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**Safety of machinery — Guards  
— General requirements for the  
design and construction of fixed and  
movable guards**

*Sécurité des machines — Protecteurs — Prescriptions générales pour  
la conception et la construction des protecteurs fixes et mobiles*

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ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

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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)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information \(standards.iteh.ai\)](http://Foreword - Supplementary information (standards.iteh.ai))

The committee responsible for this document is ISO/TC 199, *Safety of machinery*.

This second edition cancels and replaces the first edition (ISO 14120:2002), which has been technically revised. The main changes from the previous edition are as follows:

- Definitions have been brought into line with ISO 12100. The figures showing examples of guards have been updated where appropriate.
- [Clause 5](#) has been updated with new references to ISO 13855 and ISO 14119. Requirements on the removal of guards have been amended. [Subclause 5.3.9](#) describes requirements for the removal of fixed guards only with a tool. In addition, there is a requirement that fixed guards be designed to prevent easy removal. The subclause about impact and ejection resistance ([5.4](#)) has been strengthened. Subclauses on Climbing ([5.18](#)), Retained fastenings ([5.19](#)), Warning signs ([5.21](#)), Colour ([5.22](#)) and Appearance ([5.23](#)) have been added.
- [Clause 6](#) has been amended and updated to better include cover combinations of different guards or of guards with other devices. Selection of guards according to the number and size of the hazards ([6.3](#)) has been changed and updated. [Subclause 6.4.4.2](#), where access is required during the working cycle, has been changed and updated.
- Clauses on verification and validation have been introduced ([Clause 7](#)). This includes a table which outlines the safety requirements and/or measures by subclause.
- The text of [Clause 8](#) has been updated, including requirements for procedures for removal of guards (use of a tool and the safe working procedure). The subclause for removal of guards ([8.5](#)) has changed.
- Two new informative annexes on test methods, one on projectile tests and the other on impact tests, have been added.
- The Bibliography, which contains a list of International and European Standards published or in preparation that can be helpful in the design and commissioning of guards, has been updated.

## Introduction

The structure of safety standards in the field of machinery is as follows:

- a) **type-A standards** (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to all machinery;
- b) **type-B standards** (generic safety standards) dealing with one safety aspect or one or more type(s) of safeguard that can be used across a wide range of machinery:
  - type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);
  - type-B2 standards on safeguards (e.g. two-hand controls, interlocking devices, pressure-sensitive devices, guards);
- c) **type-C standards** (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This International Standard is a type-B2 standard as stated in ISO 12100.

Guards provide a risk reduction for both protection against unintended access and against ejected parts and substances. The guarding can also give protection against others hazards, e.g. noise, fire, biological hazards, and radiation.

The requirements of this document can be supplemented or modified by a type-C standard.

For machines that are covered by the scope of a type-C standard and that have been designed and built according to the requirements of that standard, the requirements of that type-C standard take precedence.

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# Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards

## 1 Scope

This International Standard specifies general requirements for the design, construction, and selection of guards provided to protect persons from mechanical hazards.

This International Standard indicates other hazards that can influence the design and construction of guards.

This International Standard applies to guards for machinery which will be manufactured after it is published.

The requirements are applicable if fixed and movable guards are used. This International Standard does not cover interlocking devices. These are covered in ISO 14119.

This International Standard does not provide requirements for special systems relating specifically to mobility such as ROPS (rollover protective structures), FOPS (falling-object protective structures), and TOPS (tip over protective structures) or to the ability of machinery to lift loads.

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## 2 Normative references (standards.iteh.ai)

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 13855, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body*

ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14119, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14123-1, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

ISO 14159, *Safety of machinery — Hygiene requirements for the design of machinery*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

### 3.1

#### **guard**

physical barrier, designed as part of the machine, to provide protection

Note 1 to entry: A guard may act either

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- alone, in which case it is only effective when “closed” (for a movable guard) or “securely held in place” (for a fixed guard), or
- in conjunction with an interlocking device with or without guard locking, in which case protection is ensured whatever the position of the guard.

Note 2 to entry: Depending on its construction, a guard may be described as, for example, casing, shield, cover, screen, door, enclosing guard.

