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Tools for pressing — Gas springs —

Part 5: Safety instructions for gas springs

Outillage de presse — Ressorts à gaz —

Partie 5: Instructions de sécurité pour les ressorts à gaz

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Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 8, *Tools for pressing and moulding*.

A list of all parts in the ISO 11901 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html

Introduction

This document was developed to align the ISO standard with the most commonly used gas springs safety standard, and to give some recommendations about instructions for use.

Tools for pressing — Gas springs —

Part 5: Safety instructions for gas springs

1 Scope

This document describes the safety requirements for gas springs in accordance with ISO 11901-1, ISO 11901-3 and ISO 11901-4 intended for use in press tool and their correct installation instructions.

The instructions and operating conditions described in Annex A help to maximise lifetime and ensure the safe operation of nitrogen gas springs.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Safety protection for nitrogen gas springs

4.1 General

Incorrect use of nitrogen gas springs can pose a risk to people and the machine/die.

Some potential causes of damage and the mode of operation of the protection equipment used to avoid them are described in 4.2 to 4.4.

4.2 Uncontrolled return stroke safety protection

It is possible that the piston rod of the nitrogen gas spring does not immediately follow the return stroke of the press: this can be caused by a jammed tool part or cam (see Figure 1). As a result, when the jammed part is released, the piston rod of the nitrogen gas spring exceeds the permitted speed during the return stroke and the piston rod slams unchecked onto the final stop (return stroke of the rod pushing out the jammed part without stamping counterforce). This can seriously damage the nitrogen gas spring or cause it to fail. To avoid this, nitrogen gas springs shall be designed to vent the gas to the atmosphere – thereby depressurizing the spring – in the event that the maximum permitted piston rod speed is exceeded. This reduces the risk of injuries caused by the ejection of gas spring parts.

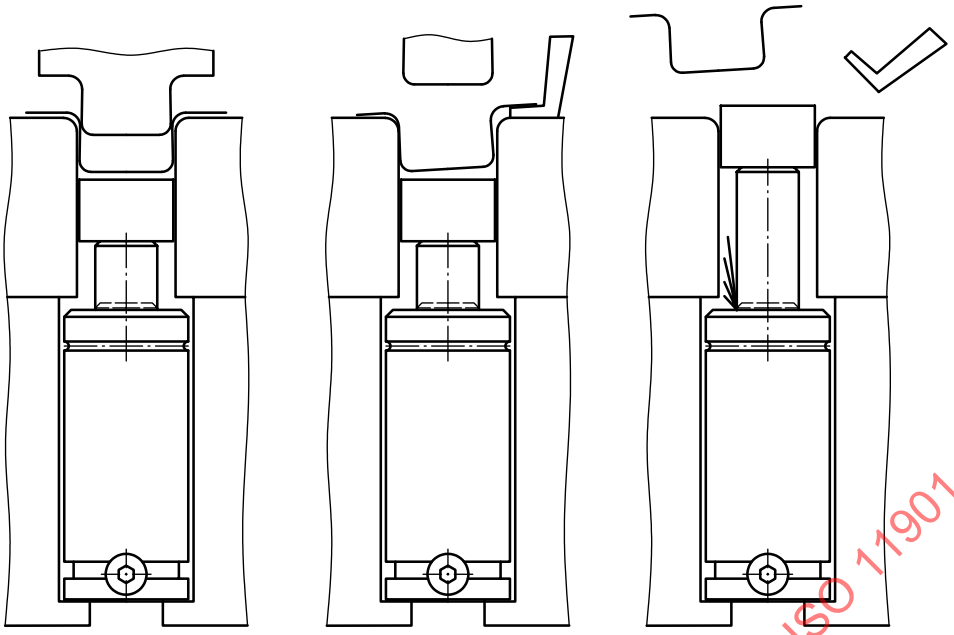


Figure 1 — Return stroke of nitrogen gas spring without counterforce

4.3 Overstroke safety protection

Overstroke occurs when the piston rod is pushed deeper into the gas spring body than nominal stroke. This could damage the gas spring (see Figure 2) and cause sudden dislocation of spring body (e.g. the spring base). Therefore, gas springs shall be designed to vent the gas to the atmosphere in a controlled manner in the event of overstroke.

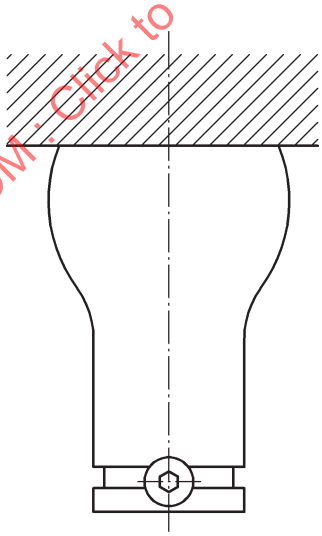


Figure 2 — Damaging of the gas spring due to overstroke

4.4 Overpressure safety protection

If the pressure inside gas springs rises above the permitted limit, due to fluid penetration or incorrect charging, gas springs can break away. Therefore, gas springs shall include overpressure protection.

When the overpressure protection system is triggered, the gas is vented to the atmosphere.

Annex A
(informative)

Instructions for use

A.1 General

Nitrogen gas springs use should comply with the following instructions to ensure their safe operation. Moreover, compliance with the operating instructions of the nitrogen gas springs manufacturer is also required.

A.2 Symbols

The symbols in Table A.1 are used throughout this annex.

Table A.1 — Symbols used in this annex

Symbol	Designation	Unit
d_1	cylinder body outside diameter of nitrogen gas spring	mm
d_2	diameter of holes and pockets	mm
d_3	drill diameter	mm
F	force	N
h_1	safeguard gap	mm
l_1	cylinder body length of nitrogen gas spring	mm
p_{max}	maximum charging pressure	bar
T_{max}	maximum operating temperature	°C
T_{min}	minimum operating temperature	°C
v	piston rod speed	m/s

A.3 Operating conditions

Nitrogen gas springs for installation in stamping dies should be designed for

— at least two million full strokes at maximum charging pressure, and

— maximum operating temperature.

Furthermore, they should be designed for all permitted mounting options listed in A.10.

Ideally, nitrogen gas springs should be mounted within the die (see A.10).

CAUTION — For mounting and demounting operations the gas spring rod should be fully extended and free of any outside load.

Dies fitted with nitrogen gas springs should carry an appropriate warning and caution sign. Figure A.1 shows an example.

Caution

This die is fitted with ___ nitrogen gas springs with a maximum charging pressure of 150 bar and/or 180 bar.

No	Quantity	Spring type	Charging pressure in bar	Total force in daN
1	____	_____	____	____
2	____	_____	____	____
3	____	_____	____	____
4	____	_____	____	____
5	____	_____	____	____

Figure A.1 — Example of a caution sign to affix to dies containing nitrogen gas springs

A.4 Piston rod speed

To avoid the high-speed return of the rod and thus prevent internal damage, the piston rod should not be released suddenly from a pressurized position. A maximum permitted piston rod speed v_{max} should be specified. See Figure A.2.

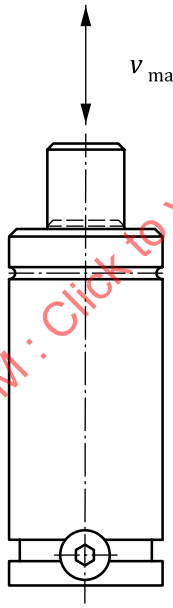


Figure A.2 — Specification of the permitted piston rod speed

A.5 Operating temperature

The specified permitted operating temperature range should be from 0 °C to 80 °C. The operating temperature can rise either due to external warming (e.g. thermoforming or drop forging) or internal warming (frictional energy, compression energy). Exceedance of the temperature range can reduce spring life (Figure A.3).

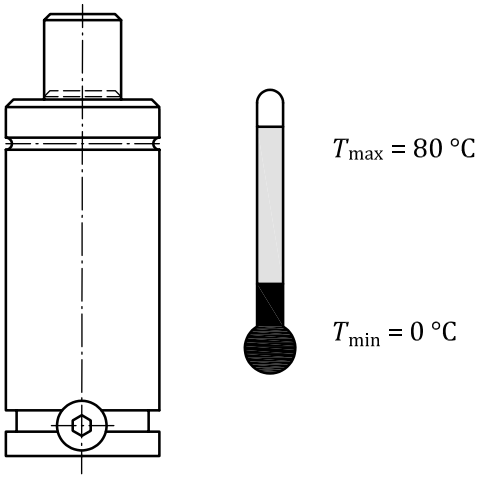


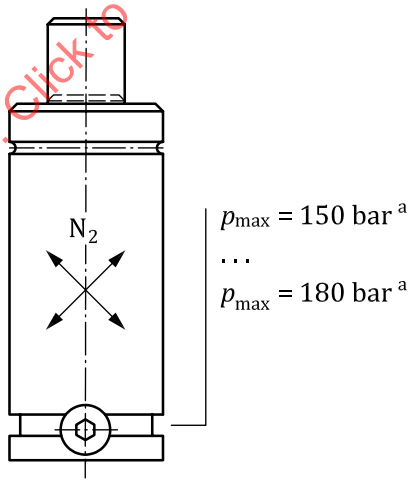
Figure A.3 — Specification of the operating temperature range

A.6 Maximum charging pressure

The only gas allowed to charge a gas spring is nitrogen (N_2).

