Singapore Standards Council

SS ISO 13482 : 2017

ISO 13482:2014, IDT

(ICS 25.040.30)

SINGAPORE STANDARD

Robots and robotic devices — Safety requirements for personal care robots

Published by

Enterprise Singapore

SS ISO 13482 : 2017
ISO 13482:2014, IDT
(ICS 25.040.30)

SINGAPORE STANDARD

Robots and robotic devices — Safety requirements for personal care robots

ISBN 978-981-47-8471-9

This Singapore Standard was approved by the Manufacturing Standards Committee on behalf of the Singapore Standards Council on 7 December 2017.

First published, 2018

The Manufacturing Standards Committee, appointed by the Standards Council, consists of the following members:

		Name	Capacity
Chairman	:	Dr John Yong	*Individual Capacity*
Deputy Chairman	:	Mr Brandon Lee	*Individual Capacity*
Secretary	:	Mr Kwok Wing Kit	*Singapore Manufacturing Federation – Standards Development Organisation*
Members	:	Ms Fong Pin Fen	*Economic Development Board*
		Mr Goh Wee Hong	*TUV SUD PSB Pte Ltd*
		Mr Ho Chi Bao	*SPRING Singapore*
		Mr Steven Koh	*Singapore Precision Engineering and Technology Association*
		Ms Lee Wan Sie	*Economic Development Board*
		Dr Jim Li Hui Hong	*Individual Capacity*
		Dr Lim Ee Meng	*National Metrology Centre*
		Mr Loh Wai Mun	*Science & Engineering Research Council Engineering*
		Er Prof Ramakrishna Seeram	*The Institution of Engineers, Singapore*

The Technical Committee on Automation, Robotics and Precision Engineering, appointed by the Manufacturing Standards Committee, consists of representatives from the following organisations:

		Name	Capacity
Co-Chairmen	:	Mr Michael Leong	*Individual Capacity*
		Dr Lin Wei	*Individual Capacity*
Secretary	:	Mr Lee Wei Guo	*Singapore Manufacturing Federation – Standards Development Organisation*
Members	:	Prof Marcelo H Ang Jr	*National University of Singapore*
		Mr Cheng Xiao Fan	*Rockwell Automation*
		Mr Roy Guo	*Singapore Manufacturing Federation*
		Mr Esmond K C Lim	*Singapore Precision Engineering & Tooling Association*
		Mr George Lim	*Makino Asia Pte Ltd*
		Mr Rayner Ng Chun Piaw	*National Robotics Research Programme Office*

		Name	Capacity
Members	:	Ms Selina Seah	*Changi General Hospital*
		Mr Lars Skovsgaard	*Zacobria Pte Ltd*
		Mr Alex Tan	*Singapore Industrial Automation Association*
		Mr Marc Tan	*Singapore Precision Engineering & Tooling Association*
		Ms Tan Sock Cheng	*SPRING Singapore*
		Mr Thomas Teo	*Ministry of Manpower*
		Mr Zheng Yu	*ABB Pte Ltd*

The Working Group on Personal Care Robots, appointed by the Technical Committee to assist in the preparation of this standard, comprises the following experts who contribute in their *individual capacity*:

		Name
Convenor	:	Ms Selina Seah
Secretary	:	Mr Lee Wei Guo
Members	:	Prof Marcelo H Ang Jr
		Dr Domenico Campolo
		Ms Chong Pue Kim
		Mr Francis Chu
		Ms Rubina Gan
		Mr Dominic Kan
		Mr Christopher Lam
		Mr Michael Leong
		Dr Lin Wei
		Mr Edwin Low
		Mr Ong Beng Yang
		Mr Lars Skovsgaard
		Mr Alex Tan
		Mr Joel Tan
		Mr Zheng Yu

The organisations in which the experts of the Working Group are involved are:

ABB Pte Ltd
Changi General Hospital
Health Sciences Authority
HOPE Technik Pte Ltd
Info-communications Media Development Authority
Jurong Health Services Pte Ltd
Multi-Contact (South East Asia) Pte Ltd

Nanyang Technological University
National University of Singapore
Panasonic System Solutions Asia Pacific
Singapore Institute of Manufacturing Technology
Tan Tok Seng hospital
Temasek Polytechnic
TUV SUD
Zacobria Pte Ltd

Contents

Page

Annexes

National Foreword

This Singapore Standard was prepared by the Working Group on Personal Care Robots appointed by the Technical Committee on Automation, Robotics and Precision Engineering under the direction of the Manufacturing Standards Committee.

This standard is identical with ISO 13482 : 2014, published by the International Organization for Standardization.

Where appropriate, the words 'International Standard' shall be read as 'Singapore Standard'.

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.

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. 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. 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.

The committee responsible for this document is ISO/TC 184, Automation systems and integration, Subcommittee SC 2, Robots and robotic devices.

