

# ISO 14119:2024-09 (E)

## Safety of machinery - Interlocking devices associated with guards - Principles for design and selection

---

<b>Contents</b>		<b>Page</b>
Foreword .....		v
Introduction .....		vi
1	Scope .....	1
2	Normative references .....	1
3	Terms and definitions .....	2
4	Symbols .....	9
5	Operating principles and types of interlocking devices associated with guards .....	10
5.1	General .....	10
5.2	Principles of guard interlocking without guard locking .....	13
5.3	Principles of guard interlocking with guard locking .....	13
5.3.1	General .....	13
5.3.2	Interlocking device with guard locking .....	14
6	Requirements for the design and the arrangements of interlocking devices with and without guard locking .....	16
6.1	General .....	16
6.2	Arrangement and fastening of position switches, bolt locks and access locks .....	16
6.3	Arrangement and fastening of actuators .....	17
6.3.1	General .....	17
6.3.2	Cams .....	17
6.4	Actuation modes of interlocking devices .....	17
6.5	Mechanical stop .....	18
6.6	Additional requirements on guard-locking devices .....	18
6.6.1	General .....	18
6.6.2	Locking force .....	19
6.6.3	Electromechanical guard-locking device .....	19
6.6.4	Electromagnetic guard-locking device .....	20
6.7	Additional requirements on access locks .....	21
6.7.1	General .....	21
6.7.2	Locking force .....	21
6.8	Whole body access .....	22
6.9	Supplementary releases .....	22
6.9.1	Escape release of guard locking .....	22
6.9.2	Auxiliary release of guard locking .....	22
6.9.3	Emergency release of guard locking .....	23
6.10	Interlock blocking .....	23
7	Selection of an interlocking device .....	23
7.1	General .....	23
7.2	Selection of a guard-locking device .....	24
7.2.1	Overall system response time and access time .....	24
7.2.2	Specific requirements for selection of guard-locking devices .....	24
7.2.3	Selection of supplementary guard-locking releases .....	25
7.3	Environmental conditions considerations .....	26
7.3.1	General .....	26

7.3.2	Influence of dust on Type 2 and Type 5 interlocking devices .....	26
7.4	Considerations for the application of trapped key interlocking systems .....	26
8	Design to minimize the motivation to defeat .....	26
8.1	System design .....	26
8.2	Methodology procedure .....	27
8.3	Additional measures to minimize possibility of defeat .....	28
8.4	Additional measures to minimize possibility of defeat for Type 5 devices .....	32
8.4.1	General .....	32
8.4.2	Key retention .....	32
8.4.3	Reproduction of keys .....	33
9	Requirements for the control system .....	33
9.1	General .....	33
9.2	Assessment of faults and fault exclusions .....	33
9.2.1	Assessment of faults .....	33
9.2.2	Fault exclusion .....	34
9.2.3	Examples for measures to prevent common cause failures through direct and non-direct mechanical action of the position switches of Type 1 interlocking devices .....	36
9.2.4	Energy source diversity .....	38
9.3	Release of guard-locking device .....	38
9.4	Series connection of electro-mechanical interlocking devices .....	38
9.5	Electrical and environmental conditions .....	38
9.5.1	General .....	38
9.5.2	Performance considerations .....	39
9.5.3	Immunity from disturbance .....	39
9.5.4	Electrical operating conditions .....	39
9.5.5	Clearances and creepage distances .....	39
10	Information for use .....	39
10.1	General .....	39
10.2	Information for use given by the manufacturer of interlocking devices .....	39
10.2.1	Marking .....	39
10.2.2	Instructions .....	40
10.3	Information for use given by the manufacturer of the machine .....	41
Annex A (informative)	Type 1 interlocking device -- Examples .....	42
Annex B (informative)	Type 2 interlocking device -- Examples .....	47
Annex C (informative)	Type 3 interlocking device -- Example .....	49
Annex D (informative)	Type 4 interlocking devices -- Examples .....	51
Annex E (informative)	Example of guard-locking devices .....	54
Annex F (informative)	Application examples of interlocking devices used within a safety function ..	59
Annex G (informative)	Motivation to defeat interlocking devices (defeating of protective devices) ...	65
Annex H (informative)	Examples for maximum static action forces .....	69
Annex I (normative)	Test procedures .....	71
Annex J (normative)	Evaluation of fault masking in series connections of interlocking devices with potential free contacts .....	73
Annex K (normative)	Trapped key interlocking systems .....	89
Bibliography	.....	106