

● **FAEBI® Product Description**

Rubber air-spring for highly effective insulation of machinery and sub-assemblies against impact and oscillation. The bell-shaped component is made of high-grade elastomer. The construction allows a highly effective insulation without the disadvantage of excessive horizontal deflection. It is impossible for the element to break down as a result of overloading or a sudden drop in pressure. To reduce vertical damping, the component is available with additional attenuation. The baseplate is equipped with an anti-slip plate so there is no need to anchor the machine to the floor.

**Note:** For outdoor use (e.g. isolation of a roof top air condition unit) the FAEBI® can be supplied in **stainless steel** and **EPPDM elastomer** version.

**BILZ Level Controller Systems**

Level control is important part of an optimally functioning air-spring system. Level control can be utilized whenever load changes occur on rubber air-spring insulated machines, causing an unwanted one-sided spring deflection of the air elements, e.g. tilting of the machine.

**Insulation against Impact and Oscillation**

Depending upon the static load, the natural frequency of the elements varies between to 2,5 – 6 Hz in vertical direction. The ratio between vertical and horizontal natural frequency is 1 – 1,2. Maximum spring deflection during impulse load is approximately 15 mm.

**Range of Application**

Excellent suited for active insulation of high-speed power presses, forging hammers as well as other machines and equipment with highly dynamic forces. Passive insulation of measuring and testing machines as well as high-precision machine tools. Can be supplied optionally with electronic or mechanical level control! (See page 21)

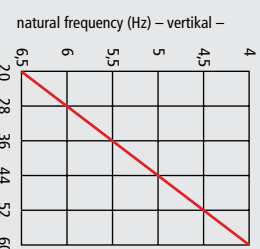
**Assembly**

The components are screwed on to the machine by means of pre-drilled holes. It is not necessary to anchor the machine to the floor. The machine is placed on deflated elements which are then inflated to a maximum of 5–6 bar via a standard valve. To level the machine, air can either be released or added. The maximum height adjustment available is 10 mm.

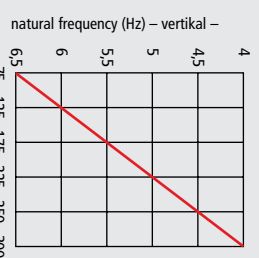
**Control of Air Pressure**

Upon request, FAEBI® elements can be equipped with an air pressure monitor. This monitor will indicate if air-pressure goes below the desired value.

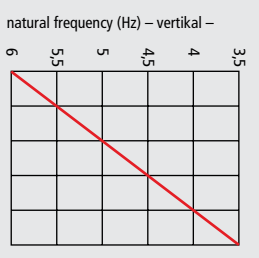
**FAEBI® 50**  
Load (daN)



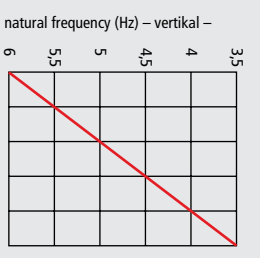
**FAEBI® 100**  
Load (daN)



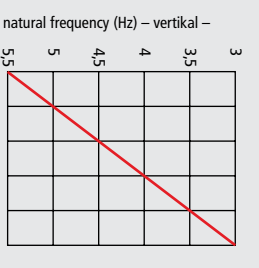
**FAEBI® 150**  
Load (daN)



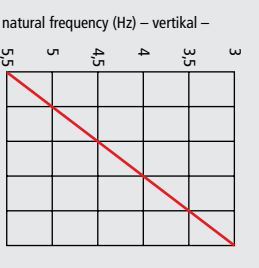
**FAEBI® 200**  
Load (daN)



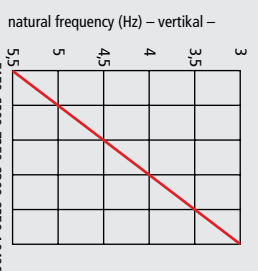
**FAEBI® 300**  
Load (daN)



**FAEBI® 430**  
Load (daN)



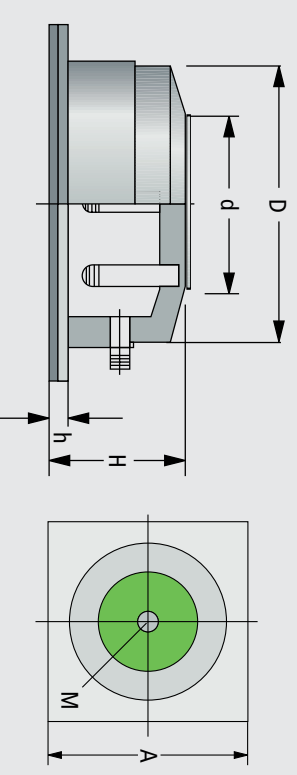
**FAEBI® 580**  
Load (daN)



● **FAEBI® mechanical-pneumatic control valves**

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 slide valve. Depending on the slide valve position, pressure is applied to the air spring or the inside pressure is reduced. The level can be maintained at an accuracy ± 1/10 mm.

Principally three control valves are used. A pressure control valve to limit system pressure to a maximum of 6 bar, water trap to remove vapour and an air filter to remove dust and any foreign bodies from the air supply.



type	load daN/pc.	max. pressure / bar	A mm	D mm	H approx. mm = workheight	h mm	M
FAEBI® 50	20 - 60	3	110	110	60	35	M 10
FAEBI® 100	75 - 300	5	135	135	72	60	M 12
FAEBI® 150	250 - 800	6	200	200	90	80	M 16
FAEBI® 200	625 - 1500	6	260	260	90	130	M 16
FAEBI® 300	1150 - 3400	6	370	370	90	200	M 20
FAEBI® 430	2750 - 6500	6	500	500	90	315	M 20
FAEBI® 580	5150 - 10400	6	680	680	99	380	M 24

**Important Notice:**

The element must be chosen in such a way as not to exceed the maximum load! Inflation and deflation may be carried out under pressure only! Screw must be screwed in manually – do not use any spanner! Subject to technical changes!

**Protective cup:**

If the machine base doesn't covers Ø "d" fully we recommend to use our special protective cups.

for shock and vibration insulation of machines, equipment and sub-assemblies



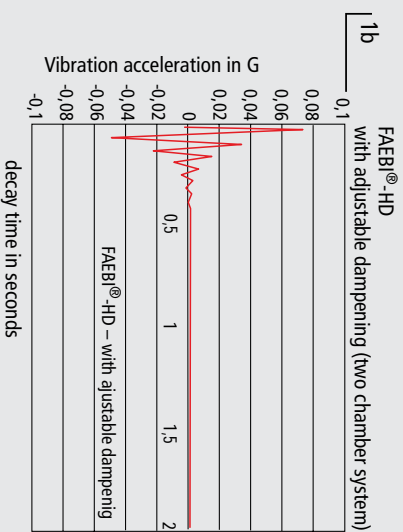
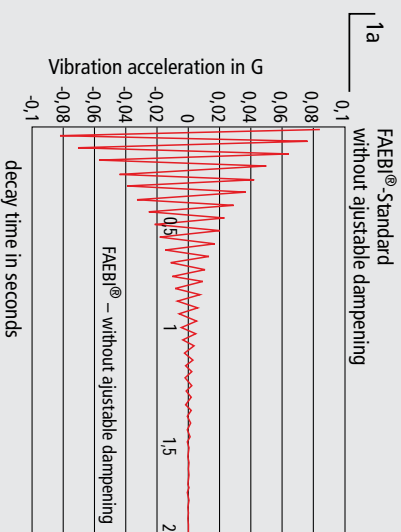
● Combined Rubber-Airspring-Insulator FAEBI®-HD with adjustable dampening

Rubber air-spring insulator FAEBI®-HD is made of a combination between high-grade elastomer and metal with an amplified sidewall. In order to obtain as high a dampening effect as possible, the air space is split into two chambers (load / dampening volume) linked by an air pipe. By the adjustable valve the dampening can be changed easily from outside. Due to the friction caused by the air-stream passing through the bypass valve, it is possible to adapt the dampening to each application.

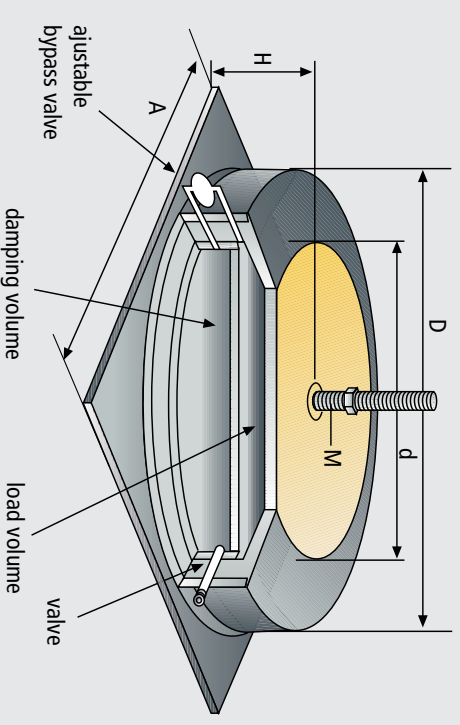
Because of the very high dampening, the resonance amplitude is much more smaller and you can realize less machine movement. (see graph 1a + 1b) Furthermore the increased transformable energy takes effect on the production quality of your machinery.

**Note:**

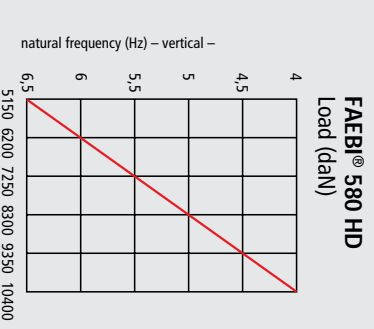
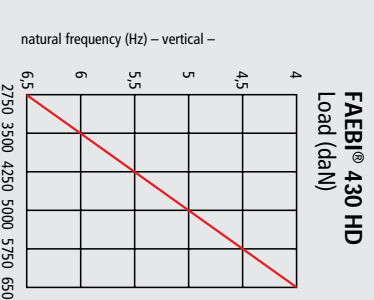
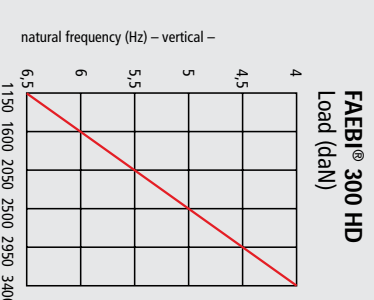
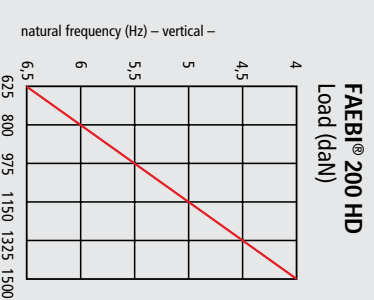
In contrast to viscose dampers, the air dampening is absolutely wear-resistant and free of maintenance. Furthermore it is possible to change the dampening from outside.



