

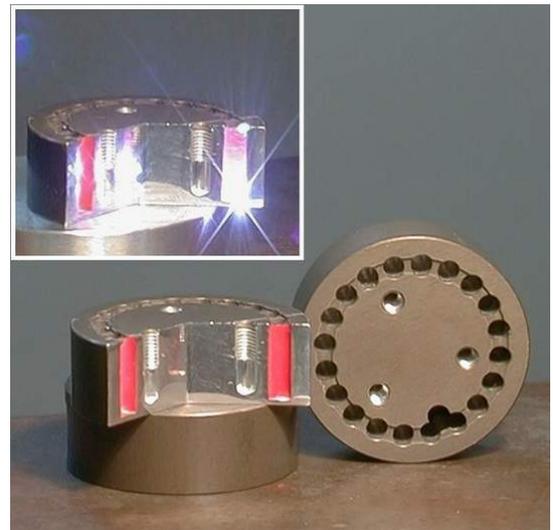
## Air Bearings

The basic technology with laser-drilled micro nozzles allows the most efficient air bearing

We drill the micro nozzles automatically with a laser beam in top-quality and repeatability. The physical behaviours of our air bearings prove to have a low variation for large as well as for small production volumes. With this technique our air bearings require, other than conventional air bearings, no manual, costly manufacturing.

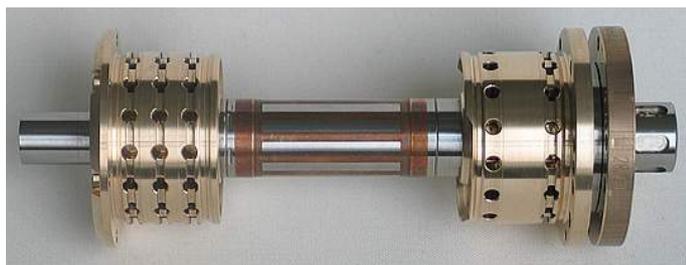
We guarantee low operation costs through an optimized air consumption.

Laser drilling  
(sectional view through  
a flat air bearing)



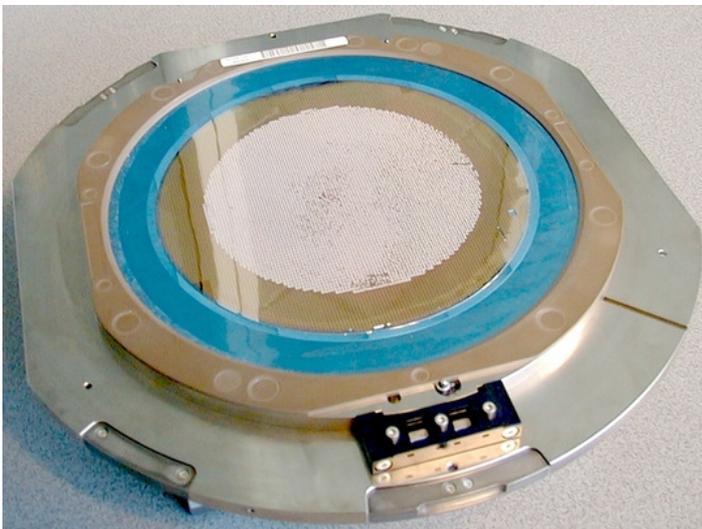
A high amount of specific laser-drilled micro nozzles is the stand-out feature of these air bearings. The dead volume of our air bearings nearly disappears compared to all other air bearings. Accurate calculations ensure the perfect amount, distribution, and geometry of the micro nozzles. In doing so, we perfectly adjust our air bearings behaviors to the customer's needs. As for the high amount of micro nozzles, there is an unlimited number of variations between the static and dynamic features possible. As for their application, our air bearings offer opportunities never seen before with conventional air bearings.

