IEC 62899-301-1

Edition 1.0 2017-05

INTERNATIONAL STANDARD

colour inside

Printed electronics – Part 301-1: Equipment – Contact printing – Rigid master – Measurement method of plate master external dimension

IEC 62899-301-1:2017-05(en)

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.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
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 It also gives information on projects, replaced and withdrawn publications.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 also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions 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
65 000 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.

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: csc@iec.ch.

IEC 62899-301-1

Edition 1.0 2017-05

INTERNATIONAL STANDARD

colour inside

Printed electronics – Part 301-1: Equipment – Contact printing – Rigid master – Measurement method of plate master external dimension

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 19.080; 37.100.10

ISBN 978-2-8322-4302-2

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 Measurement methods for geometrical size of plate master 11
4.1 General 11
4.2 Procedure A 11
4.2.1 Measuring instrument 11
4.2.2 Measurement of edge length 11
4.2.3 Edge squareness [1][2] 12
4.2.4 Measurement of edge straightness 13
4.2.5 Thickness 14
4.3 Procedure B 15
4.3.1 Measuring instrument 15
4.3.2 Procedure 15
4.3.3 Report 16
5 Measurement method for flatness of plate master substrate [4] 16
5.1 Measuring instrument 16
5.1.1 Method 16
5.1.2 Mechanical stylus measuring instrument 16
5.1.3 Optical stylus measuring instrument 16
5.1.4 Calibration 16
5.1.5 Environment control 17
5.1.6 Measurement conditions 17
5.1.7 Measurement location 17
5.2 Procedure 17
5.3 Report 18
6 Measurement method for surface roughness of plate master substrate [5] 19
6.1 Measuring instrument 19
6.1.1 Method 19
6.1.2 Mechanical stylus measuring instrument 19
6.1.3 Optical stylus measuring instrument 19
6.1.4 Calibration 19
6.1.5 Environment control 19
6.1.6 Measurement conditions 19
6.1.7 Measurement location 19
6.2 Procedure 20
6.3 Report 20
Bibliography 21

Figure 1 – Illustration of the terms defined for measuring the geometrical size of a plate master 8
Figure 2 – Graphical illustration of flatness [1] 9
Figure 3 – Measurement procedure of edge length 12
Figure 4 – Measurement procedure of edge squareness 13

Figure 5 – Measurement procedure of edge straightness 14
Figure 6 – Measurement locations for geometrical size of plate using CMM 16

Table 1 – Example of profile measurement results 18
Table 2 – Example of flatness measurement results 18
Table 3 – Example of surface roughness measurement results 20

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

PRINTED ELECTRONICS –

Part 301-1: Equipment – Contact printing – Rigid master – Measurement method of plate master external dimension

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 62903-1 has been prepared by IEC technical committee:119: Printed electronics.

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

FDIS	Report on voting
119/152/FDIS	119/162/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.

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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

When dissecting the term “printed electronics”, it can be easily understood that this industry involves electronic devices and products that are made using some kind of printing technique. Printing methods have been widely used in textile and paper type substrates for centuries. In the past, the advent of mass producible printouts has brought huge impacts on how knowledge is stored, transferred and reproduced. At this current stage of technological development, printing on either rigid or flexible substrates is considered to supplement or replace traditional electronic device manufacturing processes. The difference between media printing and printed electronics stems from the fact that media print is used to convey information for humans to process using their eyes while printed electronics requires machines to process electronic information; the level of required resolution and functionality makes the difference. Some of the widely used functional materials for printed electronics are though not limited to: nano- or micro-size metal particles, semiconductive polymers, and dielectric materials. Due to the available and required readout resolution, small feature sizes below 20 μm need to be printed. Layer thickness and registration accuracy of printed products are closely related to the quality control of electronic devices and ink materials require a high level of quality. Overall, printing tolerance is much smaller in printed electronics.

There are two main categories in the printing process for the printed electronics. One is a non-contact printing process, such as inkjet printing and electrostatic discharge (ESD) printing process. The other is a contact printing process such as gravure printing, gravure offset printing, reverse offset printing and screen printing. This document provides a proposal for measuring and assessing the printing master, therefore the scope is limited to the printing process using the printing master.

The quality of the printing master is important because the ink is transferred from the printing master to the substrate directly in these processes, which means that the quality of the results of the printed circuit depends on the quality of the printing master. For a mass production of the printed electronic devices, many companies such as device manufacturers, printing master manufacturers and printing master manufacturing equipment vendors are related to manufacturing and they would be using the printing master and the standardized measurement and assessment methods.

PRINTED ELECTRONICS –

Part 301-1: Equipment – Contact printing – Rigid master – Measurement method of plate master external dimension

1 Scope

This part of IEC 62899 defines measurement terms and methods related to the external dimension of a rigid plate master.

Measurement terms include geometrical size such as edge length, edge squareness, edge straightness and thickness, flatness of plate master substrates, and surface roughness of plate master.

2 Normative references

There are no normative references in this document.

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

3.1
plate master
device that carries the image to be printed

Note 1 to entry: The image on the plate may be raised above the surface (relief) or may be carved into the surface.