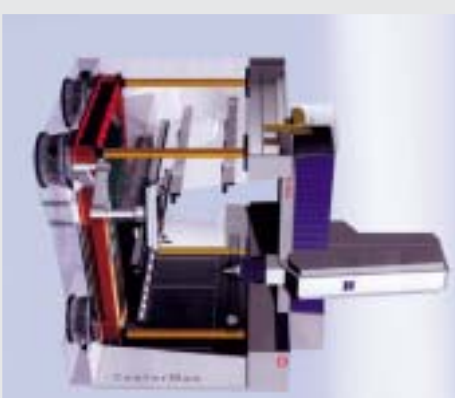
Example of application:  
TRUMPF 5000 R auf FAEBI®-HD



type	load daN/pc.	max. pressure / bar	A mm	D mm	H approx. mm = workheight	d mm	≙
FAEBI® HD 200	625 - 1500	6	260	236	90	130	M 16
FAEBI® HD 300	1150 - 3400	6	370	340	90	200	M 20
FAEBI® HD 430	2750 - 6500	6	500	480	90	315	M 20
FAEBI® HD 580	5150 - 10400	6	680	650	136	380	M 24



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



Application example:  
Zeiss measuring center mounted on BiAir®

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

type	BiAir 0,15 - ED*	BiAir 0,25 - ED*	BiAir 0,5 - ED*	BiAir 0,5 - ED**	BiAir 1 - ED**	BiAir 2 - ED**	BiAir 2,5 - ED**	BiAir 3 - ED**	BiAir 4 - ED**	BiAir 5 - ED**	BiAir 1 - ED/HE**	BiAir 2 - ED/HE**	BiAir 2,5 - ED/HE**	BiAir 3 - ED/HE**	BiAir 4 - ED/HE**	BiAir 5 - ED/HE**	workheight H mm		max. load daN at max. 4 bar		max. load daN at max. 6 bar		natural frequency Hz (verticale) approx.		natural frequency Hz (horizontale) approx.	
																	77	100	67	100	67	100	2,5	2,5	2,5	2,5
	76	110	130	120	172	226	271	348	490	747	172	226	271	348	490	747	200	307	267	400	2,5	2,5	2,5	2,5		
	182	190	216	288	335	378	467	605	855	288	335	378	467	605	855	260	307	633	950	2,5	2,5	2,5	2,5			
	110	129	110	200	260	300	382	530	798	260	300	382	530	798	260	307	1420	2130	1967	2950	1,5	1,5	1,5	1,5		
	130	129	110	200	260	300	382	530	798	260	300	382	530	798	260	307	1967	2950	3413	5120	1,5	1,5	1,5	1,5		
	130	129	110	200	260	300	382	530	798	260	300	382	530	798	260	307	15573	23360	6573	9860	2,5	2,5	2,5	2,5		
	130	129	110	200	260	300	382	530	798	260	300	382	530	798	260	307	15573	23360	6573	9860	2,5	2,5	2,5	2,5		

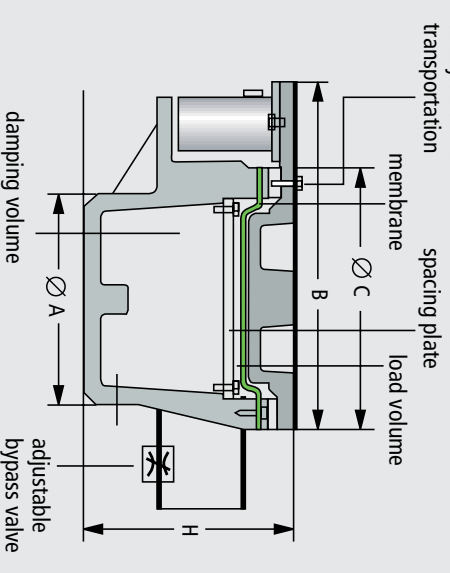
\*Steel \*\*Aluminium

### 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 BiAir® or FAEBI® 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 statcal overdefiniton. This is achieved by connecting sets of air springs in parallel.



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

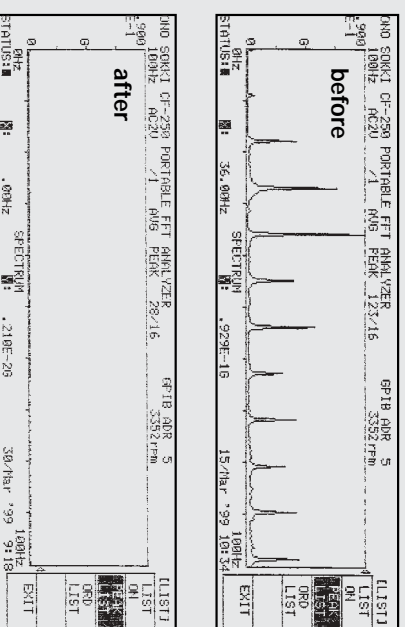


### BiAir®

#### 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 roller diaphragm. The plunger 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 25 % dampening can be effected. Additional safety valves will protect the roller diaphragm from getting damaged by over-inflation.