Nitrogen gas springs should be charged only with commercial grade nitrogen in purity class 5.0 (99,999 0 % volume fraction) or higher.

The maximum charging pressure p_{max} at 20 °C should not exceed the maximum charging pressure prescribed by the manufacturer, as otherwise system safety cannot be guaranteed (Figure A.4). The maximum charging pressure should be indelibly written on the gas spring body.



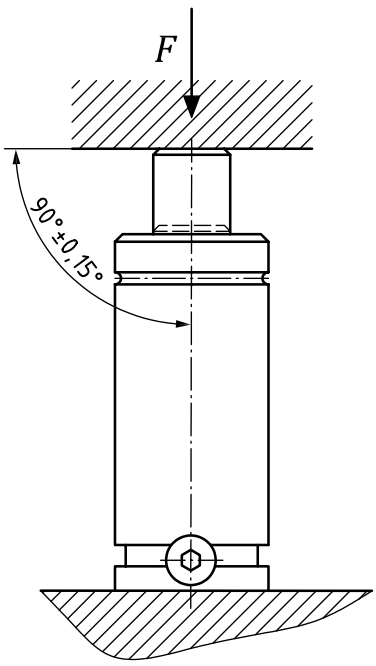
[a] At 20 °C.

Figure A.4 — Maximum permitted charging pressure (depending on manufacturer)

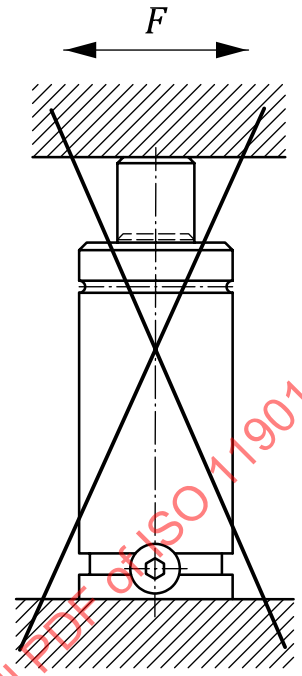
A.7 Force transmission

Force should be applied evenly across the surface of the piston rod head, i.e. side force should be avoided. The mounting surface of nitrogen gas springs should always be at right angles to the direction of force transmission. The contact surface of the piston rod should be at right angles to the spring

stroke (Figure A.5 a)) and should have sufficient compressive strength. No lateral forces should act on the nitrogen gas spring (Figure A.5 b)).



a) Permissible: right angled force transmission



b) Not permissible: lateral forces

Figure A.5 — Force transmission

A.8 Maximum working stroke

A safeguard gap h_1 of

— at least ten percent of the nominal stroke for strokes ≤50 mm, and

— at least 5 mm for strokes >50 mm

should be provided (Figure A.6).

This prevents exceedance of the permitted stroke (Figure A.7, see also 4.3). To avoid unintentionally exceeding the permitted stroke (e.g. when depressurizing the nitrogen gas spring), provision should be made to mechanically limit the working stroke of the die accordingly.

