# INTERNATIONAL STANDARD

# ISO 9409-1

Third edition
2004-03-01

# Manipulating industrial robots — Mechanical interfaces —

## Part 1: **Plates**

*Robots manipulateurs industriels — Interfaces mécaniques —*

*Partie 1: Interfaces à plateau*

Reference number
ISO 9409-1:2004(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 9409-1 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 2, *Robots for industrial environments*.

This third edition cancels and replaces the second edition (ISO 9409-1:1996) and the Technical Corrigendum ISO 9409-1:1996/Cor.1:1998, of which it constitutes a technical revision. Clause 5 and Figure 1 have been revised, Figures 2 and 3 have been added, and Table 1 has been revised.

ISO 9409 consists of the following parts, under the general title *Manipulating industrial robots — Mechanical interfaces*:

— *Part 1: Plates*

— *Part 2: Shafts*

# Introduction

This part of ISO 9409 is part of a series of International Standards dealing with manipulating industrial robots. Other International Standards cover such topics as safety, general characteristics, coordinate systems, performance criteria and related test methods, terminology, and robot programming. It is noted that these standards are interrelated and also related to other International Standards.

Manipulating industrial robots are steadily growing in importance in industrial automation. Depending on the type of application, they may require removable end effectors such as grippers or tools which are attached to the mechanical interface.

# Manipulating industrial robots — Mechanical interfaces —

# Part 1: Plates

## 1 Scope

This part of ISO 9409 defines the main dimensions, designation and marking for a circular plate as mechanical interface. It is intended to ensure the exchangeability and to keep the orientation of hand-mounted end effectors.

This part of ISO 9409 does not define other requirements of the end effector coupling device.

This part of ISO 9409 does not contain any correlation of load-carrying ranges, as it is expected that the appropriate interface is selected depending on the application and the load-carrying capacity of the robot.

The mechanical interfaces specified in this part of ISO 9409 will also find application in simple handling systems which are not covered by the definition of manipulating industrial robots, such as pick-and-place or master-slave units.

## 2 Normative references

The following referenced documents are indispensable for the application 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 261:1998, *ISO general-purpose metric screw threads — General plan*

ISO 286-1:1988, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*

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

ISO 9787:1999, *Manipulating industrial robots — Coordinate systems and motion nomenclatures*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8373 apply.

# 4 Dimensions

## 4.1 General

It is recommended that the dimensions for the mechanical interface be specified in accordance with Table 1, series 1. The supplementary series 2 shall be used only in special cases where the graduation of series 1 is not sufficient for the intended use.

Only one centering diameter is required. $d_3$ is preferred. The use of $d_2$ is application dependent.

The hole, $d_5$, is intended to have a location pin fitted, which is application dependent. The location pin may have different shapes, e.g. cylindrical or diamond. Any over-dimension shall be excluded by the selection of the location pin.

The location pin hole centre shall be aligned with the $+X_m$ axis vector of the mechanical interface coordinate system (see ISO 9787).

Detailed dimensions (e.g. undercuts), not stated here, are to be selected appropriately.

## 4.2 Tolerances

The mechanical interface dimensions shall be toleranced in accordance with ISO 286. Geometric tolerances shall be interpreted in accordance with ISO 1101. The plane A, counterbore diameter, $d_3$, and the guide pin hole, $d_5$, shall be the datums for all geometrical tolerances, as shown in Figures 1 to 3.

## 4.3 Threaded holes

The thread shall be in accordance with ISO 261.

## 4.4 Provision for routing service lines

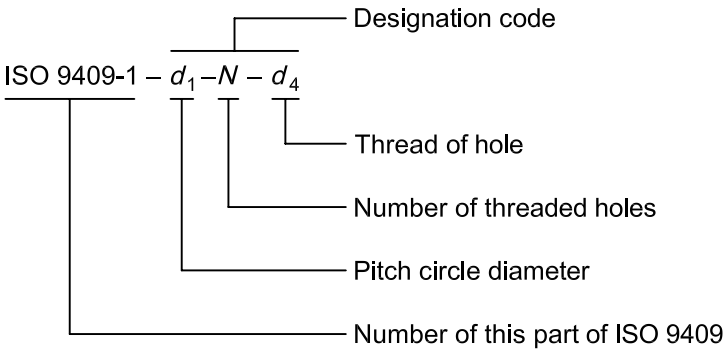
If the plate is provided with a hollow centre, the centre hole shall have a diameter, $d_6$, equal to or less than $d_3$.

## 4.5 End effector requirements

The dimensions and related tolerances of the mating surface of the end effector shall be compatible with the dimensions and tolerances specified in this part of ISO 9409.