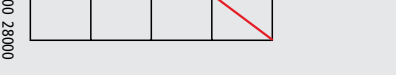
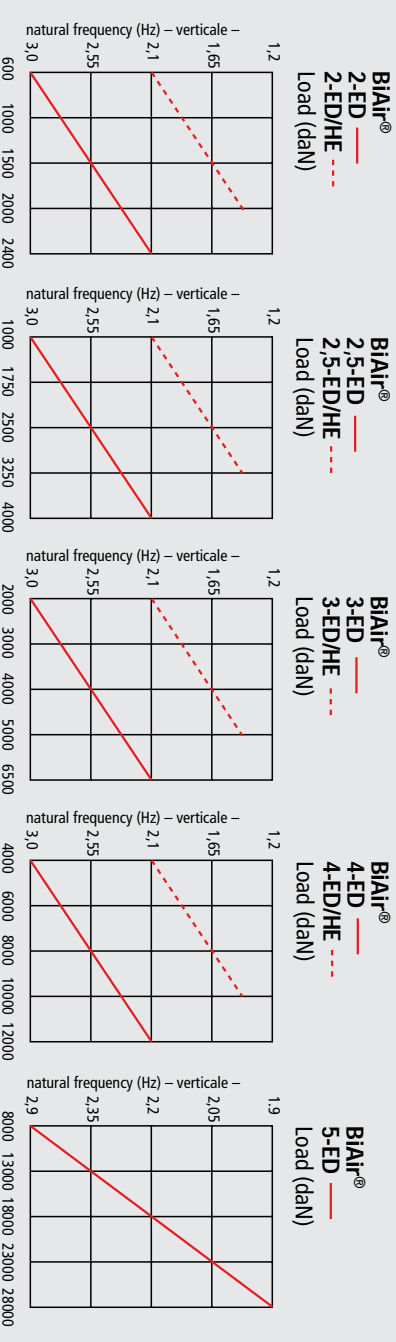
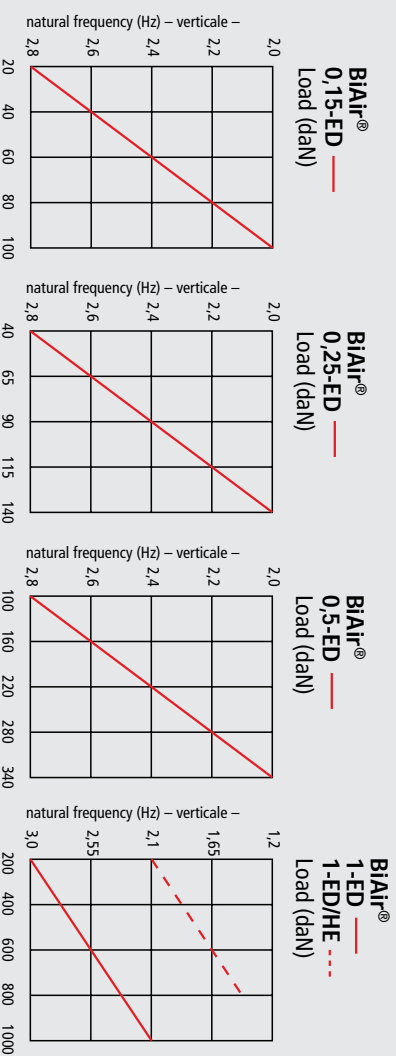


#### Range of Application

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!





● **BiAir® mechanical-pneumatic control valves**

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 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® electro-pneumatic positioner/controller**

**Advantages**

Important advantages of the BLZ 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



● **LTH-Insulated Tables**

Plate: Granite

**Product Description**

- adjustable feet
- torsion proofed, welded steel frame
- membrane air-spring insulators BiAir® (vertical natural frequency approx. 2 Hz) between frame and plate
- mechanical-pneumatic level control (level accuracy of  $\pm 1/100$  mm or  $\pm 1/10$  mm)
- plate in granite (LTH)

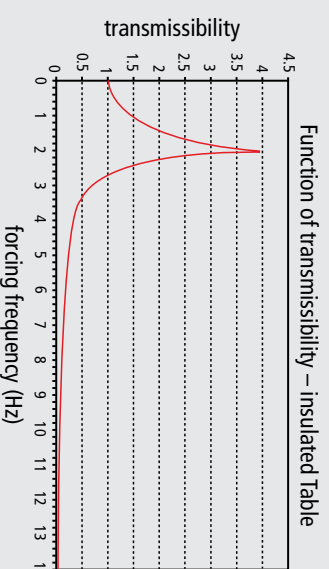
**Range of Application**

Vibration sensitive measuring and testing machines, laser scales, optical and electronic as well as medical equipment. The new insulated table LTH is used for all applications where vibrations or load changes may disturb the experiment or machine.

**Technical**

BLZ insulated table LTH is a vibration insulated workplace. Vibration of the surrounding area is insulated by high efficient membrane air springs. The level controller (mechanical-pneumatic valves) will maintain a level accuracy of  $\pm 1/100$  mm or  $\pm 1/10$  mm automatically even while the loading may change. An air regulator with water trap and air filter is included.

As standard the insulated table is available in 3 different sizes. We are always pleased to fulfill custom made sizes and colours. The work surface of the table can be delivered in granite (LTH).



**Standard Sizes**

Plate: Granite

size	width	depth	height	loading capacity
50	1100 mm	500 mm	760 mm	310 kg
63	1000 mm	630 mm	760 mm	270 kg
90	600 mm	500 mm	760 mm	370 kg

**Special dimensions**

When desired it is possible to supply special dimensions, higher loads, stainless steel solutions, honeycomb structure plates.



**Example: Special design**

**Range of application**

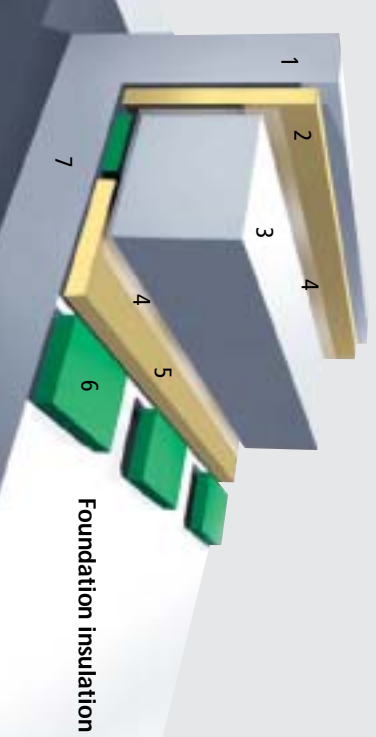
Vibration insulation of optical and opto-electronic working stations and small, high precision table top measuring instruments, e.g. roundness testers, gear measuring machines, surface measuring machines, etc.

