

# SVENSK STANDARD

## SS-ISO 18646-3:2021

Robotik – Prestandaredovisning och motsvarande  
provningmetoder för servicerobotar -Del 3:Manipulation  
(ISO 18646-3:2021, IDT)

Robotics — Performance criteria and related test methods for  
service robots —  
Part 3: Manipulation (ISO 18646-3:2021, IDT)



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Standarden 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](https://www.sis.se) - där hittar du mer information.

Den internationella standarden ISO 18646-3:2021 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 18646-3:2021.

The International Standard ISO 18646-3:2021 has the status of a Swedish Standard. This document contains the official English version of ISO 18646-3:2021.

## LÄSANVISNINGAR FÖR STANDARDER

I dessa anvisningar behandlas huvudprinciperna för hur regler och yttre begränsningar anges i standardiseringsprodukter.

### Krav

Ett krav är ett uttryck i ett dokumentets innehåll som anger objektivet verifierbara kriterier som ska uppfyllas och från vilka ingen avvikelse tillåts om efterlevnad av dokumentet ska kunna åberopas. Krav uttrycks med hjälpverbet ska (eller ska inte för förbud).

### Rekommendation

En rekommendation är ett uttryck i ett dokumentets innehåll som anger en valmöjlighet eller ett tillvägagångssätt som bedöms vara särskilt lämpligt utan att nödvändigtvis nämna eller utesluta andra. Rekommendationer uttrycks med hjälpverbet bör (eller bör inte för avrådanden).

### Instruktion

Instruktioner anges i imperativ form och används för att ange hur något görs eller utförs. De kan underordnas en annan regel, såsom ett krav eller en rekommendation. De kan även användas självständigt, och är då att betrakta som krav.

### Förklaring

En förklaring är ett uttryck i ett dokumentets innehåll som förmedlar information. En förklaring kan uttrycka tillåtelse, möjlighet eller förmåga. Tillåtelse uttrycks med hjälpverbet får (eller motsatsen behöver inte). Möjlighet och förmåga uttrycks med hjälpverbet kan (eller motsatsen kan inte).

## READING INSTRUCTIONS FOR STANDARDS

These instructions cover the main principles for the use of provisions and external constraints in standardization deliverables.

### Requirement

A requirement is an expression, in the content of a document, that conveys objectively verifiable criteria to be fulfilled, and from which no deviation is permitted if conformance with the document is to be claimed. Requirements are expressed by the auxiliary shall (or shall not for prohibition).

### Recommendation

A recommendation is an expression, in the content of a document, that conveys a suggested possible choice or course of action deemed to be particularly suitable, without necessarily mentioning or excluding others. Recommendations are expressed by the auxiliary should (or should not for dissuasion).

### Instruction

An instruction is expressed in the imperative mood and is used in order to convey an action to be performed. It can be subordinated to another provision, such as a requirement or a recommendation. It can also be used independently and is then to be regarded as a requirement.

### Statement

A statement is an expression, in the content of a document, that conveys information. A statement can express permission, possibility or capability. Permission is expressed by the auxiliary may (its opposite being need not). Possibility and capability are expressed by the auxiliary can (its opposite being cannot).

# Contents

Page

<b>Foreword .....</b>	<b>vi</b>
<b>Introduction .....</b>	<b>vii</b>
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Test conditions .....</b>	<b>3</b>
4.1 General.....	3
4.2 Operational mode.....	3
4.3 Test configuration and trial.....	4
<b>5 Grasping characteristics .....</b>	<b>4</b>
5.1 General.....	4
5.2 Grasp size .....	4
5.2.1 Purpose.....	4
5.2.2 Test facility .....	4
5.2.3 Test procedure.....	5
5.2.4 Test result.....	6
5.3 Grasp strength.....	6
5.3.1 Purpose.....	6
5.3.2 Test facility .....	6
5.3.3 Test procedure.....	7
5.3.4 Test result.....	8
5.4 Grasp slip resistance.....	8
5.4.1 Purpose.....	8
5.4.2 Test facility .....	8
5.4.3 Test procedure.....	9
5.4.4 Test result.....	9
<b>6 Use cases .....</b>	<b>10</b>
6.1 General .....	10
6.2 Opening a hinged door .....	10
6.2.1 Purpose.....	10
6.2.2 Test facility .....	10
6.2.3 Test procedure.....	11
6.2.4 Test result.....	11
6.3 Opening a sliding door .....	11
6.3.1 Purpose.....	11
6.3.2 Test facility .....	11
6.3.3 Test procedure.....	12
6.3.4 Test result.....	12
<b>Bibliography.....</b>	<b>14</b>

## 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](http://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](http://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 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](http://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 18646 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](http://www.iso.org/members.html).

