Schiller GmbH

AIR SPRINGS

MAS, BZ, MBZ, RB-SH, GRB

LEVEL CONTROL SYSTEMS

MC, LC, EC, µC

May 2017

Schiller GmbH

TYPE MAS

Type	Pressure [bar]	Load [kN]	Natural Frequency (dyn.) [Hz]	Page
MAS M10/-C	4	0,66	2,6	11
	6	1	2,5	
MAS M20/-C	4	1,33	2,6	12
	6	1,99	2,5	
MAS M40/-C	4	2,66	2,6	13
	6	3,99	2,5	
MAS 25/-C	4	1,9	2,4	14
	6	2,8	2,3	
MAS 55/-C	4	3,9	2,4	15
	6	5,9	2,3	
MAS 100/-C	4	7,2	2,2	15
	6	10,8	2,1	
MAS 230/-C	4	15,4	2,2	16
	6	23,3	2,1	
MAS 320/-C	4	21,5	2,2	16
	6	32,2	2,1	
MAS 500/-C	4	32,6	2,2	17
	6	49,0	2,1	
MAS 1000/-C	4	66,7	2,3	18
	6	100,0	2,2	
MAS 2000/-C	4	133,4	2,4	19
	6	200,0	2,3	

TYPE BZ / DBZ

BZ 34	4	2,3	3,3	20
	6	3,4	3,3	
	8	4,4	3,2	
BZ 46	4	3,0	3,3	21
	6	4,6	3,3	
	8	6,1	3,2	
BZ 52	4	3,7	2,9	22
	6	5,7	2,8	
	8	7,7	2,7	
BZ 85	4	5,3	2,8	23
	6	8,3	2,6	
	8	10,9	2,6	
BZ 120 MB	4	7,5	2,6	24
	6	11,9	2,6	
	8	15,7	2,6	
BZ 210 DS	4	14,2	2,4	25
	6	21,8	2,3	
	8	29,0	2,3	
BZ 320 DS	4	20,1	2,5	26
	6	31,6	2,4	
	8	42,2	2,3	
BZ 570 DS	4	38,8	2,2	27
	6	58,7	2,2	
	8	78,1	2,1	

Table of content

TYP MBZ

TYP RB-SH

TYP GRB

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1987 › The first production hall with administrative building is developed in Roetgen

1997 › Dipl.-Ing. Wolfgang Peters becomes director of **CFM-Schiller**. Expansion of product range; test bench components for servo-hydraulic test benches added

1978 › Dipl.-Ing. Hubertus Schiller establishes **CFM** for the assembly and design of vibration isolation and seismic masses with air springs

1994 › Production expanded; new production hall and two assembly halls

2002 › Construction of a test laboratory with servo-hydraulic test benches for verifying our own products

1999 › Introduction of Finite-Element method NASTRAN, WINDOWS based

1998 › Commissioning of a portal milling machine

2005 › New innovative products are introduced to the market; MAS air springs and ***MOCOKIT***®, Extension of the machine park; column milling machine with 3 500 x 2 000 mm working surface

2000 › Introduction of 3D-CAD system inventor

2003 › Company expansion, including new assembly halls and administrative wing

2006 › Establishment of subsidiary company **CFM-ITBONA**, USA

2009 › Production optimization; new 9-axle welding robot

2008 › Expansion of the machine park; CNC milling machine with 6 000 x 2 500 mm working surface. Establishment of **CFM Schiller**, France

2011 › Expansion of machine park; 5-axle CNC milling machine including CAD-CAM technology

2010 › Production optimization; new 7-axle welding robot

2012 › Expansion of **CFM Schiller** Engineering PVT India, Pune, India

2014 › Expansion of machine park; new 5-axle CNC travelling column milling machine with 10 000 x 3 000 mm working surface

2013 › Production optimization; second 3-axle CNC milling machine including CAD-CAM technology. Expansion of the company; new 1 100m² workshop with paint shop and an additional administration facility

2015 › Expansion of machine park; new 5-axle CNC travelling column milling machine with 6 000 x 2 000 mm working surface

38 YEAR OLD CFM SCHILLER

Competency in development and production

CFM Schiller GmbH looks back on more than 38 years' experience in the areas of vibration isolation systems and vibration foundations.
Since the beginnings, our core business has been to create solutions for problems concerning the safety of people, buildings and plants by employing vibration-isolated bearings.
The increasing productive efficiency of machines and test rigs, chiefly in the automotive industry, is leading to a constant increase of disturbances emitted into the environment.
This particularly involves analyses on the operational stability of vehicles and their components as well as flexural fatigue tests on steel and aluminium structures.
We offer our customers high-tech, reliable products of the highest quality! The **CFM products** are manufactured on our premises using state-of-the-art manufacturing technology. Long-term partnerships with carefully selected partners ensure a consistently high standard of quality. Our aim is to entertain long-lasting business relationships based on cooperation with satisfied customers. Our employees guarantee our success.
Cooperation is marked by mutual support, open communication and a flat hierarchy.

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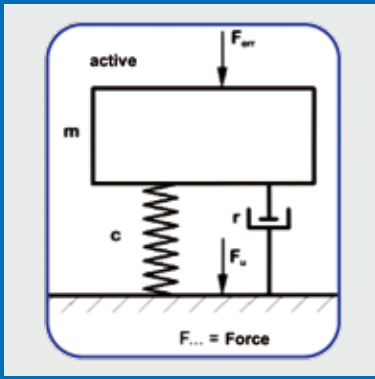
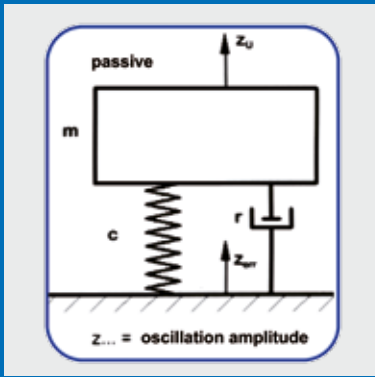
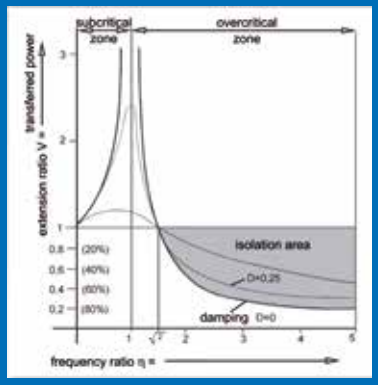






$$\eta = \frac{\text{excitation frequency}}{\text{natural frequency}} = \frac{f_{err}}{f_0}$$

THE PRINCIPLE OF VIBRATION ISOLATION

Active vibration isolation:
In active vibration isolation, the vibrations emitted from machines or test systems are reduced to such extent that the adjacent parts of the building, machines and those people working on them are not harmed or affected in any way.

Passive vibration isolation

In passive vibration isolation, the vibration isolation protects sensitive machines or measuring equipment such as precision tool machinery, measuring machines and scanning electron microscopes and laser measuring equipment from vibrations which impact the building from the outside, e.g. from underground.

Periodic vibration isolation

In most cases machines and test rigs emit forced, damped vibrations. An important criterion for the effectiveness of the vibration isolation is the **frequency ratio (η)**. The greater **η** is, the better the isolation effect. The transfer function pictured here shows that vibration isolation only exists when the frequency ratio is greater than **√2**. Effective vibration isolation is achieved at a frequency ratio of 3-4.

AIR SPRING SYSTEMS

CFM Air Spring Systems are being used for elastic bearing in low frequency mode with frequencies of 0.6Hz to 2.5Hz. Hence the air spring is applied at the lower edge of all physical solutions. An air spring system for vibration isolation of machines and/or test systems basically consists of the following main components:

1. Seismic mass

Additional inertial mass of the swinging system. In case of not sufficient available mass of the test system itself an additional mass (i.e. concrete with clamping plate) is added in the function of a base plate.

2. Air spring

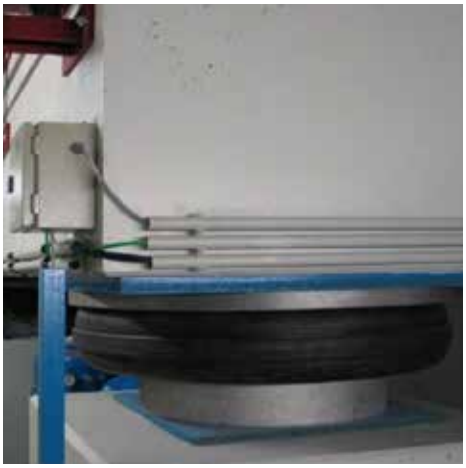
The air spring de-couples the machine and/or test system from the laboratory environment. The air spring is precisely selected according to load capacity, natural frequency, amplitude limits and further technical conditions.

3. Damper

The damper is the component to ensure that the vibration amplitude is limited within a permissible level. All dampers are integrated within the air springs and do not require additional space. The air spring type MAS offer a wide adjustment range by means of an air regulator. The use of air springs with viscous damping enables us to accommodate customer requirements.

Additional volume

Through the enlarged volume of an air spring it is possible to lower down the natural frequency until 0.6Hz. Except in the case of the air spring type GRB 2480-1200 ZV, the additional volume is not integrated into the air spring itself. Due to the additional volume the air spring system has two switchable natural frequencies (with and without additional volume). The optimized arrangement of the main components guarantees a vibration isolation of highest efficiency.



Air Spring with additional volume

Air Spring with additional volume

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WE 300

MC 300-S

LC 300

LEVEL CONTROL SYSTEMS

When using air springs in a vibration isolation system, a level control unit is required to adjust the zero level of the machine or test rig. Furthermore, it is necessary to mount a maintenance unit on the inlet side in order to adjust the inlet pressure, separate condensation water and decouple the system from the air pressure supply when required.

WE 300

This reasonably priced supply unit comprises an inlet pressure control valve and an air treatment unit, as well as ball valves to deflate the system. The WE 300 is for exclusive use with the air springs from our MAS range.

MC 300-S

This supply unit comprises an inlet pressure valve and a water separator. The current pressure in the individual systems as well as the inlet pressure is displayed on a pressure gauge. The plant can be lowered by means of ball valves. The regulating valve for 3-point level control is included in the scope of supply.

LC 300/302

The resting position of the test rig is indicated by means of color changing LEDs on the level control unit LC 300. A key switch is used to raise or lower the seismic mass. The regulating valves for the 3-point level control are included in the scope of supply. An additional key switch available on the LC 302 enables the increase of volume to change the air spring system's natural frequency. Floating contacts allows external equipment condition monitoring.

EC 303

The electronic level control system EC 303 serves as full automatic as high precision level control unit for **CFM air spring** systems.
The EC 303 level control unit can be used with all ranges of **CFM air springs.**
The EC 303 comprises of three of electronic control circuits, three of valve units incl. digital pressure sensors with 7 segment display which are integrated into a ridged industrial case.
The front plate of the main EC 303 control box is provided with pressure gauges for input and system pressure as well as a HMI Panel to operate the Level control unit.
The following functions are integrated into the standard system:

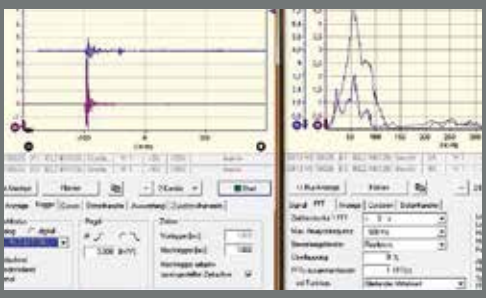
- Height adjustability of each control loop
- Monitoring of height and pressure of each control loop
- switching of resonance frequency
- quick lifting an lowering of the seismic mass
- full quick air evacuation
- preset up of 3 different levels

Depending on the choosed sensors the level control system has a precision of ± 0,05 mm.
As option it is possible to integrate an active monitoring function of the moving amplitues of the seismic mass and automatic switching of the resonance frequency depending.

EC 303

Schiller GmbH

µC 300



Vibration analysis

µC 300

The µC 300 provides an electronic level control with active damping. With the µC 300 the build up of the system can be avoided and the decay time can be minimized.
The level of the controlled item is detected by contact free position sensors. The controller works with high-dynamic proportionalvalves. The µC 300 analyzes seven sensor signals, three ultrasonic position sensors and four pressure sensors. The Air stream to the air springs is controlled by three highdynamic proportional valves. Each air spring group is controlled by one valve.
The advantage over a passive mechanical system is the possibility to optimize the parameters to the characteristic of the system.
The controller is realized with a FPGA with a40MHz clock rate.
The software to parametrize the controller is connected via Ethernet. There all relevant parameters can be visualized and adjusted.
A visualization can although be done on a mobile device. With this feature a smart and quick check of the status of the vibration isolation system is possible.

Measuring method

We measure vibrations which occur on buildings or machines using state-of-the-art measuring equipment. The acceleration that occurs is measured with highly sensitive sensors.
The results of these measurements form the dimensioning of the required vibration isolation components. This process is carried out according to DIN 4150, which defines this type of measurement and evaluation in buildings.
Measuring vibration acceleration / vibration speed is indispensable, particularly when designing the vibration isolation of high-precision and highly sensitive plants and equipment.

Air springs type MAS M

The MAS Air Spring works by the principle of an enclosed air volume in a container, sealed off through a rubber membrane. On top of the membrane, the air spring's pressure plate carries the object that has to be isolated. With rising pressure inside the air volume, the force upon the membrane rises as well. If this force is greater than the weight of the object, the membrane arches upwards and lifts the object.

A level control system provides a steady working height of the air spring even under changing loads. Advantages of membrane air springs are high horizontal spring stiffness and variable air damping that is adjusted by a throttle.

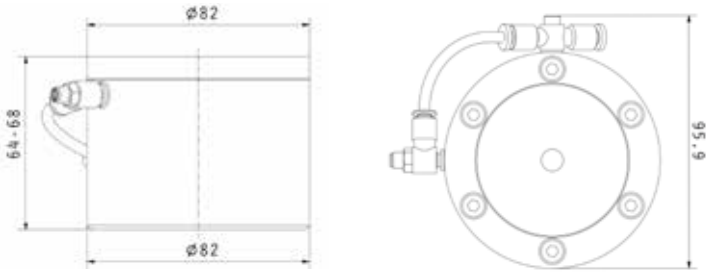
Membrane Air Springs Type C feature an included level control valve. Air Springs of Type CPC comprise of the level control valve and an electronic position monitoring.

Additional options:
Fixation threads in the cover plate or the body can be manufactured after customer preference.

Application:
Passive vibration isolation:
- metrological devices
- electron microscopes
- laser technology equipment
- measurement setups

Active vibration isolation:
- machines*
- engine test rigs*
- transmission test rigs*
- * = with low dynamics

MAS M10



Weight: **MAS M10** **0,65 kg**

Dynamic spring data for vibration isolation
at 66 mm operating height and f_{err} = 1Hz

		vertikal		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural Frequency** (dyn.) [Hz]	**Damping ratio**
4	0,66	17	2,6	0,05 - 0,1
6	1	25	2,5	0,05 - 0,1

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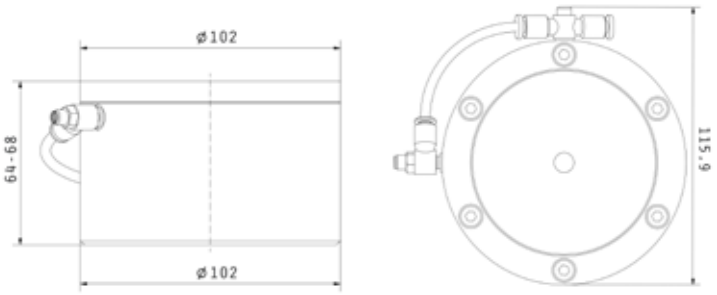
MAS M20



Air springs type MAS M

The MAS Air Spring works by the principle of an enclosed air volume in a container, sealed off through a rubber membrane. On top of the membrane, the air spring's pressure plate carries the object that has to be isolated. With rising pressure inside the air volume, the force upon the membrane rises as well. If this force is greater than the weight of the object, the membrane arches upwards and lifts the object.

A level control system provides a steady working height of the air spring even under changing loads. Advantages of membrane air springs are high horizontal spring stiffness and variable air damping that is adjusted by a throttle.

Membrane Air Springs Type C feature an included level control valve. Air Springs of Type CPC comprise of the level control valve and an electronic position monitoring.

Additional options:
Fixation threads in the cover plate or the body can be manufactured after customer preference.

Application:
Passive vibration isolation:
- metrological devices
- electron microscopes
- laser technology equipment
- measurement setups

Active vibration isolation:
- machines*
- engine test rigs*
- transmission test rigs*
- * = with low dynamics

Weight: **MAS M20** **0,90 kg**

Dynamic spring data for vibration isolation
at 66 mm operating height and f_{err} = 1Hz

		vertikal		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural Frequency** (dyn.) [Hz]	**Damping ratio**
4	1,33	35	2,6	0,05 - 0,1
6	1,99	49	2,5	0,05 - 0,1

Air springs type MAS M

The MAS Air Spring works by the principle of an enclosed air volume in a container, sealed off through a rubber membrane. On top of the membrane, the air spring's pressure plate carries the object that has to be isolated. With rising pressure inside the air volume, the force upon the membrane rises as well. If this force is greater than the weight of the object, the membrane arches upwards and lifts the object.

A level control system provides a steady working height of the air spring even under changing loads. Advantages of membrane air springs are high horizontal spring stiffness and variable air damping that is adjusted by a throttle.

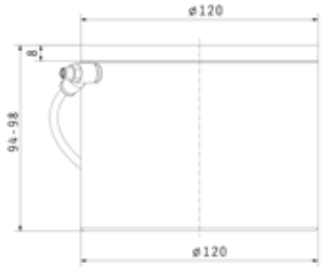
Membrane Air Springs Type C feature an included level control valve. Air Springs of Type CPC comprise of the level control valve and an electronic position monitoring.

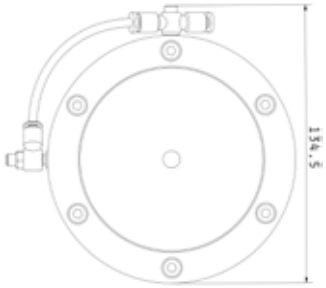
Additional options:
Fixation threads in the cover plate or the body can be manufactured after customer preference.

Application:
Passive vibration isolation:
- metrological devices
- electron microscopes
- laser technology equipment
- measurement setups

Active vibration isolation:
- machines*
- engine test rigs*
- transmission test rigs*
- * = with low dynamics

MAS M40





Weight: **MAS M40** **1,7 kg**

Dynamic spring data for vibration isolation
at 96 mm operating height and f_{err} = 1Hz

		vertikal		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural Frequency** (dyn.) [Hz]	**Damping ratio**
4	2,66	69	2,6	0,05 - 0,1
6	3,99	99	2,5	0,05 - 0,1

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MAS 25/MAS 25-C

Air springs type MAS

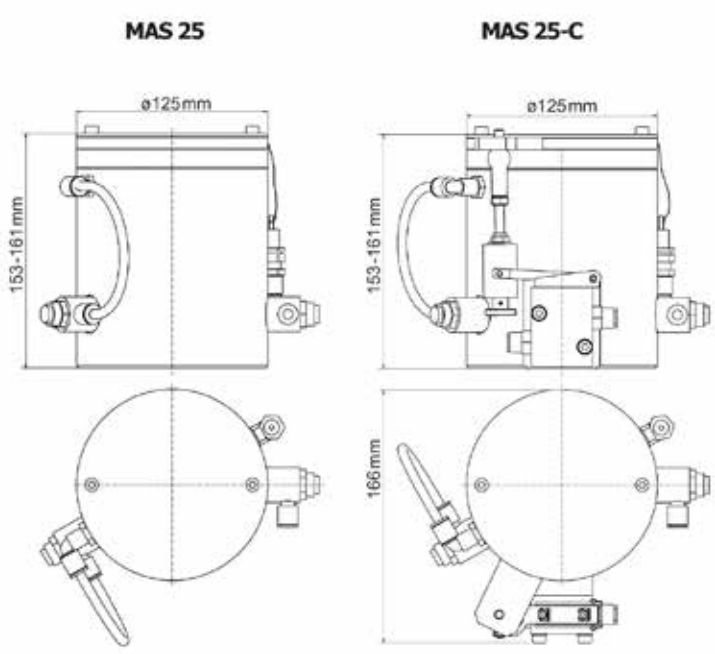
At this product an air volume is enclosed via a special rubber membrane. The isolated mass is supported through this membrane by the internal air pressure and the internal load plate. The equilibrium between the vertical force of the isolated mass and the resulting force out of the internal air pressure is given due to the integrated controlling valve. An additional safety valve avoids any kind of overload to the membrane spring.
Fundamental advantages of this air spring concept are the higher vertical stiffness as well as the adjustable damping function.
Sub-versions:
MAS ...-C: leveling valve mounted directly at air spring body; MAS ...-CPC: additional to leveling valve mounted roller type limit switch.

Note:
Optional manufacturing of the threads in the top cover and housing according to agreement with customer.

Application:
Passive vibration isolation:
- metrological instruments
- electron microscopes
- equipment in laser technology
- measuring buildups

Active vibration isolation:
- machines *
- motor test rig *
- gear test rig *

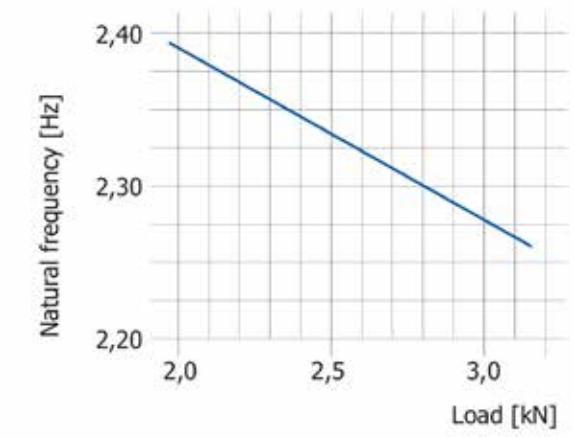
* = with low dynamic



Weight: **MAS 25** **5 kg**
MAS 25-C **5,5 kg**

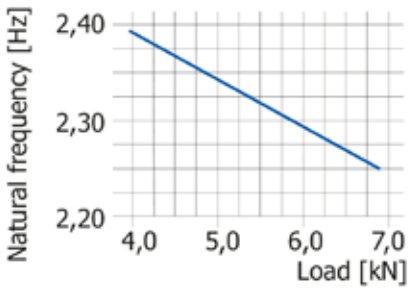
Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

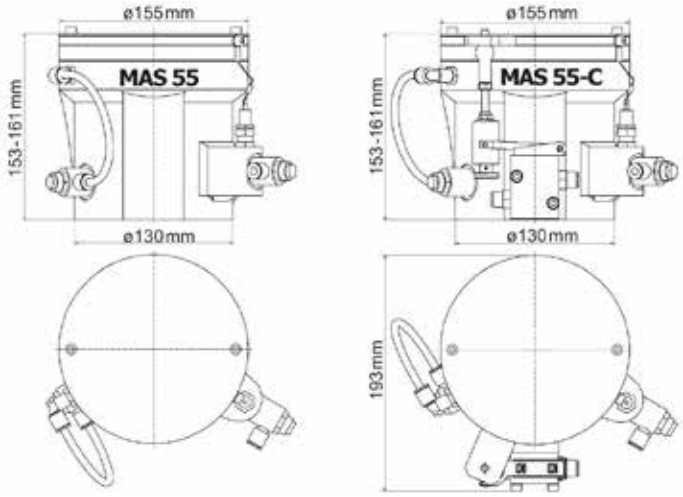
		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	1,9	44	2,4	0,05 - 0,1
6	2,8	61	2,3	0,05 - 0,1



MAS 55 / MAS 55-C

Weight: **MAS 55** **4,5 kg**
MAS 55-C **5,0 kg**



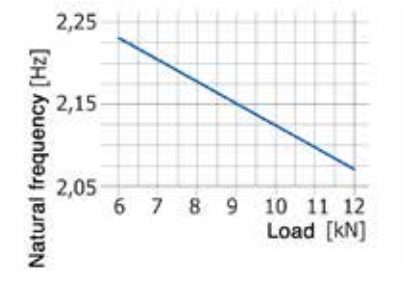


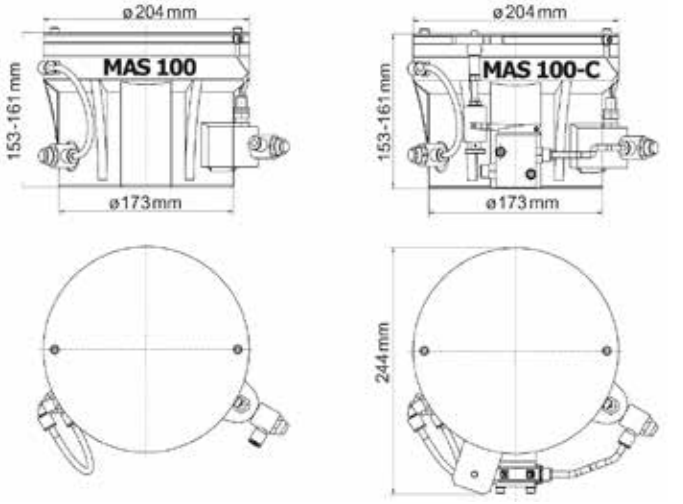
Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	3,9	89	2,4	0,05 - 0,1
6	5,9	124	2,3	0,05 - 0,1

MAS 100 / MAS 100-C

Weight: **MAS 100** **7,6 kg**
MAS 100-C **8,1 kg**





Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	7,2	140	2,2	0,1 - 0,2
6	10,8	200	2,1	0,1 - 0,2

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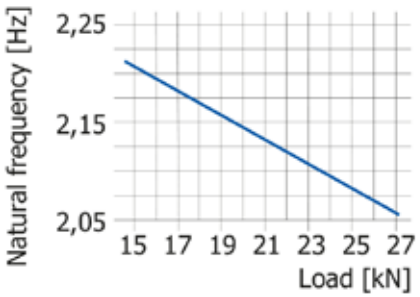
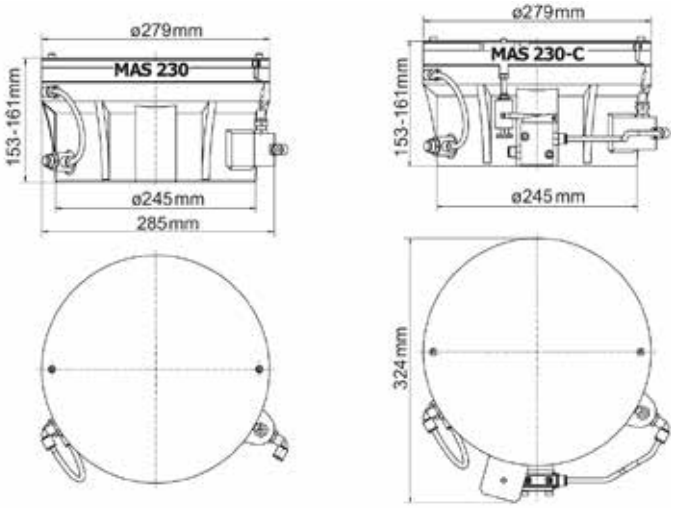
MAS 230 / MAS 230-C

Weight: **MAS 230** **15,5 kg**
MAS 230-C **16,0 kg**



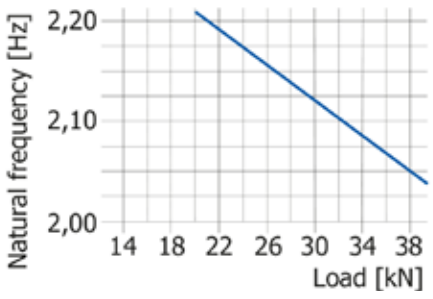


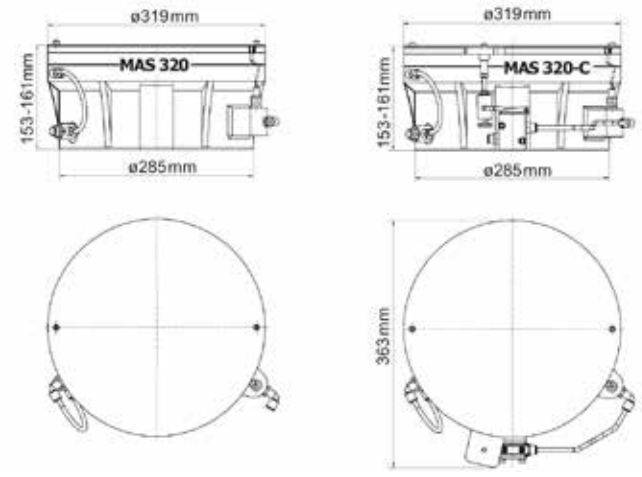
Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	15,4	290	2,2	0,1 - 0,2
6	23,2	400	2,1	0,1 - 0,2