Note 3 to entry: The terms for types of guards are defined in ISO 12100:2010, 3.27.1 to 3.27.6. See also ISO 12100:2010, 6.3.3.2 for types of guards and their requirements.

[SOURCE: ISO 12100:2010, 3.27]

### 3.2

#### **fixed guard**

guard affixed in such a manner (for example, by screws, nuts, and welding) that it can only be opened or removed by the use of tools or by destruction of the means by which the guard is affixed

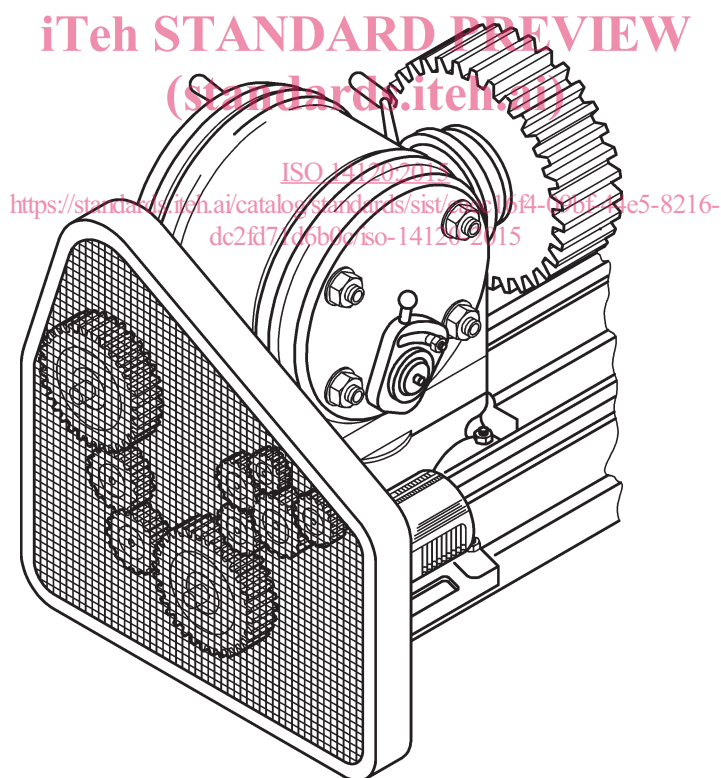
[SOURCE: ISO 12100:2010, 3.27.1]

#### 3.2.1

##### **enclosing guard**

guard which prevents access to the hazard zone from all sides

Note 1 to entry: See [Figure 1](#).



**Figure 1 — Example of an enclosing guard totally preventing access to transmission machinery**

#### 3.2.2

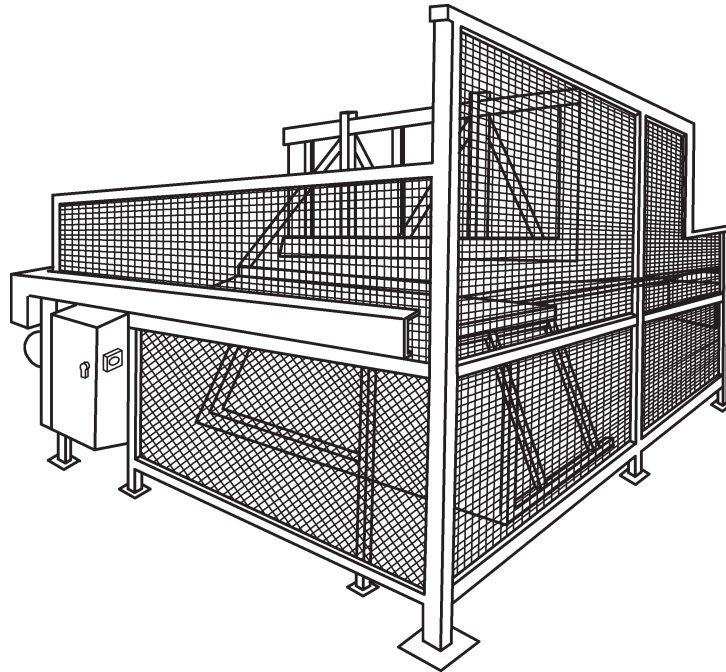
##### **distance guard**

guard which does not completely enclose a hazard zone, but which prevents or reduces access by virtue of its dimensions and its distance from the hazard zone, for example perimeter fence or tunnel guard

