Schiller GmbH

Vibration Isolation Systems

Components

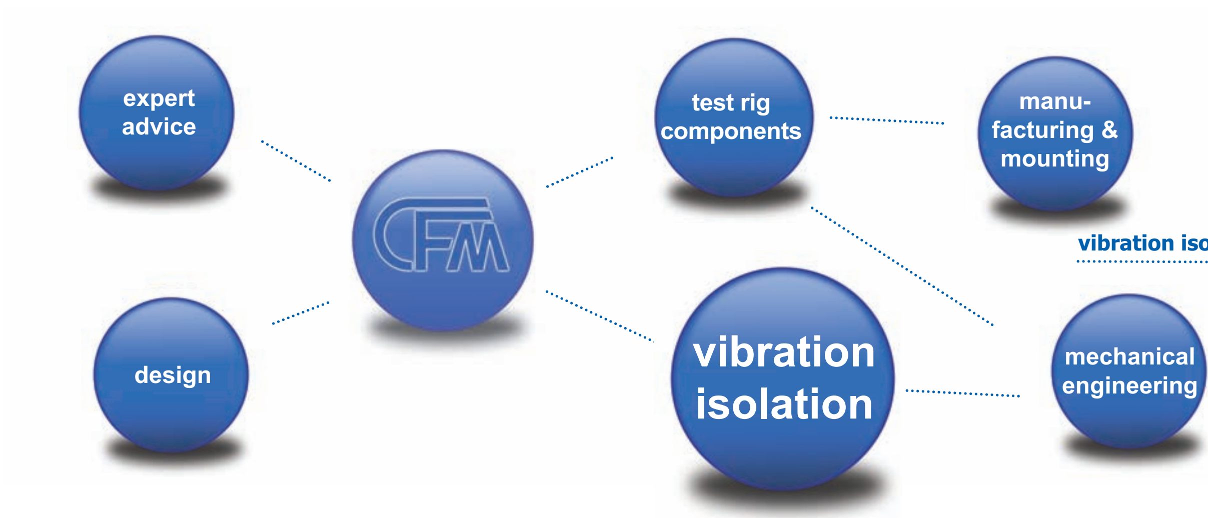
Vibration Isolation

Air springs
Level Control Systems

Excellence and Experience

CFM Schiller looks back on more than 30 years' experience in the areas of test rigs and mechanical engineering. We offer our clients modern, reliable and fairly-priced products of the highest quality!

We employ all our innovative and technical expertise to achieve economic success and to serve the increasing demands of our clients. Our high-frequency load frames are manufactured on our premises using state-of-the-art manufacturing technology.



vibration isolation systems

Our company operations displayed in form of a sphere model

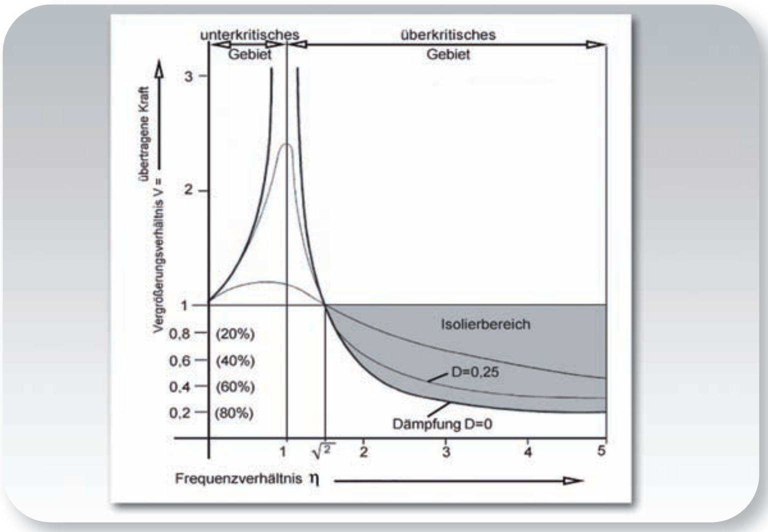
Long-term partnerships with carefully selected partners ensure a consistently high standard of quality. Our aim is to entertain long-lasting business relationships based on co-operation with satisfied customers. Owing to the company culture, which is based on mutual support, open communication and a flat hierarchy, our employees guarantee our success. CFM Schiller operates on a global scale and is renowned for delivering the best possible solution of the highest quality.

CFM Schiller GmbH

Principal office in Roetgen

Selecting the appropriate vibration isolation is fundamental in order to obtain the best possible isolation effectiveness. The crucial factor here is the relationship of excitation frequency and natural frequency of the spring element.

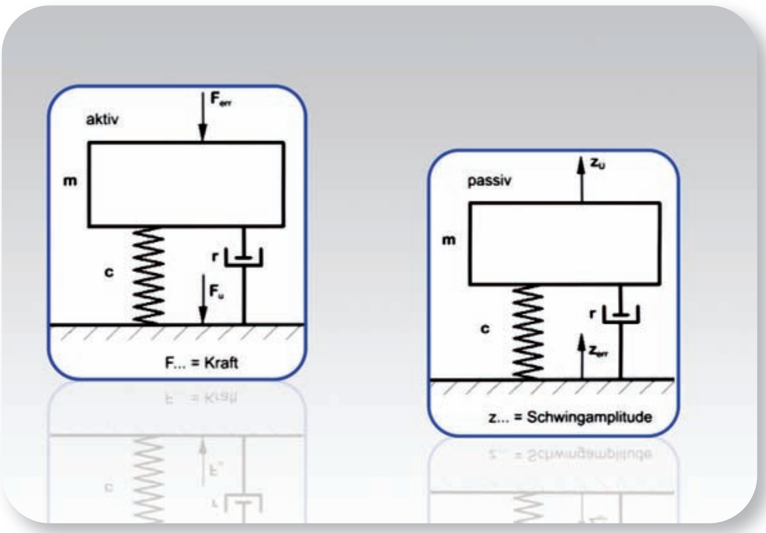
$$\eta = \frac{Erregerfrequenz}{Eigenfrequenz} = \frac{f_{err}}{f_o}$$



Effective isolation starts at a relationship of η=√2. As a rule, the frequency tuning relationship is adjusted to a value between 3 and 4. In the case of particularly high requirements, it is possible to achieve higher values, which, however, will approach the economical limit.

The isolation efficiency is calculated as follows:

$$J = \frac{\left(\frac{f_{err}}{f_o}\right)^2 - 2}{\left(\frac{f_{err}}{f_o}\right)^2 - 1} \bullet 100\%$$



active and passive vibration isolation

Air springs systems

CFM Schiller offers clients a broad spectrum of vibration isolation elements for their individual applications. The air springs series GRB 2480-1200 ZV have an integrated capacity reservoir with a

Air springs with and without integrated capacity reservoir

pneumatic activation option. The piston is made of steel and the cover plate aluminium. The belted rubber bellows are manufactured from high-quality elastomer materials with a vulcanized wire belt. It therefore possesses sound vertical and lateral characteristics.

Membrane air springs seal air in a reservoir by means of a rubber membrane. The cover plate above the membrane carries the object that must be vibration isolated. Increasing air pressure in this sealed volume increases the force onto the membrane. If this force is greater than the mass force of the load on top, the membrane arches upward and lifts the mass. By means of a level control you prevent that the mass is being lifted too high and thereby the membrane damaged.
In comparison to our single convolution air springs of the series BZ the membrane air springs MAS have a higher horizontal stiffness and in addition the air damping can be controlled by a throttle.

air springs

Membrane air springs series MAS

air springs

Level control units

We employ level controls for the automatic level control of air spring systems to suit different requirements, from the simple mechanical solution MC 300 S to the active position control with microprocessor µC300. All of them are 3-point control systems.

MC 300-S

The MC300 is a mechanical pneumatic level control unit for applications wich does not require external monitoring.

- 3-point control system with maintenance and control unit
- Control accuracy ±0.1 mm

LC 300/302

Electro-pneumatic level control system offering external equipment monitoring.

- Level position of all 3 systems
- Inlet pressures
- Raising and lowering, using key switches on the control unit
- Switching the natural frequency of the air spring suspension on the control unit (LC 302 only)
- Control accuracy ±0.1 mm

EC 300

Electronic-pneumatic level control unit with analogue position encoders and electric control valves. It also offers external equipment monitoring.

- Control accuracy ±0.05 mm

µC 300

Electronic-pneumatic active position control system with micro-processor and controller. This position control system is used to avoid resonance step-ups and minimize the time for vibration. At the same time this significantly reduces the oscillation damping time.
Using the µC300 can significantly reduce seismic masses. Please consult our product brochure µC300 for more details.

level control

Level control system EC 301

Membrane air spring MAS 25/ MAS 25-C

Air springs type MAS

Membrane air springs seal air in a reservoir by means of a rubber membrane. The cover plate above the membrane carries the object that must be vibration isolated. Increasing air pressure in this sealed volume increases the force onto the membrane. If this force is greater than the mass force of the load on top, the membrane arches upward and lifts the mass. By means of a level control you prevent that the mass is being lifted too high and thereby the membrane damaged.
In comparison to our single convolution air springs of the series BZ the membrane air springs MAS have a higher horizontal stiffness and in addition the air damping can be controlled by a throttle.

