

INTERNATIONAL STANDARD

Performance evaluation methods of robots for household and similar use



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2025 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 General conditions for testing	9
4.1 Conditions prior to testing	9
4.2 Operating and environmental conditions	10
4.2.1 General	10
4.2.2 Operating conditions	10
4.2.3 Atmospheric conditions	10
4.2.4 Lighting conditions	10
4.3 Test equipment and materials	10
4.4 Number of samples	10
4.5 Preparation of battery	11
4.6 Operation of the household robot	11
4.7 Measurement resolution and accuracy	11
4.8 Tolerance of dimensions	12
5 Units	12
6 Mobility	12
6.1 Threshold overcome	12
6.1.1 General	12
6.1.2 Test equipment	13
6.1.3 Test method	15
6.2 Transition overcome	16
6.2.1 General	16
6.2.2 Test equipment – Basic test bed configuration	16
6.2.3 Test method	16
6.3 Managing a single step	17
6.3.1 General	17
6.3.2 Test bed	17
6.3.3 Test method	18
6.4 Managing a ramp	19
6.4.1 General	19
6.4.2 Test equipment	19
6.4.3 Test method	21
6.4.4 Test results	21
6.5 Cable traversing behaviour	22
6.5.1 General	22
6.5.2 Test bed	22
6.5.3 Test method	24
7 Navigation	26
7.1 Pose measurements	26
7.1.1 General	26
7.1.2 Test bed	26
7.1.3 Square test mode	26

7.1.4	Straight line test mode	28
7.2	Capability of homing function	29
7.2.1	General	29
7.2.2	Test room	29
7.2.3	Test method	30
7.3	Obstacle avoidance	31
7.3.1	General	31
7.3.2	Test bed	32
7.3.3	Test method	33
7.4	Lighting effects	34
7.4.1	General	34
7.4.2	Lighting conditions.....	35
7.4.3	Test equipment and materials.....	35
7.4.4	Test method	36
8	Energy use	36
8.1	Energy consumption of a household robot.....	36
8.1.1	General	36
8.1.2	Test conditions	36
8.1.3	Test method	37
8.2	Operation time per single charge	39
8.2.1	General	39
8.2.2	Test bed	39
8.2.3	Test method	40
9	Instructions for use	41
Annex A (informative)	Recommended robot test room for household and similar use	42
A.1	General.....	42
A.2	Test condition	42
A.3	Test bed	42
A.4	A compositions of multi-room	43
A.4.1	General	43
A.4.2	Room definitions.....	43
A.4.3	Layout definitions	44
Annex B (informative)	Usage profile for robot for household and similar use	48
Annex C (informative)	Simulated work cycle	50
Annex D (informative)	Matrix of multiple operation modes.....	51
Annex E (informative)	Example of transition overcome test beds	52
Bibliography	54
Figure 1 – Basic test bed configuration for mobility testing.....		13
Figure 2 – Test bed with additional threshold		14
Figure 3 – Drawings of cylindrical, rectangular and trapezoid thresholds.....		14
Figure 4 – Starting positions and orientations		15
Figure 5 – Process to determine the maximum passable transition height.....		17
Figure 6 – Managing a single step configuration		18
Figure 7 – Starting position for managing a single step test		19
Figure 8 – Side view (15° configuration).....		20
Figure 9 – Top view (15° configuration).....		20

Figure 10 – Zoom on transitions (15° configuration)	21
Figure 11 – Wire fastening configuration	23
Figure 12 – Floor circle marks schematic diagram	23
Figure 13 – Floor circle marks schematic diagram with robot	24
Figure 14 – Top view of cable traversing behaviour configuration	24
Figure 15 – Side view of cable traversing behaviour configuration	25
Figure 17 – Pose measurements configuration-straight line mode	28
Figure 18 – Capability of homing function configuration	30
Figure 19 – Obstacle avoidance configuration	32
Figure 20 – Starting position for obstacle avoidance test	33
Figure 21 – Illustration of pendant light	35
Figure 22 – Operation time per single charge configuration	40
Figure A.1 – Interconnection diagram of multi-room (alternative)	45
Figure A.2 – Schematic of robot test room	46
Figure E.1 – Transition formed by stacking sheets on area B	52
Figure E.2 – Transition formed by adjusting the height of platform B	53
Table 1 – Tolerance of linear dimension	12
Table 2 – Tolerance of external radius and chamfer heights	12
Table 3 – Typical thresholds and its characteristic	13
Table 4 – Test results of the managing a ramp	22
Table 5 – Outcome and maximum swinging distance	26
Table 6 – Objects for pose measurement	28
Table 7 – Overview of duration and the values that should be reported in this test	39
Table A.1 – Dimensions of furniture	46
Table D.1 – Combination regarding multiple operation modes	51

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Performance evaluation methods of robots for household and similar use

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62849 has been prepared by IEC technical committee 59: Performance of household and similar electrical appliances. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the title has been changed to "Performance evaluation methods of robots for household and similar use";
- b) the scope is more clearly defined and the physical specifications of robots for household and similar use covered by this document are clearly defined;
- c) new evaluation methods for 6 performance items have been added, including obstacle avoidance, managing a ramp, lighting effects, transition overcome, threshold overcome, energy consumption of robots;

- d) new structure has been introduced, which provides basic common test methods in each category and can be used by other robotics standards, including the following:
- 1) mobility,
 - 2) navigation,
 - 3) energy use,
 - 4) effects on environment,
 - 5) other/miscellaneous.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59/857/FDIS	59/860/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

In this standard, the following print types are used:

- terms defined in Clause 3: **bold type**.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

As stated in the Foreword, this document has made adjustments and improvements in terms of name, scope, performance items, overall structure, etc. and will cover the generic performance test methods of robots for household and similar use within one document.

The needs in terms of environmental effects (noise, photoelectric pollution, etc.), other/miscellaneous (human-robot interface, facial recognition, voice recognition, information security, reliability, AI, etc.) linked to the increasing performance and demand for robots used outdoors will be taken into account in a future version of this document.

1 Scope

This document provides performance testing and evaluation methods for the common features of robots for household and similar use, their physical specifications satisfying the following:

- height: maximum 1,75 m,
- dimensions: maximum 700 mm wide (to be able to fit through doorways),
- speed: maximum 1,5 m/s,
- floor supported wheeled or wheel-track robots.

This document is neither concerned with safety nor with performance requirements.

This document is applicable for indoor floor use robots.

This document is not applicable to the following products:

Wet and dry surface-cleaning robots or combination of such functions.

NOTE If different testing and evaluating methods are given in other standards for specific robots, these methods can be considered for priority use.

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.

IEC TS 61496-4-3, *Safety of machinery - Electro-sensitive protective equipment - Part 4-3: Particular requirements for equipment using vision based protective devices (VBPD) - Additional requirements when using stereo vision techniques (VBPDEST)*

IEC TS 62885-1, *Surface cleaning appliances - Part 1: General requirements on test material and test equipment*

IEC/ASTM 62885-7:2020, *Surface cleaning appliances - Part 7: Dry-cleaning robots for household or similar use - Methods for measuring the performance*
IEC/ASTM 62885-7:2020/AMD1:2022

ISO 554, *Standard atmospheres for conditioning and/or testing - Specifications*

ISO 2768-1:1989, *General tolerances - Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 13856-3, *Safety of machinery - Pressure-sensitive protective devices - Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices*