

Thin Film and Short Path Distillation with Laboratory and Pilot Plants



Custom Vacuum Distillation Plants

turnkey distillation plants • capacity range: 100 grams to over 10 tons per hour • from UIC: a leading international supplier

Vacuum distillation plants

Vacuum distillation plants are used in R&D labs, in pilot applications, and for full-scale industrial mass production.

Each plant can be configured to run around the clock, at feed rates ranging from ca. 0.1 kg/h to more than 10 t/h. In addition to the main components – the Thin Film Evaporators and the Short Path Distillators – all secondary devices are integrated to guarantee smooth and reliable operation.

Applications

While vacuum distillation plants cover large areas of the process industry, common requirements of all applications are particularly gentle process conditions. The thermal load of heat-sensitive substances is minimized to avoid any deterioration of quality.

An overview of applications:

- Food additives
- Oils and fats
- Flavors and fragrances
- Fine chemicals
- Pharmaceutical products
- Separation of monomers and polymers
- Mineral oil products

Test distillations

The UIC Technology Center carries out test distillations with sample materials from our customers to provide reliable data on separation efficiencies, yields, and capacities – relatively quickly and with a minimum of effort. These parameters form an important part of the customers' investment decision.

UIC: leading international supplier

Specialized in the engineering and delivery of turnkey plants, UIC designs each solution to meet specific customer requirements. Today, we are a leading supplier of vacuum distillation plants around the world.

Laboratory and Pilot Plants

KDL 1: compact laboratory plant • even small sample quantities are sufficient • operation pressure from 0.001 mbar

The difference between laboratory plants and pilot plants is in the materials used for the main plant components:

	Laboratory plants	Pilot plants
Material used in the main components	Borosilicate glass	Stainless steel (e.g. 1.4571)
Advantages of each material	Visual observation of the distillation process, e.g. film distribution, discharge of distillate and residue	Stainless steel transfers heat better than borosilicate glass, enabling industry production-like distillation conditions in pilot plants
Surface related evaporation capacity	Considerably lower than pilot plants	Considerably higher than laboratory plants
Preferred applications	Feasibility studies, determination of maximum separation efficiencies, production of very small quantities	Pilot runs, generation of parameters for up-scaling, production of small quantities

KDL 1 BASIC

The components of our smallest Short Path Distillation plants are assembled in a compact table rack. The KDL 1 BASIC unit requires only very small sample quantities and is ideal for applications in university labs and research institutes. Upgrades allow the adjustment to numerous distillation tasks.



Main features of the KDL 1 BASIC	
Evaporation surface area	0.017 m ²
Temperatures up to	200°C (optional: 250°C)
Required sample material quantity	minimum 50 grams
Typical feed rate	0.1 - 0.4 kg / h
Operation pressures	from 0.05 mbar (optional: from 0.001 mbar)
Start-up	minimum 15 min.

KDL 1 BASIC with the following options:
 - evaporator heating device (up to 250°C)
 - heating device for feed vessel
 - oil diffusion pump
 - bottom tub

Series KDL 5 Laboratory Plants

modular laboratory plants • flexible for all distillation tasks • single or multi-stage

Our modular KDL 5 plants offer unmatched flexibility, with several hundred plants distilling a huge variety of substances all over the world. The modular concept includes a large range of proven components, which are continuously improved. Each project carefully selects the components to ensure a laboratory distillation plant that will run reliably and is easy to operate.

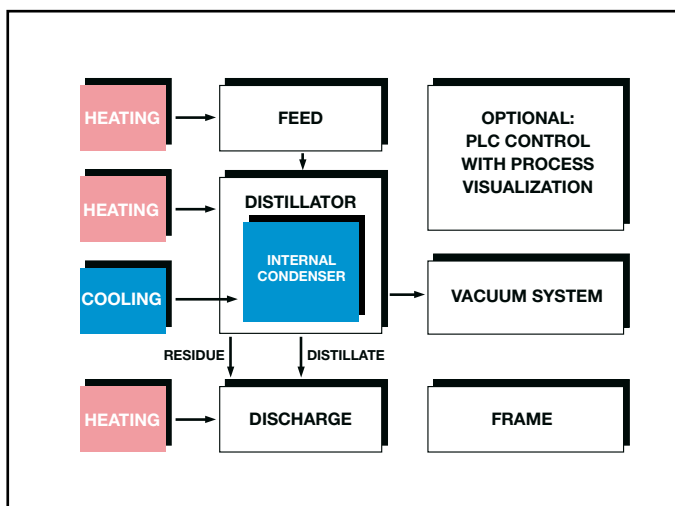
The main component of all KDL 5 plants is the Short Path Distillator with an internal condenser made of borosilicate glass, or

the Thin Film Evaporator with an external condenser. Both types are equipped with an evaporator surface area of 0.05 m².

The secondary components required for continuous operation are compatible to these distillators and evaporators. For the distillation of highly viscous or even solid (at ambient temperature) products, the components which are in direct contact with the products are also available in heatable versions.



Two-stage laboratory plant, series KDL 5, with Thin Film Evaporator and Short Path Distillator



The modular KDL 5 laboratory plants can also be assembled using combinations of Thin Film Evaporators and Short Path Distillators – i. e. for multi-stage plants.

In the two-stage plant shown above, a Thin Film Evaporator strips off the light volatile fraction (solvent) before the main fraction is separated from the heavy boiling residue in the subsequent Short Path Distillator stage.

Components of the KDL 5 modular laboratory plant

Main features of the KDL 5 laboratory plants

Main components	Short Path Distillator Thin Film Evaporator
Evaporation surface area	0.05 m ²
Heating range: Evaporation area	up to 350°C
Residue discharge	up to 250°C
Distillate discharge	up to 200°C
Typical feed rates	0.5 - 1.5 kg/h
Operating pressure	
Short Path Distillator	from 0.001 mbar
Thin Film Evaporator	from 1 mbar
Feed systems	Dosing vessel Gear pump Dosing pump
Discharge systems for distillate and residue	Glass bulb Cut measuring vessel Sample collecting carousel Gear pump
Vacuum systems	Rotary vane pump Oil diffusion pump
Heating devices and heating / cooling devices	Large selection, depending on temperature range and required capacity
Racks	Table rack Mobile floor rack



KDL 5 laboratory plant - Table rack version



KDL 5 laboratory plant - Mobile floor rack version

KDL 5 CADi Laboratory Plant (Computer Aided Distillation)

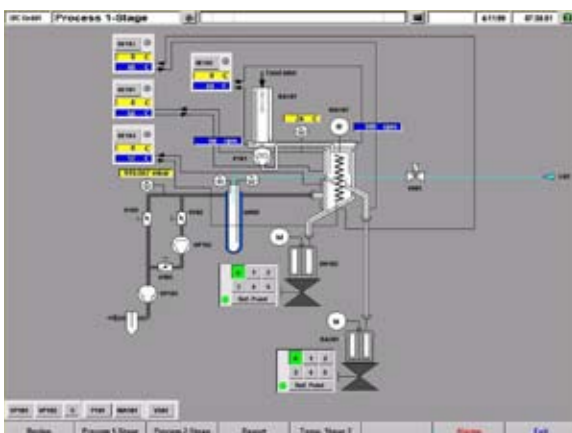
automated distillation series • up to 5 distillate and residue samples • suitable e.g. for distilling mineral oil residues

Routine distillation processes are performed in some areas of process industry, such as determining distillation curves where the cut ratio (the ratio of the distillate quantity to the feed quantity) is shown as a function of the distillation temperature. Distillation curves are important for process management in the mineral oil industry, where Short Path Distillation plants are widely used for the distillation of (high boiling) vacuum residues.



KDL 5 CADi for automated routine distillations

The KDL 5 CADi Short Path Distillation lab plant is ideal for automated distillation processes. A PLC system controls the distillation sequence, with data input and output for up to 5 sets of distillation parameters done by a PC.



KDL 5 CADi system operation via mouse and monitor

The process sequence of the automatic program includes:

- Positioning the sample collecting carousels to "intermediate runs"
- Heating the distillator up to the operating temperature for the first cut
- Positioning the sample collecting carousels to "samples No. 1"
- Collecting distillate and residue in sample cups for a set period of time
- Positioning the sample collecting carousels to "intermediate runs"
- Heating the distillator to the operating temperature for the second cut, etc.

After termination of the automatic sequence, the sample collecting carousels contain 5 distillate samples and 5 residue samples that are used for analytical evaluations. The distillation parameters are recorded by the plant operating system and printed out.

Laboratory Plants

Special Versions / Special Sizes

special materials • magnetic coupling • GMP compliant versions



KDL 30 laboratory plant

If very corrosive feed materials are being distilled, the components of the distillation plant in direct contact with the products are manufactured from special materials. The metallic components – such as the wiper basket – are made of Hastelloy, tantalum, or other chemically resistant materials.

Gold-plated components are available for applications where feed products are affected by undesirable catalytic reactions from contact with stainless steel.

For the distillation of very toxic products, a magnetic coupling between the motor and the wiper basket prevents even very small leakages at the shaft lead-through.

The materials used for elastic gaskets within the laboratory plants are carefully selected in accordance with their chemical resistance to the products to be distilled. In addition to FKM (Viton®), materials such as PTFE, EPDM or FFKM are available.

GMP compliant distillation plants are equipped with gasket materials that conform to FDA regulations.

We offer our KDL 10 and KDL 30 plants for distillation tasks that require distillators or evaporators made of borosilicate glass with higher throughput capacities than a KDL 5 plant.

	KDL 10	KDL 30
Evaporation surface area	0.10 m ²	0.30 m ²
Typical feed rate	1.0 - 2.0 kg/h	3.0 - 6.0 kg/h

Series KD 6 Pilot Plants

modular pilot plants • flexibility for all distillation tasks • applicable for up-scaling tasks

Pilot plants are a link between laboratory plants and industrial mass production plants. They are used to optimize processes developed under laboratory conditions for the application in large-scale industrial production. Pilot plants enable important data for up-scaling (for the design of large apparatuses used for commercial production plants).

In general, laboratory plants (such as our KDL 5, see page 4) are used initially for Thin Film and Short Path Distillation. Even relatively small sample material quantities (2 – 5 kg) are sufficient to perform significant test runs. The test results provide good indications for attainable separation efficiencies and yields.

Reliable parameters to define the required sizes of distillators and evaporators for industrial production plants, however, can only be determined with a pilot plant. Made of stainless steel and not borosilicate glass as with laboratory plants, pilot plants operate under process conditions, similar to those of commercial production plants.

KD 6 pilot plant with degasser and Short Path Distillator



KD 6 pilot plant with degasser, PLC control, and graphic operator panel



The KD 6 pilot plant is operated either manually or via a PLC system. A graphic operator panel or a PC monitor can be used for data input and process visualization.

KD 6 modular pilot plants

The KD 6 was designed with the same modular concept that was successfully used on the KDL 5 lab plants. Today, the KD 6 is the world's most successful pilot plant for Thin Film and Short Path Distillation.

Proven components permit the assembly of reliable and easy to handle plants that correspond precisely to the individual distillation task.

Thin Film Evaporators and Short Path Distillators with a 0.06 m² evaporation surface area are available. A degasser is used for the separation of small quantities of light volatiles (solvents) prior to the actual distillation.

All secondary components required for continuous operation are configured to the distillators, evaporators and degassers. All components which are in direct contact with the products are available in a heatable version to distill highly viscous or even solid products (at ambient temperature).



