IEC 62703

Edition 1.0 2013-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Expression of performance of fluorometric oxygen analyzers in liquid media

Expression des performances des analyseurs d'oxygène fluorométriques en milieu liquide

IEC 62703:2013

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you 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It also gives information on projects, replaced and withdrawn publications.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 on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

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: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,…).
Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 62703

Edition 1.0 2013-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Expression of performance of fluorometric oxygen analyzers in liquid media

Expression des performances des analyseurs d'oxygène fluorométriques en milieu liquide

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX X

ICS 17.020; 71.04; 71.120

ISBN 978-2-83220-835-9

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPRESSION OF PERFORMANCE OF FLUOROMETRIC OXYGEN ANALYZERS IN LIQUID MEDIA

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62703 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this standard is based on the following documents:

FDIS	Report on voting
65B/867/FDIS	65B/871/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

EXPRESSION OF PERFORMANCE OF FLUOROMETRIC OXYGEN ANALYZERS IN LIQUID MEDIA

1 Scope

This International Standard is applicable to fluorometric oxygen analyzers used for the continuous determination of dissolved oxygen partial pressure or concentration. It applies to fluorometric oxygen analyzers suitable for use in water containing liquids, ultrapure waters, fresh or potable water, sea water or other aqueous solutions, industrial or municipal waste water from water bodies (e.g. lakes, rivers, estuaries) as well as for industrial process streams and process liquids. Whilst in principle fluorometric oxygen-analyzers are applicable in gaseous phases, the expression of performance in the gas-phase will not be subject of this standard.

The sensor unit of a fluorometric oxygen analyzer being in contact with the media to be measured contains a luminophore in a polymer-membrane permeable for oxygen or within other oxygen permeable materials (or substrates).

This standard specifies the terminology, definitions, requirements for statements by manufacturers and tests for fluorometric oxygen analyzers.

This standard is in accordance with the general principles set out in IEC 60359 and IEC 60770 series.

This standard is applicable to analyzers specified for permanent installation installation in any location (indoors or outdoors) utilizing an on-line measurement technique.

Safety requirements are dealt with in IEC 61010-1.

Standard range of analogue d.c. current signals used in process control systems are dealt with in IEC 60381-1.

Specifications for values for the testing of influence quantities can be found in IEC 60654 series.

Requirements for documentation to be supplied with instruments are dealt with in IEC 61187.

Requirements for general principles concerning quantities, units and symbols are dealt with in ISO 80000-1:2009.

The object of IEC 62703 is:

– to specify the general aspects in the terminology and definitions related to the performance of fluorometric oxygen analyzers used for the continuous determination of dissolved oxygen partial pressure or concentration in liquid media;
– to unify methods used in making and verifying statements on the functional performance of such analyzers;
– to specify which tests should be performed in order to determine the functional performance and how such tests should be carried out;
– to provide basic documents to support the application of standards of quality assurance within ISO 9001.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068 (all parts), *Environmental testing*

IEC 60359:2001, *Electrical and electronic measurement equipment – Expression of performance*

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

IEC 61187, *Electrical and electronic measuring equipment – Documentation*

3 Terms, definitions, quantities and units

For the purposes of this document, the following terms, definitions, quantities and units apply.

NOTE Terms and definitions are taken partially from IEC 60359:2001and IEC 61207-1:2010.

3.1 Basic terms and definitions

3.1.1
measurand
quantity subjected to measurement, evaluated in the state assumed by the measured system during the measurement itself

Note 1 to entry: The value assumed by a quantity subjected to measurement when it is not interacting with the measuring instrument may be called unperturbed value of the quantity.

Note 2 to entry: The unperturbed value and its associated uncertainty can only be computed through a model of the measured system and of the measurement interaction with the knowledge of the appropriate metrological characteristics of the instrument that may be called instrumental load.

3.1.2
result of a measurement
set of values attributed to a measurand, including a value, the corresponding uncertainty and the unit of measurement

Note 1 to entry: The mid-value of the interval is called the value (see 3.1.3) of the measurand and its half-width the uncertainty (see 3.1.4).

Note 2 to entry: The measurement is related to the indication (see 3.1.5) given by the instrument and to the values of correction obtained by calibration.

Note 3 to entry: The interval can be considered as representing the measurand provided that it is compatible with all other measurements of the same measurand.

Note 4 to entry: The width of the interval, and hence the uncertainty, can only be given with a stated level of confidence (see 3.1.4, NOTE 1).