Application:

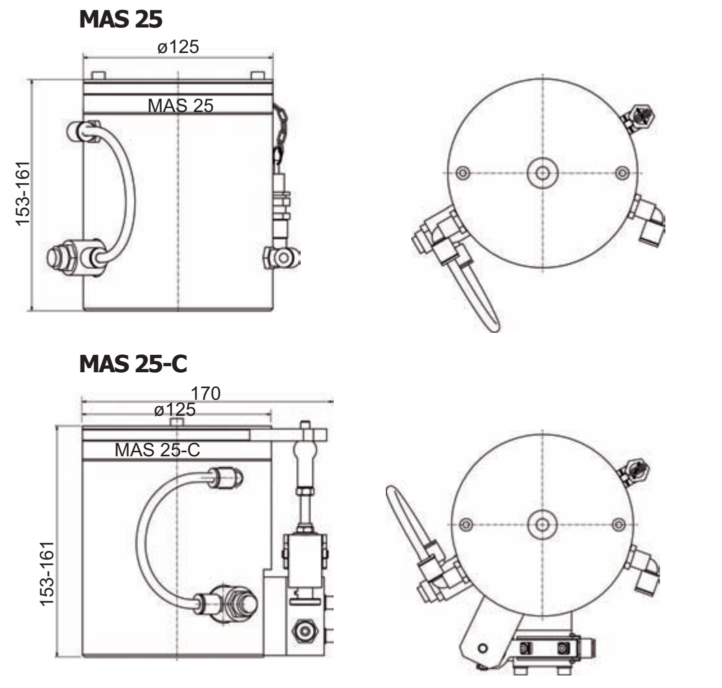
passive vibration isolation:

- metrological instruments
- electron microscopes
- equipment in laser technology
- measuring buildups

active vibration isolation:

- machines *
- motor test rig *
- gear test rig *

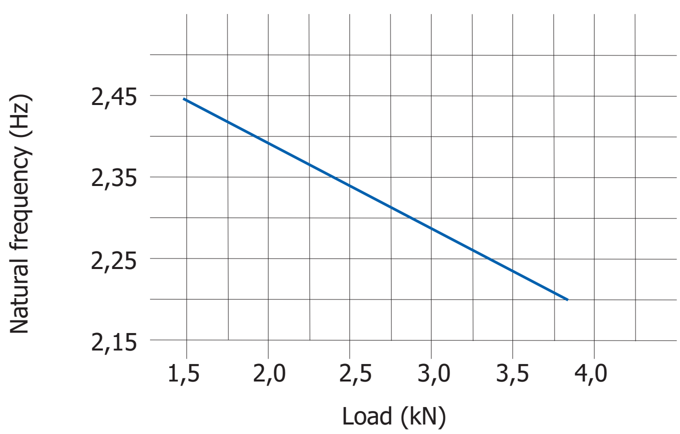
* = with low dynamic



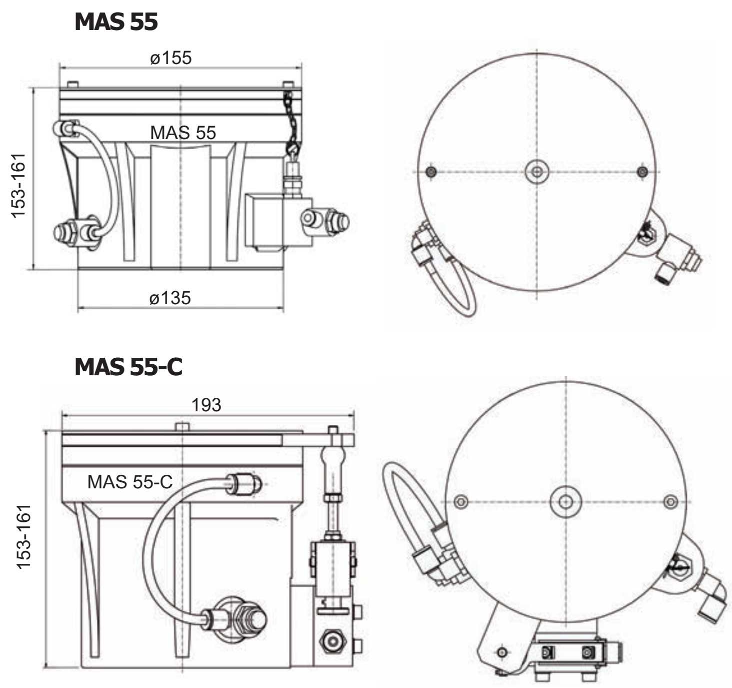
Weight: MAS 25 5 kg
MAS 25-C 5,5 kg

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

		vertical		
pressure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	1,9	0,44	2,4	0,05 - 0,1
6	2,8	0,61	2,3	0,05 - 0,1



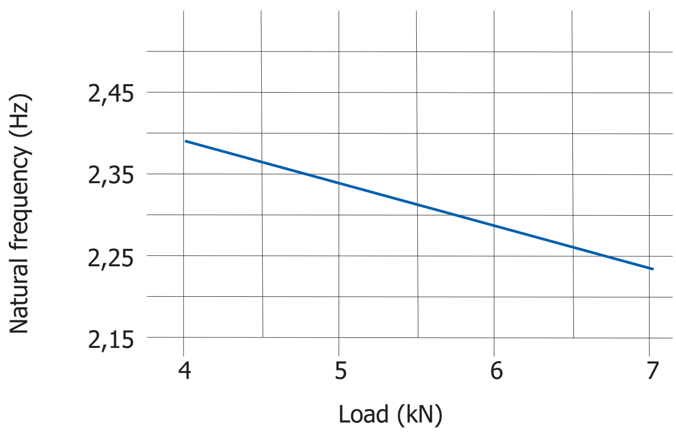
Membrane air spring MAS 55/ MAS 55-C



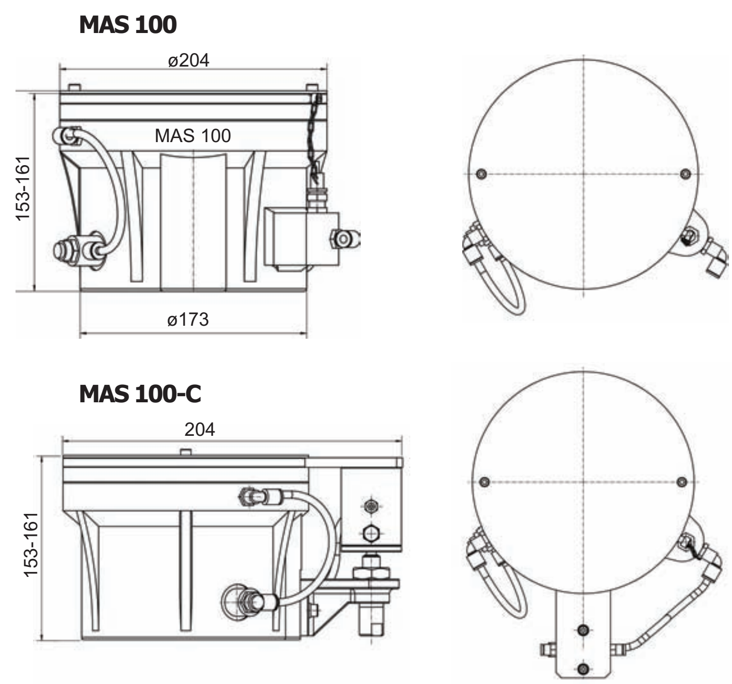
Weight:	MAS 55	6 kg
	MAS 55-C	6,5 kg

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

		vertical		
pressure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	3,87	0,89	2,4	0,05 - 0,1
6	5,86	1,24	2,3	0,05 - 0,1



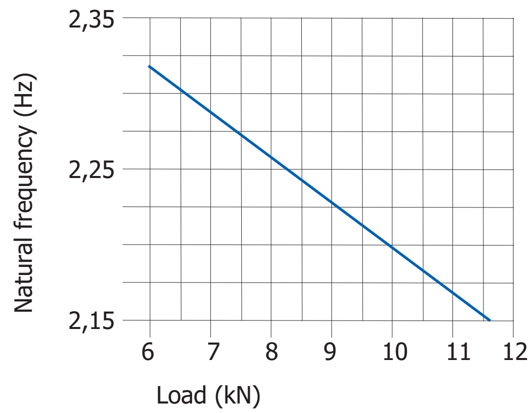
Membrane air spring MAS 100/ MAS 100-C



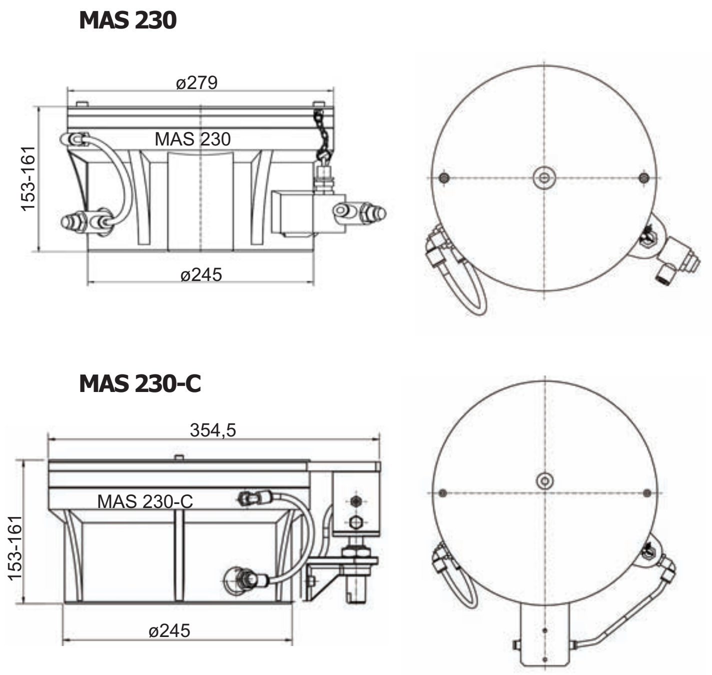
Weight: MAS 100 10,5 kg
MAS 100-C 11,0 kg

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

		vertical		
prssure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	6,7	1,28	2,4	0,1 - 0,2
6	10,1	1,79	2,1	0,1 - 0,2



