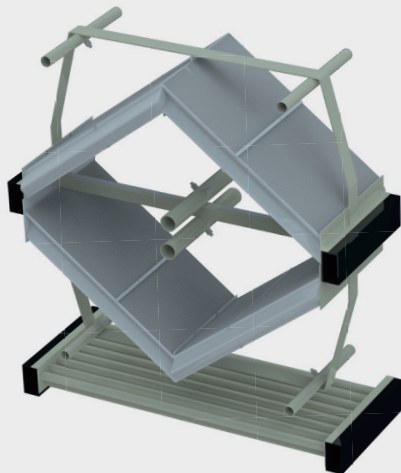
## LTV 120 C

2-stage droplet separator system with integrated cleaning system for installation on one level. This system is optimized for restricted installation spaces.



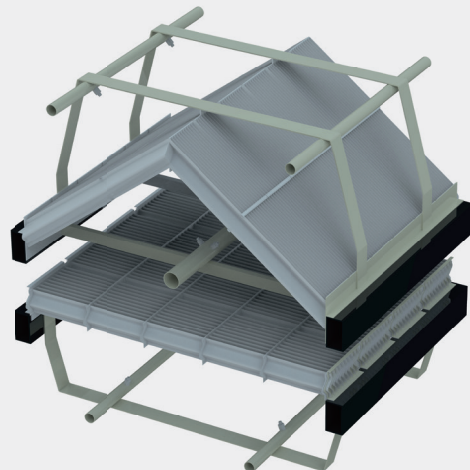
## LTV 120 CR

3-stage droplet separator system with integrated cleaning system for installation on two levels. The first separator stage consists of horizontally arranged pipes for pre-separation and flow optimization.



## LTV 120 A + LTV 400

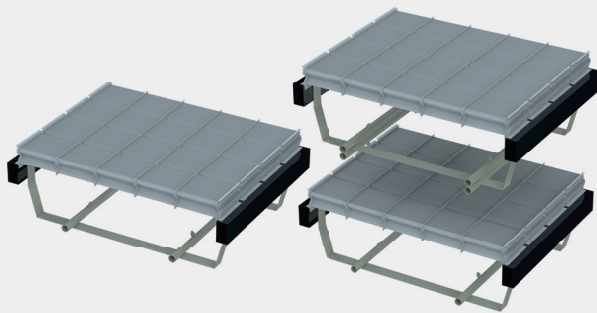
2-stage droplet separator system with integrated cleaning system for installation on two levels. The first separator stage consists of the LTV 400 as a flat separator level.



**The different droplet separator systems can be combined with each other, depending on individual requirements in relation to efficiency and space.**

### LTV 400

The LTV 400 is a universal separator system. Thanks to intensive optimization of the profile contour, the LTV 400 achieves high separation values even without additional drainage aids for the separated liquid. The resultant smooth profile surface has a very low fouling tendency and can be cleaned very easily. The LTV 400 can be realized with one or multiple stages and is available with or without cleaning system.



### LTV 271

The LTV 271 is a proven, widely used separator system. It also impresses with its straightforward handling and easy adaptation to the existing installation space. The use of our optional "Fix-Clip" connectors prevents packages from slipping.



### LTV 300

The LTV 300 is characterized by high separation performance – also for very fine droplets – and an exceptionally high hydraulic load capacity. The special profile geometry and angled installation position permit reliable draining of the separated liquid.



### LTH 100

The LTH 100 for horizontal gas flows is characterized by extremely flexible application and combination possibilities. Low pressure loss, high hydraulic load capacity as well as a low fouling tendency make the LTH 100 a universal droplet separator system that has proven itself over the course of many decades.