[SOURCE: IEC 60050-300:2001, 311-01-01, modified – revision of the definition and the notes]

3.1.3
measure-value
mid element of the set assigned to represent the measurand

Note 1 to entry: The measure-value is no more representative of the measurand than any other element of the set. It is singled out merely for the convenience of expressing the set in the format V ± U, where V is the mid element and U the half-width of the set, rather than by its extremes. The qualifier "measure-" is used when deemed necessary to avoid confusion with the reading-value or the indicated value.

3.1.4
uncertainty
uncertainty of measurement
parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand

Note 1 to entry: The parameter can be, for example, a standard deviation (or a given multiple of it), or a half-width of an interval having a stated level of confidence.

Note 2 to entry: Uncertainty of measurement comprises, in general, many components. Some of these components can be evaluated from the statistical distribution of the results of a series of measurements and can be characterized by experimental standard deviations. The other components, which can also be characterized by standard deviations, are evaluated from the assumed probability distributions based on experience or other information.

Note 3 to entry: It is understood that the result of the measurement is the best estimate of the value of the measurand, and that all components of uncertainty, including those arising from systematic effects, such as components associated with corrections and reference standards, contribute to the dispersion.

Note 4 to entry: The definition and notes 1 and 2 are from JCGM 100:2008 Clause 2.2.3 The option used in this standard is to express the uncertainty as the half-width of an interval with the GUM procedures with a coverage factor of 2. This choice corresponds to the practice now adopted by many national standards laboratories. With the normal distribution a coverage factor of 2 corresponds to a level of confidence of 95 %. Otherwise statistical elaborations are necessary to establish the correspondence between the coverage factor and the level of confidence. As the data for such elaborations are not always available, it is deemed preferable to state the coverage factor. This interval can be "reasonably" assigned to describe the measurand, in the sense of the GUM definition, as in most usual cases it ensures compatibility with all other results of measurements of the same measurand assigned in the same way at a sufficiently high confidence level.

[SOURCE: IEC 60050-300:2001, 311-01-02, modified – deletion of the existing Note 1 and addition of two new notes]

3.1.5
indication
reading-value
output signal of the instrument

Note 1 to entry: The indicated value can be derived from the indication by means of the calibration curve.

Note 2 to entry: For a material measure, the indication is its nominal or stated value.

Note 3 to entry: The indication depends on the output format of the instrument:

– for analogue outputs it is a number tied to the appropriate unit of the display;

– for digital outputs it is the displayed digitized number;

– for code outputs it is the identification of the code pattern.

Note 4 to entry: For analogue outputs meant to be read by a human observer (as in the index-on-scale instruments) the unit of output is the unit of scale numbering; for analogue outputs meant to be read by another instrument (as in calibrated transducers) the unit of output is the unit of measurement of the quantity supporting the output signal.

[SOURCE: IEC 60050-300:2001, 311-01-01, modified – modification of the definition and addition of new notes]

3.1.6
calibration
set of operations which establishes the relationship which exists, under specified conditions, between the indication and the result of a measurement

Note 1 to entry: Calibrations are performed under well-defined operating conditions for the instrument. The calibration diagram representing its result is not valid if the instrument is operated under conditions outside the range used for the calibration.

Note 2 to entry: The relationship between the indications and the results of measurement can be expressed, in principle, by a calibration diagram.

[SOURCE: IEC 60050-300:2001, 311-01-09, modified – modification of Note 1]

3.1.7
calibration diagram
portion of the co-ordinate plane, defined by the axis of indication and the axis of results of measurement, which represents the response of the instrument to differing values of the measurand

[SOURCE: IEC 60050-300:2001, 311-01-10, modified – deletion of the note]

3.1.8
calibration curve
curve which gives the relationship between the indication and the value of the measurand

Note 1 to entry: When the calibration curve is a straight line passing through zero, it is convenient to refer to the slope which is known as the instrument constant.

Note 2 to entry: The calibration curve is the curve bisecting the width of the calibration diagram parallel to the axis of results of measurement, thus joining the points representing the values of the measurand.

[SOURCE: IEC 60050-300:2001, 311-01-11, modified – deletion of Note 1]

3.1.9
indicated value
value given by an indicating instrument on the basis of its calibration curve

Note 1 to entry: The indicated value is the measure-value of the measurand when the instrument is used in a direct measurement under all the operating conditions for which the calibration diagram is valid.

[SOURCE: IEC 60050-300:2001, 311-01-08, modified – update of the definition and the note]

3.1.10
conventional value measure
value of a standard used in a calibration operation and known with uncertainty negligible with respect to the uncertainty of the instrument to be calibrated

Note 1 to entry: This definition is adapted to the object of this standard from the definition of "conventional true value (of a quantity)": value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose (see IEC 60050-300:2001 311-01-06).