**General system properties**

Vertical natural frequency: approx., 1.5 Hz  
Horizontal natural frequency: approx. 2.5 Hz

- Adjustable feet, rollable,
- rigid, welded steel frame with BiAir® pneumatic springs integrated in the table-leg
- mechanical-pneumatic controller (level accuracy  $\pm 1/10$  mm and pneumatic service unit).
- Plate: Granite

Shock and vibration insulation of foundations and mounting constructions



- 1 Foundation (side wall)
- 2 Mineral fibres and cover plates (lost formwork)
- 3 Foundation block
- 4 PVC film cover
- 5 Mineral fibres and cover plates (lost formwork)
- 6 BILZ insulation plates
- 7 Foundation (base)

● BILZ insulating plates are ideally suited for vibration suppression of foundations and baseplates

The main purpose of the foundation is to stabilize the machine as well as to increase the moment of inertia. The foundation thus positively influences machine vibration by reducing the amplitude of oscillation. It is wrong, however, to assume that any foundation large enough would eliminate all vibration problems. It is important that as much information as possible be supplied regarding the machine to be isolated, this will include machine size and weights, any dynamic features of its operation, location including ground type, condition where optimal performance is required and a vibration analysis of the machine and site conditions. A correct isolation between machine foundation and the surrounding area will result in trouble free operation. As a result of years of experience we have the necessary experience in this field. At your request we can offer all other related services including measuring of vibrations, planning and construction design.



Reference: Miele, first step, installing insulation plates

● Vibration insulation of automobile test stands

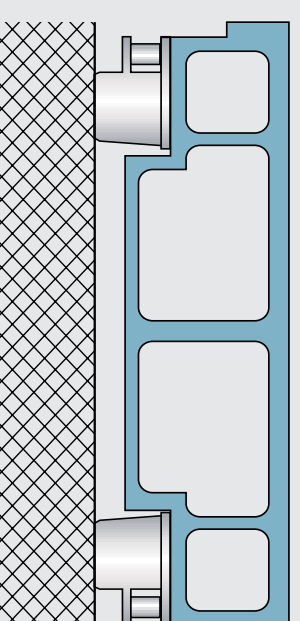
In recent years, ever higher requirements of test stands and test systems for the automobile industry have led to the need for better performing vibration isolation systems. BILZ air-springs with level control systems are ideally suited for this demanding application.

**BILZ services:**

- interpretation and supply of the vibration isolation system
- supply and installation from cast-iron plates to customer's request
- start-up of the vibration isolation system

**Experience of many years has BILZ in the vibration insulation of:**

- engine test stands
- swiveling test stands
- formula 1 test stands (BMW, Daimler Chrysler, Ferrari, Toyota, Renault)
- gearing test stands
- acoustic engine test stands
- acoustic roll test stands
- shaker
- sliding tables
- cylinder test stands
- special test stands
- hydraulic pulsating machines
- heavy shaker test stands
- road simulation test stands



● Isolated foundations for special test stands

During the vibration insulation of test stands and aggregates with high dynamic forces additionally a seismic mass is needed.

**BILZ services:**

- interpretation and supply of the vibration isolation system
- preparation of statics and building plans for foundation tubs and blocks
- raising of foundation blocks
- supply and assembly of cast-iron plates
- start-up of the vibration isolation system

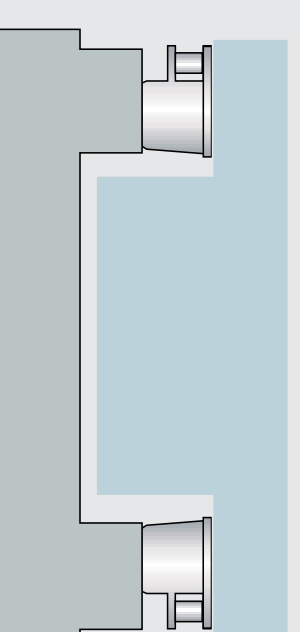


Illustration 1

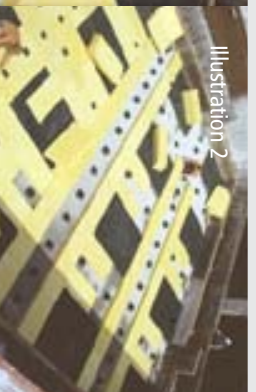


Illustration 2

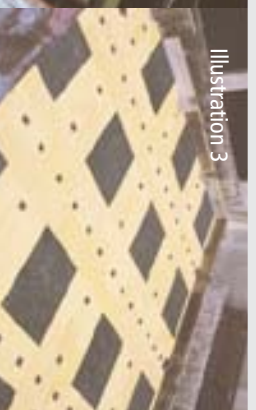


Illustration 3



Illustration 4



Illustration 5



Illustration 6



Illustration 7



Illustration 8

Application example in the plant of a major automobile manufacturer. Passive insulation protection of a Waldrich-Coburg portal milling machine from the pressing mechanism sector.  
Total mass: approx. 1200 to

Illustration 1, 2, 3: Depositing of BILZ insulation plates (green) and padding of the spaces with mineral fibre insulation plates (sacrifice formwork). Illustration 4: Covering of the entire area first with PVC sheeting as used for construction work, and then with mineral fibre cover plates. All overlappings must be pasted/glued together.  
Illustration 5, 6: Mounting of reinforcement. Illustration 7, 8: Filling in of concrete.



insulation plates

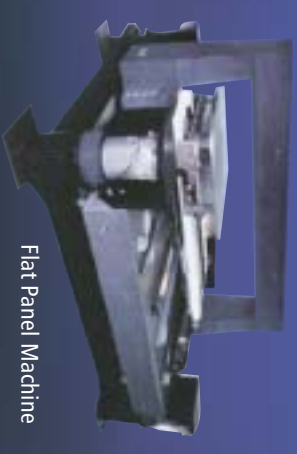


BiAir®  
membrane air-springs

Please ask for our special literature on this topic!



