



DPC: 25/30479612 DC

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Date: 12 March 2025

Origin: International

Latest date for receipt of comments: 05 May 2025

Project No. 2023/02071

Responsible committee: AMT/10 Robotics

Interested committees:

Title: Draft BS ISO 18646-5 Robotics - Performance criteria and related test methods for service robots. Part 5: Locomotion for legged robots.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 18646-5

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

Part 5: Locomotion for legged robots

*Robotique — Critères de performance et méthodes d'essai
correspondantes pour robots de service —*

Partie 5: Locomotion pour robots à pattes

ICS: 25.040.30

ISO/TC 299

Secretariat: **SIS**

Voting begins on:
2025-03-12

Voting terminates on:
2025-06-04

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Reference number
ISO/DIS 18646-5:2025(en)

Full document details: 25/30479612 DC

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Published in Switzerland

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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.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.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.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.org/members.html.

Introduction

With the development of service robot technology, legged robots have an increasing application range in the fields of service, guide, life companion and family entertainment. This industry has developed a market of a certain scale and at the same time, it has appreciable development prospects and huge market potential in the fields of industrial manufacture, facility test and maintenance, special operations and depopulated zone exploration. Currently, the product parameters of biped, quadruped and multi-legged robots are claimed inconsistently by different companies, and the test conditions and test methods for the parameters are inconsistent and unclarified. In this case, designers cannot achieve optimization through effective tests for product performance, manufacturing staff cannot monitor product quality through consistent evaluating method, and users can neither select products based on needs nor compare products of the same type according to performance parameters. Furthermore, there may appear unnecessary divergence and conflicts between legged robot products from different countries in international trade because of the lack of related international standard, which may lead to unhealthy development of legged robot industry.

This document lists a series of specifications on the performance of legged robots, as well as test conditions, test purpose, test facility, test procedures and the treatment of test results based on legged robot's unique characteristics, such as dispersed stepping movement, multiple limbs, multiple degrees-of-freedom, its application in varied topography and human-machine interaction. The purpose of this document is to establish a consistent system of performance representation and method of evaluation for legged robots, to facilitate design optimization, performance claims, quality monitoring and product selection.

This document can provide data foundation of product optimization for R&D staff, provide quality monitoring methods for manufacturing staff, provide accordance for testing and certification authorities, and provide guidance of integration for system integration companies.

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

Part 5: Locomotion for legged robots

1 Scope

This document describes methods for specifying and evaluating the locomotion performance of legged robots.

This document mainly applies to legged robots. For the test or performance evaluation of the legged robot of a certain type, this document does not specify which performance to choose. The tests listed in this document are mainly used to evaluate the complete machine, and can be also used for sample test, qualification test or check-and-accept test.

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

This document remains neutral with respect to the robot's intended use, modes of operation, or hardware setup. For example, whether the robot functions with or without a load, the identical test procedure can be employed for all robot configurations.

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 8373:2021, *Robotics — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8373 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.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

leg

link mechanism which is actuated to support and propel the mobile robot by making reciprocating motion and intermittent contact with the *travel surface* (3.3)

[SOURCE: ISO 8373:2021, 4.4]

3.2

legged robot

mobile robot that travels using one or more legs

[SOURCE: ISO 8373:2021, 4.15.2]

3.3

travel surface

terrain on which the mobile robot travels

[SOURCE: ISO 8373:2021, 8.7]

3.4

load

force, torque or both at the mechanical interface or mobile platform which can be exerted along the various direction 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 & dynamic forces supported by the robot.

[SOURCE: ISO 8373:2021, 7.2.]

3.5

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 temperature and humidity.

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

[SOURCE: ISO 8373:2021, 7.1]

3.6

rated speed

maximum speed of the *legged robot* (3.2) in *normal operating conditions* (3.5)

3.7

topography

shape of the *travel surface* (3.3)

3.8

turning

turn movement of the *legged robot* (3.2) causing an intended change of the original traveling direction of the *legged robot* (3.2)

3.9

turning space

rectangular space within which the *legged robot* (3.2) can complete *turning* (3.8)

3.10

capacity

reference to represent how a robot can accomplish a certain type of task

3.11

stride width

minimum width in the direction perpendicular to robot's traveling direction that can cover the projection of the robot on horizontal *travel surface* (3.3)

3.12

stable standing posture

standing with intended part of *leg* (3.1) touching *travel surface* (3.3) and without moving *leg* (3.1)

4 Test conditions

4.1 General

The legged robot shall be completely assembled, sufficiently charged and operational.

The tests shall be preceded by the preparations for operation as specified by the manufacturer, including calibration of any relevant sensors that have an effect on the test results.

All conditions specified in [Clause 4](#) shall 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 conformation, multiple trials can be conducted, if specified in the test procedure. Each test shall be independent to locomotion modes (walking, jumping, running) and the applied locomotion modes shall be noted in the test report. The test shall be recorded based on the information in [Annex A](#).

For comparing robots in different sizes, a practical guide is provided in [Annex C](#).

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 surpass the given conditions, then they shall be declared in the test results.

4.3 Travel surface conditions

If not specified, 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 to test the performance. The surface shall be horizontal, if not specified.

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.

5 Rated speed

5.1 Purpose

The purpose of this test is to determine how fast a robot can travel to its destination. Locomotion 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 locomotion speed is determined with 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 3 000 mm in length, or at least the length that allows the robot to step 10 times in test area, whichever is larger. The width shall be at least 1000mm wider than the stride width of the robot. The angle between the travel surface of the test area and the horizontal surface is changeable. Enough space shall be provided at each end of the test area for acceleration and deceleration. The acceleration and deceleration area shall be enough in length for the robot to finish full acceleration and deceleration processes. Sensors shall be allocated at each end of the speed measurement test area to measure the start time and finish time of the legged robot.