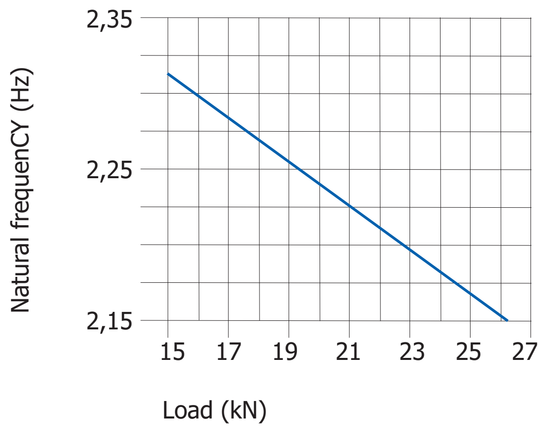
Membrane air spring MAS 230/ MAS 230-C



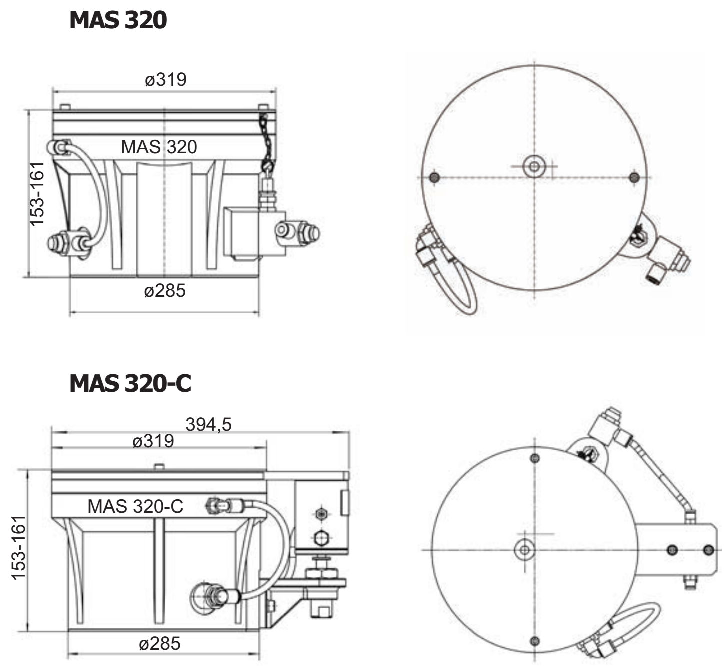
Weight: MAS 230 15,5 kg
MAS 230-C 16,0 kg

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

		vertical		
pressure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	15,3	3,14	2,4	0,1 - 0,2
6	23,1	4,0	2,1	0,1 - 0,2



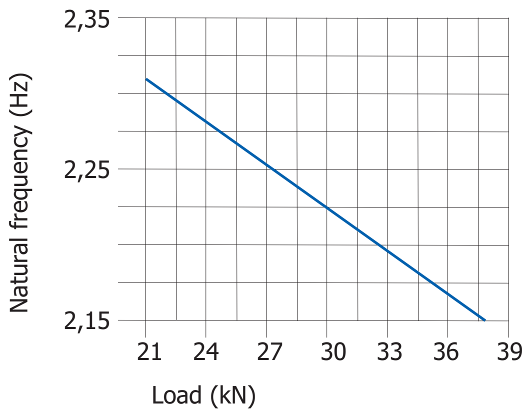
Membrane air spring MAS 320/ MAS 320-C



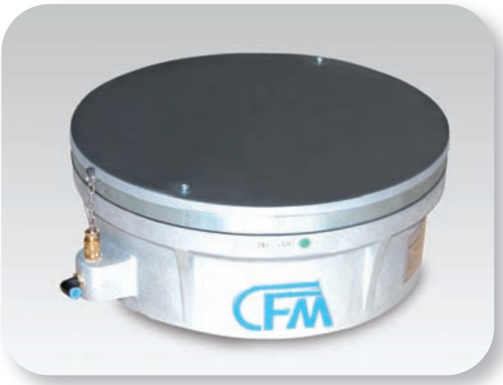
Weight: MAS 320 19,0 kg
MAS 320-C 19,5 kg

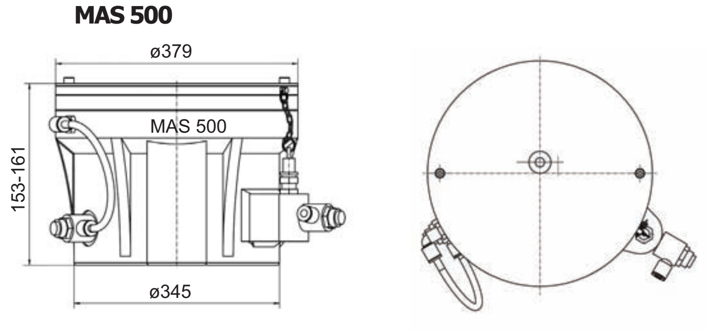
Dynamic spring data for vibration isolation
at 157 mm operating height and f_{err} = 1 Hz

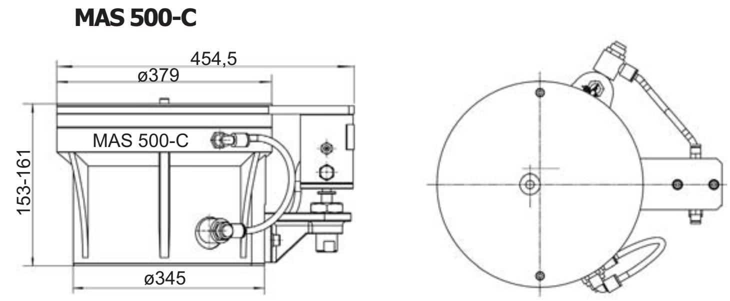
		vertical		
pressure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	21,7	4,1	2,4	0,1 - 0,2
6	32,5	5,5	2,1	0,1 - 0,2



Membrane air spring MAS 500/ MAS 500-C



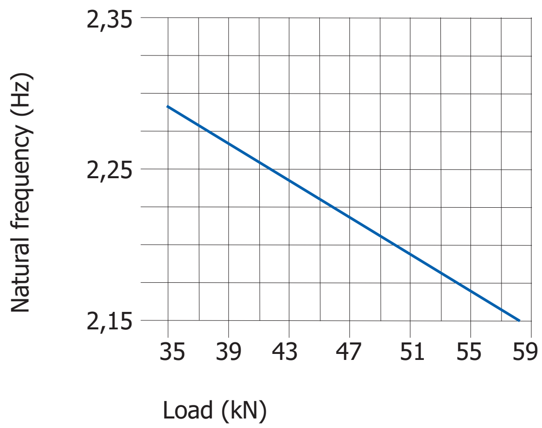




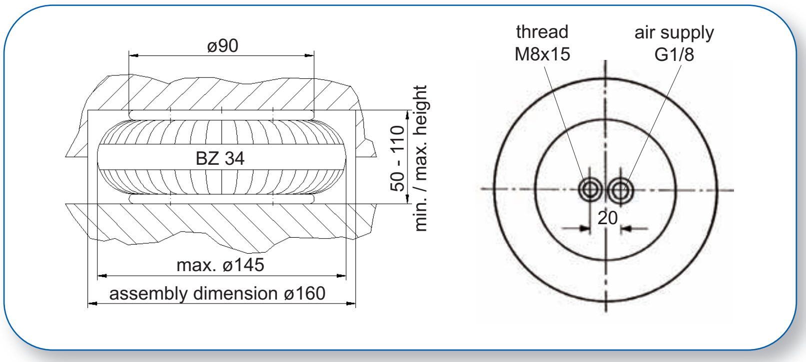
Weight:	MAS 500	26,0 kg
	MAS 500-C	26,5 kg

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

		vertical		
pressure [bar]	**load** [kN]	**stiffness** [kN/cm]	**natural frequency** (dyn.) [Hz]	**damping ratio**
4	33,4	6,97	2,4	0,1 - 0,2
6	50,1	9,75	2,2	0,1 - 0,2



Air spring BZ 34



Weight: 0,9 kg
Restoring force for min. height: ≤ 120 N

Air springs type BZ

An elastomere bellow is fixed and sealed between two steel plates. The elastomere bellow shows excellent dynamic properties, good resistance to chemicals and high leak tightness.
Air inlets are integrated into the top plate, blind nuts into the top and bottom plate.

Application:

active vibration isolation:

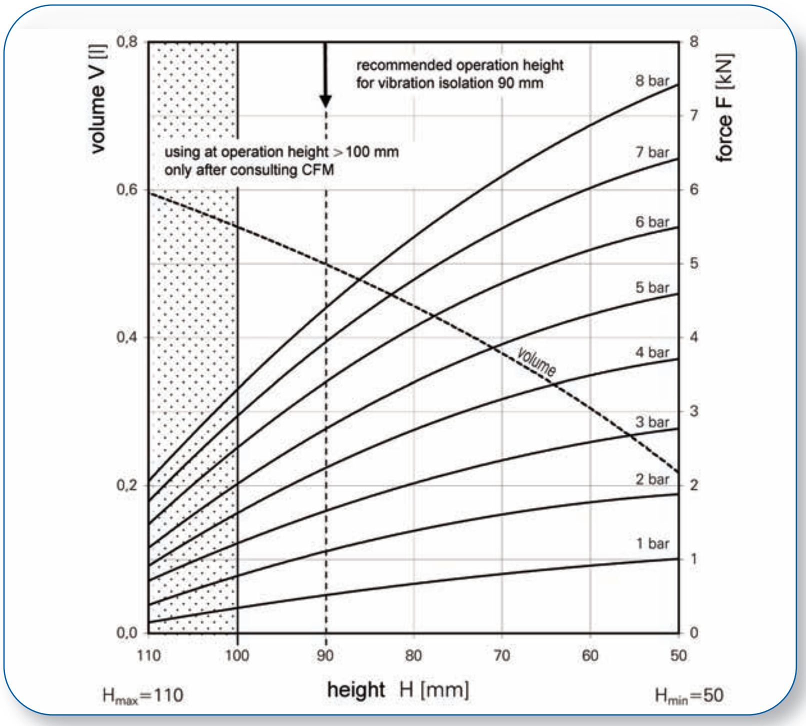
- midding dynamic
- mounting plates
- engine test rig
- actuation test rig

Dynamic spring data for vibration isolation
operating height H = 90 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	2,3	3,4	4,4
stiffness	[N/cm]	990	1480	1820
natural frequency	[Hz]	3,3	3,3	3,2