ComPASS PRO-Waver  
inspection machine



Flat Panel Machine

BLZ-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.

### Applications

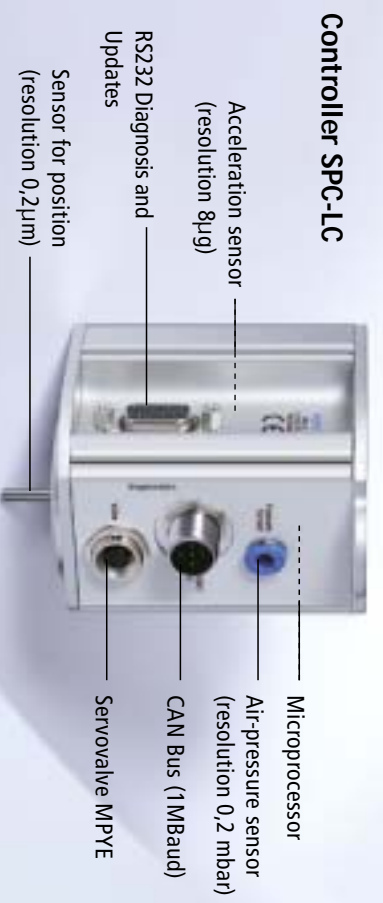
Optimal vibration isolation performance for machines with high dynamic forces that are performing sensitive measurements and inspections, lithography equipment, laser machines, high resolution electron microscopes and machinery for the semiconductor industry.

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

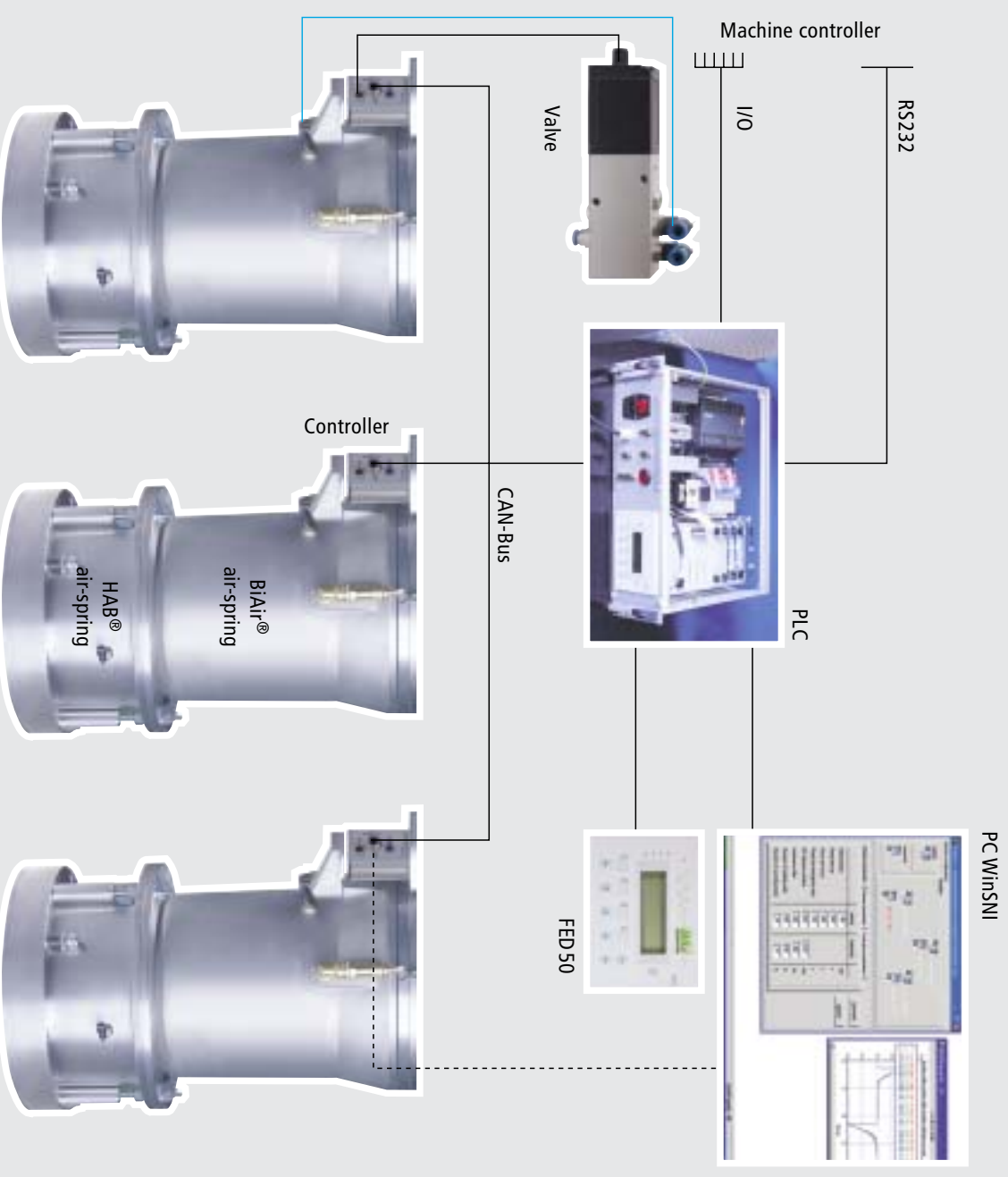
### AIS™ has two primary functions:

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



### 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.

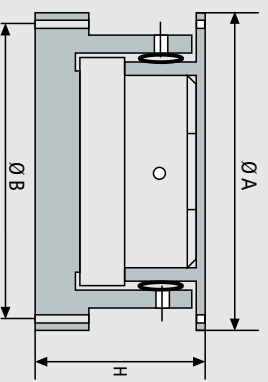
The 16 bit-controllers are connected by a CAN-BUS to the

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.



