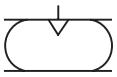
KM/31000 (Stainless steel end plates)
Air bellows, single acting

- **Ø 8 ... 14 1/2 inch (203 ... 368 mm)**
- **Almost frictionless operation**
- **No maintenance or lubrication**
- **High isolation level for vibration applications**
- **Very easy to install – no alignment problems**
- **Typical applications; actuator, air spring, or vibration isolation**



Technical features

Medium:
Compressed air lubricated or unlubricated, Nitrogen, water (with glycol)
Operation:
Single acting
Operating pressure:
5,5 bar (79 psi) recommended dynamic pressure
8 bar (116 psi) max.

Nominal diameters:
8, 10, 12, 14 1/2 inches
Strokes:
From 75 ... 380 mm max., depending on diameters and number of convolutions

Operating temperature:
for KM/31000 (Standard)
-30° ... +50°C (-22° ... +122°F)
-40° ... +70°C* (-40° ... +158°F)*
IR for TKM/31000
-20° ... +70°C (-4° ... 158°F)
-25° ... +90°C* (-13° ... 194°F)*
ECO for EKM/31000
+50° ... +115°C (+122° ... 239°F)
-20° ... +130°C* (-4° ... +266°F)*
* The number represent the maximum permissible operating temperature. It is suitabel to operated with restriction at this temperature, the air bellow may have a reduced life time!

Materials:
End plates, Studs and central ring: Stainless steel (1.4305)
Bellow: KM/31000:
NR/BR, SBR compound rubber
TKM/31000: IR
EKM/31000: ECO

Technical data

Model	KM/31081	KM/31082	KM/31101	KM/31102	KM/31103	KM/31121
Cylinder Ø (inch)	8"	8"	10"	10"	10"	12"
Port size	G1/2	G1/2	G1/2	G1/2	G1/2	G1/2
Nominal Ø (inch) x convolutions	8" x 1	8" x 2	10" x 1	10" x 2	10" x 3	12" x 1
Stroke (mm)	75	175	100	225	330	100
Installation height min (mm)	50	75	50	75	100	50
Recommended max working height (mm)	115	220	135	245	350	135
Installation height max (mm)	130	250	150	300	430	150
Retracting force to reach min height (N)	220	350	150	150	250	200
Force at 6 bar (N) depending from the stroke	See graph on page 4 & 5					
Model	**KM/31122**	**KM/31123**	**KM/31141**	**KM/31142**	**KM/31143**	
Cylinder Ø (inch)	12"	12"	14 1/2"	14 1/2"	14 1/2"	
Port size	G1/2	G1/2	G1/2	G1/2	G1/2	
Nominal Ø (inch) x convolutions	12" x 2	12 x 3	14 1/2" x 1	14 1/2" x 2	14 1/2" x 3	
Stroke (mm)	225	330	100	265	380	
Installation height min (mm)	75	100	50	75	100	
Recomended max working height (mm)	245	350	135	290	420	
Installation height max (mm)	300	430	150	340	480	
Retracting force to reach min height (N)	250	250	200	280	330	
Force at 6 bar (N) depending from the stroke	See graph on page 4 & 5					

Alternative air bellows

Symbol	Model	Material	Description	Dimension see page
	KM/31000	Standard	Ø 8 ... 14 1/2 inches (152 ...368 mm)	3
	TKM/31000	Butyl	Ø 8 ... 14 1/2 inches (152 ...368 mm)	3
	EKM/31000	Epichlore	Ø 8 ... 14 1/2 inches (152 ...368 mm)	3

Options selector

★KM/31★★★

Air bellow materials	Substitute
NR/BR, SBR compound rubber	**None**
High temperature (Butyl)	**T**
Extreme temperature (Epichlore)	**E**

Number of convolutions	Substitute
1	**1**
2	**2**
3	**3**
Nominal diameters (inches)	**Substitute**
8	**08**
10	**10**
12	**12**
14 1/2	**14**

Note: Please fill in only the numbers of digits required, e.g. KM/31081

Important instructions:

Thrust:
The thrust depends on the height of the bellow. When height increases - the thrust decreases.

