INTERNATIONAL STANDARD

ISO 9946

Second edition
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Manipulating industrial robots — Presentation of characteristics

Robots manipulateurs industriels — Présentation des caractéristiques

Contents

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9946 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 2, *Robots for manufacturing environment*.

This second edition cancels and replaces the first edition (ISO 9946:1991) of which it constitutes a technical revision.

Annexes A and B of this International Standard are for information only.

Introduction

ISO 9946 is part of a series of International Standards dealing with manipulating industrial robots. Other International Standards cover such topics as safety, performance criteria and related testing methods, coordinate systems, terminology, and mechanical interfaces. It is noted that these standards are interrelated and also related to other International Standards.

The number of manipulating industrial robots used in a manufacturing environment is constantly increasing and this has underlined the need for a standard format for the specification and presentation of robot characteristics.

The objective of ISO 9946 is to assist users and manufacturers in the understanding and comparison of various types of robots.

ISO 11593:1996 contains a vocabulary and a format for the presentation of automatic end effector exchange systems characteristics.

Annex A of this International Standard provides a recommended format for the presentation of robot specification.

Annex B provides a description of the symbols of performance criteria.

NOTE For the purposes of this International Standard, the term "robot" means "manipulating industrial robot".

Manipulating industrial robots — Presentation of characteristics

1 Scope

This International Standard specifies how characteristics of robots shall be presented by the manufacturer.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8373:1994, *Manipulating industrial robots — Vocabulary.*

ISO 9283:1998, *Manipulating industrial robots — Performance criteria and related test methods.*

ISO 9409-1:1996, *Manipulating industrial robots — Mechanical interfaces — Part 1: Plates (form A).*

ISO 9787:—[1)], *Manipulating industrial robots — Coordinate systems and motion nomenclatures.*

ISO 10218:1992, *Manipulating industrial robots — Safety.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 8373 and the following definition apply.

3.1
centre of the working space (C_W)
is the position of the wrist reference point when each active joint in the arm is in the middle position of its moving range

4 Units

Unless otherwise stated, all dimensions are as follows:

— length in millimetres (mm);

— angle in radians (rad) or degrees (°);

— time in seconds (s);

— mass in kilograms (kg);

— force in newtons (N);

— velocity in metres per second (m/s), radians per second (rad/s) or degrees per second (°/s).

1) This International Standard is subject to revision and the year of publication will be inserted at a later stage.

5 Characteristics

5.1 General

The manufacturer shall provide information related to the various characteristics and requirements as described in this clause as part of the robot documentation.

5.2 Application

The manufacturer shall specify the main type(s) of application(s) for which the robot is intended.

Examples of typical applications are

- handling;
- assembly;
- spot welding;
- arc welding;
- machining;
- spray painting;
- adhesive/sealing;
- inspection.

5.3 Power source

The manufacturer shall specify all external power sources, including type (e.g. electrical, hydraulic, pneumatic or combination) required for proper operation of the robot (e.g. mechanical structure motion actuators, control, auxiliary equipment [e.g. gripper]), together with the maximum power consumption required from each. These specifications shall also include permissible ranges and fluctuations.

The manufacturer shall also specify the type of power utilized to control axis and auxiliary motion (e.g. electric, hydraulic, pneumatic). Where more than one type of power is utilized, the manufacturer shall include a breakdown by individual motion.

5.4 Mechanical structure

The manufacturer shall specify the type of the mechanical structure and the number of mechanical axes. An outline drawing of the structure shall be provided detailing the axis motions. This drawing may be part of the drawing required for describing the working space (see 5.5).

Examples of mechanical structures:

- rectangular robot;
- cylindrical robot;
- polar robot;
- articulated robot.

