

AS 3984—1991
ISO 9283: 1990

Australian Standard[®]

**Manipulating industrial robots—
Performance criteria and related
test methods**

This Australian Standard was prepared by Committee IT/6, Information Processing Systems for Industrial Automation. It was approved on behalf of the Council of Standards Australia on 16 August 1991 and published on 15 November 1991.

The following interests are represented on Committee IT/6:

Australian Electrical and Electronic Manufacturers Association

Australian Information Industry Association

Australian Robot Association

Confederation of Australian Industry

Department of Technical and Further Education N.S.W.

Division of Manufacturing Technology, CSIRO

University of Melbourne

Review of Australian Standards. To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

Australian Standard[®]

**Manipulating industrial robots—
Performance criteria and related
test methods**

First published as AS 3984—1991.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 7110 1

PREFACE

This Standard was prepared by the Standards Australia Committee on Information Processing Systems for Industrial Automation. It is identical with and has been reproduced from ISO 9283:1990 *Manipulating industrial robots—Performance criteria and related test methods*.

Under arrangements made between Standards Australia and the international Standards bodies, ISO and IEC, as well as certain other Standards organizations, users of this Australian Standard are advised of the following:

- (a) Copyright is vested in Standards Australia
- (b) The number of this Standard is not reproduced on each page; its identity is shown only on the cover and title pages.

For the purposes of this Australian Standard, the ISO text should be modified as follows:

- (i) *Terminology* The words 'Australian Standard' should replace the words 'International Standard' wherever they appear.
- (ii) *References* The references to International Standards should be replaced by references to Australian Standards as follows:

<i>Reference to International Standard</i>	<i>Australian Standard</i>
ISO	AS
TR 8373 Manipulating industrial robots— Vocabulary	3877 Manipulating industrial robots— Vocabulary
9787 Manipulating industrial robots— Coordinate systems and motions	3986 Manipulating industrial robots— Coordinate systems and motions
9946 Manipulating industrial robots— Presentation of characteristics	3987 Manipulating industrial robots— Presentation of characteristics

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

CONTENTS

	<i>Page</i>
1 Scope	5
2 Normative references	5
3 Definitions	5
4 Units	6
5 Abbreviations and symbols	6
5.1 Basic abbreviations	6
5.2 Quantities	6
5.3 Indices	6
5.4 Other symbols	6
6 Performance testing conditions	7
6.1 Robot mounting	7
6.2 Conditions prior to testing	7
6.3 Environmental and operating conditions	7
6.4 Displacement measurement principles	7
6.5 Instrumentation	8
6.6 Load to the mechanical interface	8
6.7 Test velocities	8
6.8 Definitions of pose to be tested and paths to be followed	9
6.9 Number of cycles	14
6.10 Test procedure	14
7 Pose characteristics	14
7.1 General description	14
7.2 Pose accuracy and pose repeatability	16
7.3 Distance accuracy and repeatability (applicable only to robots with the facility for explicit programming)	21
7.4 Pose stabilization time	24
7.5 Pose overshoot	25
7.6 Drift of pose characteristics	26
8 Path characteristics	27

	<i>Page</i>
8.1 General	27
8.2 Path accuracy (AT)	27
8.3 Path repeatability (RT)	30
8.4 Cornering deviations	30
8.5 Path velocity characteristics	32
9 Minimum positioning time	33
10 Static compliance	34
11 Test report	34
Annex	
A Example of a test report	6
B Guide for selection of performance criteria for typical applications	40

Manipulating industrial robots—Performance criteria and related test methods

1 Scope

This International Standard describes methods of specifying and testing the following performance characteristics of manipulating industrial robots:

- unidirectional pose accuracy and pose repeatability;
- multi-directional pose accuracy variation;
- distance accuracy and distance repeatability;
- pose stabilization time;
- pose overshoot;
- drift of pose characteristics;
- path accuracy and path repeatability;
- cornering deviations;
- path velocity characteristics;
- minimum positioning time;
- static compliance.

This International Standard does not specify which of the above performance characteristics are to be chosen for testing a particular robot. The tests described in this International Standard are primarily intended for developing and verifying individual robot specifications, but can also be used for such purposes as prototype testing, type testing or acceptance testing.

This International Standard applies to all manipulating industrial robots as defined in ISO/TR 8373. However, for the purpose of this International Stan-

dard the term “robot” means manipulating industrial robot.

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/TR 8373:1988, *Manipulating industrial robots — Vocabulary*.

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

ISO 9946: *Manipulating industrial robots — Presentation of characteristics*.

3 Definitions

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

3.1 cluster: Set of attained poses, corresponding to the same command pose, used to calculate the accuracy and the repeatability characteristics (shown diagrammatically in figure 6).

3.2 barycentre: For a cluster of n points, defined by their coordinates $(x_j - y_j - z_j)$, the barycentre of that cluster of points is the point whose coordinates are the mean values \bar{x} , \bar{y} and \bar{z} calculated by formulae given in 7.2.1.