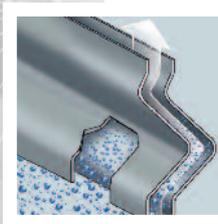
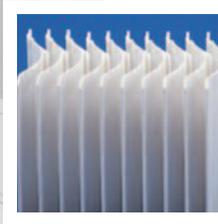
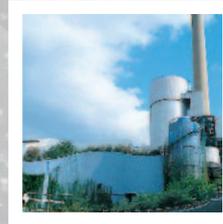


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## **Droplet Separators**



## **Droplet Separators**

## Droplet separators from Lechler – Made-to-measure solutions

### **Lechler droplet separators. Vital elements in many processing operations.**

Droplet separators have long played a vital role in many process operations and in gas washing plants. They become even more important now through the imposition of ever more stringent environmental protection regulations that necessitate a drastic reduction in the pollutants carried by the gases leaving gas-washing plants.

Such regulations make it necessary to install high-performance droplet separators that, while generating as little pressure loss as possible, are capable of arresting even the finest droplets, often with a diameter of less than 10  $\mu\text{m}$ .

Such an objective calls for a separation system with only a few components that is capable of dealing with high flow rates.

### **Lechler droplet separators. Made-to-measure for your application.**

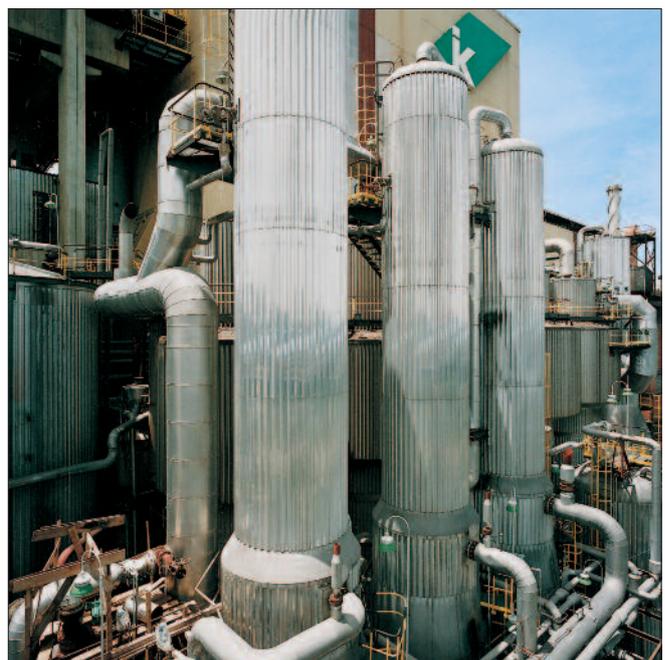
Working closely with plant operators and with scientific institutes, Lechler has developed a variety of droplet separators that exactly meet the above-mentioned requirements and they have proved to be highly successful in many fields of industry: in reducing environmental pollution from existing plants, in gas-washing installations, in the chemical and woodpulp industries, on offshore rigs, in air-conditioning and ventilation systems, in cooling towers and in evaporative condensers - in fact, wherever it is necessary to separate droplets of liquid reliably and effectively solution, that is why each droplet separator is made to measure.



Power plant (EON)



Chemical industry



Pulp and paper industry (KVAERNER PULPING)

# Lechler measurement engineering – The basis for the reliable function of droplet separators

It is necessary to the design and planning of droplet separators to have a thorough understanding of the function and performance of the various separation system as well as a good understanding of the process in which the droplet separator will be incorporated. It is of great importance when designing a droplet separator to have an understanding of how droplets are generated and of how they are transported in a flow of gas. We can honestly say that we know as much or more in this respect than any other, for we have been engaged in the detection, measurement and definition of droplets for more than 125 years. It is not without reason that Lechler droplet separators have become such essential elements in almost every field of process engineering. As a means of determining the performance data of Lechler high-performance droplet

separators we use our own laboratory facilities equipped with the most up-to-date measurement equipment that is often of our own design. For example, the droplet-particle analyser, which simultaneously measures and immediately evaluates the size and velocity of droplets, or the high speed camera which photographs droplets "in flight". Apart from our own facilities, we use a wide range of measuring equipment of many scientific institutes. Many measurements made on site in plants already in operation have proved the high performance of Lechler droplet separators and their superior design. In the design phase of a vane-type separator it is of great importance for Lechler to know the nature of the medium from which the droplets have to be separated and of the liquid of which the droplets



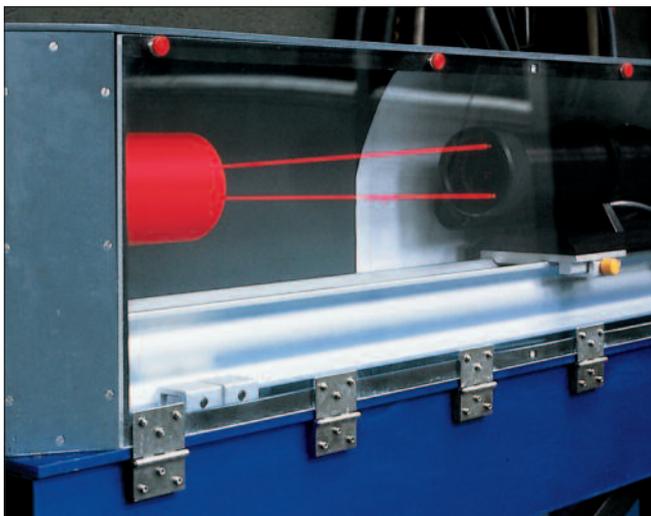
Measurement at droplet separator laboratory

are composed. Lechler's computer-aided design is based on this information and on data of water-air systems measured under normal conditions.

