



**SLOVENSKI STANDARD**  
**oSIST prEN ISO 10218-1:2021**  
**01-julij-2021**

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**Robotika - Varnostne zahteve - 1. del: Industrijski roboti (ISO/DIS 10218-1:2021)**

Robotics - Safety requirements - Part 1: Industrial robots (ISO/DIS 10218-1:2021)

Robotik - Sicherheitsanforderungen für Robotersysteme im industriellen Umfeld - Teil 1: Roboter (ISO/DIS 10218-1:2021)

Robotique - Exigences de sécurité - Partie 1: Robots industriels (ISO/DIS 10218-1:2021)

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**ICS:**

25.040.30	Industrijski roboti. Manipulatorji	Industrial robots. Manipulators
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# DRAFT INTERNATIONAL STANDARD

## ISO/DIS 10218-1.2

ISO/TC 299

Secretariat: SIS

Voting begins on:  
2021-06-16Voting terminates on:  
2021-08-11

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## Robotics — Safety requirements —

### Part 1: Industrial robots

ICS: 25.040.30

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Reference number  
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## Foreword

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

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

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

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

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

25 This document was prepared by Technical Committee ISO/TC 299, *Robotics*, in  
26 collaboration with the European Committee for Standardization (CEN) Technical  
27 Committee CEN/TC 310, *Advanced automation technologies and their applications*, in  
28 accordance with the Agreement on technical cooperation between ISO and CEN (Vienna  
29 Agreement).

30 This third edition cancels and replaces the second edition (ISO 10218-1:2011), which has  
31 been technically revised.

32 The main changes compared to the previous edition are as follows:

- 33 — incorporating safety requirements for industrial robots intended for use in  
34 collaborative applications (formerly, the content of ISO/TS 15066);
- 35 — clarifying requirements for functional safety;
- 36 — adding requirements for cybersecurity to the extent that it applies to industrial robot  
37 safety.

38 A list of all parts in the ISO 10218 series can be found on the ISO website.

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39 Any feedback or questions on this document should be directed to the user's national  
40 standards body. A complete listing of these bodies can be found at  
41 [www.iso.org/members.html](http://www.iso.org/members.html).

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## 42 Introduction

43 The ISO 10218 series has been created in recognition of the particular hazards that are  
44 presented by robotics in an industrial environment. ISO This document addresses robots  
45 as incomplete machines, while ISO 10218-2 addresses robots integrated into complete  
46 machines (systems, applications, cells).

47 This ISO document is a type-C standard according to ISO 12100.

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

- 50 — robot manufacturers (small, medium and large enterprises);
- 51 — robot system/ application integrators (small, medium and large enterprises);
- 52 — health and safety bodies (regulators, accident prevention organisations, market  
53 surveillance etc).

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

- 56 — robot system users/employers (small, medium and large enterprises);
- 57 — robot system users/employees (e.g. trade unions);
- 58 — service providers, e. g. for maintenance (small, medium and large enterprises);

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

61 Robots and the extent to which hazards, hazardous situations or hazardous events are  
62 covered is indicated in the Scope of this ISO document.

63 When provisions of a type-C standard are different from those which are stated in type-A  
64 or type-B standards, the provisions of the type-C standard take precedence over the  
65 provisions of the other standards for machines that have been designed and built in  
66 accordance with the provisions of the type-C standard.

67 In recognition of the variable nature of hazards with different uses of industrial robots, the  
68 ISO 10218 series is divided into two parts. This document ISO provides requirements for  
69 safety in the design and construction of the robot. Since safety in the application of  
70 industrial robots is influenced by the design and application of the robot application,  
71 ISO 10218-2 provides requirements for the safeguarding of operators during integration,  
72 commissioning, functional testing, programming, operation and maintenance.

73 The ISO 10218 series deals with robotics in an industrial environment, which is comprised  
74 of workplaces where the public is excluded and the people (operators) are working adults.  
75 Other standards cover such topics as coordinate systems and axis motions, general  
76 characteristics, performance criteria and related testing methods, terminology, and  
77 mechanical interfaces.

78 For ease of reading this ISO document, the words “robot” and “robot system” refer to  
79 “industrial robot” and “industrial robot system” as defined in this document.

80 This ISO document has been updated based on experience gained since the release of the  
81 ISO 10218 series in 2011. This document remains aligned with the minimum requirements  
82 of a harmonized type-C standard for robots in an industrial environment.

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83 Where appropriate, ISO/TS 15066:2016 on the safety of collaborative robot systems, was  
 84 added to the ISO 10218 series. Most of ISO/TS 15066 has been incorporated into  
 85 ISO ISO/DIS 10218-2:2020), since human-robot collaboration relates to the application  
 86 and not the robot alone. Safety functions that enable a collaborative task can be embedded  
 87 in the robot or can be provided by a protective device, or a combination of the robot and a  
 88 protective device.

89 It is important to emphasize that the term “collaborative robot” is not used in ISO this  
 90 document as only the application can be developed, verified and validated as a collaborative  
 91 application. In addition, the term “collaborative operation” is not used in this document.

92 Revisions include the following:

- 93 — category 2 stopping functions;
- 94 — cybersecurity;
- 95 — definitions and abbreviations;
- 96 — details within the information for use clause;
- 97 — functional safety requirements;
- 98 — hand-guided control (HGC) requirements;
- 99 — markings;
- 100 — mechanical strength and stability requirements;
- 101 — mode selection;
- 102 — power and force limiting (PFL) requirements to enable collaborative applications;
- 103 — power loss requirements;
- 104 — hand-guided controls (HGC) requirements;
- 105 — robot classification (Class I and Class II) for functional safety requirements;
- 106 — spaces (maximum, restricted) figures shown in Annex B;
- 107 — speed and separation monitoring (SSM) requirements to enable collaborative  
 108 applications;
- 109 — test methodology to determine the maximum force per manipulator for Class I robots.