# Spillback nozzles

## Atomization without compressed air



**Lechler spillback nozzles** atomize liquids as a fine hollow cone.

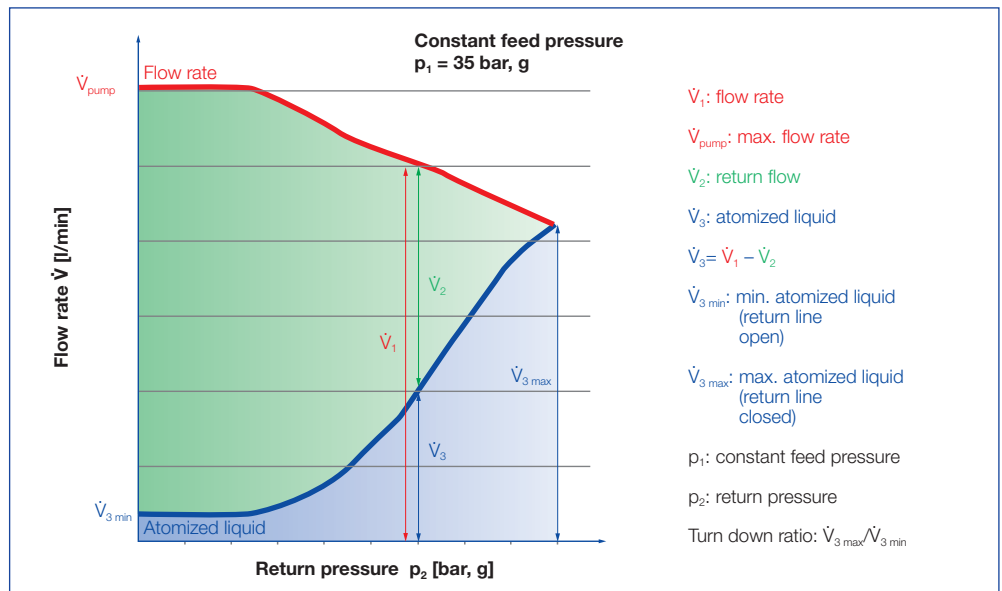
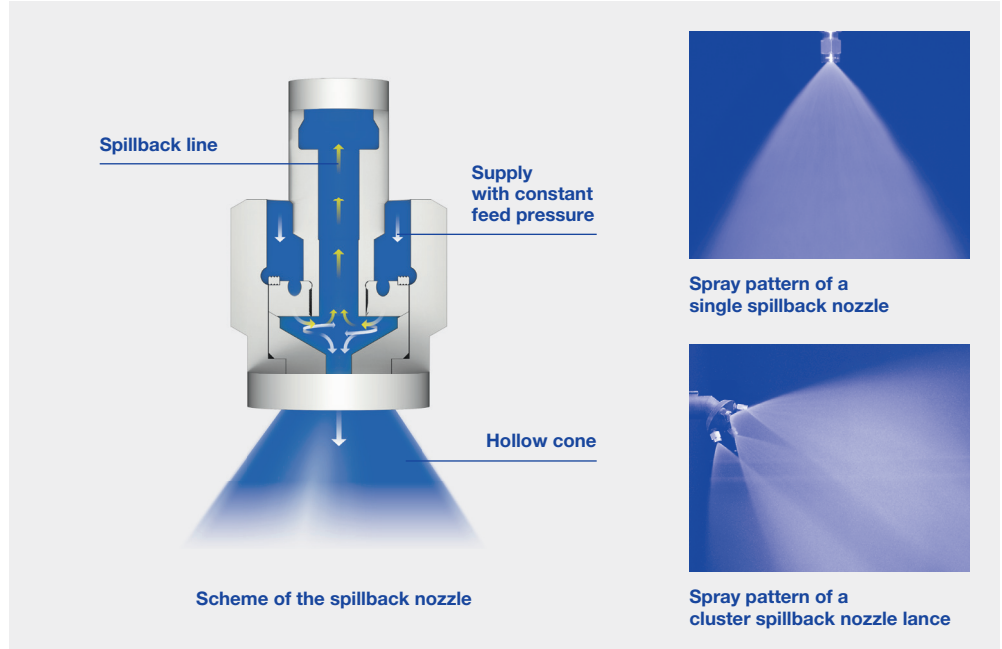
This special single-fluid nozzle works according to the pressure atomization principle. The water is sent to the nozzle with a relatively constant feed pressure, independent of the atomized flow rate.

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

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

The atomized flow rate can be distributed over cluster heads with up to six small nozzles. This results in a total spray angle of approximately 120°.