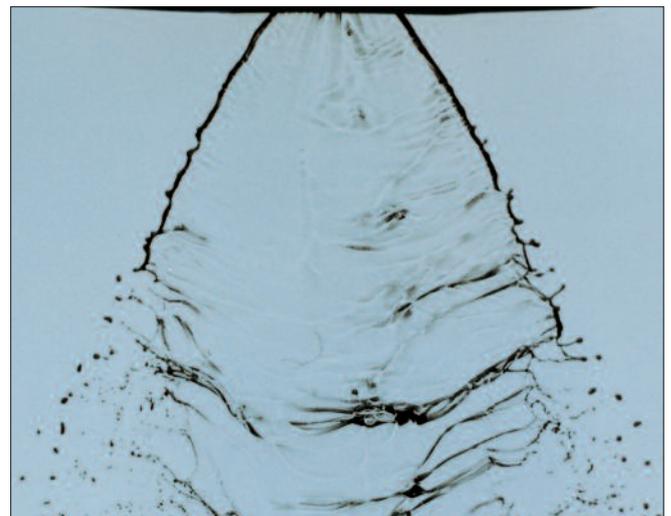
process-engineering parameters. It was developed on the basis of natural laws and its validity was confirmed through laboratory and field tests.

The working point on the impact surface is determined with the aid of a special transformation equation. This equation makes allowance for all

In addition, calculate the anticipated pressure loss, the degree of separation, the droplet flight path, and other technical data the user may need for the design of his plant.



Measurement equipment: Laser-Doppler particle analyser



Film development on a baffle vane

## The functional principle

### - Primary separation

### - Secondary separation

Lechler vane-type separators work on the physical principle of inertia, and separation is thus effected in two stages:

- Primary separation and
- Secondary separation

#### Primary separation

A flow of gas, laden with droplets, flows through a band of curved and specially formed baffle vanes. Forces of inertia act upon the droplets while these are subject to directional flow changes in the baffle vanes. These forces divert the droplets from the original gas flow.

The geometry of the baffle vanes, the nature of the gas and of the fluid, and the size and initial locations of a particular droplet, determine whether the gas will carry it through the space between the baffle vanes, or whether it will come in contact with one of the separator surfaces.

Droplets that under given conditions come 100% in contact with a baffle-vane and then join with others to form a film of liquid are designated "limit droplets" are separated at this stage. At the same time only a small number of the smaller droplets are separated at this stage.

The proportion of droplets carried on by the gas flow is designated the "fractional degree of separation" and serves as a means of assessing the efficiency of a droplet separation system.

#### Secondary separation

The curvature and shape of the baffle vanes are such that the film of liquid formed on their surfaces as a result of primary separation is completely removed from the gas flow.

This is generally achieved by the baffle vanes having specially-formed phase-separation chambers. Where droplet separators are concerned that have to work with as little pressure loss as possible, the baffle vanes are provided with a series of grooves that act as phase separators.

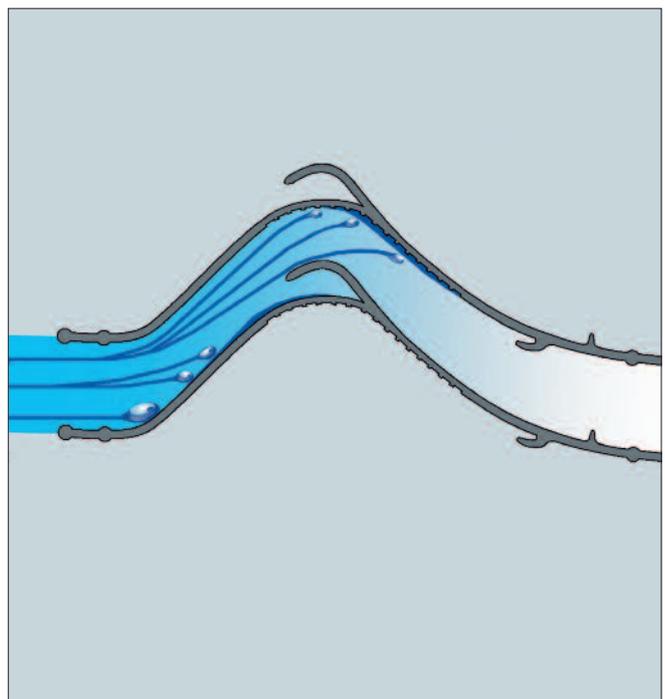
Depending on the application, the phase separation chambers differ in shape and size.

Apart from directional changes in gas flow, the number and form of the phase separation chambers considerably affect the pressure loss across the droplet separation system.

#### Horizontal, vertical or oblique gas flow

Various vertical and horizontal types of Lechler high-performance droplet separators are available, depending on the direction in which the gas is required to flow. Where circumstances demand, it is also possible to provide separators for an oblique flow of gas.

The choice of the suitable separator depends on the design of the plant and other requirements. The Lechler engineering staff will ensure the right choice and will be pleased to assist the customer in all design aspects.



Typical droplet flight paths in a horizontal separator

## The functional principle – Vertical or horizontal gas flow

### Droplet separators with vertical gas flow

In vane-type droplet separators with a vertical gas flow the baffle vanes are arranged horizontally or at a slight angle to the horizontal. Since the gas flows upwards in the opposite direction, it is necessary for the baffle vanes to be designed so that certain regions are bypassed by the gas flow. Thus zones are provided in which the droplets can be collected without interaction with the gas. These zones also provide a secure diversion of the collected liquid from the surface of the vanes. This requirement can be met in various ways and in function of the profile and shape of the vanes.

As the liquid has to flow in the opposite direction to the gas, the film of liquid that forms on the vane has to be converted

back to droplets. To prevent overstressing of the system by droplets being picked up and recirculated by the gas flow, these droplets must be substantially larger than those carried into the separator by the gas.

### Droplet separators with horizontal gas flow

Vane-type droplet separators for a horizontal gas flow have a system of vertical baffle vanes. The provision for secondary separation is of a different design from that of separators for vertical gas flow.