MAS 320 / MAS 320-C

Weight: **MAS 320** **17,2 kg**
MAS 320-C **17,9 kg**

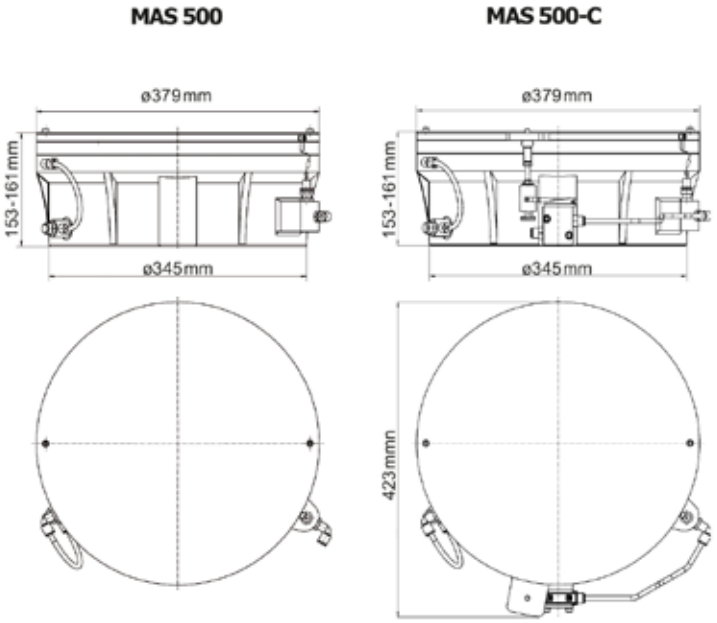




Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	21,5	410	2,2	0,1 - 0,2
6	32,2	550	2,1	0,1 - 0,2

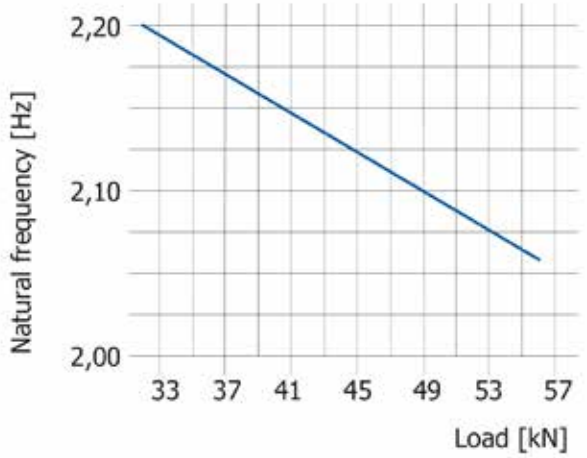
MAS 500 / MAS 500-C



Weight: **MAS 500** **23,5 kg**
MAS 500-C **24,2 kg**

Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	32,6	580	2,2	0,1 - 0,2
6	49,0	870	2,1	0,1 - 0,2



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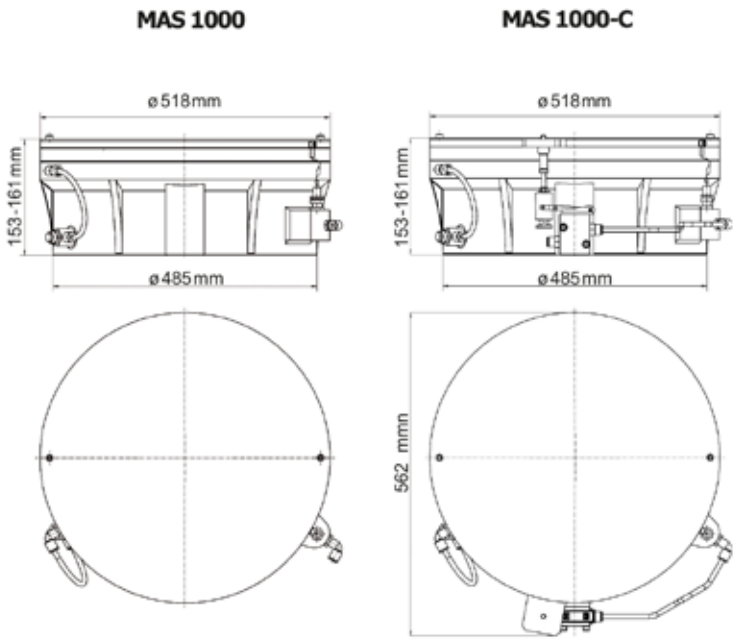
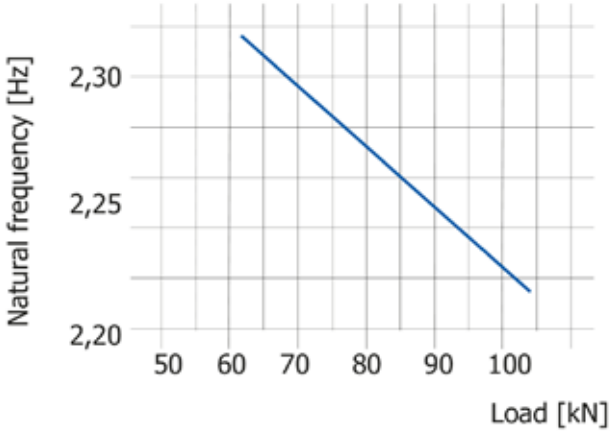
MAS 1000 / MAS 1000-C



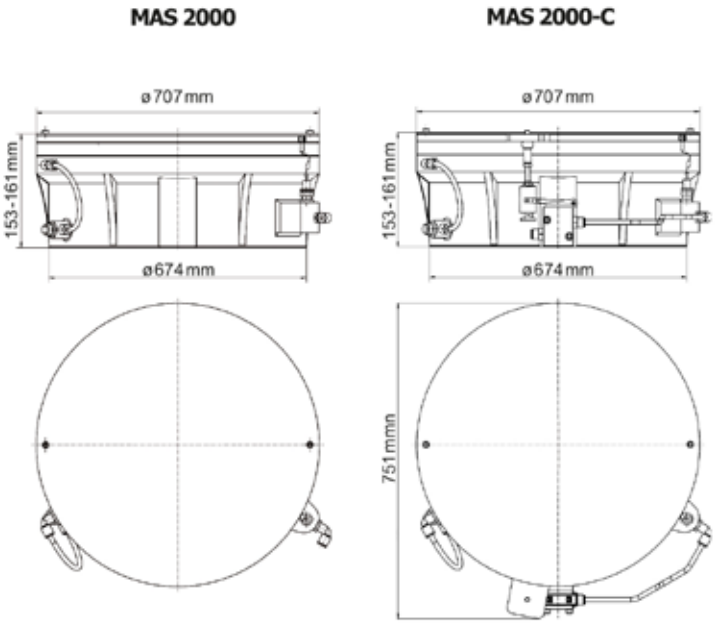
Weight: **MAS 1000 44,5 kg**
MAS 1000-C 44,8 kg

Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	66,7	1404	2,3	0,1 - 0,2
6	100,0	1965	2,2	0,1 - 0,2



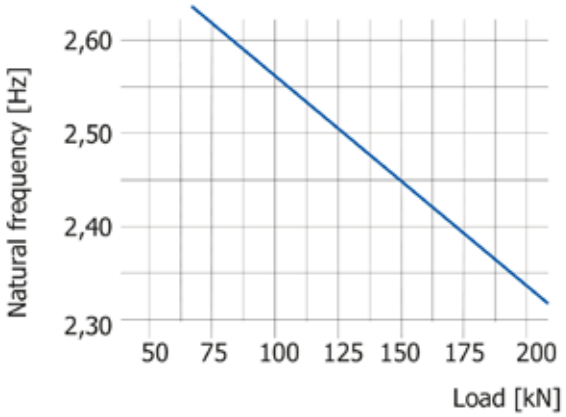
MAS 2000 / MAS 2000-C



Weight: **MAS 2000 77 kg**
MAS 2000-C 77,3 kg

Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1Hz

		vertical		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping ratio**
4	133,4	3111	2,4	0,1 - 0,2
6	200,0	4356	2,3	0,1 - 0,2



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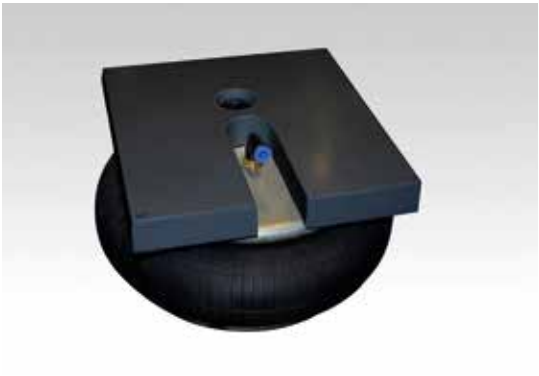
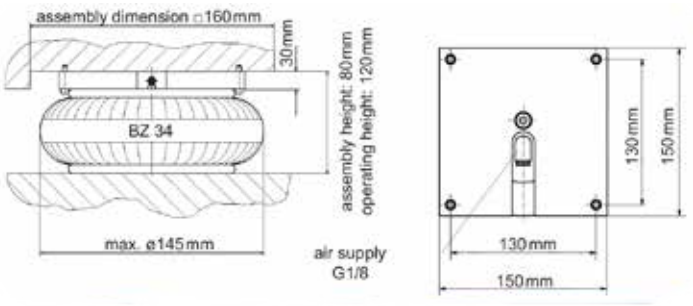
BZ 34





Weight: **1,6 kg**
Restoring force for min. height: **≤ 120 N**

Air springs type BZ

Below an adapter plate between the top and lower steel plate a rubber bellow is crimped in order to create a hermetically sealed air volume.
Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance.
The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate. The sub types BZ ... DS/MB are equipped with bump stops.

Application:
active vibration isolation:

- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

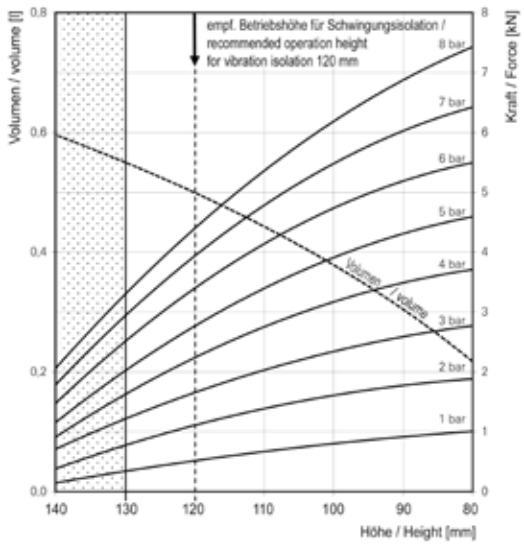
operating height incl. adapter plate = 120 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	2,3	99	3,3
6	3,4	148	3,3
8	4,4	182	3,2

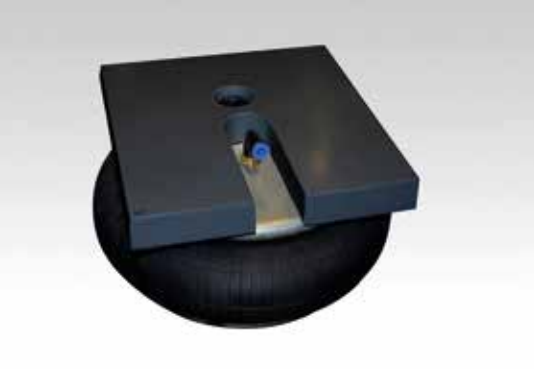
Force-height-table for single convolution air springs

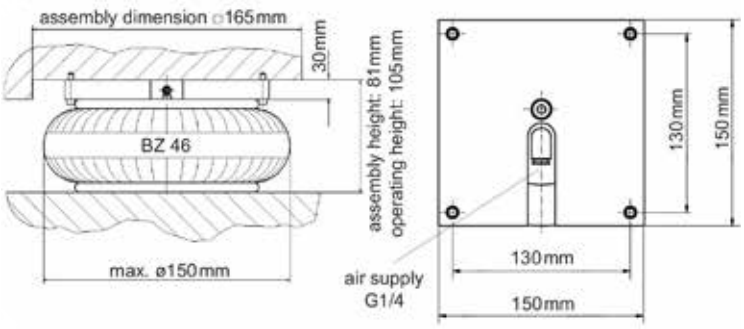
force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
130	1,2	1,6	2,0	2,5	3,0	3,4
110	2,1	2,8	3,5	4,2	4,9	5,3
90	2,6	3,5	4,3	5,2	6,1	6,9



BZ 46





Weight: **1,9 kg**
Restoring force for min. height: **≤ 250 N**

Dynamic spring data for vibration isolation

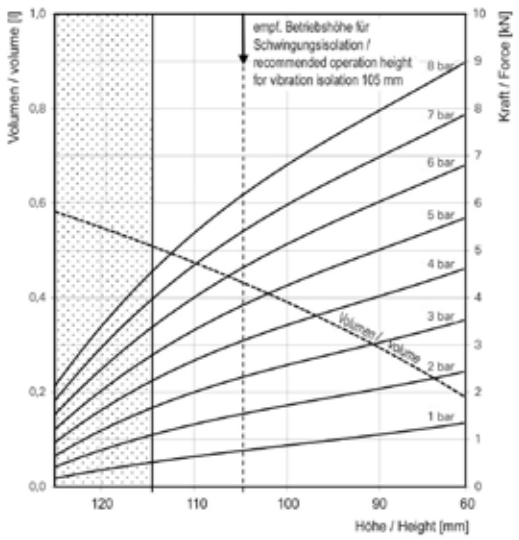
operating height incl. adapter plate = 105 mm and f_{err} = 1 Hz

Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** [Hz]
4	3,0	191	3,8
6	4,6	267	3,7
8	6,1	334	3,6

Force-height-table for single convolution air springs

force in [kN]

Height [mm]	**3** [bar]	**4** [bar]	**5** [bar]	**6** [bar]	**7** [bar]	**8** [bar]
110	2,0	2,7	3,3	4,0	4,7	5,4
100	2,6	3,4	4,3	5,1	6,0	6,8
90	3,1	4,0	5,0	6,0	7,0	8,0