This wide distribution of liquid over the entire duct is advantageous for reducing the number of lances.



### Use:

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

### Properties



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



**Low operating costs** as no atomizing air required



**Execution**  
as single or cluster nozzle lances possible



**High turn-down ratio**  
of up to 12:1

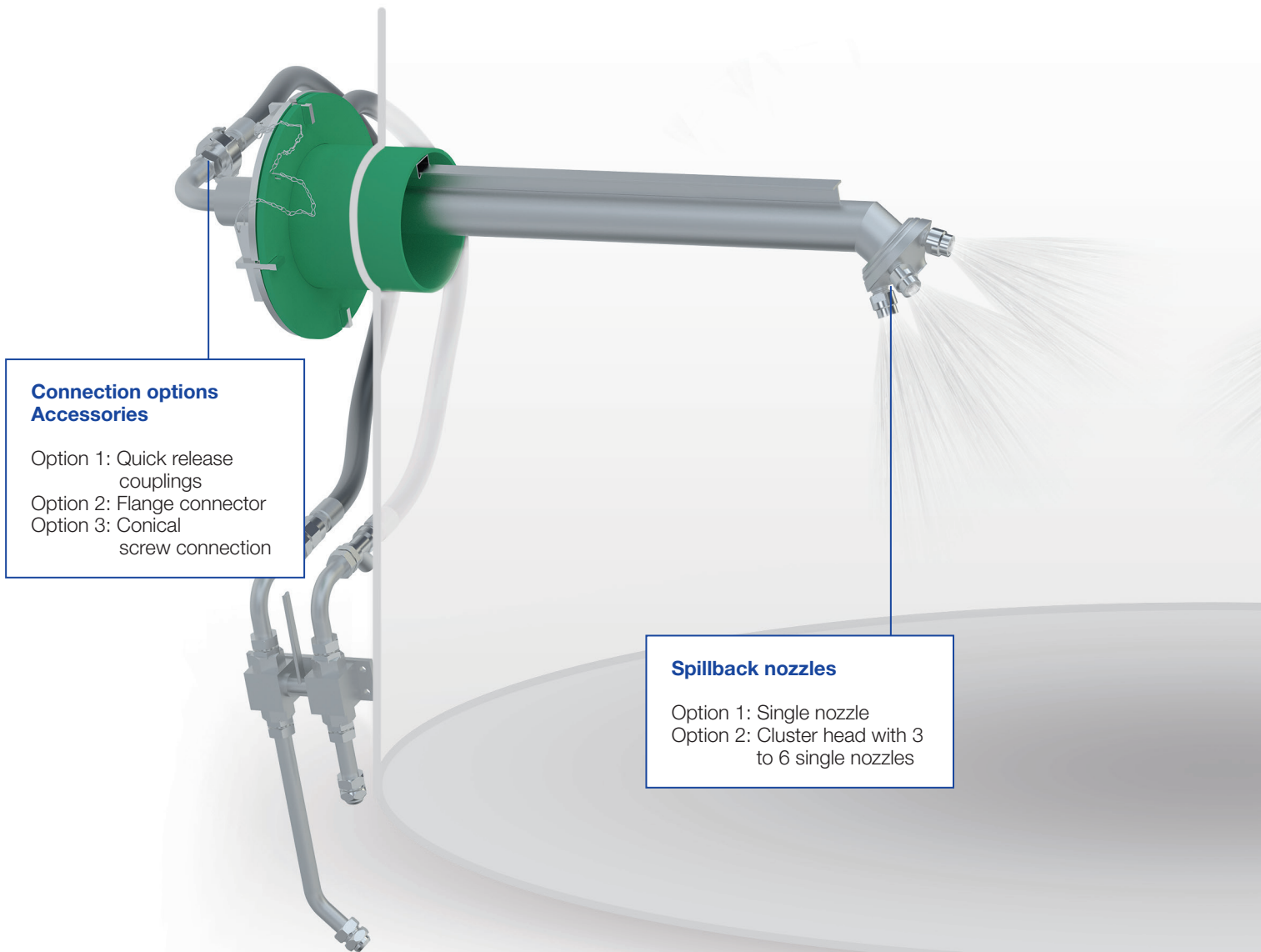


**Even and fine liquid atomization**  
over the entire control range



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

# Lechler nozzle lances - Highest spraying accuracy in the flue gas duct



## Connection options Accessories

- Option 1: Quick release couplings
- Option 2: Flange connector
- Option 3: Conical screw connection