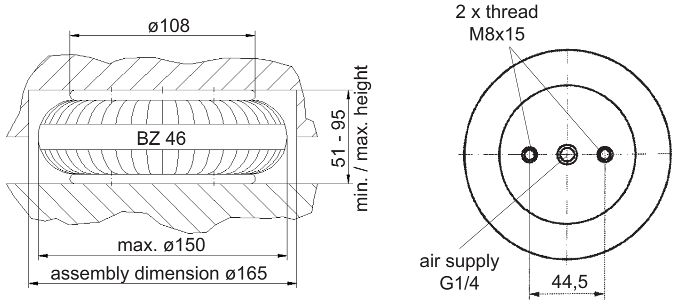
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
100	1,2	1,6	2,0	2,5	3,0	3,4
80	2,1	2,8	3,5	4,2	4,9	5,3
60	2,6	3,5	4,3	5,2	6,1	6,9



Force-height-diagram

Air spring BZ 46



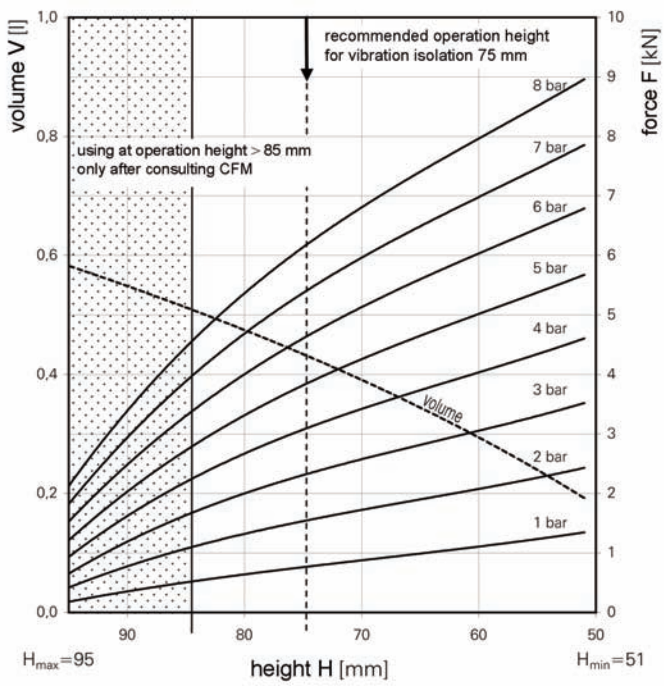
Weight: 1,2 kg
Restoring force for min. height: ≤ 250 N

Dynamic spring data for vibration isolation
operating height H = 75 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	3,04	4,57	6,08
stiffness	[N/cm]	1910	2670	3340
natural frequency	[Hz]	3,8	3,7	3,6

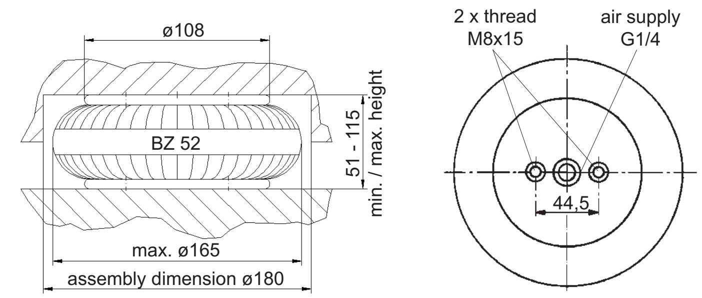
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
80	2,0	2,7	3,3	4,0	4,7	5,4
70	2,6	3,4	4,3	5,1	6,0	6,8
60	3,1	4,0	5,0	6,0	7,0	8,0



Force-height-diagram

Air spring BZ 52



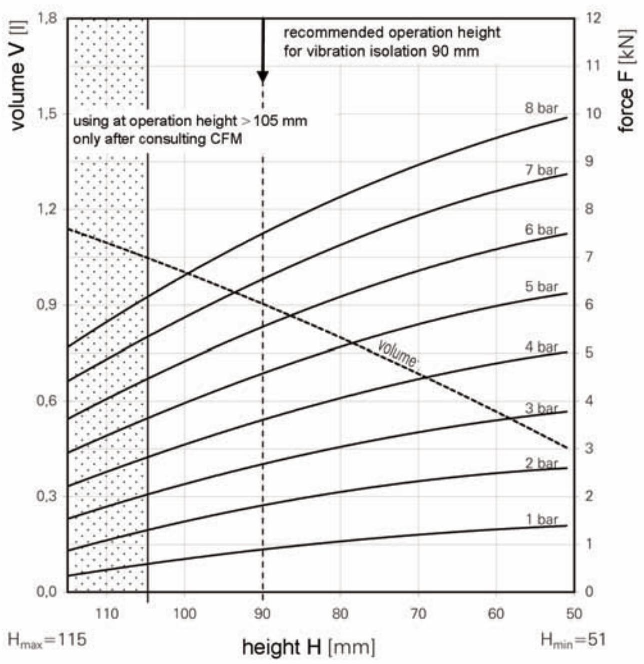
Weight: 1,2 kg
Restoring force for min. height: ≤ 200 N

Dynamic spring data for vibration isolation
operating height = 90 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	3,7	5,7	7,7
stiffness	[N/cm]	1270	1770	2325
natural frequency	[Hz]	2,9	2,8	2,7

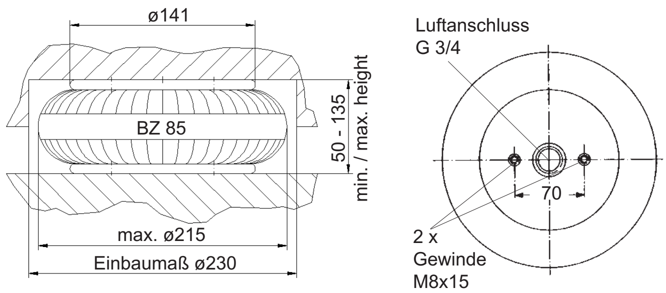
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
100	2,2	3,1	4,0	4,8	5,7	6,6
80	3,1	4,1	5,1	6,2	7,3	8,3
60	3,6	4,8	6,0	7,2	8,4	9,5



Force-height-diagram

Air spring BZ 85



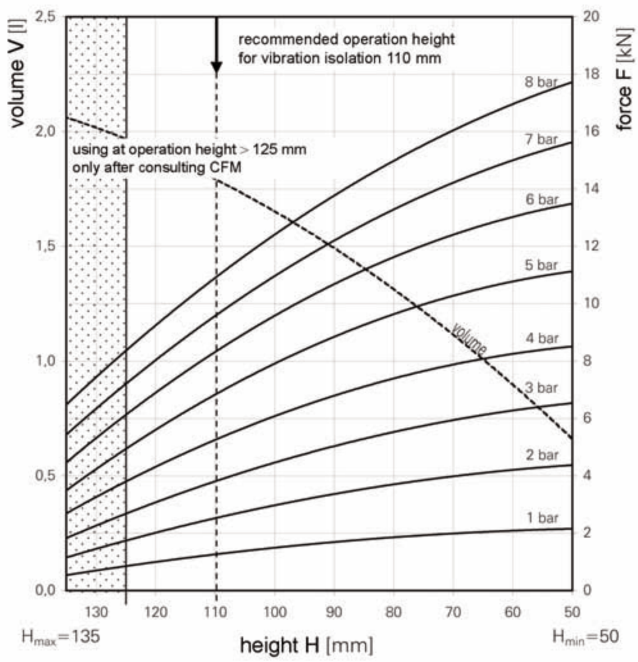
Weight: 2 kg
Restoring force for min. height: ≤ 200 N

Dynamic spring data for vibration isolation
operating height = 110 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	5,3	8,3	10,9
stiffness	[N/cm]	1620	2230	2840
natural frequency	[Hz]	2,8	2,6	2,6

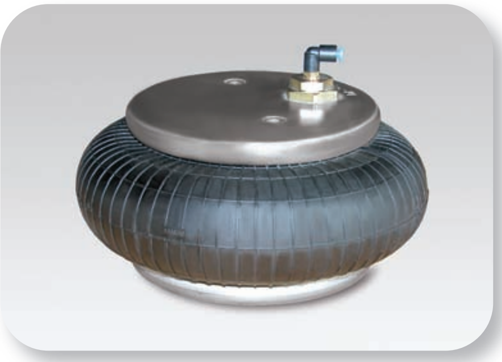
Force-height-table for single convolution air springs
force in [kN]

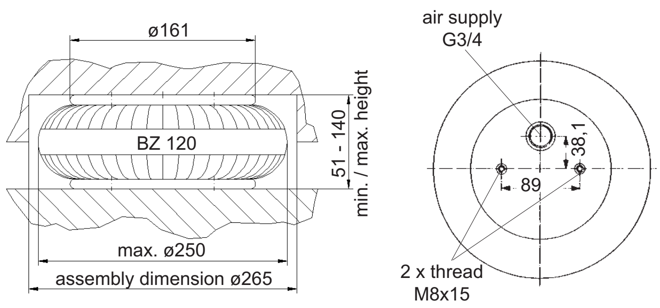
height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
120	3,1	4,3	5,6	6,9	8,0	9,2
90	5,0	6,8	8,9	10,8	12,2	13,8
60	6,3	8,2	10,7	13,0	15,0	17,0



Force-height-diagram

Air spring BZ 120





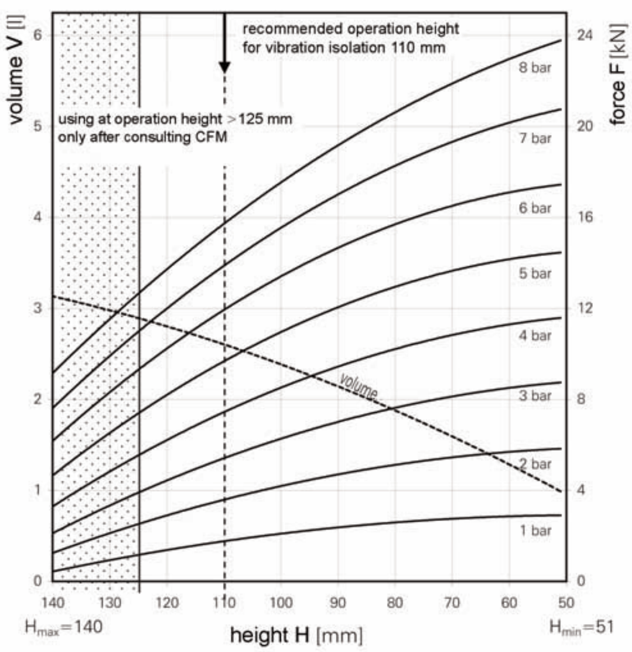
Weight: 2,5 kg
Restoring force for min. height: ≤ 200 N

