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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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# 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*.



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# 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.

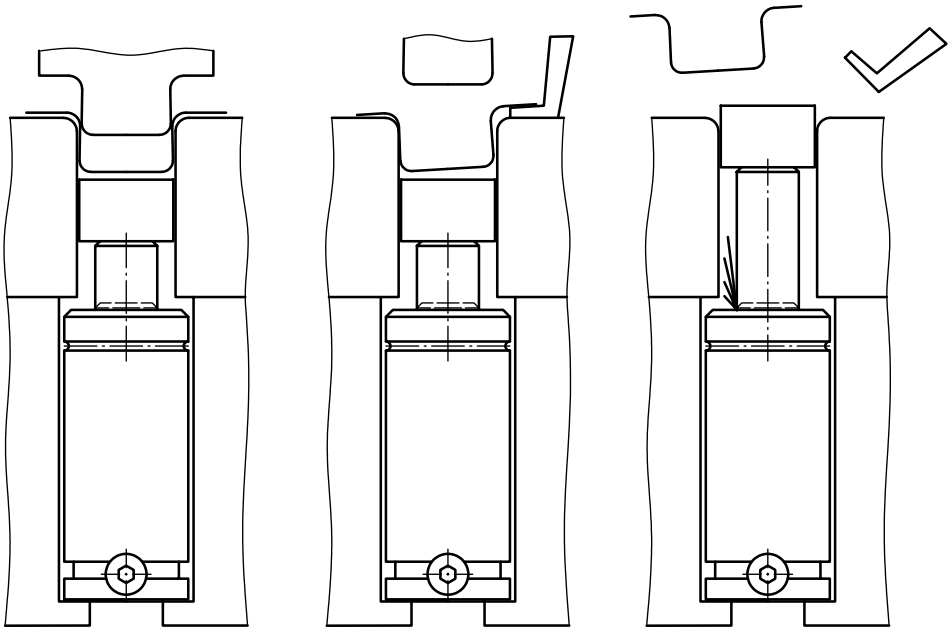


**Figure 1 — Return stroke of nitrogen gas spring without counterforce**

### 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.



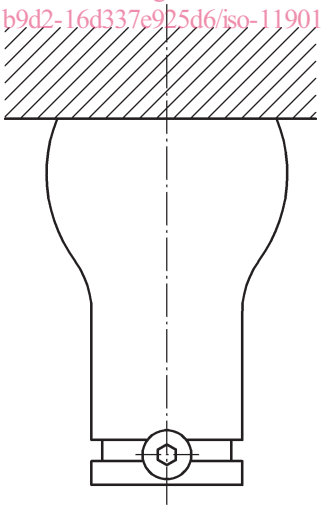


**Figure 2 — Damaging of the gas spring due to overstroke**

### 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.



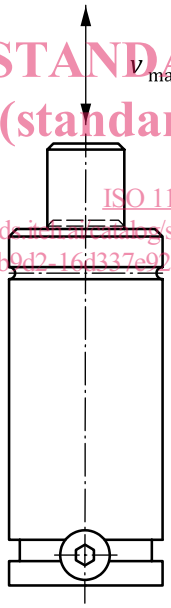



**Figure A.2 — Specification of the permitted piston rod speed**

## 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).

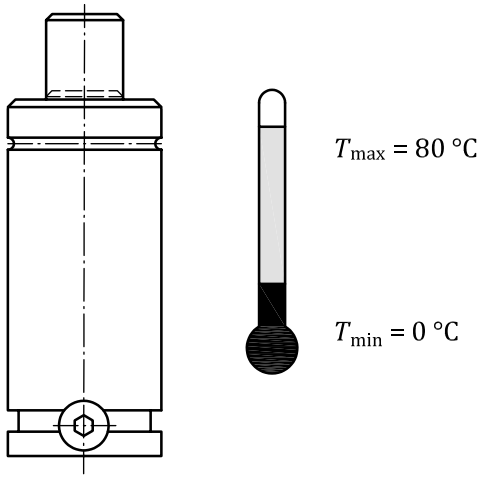



**Figure A.3 — Specification of the operating temperature range**

## A.6 Maximum charging pressure

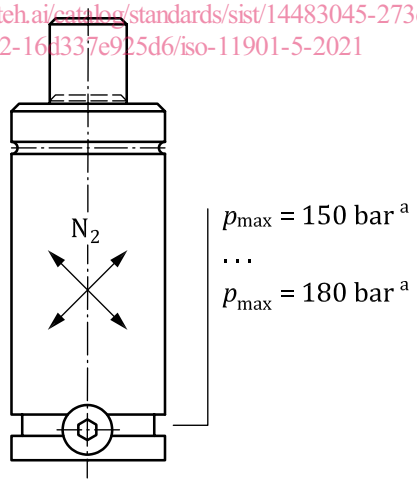
The only gas allowed to charge a gas spring is nitrogen ($N_2$).

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