

V I B R A T I O N T E C H N O L O G Y





As a global leader specializing in the field of anti-vibration, BILZ Vibration Technology offers premium solutions to problems caused by ambient vibration.

The solution process begins with an advanced on-site analyses, followed by the selection and layout of an isolation system; design, manufacturing and delivery of an isolator or even a isolated platform with the installation and acceptance tests at the customer. BILZ is your source for complete turnkey solutions.

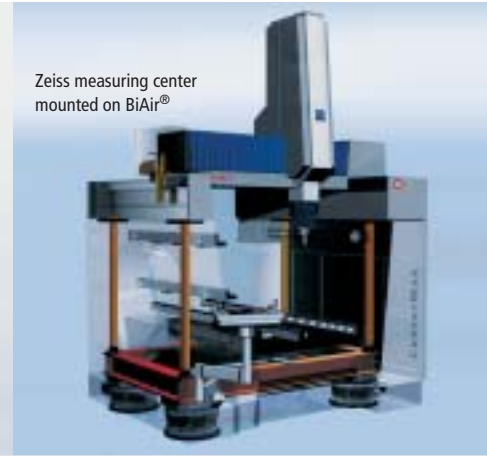
Our years of experience in the field of vibration isolation combined with our broad range of standard products guarantee the best technical and cost-effective solution.

Thousands of satisfied customers in over 30 years can attest our experience and know-how.





BiAir®



Zeiss measuring center mounted on BiAir®

BiAir®

Product Description

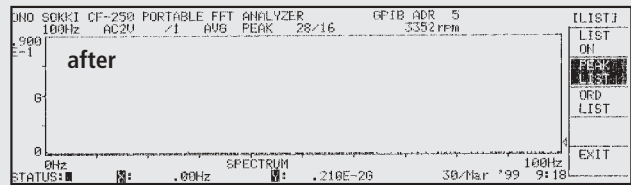
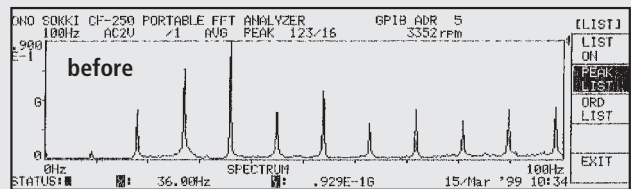
The Air-Spring Insulator **BiAir®** consists of a cast aluminum body whose air volume is enclosed by a thin-walled, flexible and pressure-resistant rolling diaphragm. The piston is seated on this diaphragm and is pushed into the air volume.

This design causes highly effective vibration insulation.

In order to obtain as high a dampening effect as possible, the air space is split into two chambers (load/dampening volume) linked by air pipe. By the adjustable valve the dampening can be easily changed from outside. Due to the friction caused by the air-stream passing through the bypass valve, up to 20% dampening can be effected. Additional safety valves will protect the roller diaphragm from getting damaged by over-inflation.

Range of Application

Highly effective vibration insulation of sensitive measuring and testing machines, fine-machining plant, as well as optical and electronic equipment. Another important range of application is the vibration-insulated foundation of vehicle, motor and other performance testers. **BiAir®** Air-Spring insulators are extremely well suited for the insulation of foundations e.g. equivalent machine loads.



Advantages compared with conventional steel springs

BiAir® Air-Spring insulators with level control are an active system. The machine/foundation level retention will always be preserved! Automatic leveling/adjustment!