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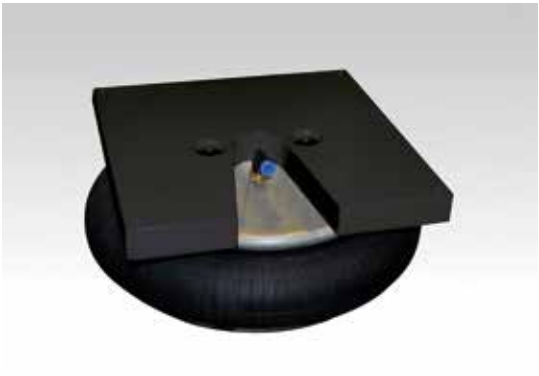
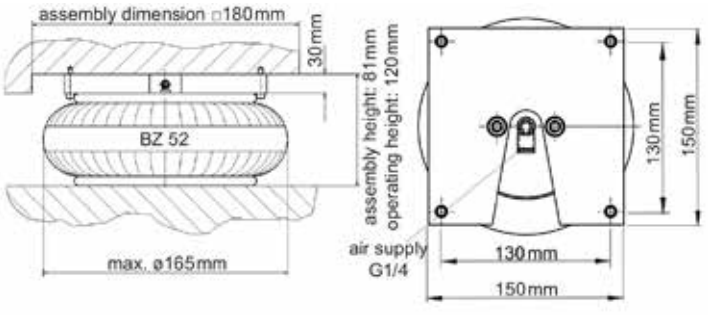
BZ 52





Weight: **1,9 kg**
Restoring force for min. height: **≤ 200 N**

Dynamic spring data for vibration isolation

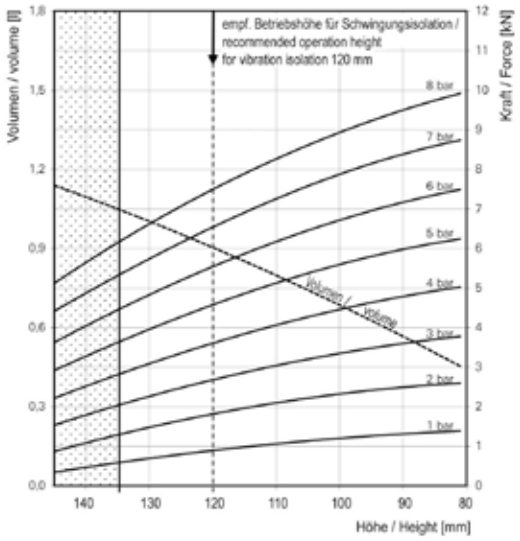
operating height incl. adapter plate = 120 mm and f_{err} = 1 Hz

Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** [Hz]
4	3,7	127	2,9
6	5,7	177	2,8
8	7,7	232,5	2,7

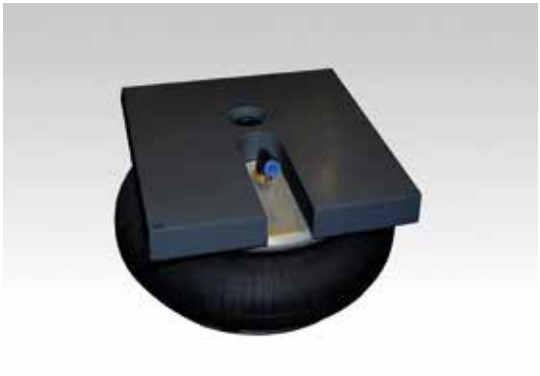
Force-height-table for single convolution air springs

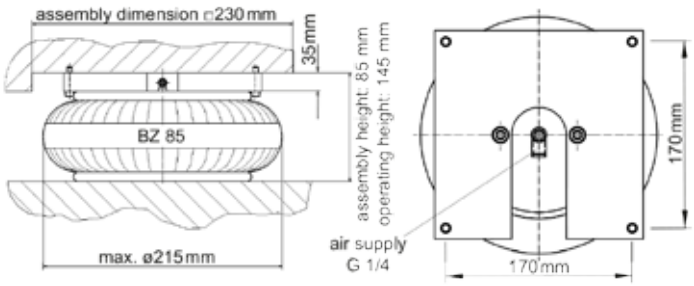
force in [kN]

Height [mm]	**3** [bar]	**4** [bar]	**5** [bar]	**6** [bar]	**7** [bar]	**8** [bar]
130	2,2	3,1	4,0	4,8	5,7	6,6
110	3,1	4,1	5,1	6,2	7,3	8,3
90	3,6	4,8	6,0	7,2	8,4	9,5



BZ 85





Weight: **2,9 kg**
Restoring force for min. height: **≤ 200 N**

Dynamic spring data for vibration isolation

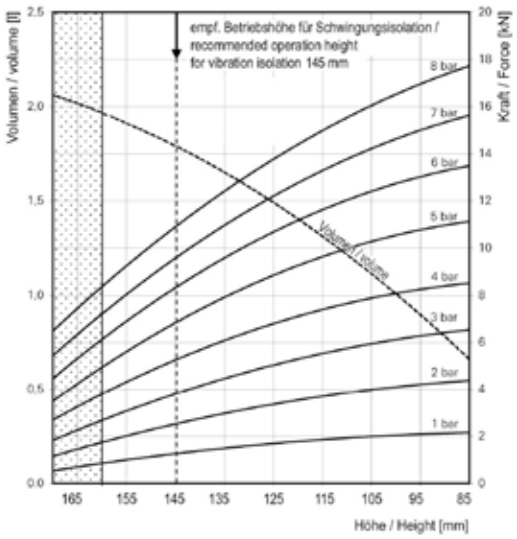
operating height incl. adapter plate = 145 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	5,3	162	2,8
6	8,3	223	2,6
8	10,9	284	2,6

Force-height-table for single convolution air springs

force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
155	3,1	4,3	5,6	6,9	8,0	9,2
125	5,0	6,8	8,9	10,8	12,2	13,8
95	6,3	8,2	10,7	13,0	15,0	17,0



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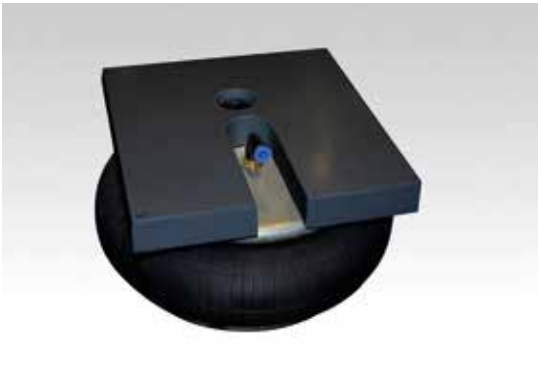
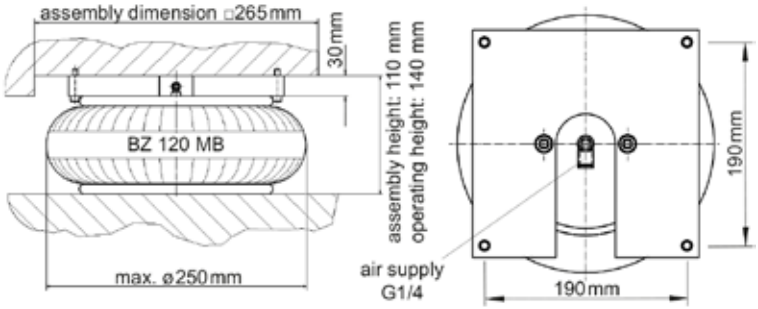
BZ 120 MB





Weight: **3,8 kg**
Restoring force for min. height: **≤ 200 N**

Air springs type BZ 120 MB

Below an adapter plate between the top and lower steel plate a rubber bellow is crimped in order to create a hermetically sealed air volume.
Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance.
The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate.
The types BZ 120 MB are equipped with internal bump stops.

Application:
active vibration isolation:

- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

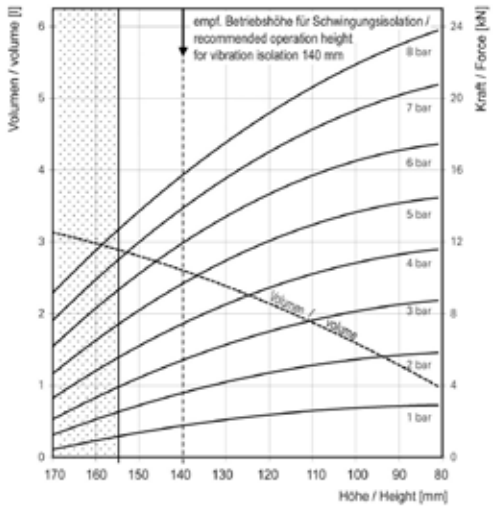
operating height incl. adapter plate = 140 mm and f_{err} = 1 Hz

Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** [Hz]
4	7,5	205	2,6
6	11,9	315	2,6
8	15,7	425	2,6

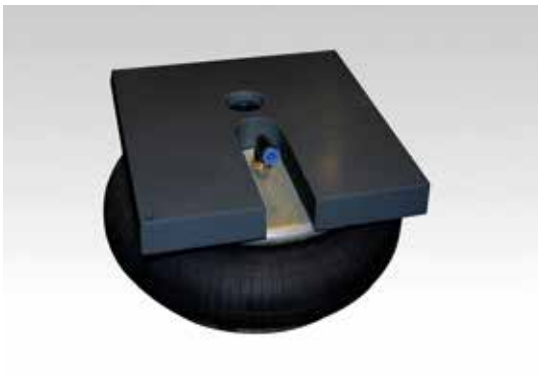
Force-height-table for single convolution air springs

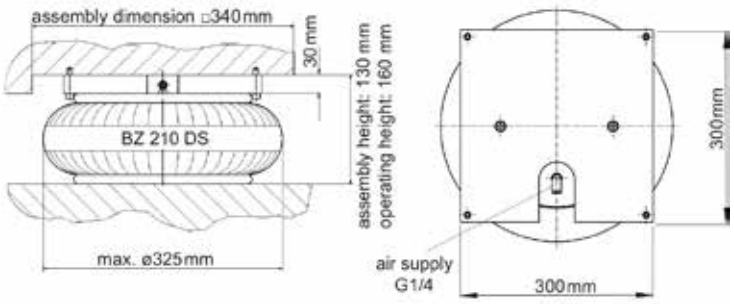
force in [kN]

Height [mm]	**3** [bar]	**4** [bar]	**5** [bar]	**6** [bar]	**7** [bar]	**8** [bar]
150	4,5	6,2	8,2	10,4	12,1	13,8
120	7,0	9,4	12,1	14,6	17,0	19,2
90	8,5	11,3	14,2	17,1	20,1	23,0



BZ 210 DS





Weight: **6,6 kg**
Restoring force for min. height: **≤ 300 N**

Air springs type BZ 210 DS

Below an adapter plate between the top and lower steel plate a rubber bellow is crimped in order to create a hermetically sealed air volume. Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance. The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate. The types BZ 210 DS are equipped with internal bump stops.

Application:
active vibration isolation:

- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

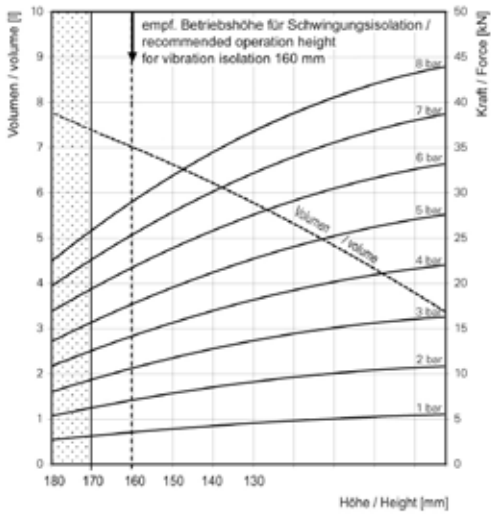
operating height incl. adapter plate = 160 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	14,2	329	2,4
6	21,8	458	2,3
8	29,0	587	2,3

Force-height-table for single convolution air springs

force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
160	10,7	14,2	17,8	21,8	25,4	29,0
150	11,9	15,7	19,6	23,8	27,8	31,8
140	12,7	16,9	21,1	25,8	30,1	34,4



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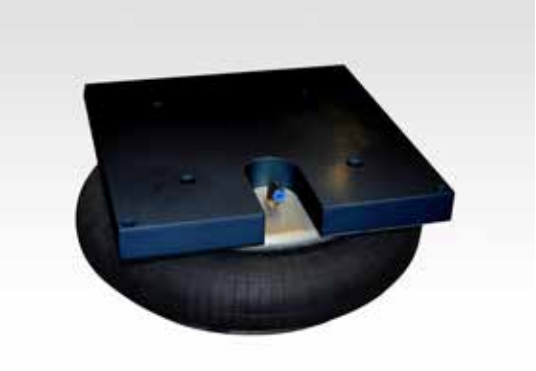
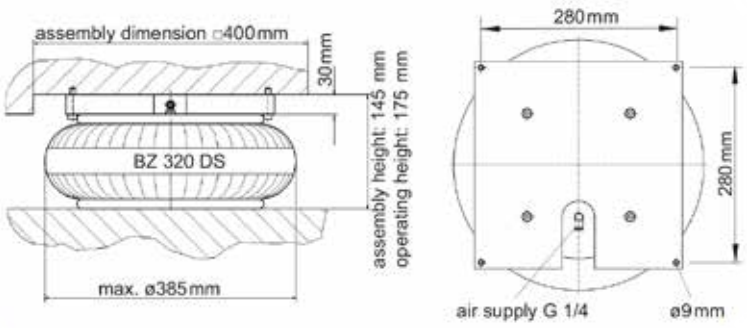
BZ 320 DS





Weight: **9,9 kg**
Restoring force for min. height: **≤ 300 N**

Air spring type BZ 320 DS

Below an adapter plate between the top and lower steel plate a rubber bellow is crimped in order to create a hermetically sealed air volume.
Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance.
The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate.
The types BZ 320 DS are equipped with internal bump stops.

