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Manipulating industrial robots — Automatic end effector exchange systems — Vocabulary and presentation of characteristics

Robots manipulateurs industriels — Systèmes de changement automatique de terminal — Vocabulaire et présentation des caractéristiques

Reference number
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International Organization for Standardization
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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 11593 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration,* Subcommittee SC 2, *Robots for manufacturing environment.*

Annex A of this International Standard is for information only.

Introduction

ISO 11593 is one of a series of standards dealing with the requirements of manipulating industrial robots. Other documents cover such topics as terminology, general characteristics, coordinate systems, performance criteria and related test methods, safety, robot programming languages, and robot companion standards to MMS. It is noted that these standards are interrelated and also related to other International Standards.

Automatic exchange systems for end effectors increase in importance for handling devices. This International Standard contains the vocabulary and presentation of characteristics, e.g. forces, moments (torques), and exchange times, for end effector exchange systems. This International Standard does not contain any details for the development and design of these systems.

Manipulating industrial robots — Automatic end effector exchange systems — Vocabulary and presentation of characteristics

1 Scope

This International Standard defines terms relevant to automatic end effector exchange systems used for manipulating industrial robots operated in a manufacturing environment.

The terms are presented by their symbol, unit, definition and description. The definition includes applicable references to existing standards.

Annex A provides a format for the presentation of automatic end effector exchange systems characteristics.

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.*

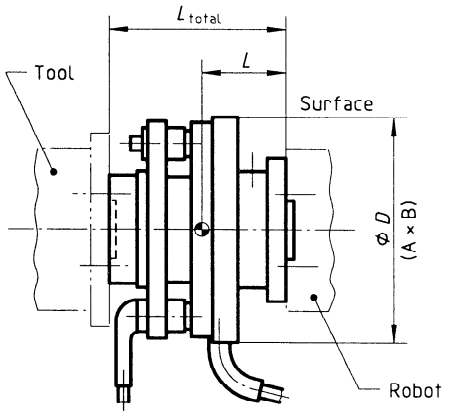
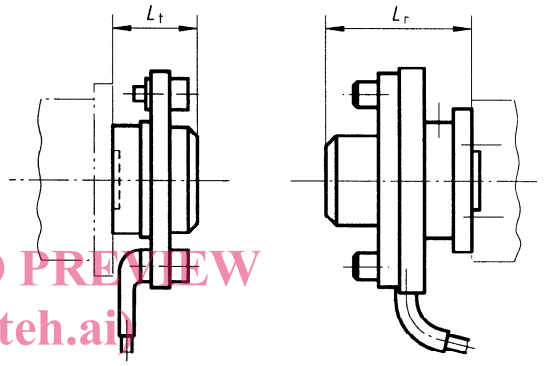
ISO 9409-1:1996, *Manipulating industrial robots — Mechanical interfaces — Part 1: Plates (form A).*

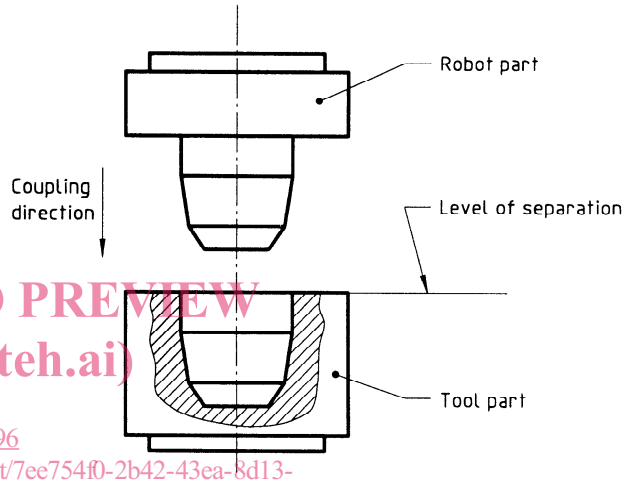
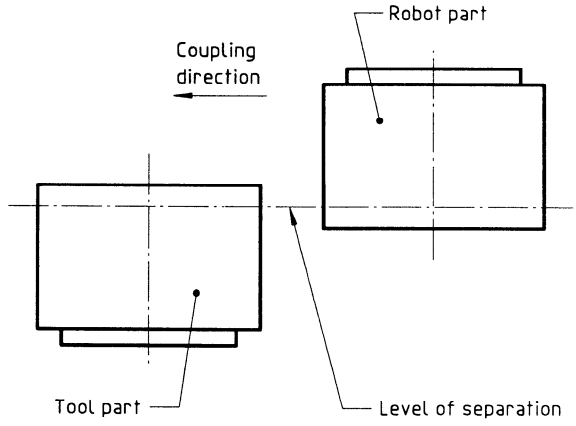
ISO 9409-2:1996, *Manipulating industrial robots — Mechanical interfaces — Part 2: Shafts (form A).*

