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Robotics — Safety design for industrial robot systems —

Part 1: End-effectors

Robotique — Conception de sécurité pour les systèmes de robots industriels —

Partie 1: Organe terminal effecteur

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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.

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

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

This document was prepared by Technical Committee ISO/TC 299, *Robotics*.

A list of all parts in the ISO 20218 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document applies to industrial robot systems as described in ISO 10218-2:2011 and ISO/TS 15066:2016.

This document provides guidance for end-effectors in robot systems, including collaborative applications where a robot system and operators share the same workspace. In such collaborative applications, the end-effector design is of major importance, particularly characteristics such as shapes, surfaces and application function (e.g. clamping forces, residual material generation, temperature).

A comprehensive risk assessment is required by ISO 10218-2:2011. This document provides additional guidance specific to end-effectors that can be helpful when performing the risk assessment in accordance with ISO 10218-2:2011.

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Robotics — Safety design for industrial robot systems —

Part 1:
End-effectors

1 Scope

This document provides guidance on safety measures for the design and integration of end-effectors used for robot systems. The integration includes the following:

— the manufacturing, design and integration of end-effectors;

— the necessary information for use.

This document provides additional safety guidance on the integration of robot systems, as described in ISO 10218-2:2011.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10218-1:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots*

ISO 10218-2:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration*

ISO 11593, *Manipulating industrial robots — Automatic end effector exchange systems — Vocabulary and presentation of characteristics*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 14539:2000, *Manipulating industrial robots — Object handling with grasp-type grippers — Vocabulary and presentation of characteristics*

ISO/TS 15066:2016, *Robots and robotic devices — Collaborative robots*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO/TS 15066:2016, ISO 10218-1:2011, ISO 10218-2:2011, ISO 14539:2000, ISO 11593 and the following apply.

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

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

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

3.1
compliant
exhibiting deformation of material or mechanism when subjected to a force

EXAMPLE Compliant linkage, compliant surface.

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Note 1 to entry: The reciprocal of compliant is stiff.

Note 2 to entry: Compliance is defined in ISO 8373:2012.

3.2
mechanical interface
end-effector (3.3) flange mounting surface at the end of the manipulator to which the end-effector is attached

[SOURCE: ISO 8373:2012, 3.10, modified — The words "end-effector flange" have been added at the start of the definition and the Note to entry has been deleted.]

3.3
end-effector
device specifically designed for attachment to the *mechanical interface* (3.2) to enable the robot to perform its task

EXAMPLE *Gripper* (3.4), welding gun, spray gun.

Note 1 to entry: In this document, the term refers to end-effectors in robot systems.

Note 2 to entry: End-effectors are sometimes known as end-of-arm tooling (EOAT).

[SOURCE: ISO 8373:2012, 3.11, modified — The words "nut runner" have been deleted from the Example and the Notes to entry have been added.]

3.4
gripper
end-effector (3.3) designed for grasping workpieces

Note 1 to entry: Grip, grasp, grasping and releasing are defined in ISO 14539:2000.

[SOURCE: ISO 8373:2012, 3.14, modified — The words "seizing and holding" have been replaced by "grasping workpieces" in the definition and the Note to entry has been added.]

3.5
fixture
device used to fixate an item as part of the handling or assembling process in a robot system, but not as an *end-effector* (3.3)

3.6
robot application
system comprising an industrial robot system [industrial robot, *end-effectors* (3.3), workpieces and any machinery, equipment, devices, external auxiliary axes or sensors supporting the robot performing its task] and any obstacle or object within the robot system workspace that has influence on the risk assessment of the workspace

[SOURCE: ISO 10218-1:2011, 3.11, modified — Adapted from definition for "industrial robot system".]

4 Risk assessment

4.1 General

This clause describes the actions and factors particularly relevant for the parts of a risk assessment that address end-effectors in a robot application. In accordance with ISO 10218-2:2011, 4.3.1, the risk assessment considers the risks for the entire robot application, including the robot, end-effector, workpieces and fixture(s), over its whole lifecycle.

According ISO 10218-2:2011, the initial risk is assessed on the assumption that no risk reduction measures have been applied. This includes modifications to existing robot applications.

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