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	3200	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	13750	490	1,1 - 1,9



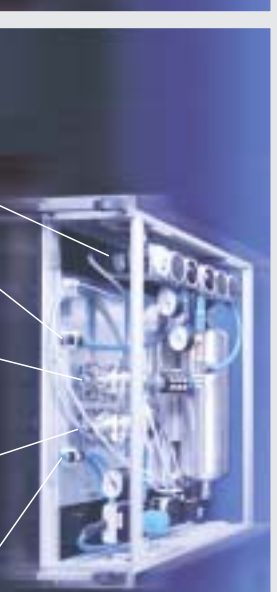
Air-Bearing  
Leveling screw  
Air-tube  
Transportation and centering screw

19" PLC-A1



Power  
Air-supply  
CAN  
Control  
winsNI I/O  
Acknowledge error  
FED 50  
w/h/d/ 483x133x348 mm

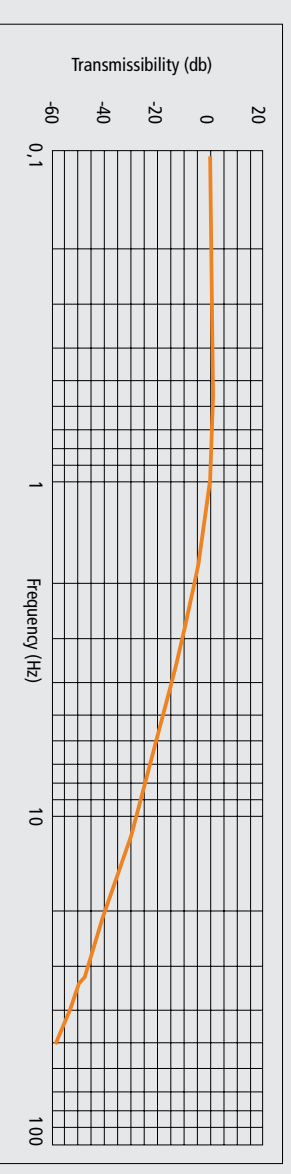
19" AirBox-A1



Air-supply  
Air-bearings  
Exhaust  
Valve horizontal  
Valve vertical  
w/h/d/ 483 x 177 x 348 mm

### Transmissibility of AIS™

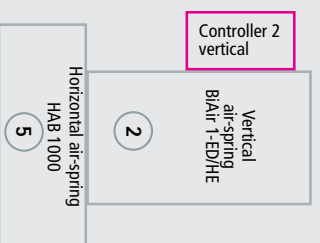
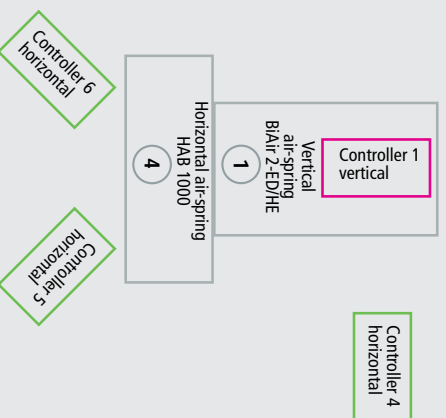
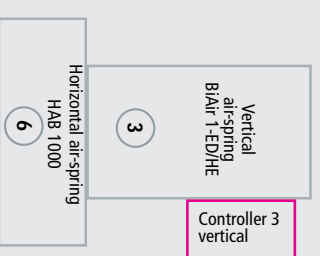
Transmissibility of new active Bilz controller at scanning mode with membrane air-springs **BlAir®/HE** and horizontal air-bearing **HAB®** with 6 controllers.



### 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.

### Positioning



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

### Design

The pneumatic 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.

Measurements of vibration and mechanical shocks. We use the most modern measurement equipment (FFT-Analyser + PC calculation programs). Owing to decades of experience in the field of vibration technology we guarantee technically and economically reliable solutions for your problems.