Application:
active vibration isolation:

- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

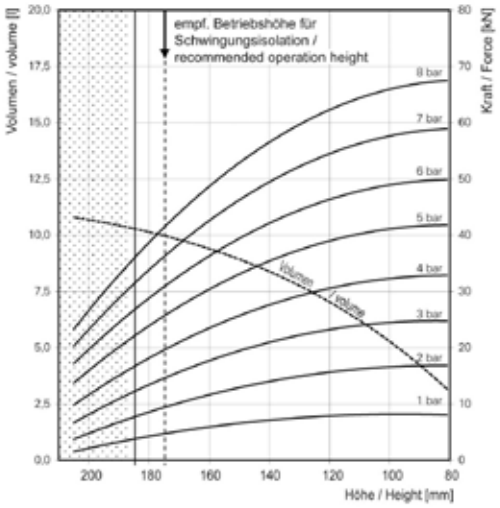
operating height incl. adapter plate = 175 mm and f_{err} = 1 Hz

Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** [Hz]
4	20,1	500	2,5
6	31,6	710	2,4
8	42,2	915	2,3

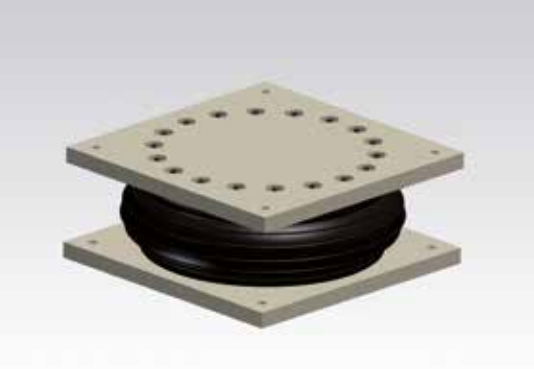
Force-height-table for single convolution air springs

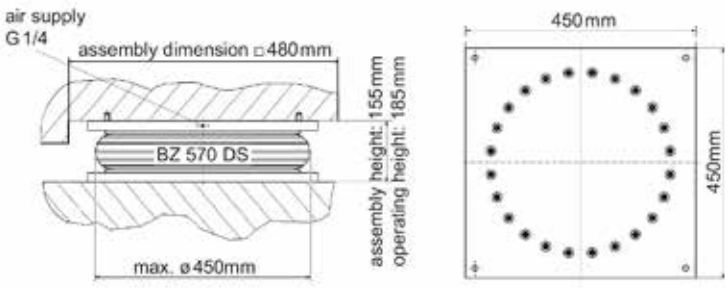
force in [kN]

Height [mm]	**3** [bar]	**4** [bar]	**5** [bar]	**6** [bar]	**7** [bar]	**8** [bar]
180	14,3	19,0	25,0	30,0	35,0	40,0
160	17,8	23,7	30,5	36,3	42,7	49,1
140	20,7	27,4	34,8	41,7	49,0	56,0



BZ 570 DS





Weight: **105 kg**
Restoring force for min. height: **≤ 100 N**

Air spring type BZ 570 DS

Between the top and lower plate a rubber bellow is crimped in order to create a hermetically sealed air volume. Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance. The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate.
The types BZ 570 DS are equipped with internal bump stops.

Application:
active vibration isolation:
- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

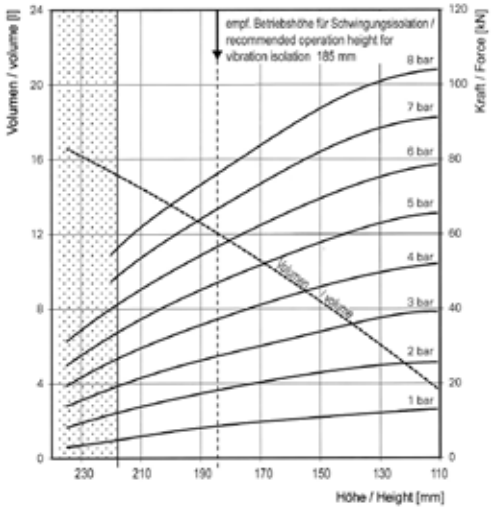
operating height incl. adapter plate = 185 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	38,8	767	2,2
6	58,7	1100	2,2
8	78,1	1453	2,1

Force-height-table for single convolution air springs

force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
190	25,8	35,8	45,1	54,3	63,9	73,4
180	28,2	38,4	48,2	58,5	68,8	78,3
170	30,0	41,2	51,7	62,3	73,5	83,5



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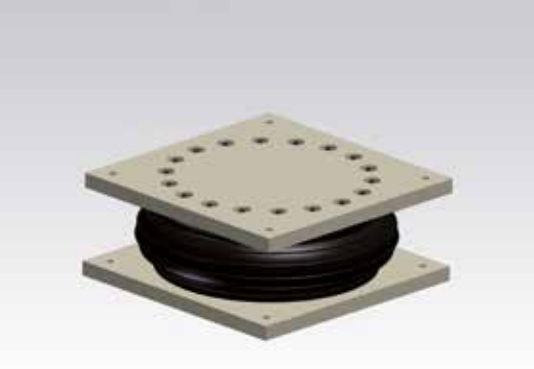
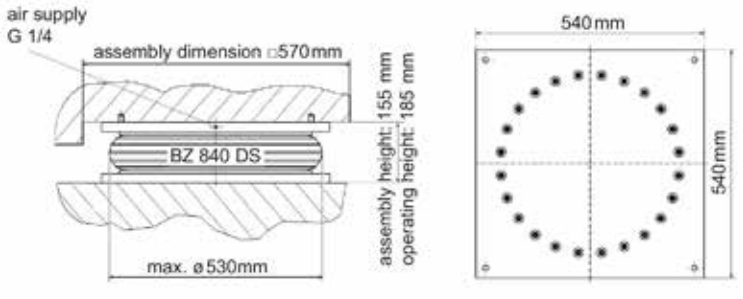
BZ 840 DS





Weight: **149 kg**
Restoring force for min. height: **≤ 89 N**

Air spring type BZ 840 DS

Between the top and lower plate a rubber bellow is crimped in order to create a hermetically sealed air volume. Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance. The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate.
The types BZ 840 DS are equipped with internal bump stops.

Application:
active vibration isolation:

- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation

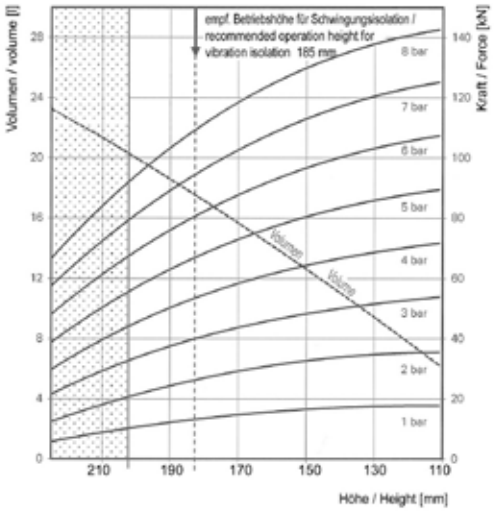
operating height incl. plates = 185 mm and f_{err} = 1 Hz

Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** [Hz]
4	52,1	1053	2,2
6	79,0	1524	2,2
8	107,6	1985	2,2

Force-height-table for single convolution air springs

force in [kN]

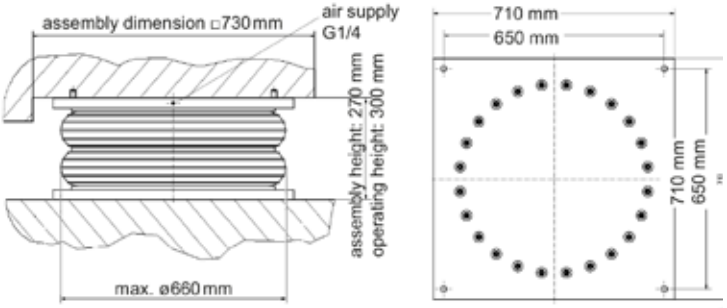
Height [mm]	**3** [bar]	**4** [bar]	**5** [bar]	**6** [bar]	**7** [bar]	**8** [bar]
190	37,4	50,2	63,0	76,1	89,2	102,4
180	40,3	54,0	67,6	81,4	95,5	111,8
170	43,0	57,6	72,3	86,7	101,8	119,0



Air spring type DBZ

Between the top and lower plate two rubber bellows are crimped in order to create a hermetically sealed air volume. Hence the rubber bellow has very good dynamic characteristics as well as good chemical resistance. The mounting threads are positioned in the top and lower plates; the air connection hose thread is positioned in the top plate.

DBZ 1370



Weight: **250 kg**
Restoring force for min. height: **≤ 445 N**

Dynamic spring data for vibration isolation

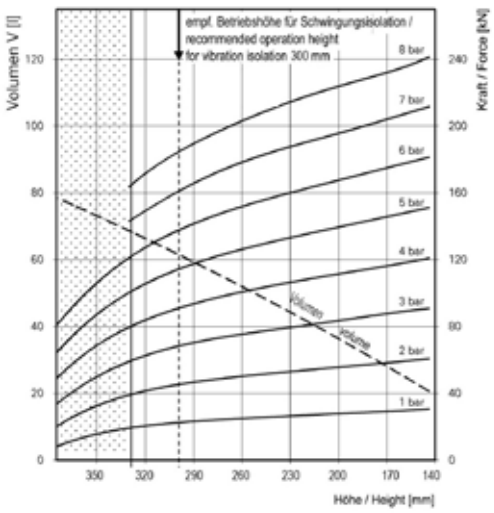
operating height incl. plates = 300 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	90,5	905	1,6
6	137,6	1299	1,5
8	186,1	1695	1,5

Force-height-table for single convolution air springs

force in [kN]

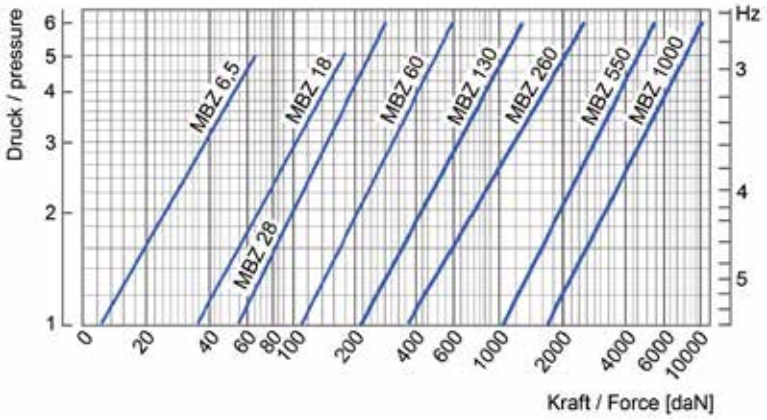
Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
300	68,0	90,7	113,9	137,2	160,5	184,0
260	74,8	100,3	125,8	151,3	179,0	202,8
220	81,4	108,4	135,8	163,3	190,7	218,2



Schiller GmbH

AIR SPRING TYPE MBZ

MBZ 28



Air spring type MBZ

This air spring type is a rubber metal design with bolted lower plate. The air chamber consists of special rubber material reinforced through additional steel rings. The rubber component has a very high elasticity combined with very good oil resistance and very good anti-aging characteristics. The hose is the same valve type like at vehicle tires.
According to height dimension and load the natural frequency of this component is between 3 Hz and 5 Hz. In case of airless mode the natural frequency is appr. 10 Hz. These air springs can be operated without level control system.

Application:
passive vibration isolation:

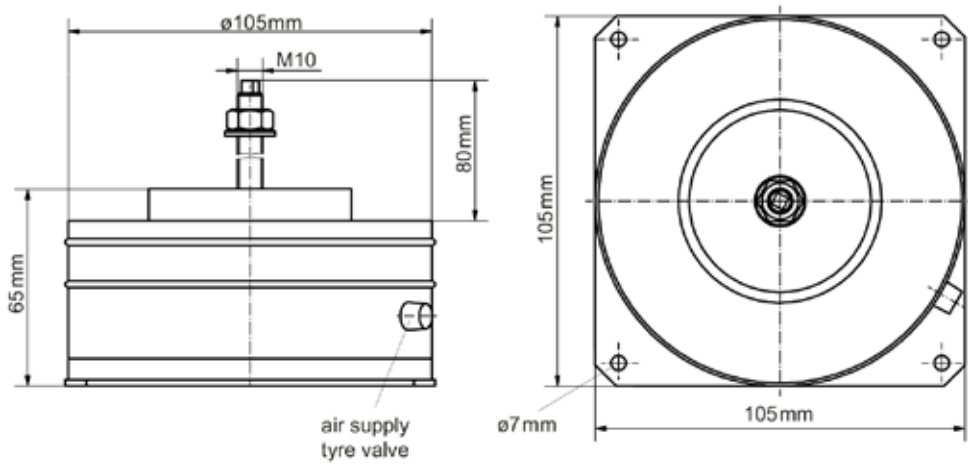
- metrological instruments
- electron microscopes
- measuring buildups

active vibration isolation:

- compressors *
- ventilators *

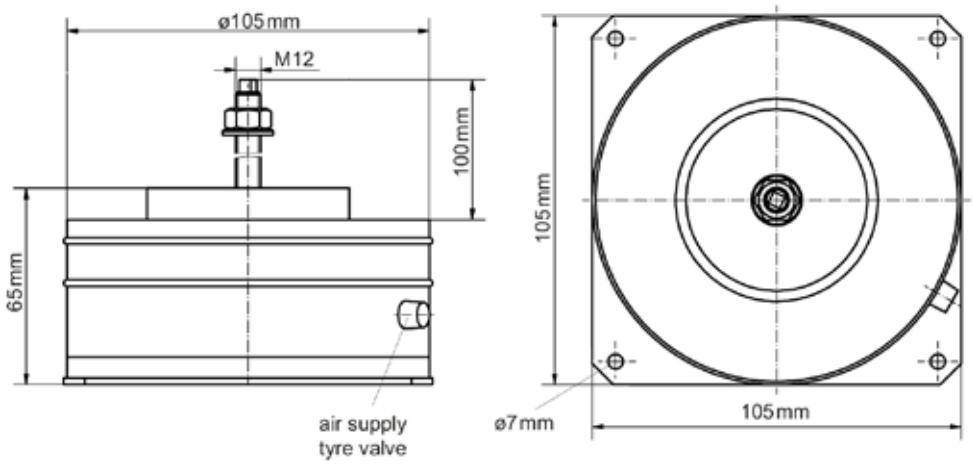
*= with low dynamic

AIR SPRING TYPE MBZ 6,5



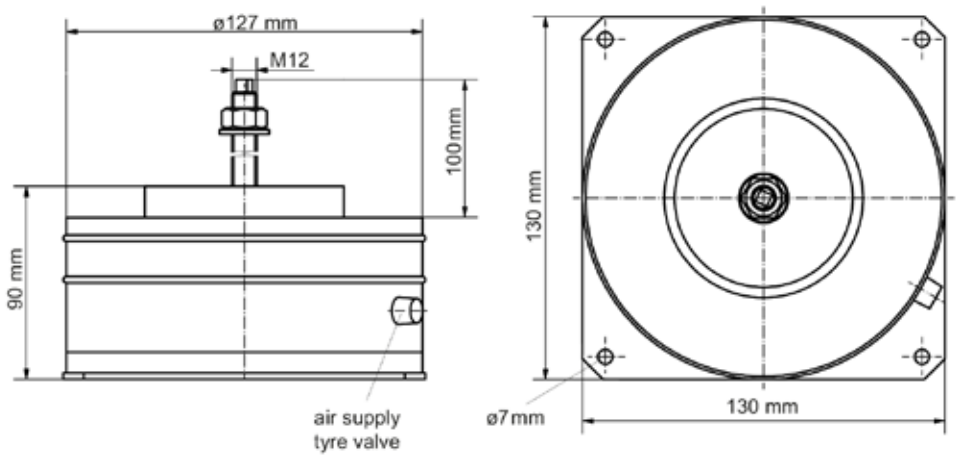
Load:	0,65 kN
Weight:	0,3 kg
Range:	±5 mm