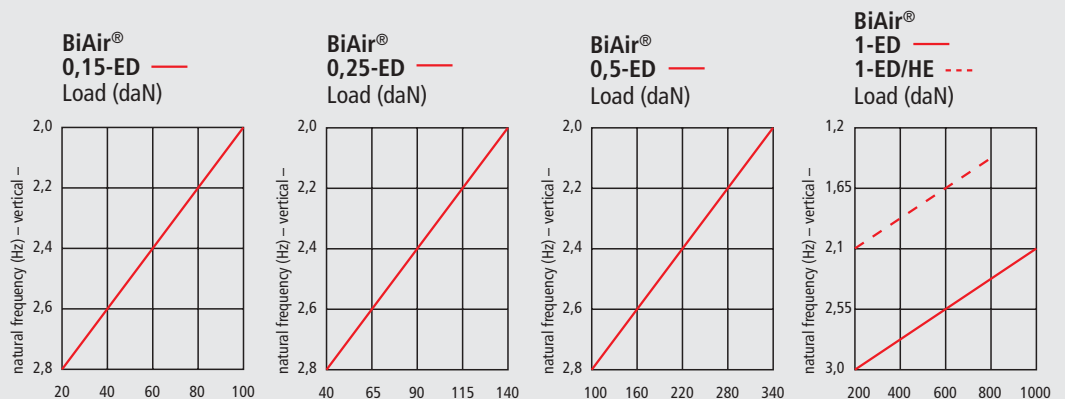
BILZ level controller systems

Level control is an important part of an optimally functioning air spring system. The automatic level controller can be utilized to overcome the problem associated with load changes in air-spring insulated machines, which can result in tilting of the machine.

The height of the specific elements can be controlled by changing the air pressure in the air-spring insulators. Quick inflation or deflation will hold the machines level even if their center of gravity keeps changing.

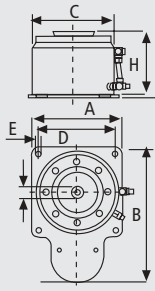
Control circuit

The circuit consists of at least three air springs. If more air springs are needed for structural or loading reasons, the system must always include 3 position pickups, e.g. three controlled components in order to avoid statical overdefinition. This is achieved by connecting sets of air springs in parallel.



Membrane Air-Spring Insulator BiAir®

with deep natural frequency and adjustable dampening (pat.)
for vibration insulation of measuring and testing machines,
optical and electronic equipment, laser machines,
fine machining plant, vehicle and motor performance testers etc.



type

BiAir 0,15-ED*
BiAir 0,25-ED*
BiAir 0,5-ED*
BiAir 1-ED*
BiAir 2-ED*
BiAir 2,5-ED*

Ø A mm

76
110
130
200
260
300

width W mm

72
182
190
275
350
390

Ø C mm

72
110
129
200
260
300

workheight H mm

77
87
100
100
100
100

max. load daN at max. 4 bar

67
113
267
633
1420
1967

max. load daN at max. 6 bar

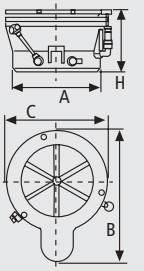
100
170
400
950
2130
2950

natural frequency Hz (vertical) approx.

2,5
2,5
2,5
2,5
2,5
2,5

natural frequency Hz (horizontale) approx.

2,5
2,5
2,5
2,5
2,5
2,5



BiAir 0,5-ED**
BiAir 1-ED**
BiAir 2-ED**
BiAir 2,5-ED**
BiAir 3-ED**
BiAir 4-ED**
BiAir 5-ED**

120
172
226
271
348
490
747

216
288
335
378
467
605
855

129
200
260
300
382
530
798

157
157
157
157
157
157
157

267
633
1420
1967
3413
6573
15573

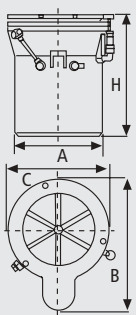
400
950
2130
2950
5120
9860
23360

natural frequency Hz (vertical) approx.

2,5
2,5
2,5
2,5
2,5
2,5
2,5

natural frequency Hz (horizontale) approx.

2,5
2,5
2,5
2,5
2,5
2,5
2,5



BiAir 1-ED/HE**
BiAir 2-ED/HE**
BiAir 2,5-ED/HE**
BiAir 3-ED/HE**
BiAir 4-ED/HE**

172
226
271
348
490

288
335
378
467
605

200
260
300
382
530

307
307
307
307
307

633
1420
1967
3413
6573

950
2130
2950
5120
9860

natural frequency Hz (vertical) approx.

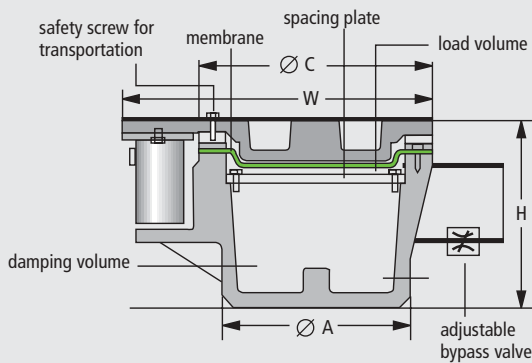
1,5
1,5
1,5
1,5
1,5

natural frequency Hz (horizontale) approx.

