

**Pneumatic spring lifts - radial clearance**

**1. Application area**

The measuring procedures and the permitted radial clearance values for the pneumatic spring lifts are documented in these operating standards. These operating standards apply to all pneumatic springs with the exception of pneumatic springs with very short outer tube. In cases such as these, measurement **E** (see Diagram 5.2) cannot be complied with. The VN 10.003 operating standard applies to this pneumatic spring.

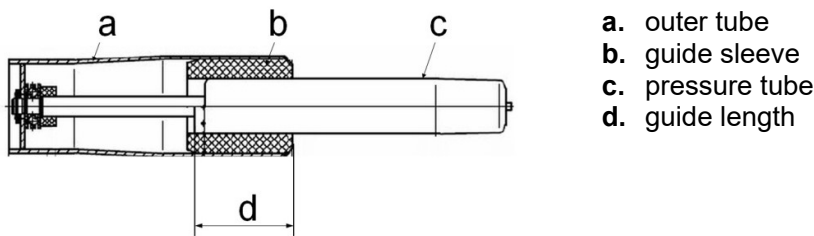
**2. Responsibility**

The quality control, product development and purchasing departments are responsible for compliance with and implementation of these operating standards.

**3. Change service**

Changes are implemented by the quality control and product development departments.

**4. Pneumatic spring lift design (informative)**



**5. Testing**

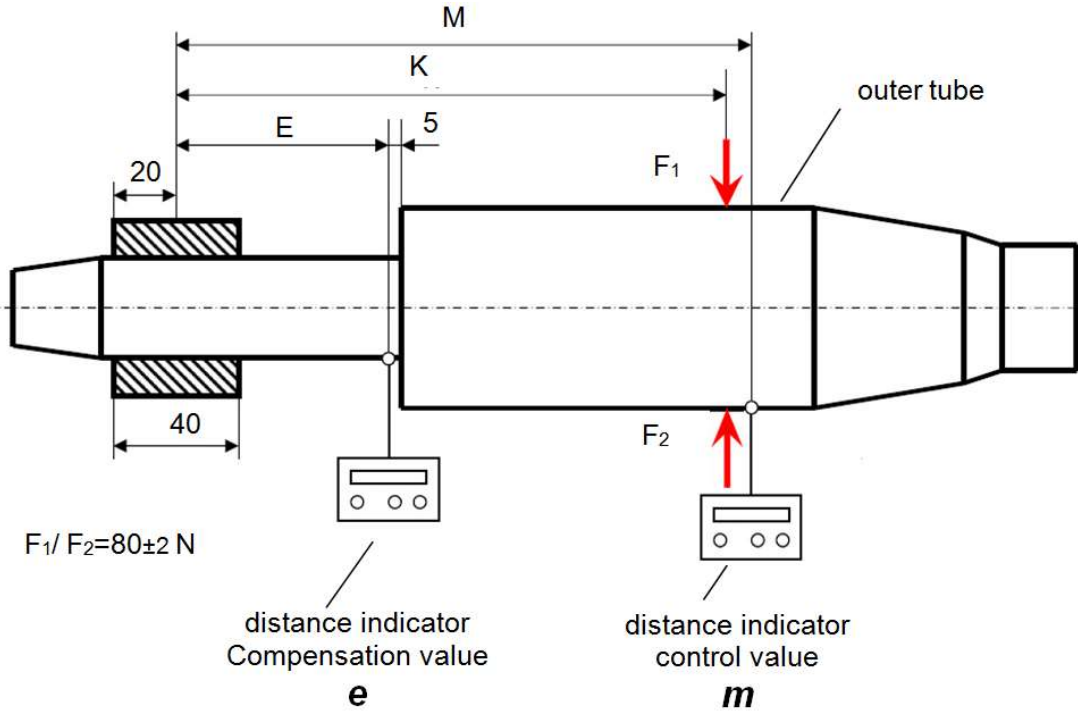
The pneumatic spring is securely attached to the **extended** pressure tube during testing. The outer tube is subjected to a lateral load. The deflection (radial clearance) resulting from this process is measured as described below. The main cause of radial clearance is the play between the guide sleeve and the pressure tube. The play in the "fixed" inspection holder is calculated from the test result using the intercept theorem.