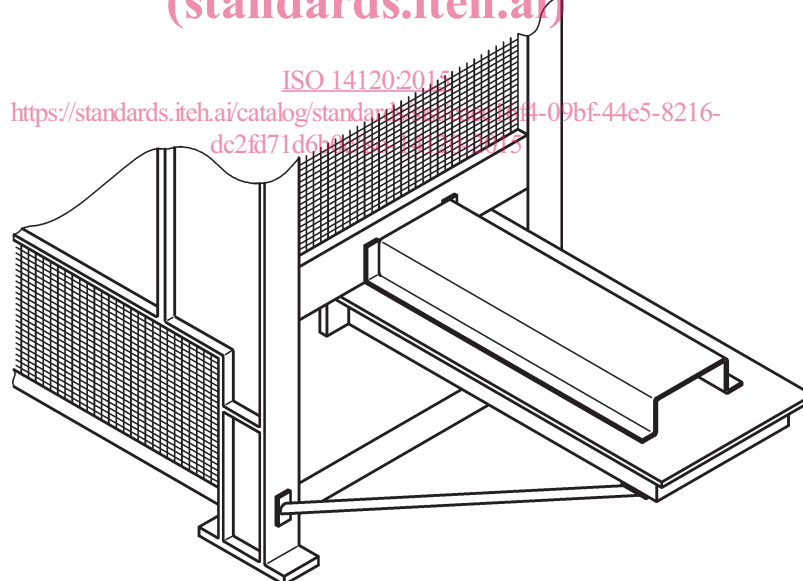
Note 1 to entry: A distance guard can be partially or fully surrounding.



Note 2 to entry: See [Figures 2](#) and [3](#).



**Figure 2 — Example of a distance guard**  
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**Figure 3 — Example of a distance guard: tunnel guard providing protection at machine feed or discharge area**

### 3.3

#### **movable guard**

guard which can be opened without the use of tools

[SOURCE: ISO 12100:2010, 3.27.2]

#### 3.3.1

##### **power-operated guard**

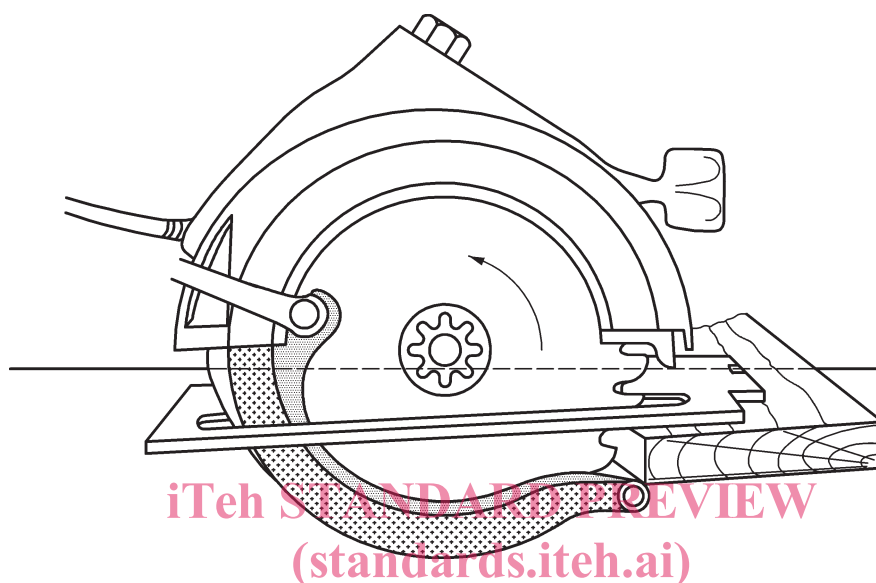
movable guard that is operated with the assistance of power from a source other than persons or gravity

### 3.3.2

#### **self-closing guard automatically adjustable guard**

movable guard operated by a machine element (e.g. moving table) or by the workpiece or a part of the machining jig, so that it allows the workpiece (and the jig) to pass and then automatically returns (by means of gravity, a spring, other external power, etc.) to the closed position as soon as the workpiece has vacated the opening through which it has been allowed to pass

Note 1 to entry: See [Figure 4](#).