2,5
2,5
2,5
2,5
2,5

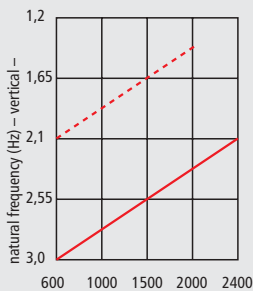
*Steel **Aluminium

When choosing the size of the air-spring consider loading at 4 bar only.

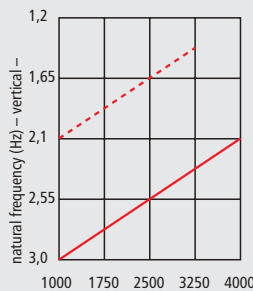


Air springs with higher max. loads as well as air springs with lower natural frequencies can be supplied upon request!

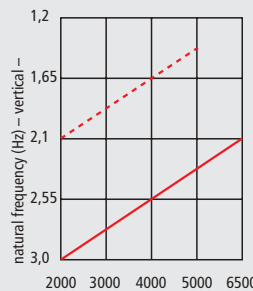
BiAir®
2-ED ———
2-ED/HE - - -
Load (daN)



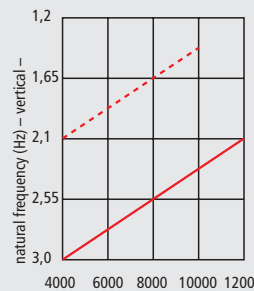
BiAir®
2,5-ED ———
2,5-ED/HE - - -
Load (daN)



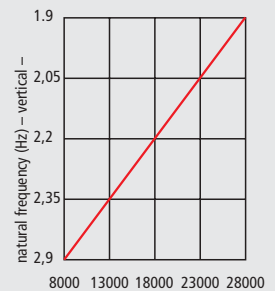
BiAir®
3-ED ———
3-ED/HE - - -
Load (daN)



BiAir®
4-ED ———
4-ED/HE - - -
Load (daN)



BiAir®
5-ED ———
Load (daN)



BiAir® MPN



BiAir® mechanical-pneumatic positioner/controller

The mechanical-pneumatic relief valves are a simple yet effective solution. The level is constantly scanned by a plunger. The plunger position is transmitted to a spool valve. Depending on the spool valve position, pressure is either applied to the air spring or vented from the inside of the air spring. The machine level can be maintained at an accuracy $\pm 1/100$ mm.

Principally three control valves are used. The incoming air supply is conditioned with a pressure regulator to limit system pressure to a maximum of 6 bar, water trap to remove vapor and an air filter to remove dust and any foreign bodies from the air supply.

BiAir® EPN



BiAir® electro-pneumatic positioner/controller

Advantages

Important advantages of the BILZ level control are:

- a high reset accuracy e.g. level accuracy of $\pm 1/100$ mm
- extremely short reaction time (within the milli-second range)
- the general possibility of being able to optimally adapt (increase and reset) the speed of the system to the specific conditions (control circuit)
- wear-resistant and sturdy relief valves
- simple and effective set-up operation

System components

Each system consists of 3 position sensors, 3 electro-pneumatic relief valves, one control unit (digital computer logic), the air-supply regulator and filter units.

Even the most severe conditions are mastered by the electro-pneumatic positioner. It is used mainly where high reset precision and extremely short reaction times are required.

Any deviation (difference between desired value and actual value) from the desired height (desired value) of the air spring insulators is measured at a precision of up to $1/100$ mm accuracy by means of position sensors.

In the control unit, these electronic signals will then be processed and the air spring elements will be inflated or deflated accordingly for level equalisation via the pneumatic relief valves.

Control unit

The control unit consists of a printed circuit board, containing the entire logic of the 3 control circuits, 3 air pressure displays for the air springs, adjusting screws for the adjustment of the machine, selection of the controller speed, and a switch to enable complete deflation of the air springs. The control unit can be supplied either as a 19 inch rack mount unit or completely enclosed within a cabinet.

Software

As an optional feature, a special software package is available. By means of this software, the adjustment and optimization of controlled conditions, the registration of adjustment parameters as well as error determination can be carried out via the serial interface (serial interface provided on the control unit).

Furthermore, the integrated serial interface enables link-ups with available machine computers or systems to be insulated. A number of more complex system modes can be realized this way.



Research workstation with optical equipment

LTH and LTO laboratory tables



Basic set-up of an optical table model LTO

BILZ workstations are characterized by high-end quality and functionality.