3.1.11
influence quantity
quantity which is not the subject of the measurement and whose change affects the relationship between the indication and the result of the measurement

Note 1 to entry: Influence quantities can originate from the measured system, the measuring equipment or the environment.

Note 2 to entry: As the calibration diagram depends on the influence quantities, in order to assign the result of a measurement it is necessary to know whether the relevant influence quantities lie within the specified range.

Note 3 to entry: An influence quantity is said to lie within a range C' to C" when the results of its measurement satisfy the relationship: $C' \leq V - U < V + U \leq C''$. (see 3.1.3)

[SOURCE: IEC 60050-300:2001, 311-06-01, modified – deletion of Note 1 and addition of a new Note 3]

3.1.12
steady-state conditions
operating conditions of a measuring device in which the variation of the measurand with the time is such that the relation between the input and output signals of the instruments does not suffer a significant change with respect to the relation obtaining when the measurand is constant in time

3.1.13
traceability
property of the result of a measurement or of the value of a standard such that it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties

Note 1 to entry: The concept is often expressed by the adjective traceable.

Note 2 to entry: The unbroken chain of comparisons is called a traceability chain.

Note 3 to entry: The traceability implies that a metrological organization be established with a hierarchy of standards (instruments and material measures) of increasing intrinsic uncertainty. The chain of comparisons from the primary standard to the calibrated device adds indeed new uncertainty at each step.

Note 4 to entry: Traceability is ensured only within a given uncertainty that should be specified.

[SOURCE: IEC 60050-300:2001, 311-01-15, modified – deletion of Note 3 and addition of new Notes 3 and 4]

3.1.14
mean
summation of the individual values divided by the total number of values for a set of values

3.2 General terms and definitions of devices and operations

3.2.1
electrical measuring instrument
measuring instrument intended to measure an electrical or non-electrical quantity using electrical or electronic means

[SOURCE: IEC 60050-300:2001, 311-03-04]

3.2.2
transducer
technical device which performs a given elaboration on an input signal, transforming it into an output signal

Note 1 to entry: Measuring instruments contain transducers and they may consist of one transducer. When the signals are elaborated by a chain of transducers, the input and output signals of each transducer are not always directly and univocally accessible.

3.2.3
intrinsic uncertainty
intrinsic instrumental uncertainty
uncertainty of a measuring instrument when used under reference conditions

[SOURCE: IEC 60050-300:2001, 311-03-09, modified – update of the term]

3.2.4
operating instrumental uncertainty
instrumental uncertainty under the rated operating conditions

Note 1 to entry: The operating instrumental uncertainty, like the intrinsic one, is not evaluated by the user of the instrument, but is stated by its manufacturer or calibrator. The statement may be expressed by means of an algebraic relation involving the intrinsic instrumental uncertainty and the values of one or several influence

quantities, but such a relation is just a convenient means of expressing a set of operating instrumental uncertainties under different operating conditions, not a functional relation to be used for evaluating the propagation of uncertainty inside the instrument.

3.2.5
verification of calibration
set of operations which is used to check whether the indications, under specified conditions, correspond with a given set of known measurands within the limits of a predetermined calibration diagram

Note 1 to entry: The known uncertainty of the measurand used for verification will generally be negligible with respect to the uncertainty assigned to the instrument in the calibration diagram.

Note 2 to entry: The verification of calibration of a material measure consists in checking whether the result of a measurement of the supplied quantity is compatible with the interval given by the calibration diagram.

[SOURCE: IEC 60050-300:2001, 311-01-13, modified – deletion of Note 1 and addition of the new Notes 2]

3.2.6
adjustment of a measuring instrument
set of operations carried out on a measuring instrument in order that it provides given indications corresponding to given values of the measurand

Note 1 to entry: When the instrument is made to give a null indication corresponding to a null value of the measurand, the set of operations is called zero adjustment.

[SOURCE: IEC 60050-300:2001, 311-03-16]

3.2.7
user adjustment of a measuring instrument
adjustment, employing only the means at the disposal of the user, specified by the manufacturer

[SOURCE: IEC 60050-300:2001, 311-03-17]

3.3 Terms and definitions for manners of expression

3.3.1
range
domain of values of a quantity included between a lower and an upper limit

Note 1 to entry: The term "range" is usually used with a modifier. It may apply to a performance characteristic, to an influence quantity, etc.

Note 2 to entry: When one of the limits of a range is zero or infinity, the other finite limit is called a threshold.