Created on:	By:	QS-notation:	Approval:	Revision status:	On:
23.12.2015	EL	-	MZi		

**5.1 Test conditions**

- **Extended** pressure pipe
- The test object must be at room temperature (between 18°C - 23°C) for at least 4 hours before the measurement.

**5.2 Test setup**



Pneumatic spring type	<i>E</i> , mm	<i>K</i> , mm	<i>M</i> , mm
With non-telescoping outer tube, outer tube length > 155 mm	55	205	215
With non-telescoping outer tube, outer tube length < 155 mm	30	115	125
With telescoping outer tube	55	275	285

- The play in the holder is measured using the **e** dial gauge
- The play between the guide sleeve and the pressure tube is measured using the **m** dial gauge

- 5.2.1 Clamp the pneumatic spring in the measuring device in compliance with the distance **E** on the pressure tube
- 5.2.2 Apply force **F<sub>1</sub>=80N +/-2N** in compliance with the distance **K**
- 5.2.3 Set both dial gauges to zero
- 5.2.4 Relieve force **F<sub>1</sub>**
- 5.2.5 Apply force **F<sub>2</sub>=80N +/-2N** from the opposite direction described in Step 5.2.2
- 5.2.6 Note the values of the dial gauges for **e<sub>0</sub>** and **m<sub>0</sub>** and record them in the measurement log
- 5.2.7 Release force **F<sub>2</sub>**

Created on:	By:	QS-notation:	Approval:	Revision status:	On:
23.12.2015	EL	-	MZi		

5.2.8 Rotate the outer tube 90° and repeat Steps 5.2.1 – 5.2.6. Write down the values determined here in the measurement log.

### 5.3 Correction calculation

The measurement results for the 0° and 90° outer tube positions from 5.2 are adjusted for the play in the holder using the following formula:

$$S_{0^\circ} = m_{0^\circ} - \frac{M}{E} \times e_{0^\circ}$$

$$S_{90^\circ} = m_{90^\circ} - \frac{M}{E} \times e_{90^\circ}$$

The largest value from the calculation is used to evaluate the radial clearance.

### 6.1 Permitted radial clearance values for non-telescoping pneumatic springs

Guide clearance class	Permitted guide clearance	
	Min.	Max.
<b>R</b>	0,3	0,55
<b>S</b> (Outer tube length ≤ 155 mm)	0,2	0,4
<b>S</b> (Outer tube length > 155 mm)	0,3	0,7

- Guide clearance class:  
**S** = Standard (preferred)  
**R** = With reduced guide clearance

### 6.2 Permitted radial clearance values for nontelelescoping pneumatic springs

Guide clearance class	Permitted guide clearance	
	Min.	Max.
<b>E</b>	0,5	1,2

- Guide clearance class:  
**E** = Expanded guide clearance due to telescoping

### 7. Applicable documentation

- Operating standard VN 10.003
- Measurement log

Created on:	By:	QS-notation:	Approval:	Revision status:	On:
23.12.2015	EL	-	MZi		

Measurement log for recording the values in accordance with  
VN 10.002

Date:

Tester:

Project:

Part-Nr.:

ISIR-Nr.:

Measurement	$m_{0^\circ}$	$e_{0^\circ}$	$m_{90^\circ}$	$e_{90^\circ}$	$S_{0^\circ}$	$S_{90^\circ}$	$S_{max}$
1							
2							
3							
4							
5							

Created on:	By:	QS-notation:	Approval:	Revision status:	On:
23.12.2015	EL	-	MZi		