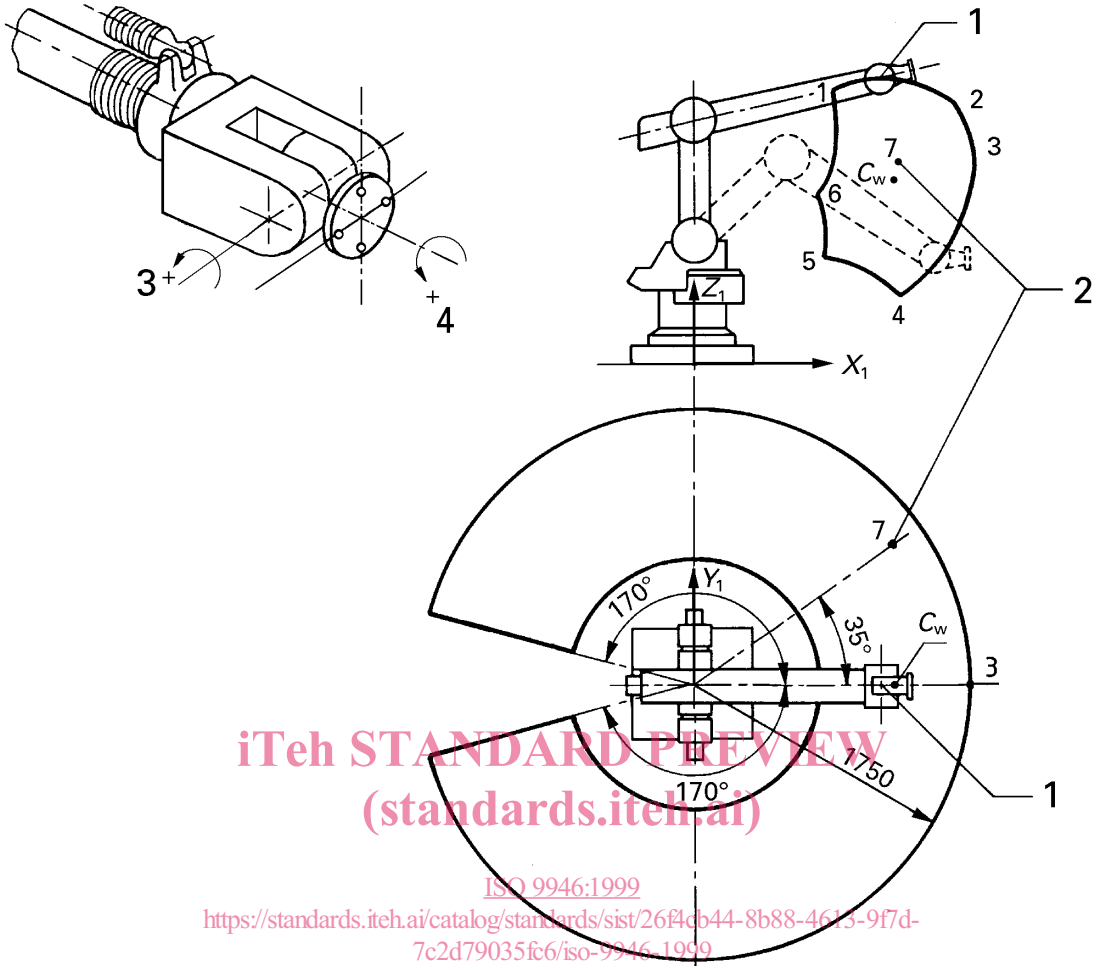
If the robot is mobile, the way in which it is guided shall be indicated.

5.5 Working space

The boundaries of the working space of the wrist reference point including the alignment pose and centre of the working space (C_W) shall be illustrated in a drawing with at least two views (one the projection of the locus of the maximum reach of the robot arm in the base coordinate X_1 - Y_1 plane (see ISO 9787) and the other the projection of the locus of the maximum reach of the arm on the base coordinate X_1 - Z_1 plane). The drawing shall also provide information on any limitation of secondary axis motion at any point(s) in the working space of the wrist reference point (see figure 1 for an example of a 5-axis robot and figure 2 for an example of a 6-axis robot).

In the drawings, it is recommended that the details of the working space and range of movement of secondary axes are given in tabular form as shown in the examples of figures 1 and 2.