Dynamic spring data for vibration isolation
operating height = 110 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	7,5	11,9	15,7
stiffness	[N/cm]	2050	3150	4250
natural frequency	[Hz]	2,6	2,6	2,6

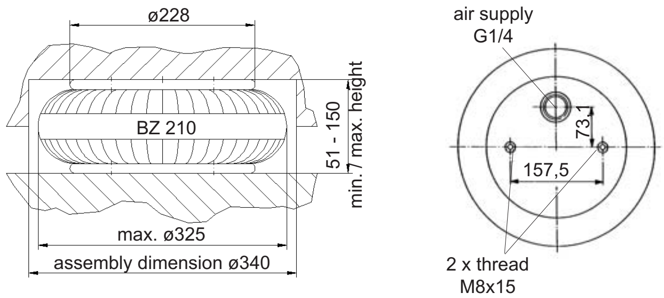
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
120	4,5	6,2	8,2	10,4	12,1	13,8
90	7,0	9,4	12,1	14,6	17,0	19,2
60	8,5	11,3	14,2	17,1	20,1	23,0



Force-height-diagram

Air spring BZ 210



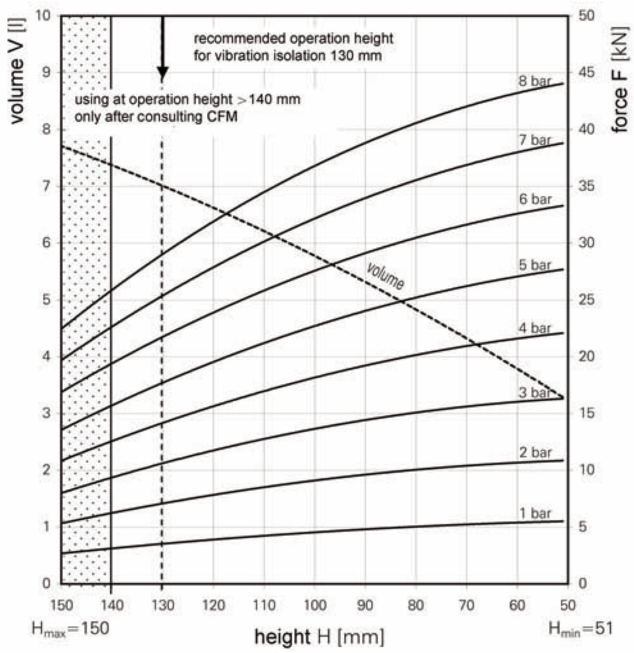
Weight: 4,3 kg
Restoring force for min. height: ≤ 300 N

Dynamic spring data for vibration isolation
operating height = 130 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	14,2	21,8	29,0
stiffness	[N/cm]	3290	4580	5870
natural frequency	[Hz]	2,4	2,3	2,3

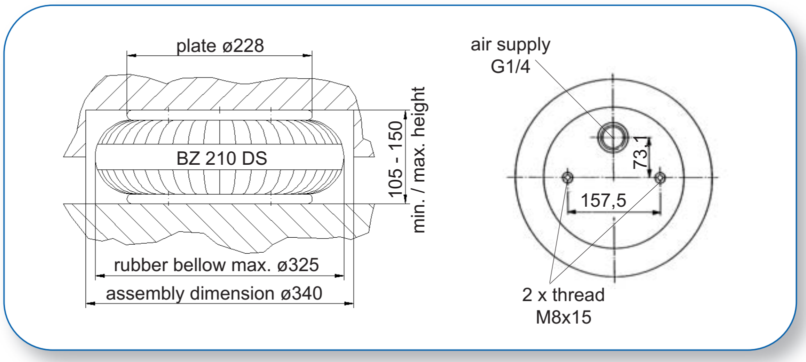
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
120	11,9	15,7	19,6	23,8	27,8	31,8
90	14,4	19,2	24,0	29,1	34,0	38,9
60	16,0	21,6	27,1	32,6	38,0	43,3



Force-height-diagram

Air spring BZ 210 DS



Weight: 5 kg

Restoring force for min. height: ≤ 300 N

Air springs type BZ ... DS

An elastomere bellow is fixed and sealed between two steel plates. The elastomere bellow shows excellent dynamic properties, good resistance to chemicals and high leak tightness.

Air inlets are integrated into the top plate, blind nuts into the top and bottom plate. The air spring is equipped with an interior limit stop, which keeps the spring from total lowering when depressurized.

Application:

active vibration isolation:

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

Dynamic spring data for vibration isolation

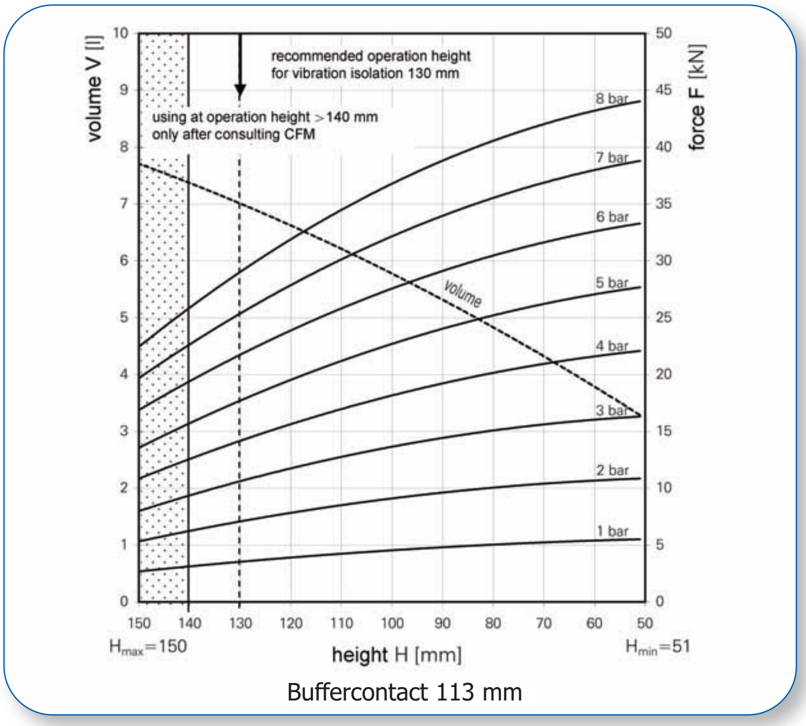
operating height = 130 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	14,2	21,8	29,0
stiffness	[N/cm]	3290	4580	5870
natural frequency	[Hz]	2,4	2,3	2,3

Force-height-table for single convolution air springs

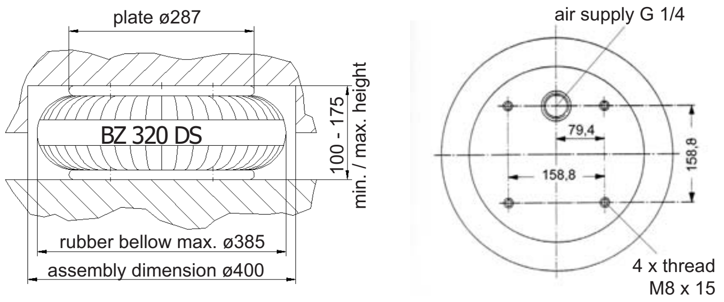
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
120	11,9	15,7	19,6	23,8	27,8	31,8
90	14,4	19,2	24,0	29,1	34,0	38,9
60	16,0	21,6	27,1	32,6	38,0	43,3



Force-height-diagram

Air spring BZ 320 DS



Weight: 7 kg

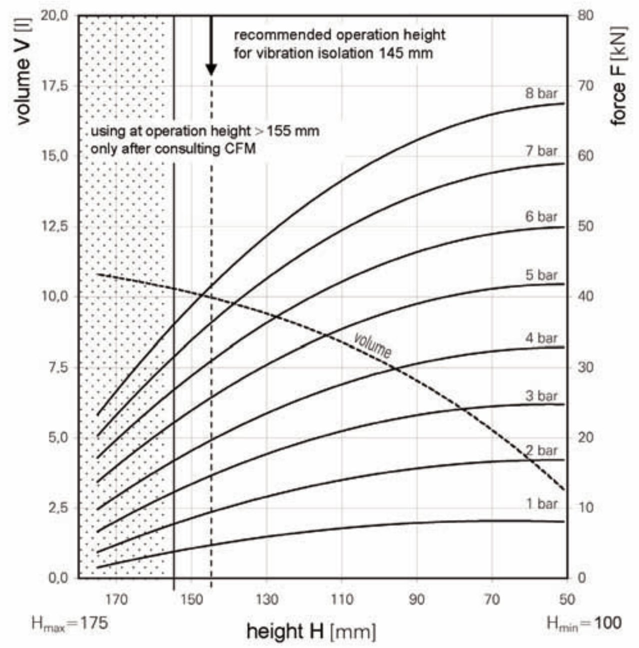
Restoring force for min. height: ≤ 300 N

Dynamic spring data for vibration isolation
operating height = 145 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	20,1	31,6	42,2
stiffness	[N/cm]	5000	7100	9150
natural frequency	[Hz]	2,5	2,4	2,3

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

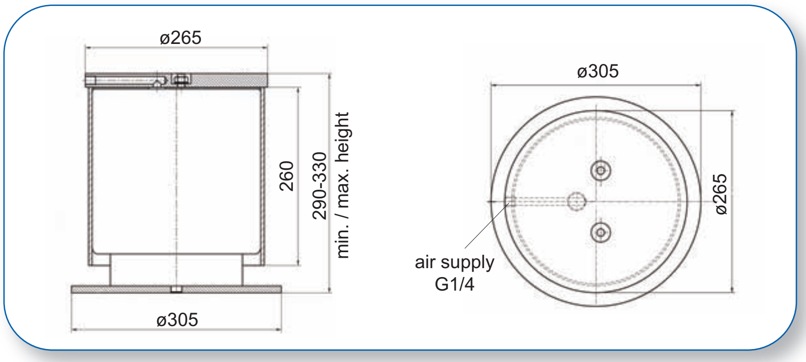
height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
150	14,3	19,0	25,0	30,0	35,0	40,0
130	17,8	23,7	30,5	36,3	42,7	49,1
90	22,8	30,0	38,1	46,0	53,9	61,6