Axial and radial air bearing  
of a high-frequency spindle  
for PCB drilling



## Advantages of the air bearings:

- ❖ Efficient use of the air cushion (close to the physical limit) through an uniform pressure within the whole gap;
- ❖ Perfect combination of static and dynamic properties;
- ❖ Highest-possible flexibility of the air bearing properties; with a particular gap height, we are able to optimize the air bearing such that it has for example a maximum load, stiffness, tilt stiffness, damping, or a minimum air consumption (respectively also in combination with others);
- ❖ Multi-approved highest precision of all air bearings, e.g. in the measurement technology due to slightest movements (< 2 nanometer) through physical, lowest-possible self-excited vibrations;
- ❖ Considerably higher tilt stiffness than conventional air bearings such that the air within the gap flows through canals from the loaded to the unloaded areas away;
- ❖ Vibration-free within the entire operating range even with high air supply (in accordance even much more than 10 bar are possible);
- ❖ Highest reliability due to the large number of nozzles: clogging of nozzles by particles is out of question (nary failure in operation) because their diameter is much higher than gap height;
- ❖ Possibility to adjust bearing properties to deformation and tolerances of bearing and opposite surface;
- ❖ Proven usability for many bearing materials and coatings;



Chuck with integrated  
air-guided lift drive

## Application:

### **Automotive Technology**

As for the automotive engineering, we increase the precision of measurements as well as the productivity and lifetime of production machines with our air-guided solutions.

### **Flat Panel Technology**

We developed numerous single or multi axis air guided drive systems for the production of flat panel displays or for different applications in the semi conductor production. Hundreds of systems are applied since 2003. Moreover, we develop and manufacture customized solutions as, for instance, high-precision chucks with integrated functions or high-sensitive measurement tools and handling systems



Chuck with integrated air/vacuum in the surface and lift pins (flatness of 5  $\mu\text{m}$  within an active surface of 0.72 m<sup>2</sup> and a height of only 80 mm!)

### **Semiconductor Technology**

In terms of the measurement of wafers and flat panels, it is tremendously important to lead the sensor chip precisely and without any contact along the surface. Therefore the chip is integrated directly into the bearing's surface. The maximum distance tolerance to the surface which refers to the gap variation of the air bearing, is smaller than 0.5  $\mu\text{m}$ . When placing the air bearing with the sensor chip, they must not touch the wafer surface being measured. As for the up-and-down movement a pneumatic piston is used which is, for repeatability reasons, also air-guided. The preload of the air bearing and thus the gap height is also adjusted with this piston.

Air-guided linear drive for highest dynamic



### **Linear Drives**

Customized system developments: The broad field of applications reaches from ultra-precise drives for the measurement technology, complex and robust multifunctional systems for the electronic and semi conductor production to low-cost drives for the automation technology.

## Medical technology

Fat and oil free drives for respirators, stick-slip-free movements of scanners or a high rotary speed of large rotors: we achieved all this with air bearings.

Air-guided  
Computer Tomography



## Production Technology

Primarily, stick-slip-free movements and/or smallest forces are required. Our air bearing technology is predestinated for fat/oil-free high-dynamic movements with short strokes.

## Solar Technology

As for the solar industry, we contribute to a higher productivity and a reduction of the substrate damaging. Based on our air bearing technology, we develop innovative solutions. With nearly forceless suckers and stick-slip-free bearings up to highest temperatures, these solutions make new perspective on transportation, when handling and for the machining of thin-film and silicon solar cells possible.

## Spindles

Printed circuit board drilling is one of the main fields for air bearings. In this industry we established a strong position with different outstanding products. Meanwhile, the broad spectrum of spindles reaches from small spindles with a very low friction to spindles with the highest speed of 300,000 rpm. Designing a new concept, we are able to simulate air-guided spindles regarding their static and dynamic behaviors and even for highest speed. For this reason, applications for the automobile industry are also under way.

## Textile Technology

In the textile industry energy savings, productivity, and reliability are most significant. With two inventions for the yarn production, we allow to take paths for solutions already for a long time dreamed of by engineers: rotor spinning with a direct drive (without belts) and ring spinning with a much higher productivity. Both solutions prove the tremendous possibilities of air bearings and show how know-how and creativity complement one another.

## Various designs

We offer our standard air bearings with various mountings to link them in system:

Bearings for flexible connection with ball-pins. This design for standard air bearings is usually supplied on the market.

Bearings with a high-stiff joint instead of a conventional ball-pin. Using this version the stiffness of the complete system is significantly higher.

Bearings with integrated piston for preload of statically determined guidances.

In addition, we offer our rectangular bearings with a fixed mounting (joint-less) for guidances with highest stiffness for uttermost accuracy or highest dynamic.

Furthermore we offer other designs from customized projects, e.g. air bearings with integrated vacuum or magnetic preload, air bearings for high temperatures with more than 400 °C, as well as manufactured with alternative materials. Together with you we will find the best solution.

