THERMAL SEPARATION

BY WIPED FILM AND SHORT PATH DISTILLATION

Laboratory and Pilot Plants, Industrial Plants, Package Units, Components, Engineering and Manufacturing, Laboratory and Pilot Tests, Toll Distillation
VTA Verfahrenstechnische Anlagen GmbH & Co. KG, based in Niederwinkling, is a wholly-owned subsidiary of MAX STREICHER GmbH & Co. KG aA and specialised in the field of thermal process engineering. The main focus of production is wiped film and short path distillation plants at laboratory, pilot and industrial scale as well as the manufacturing of the related components.

These distillation plants are operated for purification, concentration, removal of low boilers, colour improvement and drying of products in various industries. Highly qualified and responsible professionals ensure the highest quality standards. They are the foundation of the sustainable development of VTA.

VTA is a problem solver! From process development, via trials to the finished plant or the execution of a toll distillation, everything comes from one single source at VTA.

The close coordination of process development, design and manufacturing enables VTA to quickly respond to customer requests even during the manufacturing phase. Thus, the best possible solution even for complex problems is achieved for customers.
Performance requirements
Definition of separation task, specification of quality

Theoretical evaluation
Process simulation, calculations

Trial
Laboratory tests, pilot tests...

Plant construction

Toll distillation

Wiped Film Evaporators
Short Path Evaporators
Horizontal Thin Film Evaporators
Thin Film Dryers
Glass Lined Evaporators
Laboratory and Pilot Plants

Package Unit
Components
System assembled at site

STREICHER Group
Distillation Methods

**Wiped Film Distillation**
A rotating wiper system distributes the crude product to a film on the inner surface of a heated pipe. The wiping system speeds up the evaporation process by keeping the product film turbulent so that the heat transfer and mass transfer are optimised. The lower boiling fraction of the raw material evaporates out of the product film within a short time; the residence time of the product at the evaporator wall is very short. The vapours are condensed on an external condenser. The concentrate is continuously discharged out of the bottom part of the evaporator. The processing of viscous or crystallising substances at pressures down to 1 mbar is possible.

**Advantages Wiped Film Distillation**
- Continuous distillation process
- Short residence time
- High evaporation rates
- Low processing temperatures due to low operating pressures
- Processing of high-boiling or high viscosity products is possible
- Combination with a column to increase the number of theoretical plates is possible
- Low fouling on evaporator wall

**Short Path Distillation**
The short path evaporator combines thin film evaporator and condenser in a single apparatus. The vapours are condensed on the built-in condenser. The product path between the evaporation and condensation is extremely short, therefore, the pressure drop is low.

**Advantages Short Path Distillation**
- Continuous distillation process
- Short residence time
- High evaporation rates
- Low processing temperatures (down to 0.001 mbar)
- Low fouling on evaporator wall
- Compact design

**Evaporators – manufactured by VTA**
VTA provides evaporators from laboratory to production scale in sizes ranging from 0.01 - to 80 m² and for operating temperatures up to 400 °C. Different wiper systems are selected depending on the product properties. The material for the product wetted evaporator parts will be selected depending on the corrosiveness and the reactivity of the processed products.
Horizontal Thin Film Evaporators

In order to increase the residence time of the product in the evaporator, the possible evaporation rate or the percent distillate, it makes sense to use horizontal evaporators, so that gravity has less influence on the product stream.

In this type of evaporator it is possible to vary the required residence time within wide ranges.

By increasing the product residence time, horizontal evaporators can also be used to carry out continuous reactions and reactive distillation in the thin and turbulent film at vacuum conditions.

Advantages Horizontal Thin Film Evaporators

- Continuous distillation process
- Very high evaporation rates and high distillate splits possible
- Suitable for reactive distillation

Thin Film Dryers

Thin film dryers are suitable for drying dissolved or slurried crystallising or amorphous products to a pourable powder.

Advantages Thin Film Dryers

- Continuous process
- Low evaporation temperatures within the product film
- Short residence time
- High evaporation rates
- Combination with a column to increase the number of stages possible

Glass lined Wiped Film and Short Path Evaporators

For the distillation of highly corrosive products or metal active substances, VTA is offering glass lined wiped film and short path evaporators. Glass lined evaporators are also used for applications where sterility is important or where contact with metals would cause catalytic decomposition or other chemical reactions.

Internals of the evaporator are made of enamel and other corrosion resistant non-metallic materials.
### Standard sizes of VTA Wiped Film Evaporators (vertical design)

<table>
<thead>
<tr>
<th>Type</th>
<th>Surface [m²]</th>
<th>Height [mm]</th>
<th>Inner Diameter [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDL 70-4 *</td>
<td>0.04</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>VDL 70-7 *</td>
<td>0.07</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>VDL 125-15 *</td>
<td>0.15</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>VDL 200-30 *</td>
<td>0.30</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>VD 83-6 **</td>
<td>0.06</td>
<td>1,000</td>
<td>83</td>
</tr>
<tr>
<td>VD 100-10 **</td>
<td>0.10</td>
<td>1,150</td>
<td>100</td>
</tr>
<tr>
<td>VD 125-20 **</td>
<td>0.20</td>
<td>1,700</td>
<td>125</td>
</tr>
<tr>
<td>VD 200-50 **</td>
<td>0.50</td>
<td>3,300</td>
<td>200</td>
</tr>
<tr>
<td>VD 260-100 **</td>
<td>1.00</td>
<td>2,900</td>
<td>260</td>
</tr>
<tr>
<td>VD 350-200 **</td>
<td>2.00</td>
<td>4,200</td>
<td>350</td>
</tr>
<tr>
<td>VD 500-400 **</td>
<td>4.00</td>
<td>5,800</td>
<td>500</td>
</tr>
<tr>
<td>VD 630-650 **</td>
<td>6.50</td>
<td>8,800</td>
<td>630</td>
</tr>
<tr>
<td>VD 800-1000 **</td>
<td>10.00</td>
<td>7,500</td>
<td>800</td>
</tr>
<tr>
<td>VD 1000-1500 ***</td>
<td>15.00</td>
<td>9,000</td>
<td>1,000</td>
</tr>
<tr>
<td>VD 1250-2000 ***</td>
<td>20.00</td>
<td>9,300</td>
<td>1,250</td>
</tr>
<tr>
<td>VD 1250-2500 ***</td>
<td>25.00</td>
<td>10,500</td>
<td>1,250</td>
</tr>
<tr>
<td>VD 1400-3000 ***</td>
<td>30.00</td>
<td>12,000</td>
<td>1,400</td>
</tr>
<tr>
<td>VD 1600-3500 ***</td>
<td>35.00</td>
<td>13,000</td>
<td>1,600</td>
</tr>
<tr>
<td>VD 1600-4000 ***</td>
<td>40.00</td>
<td>14,000</td>
<td>1,600</td>
</tr>
<tr>
<td>VD 1800-5000 ***</td>
<td>50.00</td>
<td>14,500</td>
<td>1,800</td>
</tr>
<tr>
<td>VD 2000-6000</td>
<td>60.00</td>
<td>16,000</td>
<td>2,000</td>
</tr>
<tr>
<td>VD 2600-8000</td>
<td>80.00</td>
<td>18,500</td>
<td>2,600</td>
</tr>
</tbody>
</table>

* The Wiped Film Evaporators (series VDL) are manufactured in borosilicate glass.
** These sizes are also available as Thin Film Dryers.

If required, the evaporator sizes can be customised based on special requirement.
Standard sizes of VTA Short Path Evaporators

<table>
<thead>
<tr>
<th>Type</th>
<th>Surface [m²]</th>
<th>Height [mm]</th>
<th>Inner Diameter [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VKL 38-1 *</td>
<td>0.01</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>VKL 70-4 *</td>
<td>0.04</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>VKL 70-5 *</td>
<td>0.05</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>VKL 125-10 *</td>
<td>0.10</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>VKL 125-15 *</td>
<td>0.15</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>VKL 200-30 *</td>
<td>0.30</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>VK 100-10</td>
<td>0.10</td>
<td>1,250</td>
<td>100</td>
</tr>
<tr>
<td>VK 125-15</td>
<td>0.15</td>
<td>1,600</td>
<td>125</td>
</tr>
<tr>
<td>VK 200-40</td>
<td>0.40</td>
<td>2,000</td>
<td>200</td>
</tr>
<tr>
<td>VK 280-60</td>
<td>0.80</td>
<td>2,200</td>
<td>280</td>
</tr>
<tr>
<td>VK 350-150</td>
<td>1.50</td>
<td>3,600</td>
<td>350</td>
</tr>
<tr>
<td>VK 500-240</td>
<td>2.40</td>
<td>3,800</td>
<td>500</td>
</tr>
<tr>
<td>VK 630-450</td>
<td>4.50</td>
<td>4,000</td>
<td>630</td>
</tr>
<tr>
<td>VK 800-800</td>
<td>6.00</td>
<td>5,500</td>
<td>800</td>
</tr>
<tr>
<td>VK 800-800</td>
<td>8.00</td>
<td>6,400</td>
<td>800</td>
</tr>
<tr>
<td>VK 1000-1000</td>
<td>10.00</td>
<td>6,600</td>
<td>1,000</td>
</tr>
<tr>
<td>VK 1250-1500</td>
<td>15.00</td>
<td>8,000</td>
<td>1,250</td>
</tr>
<tr>
<td>VK 1250-2000</td>
<td>20.00</td>
<td>9,200</td>
<td>1,250</td>
</tr>
<tr>
<td>VK 1400-2500</td>
<td>25.00</td>
<td>10,100</td>
<td>1,400</td>
</tr>
<tr>
<td>VK 1600-3000</td>
<td>30.00</td>
<td>12,000</td>
<td>1,600</td>
</tr>
<tr>
<td>VK 1800-3500</td>
<td>35.00</td>
<td>13,200</td>
<td>1,800</td>
</tr>
<tr>
<td>VK 2000-5000</td>
<td>50.00</td>
<td>13,700</td>
<td>2,000</td>
</tr>
<tr>
<td>VK 2600-8000</td>
<td>80.00</td>
<td>15,500</td>
<td>2,800</td>
</tr>
</tbody>
</table>

* The Short Path Evaporators (series VKL) are manufactured in borosilicate glass.

Standard sizes of glass lined VTA Wiped Film and Short Path Evaporators

<table>
<thead>
<tr>
<th>Type</th>
<th>Surface [m²]</th>
<th>Height [mm]</th>
<th>Inner Diameter [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiped Film Evaporators - glass lined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VDE 125-15</td>
<td>0.15</td>
<td>1,700</td>
<td>125</td>
</tr>
<tr>
<td>VDE 200-40</td>
<td>0.40</td>
<td>2,000</td>
<td>200</td>
</tr>
<tr>
<td>VDE 350-100</td>
<td>1.00</td>
<td>2,400</td>
<td>350</td>
</tr>
<tr>
<td>VDE 500-200</td>
<td>2.00</td>
<td>4,000</td>
<td>500</td>
</tr>
<tr>
<td>VDE 1000-800</td>
<td>8.00</td>
<td>6,900</td>
<td>1,000</td>
</tr>
<tr>
<td>VDE 1250-1500</td>
<td>15.00</td>
<td>8,500</td>
<td>1,250</td>
</tr>
</tbody>
</table>

| Short Path Evaporators - glass lined |
| VKE 200-40 | 0.40         | 2,000       | 200                 |
| VKE 350-100 | 1.00        | 2,400       | 350                 |
| VKE 500-200 | 2.00        | 4,000       | 500                 |

If required, the evaporator sizes can be customised based on special requirement.
Laboratory and Pilot Tests at VTA

Laboratory and Pilot Tests

For complex mixtures, theoretical calculations are often not sufficient to design an industrial plant or to determine the optimum process conditions for a distillation. In the VTA test centre, tests for every offered technology can be performed.