Buffercontact 112 mm

Force-height-diagram

Air spring RB 220 SH



Weight: 28 kg
Restoring force for min. height: ≤ 3100 N
Range: 30 mm

Air springs 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:

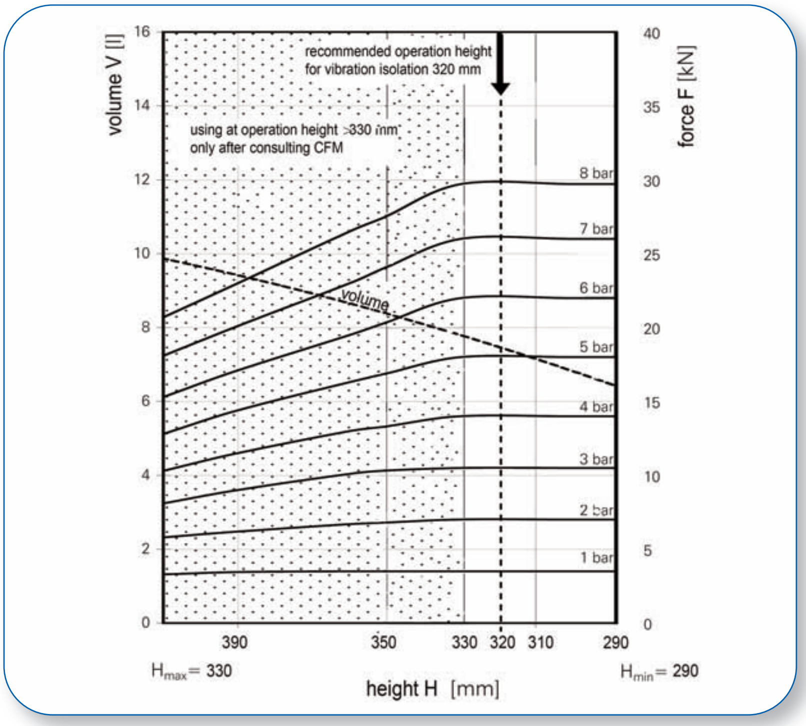
- high request degree of isolation
- low dynamic
- measurement-technology equipments
- electron microscopes
- lasertechnical rig
- measuring setups

Dynamic spring data for vibration isolation
operating height = 320 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	14,0	22,0	29,7
stiffness	[N/cm]	1230	1920	2450
natural frequency	[Hz]	1,5	1,5	1,5

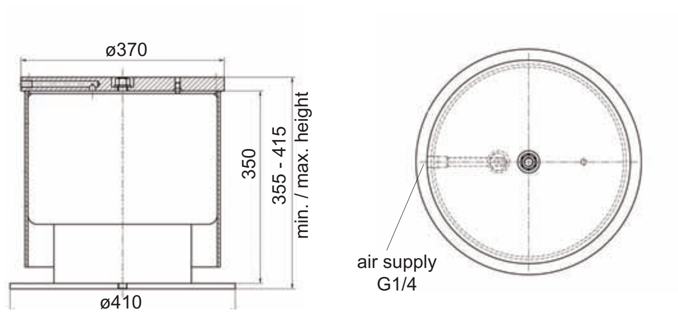
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
330	10,1	13,0	16,3	19,5	23,0	26,5
270	10,5	14,0	18,0	22,0	26,0	29,7
210	10,5	14,0	18,0	22,0	26,0	29,7



Force-height-diagram

Air spring RB 410 SH



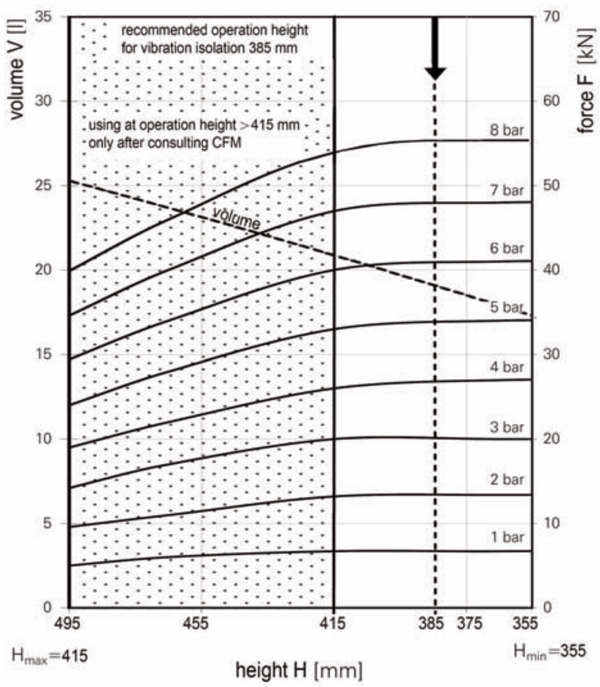
Weight: 52 kg
Restoring force for min. height: ≤ 6200 N
Range: 30 mm

Dynamic spring data for vibration isolation
operating height = 385 mm and f_{err} = 1 Hz

pressure	[bar]	4	6	8
load	[kN]	26,5	40,5	54,2
stiffness	[N/cm]	1520	2420	3180
natural frequency	[Hz]	1,2	1,2	1,2

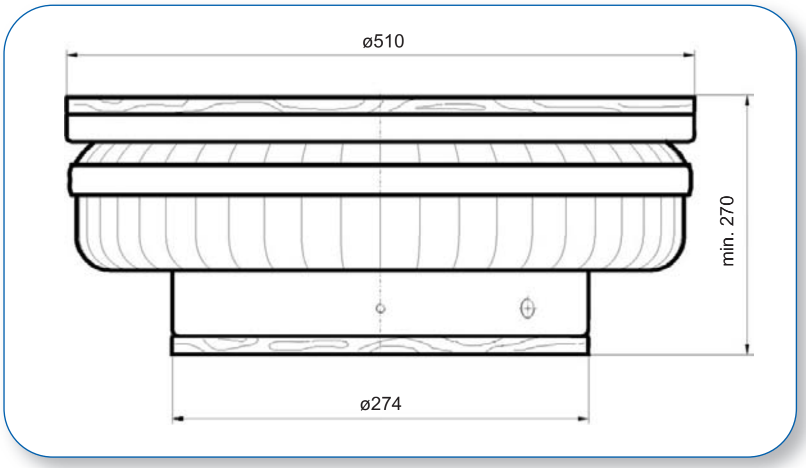
Force-height-table for single convolution air springs
force in [kN]

height [mm]	3 [bar]	4 [bar]	5 [bar]	6 [bar]	7 [bar]	8 [bar]
380	20	26	33	40	47	54
280	20	27	34	41	48	55
180	20	27	34	41	48	55



Force-height-diagram

GRB 780



Weight:	28 kg
Volume:	24 l
Air supply:	1/4"
Damping ratio vertical:	0,03

Air springs type GRB

Cover plate and piston are made from cast aluminium. 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.

Application:

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

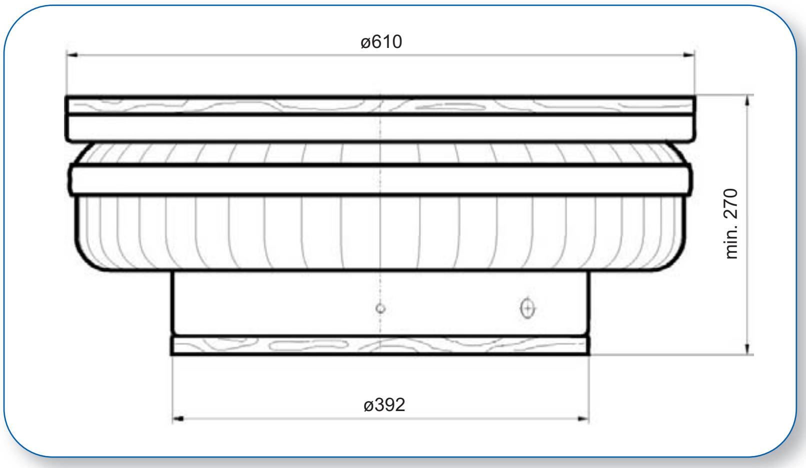
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	470	1,8
4	52	565	1,7
5	65	655	1,6
6	78	770	1,6
7	91	860	1,6
8	104	930	1,5

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	210	1,2
4	52	235	1,1
5	65	250	1,0
6	78	260	0,9
7	91	263	0,9
8	104	267	0,8

GRB 1240



Weight:	43 kg
Volume:	40 l
Air supply:	1/4”
Damping ratio vertical:	0,03

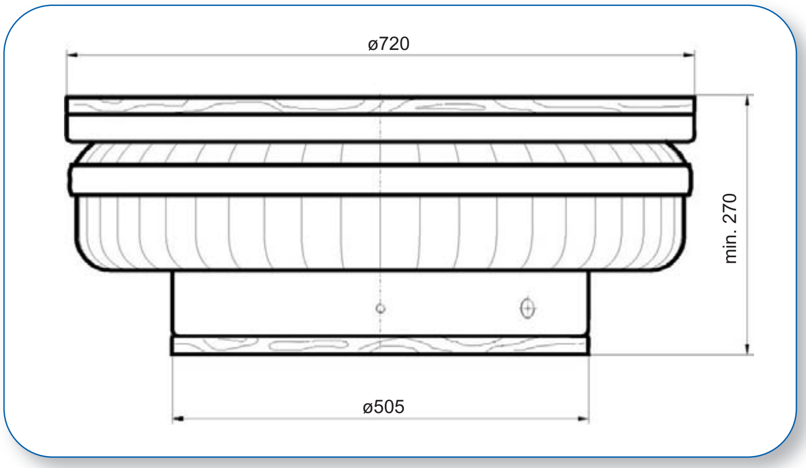
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	620	1,6
4	83	750	1,5
5	104	850	1,4
6	124	960	1,4
7	144	1045	1,4
8	165	1145	1,3