- Before installing the air bellow, check it carefully for any damage it may have suffered from transport or improper storage.
- Do not inflate the air bellow until it has been secured properly.

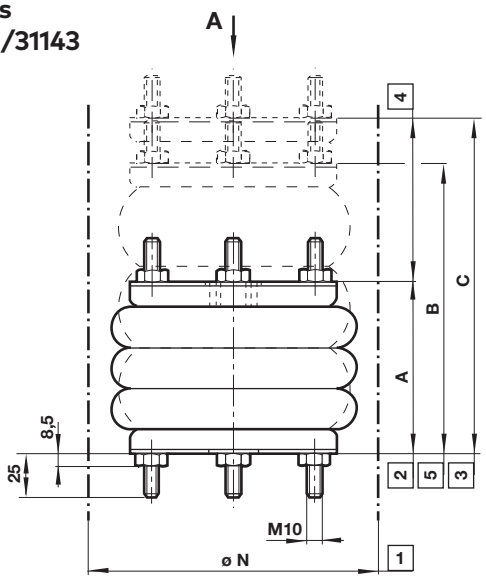
Clearance:
There must be enough clearance around the air bellow.

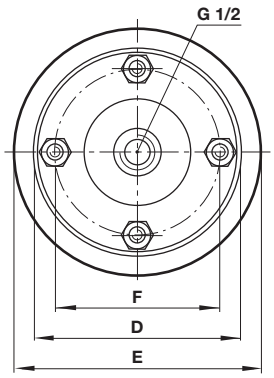
- The full surface of the metal parts is to be used to bear the forces.
- Air bellows must be equipped with lateral guides.
- Deflate the air bellows fully before removing.
- Ensure that the bellows is not constantly in contact with hydraulic oil, lubricants, solvents, metal cuttings and welding sparks.
- Should the air bellow be subjected to special media in an application, ask Norgren for further information, specifying the medium, temperature and concentration

Stops:
To avoid damage when the bellow is compressed or extended mechanical stops at both end positions have to be used.

Basic dimensions
KM/31081 ... KM/31143

Dimensions in mm
Projection/First angle



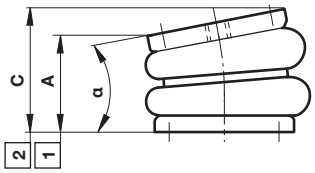


1 Installation diameter min.
2 Installation height min.
3 Installation height max.
4 Stroke
5 Recommended max. working hight

Table 1

Nominal Ø (inch) x convolutions	Stroke (mm)	Installation height [A] min. (mm)	Recommended working height [B] max. (mm)	Installation height [C] max. (mm)	Max. torque for mounting studs (Nm)	Natural frequency [fn] at 4 bar (Hz)	Siffness at 4 bar (N/mm)	Recomended vibration height [mm]	Ø E	Ø D	Ø F	Ø N	Weight (kg)	Models
8" x 1	75	50	115	130	25	2,72	250	100	230	184	155,5	245	3,0	KM/31081
8" x 2	175	75	220	250	25	1,86	105	200	230	184	155,5	245	3,7	KM/31082
10" x 1	100	50	135	150	25	2,6	257	120	270	210	181	300	4,1	KM/31101
10" x 2	225	75	245	300	25	1,8	123	220	270	210	181	300	4,7	KM/31102
10" x 3	330	100	350	430	25	-	-	-	270	210	181	300	5,2	KM/31103
12" x 1	100	50	135	150	25	2,5	372	120	330	260	232	350	5,4	KM/31121
12" x 2	225	75	245	300	25	1,8	200	220	330	260	232	350	6,2	KM/31122
12" x 3	330	100	350	430	25	-	-	-	330	260	232	350	6,9	KM/31123
14 1/2" x 1	100	50	135	150	25	2,4	558	130	400	310	282,5	425	7,1	KM/31141
14 1/2" x 2	265	75	290	340	25	1,6	252	250	400	310	282,5	425	8,3	KM/31142
14 1/2" x 3	380	100	420	480	25	-	-	-	400	310	282,5	425	9,6	KM/31143