AIR SPRING TYPE MBZ 18



Load:	1,8 kN
Weight:	0,7 kg
Range:	±5 mm

AIR SPRING TYPE MBZ 28



Load:	2,8 kN
Weight:	1 kg
Range:	±6 mm

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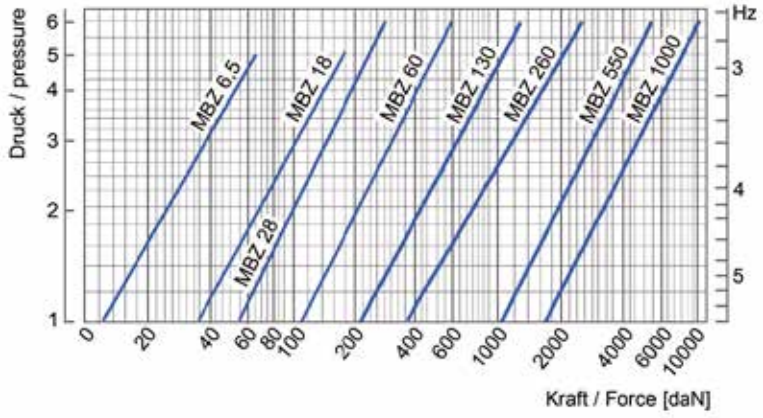
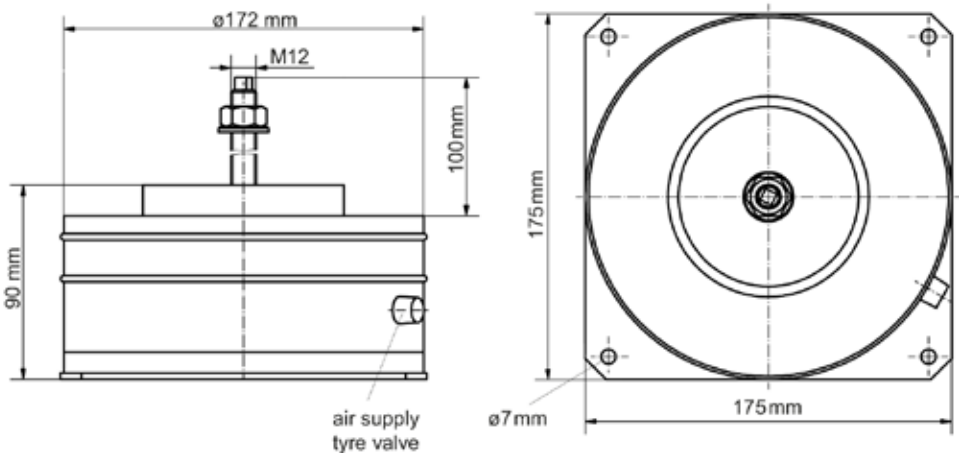
MBZ 60

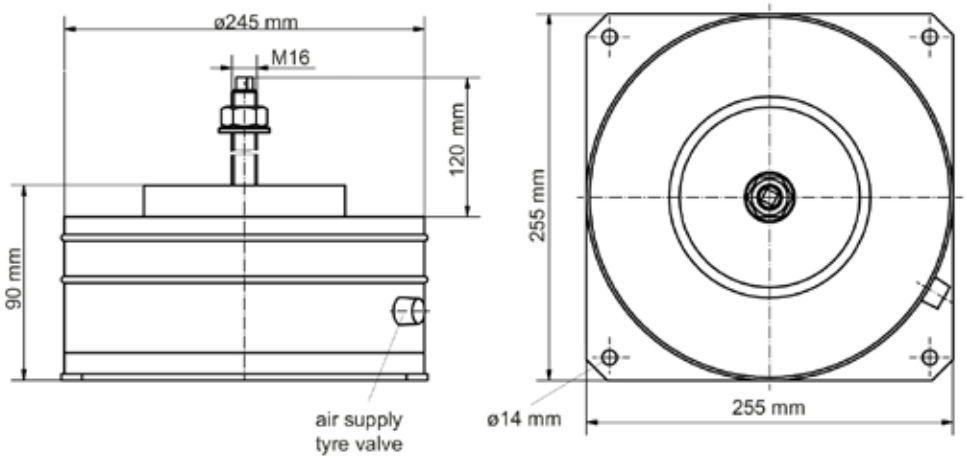


AIR SPRING TYPE MBZ 60



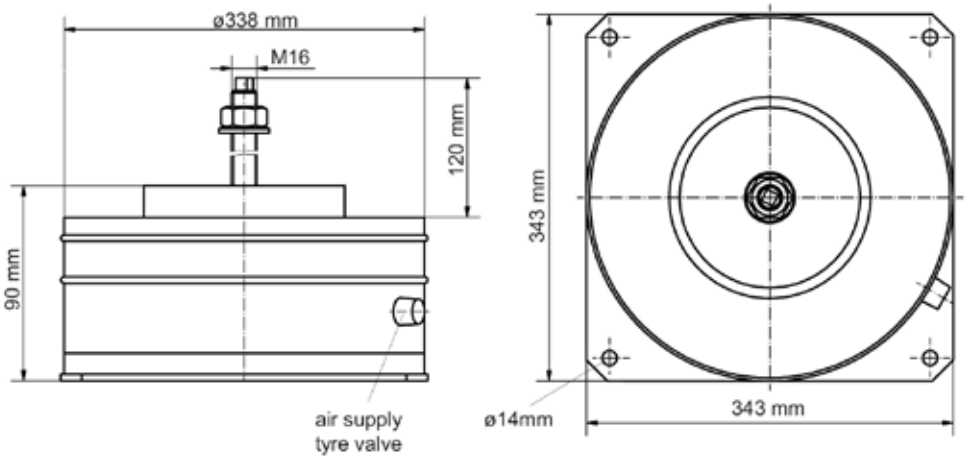
Load:	6 kN
Weight:	1,8 kg
Range :	±6 mm

AIR SPRING TYPE MBZ 130



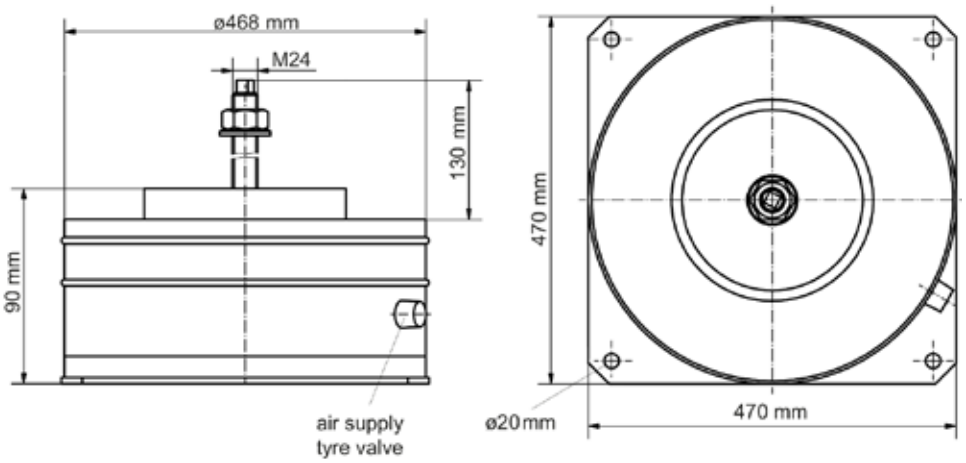
Load:	13 kN
Weight:	5,4 kg
Range:	±6 mm

AIR SPRING TYPE MBZ 260



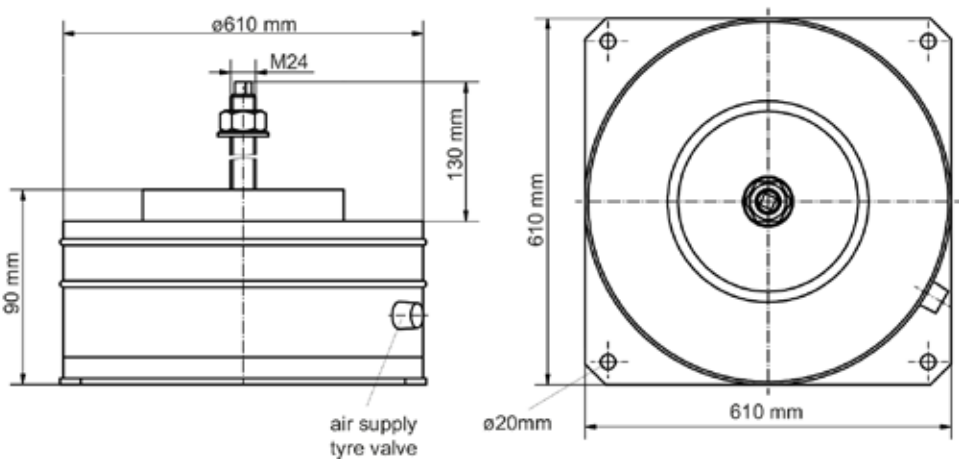
Load:	26 kN
Weight:	10,7 kg
Range:	±6 mm

AIR SPRING TYPE MBZ 550



Load:	55 kN
Weight:	29,1 kg
Range:	±6 mm

AIR SPRING TYPE MBZ 1000



Load:	100 kN
Weight:	38,6 kg
Range:	±6 mm

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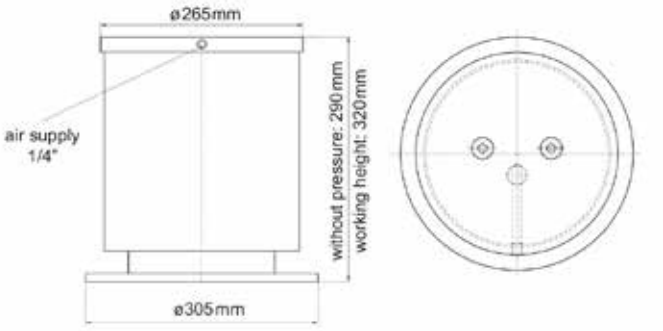
RB 220 SH



Air spring type RB ... SH

An elastomere bellow is fixed between a steel piston and the top plate from steel. The elastomere belt shows excellent dynamic properties and good resistance to chemicals. The air inlet is integrated into the top plate.
Furthermore the air spring is equipped with a support cap from steel and the according bottom plate. This construction realizes horizontal stability at minimum height.

Application:
passive vibration isolation:

- high request degree of isolation
- low dynamic
- measurement-technology equipments
- electron microscopes
- lasertechnical rig
- measuring setups

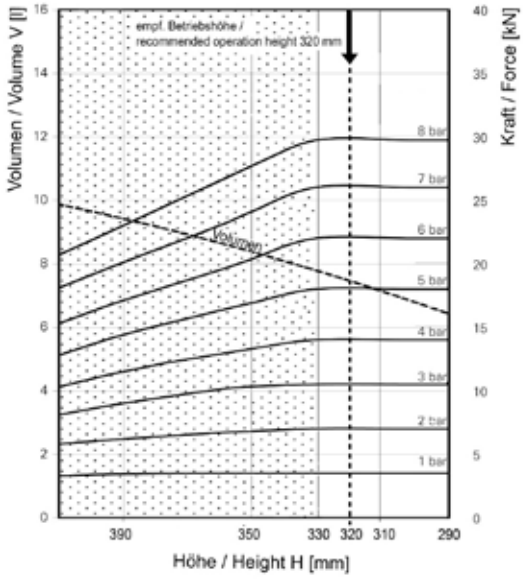
Weight: **31,5 kg**
Restoring force for min. height: **≤ 3100 N**
Range: **30 mm**

Dynamic spring data for vibration isolation
operating height = 320 mm and $_{ferr}$ = 1 Hz

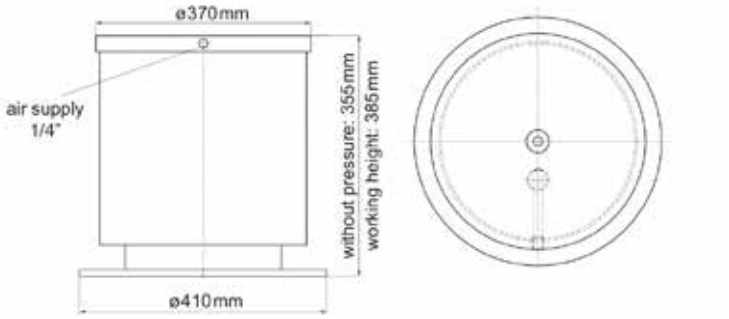
Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	14,0	123	1,5
6	22,0	192	1,5
8	29,7	245	1,5

Force-height-table for single convolution air springs
force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
330	10,5	14,0	18,0	22,0	26,0	29,7
300	10,5	14,0	18,0	22,0	26,0	29,7



RB 410 SH



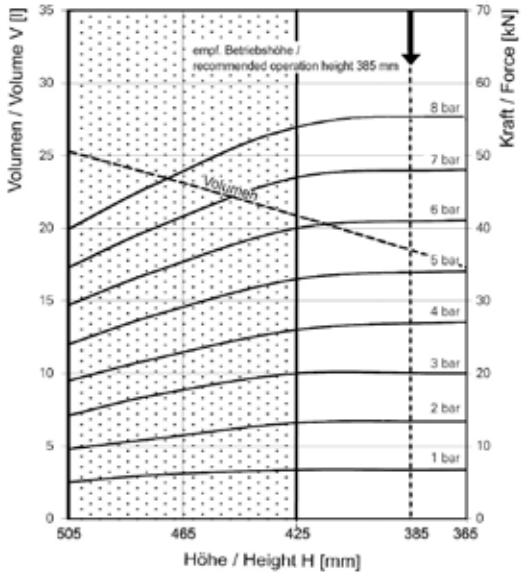
Weight: 54 kg
Restoring force for min. height: ≤ 6200 N
Range: 30 mm

Dynamic spring data for vibration isolation
operating height = 385 mm and ferr = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency [Hz]
4	26,5	152	1,2
6	40,5	242	1,2
8	54,2	318	1,2

Force-height-table for single convolution air springs
force in [kN]