<table>
<thead>
<tr>
<th>Laboratory tests</th>
<th>Pilot tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determination of the general feasibility</td>
<td>Dimensioning of process equipment and aggregates of the industrial plant</td>
</tr>
<tr>
<td>Determination of process parameters</td>
<td>Selection of the optimum wiper system</td>
</tr>
<tr>
<td>Determination of achievable product quality and yields</td>
<td>Final determination of process parameters</td>
</tr>
<tr>
<td>Production of sample volumes up to several kilograms</td>
<td>Identifying and confirming the achievable product quality and yields</td>
</tr>
<tr>
<td>Determination of process parameters required for toll distillation</td>
<td>Production of sample volumes up to several tons</td>
</tr>
<tr>
<td>Required raw material quantities about 1 – 3 kg</td>
<td>Determination of design parameters for the planned distillation system</td>
</tr>
<tr>
<td>Monitoring of product properties during distillation (foaming, fouling etc.)</td>
<td>Verification of the results of the laboratory tests under real process conditions</td>
</tr>
<tr>
<td></td>
<td>Monitoring of the product properties during distillation (foaming, fouling etc.)</td>
</tr>
</tbody>
</table>

Analytics

A central analytical department is assigned to the VTA test centre and tolling facilities. Retained samples of all raw materials and purified products are kept for at least three years. In this way VTA obtains a completely documented data base for the evaluation of products and processes.

Available analytical methods, among others:
- Capillary gas chromatography with autosampler (GC)
- Overhead capillary gas chromatography
- High pressure liquid chromatography (HPLC) with autosampler
- Gel permeation chromatography (GPC) with autosampler
- Capillary and rotational viscometers
- Determination of colour index by means of colorimeters
- Aqueous and non-aqueous titrations with automatic titration systems
- Water determination according to Karl Fischer (coulometric method)
- Determination of ash content
Concept studies
- Preliminary plant layout
- Economic feasibility

Process studies and product development
- Process simulation
- Lab and pilot tests in the inhouse test centre

Basic engineering
- Preparation of process relevant documents (e.g. PID, PFD)
- Sizing of evaporators, heat exchangers, vessels and components
- Arrangement drawing

Detail engineering
- Mechanical design of evaporators, heat exchangers, vessels and components
- General arrangement
- Skid and piping design
- Selection of valves and instruments
- Design of switch cabinet
- Programming of PLC and visualisation

Manufacturing of components
- Production planning
- Manufacturing of apparatuses
- Purchasing
- Quality assurance, approval with necessary certificates and inspections (FAT)

Assembly: Industrial plants / Package Units
Packing and shipping (industrial plants)
- Assembly of the plant
- Assembly skid
- Installation of main components
- Installation of piping, valves and instruments
- Electrical installation (switch cabinet, cabling, control system and visualisation)
- Insulation
- Factory Acceptance Test (FAT) (industrial plants) ⇔ vacuum, pressure, electrical, control system

Disassembly, packing and shipping (Package Units)

SAT and commissioning

After sales service
- Maintenance
- Spare parts
- Training
- Toll distillation
Package Units

Package units are skid mounted, pre-assembled systems for wiped film and short path distillation, rectification and thin film drying. Assembly of the plant directly at VTA’s site.

**Package Units ensure the customer**

- Minimised design effort
- Smooth project execution
- Minimised amount of interfaces
- On schedule completion
- Minimised development effort
- Fast and smooth implementation in existing production facilities

Ready assembled units are not only interesting for new installations, but also in the expansion of existing production facilities e.g. to increase capacity or to improve existing processes. Implementation of the package units into existing operating production facilities is done with only a short interruption in production. Even moving of a package unit to a new location is possible within short time and with little effort.
Manufacturing at VTA

All core components are manufactured in modern manufacturing facilities by highly qualified workers either of VTA or of the STREICHER company group, especially of STREICHER Maschinenbau GmbH & Co. KG. In modern production halls welding structures up to 100 tons piece weight are manufactured and machined. All common and prescribed surface treatments can be performed.