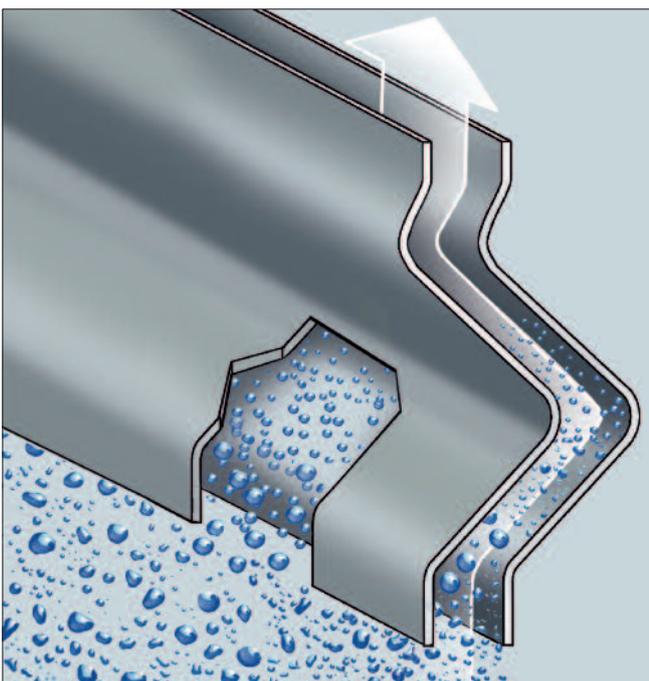
When the flow of gas is horizontal the baffles stand vertically and the liquid film that forms on them flows downwards by gravity. The provision of regions, before or behind the phase-separation chambers, that are bypassed by the gas flow, enable the liquid film to flow off the baffles without renewed contact with the gas.

The fact that the flow-off is assisted by gravity results in droplet separators with a particularly high performance.

Depending on the separator, gas-flow rates of up to 10 m/s can be achieved.

The baffles can be shaped for particularly satisfactory gas flow characteristics, therefore the pressure loss across such separators is remarkably low.

To suit the needs of each particular application, a choice can be made from a finely staged range of baffle-vane types with a simple or multiple gas-flow diversion.



Functional principle of a vertical separator



Functional principle of a horizontal separator

# Lechler droplet separator for horizontal gas flow Type LTH 100

The LTH 100 is well proven with its many sided application and combination capabilities. The plastic sinusoidally corrugated profile plate with protruding phase separation chambers, reaches a high separation performance over a wide gas flow velocity spectrum.

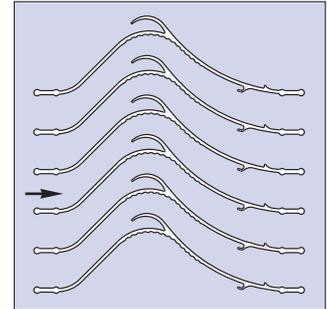
Minimal pressure loss, high hydraulic separation capacity, and a low fouling tendency make the LTH 100 a universally installable, decades proven, drop separator system, especially in the waste gases treatment area.

We deliver the LTH 100 to you in many different configurations:

- As a complete housing unit to be connected to your existing pipe systems or as a frame unit for installation into your current construction site.
- In a light package construction or in a stabile profile frame unit for the highest demands.
- In a one-stage design or multiple staged with a rinsing system.
- With larger distances between the separator profiles for separating with high solid particle contents or with smaller distances for separating the finest of droplets.

With the LTH 100 from Lechler, you have the flexible separator system for the optimal fulfillment for your demands and wishes.

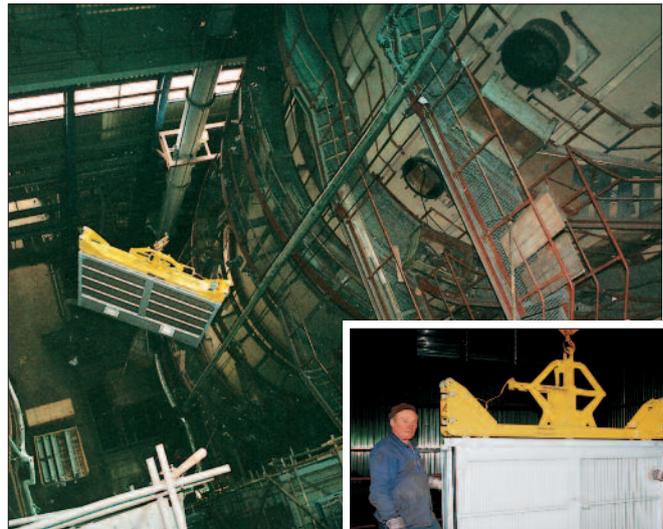
[We would be happy to send you a copy of our technical data sheet on the LTH 100.](#)



LTH 100 profile geometry



LTH100 with housing



LTH 100 being installed in a flue-gas desulphurization plant



Installed LTH 100 in a flue-gas desulphurization plant

# Lechler droplet separator for horizontal gas flow Type LTH 600

The type series LTH 600 includes four, exclusively stainless steel profile geometry's. From type LTH 601 to the LTH 604, in each series is an increasing number of separation effective inversions of the gas flow. Through these graduations and the variable distances between the separation profiles, you can achieve the best possible fine tuning to meet the specific demands for your operations.

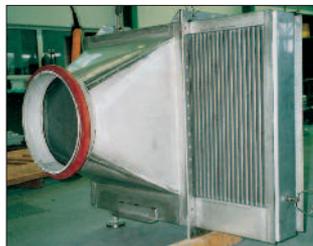
The most widely used profile shape, the LTH 603 with 3 phase separation chambers, shows its superiority through its high hydraulic separation capacity. It attains a high degree of separation and is also suitable for high gas flow velocities.

