

ISO 14119 – Understanding Different Types of Interlocks

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Objective

- To provide an overview of ISO 14119 and provide a better understanding of different types of interlocking devices.

Agenda

- What is an Interlocking Device?
- Overview of ISO 14119
- Example of an interlocking device
- Some definitions
- ‘Types’ of interlocking devices
- Different types of guard locking devices
- Supplementary guard locking release

What is an Interlocking Device?

- A mechanical, electrical, or other device which prevents hazardous machine functions under specific conditions.
 - ...generally when the guard that the interlock is affixed to is not closed

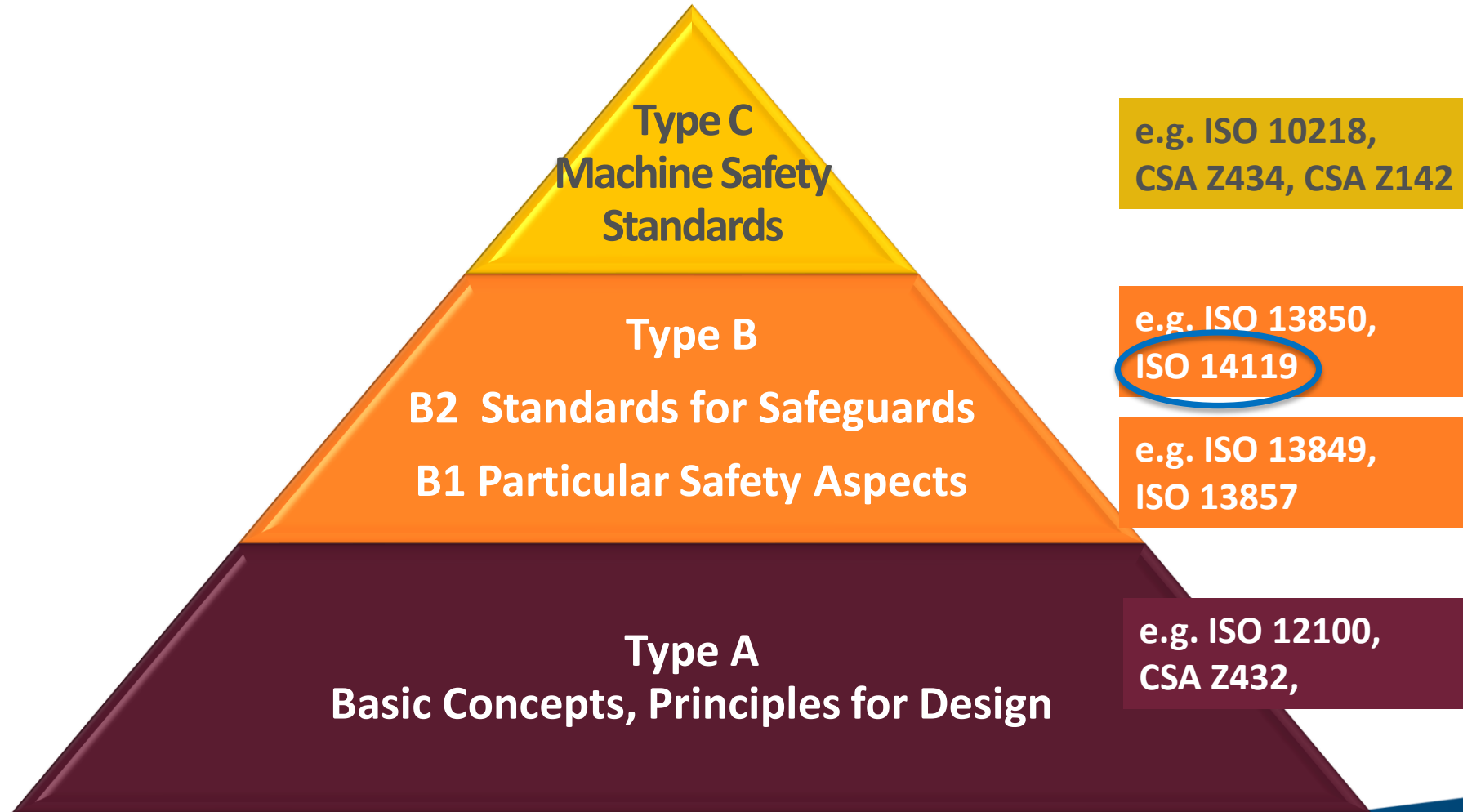
[International Organization for Standardization, [ISO] 14119 2013, p 3]

ISO 14119:2013 - Safety of Machinery – Interlocking devices associated with guards – Principles for design and selection

Overview

- Current version of ISO 14119 is ‘2013’ version
- Second edition – replaced ISO 14119:1998/Amd 1:2007
- Standard Type - *‘Type-B2’ – Standard for Safeguards*
- An updated version of ISO 14119 is currently under development (*see ISO/DIS 14119.2*)

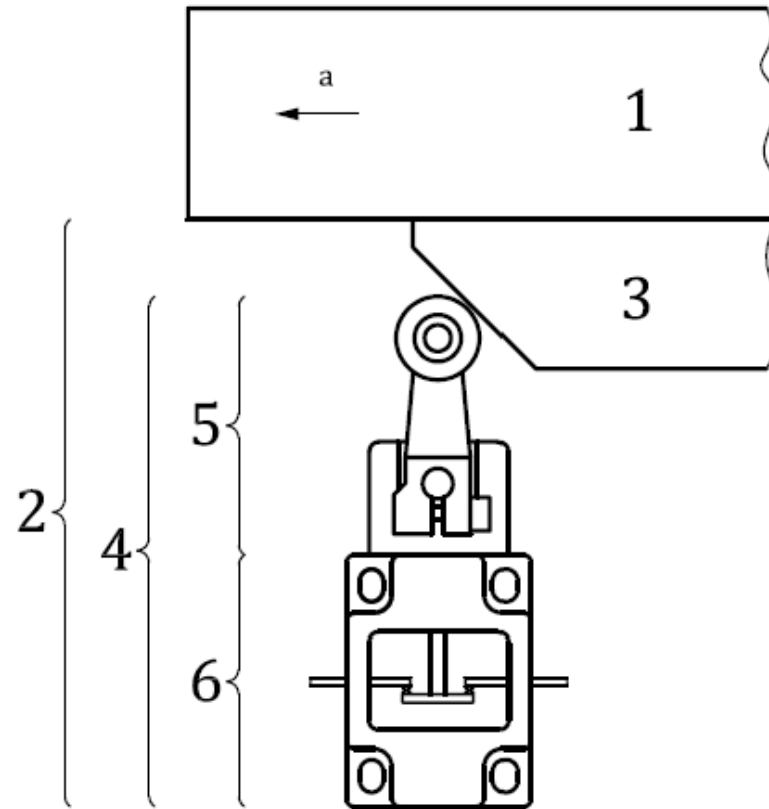
Machine Safety Standard Types



Example of an interlocking device

Key

- | | | | |
|---|----------------------|---|------------------|
| 1 | guard | 4 | position switch |
| 2 | interlocking device | 5 | actuating system |
| 3 | actuator | 6 | output system |
| a | Direction of opening | | |



[International Organization for Standardization, [ISO] 14119 2013, Figure 1, p.2]

ISO 14119 – Some Definitions

- *Interlocking guard* – A guard equipped with an interlocking device that is integrated into the control system and performs the following functions:
 - Prevents operation of hazardous machine functions.
 - Sends a stop signal if opened during operation of hazardous machine functions.
 - When the guard is closed, hazardous machine functions that the closed guard prevents access to can operate (*guard closure does not by itself cause hazardous machine functions to start*).
- *Interlocking guard with a start function (control guard)* - An interlocking guard which, upon reaching its closed position, gives a command to initiate the hazardous machine function(s) without the use of a separate start control.

[International Organization for Standardization, [ISO] 14119 2013, p.2]

ISO 14119 – Some Definitions

- *Guard Locking Device* – A device that locks a guard in the closed position and is integrated into the control system.
- *An Interlocking guard with guard locking* - A guard equipped with an interlocking device that, in conjunction with the machine control system performs the following functions:
 - Prevents operation of hazardous machine functions until guard is closed and locked
 - Guard remains closed and locked until hazardous machine functions have ceased
 - When guard is closed and locked hazardous machine functions can operate (*guard closure and locking does not by itself cause hazardous machine functions to start*).

[International Organization for Standardization, [ISO] 14119 2013, p.2, 3]

Interlocking Device ‘Types’

Table 1 — Overview of interlocking devices

Actuation principle examples		Actuator examples		Type	Examples: see Annex ^a
Mechanical	Physical contact/ force	Uncoded	Rotary cam	Type 1	A.1
			Linear cam		A.2, A.4
			Hinge		A.3
		Coded	Tongue (-shaped actuator)	Type 2	B.1
			Trapped-key		B.2
Non- contact	Inductive	Uncoded	Suitable ferric metal	Type 3	C
	Magnetic		Magnet, solenoid		
	Capacitive		Any suitable object		
	Ultrasonic		Any suitable object		
	Optic		Any suitable object		
	Magnetic	Coded	Coded magnet	Type 4	D.1
	RFID		Coded RFID tag		D.2
	Optic		Optically coded tag		—

[International Organization for Standardization, [ISO] 14119 2013, Table 1, p. 7]

Guard interlocking without guard locking

- A guard equipped with an interlocking device '*without guard locking*' can be opened at any time during machine operation.
 - Upon opening the guard, the interlocking device sends a stop signal to the system.
 - It is important to ensure that the access time to machine hazards is longer than system stopping performance.

