IEC 61514

Edition 2.0 2026-06

INTERNATIONAL STANDARD

Industrial-process control systems - Methods of evaluating the performance of valve positioners with pneumatic outputs

ICS 23.060.99; 25.040.40

ISBN 978-2-8327-1288-7

IEC 61514:2026-06(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2026 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 General conditions for tests 11
4.1 Environmental test conditions 11
4.1.1 General 11
4.1.2 Limits of ambient conditions for test measurements 11
4.2 Supply conditions 11
4.2.1 Reference values 11
4.2.2 Tolerances 11
5 General testing procedures 12
5.1 Test equipment 12
5.2 Test methods 12
5.3 Testing precautions 12
5.4 Basic test arrangement 13
5.4.1 General 13
5.4.2 Positioner tested independently of an actuator 13
5.4.3 Positioner tested in conjunction with an actuator 14
5.5 Initial setting-up 15
5.5.1 General 15
5.5.2 Positioner tested independently of an actuator 15
5.5.3 Positioner tested in conjunction with an actuator 15
6 Test procedures 15
6.1 Gain characteristic 15
6.1.1 General 15
6.1.2 Positioner tested independently of an actuator 16
6.1.3 Positioner tested in conjunction with an actuator 16
6.2 Travel characteristic 17
6.2.1 General 17
6.2.2 Positioner tested independently of an actuator 17
6.2.3 Positioner tested in conjunction with an actuator 17
6.3 Accuracy related terms 18
6.3.1 Inaccuracy 18
6.3.2 Measured error 18
6.3.3 Conformity error or linearity error (non-conformity/non-linearity) 18
6.3.4 Hysteresis 18
6.3.5 Repeatability error (non-repeatability) 18
6.4 Dead band 19
6.4.1 Dead band – Input path 19
6.4.2 Dead band – Travel path 20
6.5 Airflow data 21
6.5.1 Airflow characteristic 21
6.5.2 Steady-state air consumption 23
6.6 Effects of influence quantities 24
6.6.1 General 24

6.6.2 Supply pressure 25
6.6.3 Ambient temperature 25
6.6.4 Relative humidity 26
6.6.5 Mounting position 27
6.6.6 Mechanical shock 27
6.6.7 Vibration 28
6.6.8 Power-frequency magnetic field 29
6.6.9 Radiated electromagnetic field interference 30
6.6.10 Electrical fast transients (burst) 30
6.6.11 Surge voltage immunity 31
6.6.12 Series mode interference 32
6.7 Input over-range 32
6.7.1 General 32
6.7.2 Positioner tested independently of an actuator 33
6.7.3 Positioner tested in conjunction with an actuator 33
6.7.4 Common text for positioners tested independently of an actuator/with an actuator 33
6.8 Drift 33
6.8.1 General 33
6.8.2 Start-up drift 33
6.8.3 Long-term drift 34
6.9 Accelerated life test 34
6.9.1 Positioner tested independently of an actuator 34
6.9.2 Positioner tested in conjunction with an actuator 34
6.9.3 Common text for positioners tested in conjunction with/independently of an actuator 35
6.10 Dynamic response 35
6.10.1 General 35
6.10.2 General considerations 35
6.10.3 Basic test arrangement 35
6.10.4 Frequency response 36
6.10.5 Step response 37
7 Other considerations 39
7.1 General 39
7.2 Safety 40
7.3 Degree of protection provided by enclosures 40
7.4 Documentary information 40
7.5 Installation 41
7.6 Routine maintenance and adjustment 41
7.7 Repair 41
7.8 Protective finishes 41
7.9 Design features 41
7.10 Variants 41
7.11 Tools and equipment 41
8 Test report and documentation 42
Bibliography 44

Figure 1 – Single- and double-acting positioner/actuator 8

Figure 2 – Gain characteristic 10
Figure 3 – Basic test arrangement 14
Figure 4 – Typical error plot 20
Figure 5 – Test arrangement for measurement of airflow characteristic 22
Figure 6 – Typical air flow characteristic 23
Figure 7 – Series mode interference 32
Figure 8 – Simple dynamic response test arrangement 36
Figure 9 – Two examples of frequency response tests 37
Figure 10 – Two examples of responses to a step input 39

Table 1 – Environmental conditions 11
Table 2 – Typical table of errors 19
Table 3 – Vibration test levels 28
Table 4 – Document information 40
Table 5 – Test results to be reported 42

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Industrial-process control systems - Methods of evaluating the performance of valve positioners with pneumatic outputs

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61514 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control. It is an International Standard.