## Introduction

This document defines characteristics for the manipulation performance of service robots and describes how to specify and test them. It is intended that the reader of this document selects which performance characteristics to test, 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. The verification and validation of safety requirements are specified in safety related standards developed by ISO/TC 299.

Tests for position and path accuracy of manipulators, which can be useful in addition to the tests specified in this document, are provided in ISO 9283.

Tests for locomotion of mobile robots, such as rated speed and stopping characteristics are provided in ISO 18646-1. Tests for pose accuracy and pose repeatability for mobile robots are also provided in ISO 18646-2.





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

## Part 3: Manipulation

### 1 Scope

This document describes methods of specifying and evaluating the manipulation performance of service robots, notably:

- grasp size;
- grasp strength;
- grasp slip resistance;
- opening a hinged door; and
- opening a sliding door.

There are other grasping characteristics and use cases for manipulation of service robots. It is expected that these will be included in a future revision.

This document deals with the indoor environment only. However, the depicted tests can also be applicable for robots operating in outdoor environments.

This document is not applicable for the verification or validation of safety requirements.

### 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 9379:2005, *Operating forces — Test method — Doors*

### 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 <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

#### 3.1

##### robot

programmed actuated mechanism with a degree of autonomy to perform locomotion, manipulation or positioning

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

EXAMPLE Manipulator, mobile platform, and wearable robot.

## SS-ISO 18646-3:2021 (E)

[SOURCE: ISO 8373:2012, 2.6, modified — The phrase “actuated mechanism programmable in two or more axes” is replaced with “programmed actuated mechanism”, the phrase “moving within its environment, to perform intended tasks” is replaced with “to perform locomotion, manipulation or positioning”, note 1 to entry is modified, note 2 is removed, and EXAMPLES are added]

### 3.2 service robot

robot 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 platform

assembly of all components of the mobile robot which enables locomotion

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

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]

### 3.4 manipulator

mechanism usually consisting of a series of segments, connected to one another by joints, for the purpose of grasping and/or moving objects usually in several degrees of freedom

Note 1 to entry: A manipulator does not include an end-effector.

[SOURCE: ISO 8373:2012, 2.1, modified — The phrase “machine in which the mechanism usually consists of” is replaced with “mechanism usually consisting of”, the phrase “jointed or sliding relative to one another” is replaced with “connected to one another by joints”, the phrase “(pieces or tools)” is removed, and note 1 is removed]

### 3.5 end effector

device specifically designed for attachment to the mechanical interface to enable the robot to perform its task

EXAMPLE Gripper, nut runner, welding gun, spray gun.

[SOURCE: ISO 8373:2012, 3.11]

### 3.6 gripper

end effector designed for seizing and holding

[SOURCE: ISO 8373:2012, 3.14]

### 3.7 palm

solid member in the basic mechanical structure of a gripper on which the first joints of fingers are fixed

Note 1 to entry: A palm may make direct contact to objects.

[SOURCE: ISO 14539:2000, 4.2.1.2]

### 3.8

#### **normal operating conditions**

range of environmental conditions and other parameters within which the robot is expected to perform as specified by the manufacturer

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

Note 2 to entry: Other parameters include electrical supply instability, electromagnetic fields, etc.

[SOURCE: ISO 8373:2012, 6.1, modified — The phrase “which can influence robot performance (such as electrical supply instability, electromagnetic fields) within which the performance of the robot (2,6) specified by the manufacturer is valid” is replaced with “within which the robot is expected to perform as specified by the manufacturer”, and note 2 to entry is added]

### 3.9

#### **autonomous mode**

operational mode in which the robot function accomplishes its assigned task without direct human intervention

[SOURCE: ISO 13482:2014, 3.24.2, modified — The word “mission” is replaced with “task” and the EXAMPLE has been removed.]

### 3.10

#### **test configuration**

particular arrangement of test objects

### 3.11

#### **trial**

single instance of test procedure performed under identical test configuration

Note 1 to entry: A trial can be repeated multiple times.

## 4 Test conditions

### 4.1 General

The service robot, hereafter referred to as robot, shall be completely assembled, configured with a mobile platform, if applicable, a manipulator and a gripper, sufficiently charged and operational. If there are any diagnostic tests that have to be performed before the normal operation, they shall be satisfactorily completed. Appropriate precautions should be taken to protect the personnel during the test. The tests shall be preceded by the preparations for operation as specified by the manufacturer.

All performance shall be measured under normal operating conditions and these conditions shall be included in the test report.

All sensors used in the test specified in this document shall be calibrated prior to performing any tests.

The robot may use any sensors and recognition means to identify the object for each test, as long as they are reported in the test report.

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

### 4.2 Operational mode

Each test described in this document shall be carried out in the autonomous mode of the service robot.