Height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
425	20	26	33	40	47	54
375	20	27	34	41	48	55



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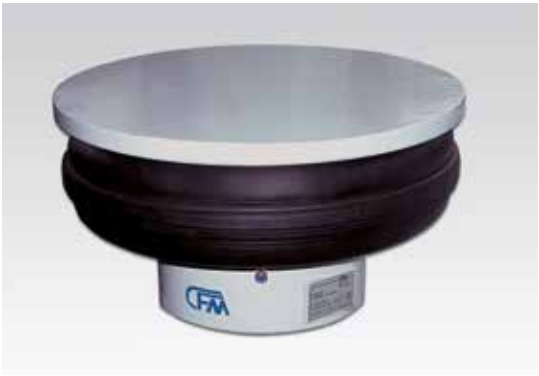
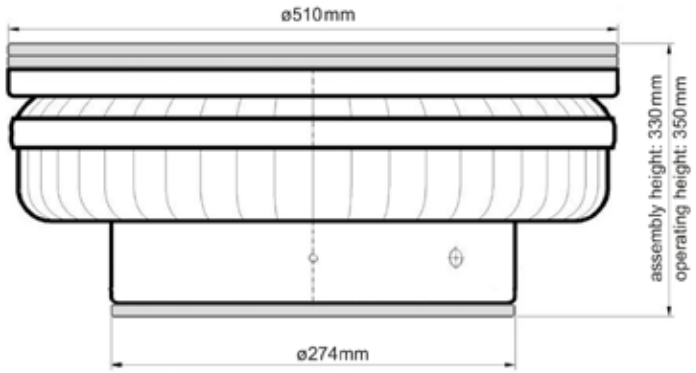
GRB 780





Air spring type GRB 780

A rolling rubber bellow is positioned between the top contact plate and the air spring pot.
Due to this concept very low vertical and lateral stiffness are realised in order to get much more lower natural frequencies in comparison to other air types.
In combination with shiftable additional air volumes natural frequencies of well below 1Hz can be realized. Due to this functional concept high spring displacement is reached as well.
Hence this product is nearly perfectly designed to be used in a wide spectrum especially in case of high dynamically operated machines and test bench systems.
Furthermore in the discipline of passive bearing functionality (i.e. electron scanning microscope) the GRB air spring is an outstanding product.

Application:

- heavy seismic masses (>20 tons)
- systems with high dynamic

Weight:	**28 kg**
Volume:	**ca. 24 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,03**
Recommended range:	**23 mm**

Dynamic spring data for vibration isolation
operating height incl. distance plates = 350 mm and f_{err} = 1 Hz

GRB 780 GRB 780 MD GRB 780 VD*		vertical		horizontal	
Pressure [bar]	**Load** [kN]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]
3	39	470	1,8	210	1,2
4	52	565	1,7	235	1,1
5	65	655	1,6	250	1,0
6	78	770	1,6	260	0,9
7	91	860	1,6	263	0,9
8	104	930	1,5	267	0,8

GRB 780 MD

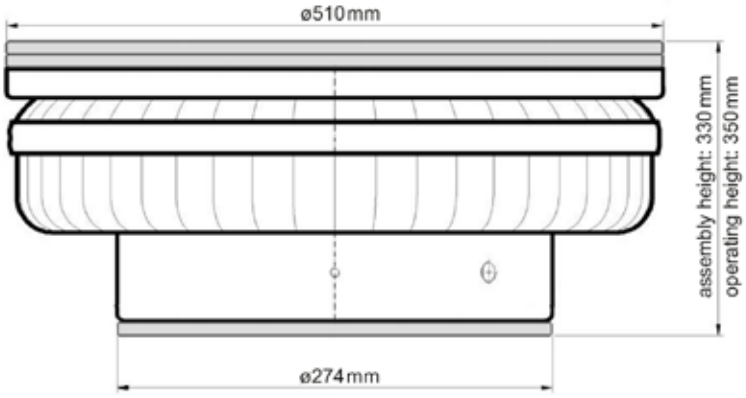
Air spring type GRB 780 MD

Integrated air damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>20 tons)
- systems with high dynamic



Weight:	**33 kg**
Volume:	**ca. 24 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,1**
Recommended range:	**18 mm**

GRB 780 VD

Air spring type GRB 780 VD

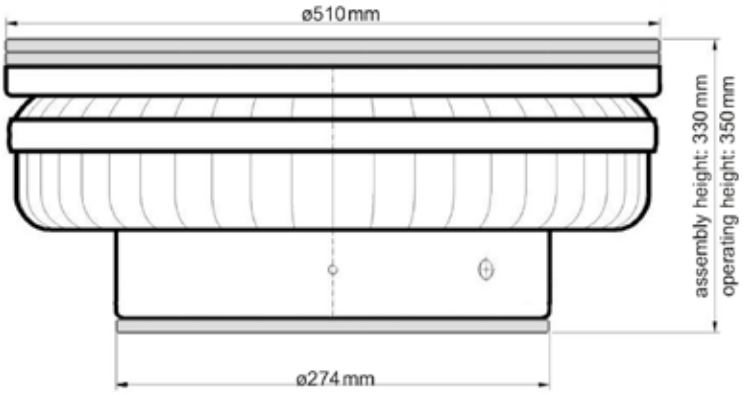
Integrated viscose damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>20 tons)
- systems with high dynamic

* GRB 780 VD: Value for stiffness and natural frequency on request.



Weight:	**32 kg**
Volume:	**ca. 21 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,15-0,25**
Recommended range:	**23 mm**

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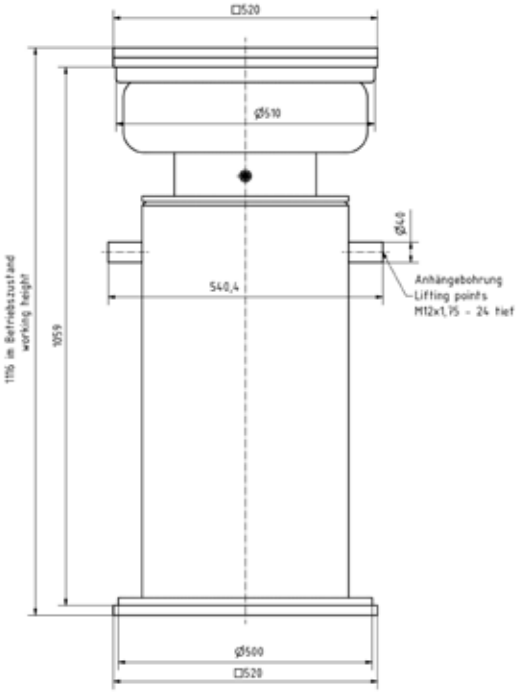
GRB 780 ZV VD



Air spring type GRB 780 ZV VD

The additional volume and a viscous damper are both integrated in the air spring. Its vertical damping ratio is 0.15.
The cover plate is made out of cast aluminium, the piston is a coated steel welding construction. Sealing surfaces are machined with a surface finish of approx. Rz 16 µm, all other surfaces are blasted.
The rolling lobe is made out of first class elastomer with a molded wire-reinforced ring. It shows good vertical and lateral spring properties.
Main advantages compared to conventional air springs:

- When used with T-shaped seismic masses, concrete supports below the air springs are not required.
- Less installation space is required due to the integrated additional volume.

Application:

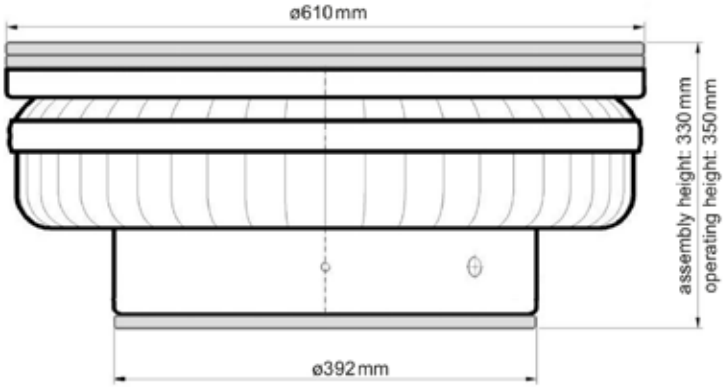
- suspension of large seismic masses (>20t)
- for passive vibration isolation
- high requirement for the degree of isolation.
- minor dynamics
- metrological devices
- laser technology equipment
- electron microscopes
- measurement setups

Weight: **232 kg / 512 lbs**
Volume: **ca. 78 l**
Air supply: **1/4"**
Damping ratio vertical: **0,15**
Recommended range: **23 mm**

Dynamic spring data for vibration isolation
operating height incl. distance plates = 1116 mm and $f_{fexcitation} = 1$ Hz

GRB 780 GRB 780 MD GRB 780 VD GRB 780 ZV VD*		vertical		horizontal	
Pressure [bar]	Load [kN]	Stiff-ness* [N/mm]	Natural frequency* (dyn.) [Hz]	Stiff-ness* [N/mm]	Natural frequency* (dyn.) [Hz]
3	39	210	1,2	300	1,4
4	52	235	1,1	315	1,2
5	65	250	1,0	335	1,2
6	78	260	0,9	350	1,1
7	91	263	0,9	365	1,0
8	104	267	0,8	375	1,0

GRB 1240



Air spring type GRB 1240

A rolling rubber bellow is positioned between the top contact plate and the air spring pot. Due to this concept very low vertical and lateral stiffness are realised in order to get much more lower natural frequencies in comparison to other air types.
In combination with shiftable additional air volumes natural frequencies of well below 1Hz can be realized. Due to this functional concept high spring displacement is reached as well.
Hence this product is nearly perfectly designed to be used in a wide spectrum especially in case of high dynamically operated machines and test bench systems.
Furthermore in the discipline of passive bearing functionality (i.e. electron scanning microscope) the GRB air spring is an outstanding product.

Application:

- heavy seismic masses (>30 tons)
- systems with high dynamic

Weight:	**43 kg**
Volume:	**ca. 40 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,03**
Recommended range:	**23 mm**

Dynamic spring data for vibration isolation
operating height incl. distance plates = 350 mm and f_{err} = 1 Hz

GRB 1240 GRB 1240 MD GRB 1240 VD*		vertical		horizontal	
Pressure [bar]	**Load** [kN]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]
[bar]	62	620	1,6	490	1,4
4	83	750	1,5	530	1,3
5	104	850	1,4	560	1,2
6	124	960	1,4	580	1,1
7	144	1045	1,4	610	1,1
8	165	1145	1,3	650	1,0

Schiller GmbH

Air spring type GRB 1240 MD

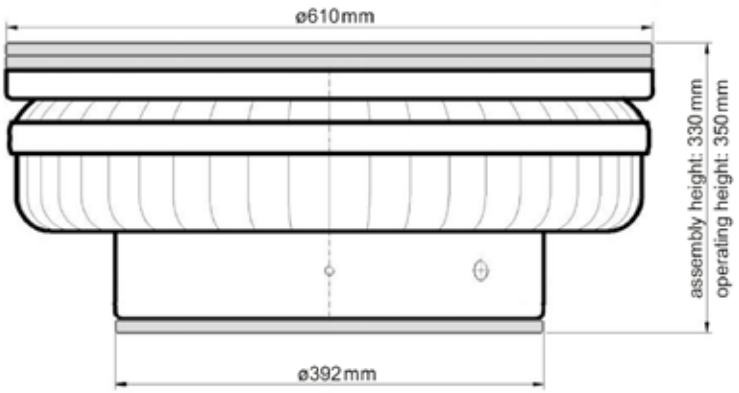
Integrated air damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>30 tons)
- systems with high dynamic

GRB 1240 MD



Weight:	**48 kg**
Volume:	**ca. 40 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,1**
Recommended range:	**18 mm**

Air spring type GRB 1240 VD

Integrated viscose damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

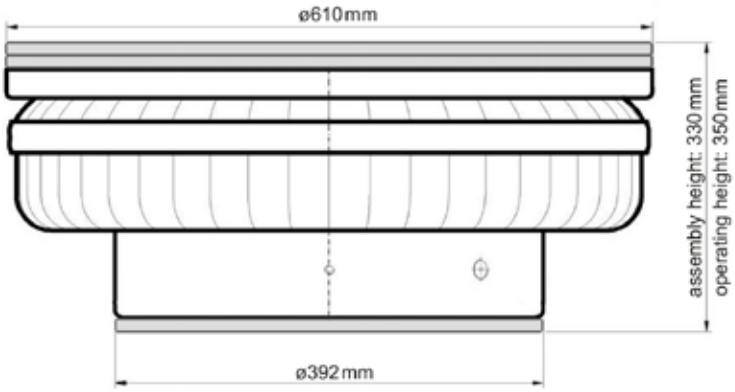
Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>30 tons)
- systems with high dynamic

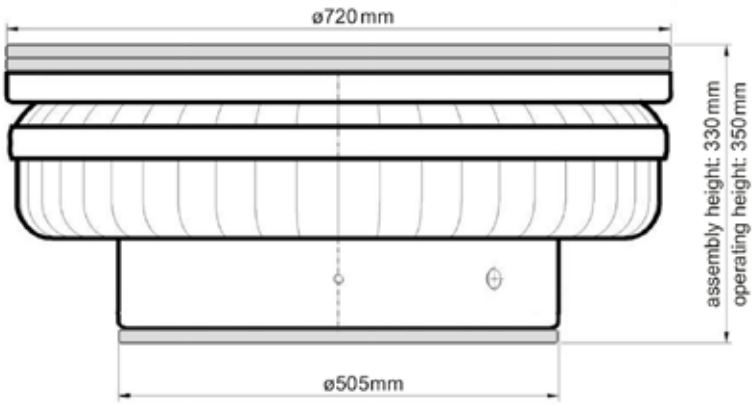
* GRB 1240 VD: Value for stiffness and natural frequency on request.

GRB 1240 VD



Weight:	**50 kg**
Volume:	**ca. 34 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,15-0,25**
Recommended range:	**23 mm**

GRB 1820



Air spring type GRB 1820

A rolling rubber bellow is positioned between the top contact plate and the air spring pot. Due to this concept very low vertical and lateral stiffness are realised in order to get much more lower natural frequencies in comparison to other air types.
In combination with shiftable additional air volumes natural frequencies of well below 1Hz can be realized. Due to this functional concept high spring displacement is reached as well.
Hence this product is nearly perfectly designed to be used in a wide spectrum especially in case of high dynamically operated machines and test bench systems.
Furthermore in the discipline of passive bearing functionality (i.e. electron scanning microscope) the GRB air spring is an outstanding product.