Dimensions in millimetres



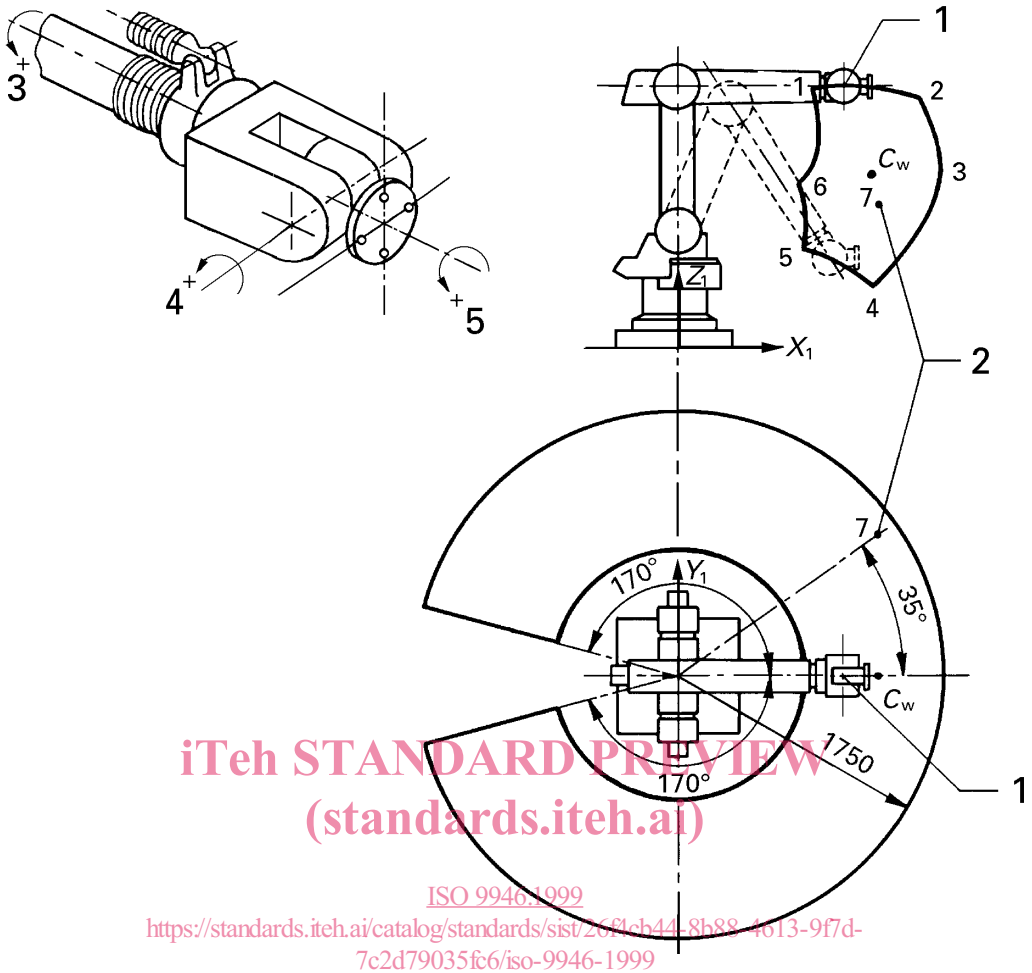
Key

1 Wrist reference point
2 Alignment pose
3 4th axis
4 5th axis

Point in space	Working space of the wrist reference point		Range of movement of secondary axes	
	X_1 (mm)	Z_1 (mm)	4th	5th
1	925	1 635	+ 75° – 90°	+ 170° – 150°
2	1 610	1 550	+ 75° – 90°	± 180°
3	1 750	1 140	+ 75° – 105°	± 180°
4	1 310	345	+ 45° – 120°	± 180°
5	870	600	+ 45° – 120°	+ 150° – 170°
6	840	1 000	+ 75° – 120°	+ 140° – 150°
7	1 350	750	–	–

Figure 1 — Example of a 5-axis robot working space

Dimensions in millimetres



Key

1 Wrist reference point
2 Alignment pose
3 4th axis
4 5th axis
5 6th axis

Point in space	Working space of the wrist reference point		Range of movement of secondary axes		
	X_1 (mm)	Z_1 (mm)	4th	5th	6th
1	925	1 635	± 210°	+ 75° – 90°	+ 170° – 150°
2	1 610	1 550	± 210°	+ 75° – 90°	± 180°
3	1 750	1 140	± 210°	+ 75° – 105°	± 180°
4	1 310	345	± 210°	+ 45° – 120°	± 180°
5	870	600	± 210°	+ 45° – 120°	+ 150° – 170°
6	840	1 000	± 210°	+ 75° – 120°	+ 140° – 150°
7	1 350	750	–	–	–

Figure 2 — Example of a 6-axis robot working space