The LTH 600 is used in every place where temperature or corrosion resistant stainless steel is required, and the finest droplets need to be assuredly and effectively removed from horizontal gas flow.

For example in the pulp and paper industry, in sugar and chemical industry for the use in evaporators, condensers, scrubbers etc.

We can deliver the LTH 600 tailored to your needs:

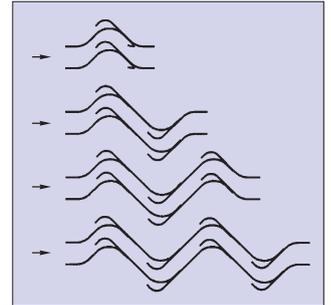
- As a complete housing unit for direct connection to your existing pipes.
- As an ready to install frame unit to be built into your current construction site.
- As a sectional frame unit, which can be installed through a manhole entrance to your vessel.



LTH 600 with housing

With the Lechler LTH 600, you always have the right profile for the right situation!

We would be happy to send you a copy of our technical data sheet on the LTH 600.



LTH 601 to 604 profile geometry



LTH 600 with frame, sectional design



LTH 600 with frame

# Lechler droplet separator for vertical gas flow Type LTV 271

The LTV 271 is a proven, well-known separator system made of plastic. The characteristic guidance channels, which are integrated in the separation profile assures the proper drainage of the separated liquid.

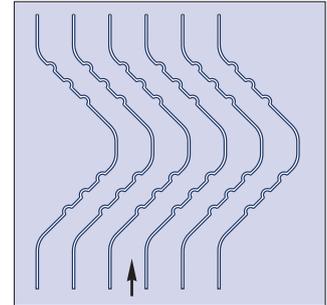
The LTV 271 has a wide field of uses; in the waste gas treatment, as a fine separator in flue-gas desulphurization plants, in evaporators and columns or in exhaust air systems the LTV 271 is convincing through its problem free

handling and the simple adaptability to the constructional situation where it is to be installed.

Through the standardized construction shape of the LTV 271, you have a cost-use factor advantage and reduced ordering-to-delivery times. We deliver the LTV 271 as a standardized package in the standard widths of 305, 610 and 905 mm, with graduated package lengths for the installation through the usual manhole entrance sizes.

Large separator areas can in this way be assembled together out of handy sized, singular standardized sections.

Through the use of our optional clip connectors, "Fix-clip", the packages can be secured against slippage. Also deliverable are special constructions such as cut-to-size round sections for the optimal exploitation of the available space the stream cross-section.



LTV 271 profile geometry

With the LTV 271 from Lechler, you get proven, easy to handle separator technology in a robust construction.

We would be happy to send you a technical data sheet on the LTV 271.



LTV 271 during installation



LTV 271 circular cut



Close-up view of the LTV 271 circular cut



LTV 271 as a fine separator in a flue-gas desulphurization plant

# Lechler droplet separator for vertical gas flow Type LTV 300

The LTV 300 is characterized by its superior separating performance even the finest droplets and an extremely high separating capacity. Through the special profile geometry, there are small "drain off channels", which, when they are installed in an angled position from 15°-60°, assure the removal of the separated fluids out of the flow stream. The LTV 300, made of plastic or stainless steel, finds usage in the waste gas treatment, in evaporators, in process gas cleaning and

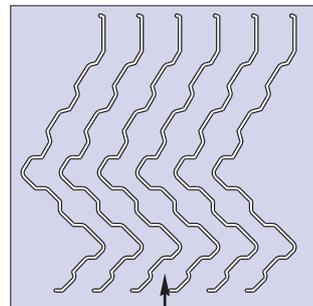
similar uses. Wherever finest droplets must be effectively separated out of vertical gas streams. The LTV 300 is delivered in handy packages, that easily fit into the installation area where they then can be assembled into larger separator areas.

In the special format LTV 300.30.B (roof construction) a horizontal support construction is made possible. The round and angled cut LTV 300 for angled installation from 15°-45° enables an

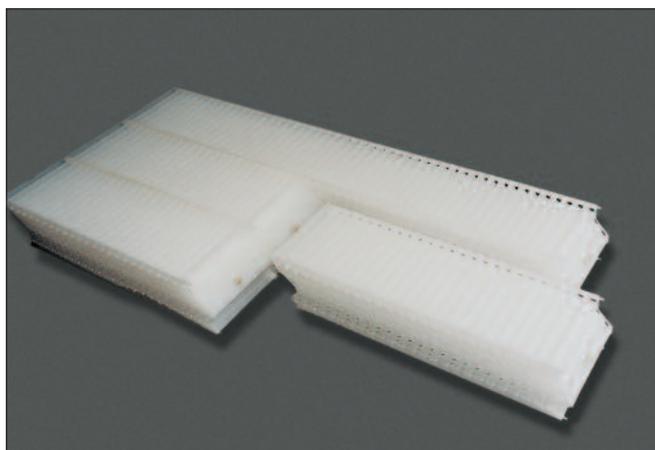
optimal exploitation of the flow cross section.

With the LTV 300 from Lechler, you get easy to handle, but highly effective and safe separator technology.

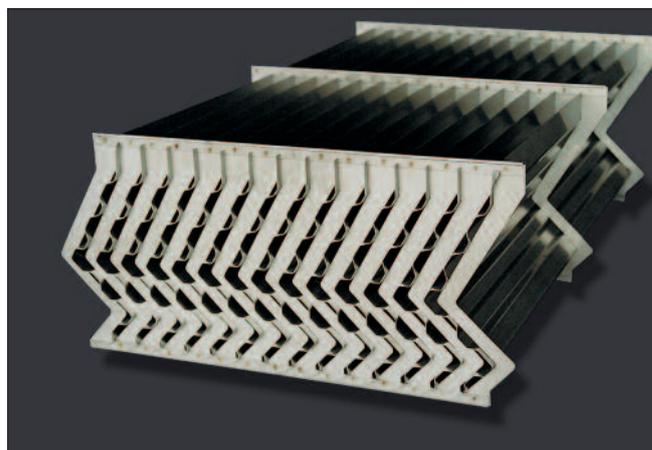
We would be happy to send you a copy of the technical data sheet on the LTV 300.