This second edition cancels and replaces the first edition published in 2000. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) in 6.6.8 and Table 5, the magnetic field has been changed from 100 A/m to of 30 A/m (Mean Root Square);
b) 6.10.4 and Figure 9 have been modified for better understandability;

c) in 7.4, the reference to IEC 61187 has been deleted and replaced with a new Table 4: Document information.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65B/1309/FDIS	65B/1321/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

1 Scope

This International Standard specifies tests designed to determine the static and dynamic performance of single-acting or double-acting analogue positioners. The tests apply to positioners which receive standard analogue input signals (as specified in IEC 60381-1, IEC 60381-2 and IEC 60382) and have a pneumatic output.

Positioners with pulsed or digital input signals, positioners with digital controllers and positioners with pulsed outputs are outside the scope of this document.

Testing is conducted either on a positioner alone, independently of an actuator, or on a positioner mounted and connected to a specific actuator, as a combined unit. The text makes clear where different approaches are required.

The methods of evaluation given in this document are intended for use by manufacturers to determine the performance of their products, and by users, or independent testing establishments, to verify manufacturers' performance specifications.

The closest liaison between the evaluating body and the manufacturer is indispensable during the tests, including the possibility for the manufacturer to influence the test programme based on the manufacturer's specifications for the instrument and comment on both the test programme and the results.

This document is intended to provide definitions of positioner elements, actions, and characteristics, to specify uniform methods of measuring performance errors and effects of influence quantities on those characteristics, and to describe methods of reporting and evaluating the results of the measurement data obtained.

The test conditions described in this publication (for example range of ambient temperatures and power supply) relate to conditions which commonly arise in use. Consequently, the values specified are used where no other values are specified by the manufacturer or user. If other values are used, they will be stated. It is recognized that the manufacturer's specifications and instructions for installation and operation apply during all steps.

The tests specified in this document are not necessarily sufficient for instruments specifically designed for unusually arduous conditions. Conversely, a reduced series of tests can serve adequately for instruments designed to perform within a more limited range of conditions.

When a full evaluation, in accordance with this document, is not required or possible, only the tests which are required are performed and the results reported in accordance with the relevant parts of this document. In such cases, the test report will state that it does not cover the full number of tests specified herein.

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.

IEC 60050-311, *International electrotechnical vocabulary - Electrical and electronic measurements - Part 311: General terms relating to electrical measurements*

IEC 60050-351, *International electrotechnical vocabulary - Part 351: Control technology*

IEC 60068-2-1, *Environmental testing - Part 2-1: Tests - Test A: Cold*

IEC 60068-2-2, *Environmental testing - Part 2-2: Tests - Test B: Dry heat*

IEC 60068-2-6, *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*

IEC 60068-2-31, *Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-78, *Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state*

IEC 60381-1, *Analogue signals for process control systems - Part 1: Direct current signals*

IEC 60381-2, *Analogue signals for process control systems - Part 2: Direct voltage signals*

IEC 60382, *Analogue pneumatic signal for process control systems*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60654 (all parts), *Industrial-process measurement and control equipment - Operating conditions*

IEC 60721-3 (all parts), *Classification of environmental conditions - Part 3 Classification of groups of environmental parameters and their severities*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*

IEC 61032, *Protection of persons and equipment by enclosures - Probes for verification*

IEC 61298-4, *Process measurement and control devices - General methods and procedures for evaluating performance - Part 4: Evaluation report content*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-311 and IEC 60050- 351 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
positioner
position controller connected to the moving part of a final control element or its actuator; automatically adjusts its output signal Y to the actuator in order to maintain a desired travel signal X that bears a predetermined relationship to the input signal W

Note 1 to entry: In this document, only positioners with pneumatic output signals Y are considered. The input signal W may be an air pressure (pneumatic positioner), or an electric current or voltage (electro-pneumatic positioner).