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Robotik – Prestandaredovisning och motsvarande provningsmetoder för servicerobotar – Del 1: Förflyttning av robotar försedda med hjul (ISO 18646-1:2016, IDT)

Robotics – Performance criteria and related test methods for service robots – Part 1: Locomotion for wheeled robots (ISO 18646-1:2016, IDT)

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Den internationella standarden ISO 18646-1:2016 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 18646-1:2016.

The International Standard ISO 18646-1:2016 has the status of a Swedish Standard. This document contains the official English version of ISO 18646-1:2016.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Robotik, SIS/TK 278.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

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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).

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 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.

The committee responsible for this document is Technical Committee ISO/TC 299, *Robotics*.

A list of all the parts in the ISO 18646 series can be found on the ISO website.

Introduction

This document is intended to facilitate understanding of performance of wheeled robots between users and manufacturers. It defines the important performance characteristics, describes how they are specified and recommends how to test them.

The characteristics for which test methods are given in this document are those considered to affect robot performance significantly. Users of this document are intended to select the performance characteristics to be tested, in accordance with the specific requirements.

The performance criteria specified in this document are not intended to be interpreted as the verification or validation of safety requirements. This document deals with indoor environments only.

Robotics — Performance criteria and related test methods for service robots —

Part 1: Locomotion for wheeled robots

1 Scope

This document describes methods for specifying and evaluating the locomotion performance of wheeled robots in indoor environments.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
robot
programmed actuated mechanism with a degree of autonomy, moving within its environment, to perform intended tasks

Note 1 to entry: A robot includes the control system and interface of the control system.

Note 2 to entry: The classification of robot into industrial robot or *service robot* (3.2) is done according to its intended application.

[SOURCE: ISO 8373:2012, 2.6, modified]

3.2
service robot
robot (3.1) that performs useful tasks for humans or equipment excluding industrial automation applications

Note 1 to entry: Industrial automation applications include, but are not limited to, manufacturing, inspection, packaging, and assembly.

Note 2 to entry: While articulated robots used in production lines are industrial robots, similar articulated robots used for serving food are service robots.

[SOURCE: ISO 8373:2012, 2.10]

3.3
mobile robot
robot (3.1) able to travel under its own control

Note 1 to entry: A mobile robot can be a *mobile platform* (3.5) with or without manipulators.

[SOURCE: ISO 8373:2012, 2.13]

3.4
wheeled robot
mobile robot (3.3) that travels using wheels

[SOURCE: ISO 8373:2012, 3.16.1, modified]

3.5
mobile platform
assembly of all components of the *mobile robot* (3.3) which enables locomotion

Note 1 to entry: A mobile platform can include chassis which can be used to support a *load* (3.7).

Note 2 to entry: Because of possible confusion with the term "base", it is advisable not to use the term "mobile base" to describe a mobile platform.

[SOURCE: ISO 8373:2012, 3.18]

3.6
travel surface
terrain on which the *mobile robot* (3.3) travels

[SOURCE: ISO 8373:2012, 7.7]

3.7
load
force and/or torque at the mechanical interface or *mobile platform* (3.5) which can be exerted along the various directions of motion under specified conditions of velocity and acceleration

Note 1 to entry: The load is a function of mass, moment of inertia, and static and dynamic forces supported by the *robot* (3.1).

[SOURCE: ISO 8373:2012, 6.2.1]

3.8
rated load
maximum *load* (3.7) that can be applied to the mechanical interface or *mobile platform* (3.5) in *normal operating conditions* (3.9) without degradation of any performance specification

Note 1 to entry: The rated load includes the inertial effects of the end effector, accessories and workpiece, where applicable.

[SOURCE: ISO 8373:2012, 6.2.2]

3.9
normal operating conditions
range of environmental conditions and other parameters which can influence *robot* (3.1) performance (such as electrical supply instability, electromagnetic fields) within which the performance of the robot specified by the manufacturer is valid

Note 1 to entry: Environmental conditions include, for example, temperature and humidity.

[SOURCE: ISO 8373:2012, 6.1]

3.10
stopping distance
maximum distance travelled by the *mobile platform* (3.5) origin between the initiation of the stop and the full stop of the mobile platform

3.11
rated speed
maximum speed of the *mobile platform* (3.5) equipped with the *rated load* (3.8) in *normal operating conditions* (3.9)

3.12
turning
turn
movement of the *mobile platform* (3.5) causing a change of orientation of the mobile platform coordinate system

Note 1 to entry: Turning is typically accompanied by a change in direction of travel of the mobile platform.

3.13
spin turn
spinning
in-place rotation, or rotation about the *mobile platform* (3.5) origin without translation

3.14
turning width
minimum width of the rectangular passage within which the *mobile platform* (3.5) can complete a specific type of *turning* (3.12)

3.15
reverse turning width
turning width (3.14) for the *mobile platform* (3.5) with a 180° turn

3.16
U-turn width
U-shaped reverse turning width
reverse turning width (3.15) for the *mobile platform* (3.5) with a U-shaped turning path

Note 1 to entry: See Figure A.1.

3.17
three-point-turn width
three-point reverse turning width
reverse turning width (3.15) for the *mobile platform* (3.5) using one initial forward travel, one backward travel and one final forward travel

Note 1 to entry: See Figure A.2.