Product description:

- Adjustable feet. - torsion proofed, welded steel frame.
- Membrane air-spring insulators BiAir® between frame and plate. Other insulators on demand
- mechanical-pneumatic positioner/controller (level accuracy of plus/minus 1/100 mm or plus/minus 1/10 mm)

Range of application

- set-up of optical laser systems, - interferometer
- special microscopy

Optical Table Top LTO

HD steel honeycomb core with high natural damping, cover plate **without** thread insert

HDT steel honeycomb core with high natural damping, cover plate **with** thread insert

Granite Table Top LTH

Standard Sizes LTO

sizes		LTO 60-50		LTO 90-60		LTO 120-60		LTO 150-90		LTO 200-100		LTO 240-120		LTO 300-150	
		width	depth	width	depth	width	depth	width	depth	width	depth	width	depth	width	depth
	width	600 mm	900 mm	1200 mm	1500 mm	2000 mm	2400 mm	3000 mm							
	depth	500 mm	600 mm	600 mm	900 mm	1000 mm	1200 mm	1500 mm							
	thickness hard stone	100 mm	100 mm	100 mm	100 mm	200 mm	200 mm	300 mm							
	height	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm							
	max. loading capacity	150 kg	200 kg	300 kg	500 kg	500 kg	750 kg	750 kg							

Standard Sizes LTH

sizes		LTH 60-50		LTH 100-63		LTH 90-75		LTH 100-80		LTH 100-100		LTH 150-100		LTH 200-100	
		width	depth	width	depth	width	depth	width	depth	width	depth	width	depth	width	depth
	width	600 mm	1000 mm	900 mm	1000 mm	1000 mm	1000 mm	1000 mm	1000 mm	1000 mm	1500 mm	2000 mm			
	depth	500 mm	630 mm	750 mm	800 mm	1000 mm	1000 mm	1000 mm	1000 mm	1000 mm	1000 mm	1000 mm			
	thickness hard stone	100 mm	100 mm	100 mm	140 mm	160 mm	160 mm	160 mm	160 mm	160 mm	190 mm	220 mm			
	height	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm	760 mm			
	max. loading capacity	250 kg	320 kg	320 kg	700 kg	750 kg	750 kg	750 kg	750 kg	750 kg	1800 kg	2800 kg			

Description of construction

Cover plate: stainless steel 3mm/ magnetic or magnetic/ bloomed

Base plate: steel plate 3mm

Thread insert: M6 (HDT)

Core: (HD/T) steel honeycomb core with a 0.5mm galvanized steel plate, precision formed / bonded with special resin.

Thread inserts: floating bedded thread inserts M6 / no connection to the table core through closed sleeves / adjustment of turnbuckles about 5 mm during simultaneous addition about plus/minus 3 degrees are possible / Max. depth of thread 30mm

Optical workstations provide optimal damping and rigidity at a low weight.

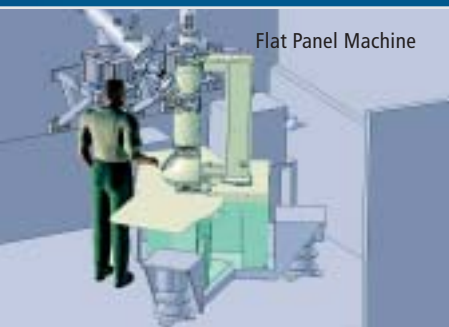
The damping properties of the **BILZ LTO honeycomb lattice boards** have been optimized. High amplitudes at resonance, typically in high frequencies ranges, will be almost completely eliminated the HD-series table by the high internal damping coefficient.



ComPASS PRO Wafer inspection machine



Lab table with active isolation



Flat Panel Machine



BILZ-Testfields

Active Isolation System AIS™

- Active electro-pneumatic vibration isolation providing control in six degrees of freedom.
- Optimal vibration isolation performance without any amplification at resonance.
- Excellent level accuracy in both the vertical and horizontal plane.
- Minimal deflection and settling time after an acceleration or deceleration of a moving mass within the machine, shorter settling times equals greater machine throughput.
- Very efficient realtime control.
- PLC, CAN-Bus, one Controller and one High Speed electro-pneumatic servovalve for each degree of freedom.
- Each Controller consists of a microprocessor and integrated, high resolution sensors for position, air-pressure and acceleration.
- Easy-to-use, intelligent WinSNI-Software for setting up and optimizing the AIS™ and for providing system diagnostics.
- Two different modes of operation can be selected simply using a digital I/O. For example, scanning mode (during sensitive machine operations) to loading mode (during moving mass within the machine).
- Feedforward-signal is not required from the machine controller.
- No disturbing heat generation, magnetic variations or high electrical power consumption as by electromagnetic actuators / linear motors.