LTV 300 profile geometry



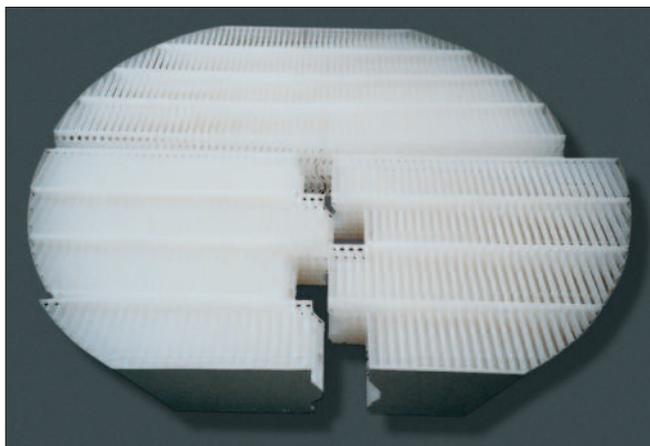
LTV 300 in plastic, standard construction



LTV 300 in stainless steel



LTV 300.30.B, for horizontal support constructions



LTV 300, round / angled cut, for 30° installation

# Lechler droplet separator for vertical gas flow Type LTV 400

The LTV 400 is an universal separator system made of plastic or stainless steel. Many years of separator technology experience have flown into the LTV 400.

Through intensive development and optimizations in the profile contours, the LTV 400 achieves high separation values, even without the additional drain off aids for the separated fluids.

The resulting smooth profile has a very low fouling tendency and is easy to clean.

The LTV 400 is particularly flexible in its application possibilities because of its variable

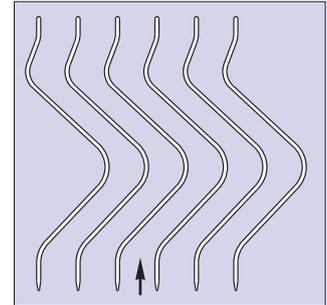
package lengths and the different deliverable separation distances of the separation profiles.

The LTV 400 is especially recommended where high separation capacities are needed, even with high solid particle contents.

It is often used in the treatment of waste gases, (for example: coarse and fine separation in flue-gas desulphurization plants), in evaporators, condensers (pulp and paper industry, chemical industry) and similar uses.

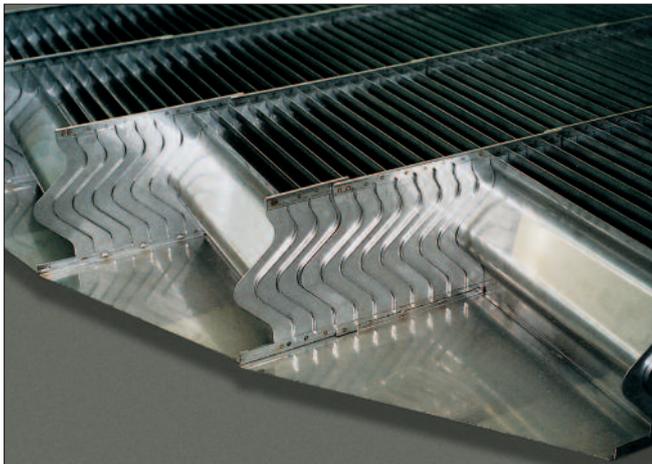
The LTV 400 can be delivered in handy package units. Also available are special designs, such as round cut sections for optimal exploitation of the available space in the flow cross section.

With the LTV 400, you get a highly effective, easy to clean separator with further reaching construction possibilities for adaptability to your installation situation.

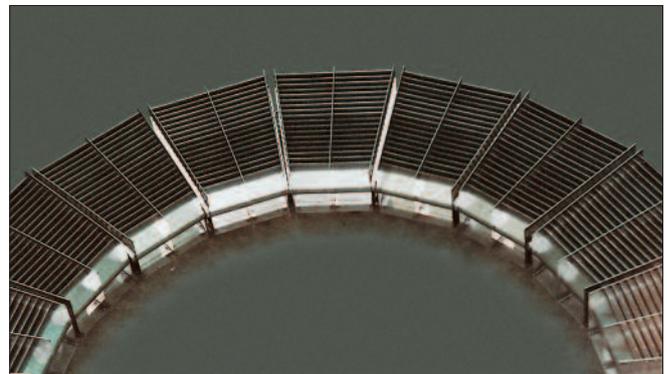


LTV 400 profile geometry

We would be happy to send you a technical data sheet on the LTV 400.



LTV 400 in stainless steel



LTV 400, stainless steel, shape "cake piece"



Assembly of the LTV 400, plastic, in a flue-gas desulphurization plant



Installed LTV 400 in a flue-gas desulphurization plant

## A large variety of profiles for horizontal and vertical gas flow

Lechler has a large diversity in many different separator profiles. We have therewith the optimal possibility to solve your just as diverse problems. Over and beyond the already shown systems on the previous pages, we would like to show you a few other of our proven profiles, a few of which can be seen here in the pictures. For example the LTV 110.33.B, which has proven itself for coarse separation in flue-gas desulphurization plants.

Other types which can be ordered and delivered with short notice, are the models:

- LTH 200
- LTH 400
- LTH 500
- LTV 203
- LTV 900

Just ask for the right profile!