<b>Rectangular flat standard air bearings</b>			
<b>Type</b>	<b>Measures</b>	<b>Recommended max. loadt</b>	<b>Max. static stiffness</b>
<b>AL-54-24-HD+F</b> Inflexible/fixed mounting	54mmx24mm	430 N (5 bar / 5,5 µm air gap)	52 N/µm (5 bar / 8 µm air gap)
<b>AL-69-50-HD</b> High-stiffness joint or integrated piston	69mmx50mm	1 100 N (5 bar / 6,4 µm air gap)	125 N/µm (5 bar / 7,8 µm air gap)
<b>AL-75-55-HD</b> High-stiffness joint or integrated piston	75mmx55	1 200 N (5 bar / 5,2 µm air gap)	170 N/µm (5 bar / 5,8 µm air gap)
<b>AL-80-40-HD+F</b> Inflexible/fixed mounting	80mmx40mm	960 N (5 bar / 6 µm air gap)	150 N/µm (5 bar / 6,8 µm air gap)
<b>AL-90-71-HD</b> High-stiffness joint or integrated piston	90mmx71mm	2 000 N (5 bar / 5,8 µm air gap)	250 N/µm (5 bar / 7 µm air gap)
<b>AL-98-79-HD</b> High-stiffness joint or integrated piston	98mmx79mm	2 400 N (5 bar / 5,5 µm air gap)	310 N/µm (5 bar / 6 µm air gap)
<b>AL-110-55-HD+F</b> Inflexible/fixed mounting	110mmx55mm	1 820 N (5 bar / 7,2 µm air gap)	285 N/µm (5 bar / 7,5 µm air gap)
<b>AL-110-55-HD+B</b> Conventional ball pin	110mmx55mm	1 750 N (5 bar / 6,5 µm air gap)	200 N/µm (5 bar / 7,5 µm air gap)

Round flat standard-air bearings			
Type	Ør	Recommended max. loadt	Max. static stiffnesst
		high dynamic application HD	
<b>AL-12-HD</b>	12 mm	25 N (5 bar/ 6,5 µm air gap)	3,8 N/µm (5 bar/ 7,5 µm air gap)
<b>AL-18-HD</b>	18 mm	65 N (5 bar/ 5,8 µm air gap)	9 N/µm (5 bar/ 7 µm air gap)
<b>AL-24-HD</b>	24 mm	120 N (5 bar/6,5 µm air gap)	18 N/µm (5 bar/ 7 µm air gap)
<b>AL-30-HD/HS</b>	30 mm	high dynamic application HD	
		190 N (5 bar/6,8 µm air gap)	25 N/µm (5 bar/ 8 µm air gap)
		high precision application HS	
		190 N (5 bar/4,3 µm air gap)	40 N/µm (5 bar/ 5 µm air gap)
<b>AL-45-HD/HS</b>	45 mm	dynamische Anwendung HD:	
		470 N (5 bar/6,5 µm air gap)	65 N/µm (5 bar/ 7 µm air gap)
		high precision application HS	
		470 N (5 bar/4,3 µm air gap)	85 N/µm (5 bar/ 4,8 µm air gap)
<b>AL-60-HD/HS</b>	60 mm	high dynamic application HD	
		800 N (5 bar/6,5 µm air gap)	110 N/µm (5 bar/ 7 µm air gap)
		high precision application HS	
		800 N (5 bar/4,3 µm air gap)	145 N/µm (5 bar/ 4,8 µm air gap)
<b>AL-80-HD/HS</b>	80 mm	high dynamic application HD	
		1500 N (5 bar/ 6,3 µm air gap)	205 N/µm (5 bar/ 7 µm air gap)
		high precision application HS	
		1500 N (5 bar/ 3,9 µm Spalthöhe)	300 N/µm (5 bar/ 4,3 µm Spalthöhe)
		high dynamic application HD	
<b>AL-100-HD</b>	100 mm	2400 N (5 bar/ 6,8 µm air gap)	290 N/µm (5 bar/ 7,5 µm air gap)
<b>AL-125-HD</b>	125 mm	3750 N (5 bar/ 6,4 µm air gap)	400 N/µm (5 bar/ 7,5 µm air gap)
<b>AL-400-HD</b>	400 mm	40600 N (5 bar/ 26 µm air gap)	830 N/µm (5 bar/ 40 µm air gap)