Range of application

Optimal vibration isolation performance for machines with high dynamic forces that are performing sensitive measurements and inspections, lithography equipment, laser machines, high resolution electron microscopes and machinery for the semiconductor industry.

The AIS™ is utilized when the efficiency of isolation and the settling time of conventional air-springs with electro-pneumatic leveling systems is insufficient.

AIS™ has two primary functions:

One function is to protect the precision machine from floor vibration. The other primary function is to improve the performance of the machine by minimizing structure borne vibration created by the high dynamic forces produced during an acceleration or deceleration of a moving mass within the machine. In addition, settling time is reduced which minimizes the delay time before the machine can start performing its sensitive operation.

Controller SPC-LC

Acceleration sensor
(resolution 8µg)

RS232 Diagnosis and
Updates

Sensor for position
(resolution 0,2µm)



Microprocessor

Air-pressure sensor
(resolution 0,2 mbar)

CAN Bus (1MBaud)

Servovalve MPYE

○ AIS™ Design



The AIS™ consists of a PLC, CAN-Bus, 16 bit-Controllers, High Speed electropneumatic servovalves and BiAir air springs and/or HAB horizontal air springs. A range of sizes are available for both the vertical and horizontal air springs. One 16 bit-controller and one High Speed electro-pneumatic servovalve is used for each air spring or group of air springs. The AIS™ works with a minimum of 3 groups (degrees of freedom) to a maximum of 6 groups (degrees of freedom). The 16 bit-controller can be mounted directly to the air-spring itself or to the machine, in the same direction as the isolator motion. Located Inside the 16 bit-controller is a microprocessor, a position sensor (resolution 0,2 μm), an acceleration sensor (resolution 8 μg) and an air-pressure sensor (resolution 0,2 mbar). The signals from each of these sensors will be sampled at the rate of 4 kHz. Since each 16 bit-controller has a microprocessor with specially developed control algorithms along with a special high dynamic pneumatic servo valve, the resulting performance is a very efficient realtime control and no feed-forward signal is required.

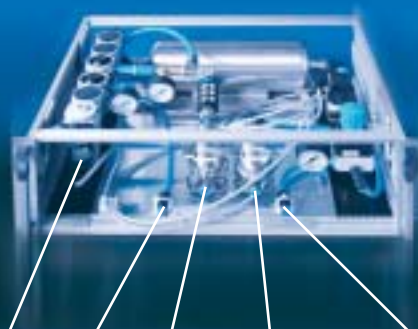
The 16 bit-controllers are connected by a CAN-BUS to the PLC.

The PLC can be connected to a PC by a standard RS-232 for initial set-up and diagnosis. The primary function of the PLC is to manage and watch over the 16-bit controllers. In addition, the PLC has digital Inputs and Outputs. For example, Ready, Motion Complete, Inspection of Position, Pressure and Power Supply, Switch over from Scanning Mode to Loading Mode, Emergency Stop.

The PLC also provides the possibility to switch from scanning mode to loading mode by using a digital I/O. The PLC takes care of downloading all of the necessary parameters to each 16 bit-controller to achieve the two different modes. The advantage of providing two different modes is the performance of the system can be optimized for each mode. For example, during scanning mode when machine is performing sensitive operations the system should be very soft and not be very aggressive otherwise forces created by the isolation system can affect the machine performance. During loading mode, level accuracy and shortest possible settling times are the most important factors and a very stiff, fast and aggressive system will provide the best performance.