Introduction

This International Standard has been developed in recognition of the particular hazards presented by newly emerging robots and robotic devices for new applications in non-industrial environments for providing services rather than manufacturing applications in industrial applications. This International Standard focuses on the safety requirements for personal care robots in non-medical applications.

This International Standard complements ISO 10218 1, which covers the safety requirements for robots in industrial environments only. This International Standard includes additional information in line with ISO 12100 and adopts the approach proposed in ISO 13849 and IEC 62061 to formulate a safety standard for robots and robotic devices in personal care to specify the conditions for physical human-robot contact.

This International Standard is a type-C standard, as stated in ISO 12100.

When a type-C standard deviates from one or more technical provisions dealt with by type-A or by type-B standards, the type-C standard takes precedence.

It is recognized that robots and robotic devices in personal care applications require close human-robot interaction and collaborations, as well as physical human-robot contact.

The robots or robotic devices concerned, and the extent to which hazards, hazardous situations or hazardous events are covered, are indicated in the scope of this International Standard.

Hazards are well recognized, and the sources of the hazards are frequently unique to particular robot systems. The number and types of hazards are directly related to the nature of the robot application, the complexity of the installation, and the level of human-robot interaction incorporated.

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.

Not all of the hazards identified by this International Standard apply to every personal care robot, nor will the level of risk associated with a given hazardous situation be the same from robot to robot. Consequently, the safety requirements, and/or protective measures can vary from what is specified in this International Standard. A risk assessment is conducted to determine the protective measures needed when they do not meet safety requirements and/or protective measures specified in this International Standard, and for the particular application being considered.

In this International Standard, the following verbal forms are used:

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates a possibility or a capability.

In recognition of the variable nature of hazards with personal care robot applications, this International Standard provides guidance for the assurance of safety in the design and construction of the non-medical personal care robot, as well as the integration, installation, and use of the robots during their full life cycle. Since safety in the use of personal care robots is influenced by the design of the particular robot system, a supplementary, though equally important, purpose is to provide guidelines for the information for use of personal care robots and robotic devices.

The safety requirements of this International Standard have to be met by the manufacturer and the supplier of the personal care robot.

Future editions of this International Standard might include more specific requirements on particular types of personal care robots, as well as more complete numeric data for different categories of people (e.g. children, elderly persons, pregnant women).

Robots and robotic devices — Safety requirements for personal care robots

1 Scope

This International Standard specifies requirements and guidelines for the inherently safe design, protective measures, and information for use of personal care robots, in particular the following three types of personal care robots:

— mobile servant robot;

— physical assistant robot;

— person carrier robot.

These robots typically perform tasks to improve the quality of life of intended users, irrespective of age or capability. This International Standard describes hazards associated with the use of these robots, and provides requirements to eliminate, or reduce, the risks associated with these hazards to an acceptable level. This International Standard covers human-robot physical contact applications.

This International Standard presents significant hazards and describes how to deal with them for each personal care robot type.

This International Standard covers robotic devices used in personal care applications, which are treated as personal care robots.

This International Standard is limited to earthbound robots.

This International standard does not apply to:

— robots travelling faster than 20 km/h;

— robot toys;

— water-borne robots and flying robots;

— industrial robots, which are covered in ISO 10218;

— robots as medical devices;

— military or public force application robots.

NOTE The safety principles established in this International Standard can be useful for these robots listed above.

The scope of this International Standard is limited primarily to human care related hazards but, where appropriate, it includes domestic animals or property (defined as safety-related objects), when the personal care robot is properly installed and maintained and used for its intended

purpose or under conditions which can reasonably be foreseen.

This International Standard is not applicable to robots manufactured prior to its publication date.

This International Standard deals with all significant hazards, hazardous situations or hazardous events as described in Annex A. Attention is drawn to the fact that for hazards related to impact (e.g. due to a collision) no exhaustive and internationally recognized data (e.g. pain or injury limits) exist at the time of publication of this International Standard.

2 Normative references

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

ISO 2631 (all parts), *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration*

ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

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 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 8373:2012, *Robots and robotic devices — Vocabulary*

ISO 11202, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections*

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

ISO 13849-1, *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[1], *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 15534 (all parts), *Ergonomic design for the safety of machinery*[1]

IEC 60204-1:2009, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements*

IEC 60335-2-29, *Household and similar electrical appliances — Safety — Part 2-29: Particular requirements for battery chargers*

IEC 60417-1, *Graphical symbols for use on equipment — Part 1: Overview and application*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements*

IEC 61140, *Protection against electric shock — Common aspects for installation and equipment*

IEC 61496 (all parts), *Safety of machinery — Electro-sensitive protective equipment*

IEC 62061:2012, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

IEC 62471, *Photobiological safety of lamps and lamp systems*

[1] If used, consideration shall be given as to the relevance and applicability of the quantitative data to the intended users of the robot, especially for elderly people and children.