# 5 Designation code

The designation of the mechanical interface whose dimensions are in accordance with this part of ISO 9409 shall be as follows:




EXAMPLE A mechanical interface of a pitch circle diameter, $d_1$ = 160 mm, and six M10 holes, shall be designated as follows:

**ISO 9409-1–160–6–M10**

## 6 Marking

When the plate and related end effectors made in accordance with this part of ISO 9409 are marked, they shall be permanently marked with the designation code (see Clause 5).

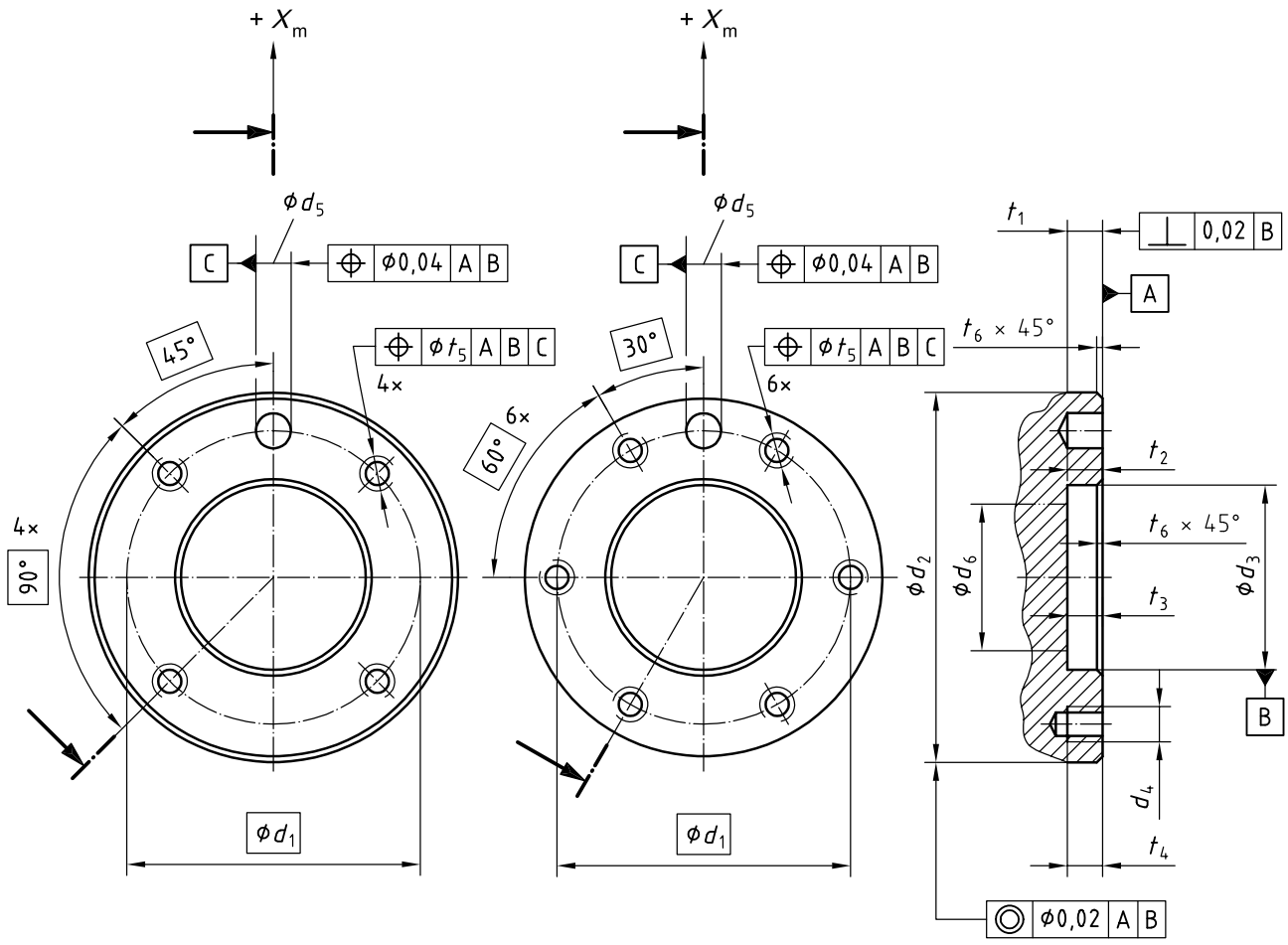



**Figure 1 — Design according to Table 1, positions 1 to 9, 11, and 13**

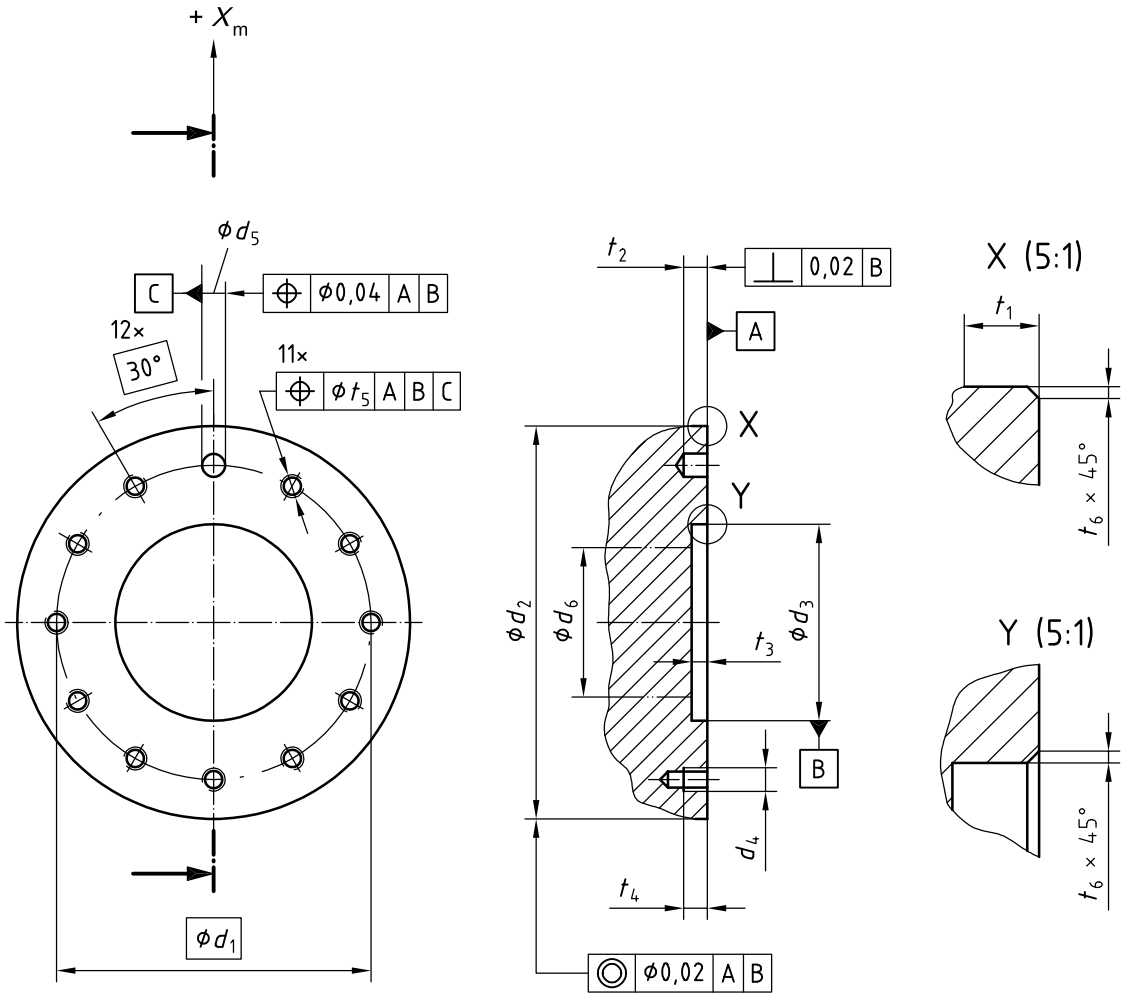