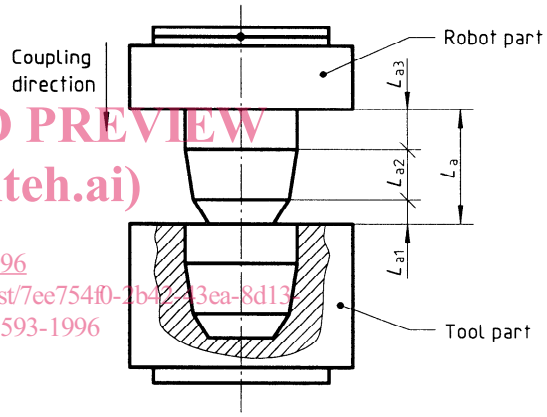
ISO 9787:1990, *Manipulating industrial robots — Coordinate systems and motions.*

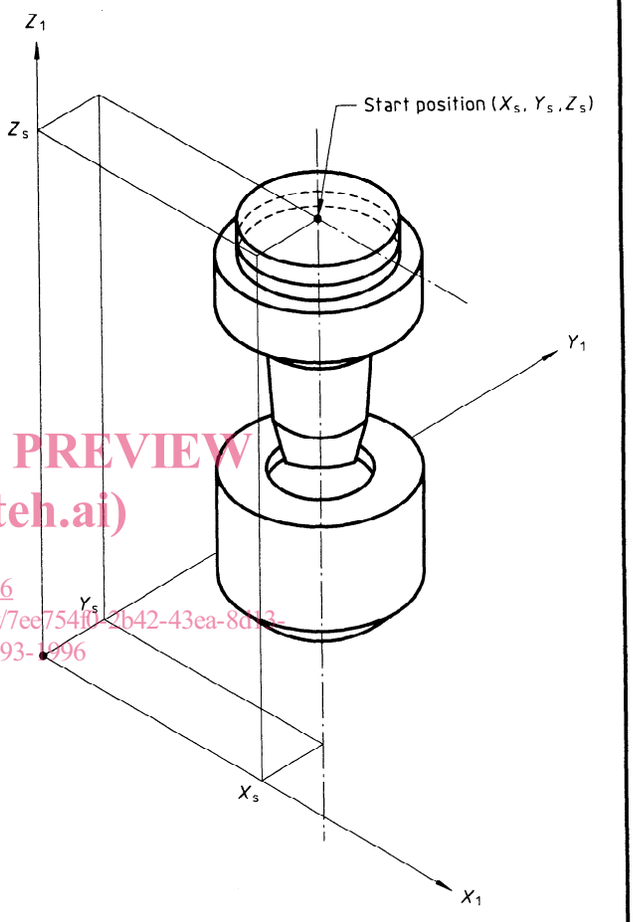
3 Terms and definitions

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

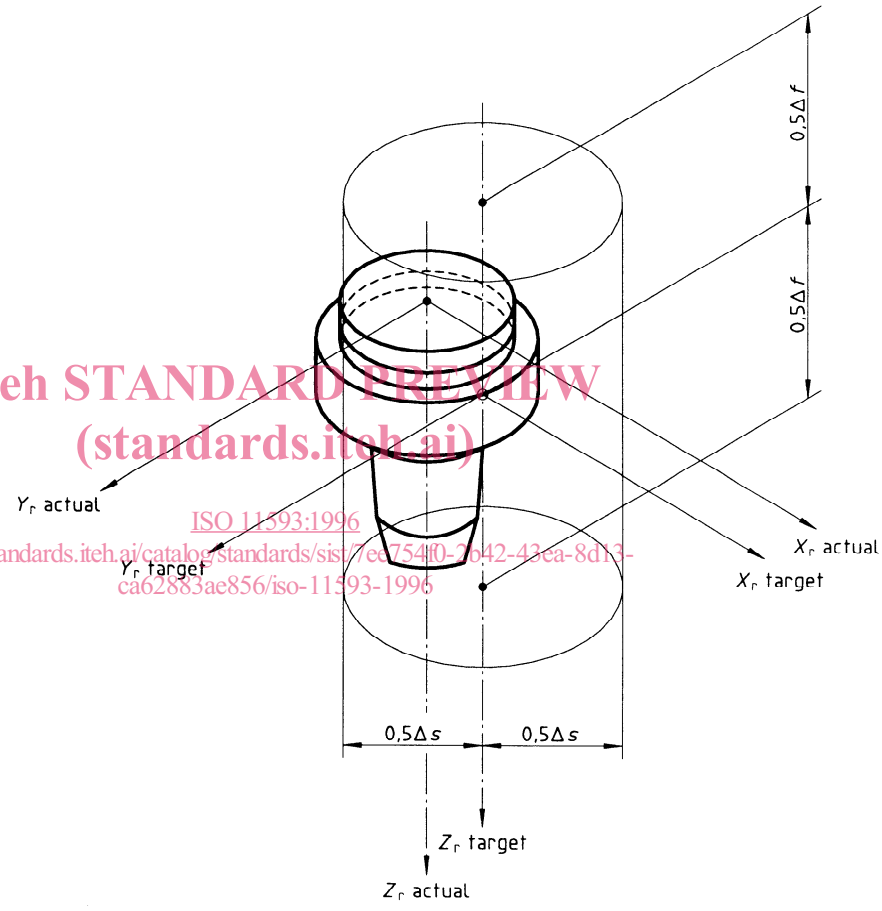
No.	Term	Symbol	Unit	Definition and description
3.1 External shape and main dimensions of the exchange system				
				
				
3.1.1	structural shape			Overall dimensions of device:
		D	mm	external diameter (for circular shape)
		A	mm	width } (for other)
		B	mm	depth } (for other)
		L_r	mm	length of the individual robot-mounted part
		L_t	mm	length of the individual tool-mounted part
3.1.2	face-to-face dimension			Distance measured from the robot interface to the tool interface:
		$L_{total} \pm \Delta$	mm	length of the coupled systems;
		$L_{cr} \pm \Delta$	mm	coupling length of the robot part;
		$L_{ct} \pm \Delta$	mm	coupling length of the tool part.
				The tolerance of the length L_{cr} and L_{ct} has a significant effect on the pose accuracy of the complete system when using different tools.
3.1.3	centre of gravity in the coupled system	L_g	mm	Distance of the centre of gravity in the coupled system from the reference plane of the mechanical interface of the robot.
3.1.4	moment of inertia of the coupled system	I	kg·m^2	Moment of inertia of the coupled system about the Z_m axis.
3.1.5	mass	m_r	kg	Mass of the robot part.
		m_t	kg	Mass of the tool part.
3.1.6	interface for robot side and tool side			Description and marking for robot part and tool part according to ISO 9409-1 and ISO 9409-2.

No.	Term	Symbol	Unit	Definition and description
3.1.7	cable routing			Position and dimension of routing and tracking of cable for robot part and tool part in one drawing.
3.2 Positioning and orientation in coupling procedures				
3.2.1	coupling direction			The coupling direction is the direction in which the robot-mounted and/or the tool-mounted part are moved to each other. Kinds of coupling direction: On axial coupling direction the motion of coupling runs vertical to the level of separation of the interface.  On lateral coupling direction the motion of coupling runs parallel to the level of separation of the interface. 

No.	Term	Symbol	Unit	Definition and description
3.2.2	length of the approach distance	L_a	mm	The length of the approach distance shows the total distance of operation of the robot-mounted (and/or tool-mounted) part in coupling direction until the complete coupling of both parts. The approach distance results from the total of the following single coupling distances: L_{a1} mm distance of operation for precentring; L_{a2} mm distance of operation for centring; L_{a3} mm distance of operation thereafter until the complete coupling $L_a = L_{a1} + L_{a2} + L_{a3}$. On axial coupling direction the approach distance runs vertical to the reference plane, on lateral coupling direction it runs parallel to the reference plane. Example for axial coupling direction: 

No.	Term	Symbol	Unit	Definition and description
3.2.3	start position	X_S Y_S Z_S	mm mm mm	The start position represents the position of the robot-mounted part of the exchange device in relation to the tool-mounted part shortly before the coupling process begins. If the start position is related to a typical kind of arrangement, the start position can be defined in the cartesian coordinate system X_1, Y_1, Z_1 of the robot (according to ISO 9787) as X_S, Y_S, Z_S. Example for axial coupling direction: 

No.	Term	Symbol	Unit	Definition and description
3.2.4	position tolerance in the start position	s f	mm mm	To permit the assembly of both parts of the exchange system, the start position must be fixed with a defined accuracy. The position tolerance in the start position is fixed by the attained pose within a cylindrical space. The command start position represents the centre of thus tolerancing space, which is marked by the diameter s in circular direction and the height f in axial direction. Example for axial coupling direction:



No.	Term	Symbol	Unit	Definition and description
3.2.5	orientation tolerance in the start position			The orientation tolerance must be fixed with a precise accuracy. All values concerning the orientation tolerance are related to the mechanical interface coordinate system X_m, Y_m, Z_m. The command value for the orientation is given by the alignment X_m, Y_m, Z_m, A, B, C.
				NOTE — The orientation tolerance is defined from the two measures "limit value of the misalignment" and "limit value of distortion".
3.2.6	limit value of the misalignment	$\pm 0{,}5\ \alpha$ $\pm 0{,}5\ \beta$	rad or degree rad or degree	The limited deviations of the attained pose from the command pose according to the X_m and Y_m axis (rotations $\pm\ \alpha$ and $\pm\ \beta$ respectively) can normally be regarded as identical and are represented as limit values of the misalignment $\pm 0{,}5\ \alpha$ and $\pm 0{,}5\ \beta$ respectively (see the figure in 3.2.5).
3.2.7	limit value of the distortion	$\pm 0{,}5\ \gamma$	rad or degree	The deviation of the attained pose from the command pose according to the Z_m axis is represented as limit value of the distortion $\pm 0{,}5\ \gamma$ (see the figure in 3.2.5).
3.2.8	tolerance of the coupling path			The deviation of the coupling path shall be within the approved position tolerance in the start position.