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**Machine tools safety — Presses — Part 4: Safety requirements for  
pneumatic presses**

*Sécurité des machines-outils — Presses — Partie 4: Exigences de sécurité pour les presses pneumatiques*

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## ISO 16092-4:2019(E)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 10, *Safety*.

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](http://www.iso.org/members.html).

A list of all parts in the ISO 16092 series can be found on the ISO website.

## Introduction

This document is a type-C standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e. g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

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## Machine tools safety — Presses — Part 4: Safety requirements for pneumatic presses

### 1 Scope

This document, in addition to ISO 16092-1, specifies the technical safety requirements and measures to be adopted by persons undertaking the design, manufacture and supply of pneumatic presses which are intended to work cold metal or material partly of cold metal.

This document deals with all significant hazards relevant for pneumatic presses, when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4). All the phases of the lifetime of the machinery as described in ISO 12100:2010, 5.4, have been taken into consideration.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 16092-1:2017, *Machine tools safety — Presses — Part 1: General safety requirements*

ISO 13851:2019, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 13849-1:2015, ISO 16092-1:2017 and the following apply.

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/>

#### 3.1

##### restraint valve

device which protects against a gravity fall of the slide/ram

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### 3.2

#### **overall closing time**

time interval from the initiation of a slide movement at TDC to the termination of the movement (the closing of tools) at BDC

## **4 List of significant hazards**

This clause contains all the significant hazards, hazardous situations and events identified by risk assessment as significant for the machines defined in the scope and which require a specific action to eliminate or reduce the risk.

These hazards are listed in ISO 16092-1:2017, Annex A. Additional hazards are listed in Table A.1.

## **5 Safety requirements and/or measures**

### **5.1 General**

Pneumatic presses shall comply with the safety requirements and/or protective/risk reduction measures of this clause. In addition, the machine shall be designed according to the principles of ISO 12100 for relevant but not significant hazards which are not dealt with by this document.

### **5.2 Basic design considerations**

#### **5.2.1 Hydraulic and pneumatic systems — Common features**

ISO 16092-1:2017, 5.2.1, shall apply.

#### **5.2.2 Pneumatic systems**

ISO 16092 1:2017, 5.2.2, shall apply.

#### **5.2.3 Hydraulic systems**

In addition to the requirements given in ISO 16092-1:2017, 5.2.3, the following shall apply.

Where a pneumatic press is fitted with a pneumatic/hydraulic intensifier, the general requirements in ISO 4413 shall be followed in designing the hydraulic system.

#### **5.2.4 Electric systems**

ISO 16092 1:2017, 5.2.4, shall apply.

### **5.3 Mechanical hazards in the tools area**

#### **5.3.1 Major danger zone**

ISO 16092-1:2017, 5.3.1, shall apply.

#### **5.3.2 Safeguarding measures**

ISO 16092-1:2017, 5.3.2, shall apply

#### **5.3.3 Other safety requirements**

ISO 16092-1:2017, 5.3.3, shall apply.

#### **5.3.4 Release of trapped persons between the tools**

ISO 16092-1:2017, 5.3.4, shall apply.



### 5.3.5 Release of persons trapped inside enclosed areas

ISO 16092-1:2017, 5.3.5, shall apply.

### 5.3.6 Prevention of gravity fall during maintenance or repair

In addition to the requirements given in ISO 16092-1:2017, 5.3.6, the following shall apply.

On presses with an opening stroke length of more than 500 mm and a depth of table of more than 800 mm, a mechanical restraint device shall be permanently fixed and integrated with the press. It can be manually operated.

If an integrated device, when active, cannot be easily seen from the operator's position, an additional clear indication of the position of the device shall be provided.

### 5.3.7 Prevention of unintended gravity fall during production (down-stroking press)

**5.3.7.1** Measures shall be provided to prevent unintended gravity fall of the slide/ram in the production mode with manual or automatic feed or removal (see Tables 1 and 2). Such a fall can be due to a failure of the pneumatic system, mechanical failure or a failure of the electrical control system.

In this case, the following shall be provided:

- a mechanical restraint device;
- a pneumatic restraint device, as defined in 5.3.7.2; or
- a combination of a single valve pneumatic restraint device and a mechanical restraint device.

The restraint devices shall operate automatically and be effective whenever the tool is stopped and access to the tools is possible for the operator.

**5.3.7.2** The restraint device shall consist of one or more of the following measures, provided that they are capable of holding up the slide/ram:

- a) return spring;
- b) clamping device;
- c) two pneumatic restraint valves, one of which is fitted as close as possible to the cylinder outlet, using flanged or welded pipework, capable of holding the slide/ram.

## 5.4 Control and monitoring system

### 5.4.1 Control and monitoring functions

**5.4.1.1** In addition to the requirements given in ISO 16092-1:2017, 5.4.1, the following control and monitoring functions shall apply.

