IEC 62899-505

Edition 1.0 2020-06

INTERNATIONAL STANDARD

This document is a preview generated by EVS

Printed electronics –
Part 505: Quality assessment – Flexible gas sensor – Mechanical and thermal testing



IEC 62899-505:2020-06(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2020 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 Central Office
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 It also gives information on projects, replaced and withdrawn publications.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.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

This document is a preview generated by EVS

IEC 62899-505

Edition 1.0 2020-06

INTERNATIONAL STANDARD

This document is a preview generated by EVS

Printed electronics –
Part 505: Quality assessment – Flexible gas sensor – Mechanical and thermal testing

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.220.01

ISBN 978-2-8322-8490-2

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

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms and definitions 6
4 Measurement of gas sensing performance 7
4.1 General 7
4.2 Standard environmental conditions 7
4.2.1 Test gas 7
4.2.2 Temperature 7
4.2.3 Humidity 7
4.2.4 Pressure 7
4.2.5 Volume fraction of test gas 7
4.3 Measurement procedure 8
5 Mechanical test methods 8
5.1 General 8
5.2 Bending test 9
5.2.1 General 9
5.2.2 Test method 9
5.2.3 Report of the results 9
5.3 Torsion test 9
5.3.1 General 9
5.3.2 Test method 9
5.3.3 Report of the results 9
5.4 Stretching test 10
5.4.1 General 10
5.4.2 Test method 10
5.4.3 Report of the results 10
6 Thermal test methods 10
6.1 General 10
6.2 Test method 10
6.2.1 Tolerances 10
6.2.2 Conditioning 11
6.2.3 Test cycle 11
6.2.4 Performance measurement 11
6.3 Severities 12
6.4 Report of the results 12
Bibliography 13

Figure 1 – Example of gas sensing apparatus 8
Figure 2 – Temperature cycle 11

Table 1 – Upper temperature 12
Table 2 – Lower temperature 12

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

PRINTED ELECTRONICS –

Part 505: Quality assessment – Flexible gas sensor – Mechanical and thermal testing

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 62899-505 has been prepared by IEC technical committee 119: Printed Electronics.

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

FDIS	Report on voting
119/305/FDIS	119/309/RVD

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

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

This document is a preview generated by EVS

A list of all parts in the IEC 62899 series, published under the general title *Printed electronics*, can be found on the IEC website.

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

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

This document is a preview generated by EVS

INTRODUCTION

There is an increasing worldwide demand for flexible and/or wearable gas sensors for fire fighter's garment, industrial workwear, wearable patch, etc. In recent years, many efforts have been spent to develop and commercialize flexible and/or wearable gas sensors composed of a flexible substrate, electrode, and gas sensing layer. These printed flexible gas sensors should provide information about the level of gases in the surrounding environment regardless of mechanical deformations, which might happen for a flexible movement. Further, the surrounding temperature and humidity have a crucial effect on the performance of the gas sensor, since the sensing parts face directly outwards to detect gaseous molecules. However, these mechanical and thermal durabilities have been treated only to a minor extent. This document helps to unify the testing and qualification of printed flexible gas sensors manufactured using the printing process in order to push the commercial production of reliable printed flexible gas sensors containing wearable products.

This document is a preview generated by EVS

PRINTED ELECTRONICS –

Part 505: Quality assessment – Flexible gas sensor – Mechanical and thermal testing

This document is a preview generated by EVS

1 Scope

This part of IEC 62899 specifies mechanical and thermal test methods for the determination of the reliability characteristics of a printed flexible gas sensor, which is operated at relatively low temperature and is composed of a flexible substrate, electrode, and gas sensing layer. The examples of target gas include in-door air pollutants, combustion gas from a fire situation, and industrial flue gas.

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 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60721-3-7, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 7: Portable and non-stationary use*

IEC 62899-201, *Printed electronics – Part 201: Materials – Substrates*

IEC 62899-501-1, *Printed electronics – Quality assessment – Part 501-1: Failure modes and mechanical testing – Flexible and/or bendable primary or secondary cells*

IEC 62899-502-1, *Printed electronics – Part 502-1: Quality assessment – Organic light emitting diode (OLED) elements – Mechanical stress testing of OLED elements formed on flexible substrates*

ISO 11999-3, *PPE for firefighters – Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures – Part 3: Clothing*

3 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp