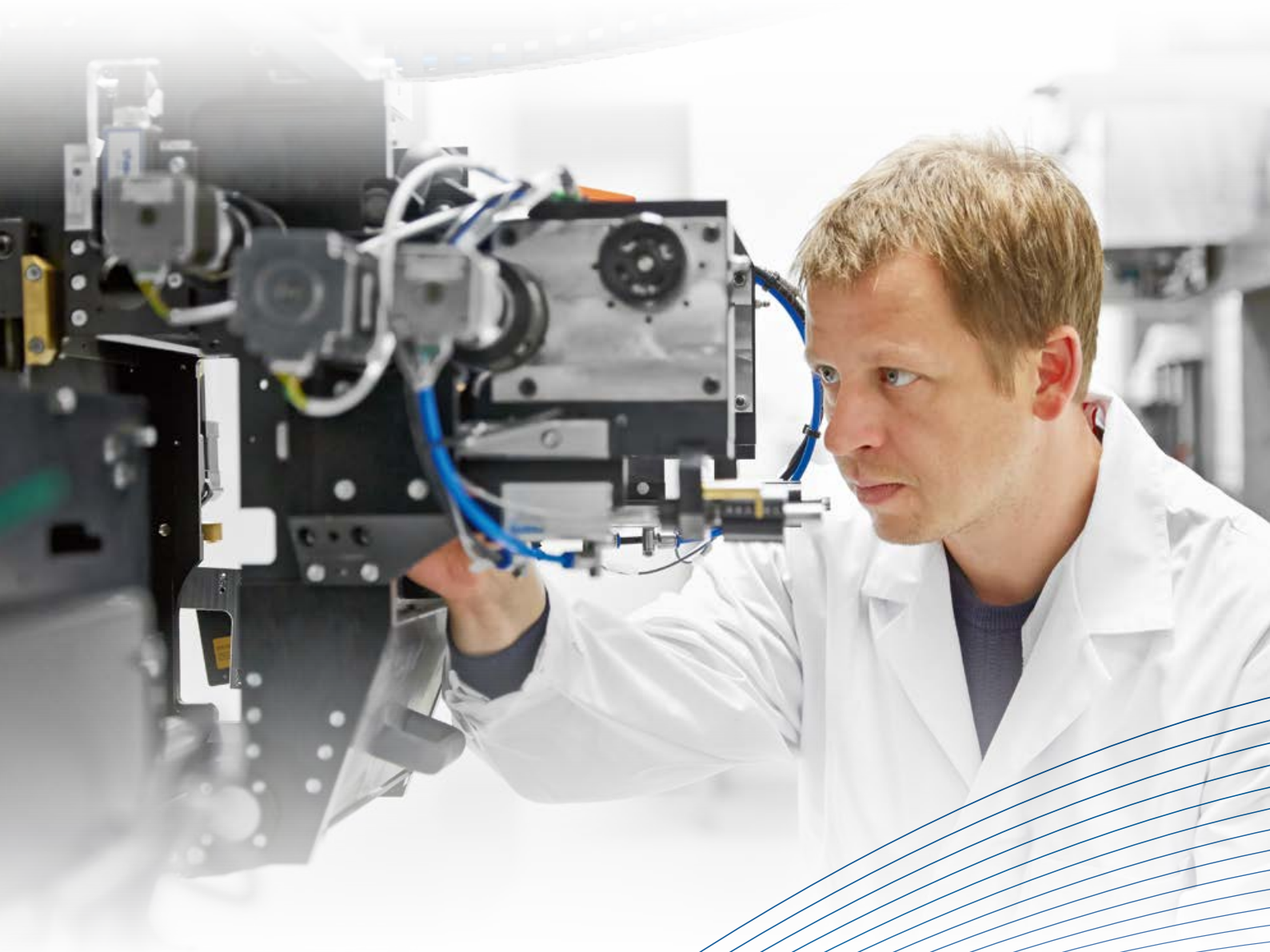
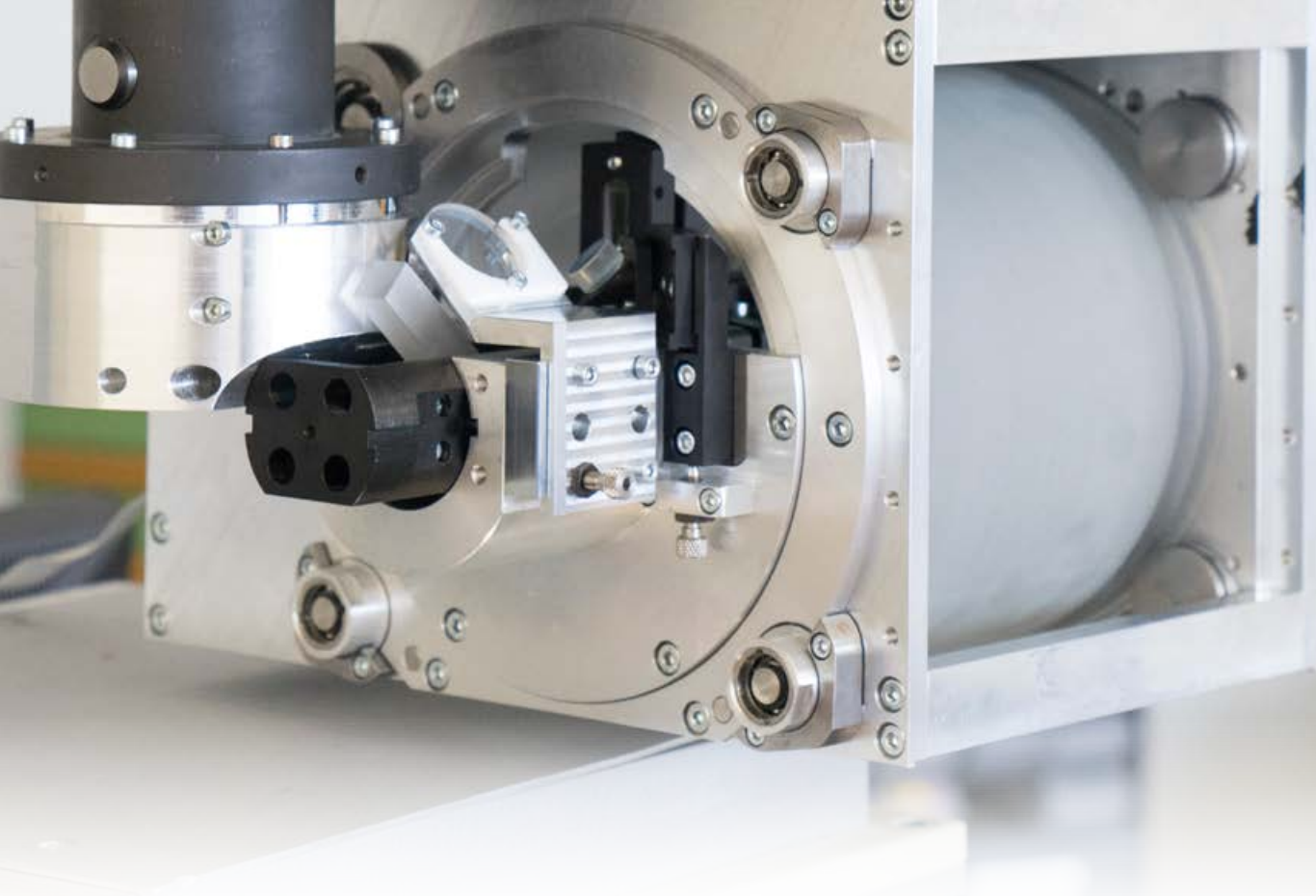


Digital Laser Transfer Printing for Highly Filled Inks  
LPKF LTP Printers for a Wide Range of Applications



**LPKF**  
Laser & Electronics



## Laser-sharp Digital Printing

LPKF Laser Transfer Printing combines the best of two worlds: the accuracy and flexibility of a laser-based digital printing process and the application options offered by screen printing. With the LTP process, even highly filled printing inks can be transferred with previously unknown micron-range precision to flat substrates, even in multiple passes for thick coatings in combination with filigree structures.



### **Individualized, Accurate Printing**

Laser processes are precise, flexible, fast, and minimally damaging due to their noncontact nature. LPKF has transferred these properties to a printing process.

In the Laser Transfer Printing process, a laser beam removes a defined amount of ink from a carrier and transfers it to the target medium. This enables inks with compositions and especially pigment sizes that make them unsuitable for use with other digital printing techniques.

- Digital, noncontact, with no masks or screens
- Fine line printing due to high resolution
- Multipass printing due to high repeat accuracy
- Printing of highly filled qualified inks

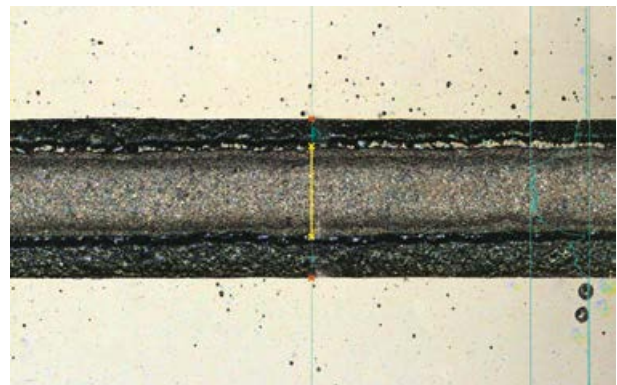
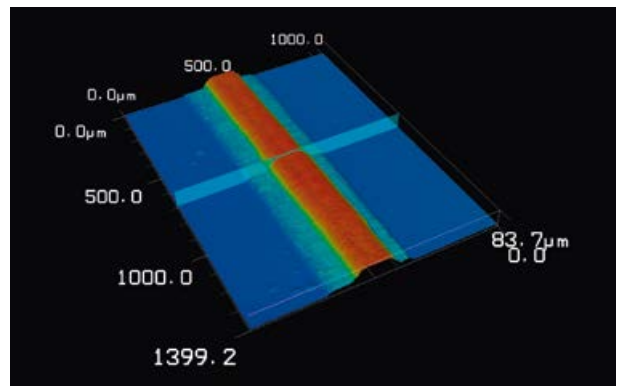
In screen printing, it is not the ink consistency, but rather the binding of the ink to the printing stencil, that is the problem. Screen printing uses screens or stencils and can hence not be customized for the individualization of parts.

The LPKF Laser Transfer Printing process overcomes this hurdle: it can process highly filled inks, precisely controls the amount of ink applied, and can print each substrate and part differently. The precision of the system also enables overprinting – up to 100-micron-wide lines with high aspect ratios as well as large areas with thick coatings can be produced.

With these characteristics, the LTP process can be used to build up functional coating systems such as antennas, heating conductors, or electrical circuits.

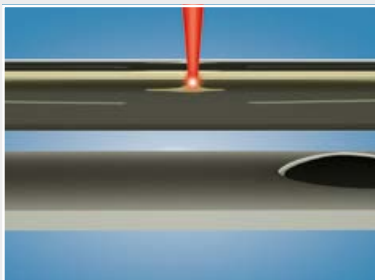
**LPKF LTP – an innovative process with new product options in the following fields**

- Automotive glass
- Circuit printing
- Displays
- Architectural glass

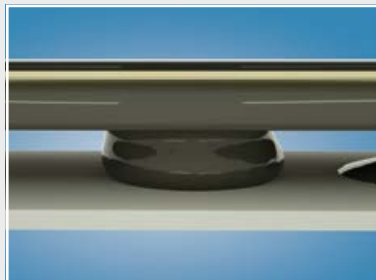


Layer structure after silver paste printing on a black base line: sharp print quality and homogeneous coating

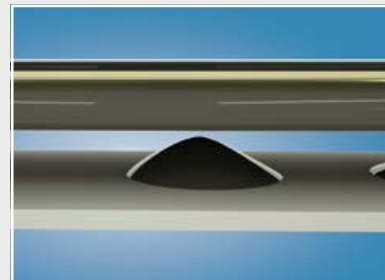
**LTP Process**



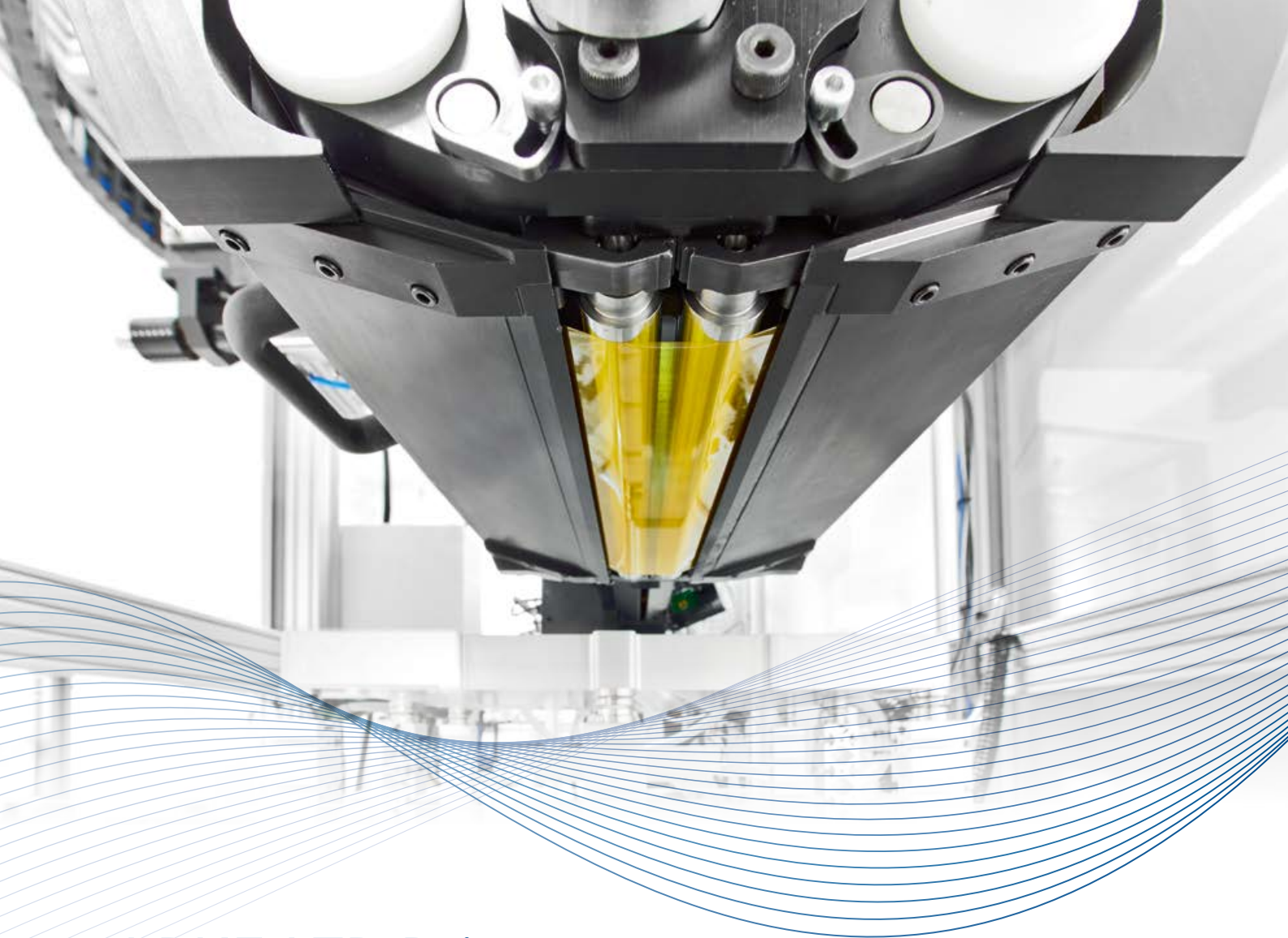
The laser beam passes through the target to the ink below, emitting its energy into the ink



The absorbed laser energy causes the ink to be detached



The ink is transferred to the substrate (e.g., glass or ceramic)



# LPKF LTP Printer

The LTP process incorporates laser micro material processing capabilities, comprehensive knowledge of materials, and years of development work. Qualified commercial printing inks are applied to a rotating target in a continuous coating process.

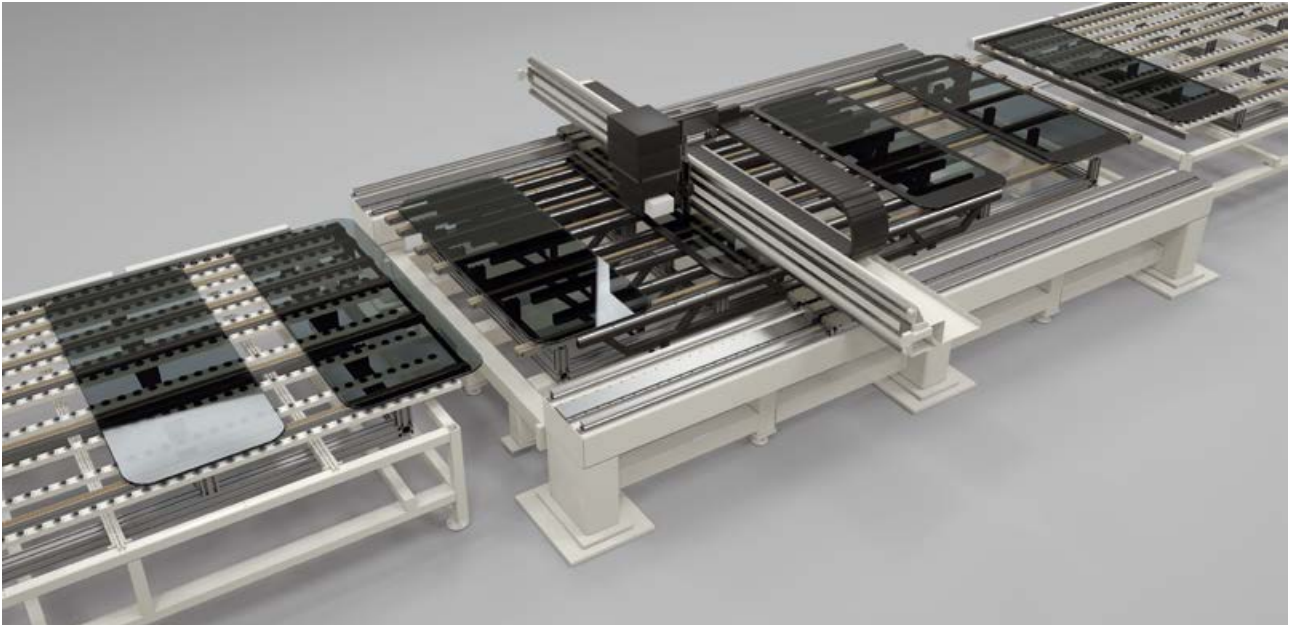
## LTP Print Head

At the core of the LPKF LTP printer are laser print heads with application-specific designs. They each consist of a printing unit and an extremely fast scanner-based laser beam guide.

In the printing unit, a rotating target that is transparent to laser radiation is continuously and homogeneously coated with the ink for printing. Inside this, the laser beam is guided extremely rapidly over the target to perform the printing operation.



- Cost-effective fiber laser
- Easy cleaning of components being in contact with ink
- Distance control to substrate for optimum process results



The shown LPKF LTP printer can process glass with dimensions of up to 2000 x 3000 mm

### Printing on Vehicle Glass

The first system in the product line was developed for printing on vehicle glass. Conventional cars as well as buses, trains, airplanes, and ships are included in this segment.

The LTP system designed for this application draws on LPKF's experience in fast, high-precision processing of glass-based thin film solar modules. The LTP vehicle

glass printer is equipped with fast linear axes based on a gantry design. The axis system can hold several print heads for various inks or for optimizing cycle times.

The machine base can be scaled to accommodate different glass sizes. The system is completely enclosed and climate-controlled to ensure optimized process conditions, regardless of the conditions of the surroundings.

Technical Data: LPKF LTP Printer (Model Automotive Glass)	
Dimensions (L x W x H)	5 000 mm x 4 500 mm x 2 200 mm
Weight	Ca. 5 900 kg (inkl. Kabine 1 500 kg)
Max. printing speed	250 mm/s
Max. productivity (without handling)	90 m <sup>2</sup> /h
Printing resolution (addressable)	1200 dpi x 600 dpi
Min. / max. glass size	300 mm x 300 mm – 2000 mm x 3000 mm (smaller with passepartout)
Min. / max. glass thickness	2 mm – 8 mm
LTP print colours	Ferro black and silver, others upon request
Cabine	Air conditioned 20 °C – 22 °C ± 2 °K, internal cabine humidity 55% ± 10%