## Spillback nozzles

- Option 1: Single nozzle
- Option 2: Cluster head with 3 to 6 single nozzles

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

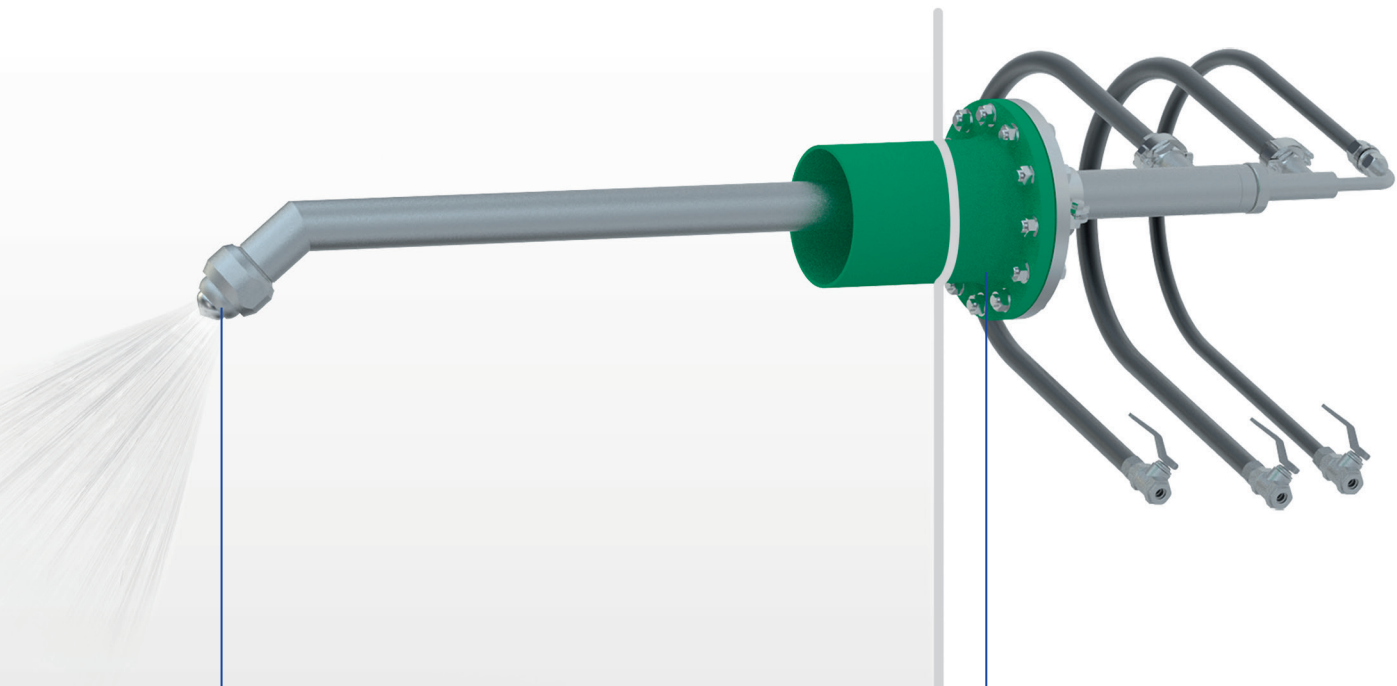
The nozzles themselves have a low-maintenance design and can be quickly cleaned or exchanged with minimal effort.