**5.4.1.2** For presses pneumatically controlled with a stroke length equal to or less than 30 mm, and a maximum press force equal to or less than 1 000 N, the two-hand control device shall be fixed at the minimum distance as calculated by Formula (1):

$$t = 3 \times t_{\max} \quad (1)$$

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where

$t$  is the overall response time;

$t_{\max}$  is the maximum overall closing time (see also Annex B).

NOTE The factor 3 is intended to compensate the type of two-hand control device selected.

This subclause applies to presses fitted with two-hand control devices used for normal operation. They shall at least correspond to type IIIB of ISO 13851;

It shall not be possible for the overall closing time to be exceeded by any adjustment.

**5.4.1.3** Power interlocking, as defined in ISO 14119:2013, 3.31, may be provided for presses fitted with interlocking guards. The guard interlocking device shall be positively linked with the valve to directly control the flow of fluid to and from the cylinder (see Annex C).

### 5.4.2 Muting

In addition to the requirements given in ISO 16092-1:2017, 5.4.2, the following shall apply.

The means for setting the start point at which the safeguarding system is muted during the closing stroke shall be:

- a position signal when the tools are closed; and
- a pressure signal or suitable alternative signals which actuate when the machine begins to apply the force.

### 5.4.3 Selection devices

ISO 16092-1:2017, 5.4.3, shall apply.

### 5.4.4 Position sensors

ISO 16092-1:2017, 5.4.4, shall apply.

### 5.4.5 Control devices

ISO 16092-1:2017, 5.4.5, shall apply.

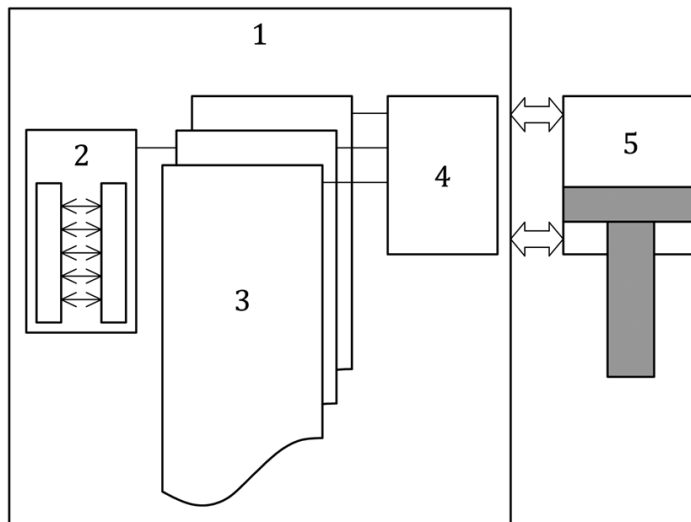
### 5.4.6 Valves

Manual override devices shall not be directly fitted to restraint valves. If manual override devices are incorporated into other valves for test or maintenance purposes, they shall require the use of a tool to operate the override.

This override shall be of the non-locking type.

### 5.4.7 Performance level of safety functions

Safety functions of a pneumatic press shall meet the requirements stated in the Tables 1 and 2. Figure 1 shows an example of all relevant parts of a control system of pneumatic press with a safety function to stop any down stroke of the slide by ESPE using AOPD.



**Key**

- 1 overall SRP/CS of a safety function "Stop slide down stroke by ESPE using AOPD"
- 2 "Input": ESPE using AOPD
- 3 "Logic": control parts (plausibility check of selection, Logic of AOPD, Logic of muting...)
- 4 output: pneumatic safety-related part
- 5 pneumatic actuator

**Figure 1 — Example of a safety function with all relevant safety-related parts**

The performance levels in Tables 1 and 2 are the minimum required performance levels and already take the probability of occurrence into account.

**Table 1 — Summary of requirements for the operator safeguarding of the danger zones at the tools, die cushions, work-piece ejectors and transfer systems areas (see ISO 16092-1:2017, 5.3.1) for different modes of operation — Mode of production: Single cycle, manual feed or removal**

Main safety system	Hazardous movement	Safety function	Minimum required PL (PL <sub>r</sub> ) for safety function and I, L and O	Basis for the design of input, logic, output of safety function			
				Requirement for category of Input, Logic and Output <sup>a</sup>	I — Input (sensor area)	L — Logic (control)	O — Output (pre-actuator)
Closed tools used as the only means of protection [see ISO 16092-1:2017, 5.3.2.1 a)]	Movement (e.g. the slide, die cushions, workpiece ejectors	Cycle initiation/stop	PL a	Cat B	Any <sup>g</sup>	Any	Pneumatic system (e.g. air valves)
Closed tools used in a press with other operating modes with different main safety systems [see ISO 16092-1:2017, 5.3.2.1 a)]							
Fixed enclosing guard used as the only means of protection [see ISO 16092-1:2017, 5.3.2.1 b)]	Movement (e.g. closing stroke) of the slide, die cushions, workpiece ejectors and transfer systems	Cycle initiation/stop	PL a	Cat B	Any <sup>g</sup>	Any	Pneumatic system (e.g. air valves)