Note 3 to entry: No uncertainty is associated with the values of range limits or thresholds as they are not themselves results of measurements but a priori statements about conditions to be met by results of measurements. If the result of a measurement have to lie within a rated range, it is understood that the whole interval $V \pm U$ representing it shall lie within the values of the range limits or beyond the threshold value, unless otherwise specified by relevant standards or by explicit agreements.

Note 4 to entry: A range may be expressed by stating the values of its lower and upper limits, or by stating its mid value and its half-width.

3.3.2
variation due to an influence quantity
difference between the indicated values for the same value of the measurand of an indicating instrument, or the values of a material measure, when an influence quantity assumes, successively, two different values

Note 1 to entry: The uncertainty associated with the different measure values of the influence quantity for which the variation is evaluated should not be wider than the width of the reference range for the same influence quantity.

The other performance characteristics and the other influence quantities should stay within the ranges specified for the reference conditions.

Note 2 to entry: The variation is a meaningful parameter when it is greater than the intrinsic instrumental uncertainty.

[SOURCE: IEC 60050-300:2001, 311-07-03, modified – addition of two new notes]

3.3.3
limit of uncertainty
limiting value of the instrumental uncertainty for equipment operating under specified conditions

Note 1 to entry: A limit of uncertainty may be assigned by the manufacturer of the instrument, who states that under the specified conditions the instrumental uncertainty is never higher than this limit, or may be defined by standards, that prescribe that under specified conditions the instrumental uncertainty should not be larger than this limit for the instrument to belong to a given accuracy class.

Note 2 to entry: A limit of uncertainty may be expressed in absolute terms or in the relative or fiducial forms.

3.3.4
specified measuring range
range defined by two values of the measurand, or quantity to be supplied, within which the limits of uncertainty of the measuring instrument are specified

Note 1 to entry: An instrument can have several measuring ranges.

Note 2 to entry: The upper and lower limits of the specified measuring range are sometimes called the maximum capacity and minimum capacity respectively.

[SOURCE: IEC 60050-300:2001, 311-03-12, modified – addition of a new Note 2]

3.3.5
reference conditions
appropriate set of specified values and/or ranges of values of influence quantities under which the smallest permissible uncertainties of a measuring instrument are specified

Note 1 to entry: The ranges specified for the reference conditions, called reference ranges, are not wider, and are usually narrower, than the ranges specified for the rated operating conditions.

[SOURCE: IEC 60050-300:2001, 311-06-02, modified – update of the definition and addition of a new note]

3.3.6
reference value
specified value of one of a set of reference conditions

[SOURCE: IEC 60050-300:2001, 311-07-01, modified – update of the definition]

3.3.7
reference range
specified range of values of one of a set of reference conditions

[SOURCE: IEC 60050-300:2001, 311-07-02, modified – update of the definition]

3.3.8
rated operating conditions
set of conditions that shall be fulfilled during the measurement in order that a calibration diagram may be valid

Note 1 to entry: Beside the specified measuring range and rated operating ranges for the influence quantities, the conditions may include specified ranges for other performance characteristics and other indications that cannot be expressed as ranges of quantities.

3.3.9
nominal range of use
rated operating range for influence quantities
specified range of values which an influence quantity can assume without causing a variation exceeding specified limits

Note 1 to entry: The rated operating range of each influence quantity is a part of the rated operating conditions.

[SOURCE: IEC 60050-300:2001, 311-07-05, modified – addition of a new Note 1]

3.3.10
limiting conditions
extreme conditions which an operating measuring instrument can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions

3.3.11
limiting values for operation
extreme values which an influence quantity can assume during operation without damaging the measuring instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

Note 1 to entry: The limiting values can depend on the duration of their application.

[SOURCE: IEC 60050-300:2001, 311-07-06]

3.3.12
storage and transport conditions
extreme conditions which a non-operating measuring instrument can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions

3.3.13
limiting values for storage
extreme values which an influence quantity can assume during storage without damaging the measuring instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

Note 1 to entry: The limiting values can depend on the duration of their application.

[SOURCE: IEC 60050-300:2001, 311-07-07]

3.3.14
limiting values for transport
extreme values which an influence quantity can assume during transport without damaging the instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

Note 1 to entry: The limiting values can depend on the duration of their application.

[SOURCE: IEC 60050-300:2001, 311-07-08]

3.4 Specific terms and definitions for fluorometry

3.4.1
luminescence
spontaneous emission of radiation from an electronically excited molecular entity (or atom or group of atoms) emitted with a particular intensity (luminescence-intensity)