Operation angle



1 Installation height min
2 Installation height max

Out of alignment

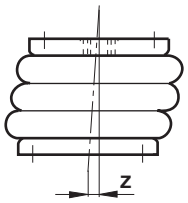


Table 2

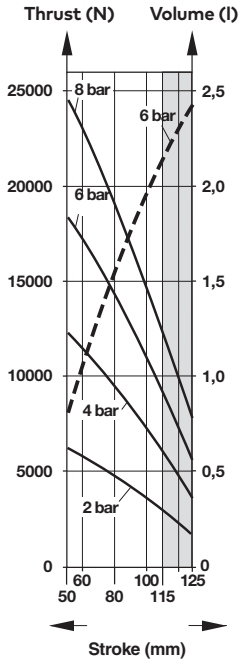
Nominal Ø (inch) x convolutions	Operating angel [α] max. (°)	Out of algignment [Z] max. (mm)	Installation height [A] min. (mm)	Installation height [C] max. (mm)	Models
8" x 1	10	10	50	130	KM/31081
8" x 2	10°	10	75	250	KM/31082
10" x 1	10 ... 20	10	50	150	KM/31101
10" x 2	15 ... 25	20	75	300	KM/31102
10" x 3	15 ... 30	30	100	430	KM/31103
12" x 1	10 ... 20	10	50	150	KM/31121
12" x 2	15 ... 25	20	75	300	KM/31122
12" x 3	15 ... 30	30	100	430	KM/31123
14 1/2" x 1	10 ... 20	10	50	150	KM/31141
14 1/2" x 2	15 ... 25	20	75	340	KM/31142
14 1/2" x 3	15 ... 30	30	100	480	KM/31143

Operation angle

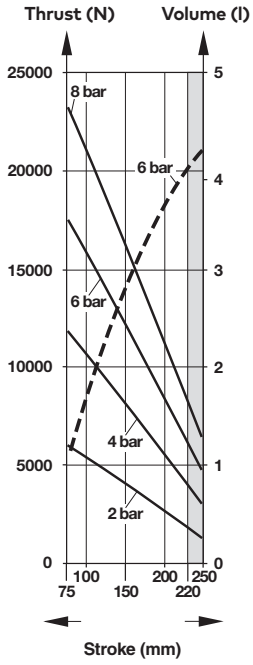
Tilt angles from 10 ... 30° are possible, depending on the air bellow design.
Ensure application is within minimum and maximum installation heights.

Thrust (at 2, 4, 6, 8 bar), volume (at 6 bar)