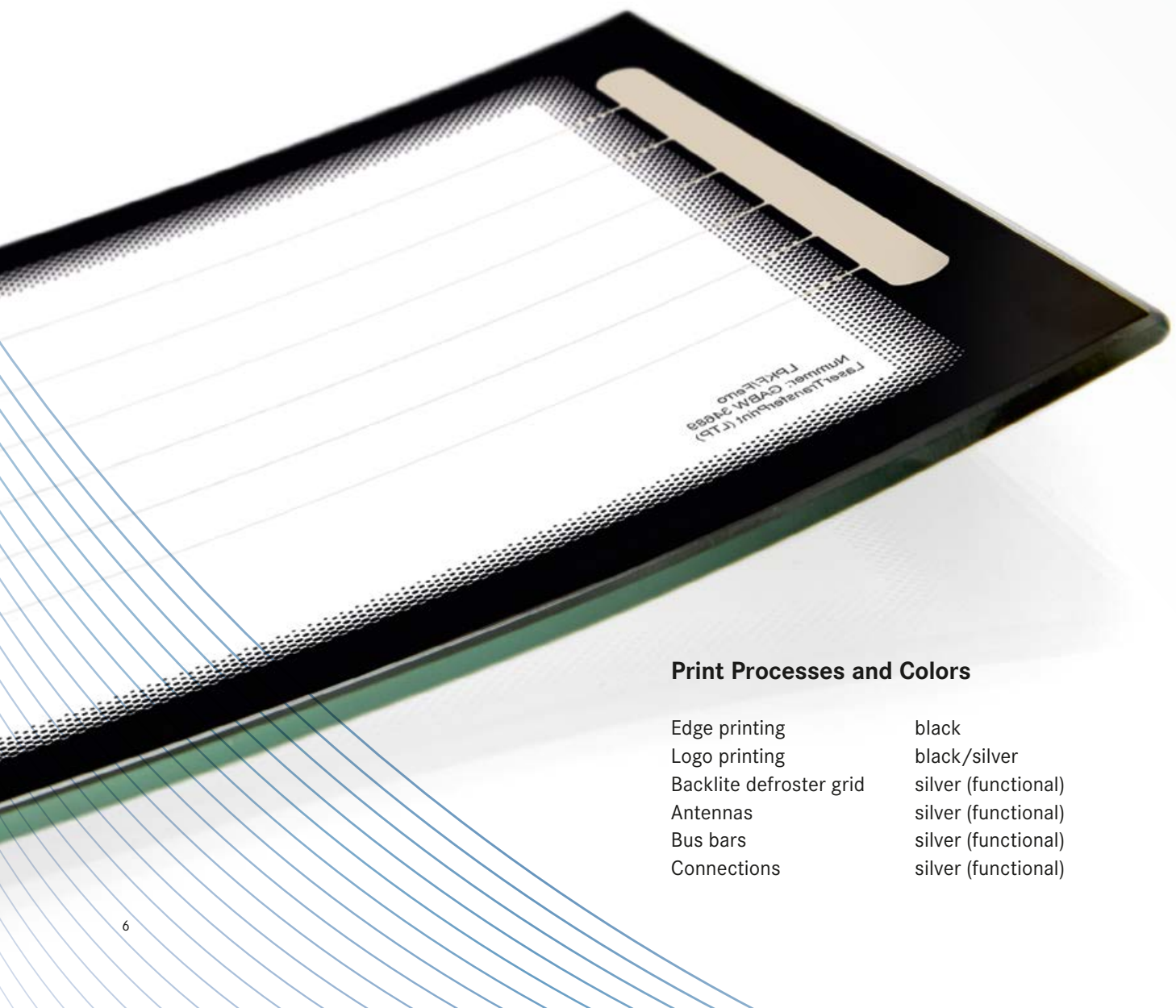
# LTP Printing Process for Vehicle Glass

The vehicle glass segment covers windshields, backlites etc. for conventional cars, buses, and trucks as well as trains, airplanes, and ships. The glass sizes vary from very small to very large, encompass a wide range of thicknesses, and must meet a number of different functional requirements. The advantages of the LTP process are clear.

## Individualized Printing

The system can be used for cost-effective printing of single items or mass-produced items. Different shapes, quantities, and printing patterns such as barcodes or data matrix codes can be printed successively without any interruptions in the process through

simple modification of the printing program – there is no need to change the screen or stencil (unlike with screen printing). This makes digital printing of highly filled certified inks in the automotive segment for serialization or individualization possible.



