Robots and robotic devices — Safety requirements for industrial robots —

Part 1:
Robots

Robots et dispositifs robotiques — Exigences de sécurité pour les robots industriels —

Partie 1: Robots
Contents

Foreword iv
Introduction v
1 Scope 1
2 Normative references 1
3 Terms and definitions 2
4 Hazard identification and risk assessment 6
5 Design requirements and protective measures 7
5.1 General 7
5.2 General requirements 7
5.3 Actuating controls 8
5.4 Safety-related control system performance (hardware/software) 8
5.5 Robot stopping functions 9
5.6 Speed control 11
5.7 Operational modes 11
5.8 Pendant controls 13
5.9 Control of simultaneous motion 15
5.10 Collaborative operation requirements 15
5.11 Singularity protection 16
5.12 Axis limiting 16
5.13 Movement without drive power 18
5.14 Provisions for lifting 18
5.15 Electrical connectors 18
6 Verification and validation of safety requirements and protective measures 19
6.1 General 19
6.2 Verification and validation methods 19
6.3 Required verification and validation 19
7 Information for use 20
7.1 General 20
7.2 Instruction handbook 20
7.3 Marking 21
Annex A (informative) List of significant hazards 23
Annex B (normative) Stopping time and distance metric 28
Annex C (informative) Functional characteristics of three-position enabling device 30
Annex D (informative) Optional features 31
Annex E (informative) Labelling 33
Annex F (normative) Means of verification of the safety requirements and measures 34
Bibliography 43
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 10218-1 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

ISO 10218 has been created in recognition of the particular hazards that are presented by industrial robots and industrial robot systems.

This part of ISO 10218 is a type-C standard as outlined in ISO 12100.

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

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the Scope of this part of ISO 10218.

Hazards associated with robots are well recognized, but the sources of the hazards are frequently unique to a particular robot system. The number and type(s) of hazard(s) 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.

NOTE Not all of the hazards identified by ISO 10218 apply to every robot, nor will the level of risk associated with a given hazardous situation be the same from robot to robot. Consequently, the safety requirements, or the protective measures, or both, can vary from what is specified in ISO 10218. A risk assessment can be conducted to determine what the protective measures should be.

In recognition of the variable nature of hazards with different uses of industrial robots, ISO 10218 is divided into two parts. This part of ISO 10218 provides guidance for the assurance of safety in the design and construction of the robot. Since safety in the application of industrial robots is influenced by the design and application of the particular robot system integration, ISO 10218-2 provides guidelines for the safeguarding of personnel during robot integration, installation, functional testing, programming, operation, maintenance and repair.

This part of ISO 10218 has been updated based on experience gained in developing the ISO 10218-2 guidance on system and integration requirements, in order to ensure it remains in line with minimum requirements of a harmonized type-C standard for industrial robots. Revised technical requirements include, but are not limited to, definition and requirements for singularity, safeguarding of transmission hazards, power loss requirements, safety-related control circuit performance, addition of a category 2 stopping function, mode selection, power and force limiting requirements, marking, and updated stopping time and distance metric and features.

This part of ISO 10218 is not applicable to robots that were manufactured prior to its publication date.