The following equipment is available in the manufacturing halls:
- Plasma and gas cutting machine
- TIG, MIG, orbital and MAG welding equipment
- Bending rollers and sheet metal benders
- Boring machines and turning machines
- Sand blasting, passivation and painting systems
- Non-destructive testing equipment

The design of the systems and components will be planned depending on the location and type of installation in accordance with the relevant regulations and documents such as:
- Machinery Directive 2006/42/EC
- PED (AD 2000), ASME, SQL, DIN EN 13445, DIN EN 1090
- ATEX Directive 94/9 EG (ATEX) or NEC „National Electrical Code“
- cGMP
- GAMP5 and CFR 21 Part 11
Wiped Film and Short Path Distillation Units for laboratory use

With laboratory units, reliable conclusions about the feasibility of a separation process can be made by only using small product amounts.

Lab units are used for

- Verifying the feasibility of a separation task
- Performing first process development steps
- Producing small sample amounts of final products
- Optimising existing processes

Features of laboratory units

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedrate</td>
<td>20 g/h up to 6 kg/h</td>
</tr>
<tr>
<td>Product wetted material</td>
<td>Borosilicate glass, stainless steel or other special materials</td>
</tr>
<tr>
<td>Max. heating temperature</td>
<td>350 °C</td>
</tr>
<tr>
<td>Evaporator size</td>
<td>0.01 up to 0.30 m²</td>
</tr>
<tr>
<td>Achievable pressure in wiped film evaporator</td>
<td>&lt;0.1 mbar</td>
</tr>
<tr>
<td>Achievable pressure in short path evaporator</td>
<td>&lt;0.001 mbar</td>
</tr>
</tbody>
</table>

Set-ups and options:

- Short path distillation systems VKL in different sizes
- Wiped film distillation systems VDL in different sizes
- Wiped film distillation systems with rectification column
- Horizontal wiped film evaporator VDLH
- Multi-stage lab units
- Completely jacketed (trace-heated) systems
- Continuous feeding and discharge options (pumps)
- PLC and visualisation
- Different wiping systems
Pilot plants for Wiped Film and Short Path Distillation

Main target is to generate scalable data and results during the pilot tests (with small sample quantities) to enable a later scale up to industrial systems. Furthermore these pilot systems can be used for distillation or drying of small product quantities.

**Pilot plants are used for**

- Generating the scalable data for industrial systems
- Producing certain sample quantities
- Optimisation of existing processes

**Features of pilot units**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedrate</td>
<td>5 kg/h up to 50 kg/h</td>
</tr>
<tr>
<td>Product wetted material</td>
<td>Stainless steel or other special materials</td>
</tr>
<tr>
<td>Max. heating temperature</td>
<td>350 °C (hot oil)</td>
</tr>
<tr>
<td></td>
<td>For temperatures &gt; 350 °C inductive heating possible</td>
</tr>
<tr>
<td>Evaporator size</td>
<td>0.06 up to 0.50 m²</td>
</tr>
<tr>
<td>Achievable pressure in wiped film evaporator</td>
<td>&lt;0.1 mbar</td>
</tr>
<tr>
<td>Achievable pressure in short path evaporator</td>
<td>&lt;0.001 mbar</td>
</tr>
</tbody>
</table>

**Set-ups and options:**

- Short path distillation systems VK in different sizes
- Wiped film distillation systems VD in different sizes
- Wiped film distillation systems with rectification column
- Multi-stage pilot units
- Different wiping systems
- Completely jacketed (trace-heated) systems
- Continuous feeding and discharge options (pumps)
- PLC and visualisation
- GMP and ex-proof design (if requested)
VTA operates various wiped film and short path distillation plants for toll distillation of different products.

**Reasons for toll distillation:**

- Capacity constraints
- Securing a second production site
- Market launch of new products
- Hold back investment for own distillation facility
- Collection of production know-how for new products
- Improving the quality of market introduced products
- Continuation of the production of expiring products while new products are produced on the customer’s own plants
- Ensuring the cost base in the production of new products
- No setting up of own production facilities

**General features of the toll distillation plants**

Toll distillations are performed on multi purpose plants. Variable connection of wiped film evaporators, short path evaporators and equipment for rectification.

High-melting or higher viscosity products can be distilled easily. The system is designed according to the European explosion protection directive. For the distillation of food, pharmaceutical and cosmetic products, the specific distillation system is validated separately.