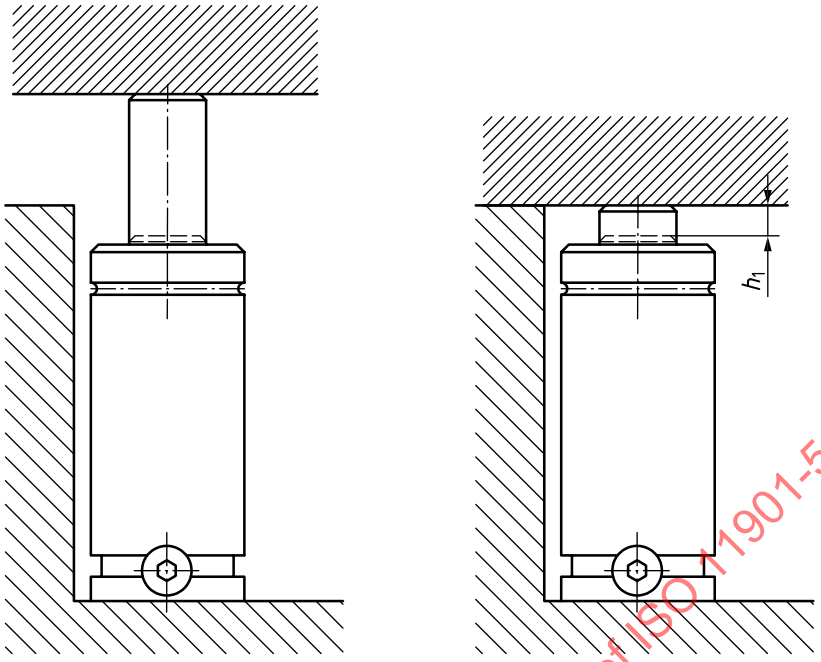


Figure A.6 — Permissible – operating at maximum working stroke

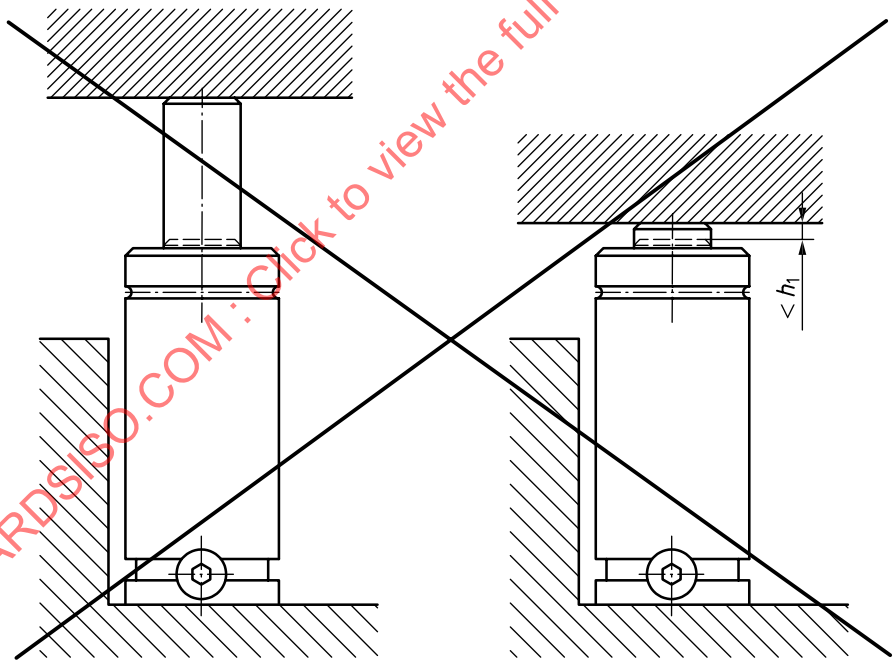


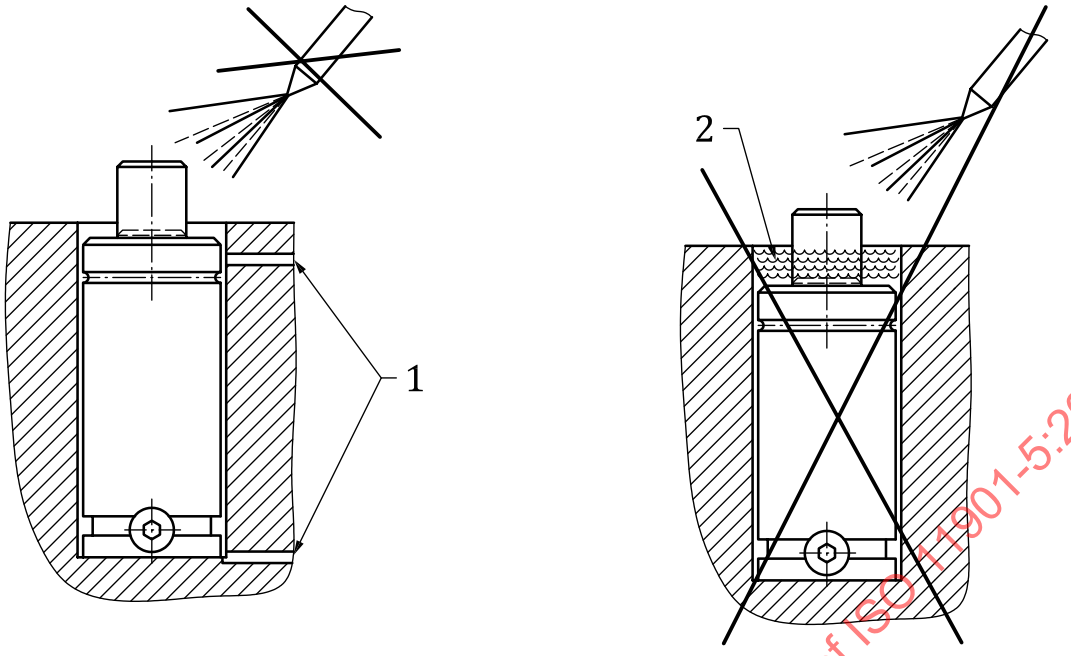
Figure A.7 — Not permissible – maximum working stroke exceeded