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

Lechler nozzle lances are available with many options, including but not limited to:

- Protection tube to increase the service life in case of higher temperatures, high dust loads and aggressive gases, with barrier air as an option.
- Wedge flange, standard flange and special flange in accordance with customer requirements
- Guide rail to facilitate lance installation
- Shifting device to change the insertion length – with or without gastight sealing
- Expansion joint or stuffing box for expansion compensation at high temperatures
- Assembly connecting piece with flange connector for welding onto flue gas duct
- Further special customizations including wear protection, insulation, water cooling or coating
- Pre-assembled accessory kits for process media connections (e.g. quick release couplings, shut-off ball valves, strainers)

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

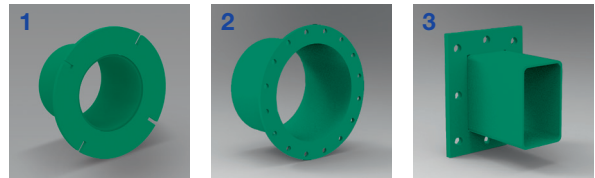


**VarioJet® nozzle**

- Option 1: without protection tube and without protection cap
- Option 2: with protection tube and with protection cap

**Flange connections**

- Option 1: Wedge
- Option 2: Standard flange e.g. DIN, ANSI etc.
- Option 3: Special flange according to customer specification



**Material**

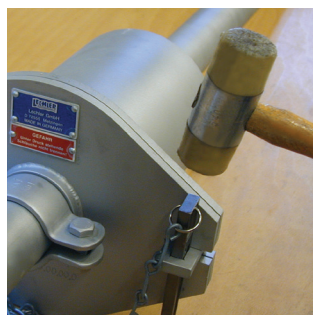
Lances are manufactured from stainless steel (316/316L) as standard, but depending on requirements can also be made of chemical and high-temperature resistant materials.

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



**Talk to us**

Each gas cooling tower and flue gas duct is different. Which is why standard solutions do not always make sense. Speak with us and let us work together to find the best solution for your purposes.



# VarioCool® gas cooling system – for a perfectly tailored solution

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

## First-class engineering

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

## High-quality components

An exact knowledge of the characteristic properties of our nozzles is key here. For only a complete system that is coordinated to how the nozzles function and operate will ensure smooth and economical operation of the gas cooling system. The service life of the products used is key to a cement plant's profitability. Unexpected failures can quickly lead to plant stoppages and costly production outages. Which is why we fit our pump and control skids with high-quality components from well-known manufacturers as standard and the most important functional components are even realized in redundant design.

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

## Tested quality

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

## Control concept from the nozzle specialist

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



## Option packages for our VarioCool® pump and control skids

### Electrical wiring of the components:



#### Junction box

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

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



#### Control cabinet with complete PLC

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

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

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

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

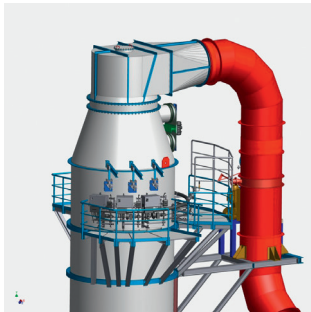
# Lechler Online Cleaning (LOC<sup>®</sup>)

## Cleaning-in-Place system for twin-fluid nozzle lances

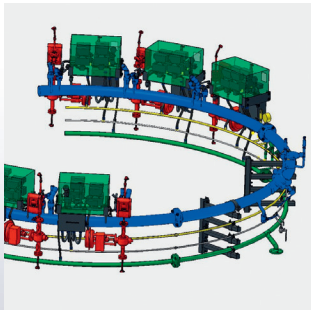
**In the semi-dry flue gas cleaning processes used in power plants, an alkaline washing suspension, usually lime slurry, is injected into the hot flue gas in spray towers. The droplets injected by twin-fluid nozzles are evaporated by the transferred heat. At the same time, pollutants such as SO<sub>2</sub>, HCl and HF react with the reactants in the washing fluid.**

The washing suspension frequently causes damaging deposits and blockages in the nozzles, nozzle lances and pipelines. In the past, reliable long-term plant installation was often not possible without regularly dismantling and cleaning the nozzle lances. Good process results frequently came at the cost of high maintenance effort.