**Figure 2 — Design according to Table 1, position 10**

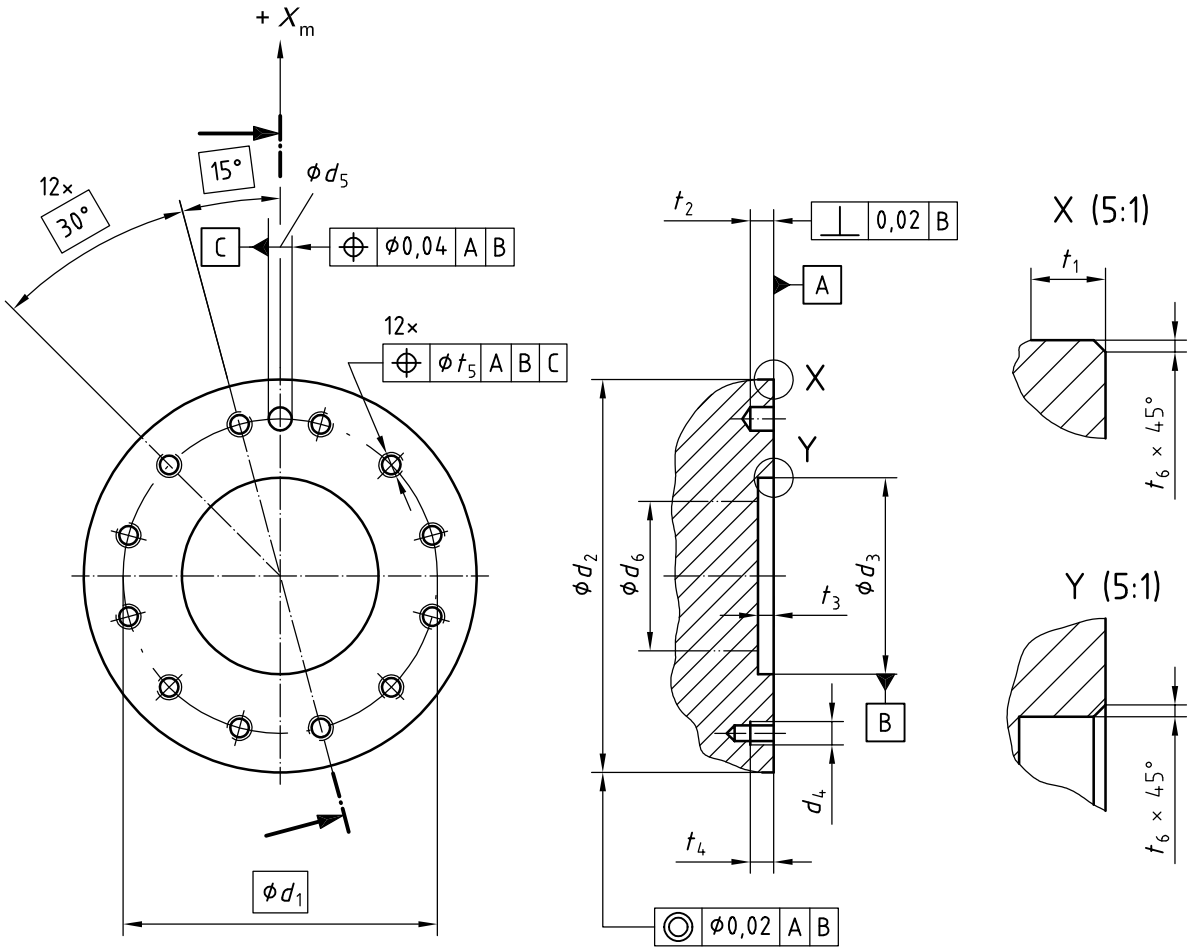



**Figure 3 — Design according to Table 1, position 12**

**Table 1 — Preferred series 1 and supplementary series 2 of the circular mechanical interface**

| Position | Pitch circle diameter, $d_1$ | | $d_2$ | $d_3$ | $d_4$ | $d_5$ | $d_6$ | $t_1$ | $t_2$ | $t_3$ | $t_4$ | $t_5$ | $t_6$ | Number of holes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Series 1 | Series 2 | h8 | H7 | | H7 | | min. | min. | min. | | | min. | $N$ |
| 1 | 25 | | 34 | 16 | M4 | 4 | See 4.4 | 6 | 4 | 4 | See NOTE | 0,2 | 0,5 | 4 |
| 2 | | 31,5 | 40 | 20 | M5 | 5 | | | 5 | | | | | |
| 3 | 40 | | 50 | 25 | M6 | 6 | | | 6 | 6 | | | 1 | |
| 4 | | 50 | 63 | 31,5 | | | | | | | | | | |
| 5 | 63 | | 80 | 40 | | | | | | | | | | |
| 6 | | 80 | 100 | 50 | M8 | 8 | | | 8 | | | 0,4 | | 6 |
| 7 | 100 | | 125 | 63 | | | | | | | | | | |
| 8 | | 125 | 160 | 80 | M10 | 10 | | 8 | 10 | 8 | | | | |
| 9 | 160 | | 200 | 100 | | | | | | | | | | |
| 10 | | 160 | 200 | 100 | M12 | 12 | | | 12 | | | | | 11 |
| 11 | | 200 | 250 | 125 | | | | | | | | | | 6 |
| 12 | | 200 | 250 | 125 | M16 | | | | | | 22 | | | 12 |
| 13 | 250 | 250 | 315 | 160 | M12 | | | | | | See NOTE | | | 6 |

NOTE The minimum depth of the threaded holes, $t_4$, is dependent on the material of the end effector coupling devices

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Price based on 6 pages