A.9 Contact with fluids and contaminants

Nitrogen gas springs should be protected from mechanical damage.

CAUTION — Avoid permanent contact with fluids and contaminants, e.g. lubricant, swarf, sanding dust (Figure A.8).

The use of aggressive detergents is not permitted.



a) Permissible **b) Not permissible**

Key

1 drainhole

2 fluid

Figure A.8 — Avoiding permanent contact with fluids

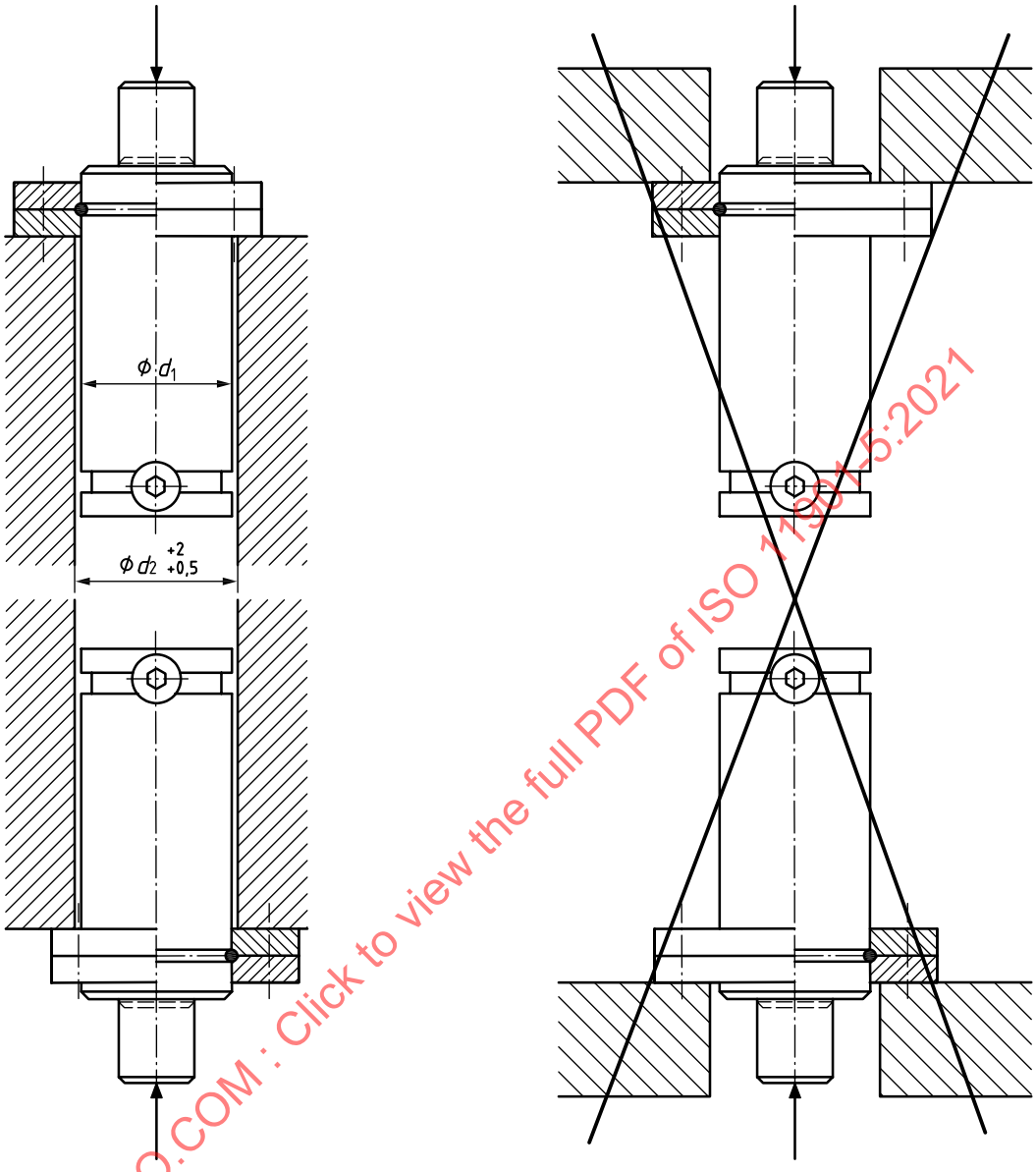
A.10 Mounting options

A.10.1 General

Where possible, nitrogen gas springs should be mounted in the die or machine using standard elements. Maximum tightening torques and thread lengths should comply with the specifications in the manufacturers' instructions, if the gas springs are mounted using the threads in their bases. In those applications, where vibrations may occur, all mounting bolts should be locked.