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## 110 **Robotics – Safety requirements – Part 1: Industrial robots**

### 111 **1 Scope**

112 This ISO document specifies requirements for the inherently safe design, protective measures  
113 and information for use of robots for an industrial environment.

114 This ISO document addresses the robot as an incomplete machine.

115 This ISO document is not applicable to the following uses and products:

116 — underwater;

117 — law enforcement;

118 — military (defence);

119 — airborne and space robots, including outer space;

120 — medical robots;

121 — healthcare robots;

122 — prosthetics and other aids for the physically impaired;

123 — service robots, which provide a service to a person and as such the public can have access;

124 — consumer products as this is household use to which the public can have access;

125 — lifting or transporting people;

126 — mobile platforms;

127 — tele-operated manipulators.

128 Note 1 Requirements for robot systems, integration, and applications are covered in ISO 10218-2.

129 Note 2 Additional hazards can be created by specific applications (e.g. welding, laser cutting,  
130 machining). These system-related hazards need to be considered during robot system and robot  
131 application design. See ISO 10218-2.

132 This document deals with all significant hazards, hazardous situations or hazardous events when  
133 used as intended and under specified conditions of misuse which are reasonably foreseeable by  
134 the manufacturer.

135 This document does not cover the hazards related to:

136 — severe conditions (e.g. extreme climates, freezer applications, strong magnetic fields)  
137 outside of manufacturer's specification;

138 — underground use;

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- 139 — specific hygienic requirements;
- 140 — use in nuclear environments;
- 141 — use in potentially explosive environments;
- 142 — use in environments with ionizing and non-ionizing radiation levels;
- 143 — hazardous ionizing and non-ionizing radiation;
- 144 — handling loads the nature of which can lead to dangerous situations (e.g. molten metals,  
145 acids/bases, radiating materials);
- 146 — handling or lifting or transporting people;
- 147 — the public or non-working adults have access, i.e. service robots, consumer products.
- 148 Noise emission is generally not considered a significant hazard of the robot alone, and  
149 consequently noise is excluded from the scope of this document.
- 150 This is not applicable to robots that were manufactured prior to its publication date.

**151 2 Normative references**

- 152 The following documents are referred to in the text in such a way that some or all of their content  
153 constitutes requirements of this document. For dated references, only the edition cited applies.
- 154 ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and*  
155 *their components* oSIST prEN ISO 10218-1:2021  
<https://standards.iteh.ai/catalog/standards/sist/1d7fb1ad-d1e6-440f-abff-d6c7eb7505ce/osist-pr-en-iso-10218-1-2021>
- 156 ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and*  
157 *their components*
- 158 ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*
- 159 ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk*  
160 *reduction*
- 161 ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of*  
162 *human responses to contact with surfaces — Part 1: Hot surfaces*
- 163 ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1:*  
164 *General principles for design*
- 165 ISO 13850:2015, *Safety of machinery — Emergency stop — Principles for design*
- 166 ISO 14118:2017, *Safety of machinery — Prevention of unexpected start-up*
- 167 ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles*  
168 *for design and selection*

- 169 ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and*  
170 *construction of fixed and movable guards*
- 171 ISO 19353:2019, *Safety of machinery — Fire prevention and fire protection*
- 172 ISO 20607:2002, *Safety of machinery — Instruction handbook — General drafting principles*
- 173 ISO 20643:2005/AMD 1:2012, *Mechanical vibration — Hand-held and hand-guided machinery —*  
174 *Principles for evaluation of vibration emission*
- 175 IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General*  
176 *requirements*
- 177 IEC 60947-5-8:2006, *Low-voltage switchgear and controlgear - Part 5-8: Control circuit devices*  
178 *and switching elements - Three-position enabling switches*
- 179 IEC 61310-1:2007, *Safety of machinery — Indication, marking and actuation — Part 1:*  
180 *Requirements for visual, acoustic and tactile signals*
- 181 IEC 61310-2:2007, *Safety of machinery — Indication, marking and actuation — Part 2:*  
182 *Requirements for marking*
- 183 IEC 61310-3:2007, *Safety of machinery — Indication, marking and actuation — Part 3:*  
184 *Requirements for locations and operation of actuators*
- 185 IEC 61508-2:2010, *Functional safety of electrical/electronic/ programmable electronic safety-*  
186 *related systems — Part 2: Requirements for electrical/ electronic/ programmable electronic safety-*  
187 *related systems*
- 188 IEC 62061:2015, *Safety of machinery — Functional safety of safety-related electrical, electronic*  
189 *and programmable electronic control systems*
- 190 IEC 62745:2017, *Safety of machinery — Requirements for cableless control systems of machinery*

### 191 3 Terms, definitions and abbreviations

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

194 ISO and IEC maintain terminological databases for use in standardization at the following  
195 addresses:

196 — ISO Online browsing platform: available at <https://www.iso.org/obp>

197 — IEC Electropedia: available at <http://www.electropedia.org/>

#### 198 3.1 Terms and definitions

##### 199 3.1.1 Robot, robot system, robot application, application

###### 200 3.1.1.1

###### 201 industrial environment

202 workplace where the public is restricted from access or not reasonably expected to be present  
203 for the intended tasks and *robot application* (3.1.1.4)