LTV 110.33.-B in a wash tower



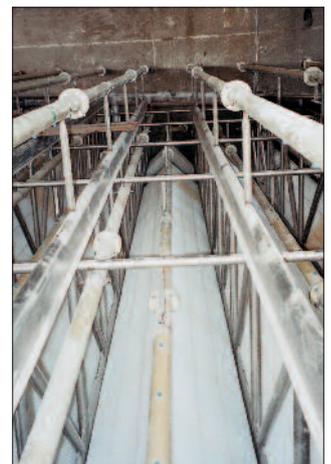
LTH 200



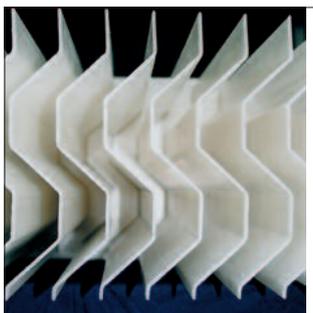
LTH 400



LTH 501, 502, 503, 504



LTV 110, view from the top, in a flue-gas desulphurization plant



LTV 203



LTV 900

## Complete ready-for-mounting droplet separators or individual baffle elements – Lechler has the individual solution

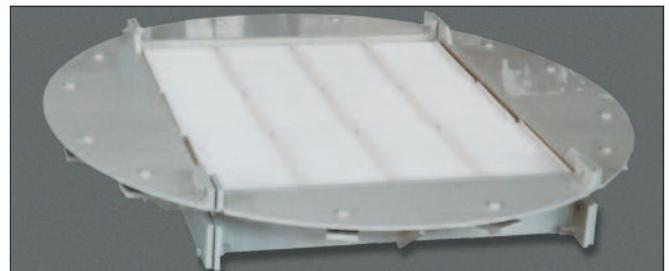
Each project calls for a special design and arrangement of droplet separators. The design, construction, and the manner in which the baffles are arranged in a Lechler droplet separator depend entirely on the requirements, details and specification of the project. Lechler does not offer a standard "off the shelf" solution but designs and assembles the most suitable separator for each specific requirement utilising standard elements of the Lechler unit construction system.



Droplet separator in a stainless steel housing



Production of LTH 600



LTV 400 with support



Production of LTV 400

## Mini or maxi – Large variety of materials

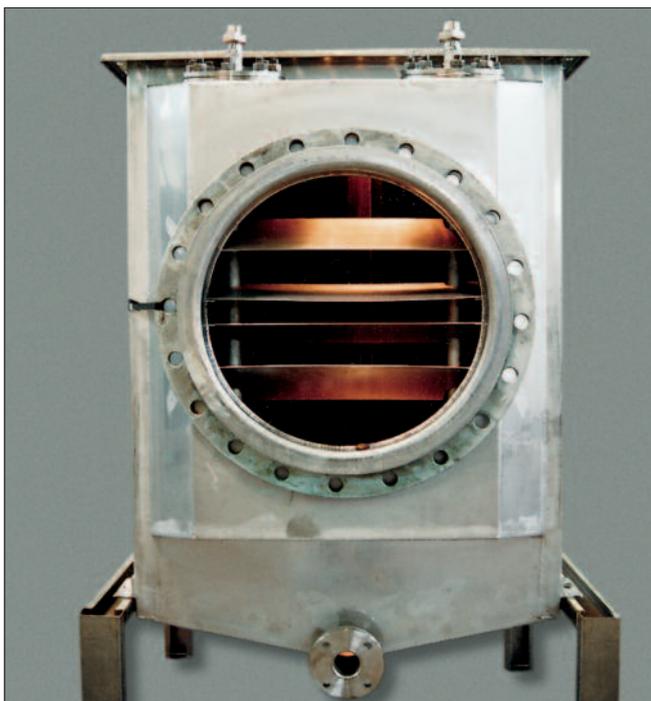
Occasionally aggressive wash suspensions with different acid or alkaline concentrations are often more than some materials can withstand. To ensure a reliable operation it is essential to choose the right material to meet the needs for each individual plant. Also here Lechler will advise the most suitable material for the construction of the droplet separator so that it will withstand the stresses imposed upon it by the specific application.

### We offer systems constructed of the following materials:

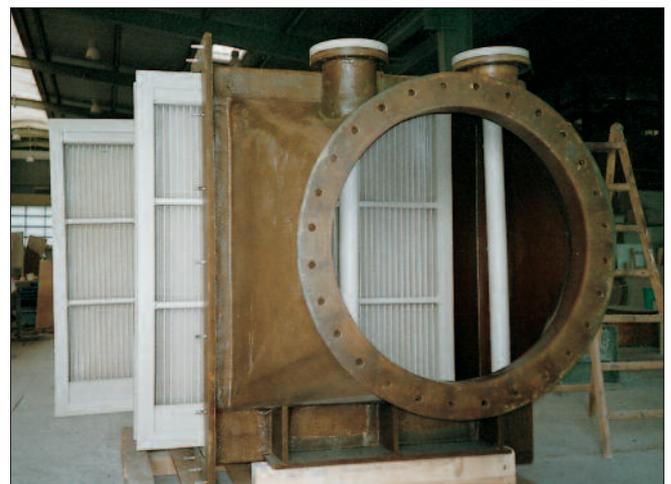
- Stainless steels of qualities 1.4301, 1.4541, 1.4571 and other special alloys.
- Plastics, such as PP, PPTv, GRP, PE, PVC, PVDF



LTV 400, circular cutted, material PE UV-stabilized



LTH 600 with stainless steel housing



LTH 100 with GRP housing

## For extremely fine droplets – Lechler aerosol separators

Under special conditions it can be necessary to separate droplets which are much more smaller than the limit drop size of a vane-type separator. In those cases fibre packs with regulated or unregulated structure are used as aerosol separator or as aerosol agglomerator in combination with vane-type separators.

### For horizontal gas flow: agglomerator and vane-type separator

This combination of a fibre pack agglomerator in the first stage and a vane-type separator as the second stage, offers special advantages.