**Figure 4 — Example of a self-closing guard**

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### 3.4

#### **adjustable guard**

guard which is adjustable as a whole or which incorporates adjustable part(s)

[SOURCE: ISO 12100:2010, 3.27.3]

#### 3.4.1

##### **manually adjustable guard**

adjustable guard where the adjustment is made manually and the adjustment remains fixed during a particular operation

Note 1 to entry: See [Figure 5](#).

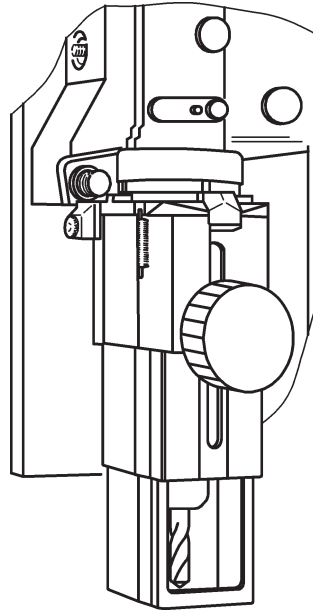


Figure 5 — Example of an adjustable guard for a radial or pedestal drilling machine

### 3.5

#### interlocking guard

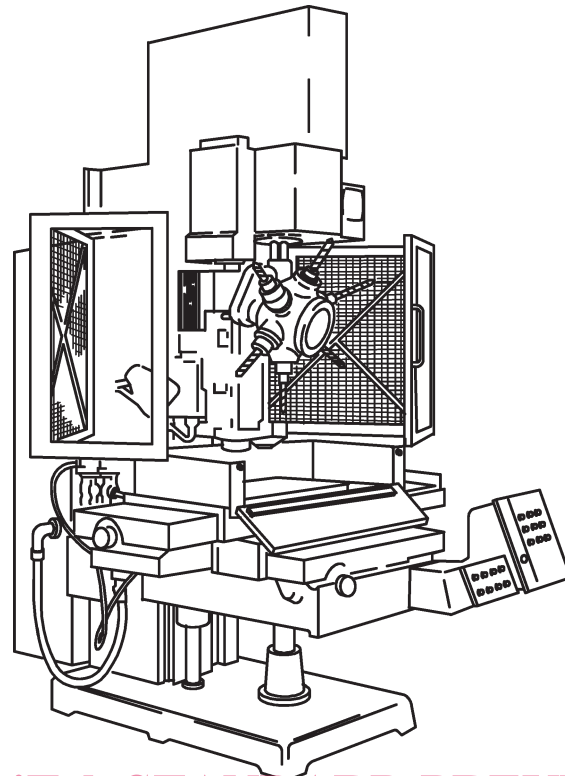
guard associated with an interlocking device so that, together with the control system of the machine, the following functions are performed:

- the hazardous machine functions “covered” by the guard cannot operate until the guard is closed;
- if the guard is opened while hazardous machine functions are operating, a stop command is given;
- when the guard is closed, the hazardous machine functions “covered” by the guard can operate (the closure of the guard does not, by itself, start the hazardous machine functions)

Note 1 to entry: See [Figure 6](#) and [7](#).

Note 2 to entry: See ISO 14119 about interlocking devices.

[SOURCE: ISO 12100:2010, 3.27.4]



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Figure 6 — Example of interlocking hinged guards; these enclose the hazard zone when closed  
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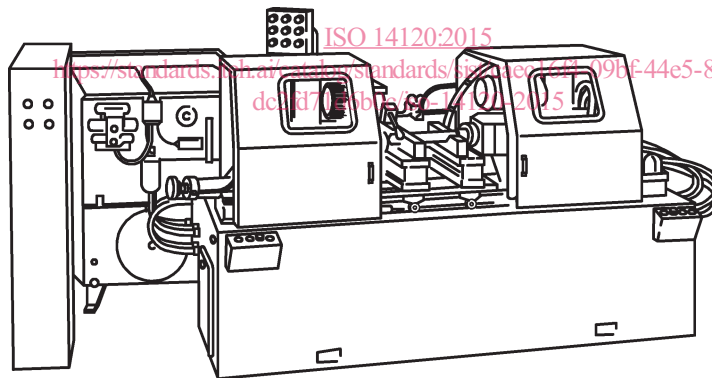