Power
Air-supply
CAN
Control
WinSNI
I/O
Acknowledge error
FED 50



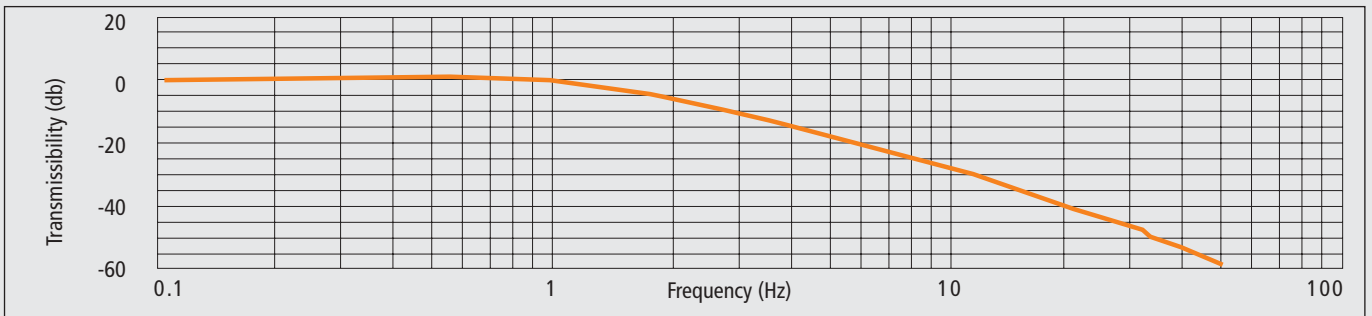
Air-supply
Air-bearings
Exhaust
Valve horizontal
Valve vertical

w/h/d/ 483x133x348 mm

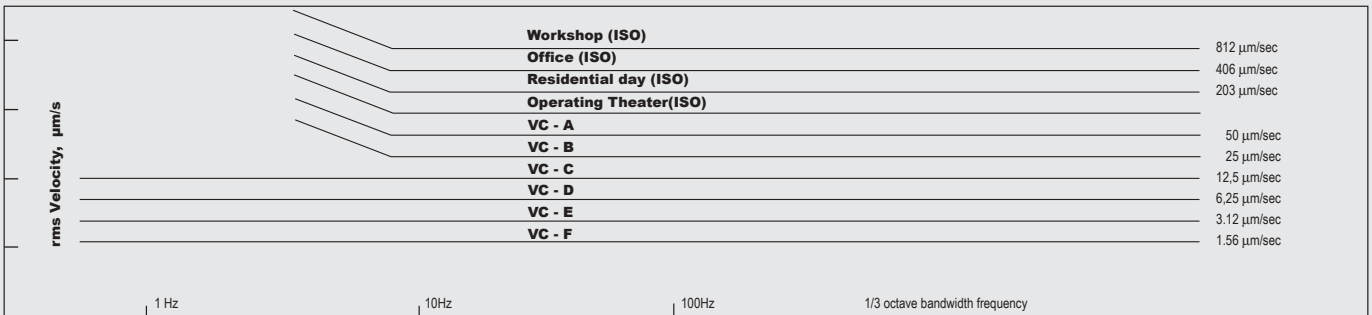
w/h/d/ 483x177x348 mm

Transmissibility of new active Bilz controller at scanning mode with membrane air-springs **BiAir®/HE** and horizontal air-bearing **HAB®** with 6 controllers.

