

SINGAPORE STANDARD

**Robots and robotic devices – Safety
requirements for industrial robots**

– Part 2 : Robot systems and integration



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Singapore Industrial Automation Association
Singapore Institute of Manufacturing Technology
Singapore University of Technology and Design
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National Foreword

This Singapore Standard was prepared by the Working Group on Safety Requirements for Industrial Robots appointed by the Technical Committee on Automation, Robotics and Precision Engineering which is under the direction of the Manufacturing Standards Committee. This standard is identical with ISO 10218-2 : 2011, published by the International Organization for Standardization.

Attention is drawn to the following:

1. Where appropriate, the words 'International Standard' shall be read as 'Singapore Standard'.
2. Where applicable, the references to International Standards shall be replaced by the following Singapore Standards:

International Standard	Corresponding Singapore Standard
ISO 10218	SS ISO 10218
ISO 10218-1	SS ISO 10218-1

3. The comma has been used throughout as a decimal marker whereas in Singapore Standards it is a practice to use a full point on the baseline as the decimal marker.

This standard is expected to be used by machine builders, system builders, precision engineering companies, robot users, pharmaceutical manufacturing companies, robotic system integrators, manufacturing assembly lines and universities.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10218-2 was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 2, *Robots and robotic devices*.

This second edition cancels and replaces the first edition (ISO 10218-1:2006), which has been technically revised. It also incorporates Technical Corrigendum ISO 10218-1:2006/Cor.1:2007.

ISO 10218 consists of the following parts, under the general title *Robots and robotic devices — Safety requirements for industrial robots*:

Part 1: Robots

Part 2: Robot systems and integration

Introduction

This part of ISO 10218 has been created in recognition of the particular hazards that are presented by industrial robot systems when integrated and installed in industrial robot cells and lines.

Hazards are frequently unique to a particular robot system. The number and types of hazards are directly related to the nature of the automation process and the complexity of the installation.

The risks associated with these hazards vary with the type of robot used and its purpose and the way in which it is installed, programmed, operated, and maintained.

For the purpose of understanding requirements in this part of ISO 10218, a word syntax is used to distinguish absolute requirements from recommended practices or suggested actions. The word “shall” is used to identify requirements necessary for compliance with this part of ISO 10218. Such requirements have to be accomplished unless an alternative instruction is provided or a suitable alternative is determined by a risk assessment. The word “should” is used to identify suggestions, recommended actions or possible solutions for requirements, but alternatives are possible and the suggested actions are not absolute.

In recognition of the variable nature of hazards with the application of industrial robots, this part of ISO 10218 provides guidance for the assurance of safety in the integration and installation of robots. Since safety in the use of industrial robots is influenced by the design of the particular robot system, a supplementary, though equally important, purpose is to provide guidelines for the design, construction and information for use of robot systems and cells. Requirements for the robot portion of the system can be found in ISO 10218-1.

Providing for a safe robot system or cell depends on the cooperation of a variety of “stakeholders” – those entities that share in a responsibility for the ultimate purpose of providing a safe working environment. Stakeholders may be identified as manufacturers, suppliers, integrators and users (the entity responsible for using robots), but all share the common goal of a safe (robot) machine. The requirements in this part of ISO 10218 may be assigned to one of the stakeholders, but overlapping responsibilities can involve multiple stakeholders in the same requirements. While using this part of ISO 10218, the reader is cautioned that all of the requirements identified may apply to them, even if not specifically addressed by “assigned” stakeholder tasks.

This part of ISO 10218 is complementary and in addition to ISO 10218-1, which covers the robot only. This part of ISO 10218 adds additional information in line with ISO 12100 and ISO 11161, International Standards for requirements to identify and respond in a type-C standard to unique hazards presented by the integration, installation and requirements for use of industrial robots. New technical requirements include, but are not limited to, instructions for applying the new requirements in ISO 10218-1 for safety-related control system performance, robot stopping function, enabling device, programme verification, cableless pendant criteria, collaborating robot criteria and updated design for safety.

This part of ISO 10218 and ISO 10218-1 form part of a series of standards dealing with robots and robotic devices. Other standards cover such topics as integrated robotic systems, coordinate systems and axis motions, general characteristics, performance criteria and related testing methods, terminology, and mechanical interfaces. It is noted that these standards are interrelated and also related to other International Standards.

For ease of reading this part of ISO 10218, the words “robot” and “robot system” refer to “industrial robot” and “industrial robot system” as defined in ISO 10218-1.

Figure 1 describes the relationship of the scope of machinery standards used in a robot system. The robot alone is covered by ISO 10218-1, the system and cell is covered by this part of ISO 10218. A robot cell may include other machines subject to their own C level standards, and the robot system can be part of an integrated manufacturing system covered by ISO 11161 which in turn can also make reference to other relevant B and C level standards.

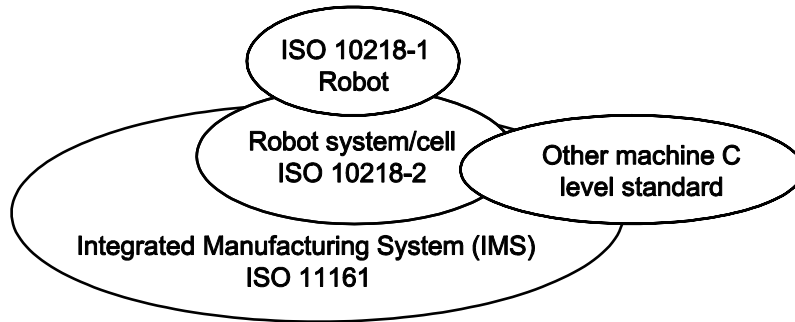


Figure 1 — Graphical view of relationships between standards relating to robot system/cell

Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration

1 Scope

This part of ISO 10218 specifies safety requirements for the integration of industrial robots and industrial robot systems as defined in ISO 10218-1, and industrial robot cell(s). The integration includes the following:

- a) the design, manufacturing, installation, operation, maintenance and decommissioning of the industrial robot system or cell;
- b) necessary information for the design, manufacturing, installation, operation, maintenance and decommissioning of the industrial robot system or cell;
- c) component devices of the industrial robot system or cell.

This part of ISO 10218 describes the basic hazards and hazardous situations identified with these systems, and provides requirements to eliminate or adequately reduce the risks associated with these hazards. Although noise has been identified to be a significant hazard with industrial robot systems, it is not considered in this part of ISO 10218. This part of ISO 10218 also specifies requirements for the industrial robot system as part of an integrated manufacturing system. This part of ISO 10218 does not deal specifically with hazards associated with processes (e.g. laser radiation, ejected chips, welding smoke). Other standards can be applicable to these process hazards.

2 Normative references

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

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 8995-1, *Lighting of work places — Part 1: Indoor*

ISO 9946, *Manipulating industrial robots — Presentation of characteristics*

ISO 10218-1, *Robots and robotic devices — Safety requirements for industrial robots — Part 1: Industrial robots*

ISO 11161, *Safety of machinery — Integrated manufacturing systems — Basic requirements*

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

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850, *Safety of machinery — Emergency stop — Principles for design*

ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

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

ISO 13856 (all parts), *Safety of machinery — Pressure-sensitive protective devices*

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

ISO 14118, *Safety of machinery — Prevention of unexpected start-up*

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

ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122 (all parts), *Safety of machinery — Permanent means of access to machinery*

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

IEC 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

IEC 61800-5-2, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional*

IEC/TS 62046, *Safety of machinery — Application of protective equipment to detect the presence of persons*

IEC 62061:2005, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*