The allowed gas velocity of the vane-type separator permits small flow areas, which with an aerosol separator alone would not be feasible. The aerosol separator catches the high speed droplets, and guides them to the vane-type separator as agglomerated, larger drops.

We can deliver this separator combination to you in plastic (PP, PVDF) or stainless steel (1.4301, 1.4571, etc.) in complete frame units, with or without housings. The diverse combination possibilities of different vane-type and fibre pack separators offers you a wide spectrum of performance.

### For vertical gas flow: the vane-type separator and aerosol separator

For vertical gas flow, we use a vane-type separator as the first stage and an aerosol separator as the second. This combination has a higher separation performance as the single components alone.

So is for example the sensitivity of aerosol (fibre pack) separa-

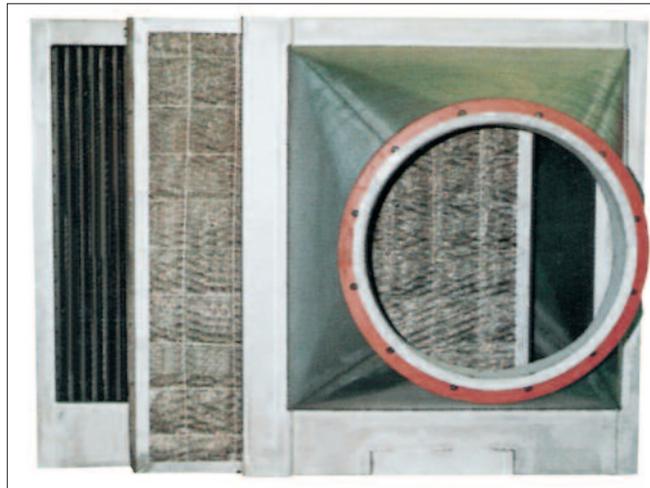
tors faced with a high water content quite unproblematic in this combination. The first stage of vane-type separator removes the large drops before they can reach the aerosol separator. The aerosol separator can then be used with much higher gas velocities as it is possible in a stand alone solution. This results in very high separation efficiencies even for the finest droplet sizes.

Lechler can deliver this separation concept in pre-fab units with the type nomenclature „Demisec“, for mounting on your support systems. When covering larger areas, the units can be connected to each other.

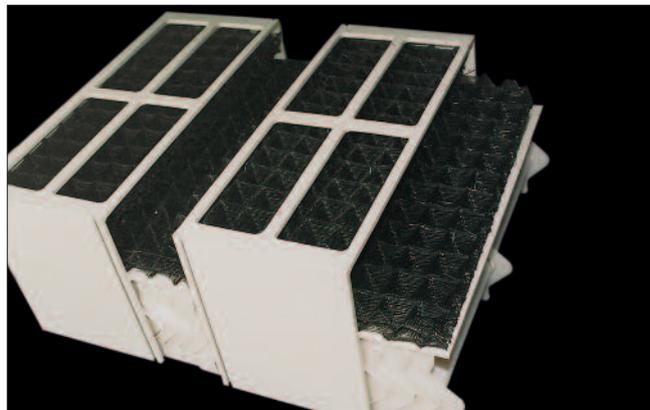
Beside the choices of materials, plastic (PP, PVDF) and stainless steel (1.4301, 1.4571 etc), the diverse combination of possibilities offer a very wide working spectrum and the possibility of adaptation to operational changes and other demands.



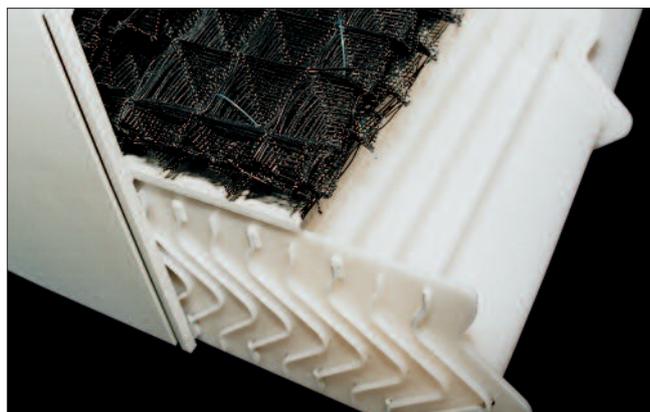
Fibre pack with regulated structure



Horizontal gas flow: vane-type separator with agglomerator



Vertical gas flow: aerosol separator Demisec (view on top)



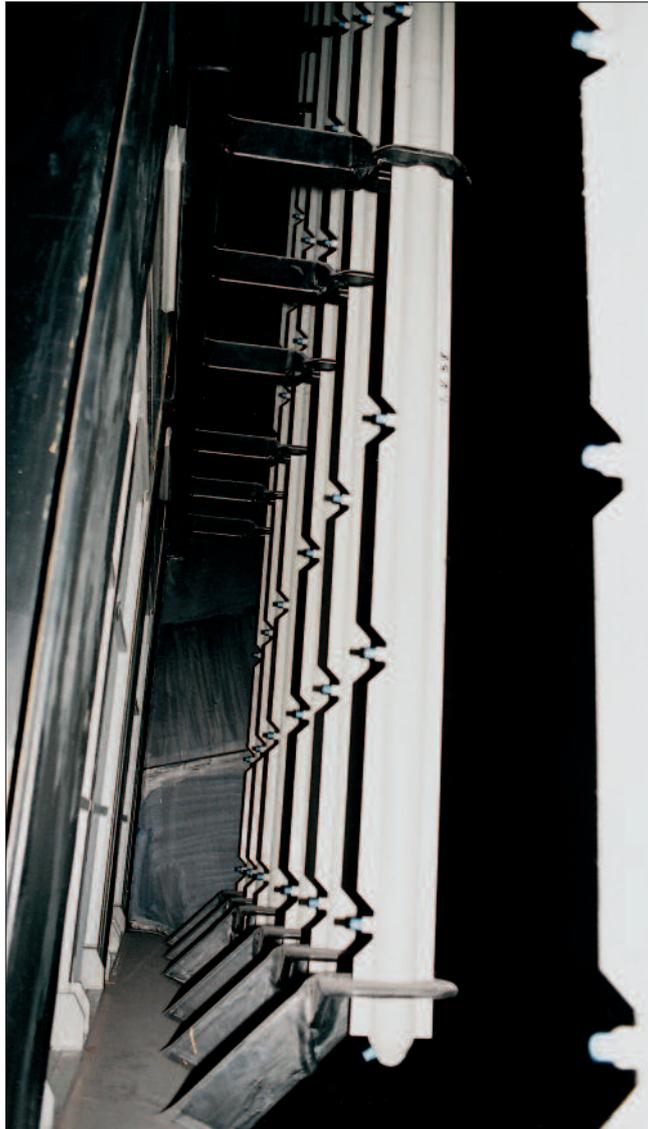
Demisec (detail)