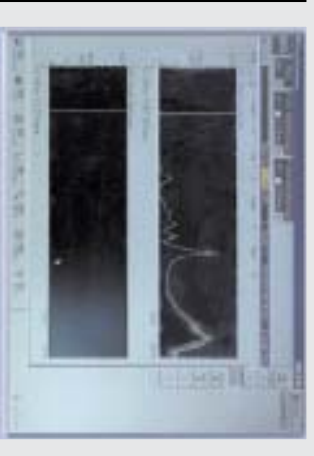
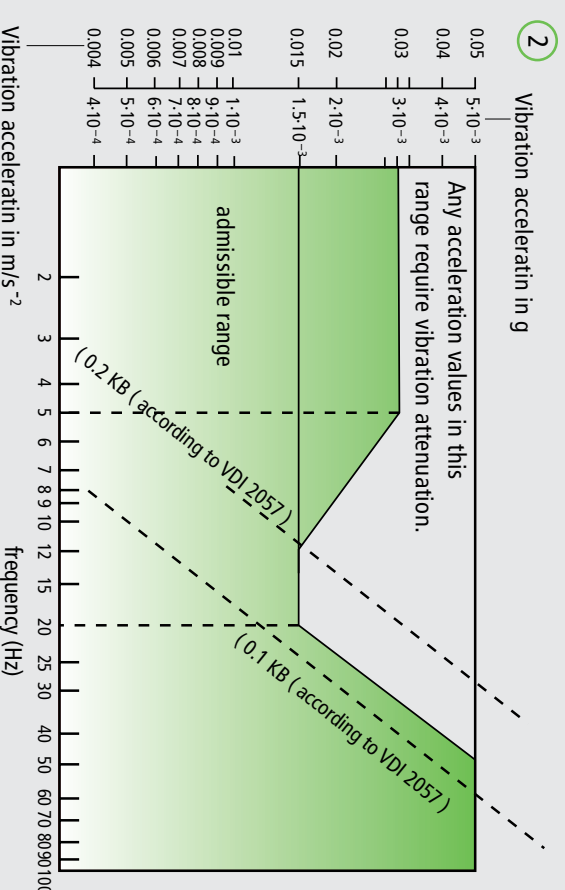
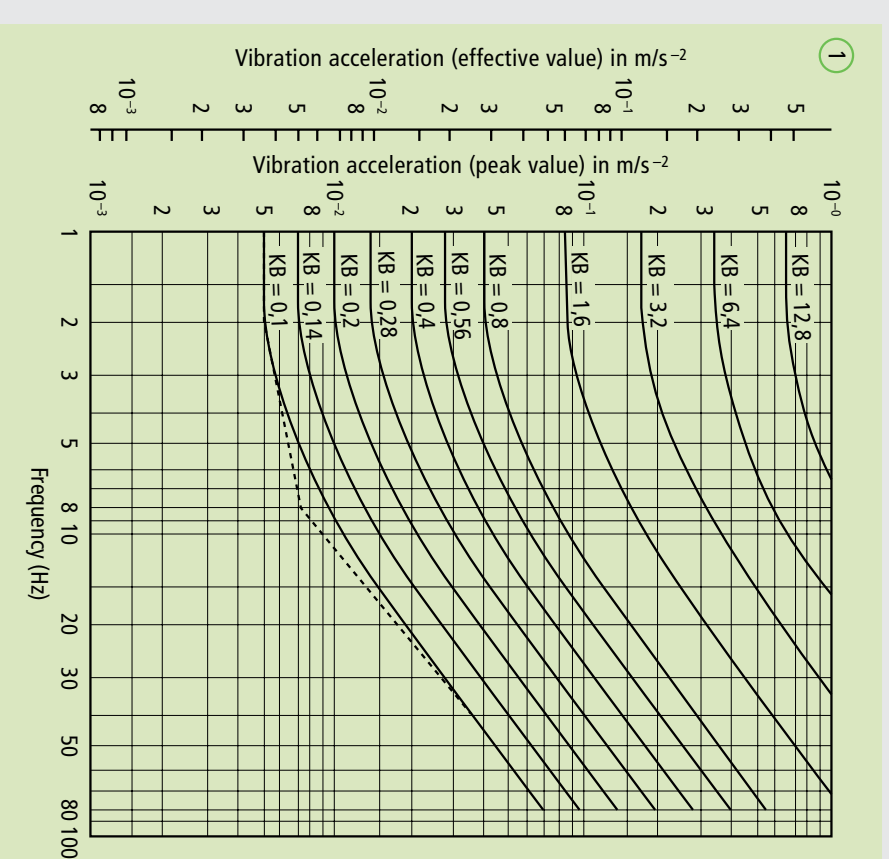


● Measurement-technological vibration analyses

Tasks

The measurement-technological coverage of oscillation emissions e.g. immissions as a basis for vibration technological measurement to observe legally laid down limit values (see graph 1). As can be seen from graph 2, different limit values must be observed, depending on the location of the machine. This standard aims at laying down principles according to which mechanical shocks can be prognosticated or measured in buildings, enabling the determination of effects of vibrations on human beings and building construction. Another relevant example for the necessity of a vibration analysis is the mounting of high-precision 3-D-measurement machines as well as of other testing, measuring or grinding machines. As a rule, measurement-tests must be carried out on envisaged locations for such machines to ensure that local ground oscillations do not exceed permissible values.

To this end oscillation accelerations within a given frequency spectrum (1–100 Hz) are taken down, because a simple summation value measurement would give only an approximate indication of the exact environmental conditions. The evaluation of the power-path signals takes place with a Fast Fourier analyser, indicating the measured value for each frequency of the spectrum (vibration acceleration in g). Should the interferences (vibration magnitude) be outside the admissible range, a suitable insulation can be worked out with the assistance of our computer calculation programs.





## Application examples:

- 1 Kraus Maffei Injection machine mounted on BiLZ Precision Wedge Mounts
- 2 Trumpf Combined laser nibbling machine Typ 5000 R mounted on FAEBI®-HD
- 3 Zeiss measuring center
- 4 Müller-Weingarten Press mounted on FAEBI®
- 5 Leica microscope on BiLZ® Insulated table LTH
- 6 ComPASS PRO Waver inspection machine with AITSM™
- 7 Bruderer high speed press mounted on BiAiR®
- 8 Mayer textil machine mounted on BiAiR®
- 9 Formula 1 test stand mounted on BiAiR® with mechanical-pneumatic level control
- 10 Isolated foundation with BiLZ membrane air springs BiAiR® and electrical-pneumatic level control to protect a BRAVO measuring machine at VOLKSWAGEN against vibration. Total weight app.: 185 to.
- 11 Reis Robot mounted on BiAiR® with mechanical-pneumatic level control
- 12 Flat Panel Machine





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