## Print Processes and Colors

Edge printing	black
Logo printing	black/silver
Backlite defroster grid	silver (functional)
Antennas	silver (functional)
Bus bars	silver (functional)
Connections	silver (functional)

## Variation of Coating Thickness

Different thicknesses are required at contact pads or on the bus bars than, e. g., on the defroster grid on the backlite. This may be a challenge for conventional screen printing – but not for the LTP process.

The LTP process can vary the coating thickness by varying the laser power or can make multiple passes over the same area to achieve local modifications. The typical per-pass print thickness is about 20 microns; in practice, up to five printing passes are possible.

## 100-Micron Line Width

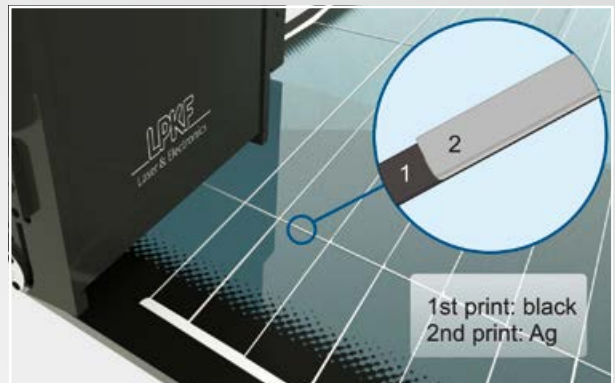
The precision of the laser is directly reflected in the line width. Line widths of 100 microns can be achieved in functional printing. High repeat accuracies allow, for example, resistance specifications for defroster systems or impedance specifications for antennas to be complied with without the need for special ink mixtures.

## Multipass/Multicolor Printing

Silver paste on glass appears yellowish and is an undesired effect in the eyes of vehicle designers. A base printing pass using black ink eliminates this effect. A fine black line with a width of about 150 microns is printed and dried, and then a finer silver line is printed on top of the black line.

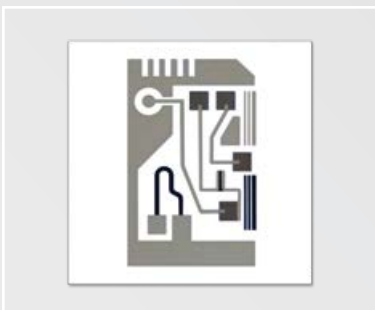


Left: conventional printing of windshield defroster; right: printing with preprinted black base



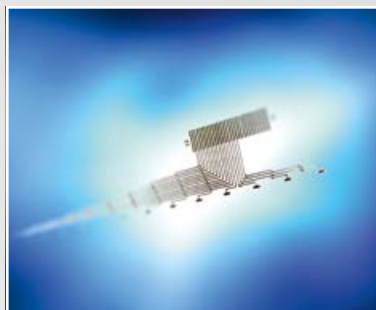
Prerequisite for multilayer printing is the high precision of the LTP process

## Other Applications



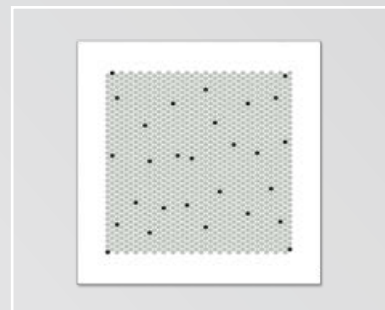
### Hybrid PCBs / Multilayer Ceramic Boards

- Conductive traces
- Resistors
- Vias
- Solder pads



### Displays

- Decorative printing (black or multicolor)
- Connections (silver, functional)
- Antennas (silver, functional)



### Architectural Glass

- Facades (multicolor)
- Interiors (multicolor)

## Faster Way to Make Your Products

24/7 in an industrial environment is no problem for LPKF's proven laser technology. Trained service personnel are on hand worldwide to perform commissioning and service tasks, and an application center is available to help with feasibility studies and machine design. More than just laser transfer printing: LPKF creates solutions – for and with its customers.



The global LPKF network for service and distribution:

- LPKF Group Headquarters
- LPKF Group
- LPKF Distributors

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