## Eliminate contamination with Lechler cleaning nozzles

Lechler droplet separators are designed to provide as little restriction as possible to the flow of gas. Where, however, the gas is heavily laden with dust, the solid particles may adhere to or be baked onto the baffles and thus affect the efficiency of the separator.

To ensure continuity of operation and to avoid costly downtimes it is desirable to install a cleaning system. An arrangement that provides cyclic washing of the droplet separator through full-cone nozzles mounted to the front and rear of the baffles has proved particularly effective.

Such an arrangement increases reliability, avoids encrustation, and ensures that the plant will maintain its optimum efficiency over a very long period.



Nozzle spray system



LTH 100 with nozzles spraying



Detail nozzle spray system



Spray pattern full cone nozzle

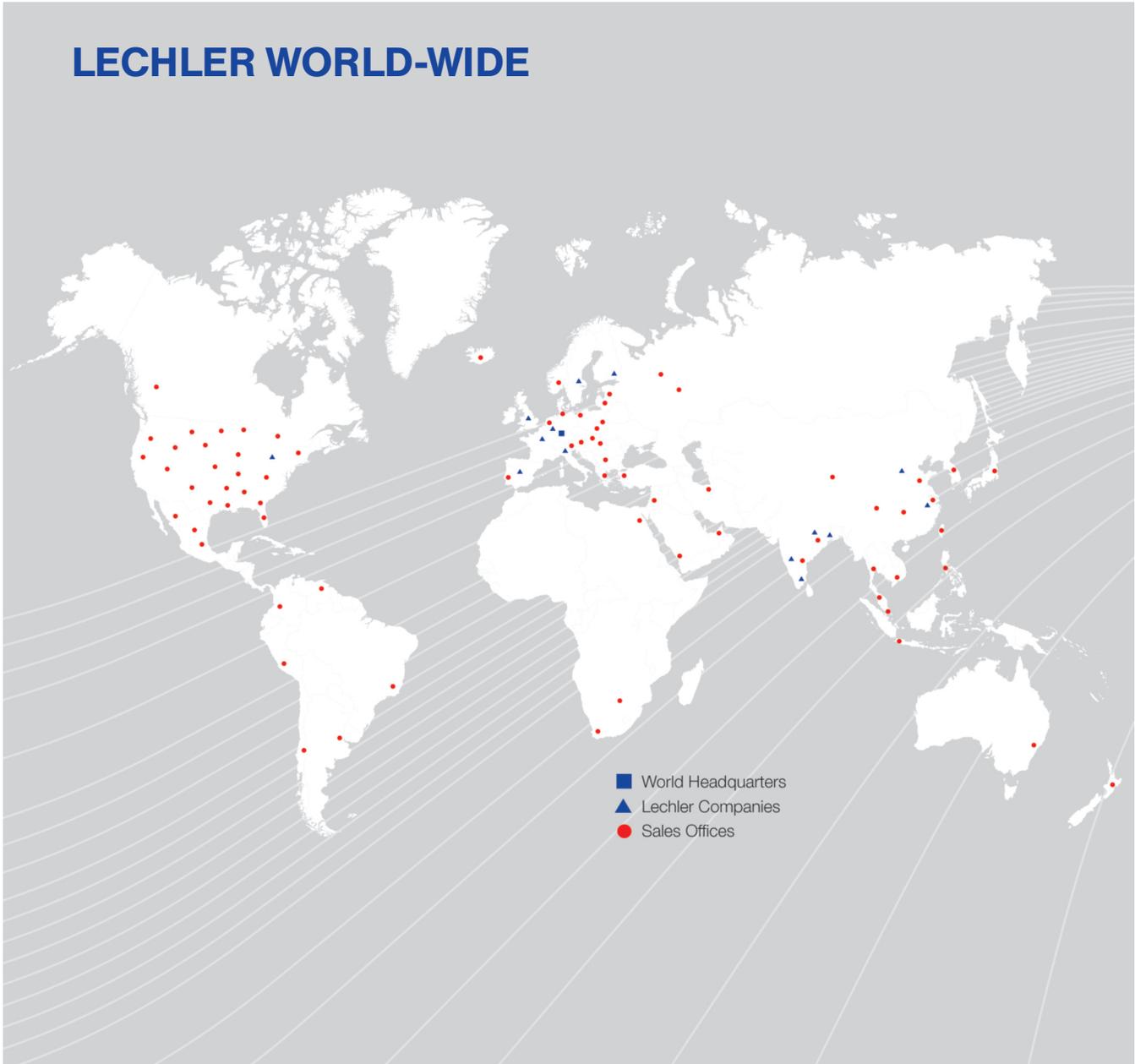


Spray pattern flat jet nozzle

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## LECHLER WORLD-WIDE



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