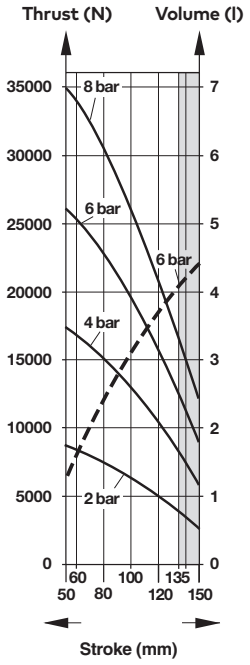
KM/31081



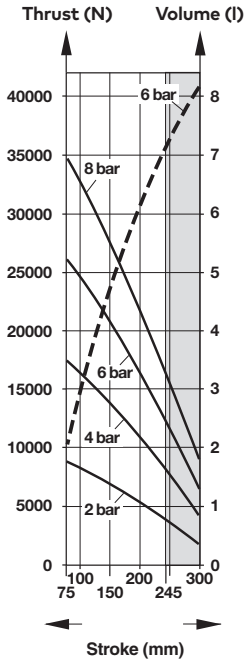
KM/31082



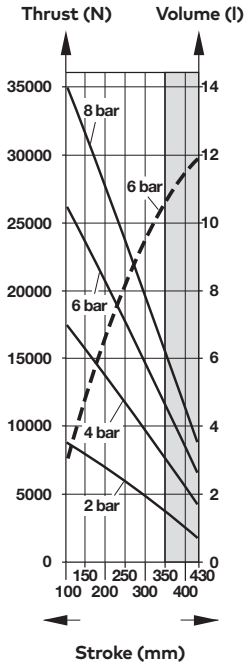
KM/31101



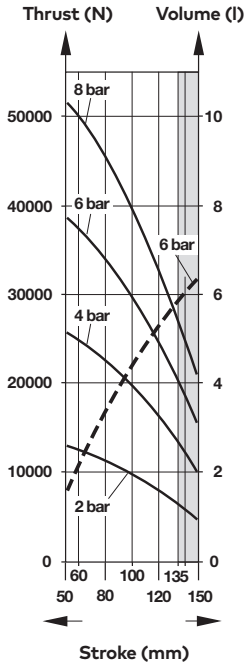
KM/31102



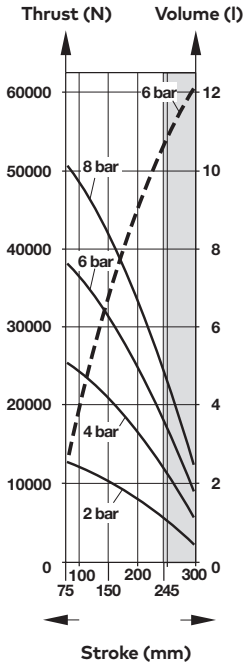
KM/31103



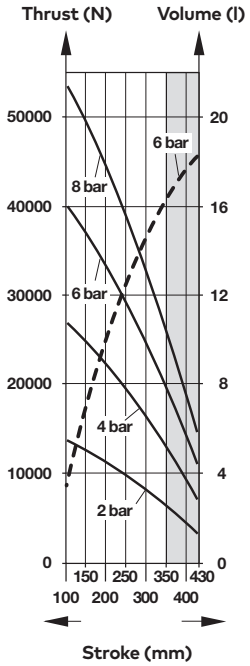
KM/31121



KM/31122



KM/31123

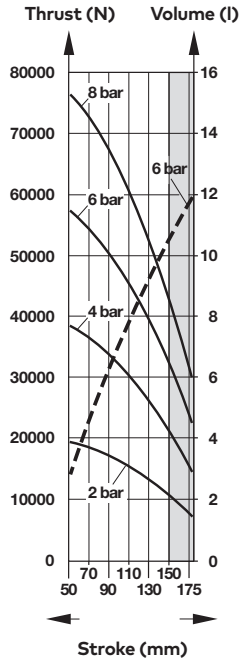


— Thrust (N) – – Volume (l)

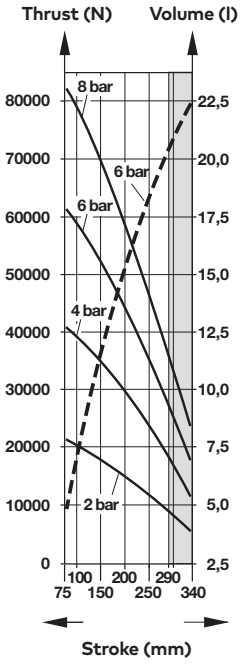
Caution!
Ensure that all applications are within the max. installation height. For applications in the grey area please contact Norgren technical service.

Thrust (at 2, 4, 6, 8 bar), volume (at 6 bar)

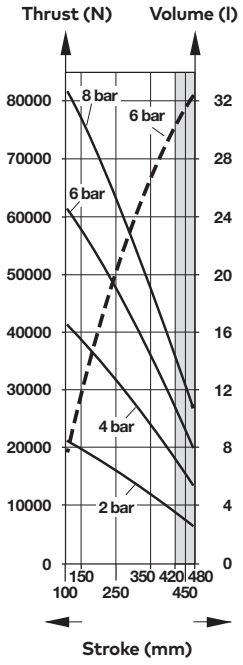
KM/31141



KM/31142



KM/31143



— Thrust (N) – – Volume (l)

Caution!
Ensure that all applications are within the max. installation height. For applications in the grey area please contact Norgren technical service.