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	490	1,4
4	83	530	1,3
5	104	560	1,2
6	124	580	1,1
7	144	610	1,1
8	165	650	1,0

GRB 1820



Weight:	62 kg
Volume:	66 l
Air supply:	1/4"
Damping ratio vertical:	0,03

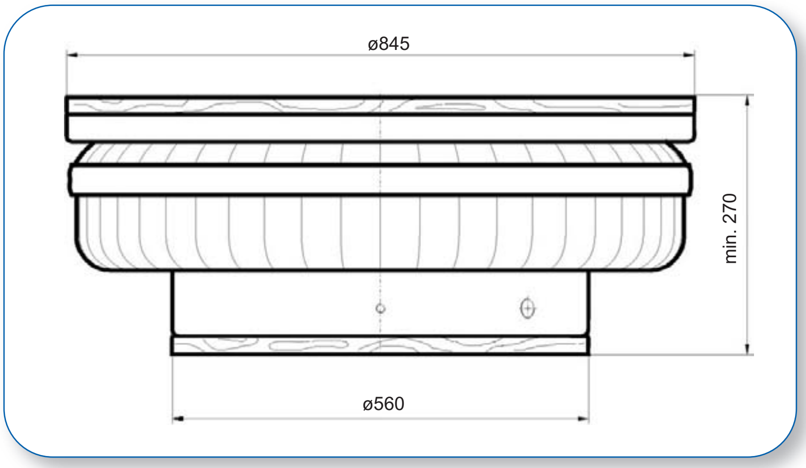
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	92	820	1,5
4	122	990	1,4
5	153	1150	1,4
6	182	1270	1,3
7	214	1400	1,3
8	244	1530	1,3

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	92	500	1,2
4	122	630	1,2
5	153	730	1,1
6	182	790	1,1
7	214	830	1,0
8	244	870	1,0

GRB 2480



Weight:	84 kg
Volume:	83 l
Air supply:	1/4"
Damping ratio vertical:	0,03

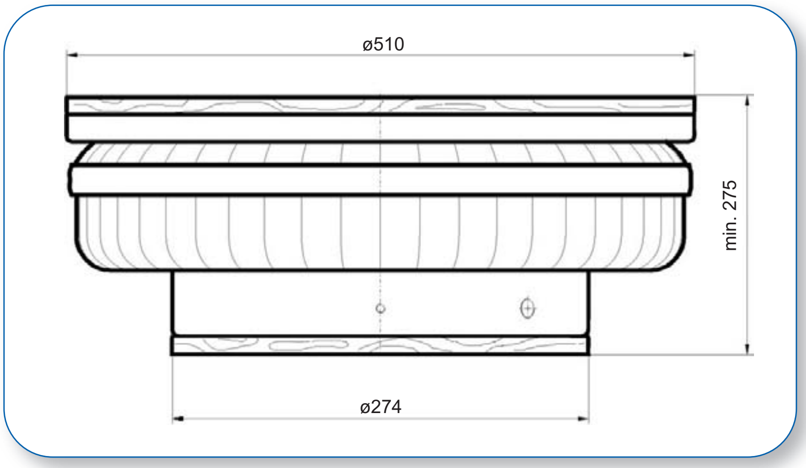
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	1170	1,6
4	165	1440	1,5
5	205	1730	1,5
6	248	1960	1,4
7	287	2180	1,4
8	329	2420	1,4

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	450	1,0
4	165	480	0,9
5	205	490	0,8
6	248	500	0,7
7	287	505	0,7
8	329	510	0,6

GRB 780 MD



Weight:	33 kg
Volume:	24 l
Air supply:	1/4"
Damping ratio vertical:	0,1

Air springs type GRB ... MD

Integrated air damping
With an integrated seperating 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 to)
- systems with high dynamic

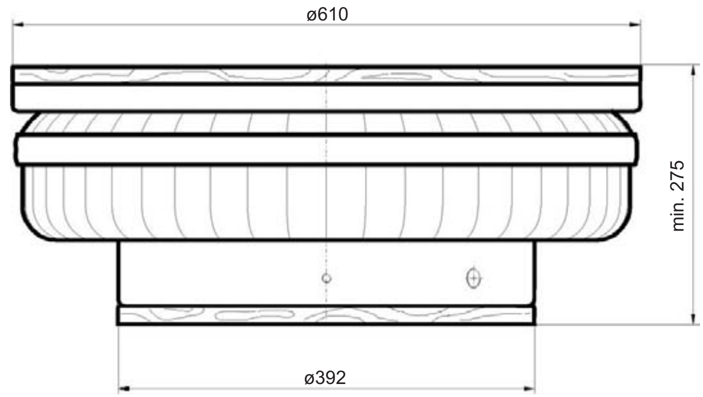
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	470	1,8
4	52	565	1,7
5	65	655	1,6
6	78	770	1,6
7	91	860	1,6
8	104	930	1,5

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	210	1,2
4	52	235	1,1
5	65	250	1,0
6	78	260	0,9
7	91	263	0,9
8	104	267	0,8

GRB 1240 MD



Weight:	48 kg
Volume:	40 l
Air supply:	1/4”
Damping ratio vertical:	0,1

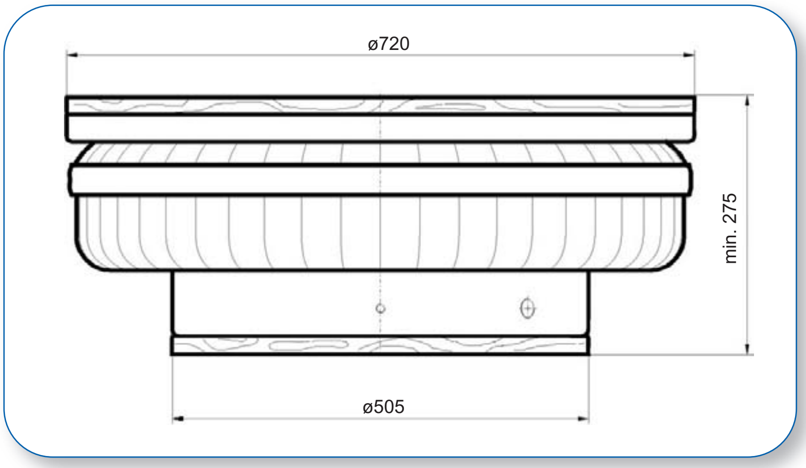
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	620	1,6
4	83	750	1,5
5	104	850	1,4
6	124	960	1,4
7	144	1045	1,4
8	165	1145	1,3

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	490	1,4
4	83	530	1,3
5	104	560	1,2
6	124	580	1,1
7	144	610	1,1
8	165	650	1,0

GRB 1820 MD



Weight:	67 kg
Volume:	66 l
Air supply:	1/4”
Damping ratio vertical:	0,1

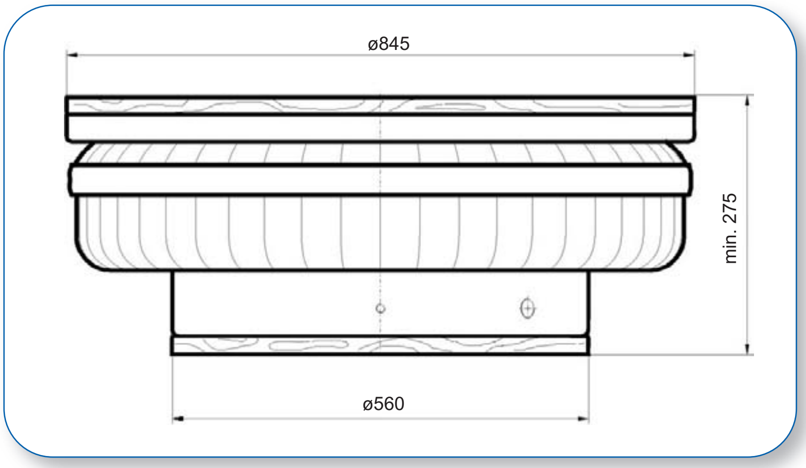
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertikal	
Druck [bar]	**Tragkraft** [kN]	**Steifigkeit** [kN/m]	**Eigenfrequenz** (dyn.) [Hz]
3	92	820	1,5
4	122	990	1,4
5	153	1150	1,4
6	182	1270	1,3
7	214	1400	1,3
8	244	1530	1,3

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

		horizontal	
Druck [bar]	**Tragkraft** [kN]	**Steifigkeit** [kN/m]	**Eigenfrequenz** (dyn.) [Hz]
3	92	500	1,2
4	122	630	1,2
5	153	730	1,1
6	182	790	1,1
7	214	830	1,0
8	244	870	1,0

GRB 2480 MD



Weight: 89 kg
Volume: 83 l
Air supply: 1/4”
Damping ratio vertical: 0,1

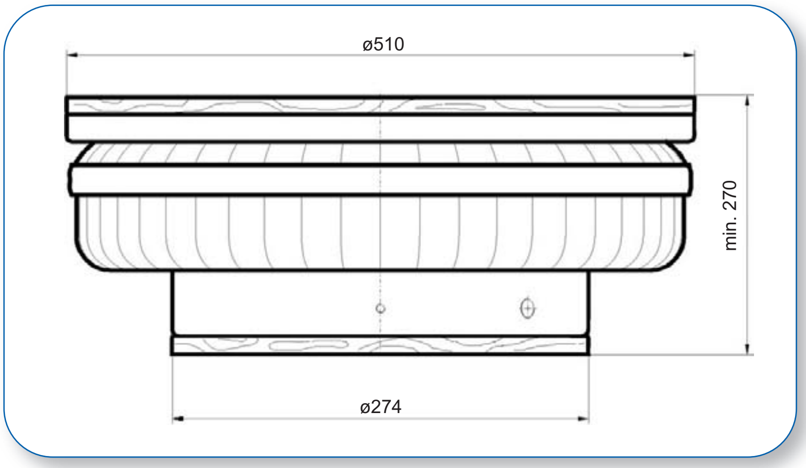
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertikal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	1170	1,6
4	165	1440	1,5
5	205	1730	1,5
6	248	1960	1,4
7	287	2180	1,4
8	329	2420	1,4