3.2
geometrical definition of plate master
definition which is needed in order to determine the shape and size of the plate

3.3
orientation corner
asymmetric corner specified for the purpose of mechanical orientation and the operator's visual confirmation of plate orientation

Note 1 to entry: This term is introduced graphically in Figure 1.

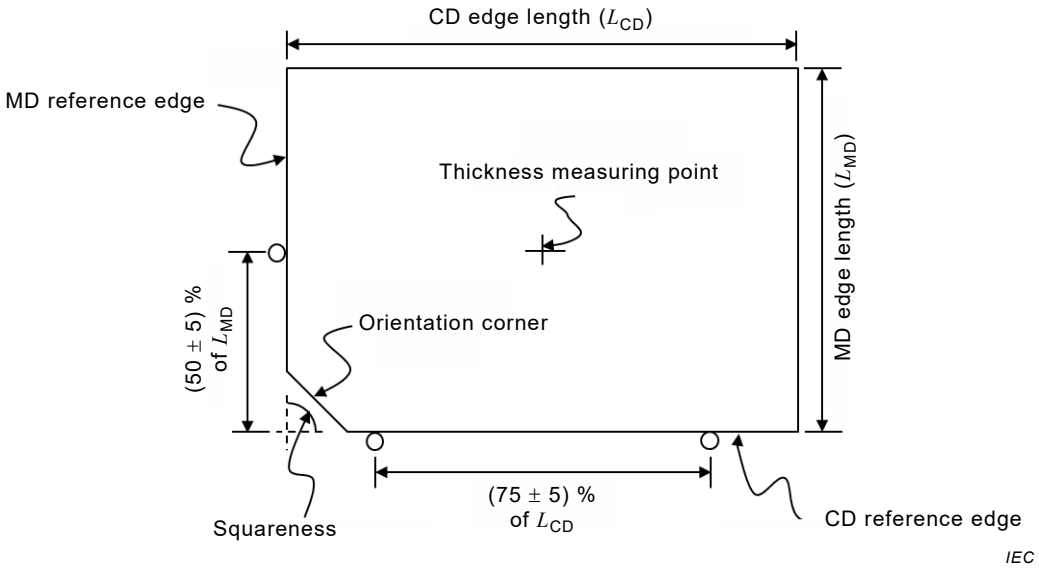

Figure 1 – Illustration of the terms defined for measuring the geometrical size of a plate master

3.4
machine direction
MD
direction in which the stock flows

Note 1 to entry: It can also mean circumferential direction of a roll of substrate.

3.5
CD
cross direction
direction at right angles to the machine direction of a substrate

3.6
reference edges
two edges adjacent to the orientation corner which are used for referencing the position of the plate master

Note 1 to entry: This term is introduced graphically in Figure 1.

3.7
MD reference edge
reference edge parallel with the MD

Note 1 to entry: This term is introduced graphically in Figure 1.

3.8
CD reference edge
reference edge parallel with the CD

Note 1 to entry: This term is introduced graphically in Figure 1.

3.9
edge length
length and width of edges in a rectangular plate master

Note 1 to entry: This term is introduced graphically in Figure 1.

Note 2 to entry: $L_{MD}$and L_{CD} are the edge length of the MD reference edge and CD reference edge, respectively.

3.10
edge squareness
angular variation of MD reference edge relative to straight lines drawn between the ends of, and perpendicular to, the CD reference edge of the plate master

Note 1 to entry: This term is introduced graphically in Figure 1.

3.11
edge straightness
S_t
deviation of an edge relative to a straight line

3.12
reference plane
user-defined flat plane approximating the front surface of a plate master and containing a coordinate system

Note 1 to entry: The same definition is applied for the measurement of flatness and surface roughness.

3.13
thickness of the plate master
relative distance of the plate master from the bottom surface to the front surface at the center position in the normal direction of the reference plane

Note 1 to entry: This term is introduced graphically in Figure 1.

3.14
flatness of plate master substrate
thickness variation of the entire plate master front surface relative to a reference plane when the substrate back surface is constrained against an ideally flat surface

Note 1 to entry: This term is introduced graphically in Figure 2.

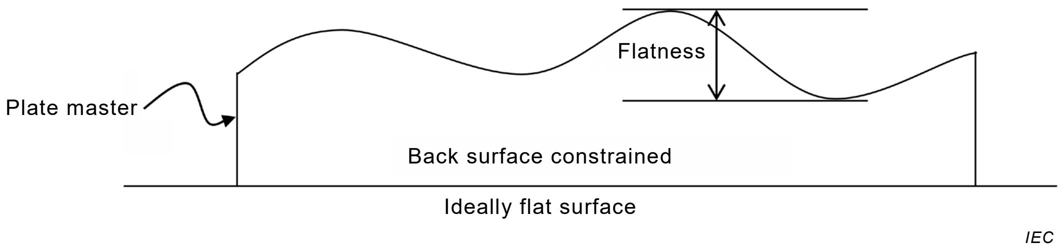

Figure 2 – Graphical illustration of flatness [1][1]

3.14.1
flatness cut-off wavelength
wavelength at which the attenuation ratio of its amplitude becomes a standard value when the traced profile is passed through the filter which eliminates the roughness element

3.14.2
profile
positive and negative vertical deviations measured from the reference plane

1 Numbers in square brackets refer to the Bibliography.