TECHNICAL REPORT

ISO/TR 20218-2

First edition
2017-12

Corrected version
2018-05

Robotics — Safety design for industrial robot systems —

Part 2: Manual load/unload stations

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

Partie 2: Stations de chargement/déchargement manuel

Reference number
ISO/TR 20218-2:2017(E)

© ISO 2017



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

 © ISO 2017 – All rights reserved

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Risk assessment **2**
5 Safety design for manual load/unload stations **2**
5.1 General 2
5.2 Typical design 3
5.3 Impeding devices of height greater than or equal to 1 400 mm 6
5.4 Impeding devices of height from 1 000 mm to 1 400 mm 6
5.5 Impeding devices of height less than 1 000 mm 7
5.6 Mechanical deterrent in fixture design 8
5.6.1 Full-body access prevention 8
5.6.2 Step elimination 8
5.7 Detection of intrusion in hazardous areas 9
5.8 Presence sensing 10
6 Information for use **12**
Annex A (informative) **Example of dimensions of openings to prevent full-body entry** **13**
Bibliography **14**

© ISO 2017 – All rights reserved

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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 the following URL: 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.

This corrected version of ISO/TR 20218-2:2017 corrects the title of the document.

© ISO 2017 – All rights reserved

Introduction

The objective of a manual load/unload station is to allow an operator to interface directly with an industrial robot system, e.g. feed/remove material into and out of a robot cell. The layout of the robot cell is designed to provide a work area that is free of hazards and to lessen the motivation to circumvent or defeat the designed safeguarding.

This document supplements the requirements for industrial robot system safety specified in ISO 10218-2:2011, 5.10.6. It provides additional guidance for manual load/unload stations that are lower than 1 400 mm, to permit the work to be performed in an ergonomic manner while maintaining safety and providing guidance for an alternative method of impeding access to the robot cell. ISO 14738, ISO 6385 and ISO 10218-2:2011, Annex A, provide further information on potential ergonomic hazards

NOTE ISO 10218-2:2011, 5.10.6, specifies that the minimum height of a perimeter guard (distance guard) needs to be 1 400 mm. In cases where the results of the risk assessment determine that the guard cannot meet the height of 1 400 mm or more because of the design of a manual load/unload station, this document provides an alternative design which offers the same level of operator protection according to ISO 10218-2:2011.

Implementing ISO 10218-2 involves carrying out a comprehensive risk assessment, which is used to identify all hazards associated with the manual load/unload process. This document provides guidance on mitigation of the risks to the operator. The risk assessment needs to take account of foreseeable misuse, with mitigation provided.

© ISO 2017 – All rights reserved

Robotics — Safety design for industrial robot systems —

Part 2:
Manual load/unload stations

1 Scope

This document is applicable to robot systems for manual load/unload applications in which a hazard zone is safeguarded by preventing access to it. For this type of application, it is important to consider the need for both access restrictions to hazard zones and for ergonomically suitable work places.

This document supplements ISO 10218-2:2011 and provides additional information and guidance on reducing the risk of intrusion into the hazard zones in the design and safeguarding of manual load/unload installations.

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10218-1, ISO 10218-2 and ISO 12100, 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
impeding device
any physical obstacle (low barrier, rail, fixture, etc.) which, without totally preventing access to a hazard zone, reduces the probability of access to this zone by offering an obstruction to free access

[SOURCE: ISO 12100:2010, 3.29]

3.2
manual load/unload station
part of the robot system designed for the direct manual intervention for the placement and removal of parts or workpieces for processing by the robot system

© ISO 2017 – All rights reserved

3.3
operator
person or persons given the task of installing, using, adjusting, maintaining, cleaning, repairing or transporting machinery

Note 1 to entry: This definition is consistent with the meaning and use as presented in ISO 10218-1, ISO 10218-2 and ISO/TS 15066.

[SOURCE: ISO 11161:2007, 3.14 modified — Note 1 to entry has been added.]

4 Risk assessment

Guidance on risk assessment is provided in ISO 12100 and ISO 10218-2. The main hazards associated with manual load/unload stations are the robot system hazards listed in ISO 10218-2:2011, Annex A. As manual load/unload stations bring the operator particularly close to these hazards, special consideration needs to be given to safeguarding.

The risk assessment for manual load/unload stations addresses the following:

a) possibility of unintentional access to the safeguarded space inside the robot cell;

b) possibility of intentional access to the safeguarded space inside the robot cell (e.g. maintenance or other manual intervention);

c) likelihood of restart of the robot system occurring while an operator is within the safeguarded space (e.g. if another person outside the robot cell restarts the system without being aware that an operator is inside);

d) normal operation with an operator in the manual load/unload station area.

5 Safety design for manual load/unload stations

5.1 General

Manual load/unload stations require operator interaction with the robot system in the same area, but not simultaneously. ISO 10218-2:2011, 5.11 and ISO/TS 15066 apply if it is a collaborative application. There are two main concerns:

a) safeguarding the operator from hazards introduced by the robot and the robot system;

b) preventing access to hazard zones beyond the manual load/unload station.

The dimensioning of safeguards and protective structures against access to hazardous areas is described in ISO 14120 and ISO 13857. To minimize ergonomic risks, manual load/unload stations can be lower than 1 400 mm. ISO 13857 states that protective structures lower than 1 400 mm should not be used without additional protective measures.

Continuous presence sensing can be used as a measure to prevent either or both of the following:

— unexpected start-up;

— contact between the operator and robot system by keeping them in separate zones.

NOTE An example of ergonomic risk is handling heavy or large workpieces during manual load/unload operations. Inadequate design of the task, machine or system could lead to increased ergonomic risk factors to the worker. Further information regarding ergonomic risk factors is given in ISO 6385, ISO 14738 and ISO 10218-2:2011, Table A.1, item 8 (ergonomic hazards).

An example layout of a manual load/unload station is illustrated in Figure 1.

© ISO 2017 – All rights reserved