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	450	1,0
4	165	480	0,9
5	205	490	0,8
6	248	500	0,7
7	287	505	0,7
8	329	510	0,6

GRB 780 VD



Weight:	32 kg
Volume:	21 l
Air supply:	1/4”
Damping ratio:	0,15-0,25

Air springs type GRB ... VD

Integrated air damping
With an integrated seperating 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 to)
- systems with high dynamic

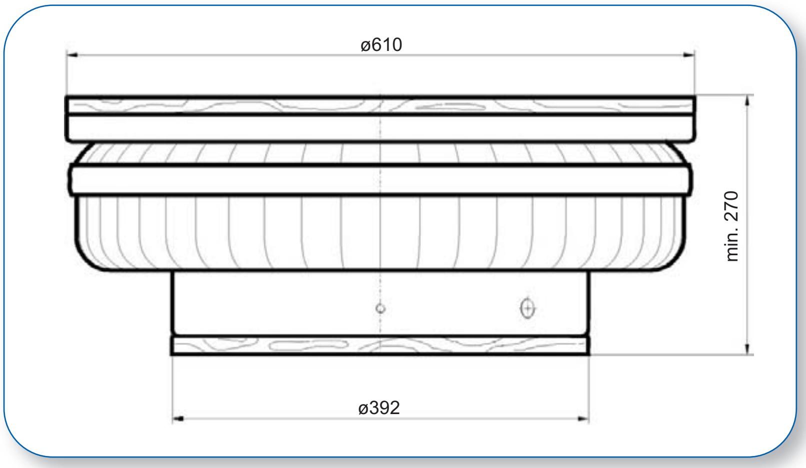
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	on request	on request
4	52		
5	65		
6	78		
7	91		
8	104		

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	39	on request	on request
4	52		
5	65		
6	78		
7	91		
8	104		

GRB 1240 VD



Weight: 50 kg
Volume: 34 l
Air supply: 1/4"
Damping ratio vertical: 0,15-0,25

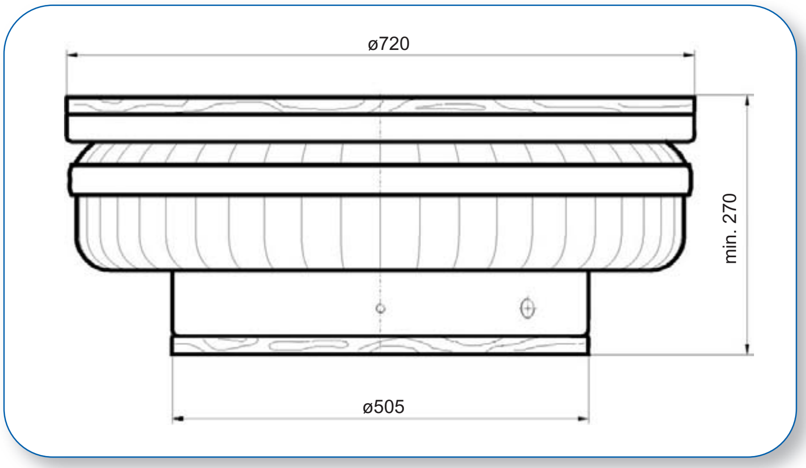
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	on request	on request
4	83		
5	104		
6	124		
7	144		
8	165		

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	62	on request	on request
4	83		
5	104		
6	124		
7	144		
8	165		

GRB 1820 VD



Weight:	74 kg
Volume:	54 l
Air supply:	1/4”
Damping ratio vertical:	0,15-0,25

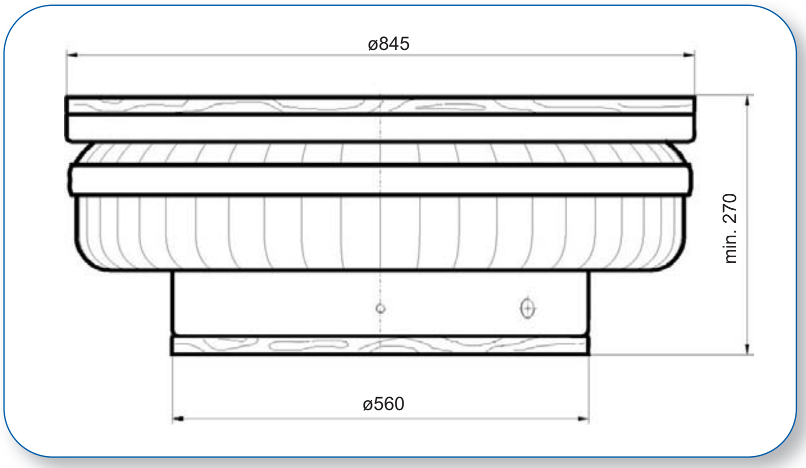
Dynamic spring data for vibration isolation
operating height = 350 mm and f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	92	on request	on request
4	122		
5	153		
6	182		
7	214		
8	244		

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	92	on request	on request
4	122		
5	153		
6	182		
7	214		
8	244		

GRB 2480 VD



Weight:	100 kg
Volume:	67 l
Air supply:	1/4”
Damping ratio vertical:	0,15-0,25

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

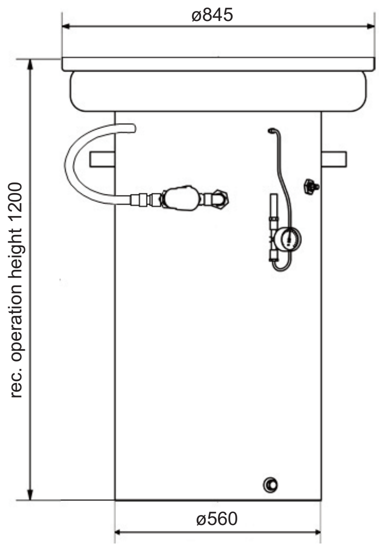
		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	on request	on request
4	165		
5	205		
6	248		
7	287		
8	329		

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

		horizontal	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**natural frequency** (dyn.) [Hz]
3	125	on request	on request
4	165		
5	205		
6	248		
7	287		
8	329		

Particular advantages over conventional air springs:
- **With T-shaped foundations shoulders for the air springs are not necessary.**
- **Requires considerably less space, because the additional capacity is integrated.**

GRB 2480-1200 ZV



Weight:	420 kg
Volume:	195 l
Air supply:	1/4"
Damping ratio vertical:	0,02

Air springs 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.

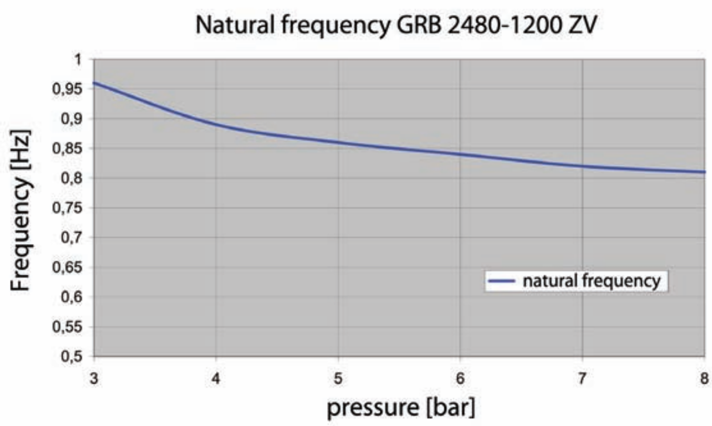
The cover plate is made of cast aluminium and piston is made of steel. Their sealing surfaces are machined, surface quality Rz 16. All other surfaces have been blasted.
The rolling lobe is made from first class elastomer with a moulded wire-reinforced ring. It shows good vertical and lateral spring properties.

Advantages over conventional air springs are:

- At T-shaped foundations shoulders are not necessary
- Less required space

Dynamic spring data for vibration isolation
operating height = 1200 mm und f_{err} = 1 Hz

		vertical	
pressure [bar]	**load** [kN]	**stiffness** [kN/m]	**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



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Schiller GmbH

CFM Schiller GmbH
Vennstraße 8
52159 Roetgen
Germany
Tel.: +49.24 71.12 46 0
Fax.: +49.24 71.12 46 20
info@cfm-schiller.de
www.cfm-schiller.de

Our Representatives:

CFM-ITBONA LLC
4282 Shoreline Drive
Spring Park, MN 55384
USA
Tel.: +1.952.942 61 04
Fax: +1.952.942 61 06
contact@cfm-itbona.com
www.cfm-itbona.com

E7 Yapı Market
Değirmenbahçe Caddesi
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sokak No:3 Çobançeşme,
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ISTANBUL
Turkey
Tel.: +90.579. 70 79 (pbx)
Fax: +90.540. 71 49
info@e7yapimarket.com
www.e7yapimarket.com

SEM, SA
Moscou, 30, 1-1
08005 Barcelona
Spain
Tel.: +34.93.221.0065
Fax: +34.93.221.0249
info@semsa.es
www.semsa.es

PES (UK) Limited
Unit 1 Watling Close
Sketchley Meadows
Business Park
Hinckley, Leicester
LE10 3EZ
Great Britain
Tel.: +44.14 55.25 12 51
Fax: +44.14 55.25 12 52
sales@pesukltd.com
www.pesukltd.com

SHANGHAI XINSHU M&E EQUIPMENT CO.,LTD.
Room A301-303, No.128
XiangYin Road, ShangHai
China
TEL: 021-51088285
FAX:021-51816755
Email: tiejun.liu@xsindu.cn
www.xsindu.cn

Sandeep Vidwans
Flat No 201,
"Kalpataru" Apartments
Survey No. 1/11 + 1/23,
Karvenagar
Pinac Colony,
Pune 411 052
Maharashtra, India
Tel. +91 96899 21575

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