Figure 7 — Example of interlocking sliding guards

### 3.5.1 interlocking guard with a start function control guard

special form of interlocking guard which, once it has reached its closed position, gives a command to initiate the hazardous machine function(s) without the use of a separate start control

Note 1 to entry: ISO 12100:2010, 6.3.3.2.5, gives detailed provisions regarding the conditions of use for a control guard (see also [5.3.14](#)).

[SOURCE: ISO 12100:2010, 3.27.6]

### 3.5.2 interlocking guard with guard locking

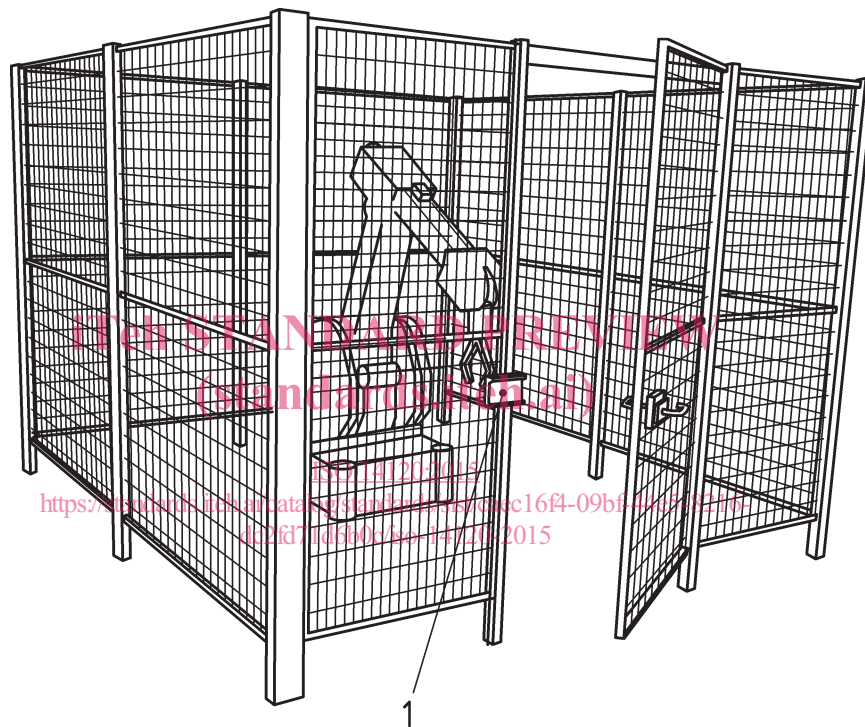
guard associated with an interlocking device and a guard locking device so that, together with the control system of the machine, the following functions are performed:

- the hazardous machine functions “covered” by the guard cannot operate until the guard is closed and locked;
- the guard remains closed and locked until the risk due to the hazardous machine functions “covered” by the guard has disappeared;
- when the guard is closed and locked, the hazardous machine functions “covered” by the guard can operate (the closure and locking of the guard do not, by themselves, start the hazardous machine functions)

Note 1 to entry: See ISO 14119 about interlocking devices.

Note 2 to entry: See [Figure 8](#).

[SOURCE: ISO 12100:2010, 3.27.5]



#### Key

- 1 example of guard locking device

**Figure 8 — Example of safeguarding using fixed distance guards and interlocking guards with guard locking**

### 3.6 closed position

position of a guard so that it performs the function for which it was designed

Note 1 to entry: The function can be to prevent/reduce access to the hazard zone, and/or prevent ejection of parts of the machine or the workpiece, and/or reduce exposure to hazards such as noise, radiation, etc.

Note 2 to entry: Open guard — guard which is not in closed position.

### 3.7 tool

implement such as a key or wrench designed to open and close a fastener

Note 1 to entry: An improvised implement, such as a coin or a nail-file, cannot be considered as a tool.