A.10.2 Lapped flange mounting

The lapped flange mounting is illustrated in Figure A.9.



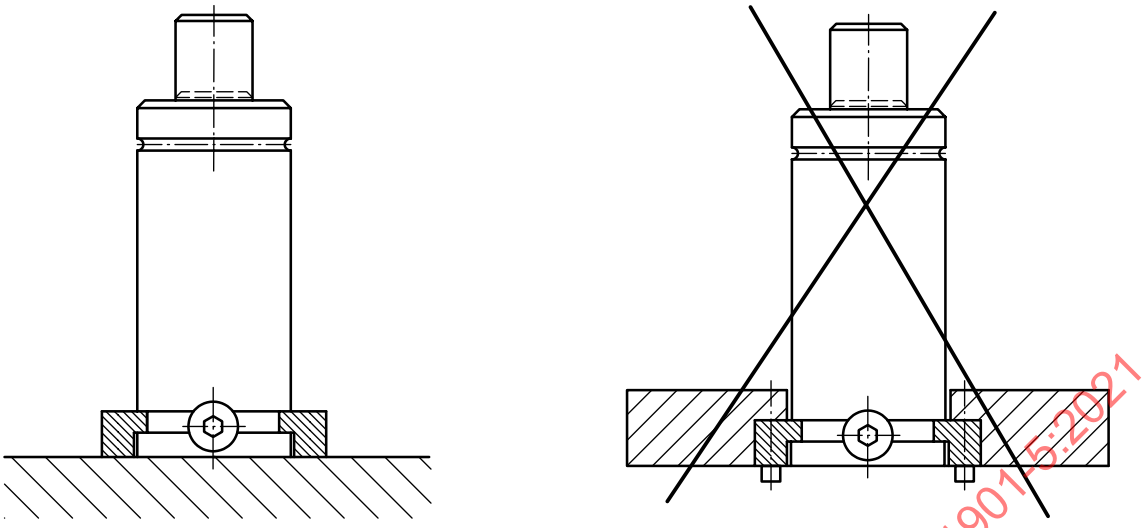
a) Permissible b) Not permissible

Figure A.9 — Lapped flange mounting

CAUTION — Do not expose mounting bolts to tensile forces.

A.10.3 Two-part mounting clamps

Two-part mounting clamps in accordance with type B of ISO 11901-2 are illustrated in Figure A.10.



a) Permissible **b) Not permissible**

Figure A.10 — Two-part mounting clamps

CAUTION — Do not expose mounting bolts to tensile forces.

A.10.4 Bottom flange mounting, split

The split bottom flange mounting is illustrated in Figure A.11.