Application example - Air bellow as an actuator
A 1000 kg conveyor carrying a 550 kg pallet needs to be lifted by 90 mm (stroke) in order to transfer the pallet to another level.
Four (4) air bellows should be used. The available operating pressure is 5 bar. The operating temperature is 45°C. There is a 270 mm square space to house each air bellow. Compression and extension stops are provided. The air bellows have to be mounted in a space which is 85 mm apart. During the lifting operation the conveyor may tilt in the second half of the stroke by a max. of 9°.

Step 1: Fill in and complete the datasheet

a)	Total weight to be lifted:	F	=	(1000 kg + 550 kg) • 10 m/s² = 15500 N
b)	Number of air bellows:	n	=	4
c)	Thrust per air bellow:	f	=	$\frac{15500\ N}{4}$ = 3875 N
d)	Operating pressure:	P	=	5 bar
e)	Required stroke:	S	=	90 mm
f)	Vertical space:	Xv	=	85 mm
g)	Horzontal space:	Xh	=	270 mm
h)	Operating temperature:	T	=	45°C
i)	Operation angle:	a	=	9°
j)	Out of alignment:	A	=	0 mm
k)	Chemical resistance:			normal environment

Step 2:
From table 1 air bellows have to be selected, that have a min. 90 mm stroke and clearance around the air bellows smaller than Xh = 270 mm.
We select: KM/31082

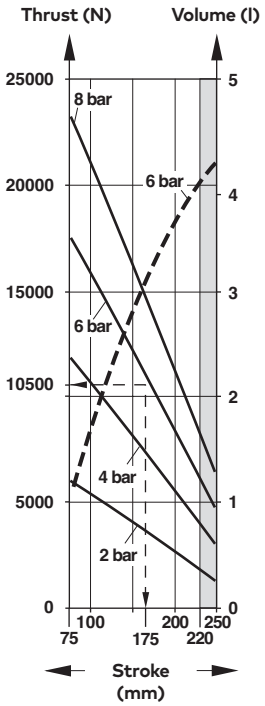
Step 3:
Calculate the total height at which the air bellow should be used, see step 1:

Vertical space	Xv	85 mm
Stroke	S	90 mm
Total height		175 mm

By refering to the total height of 175 mm and the vertical space of 85 mm, only KM/31082 (installation height min. 75 to recommended max. working height 220 mm) can be used from table 1.

Step 4:
Check the thrust at 5 bar at a height of 175 mm.
From the charts in the datasheet page 4 we can see that:

KM/31082



KM/31082 will provide 10500 N at 6 bar. To get the figure for 5 bar, we have to calculate:

$\frac{105060\ N \cdot 5}{6}$ = 8750 N at 5 bar

Result:
The air bellow KM/31082 can provide the required thrust of 3875 N.

Step 5:
Check the operation angel and the out of alignment when the selected air bellow can tilt, see table 2.
i) max. operation angle 10° is higher as existing operating angel 9°.
j) max. out of alignment is 10 mm is higher as existing alignment 0 mm.

Result:
KM/31082 can be used.

Step 6:
Check all remaining parameters
h) At 45°C Standard rubber material
-30 ... + 50°C
k) No special chemical resistance is required

Result:
KM/31082 is the chosen air bellow, because it meets all requirements.

Application example - Air bellow as a vibration isolator
A hydraulic power unit with an excitation frequency (fe) between 1200 and 3000 cycles/min. (= 20 to 50 Hz) must be vibration isolated.
The total weight of the power unit is 3800 kg. The supporting area under the unit is 1,2 m x 0,8 m. The operating temperature is 50°C. The space for the installation is 240 mm high. Four air bellows will be used. The max. operating pressure is 4 bar. A minimum of 97% vibration isolation has to be reached.