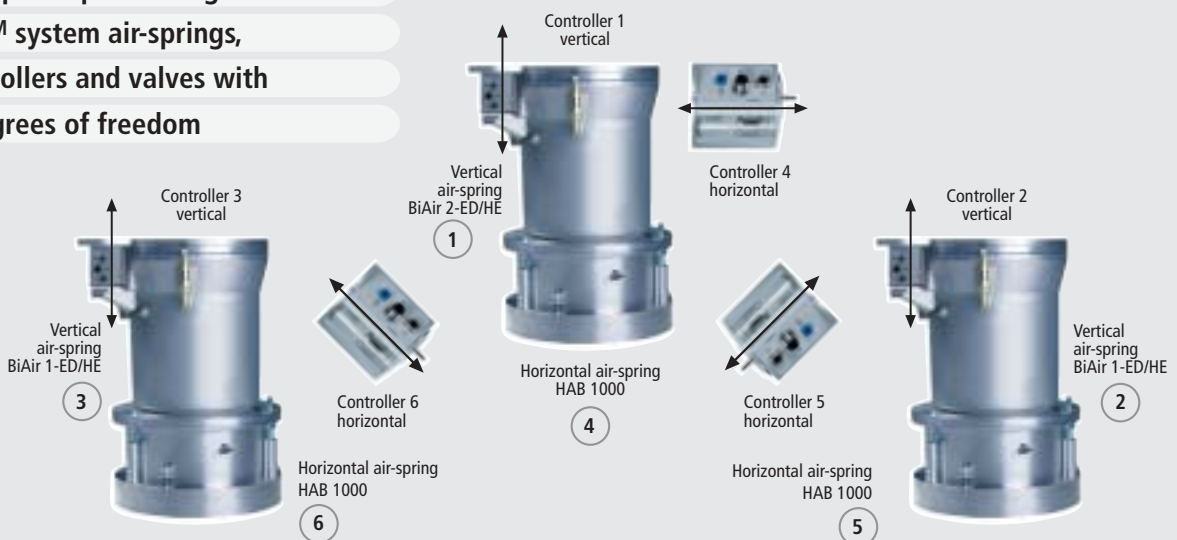
Transmissibility of AIS™



Vibrations criteria, VC



- Example of positioning of AIS™ system air-springs, controllers and valves with 6 degrees of freedom

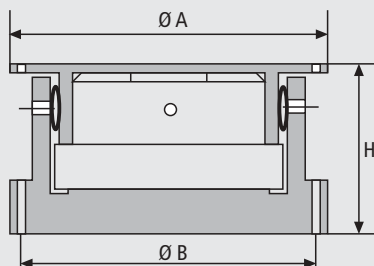




Patents: US 7,114,710 B2 - German Patent No. 102 49 647.1 - German Patent No. 102 49 647

○ HAB™ Horizontal Air Spring

Type	Ø A (mm)	Ø B (mm)	H (mm)	leveling screw	Max. vertical load at 5,5 bar (N)	Max. horizontal load at 1 bar (N)	Adjustable horizontal natural frequency (Hz)
HAB 280	200	180	101	M 10 x 1,5	3400	150	1,1 - 1,9
HAB 660	250	230	118	M 10 x 1,5	7200	380	1,1 - 1,9
HAB 1000	300	276	159	M 12 x 1,5	11000	490	1,1 - 1,9
HAB 1000-HL	300	276	159	M 12 x 1,5	14000	490	1,1 - 1,9
HAB 24000	350	326	172	M 16 x 1,5	23500	700	1,1 - 1,9
HAB 38000	422	398	187	M 16 x 1,5	38000	1100	1,1 - 1,9



Air-Bearing
Leveling screw



Air-tube
Transportation and centering screw

○ Advantages of new HAB™ in comparison to conventional air-springs:

- Adjustable horizontal natural frequency.
- Adjustable horizontal dampening.
- Very low natural frequency / very efficient vibration isolation.
- Friction free operation, no stick-slip or hysteresis.
- When used as part of the AIS™ System no amplification at resonance
- Very high dampening,
- Minimum settling time,
- Excellent level accuracy.

○ Design

The pneumatic horizontal vibration isolator HAB™ is constructed of a cylindrical top and bottom housing. Air tubes placed into the annular space between the two housings provide the horizontal force to counter any relative movement between the two housings.

The horizontal force or natural frequency of the HAB™ can be adjusted by changing the air pressure of these air tubes. A specially designed air bearing handles the vertical load and provides friction free smooth horizontal movement between the top and bottom housings.



Platform for minimum working



Platform for integration in raised-/ cleanroom floor



● Vibration isolated platforms

Our years of experience in the field of vibration isolation combined with our broad range of standard products guarantee the best technical and cost-effective solution.

● 1. Vibration Analysis

To optimize the design layout and achieve the best isolation results BILZ starts by conducting an on-site vibration analysis. BILZ uses high-end FFT-Analyzers along with the best seismic acceleration sensors and geophones on the market.

● 2. Engineering and Design

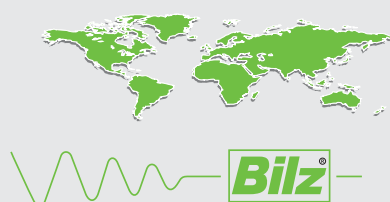
Complementing our broad range of products, BILZ offers customized systems and solutions that guarantee superior results. Engineering and design is part of our core business and our technical leadership is advanced through R&D and continuous improvement.

● 3. Production

Production, assembly and quality control is in-house and located within our headquarters in Stuttgart-Leonberg, Germany. Special requirements such as: Cleanroom packaging or special logistic solutions can also be offered. BILZ is ISO 9001 certified.

● 4. Installation

System installation can be conducted by BILZ field service engineers or by trained customer staff. The BILZ Active Electro-Pneumatic Isolation System can be installed and put into operation, including acceptance test, in one or two days. BILZ guarantees global service and support, with representatives in more than 20 countries.



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