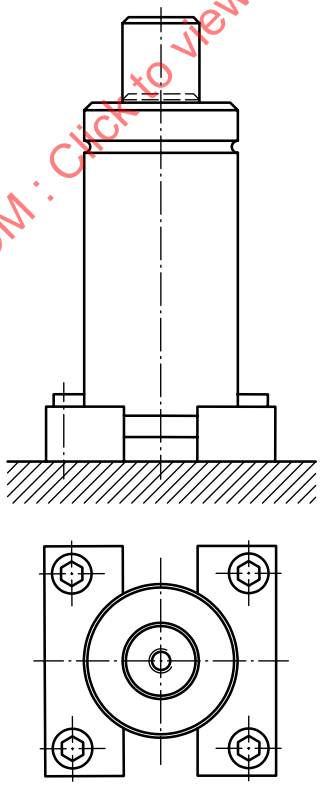
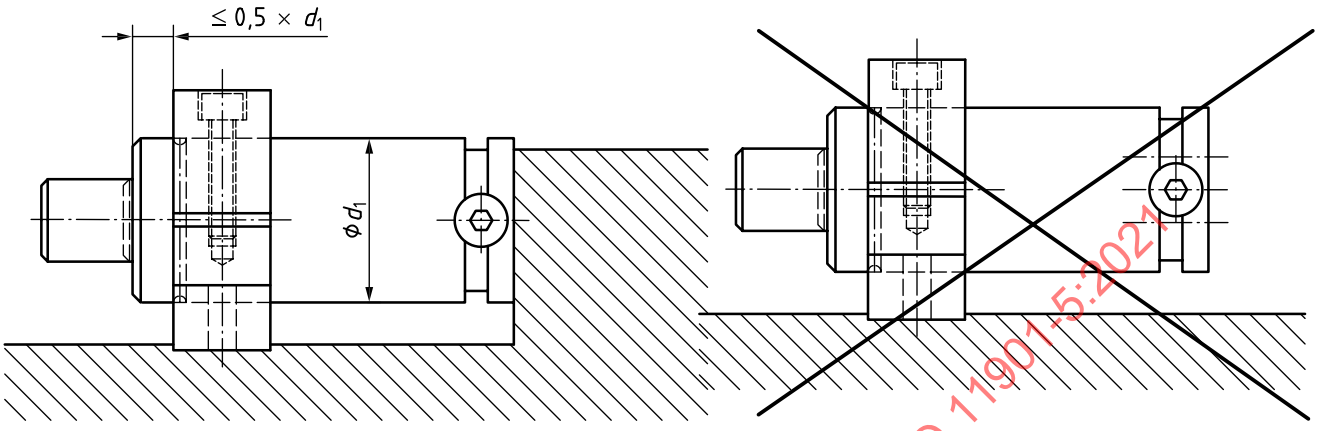


Figure A.11 — Split bottom flange mounting

A.10.5 Clamping flange mounting

Nitrogen gas springs with clamping flange mounting always require additional shouldering (Figure A.12).



a) Permissible **b) Not permissible**

Figure A.12 — Clamping flange mounting

A.10.6 Mounting hosed systems

The springs of hosed gas systems are not permitted to rotate. Rotation causes damage to the hoses which may result in damage or leakage. For this reason, it is not acceptable to install gas springs of hosed systems loosely in holes. The mounting options described in A.10.2 to A.10.5 are basically sufficient to prevent rotation of nitrogen gas springs. However, nitrogen gas springs can nevertheless rotate under unfavourable operating conditions. In these special situations the nitrogen gas springs should be bolted via the threads in the spring base

— directly, or

— onto a base plate (Figure A.13).

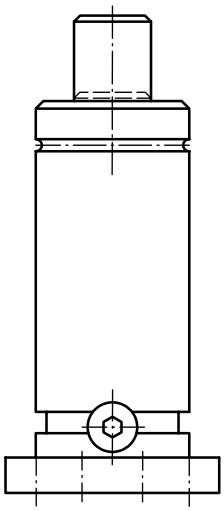
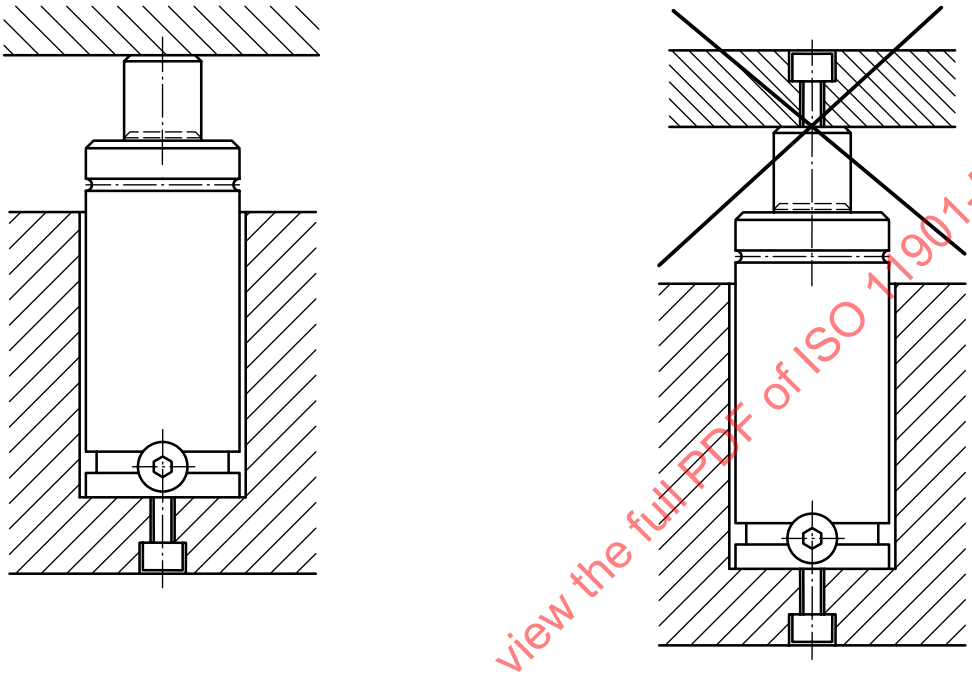