3.18
L-turn width
right angle turning width
turning width (3.14) for the *mobile platform* (3.5) with a 90° turn to pass through the L-shaped passage

Note 1 to entry: See Figure A.3.

4 Test conditions

4.1 General

The robot shall be completely assembled and sufficiently charged and operational. All self-diagnostic tests shall be satisfactorily completed. It should also be ensured that the robot operates in a safe manner throughout the tests.

The tests shall be preceded by the preparations for operation as specified by the manufacturer.

All conditions specified in Clause 4 should be satisfied for the tests described in this document, unless it is stated otherwise in the specific clauses.

Each test described in each clause of this document may have different test configurations which require separate test procedures. For each test configuration, multiple trials can be conducted, if specified in the test procedure.

4.2 Environmental conditions

The following environmental conditions shall be maintained during all tests:

— ambient temperature: 10 °C to 30 °C

— relative humidity: 0 % to 80 %

If the environmental conditions specified by the manufacturer are outside the given conditions, then this shall be declared within the test report.

4.3 Travel surface conditions

A hard and even surface with a coefficient of friction between 0,75 and 1,0 (measured according to ISO 7176-13) shall be used.

4.4 Operating conditions

All performance shall be measured under normal operating conditions. When the performance is measured in other conditions, this shall be declared within the test report.

For all tests, the robot shall be tested at the rated speed equipped with the rated load, unless otherwise specified.

5 Rated speed

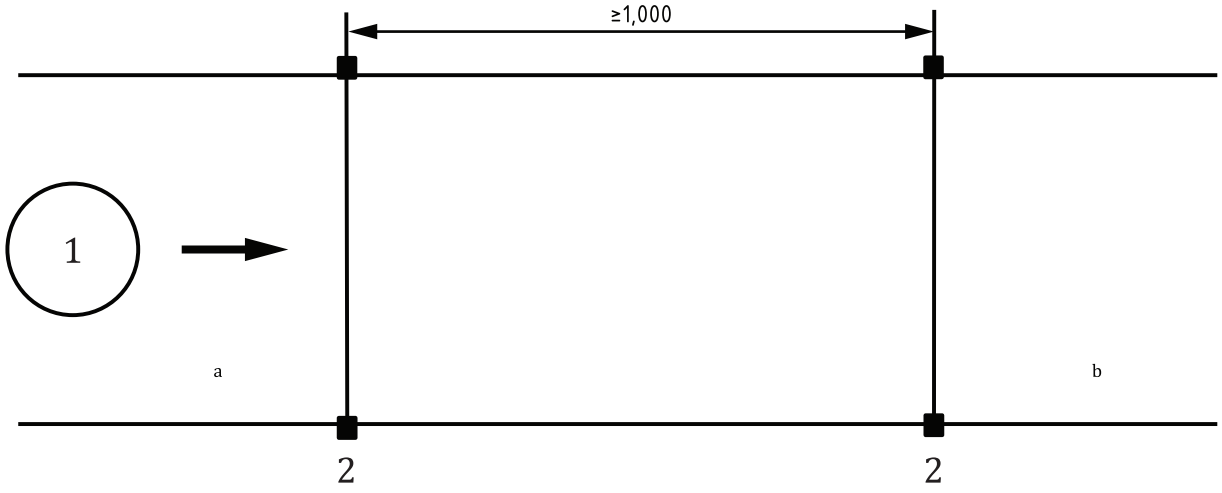
5.1 Purpose

The purpose of this test is to determine how fast a robot can travel to its destination. Rated speed is an indication of how fast the robot can generally perform tasks that are related to travelling. In the test described in 5.2 to 5.4, the rated speed is determined from a series of measurements on horizontal travel surface.

5.2 Test facility

The setup for this test is shown in Figure 1. The speed measurement test area shall be at least 1 000 mm in length and of sufficient width. Enough space shall be provided at each end of the test area for acceleration and deceleration. Sensors should be allocated at each end of the speed measurement test area to measure the start time and finish time of the wheeled robot.

Dimensions in millimetres



Key

1	mobile robot
2	sensor
a	acceleration area
b	deceleration area

Figure 1 — Test area for rated speed

5.3 Test procedure

This test consists of one test configuration. Each trial shall follow the procedure below.

a) The wheeled robot equipped with the rated load is placed at the initial position.

b) The robot starts from its initial position and accelerates so that it reaches the final attained speed before the start line.

c) While the robot moves in a straight line through the speed measurement test area, the speed of the robot is determined with the measurement system.

d) After the robot reaches the finish line, it decelerates until it stops.

A trial shall be considered to fail if the robot does not reach the finish line of the test area or if it deviates from the designated travel direction by more than 10 % of the length of the speed measurement test area. The rated speed, specified in metres per second, shall be selected as the minimum speed value from three consecutive successful trials.

5.4 Test result

Rated speed along with the specific test conditions, including friction conditions, shall be declared in the test report.

6 Stopping characteristics

6.1 Purpose

The purpose of this test is to determine stopping distance and stopping time that indicate the ability of the robot to navigate in a reliable way in its environment. A high stopping performance generally supports the manoeuvrability of the robot as it allows fast cessation of motion and turning manoeuvres.