KD 6 plant specifications

Main components	Short Path Distillator Thin Film Evaporator Degasser
Material	Stainless steel (1.4571)
Evaporator surface area	0.06 m ²
Heating range: Evaporation area	up to 350°C
Residue discharge	up to 250°C
Distillate discharge	up to 200°C
Typical feed rates	3 - 9 kg / h
Operation pressures	
Short Path Distillator	from 0.001 mbar
Thin Film Evaporator	from 1 mbar
Degasser	approx. 1 - 10 mbar
Feed systems	Reservoir vessel Gear pump
Discharge systems for distillate and residue	Glass bulb Cut measuring vessel Gear pump
Vacuum systems	Rotary vane pump Oil diffusion pump
Heating devices & heating / cooling devices	Large selection, depending on desired temperature range and capacity
Rack	Mobile floor rack with tub

KD 6 Pilot Plants

single or multi-stage pilot plants • manual operation or PLC controlled • assembly into a fume hood



Final inspection of KD 6 plants prior to delivery

KD 6 - left-hand plant:

Equipped with a degasser and a Short Path Distillator, this plant is designed to distill fish oils. It is equipped with a PLC control system and is operated via a PC. Distillate and residue are continuously discharged by gear pumps into vessels placed on electronic balances. The PLC control system allows permanent supervision of feed and discharge quantities, and the “cut ratio”.

KD 6 - center plant:

This two-stage plant is equipped with a Thin Film Evaporator and a Short Path Distillator. It is used to concentrate pharmaceutical products and meets ATEX European explosion protection regulations.

KD 6 - right-hand plant:

Equipped with two Thin Film Evaporators (each with 0.06 m² evaporation surface area), this two-stage plant can be integrated in an existing accessible fume hood and used for development and piloting of food additives.

Pilot Plants

Special Versions, Special Sizes

plant configurations to meet GMP regulations • explosion protection (ATEX) • special materials

Our primary objective is to deliver a distillation plant that meets specific customer requirements. This is particularly important for applications that demand compliance with GMP (Good Manufacturing Practice) regulations common in the pharmaceutical and food industries, and special hygiene requirements (food industry), or explosion protection guidelines (in Europe: ATEX regulation 94/9/EG).

For example, plants complying with GMP or hygiene regulations feature a certain level of surface roughness, avoidance of dead spaces, and easy cleaning (CIP: Cleaning in Process) by selecting the appropriate materials. Both external and internal explosion protection must be considered

for plants used in hazardous areas. Not only the electrical devices but also the mechanical components must be designed to meet the ATEX regulations.

Similar to laboratory plants, KD 6 pilot plants can be made of corrosion resistant materials (such as Hastelloy or FFKM) and come equipped with a magnetic coupling between motor and wiper basket.

Large capacity pilot plants

KD 6 pilot plants often carry out small production runs, much like a commercial plant, or commercial plants distill large product quantities for pilot production applications.

In addition to laboratory and pilot plants, our range of products also includes large commercial mass production plants, like the KD 5000 with an evaporation surface area of 50 m². UIC offers pilot plants of almost any size.



This KD 10 Short Path Distillation plant (evaporation surface area: 0.1 m²), is equipped with gear pumps for feed and discharge, a vacuum system with oil diffusion and rotary vane pumps, as well as heating / cooling devices.

KD 10 Short Path Distillation plant

UIC Products & Services

As a technology partner, we supply distillation solutions to our customers for the thermal separation of heat sensitive substances. Our Thin Film and Short Path Distillation technologies operate under vacuum at pressures down to 0.001 mbar.

We offer

- Feasibility studies
- Distillation trials for laboratory and pilot plants performed at the UIC Technology Center
- Basic and detailed engineering
- Delivery of turnkey plants for R&D, pilot, and industrial applications
- Plant start-up, commissioning, and process optimization
- Leak detection, maintenance, and repair
- Spare parts service
- Consulting and support through our worldwide network

Ask for our other brochures

- UIC GmbH – The Specialist in Vacuum Distillation Plants
- Function of Thin Film Evaporators and Short Path Distillators
- Applications for Thin Film Evaporators and Short Path Distillation Plants
- Client Distillation Trials at the UIC Technology Center
- Distillation Plants for Industrial Production



UIC GmbH

Am Neuen Berg 4
D-63755 Alzenau

Phone: +49 6023 950 0

Fax: +49 6023 950 250

info@uic-gmbh.de

www.uic-gmbh.de