Figure A.13 — Mounting – bolted to the base

A.10.7 Alternative mounting option

If standard elements cannot be used, the threaded holes in the spring base are to be used as an alternative (Figure A.14).

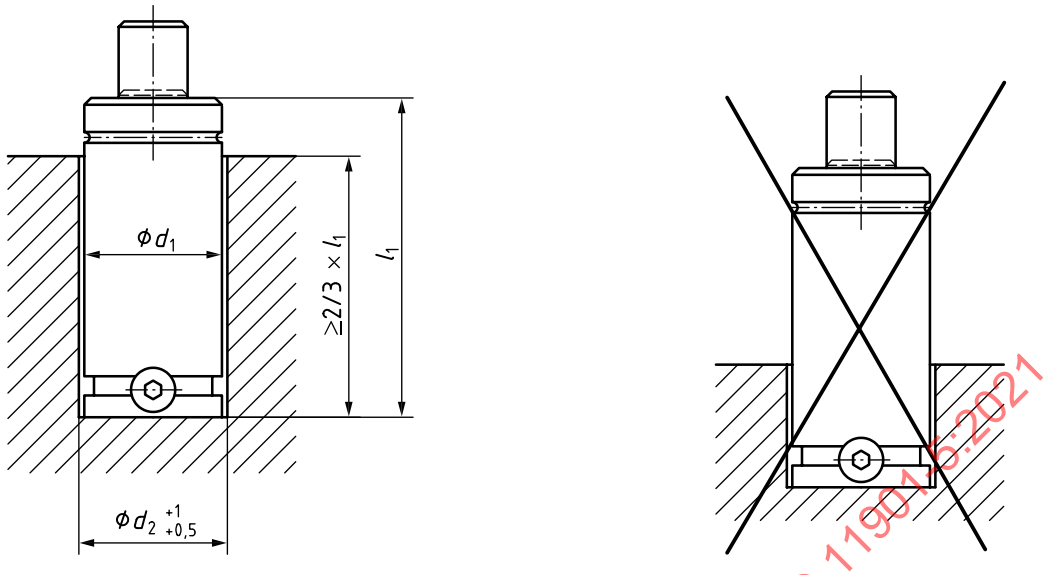
CAUTION — Do not use the threaded hole in the piston rod to mount the nitrogen gas springs or to connect other equipment. This is intended purely for transportation and maintenance purposes (Figure A.14).



a) Permissible **b) Not permissible**

Figure A.14 — Alternative mounting – bolted to the spring base

The use of unmounted springs is permitted only in fully encapsulated holes, e.g. in cams as retaining springs (Figure A.15). To prevent damage, the spring housing should be inserted at least ⅔ of the body length into the hole.



a) Permissible **b) Not permissible**

Figure A.15 — Mounting – inserted loosely in the hole

A.11 Installation in holes and pockets

Nitrogen gas springs can be installed in holes or pockets. In this case a flat bearing face is required, which should be perpendicular to the centre line of the gas spring.

A sufficient number of access points should be provided for hosing and pipework. Compliance with the instructions in A.10.6 is also required.

If they are installed loose, it is required a tighter installation tolerance for d_2 in Figure A.16 compared with lapped flange mounting, (see A.10.2) to prevent tilting.

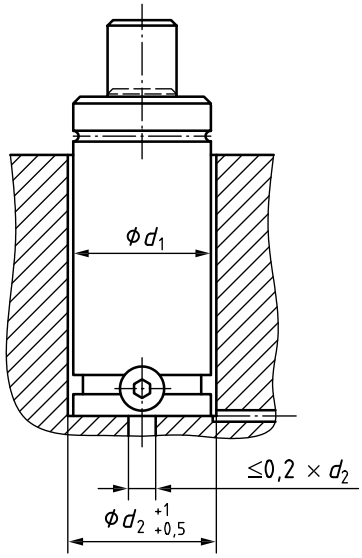


Figure A.16 — Installation in holes and pockets