**The Lechler LOC<sup>®</sup> Cleaning-in-Place system eliminates the need for complex disassembly, unnecessary downtimes and personnel costs.**



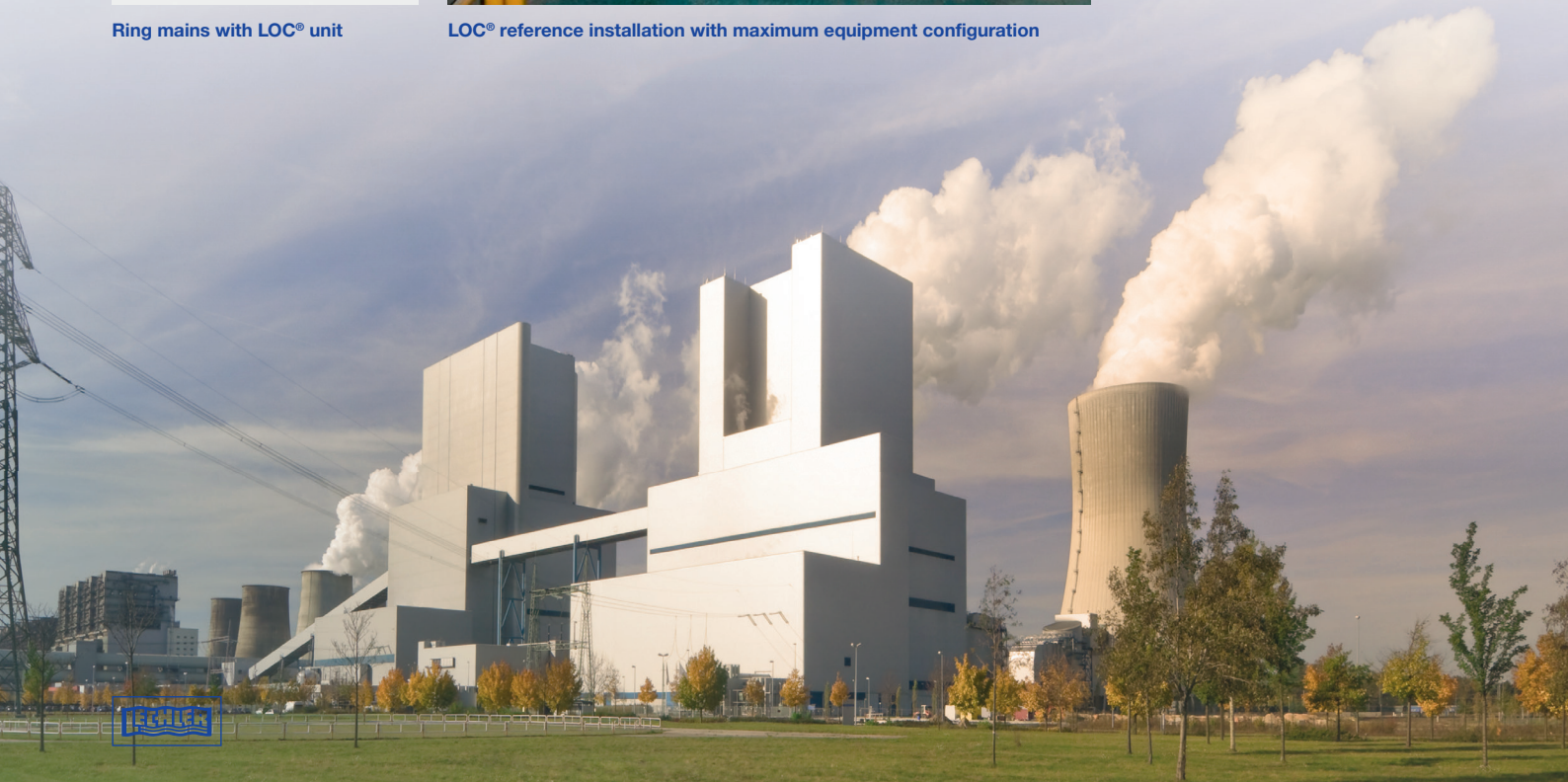
Spray absorbers/dryers

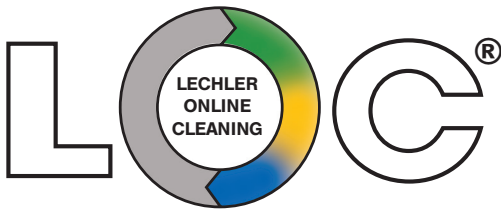


Ring mains with LOC<sup>®</sup> unit



LOC<sup>®</sup> reference installation with maximum equipment configuration

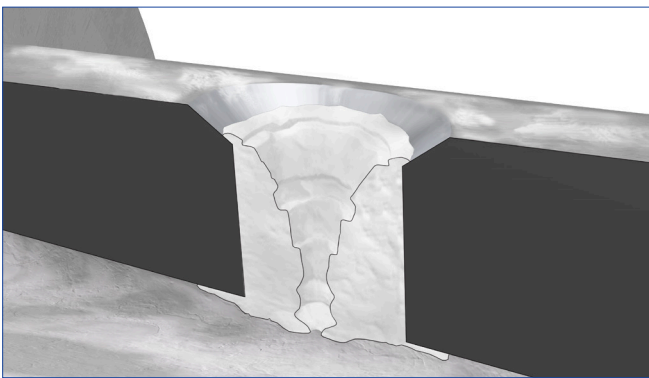




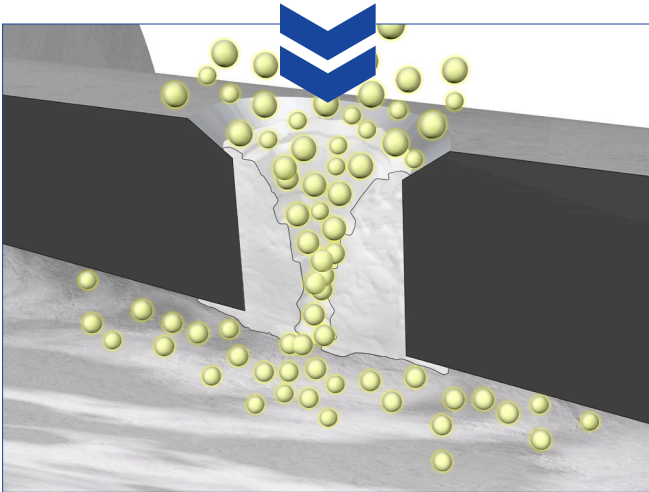
**LOC® makes your plant more economically efficient**

Lechler offers an online cleaning system tailored to the respective application which allows reliable continuous operation and inexpensive cleaning of the nozzle lances.

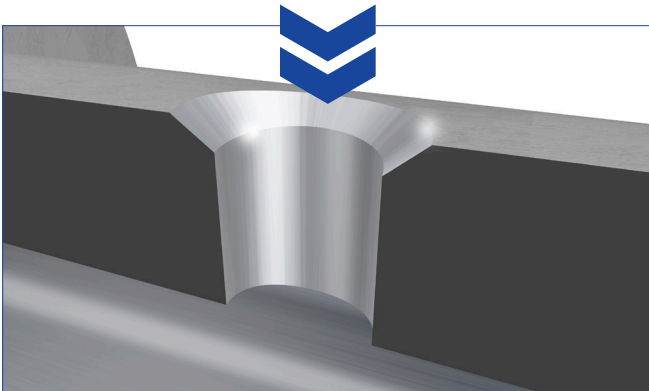
The nozzles are made of wear-resistant hard metal and have been optimized for atomizing suspensions. The individual lances are cleaned cyclically during ongoing operation using precisely metered quantities of cleaning agents. In many cases, minimum use of diluted citric acid (10%) and compressed air is sufficient for reliable cleaning while at the same time ensuring compliance with the process limit values.



**Blocked air holes**



**Cyclical cleaning with citric acid doped in compressed air**



**Cleaned nozzle**



**A visible difference:  
Nozzles before and after LOC® treatment**

**Advantages**

- High availability of the spray reactor/dryer
- Uninterrupted operation
- Minimum maintenance effort
- Low costs through the controlled use of cleaning agents

**Talk to us**

Lechler Online Cleaning (LOC®) is a tailor-made solution. The better we know your requirements and operating conditions, the more efficiently your processes will run. Let's talk to each other – about efficiency, cost savings and success.