**Analysis and quality assurance**

In our analytical department, the quality demands of our customers are monitored by means of wet chemical and instrumental analytical methods. All incoming and outgoing products are analysed. The product quality is documented by certificates of analysis. Product samples will be provided to the customer.

<table>
<thead>
<tr>
<th>Technical data of the toll distillation plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campaign sizes</td>
</tr>
<tr>
<td>Melting points</td>
</tr>
<tr>
<td>Boiling points</td>
</tr>
<tr>
<td>Operating temperatures</td>
</tr>
<tr>
<td>Operating pressures</td>
</tr>
<tr>
<td>Viscosities</td>
</tr>
<tr>
<td>Rectification</td>
</tr>
<tr>
<td>Granulation</td>
</tr>
<tr>
<td>Container size</td>
</tr>
<tr>
<td>Storage capacities</td>
</tr>
<tr>
<td>Operating mode</td>
</tr>
<tr>
<td>Explosion protection</td>
</tr>
<tr>
<td>Execution of the equipment</td>
</tr>
</tbody>
</table>
Applications

**Oils, fats and food**
- Separation of free fatty acids from edible oils and fish oils
- Pesticide removal from edible oils and fish oils
- Fractionation of tall oil
- Concentration of monoglyceride
- Concentration of EPA and DHA in fish oil esters
- Concentration of tocopherols
- Concentration of carotene
- Drying of lecithin
- Pesticide removal from lanolin
- Colour improvement of lanolin
- Concentration of sorbitol

**Chemical, agro chemical and pharmaceutical products**
- Concentration of polyphenyl compounds
- Separation of aromatic amines from secondary components
- Purification of amines
- Concentration and colour improvement of amino alcohols
- Separation of long-chain acid chlorides from high boiling impurities
- Distillation of fatty acid amide
- Concentration and purification of dimeric fatty acids
- Removal of volatile components from silicones and silicone resins
- Concentration and purification of esters
- Concentration of insecticides, fungicides and herbicides
- Concentration and purification of glycerol
- Fractionation and removal of low boiling components from natural waxes
- Colour improvement of waxes
- Deodorisation, removal of pesticides
- Concentration and purification of lactic acid
- Colour improvement of lanolin
- Distillation of acrylic acid and acrylic ester
- Distillation of pharmaceutical intermediates
- Distillation of pharmaceutically active substances

**Petrochemical products**
- Separation of microcrystalline wax from vacuum residues of crude oil
- Fractionation of synthetic and petrochemical waxes

**Polymers**
- Purification and concentration of monomers
- Purification and concentration of polymers
- Purification of plasticisers
- Minimisation of solvents and monomers in polymers

**Fragrances and flavors**
- Elimination of terpenes and concentration of essential oils
- Separation of solvents of odorous substances
- Concentration of lemon flavors
- Concentration of pepper and chilli extracts

**Recycled materials**
- Refining of used oils
- Purification of used lubricants, brake fluids, glycerol and transformer oils
- Recycling of dimethyl sulfoxide (DMSO) mother liquors
- Recycling of sulfolane
- Recycling and reprocessing of mother liquors of pharmaceutical processes
- Recycling of organic intermediates
- Recycling of mono-chlorinated acids from mother liquors
### VTA Verfahrenstechnische Anlagen GmbH & Co. KG

<table>
<thead>
<tr>
<th>Establishment</th>
<th>1994</th>
</tr>
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<tbody>
<tr>
<td>Number of employees</td>
<td>90</td>
</tr>
</tbody>
</table>
| Locations | Niederwinkling/Germany  
Subsidiary Beijing/China:  
VTA PROCESS EQUIPMENT BEIJING CO., LTD  
Branches:  
Rock Hill/US  
Seri Kembangan/Malaysia |

Visit us online:  
www.vta-process.de

### STREICHER Group

<table>
<thead>
<tr>
<th>Establishment</th>
<th>1909 (MAX STREICHER GmbH &amp; Co. KG aA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>approx. 3,500</td>
</tr>
</tbody>
</table>
| Locations | Headquarters: Deggendorf/Germany  
more than 30 locations worldwide |

Visit us online:  
www.streicher-group.com