[International Organization for Standardization, [ISO] 14119 2013, p.8]

Guard interlocking with guard locking

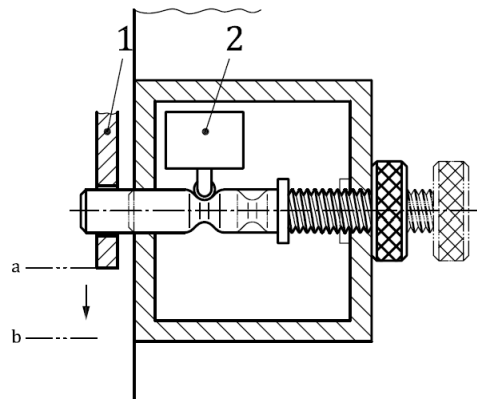
- A guard equipped with an interlocking device '*with guard locking*' is prevented from opening by the guard locking device until all hazardous machine functions have ceased.
- There are two types of guard locking functions:
 - Unconditional Unlocking* – Unlocking of the guard can be initiated anytime by operator.
 - When unlocking starts a stop command is generate
 - The time required for the guard locking device to unlock shall be > the time for hazardous machine function to cease.
 - Conditional Unlocking* – Interlock guard locking device only unlocks when all hazardous machine functions have ceased

[International Organization for Standardization, [ISO] 14119 2013, p.8]

Operation of different types of guard locking devices

- Mechanical guard locking devices shall use *'direct mechanical blocking due to form'*.
- Friction and force alone shall not be relied upon.

Manually applied/released guard locking device



Key

- 1 movable guard
- 2 position switch
- a Closed.
- b Not closed.

Powered mechanical power-actuated guard locking devices - operation modes

a)		Spring applied	Engaged
		Power-ON released	Released
b)		Power-ON applied	Engaged
		Spring released	Released
c)		Power-ON applied	Engaged
		Power-ON released	Released

Powered electromagnetic guard locking device operation modes

d)		Power-ON applied	Engaged
		Power-OFF released	Released

[International Organization for Standardization, [ISO] 14119 2013, Fig.5. p.11]

[International Organization for Standardization, [ISO] 14119 2013, Annex F, Fig. F.5, p.54]

Supplementary guard locking releases

- Depending on the application supplementary release of guard locking may be required.
- *(Note: Escape and emergency releases must meet a minimum of a Category B)*

Escape release of guard locking – some requirements

- Unlocking of guard from inside safeguarded space shall be easily possible without auxiliary means regardless of operating condition.
- Unlocking means shall be manually operated and act directly on the locking mechanism.
- Unlocking shall generate a stop command
- Unlocking means for escape release shall only be accessible from inside safeguarded space.

[International Organization for Standardization, [ISO] 14119 2013, p.17]

Supplementary guard locking releases cont'd...

Emergency release of guard locking – some requirements

- Unlocking of guard from outside safeguarded space shall be possible and easily actuated without auxiliary means regardless of operating condition.
- Unlocking means shall be manually operated and act directly on the locking mechanism.
- Unlocking shall generate a stop command
- The unlocking results in a blocking of the locking means in the released condition.
- The emergency guard release shall be clearly marked “*to be used only in emergency situation*”, and shall be positioned or shielded to prevent accidental opening.

*Note: A guard locking device with **emergency release** can be used as an **escape release** and mounted inside the safeguarded space provided it meets the escape release conditions.*

[International Organization for Standardization, [ISO] 14119 2013, p.17]

Supplementary guard locking releases cont'd...

Auxiliary release of guard locking – some requirements

- Deliberate unlocking of the guard locking device from outside the safeguarded space shall only be by the use of a *'tool'* or *'key'* regardless of operating condition.
- Shall be protected against unintended actuation.
- Shall generate a stop command
- Resetting shall only be possible by means of a tool or other method (i.e. at a control system level)

[International Organization for Standardization, [ISO] 14119 2013, p.18]

Selection of an interlocking device

- All phases of machine life must be considered.

The following factors shall be taken into account:

- Conditions of use and intended use
- Hazards present at the machine
- Severity of the possible injury
- Probability of failure of the interlocking device
- The required PL level or SIL for the safety function
- Information for use provided for the interlocking device from the manufacturer
- Means to prevent A Type 4 interlocking device actuator from being reconfigured by non-authorized personnel

[International Organization for Standardization, [ISO] 14119 2013, p.18]

References

- International Organization for Standardization (2013). *Safety of machinery – Interlocking devices associated with guards – Principles for design and selection*

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