Application:

- heavy seismic masses (>45 tons)
- systems with high dynamic

Weight:	**62 kg**
Volume:	**ca. 66 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,03**
Recommended range:	**23 mm**

Dynamic spring data for vibration isolation
operating height incl. distance plates = 350 mm and f_{err} = 1 Hz

GRB 1820 GRB 1820 MD GRB 1820 VD*		vertical		horizontal	
Pressure [bar]	**Load** [kN]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]
3	92	820	1,5	500	1,2
4	122	990	1,4	630	1,2
5	153	1150	1,4	730	1,1
6	182	1270	1,3	790	1,1
7	214	1400	1,3	830	1,0
8	244	1530	1,3	870	1,0

Schiller GmbH

GRB 1820 MD

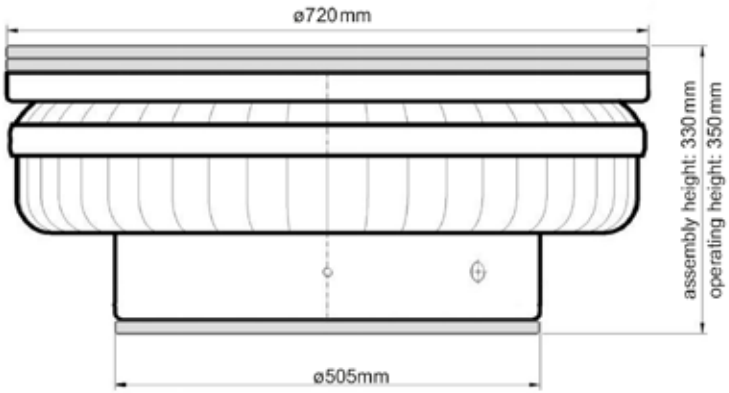
Air spring type GRB 1820 MD

Integrated air damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>45 tons)
- systems with high dynamic



Weight:	**67 kg**
Volume:	**ca. 66 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,1**
Recommended range:	**18 mm**

GRB 1820 VD

Air spring type GRB 1820 VD

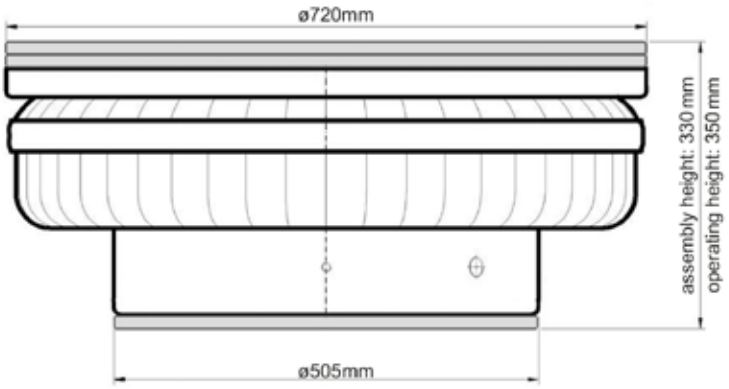
Integrated viscose damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

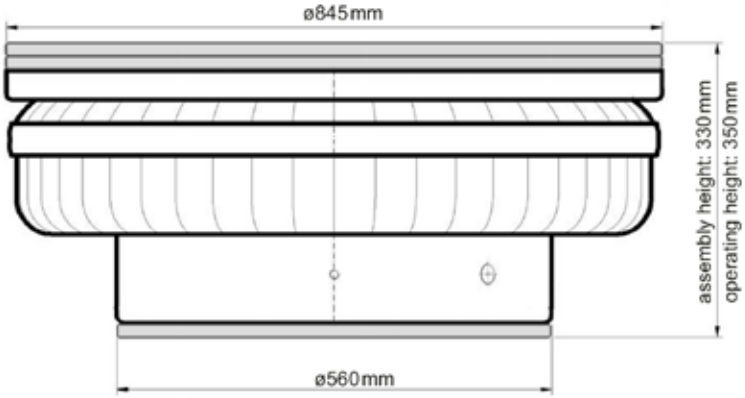
Application:
- heavy seismic masses (>45 tons)
- systems with high dynamic

* GRB 1820 VD: Value for stiffness and natural frequency on request.



Weight:	**74 kg**
Volume:	**ca. 54 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,15-0,25**
Recommended range:	**23 mm**

GRB 2480



Air spring type GRB 2480

A rolling rubber bellow is positioned between the top contact plate and the air spring pot.
Due to this concept very low vertical and lateral stiffness are realised in order to get much more lower natural frequencies in comparison to other air types.
In combination with shiftable additional air volumes natural frequencies of well below 1Hz can be realized.
Due to this functional concept high spring displacement is reached as well.
Hence this product is nearly perfectly designed to be used in a wide spectrum especially in case of high dynamically operated machines and test bench systems.
Furthermore in the discipline of passive bearing functionality (i.e. electron scanning microscope) the GRB air spring is an outstanding product.

Application:

- heavy seismic masses (>65 tons)
- systems with high dynamic

Weight:	**84 kg**
Volume:	**ca. 83 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,03**
Recommended range:	**23 mm**

Dynamic spring data for vibration isolation
operating height incl. distance plates = 350 mm and f_{err} = 1 Hz

GRB 2480 GRB 2480 MD GRB 2480 VD*		vertical		horizontal	
Pressure [bar]	**Load** [kN]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]	**Stiff-ness*** [N/mm]	**Natural frequency*** (dyn.) [Hz]
3	125	1170	1,6	450	1,0
4	165	1440	1,5	480	0,9
5	205	1730	1,5	490	0,8
6	248	1960	1,4	500	0,7
7	287	2180	1,4	505	0,7
8	329	2420	1,4	510	0,6

Schiller GmbH

GRB 2480 MD

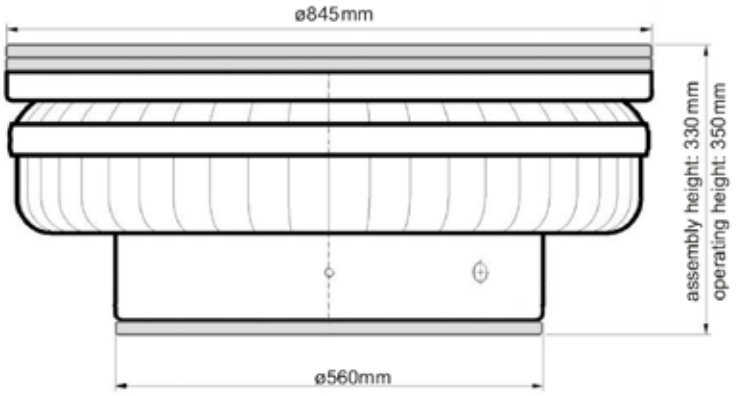
Air spring type GRB 2480 MD

Integrated air damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Application:
- heavy seismic masses (>65 tons)
- systems with high dynamic



Weight:	**89 kg**
Volume:	**ca. 83 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,1**
Recommended range:	**18 mm**

GRB 2480 VD

Air spring type GRB 2480 VD

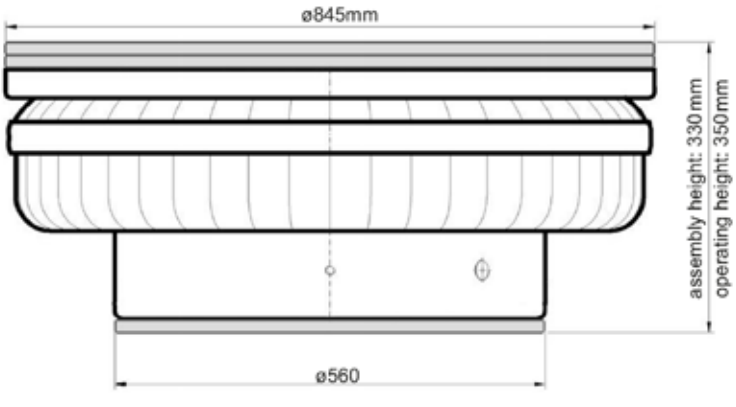
Integrated viscose damping
with an integrated separating plate the air volume is divided. By the throttle effect the damping is realised.

Cover plate and piston
are made from cast aluminium. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.

Rolling lobe with belt
the rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

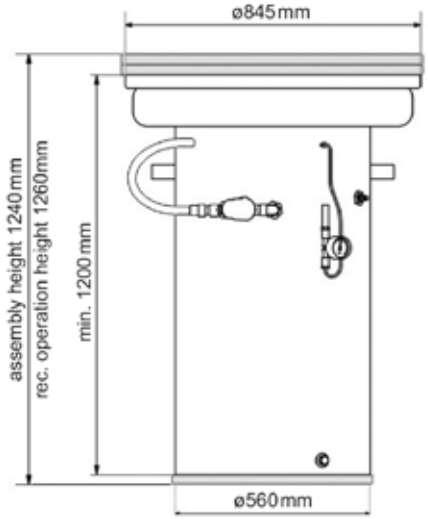
Application:
- heavy seismic masses (>65 tons)
- systems with high dynamic

* GRB 2480 VD: Value for stiffness and natural frequency on request.



Weight:	**100 kg**
Volume:	**ca. 67 l**
Air supply:	**1/4”**
Damping ratio vertical:	**0,15-0,25**
Recommended range:	**23 mm**

GRB 2480-1200 ZV



Weight:	**340 kg**
Volume:	**ca. 278 l**
Air supply:	**1/4”**
Recommended range:	**23 mm**
Damping ratio vertical:	**on request**

Air spring type GRB 2480-1200 ZV

GRB 2480-1200 ZV is an air spring with integrated additional volume with the option to switch it on or off.
The cover plate is made of cast aluminium and piston is made of steel. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.
The rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Advantages over conventional air springs are:

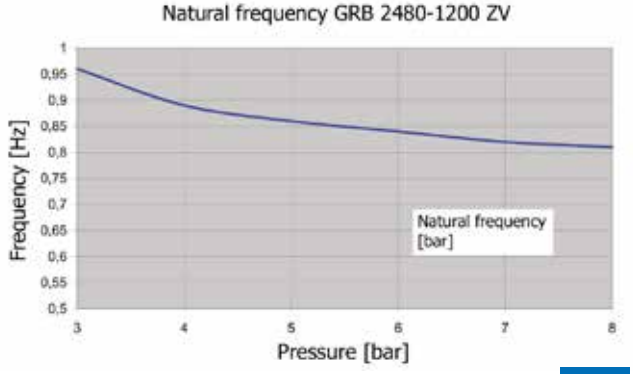
- At T-shaped foundations shoulders are not necessary
- Less required space, because of the integrated additional volume.

Application:

- Large foundations (>65 tons)
- Systems with higher dynamics

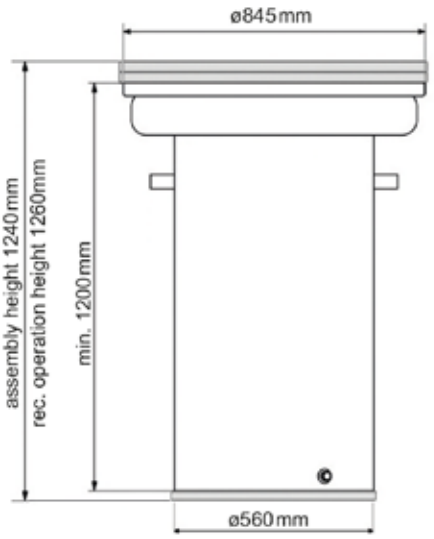
Dynamic spring data for vibration isolation
operating height incl. distance plates= 1260 mm und f_{err} = 1 Hz

		with additional volume			without additional volume		
Pressure [bar]	**Load** [kN]	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping factor**	**Stiffness** [N/mm]	**Natural frequency** (dyn.) [Hz]	**Damping factor**
3	125	394	0,96	0,005	450	1,6	0,002
4	165	471	0,89	0,005	480	1,5	0,002
5	205	549	0,86	0,005	490	1,5	0,002
6	248	632	0,84	0,005	500	1,4	0,002
7	287	715	0,82	0,005	505	1,4	0,002
8	329	790	0,81	0,005	510	1,4	0,002



Schiller GmbH

GRB 2480-1200 ZV-AV



Weight:	**329 kg**
Volume:	**ca. 278 l**
Air supply:	**1/4”**
Recommended range:	**23 mm**
Damping ratio vertical:	**on request**

Air spring type GRB 2480-1200 ZV-AV

GRB 2480-1200 ZV-AV is an air spring with integrated additional volume.
The cover plate is made of cast aluminium and piston is made of steel. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.
The rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Advantages over conventional air springs are:

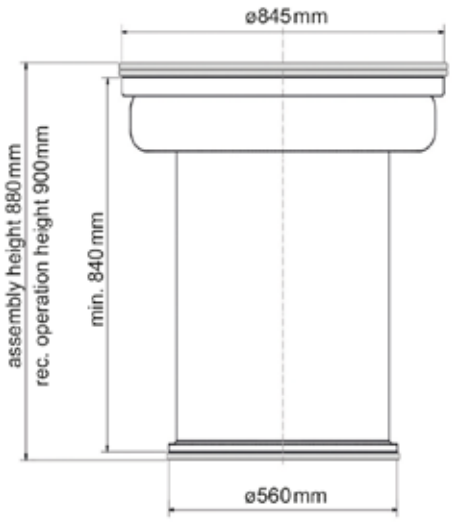
- At T-shaped foundations shoulders are not necessary
- Less required space, because of the integrated additional volume.

Application:
- Large foundations (>65 tons)
- Systems with higher dynamics

Dynamic spring data for vibration isolation
operating height incl. distance plates = 1260 mm und f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency (dyn.) [Hz]
3	125	394	0,96
4	165	471	0,89
5	205	549	0,86
6	248	632	0,84
7	287	715	0,82
8	329	790	0,81

GRB 2480-840



Weight:	**245 kg**
Volume:	**ca. 196 l**
Air supply:	**1/4”**
Recommended range:	**23 mm**
Damping ratio vertical:	**on request**

Air spring type GRB 2480-840

GRB 2480-840 is an air spring with integrated additional volume.
The cover plate is made of cast aluminium and piston is made of steel. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.
The rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Advantages over conventional air springs are:

- At T-shaped foundations shoulders are not necessary
- Less required space, because of the integrated additional volume.

Application:
- Large foundations (>65 tons)
- Systems with higher dynamics

Dynamic spring data for vibration isolation
operating height incl. distance plate = 900 mm and f_{err} = 1 Hz

Pressure [bar]	Load [kN]	Stiffness [N/mm]	Natural frequency (dyn.) [Hz]
3	125	604	1,11
4	165	688	1,03
5	205	807	1,00
6	248	888	0,95
7	287	998	0,94

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