Step 1: Fill in and complete the datasheet

a)	Total weight to be isolated:	F	=	3800 kg • 10 m/s² = 38000 N
b)	Number of air bellows:	n	=	4
c)	Thrust per air bellow:	f	=	$\frac{38000\ N}{4}$ = 9500 N
d)	Operating pressure:	P	=	4 bar
f)	Vertical space:	Xv	=	240 mm
g)	Horizontal space:	Xh	=	400 mm (0,8 m²)
h)	Operating temperature:	T	=	50°C
k)	Chemical resistance:			normal environment
m)	Minimum isolation rate:	I	=	97%
p)	Excitation frequency	fe	=	min. 20 Hz, max. 50 Hz

Two types of air bellows are chosen. Each one has to work with a vibration height lower than 240 mm and fit in a horizontal space samler than 400 mm.
From table 1 we select:
1. KM/31102 - Vibration height = 220 mm - Clearance around the air bellow = 300 mm - Airspring natural frequency "fn" at 4 bar = 1,8 Hz - Stiffness at 4 bar = 123 N/mm
2. KM/31122 - Vibration height = 220 mm - Clearance around the air bellow = 350 mm- Airspring natural frequency "fn" at 4 bar = 1,8 Hz - Stiffness at 4 bar 200 N/mm

Step 2:
Take the air bellow with the lowest airspring natural frequency fn = 1,8 Hz. Do to the fact that both air bellows constater the same natural frequency. Please use the lowest stiffness at 123 N/mm in order to get the highest isolation rate refering to fe min. = 20 Hz.

Air bellow KM/31102 is chosen.

Step 3:
Calculate the isolation rate (I) of the KM/31102 by using the formula:

Formula:

$$I = 1 - \frac{1}{\left(\frac{fe}{fn}\right)^2 - 1}$$

Example:

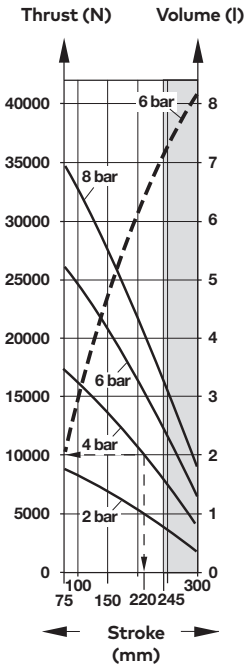
$$I = 1 - \frac{1}{\left(\frac{20}{1{,}8}\right)^2 - 1}$$

$$= 1 - \frac{1}{122{,}4} = 0{,}991$$

I = 99,1%

Step 4:
Check the thrust at 4 bar at a height of 220 mm. From the charts in the datasheet page 4 we can see that.

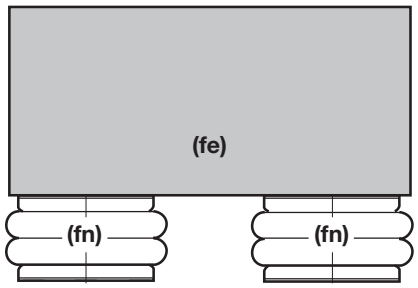
KM/31102



KM/31102 will provide 10000 N
as a vibration height of 220 mm at 4 bar.

Step 5:
Check all remaining parameters
h) At 50°C Standard rubber material (-30 ... +50°C) can be used.
g) No special chemical resistance is required.

Result:
4 x KM/31102 air bellows are chosen. They will provide 99,1% vibration isolation and lift the 3800 kg weight at 4 bar.



fe = Excitation frequency of load
fn = Airspring natural frequency

Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under **»Technical features/ data«**.
Before using these products with fluids other than those specified, for non-industrial applications, life-support systems or other applications not within published specifications,
consult Norgren.
Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes.

The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.
System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided.
System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.