

ISO 10218-1:2025-02 (E)

Robotics - Safety requirements - Part 1: Industrial robots

Contents		Page
Foreword		vi
Introduction		vii
1	Scope	1
2	Normative references	2
3	Terms, definitions and abbreviated terms	3
3.1	Terms and definitions	3
3.1.1	Robot, robot system, robot application, application	3
3.1.2	Sub-assemblies and components	4
3.1.3	Controls-related	6
3.1.4	Program-related	7
3.1.5	Power-, energy-related	8
3.1.6	Hazard-related	8
3.1.7	Role-related	8
3.1.8	Functional safety-related	9
3.1.9	Spaces, zones and distances	10
3.1.10	Risk reduction measures	11
3.1.11	Verification and validation	12
3.2	Abbreviated terms and symbols	12
4	Risk assessment	13
5	Design and risk reduction measures	13
5.1	Robot design	13
5.1.1	General	13
5.1.2	Materials, mechanical strength and mechanical design	13
5.1.3	Handling, lifting and transportation	14
5.1.4	Packaging	15
5.1.5	Stability	15
5.1.6	Temperature and fire risks	15
5.1.7	Special equipment	15
5.1.8	Position holding	15
5.1.9	Auxiliary axis (axes)	15
5.1.10	Power loss or change	16
5.1.11	Component malfunction	16
5.1.12	Hazardous energy	16
5.1.13	Electrical, pneumatic and hydraulic parts	17
5.1.14	Tool centre point (TCP) setting	17
5.1.15	Payload setting	18
5.1.16	Cybersecurity	18
5.1.17	Robot class	18
5.2	Controls	19
5.2.1	General	19
5.2.2	Protection from unexpected start-up	19
5.2.3	Singularity	20
5.2.4	Interlocking devices	20
5.2.5	Status indication and warning devices	20
5.2.6	Labelling	20
5.2.7	Modes	20

5.2.8	Means of controlling the robot	23
5.2.9	Means of initiating automatic operation	25
5.3	Safety functions	25
5.3.1	General	25
5.3.2	Functional safety standards	25
5.3.3	Performance	25
5.3.4	Failure or fault detection	26
5.3.5	Parameterization of safety functions	26
5.3.6	Communications	26
5.3.7	Electromagnetic compatibility (EMC)	27
5.4	Stopping functions	28
5.4.1	General	28
5.4.2	Emergency stop	28
5.4.3	Protective stop	29
5.4.4	Normal stop	29
5.5	Other safety functions	30
5.5.1	Single-point-of-control	30
5.5.2	Start/restart interlock and reset	30
5.5.3	Speed limit(s) monitoring	31
5.5.4	Enabling function	32
5.5.5	Monitored-standstill	33
5.5.6	Stopping time limiting	33
5.5.7	Stopping distance limiting	34
5.6	Simultaneous motion	34
5.7	Limiting robot motion	34
5.7.1	General	34
5.7.2	Mechanical limiting	35
5.7.3	Electro-mechanical limiting	35
5.7.4	Software-based limiting	35
5.7.5	Dynamic limiting	36
5.8	Movement without drive power	36
5.9	Lasers and laser equipment	36
5.10	Capabilities for collaborative applications	36
5.10.1	General	36
5.10.2	Hand-guided control (HGC)	36
5.10.3	Speed and separation monitoring (SSM)	37
5.10.4	Power and force limiting (PFL)	38
6	Verification and validation	38
6.1	General	38
6.2	Verification and validation	38
7	Information for use	38
7.1	General	38
7.2	Signals and warning devices	39
7.3	Marking	39
7.4	Signs (pictograms) and written warnings	39
7.5	Instruction handbook	40
7.5.1	General	40
7.5.2	Identification	40
7.5.3	Intended use	40
7.5.4	Installation	41
7.5.5	Stopping	41
7.5.6	Commissioning and programming	41
7.5.7	Operation and setting	42
7.5.8	Singularity	42
7.5.9	Hazardous energy	42
7.5.10	Movement without drive power	42
7.5.11	Cybersecurity	42
7.5.12	Functional safety	43
7.5.13	Teach pendants	45

7.5.14	Change or addition of component parts	46
7.5.15	Standards	46
7.5.16	Maintenance	46
7.5.17	Abnormal and emergency situations	46
7.5.18	Handling, lifting and transportation	46
Annex A (informative)	List of significant hazards	47
Annex B (informative)	Illustrations of spaces	52
Annex C (normative)	Safety functions	55
Annex D (informative)	Safety function information	61
Annex E (normative)	Test methodology for Class I robots - Maximum force per manipulator (FMPM)	63
Annex F (informative)	Symbols	71
Annex G (informative)	Means of verification and validation of the design and risk reduction measures	73
Annex H (normative)	Stopping time and distance measurement	92
Annex I (informative)	Implementation of start/restart interlock and reset functions	93
Bibliography	95