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colour inside

Printed electronics –
Part 201: Materials – Substrates

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Printed electronics –
Part 201: Materials – Substrates



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PRINTED ELECTRONICS –

Part 201: Materials – Substrates

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International Standard IEC 62899-201 has been prepared by IEC technical committee 119: Printed electronics.

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INTRODUCTION

The IEC 62899-20x series relates mainly to evaluation methods for materials of printed electronics. The series also includes storage methods, packaging and marking, and transportation conditions.

The IEC 62899-20x series is divided into parts for each material. Each part is prepared as a generic specification containing fundamental information for the area of printed electronics.

The IEC 62899-20x series consists of the following parts:

Part 201: Materials – Substrates

Part 202: Materials – Conductive ink

Part 203: Materials – Semiconductor ink[1]

(Subsequent parts will be prepared for other materials.)

Furthermore, sectional specifications, blank detail specifications, and detail specifications for each material will follow these parts.

This part of IEC 62899 is prepared for substrate used in printed electronics and contains the test conditions, the evaluation methods and the storage conditions.

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1 Under consideration.

PRINTED ELECTRONICS –

Part 201: Materials – Substrates

1 Scope

This part of IEC 62899 defines the terms and specifies the evaluation method for substrates used in the printing process to form electronic components/devices. This international standard is also applied to the substrates which make surface treatment in order to improve their performance.

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 60050 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60216-1:2013, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60216-3, *Electrical insulating materials – Thermal endurance properties – Part 3: Instructions for calculating thermal endurance characteristics*

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1:* Ageing *ovens – Single-chamber ovens*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60216-6, *Electrical insulating materials – Thermal endurance properties – Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method*

IEC 60243-1:2013, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60674-2:1988, *Specification for plastic films for electrical purposes – Part 2: Methods of* test
IEC 60674-2:1988/AMD1:2001

IEC 60674-3-1:1998, *Plastic films for electrical purposes – Part 3: Specifications for individual materials – Sheet 1: Biaxially oriented polypropylene (PP) films for capacitors*
IEC 60674-3-1/AMD1:2011

IEC 60695-11-10, *Fire hazard testing – Part11-10: Test flames – 50W horizontal and vertical flame test methods*

IEC 60721-3-1, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 61189-2:2006, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61189-3:2007, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 3: Test methods for interconnection structures (printed boards)*

IEC 62321-3-1, *Determination of certain substances in electrotechnical products – Part 3-1: Screening – Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry*

IEC 62899-202-5, *Printed electronics – Part 202-5: Materials – Conductive ink – Mechanical bending test of a printed conductive layer on an insulating substrate*

ISO 5-2, *Photography and graphic technology – Density measurements – Part 2: Geometric conditions for transmittance density*

ISO 5-3, *Photography and graphic technology – Density measurements – Part 3: Spectral conditions*

ISO 62, *Plastics – Determination of water absorption*

ISO 175:2010*, Plastics – Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 187, *Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 216, *Writing paper and certain classes of printed matter – Trimmed sizes – A and B series, and indication of machine direction*

ISO 217, *Paper – Untrimmed sizes – Designation and tolerances for primary and supplementary ranges, and indication of machine direction*

ISO 291, *Plastics – Standard atmospheres for conditioning and testing*

ISO 472, *Plastics – Vocabulary*

ISO 489:1999, *Plastics – Determination of refractive index*

ISO 527-1:2012, *Plastics – Determination of tensile properties – Part 1: General principles*

ISO 527-2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-4, *Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 527-5, *Plastics – Determination of tensile properties – Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

ISO 534, *Paper and board – Determination of thickness, density and specific volume*

ISO 535, *Paper and board – Determination of water absorptiveness – Cobb method*

ISO 536, *Paper and board – Determination of grammage*

ISO 868, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1924-2, *Paper and board – Determination of tensile properties – Part 2: Constant rate of elongation method (20 mm/min)*

ISO 1924-3, *Paper and board – Determination of tensile properties – Part 3: Constant rate of elongation method (100 mm/min)*

ISO 1974, *Paper – Determination of tearing resistance – Elmendorf method*

ISO 2039-1, *Plastics – Determination of hardness – Part 1: Ball indentation method*

ISO 2039-2, *Plastics – Determination of hardness – Part 2: Rockwell hardness*

ISO 2471, *Paper and board – Determination of opacity (paper backing) – Diffuse reflectance method*

ISO 2493-1, *Paper and board – Determination of bending resistance – Part 1: Constant rate of deflection*

ISO 2493-2, *Paper and board – Determination of bending resistance – Part 2: Taber-type tester*

ISO 2578:1993, *Plastics – Determination of time-temperature limits after prolonged exposure to heat*

ISO 2758, *Paper – Determination of bursting strength*

ISO 2759, *Board – Determination of bursting strength*

ISO 3274, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments*

ISO 3664, *Graphic technology and photography – Viewing conditions*

ISO 3696, *Water for analytical laboratory use – Specification and test methods*

ISO 3781, *Paper and board – Determination of tensile strength after immersion in water*

ISO 3783, *Paper and board – Determination of resistance to picking – Accelerated speed method using the IGT-type tester (electric model)*

ISO 4287, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 4288:1996, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Rules and procedures for the assessment of surface texture*

ISO 5626, *Paper – Determination of folding endurance*

ISO 5635, *Paper – Measurement of dimensional change after immersion in water*

ISO 6383-1, *Plastics – Film and sheeting – Determination of tear resistance – Part 1: Trouser tear method*

ISO 6383-2, *Plastics – Film and sheeting – Determination of tear resistance – Part 2: Elmendorf method*

ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

ISO 6588-1, *Paper, board and pulps – Determination of pH of aqueous extracts – Part 1: Cold extraction*

ISO 6588-2, *Paper, board and pulps – Determination of pH of aqueous extracts – Part 2: Hot extraction*

ISO 7991, *Glass – Determination of coefficient of mean linear thermal expansion*

ISO 8791-2, *Paper and board – Determination of roughness/smoothness (air leak methods) – Part 2: Bendtsen method*

ISO 8791-4, *Paper and board – Determination of roughness/smoothness (air leak methods) – Part 4: Print-surf method*

ISO 9220:1988, *Metallic coatings – Measurement of coating thickness – Scanning electron micro-scope method*

ISO 9773:1998, *Plastics – Determination of burning behaviour of thin flexible vertical specimens in contact with a small-flame ignition source*
ISO 9773:1998/AMD1:2003

ISO 11359-2:1999, *Plastics – Thermomechanical analysis (TMA) – Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ISO 11556, *Paper and board – Determination of curl using a single vertically suspended test piece*

ISO 11664-4, *Colorimetry – Part 4: CIE 1976 $L^*a^*b^*$ Colour space*

ISO 11798, *Information and documentation – Permanence and durability of writing, printing and copying on paper – Requirements and test methods*

ISO 12192, *Paper and board – Determination of compressive strength – Ring crush method*

ISO 13468-1:1996, *Plastics – Determination of the total luminous transmittance of transparent materials – Part 1: Single beam instrument*

ISO 13468-2:1999*, Plastics – Determination of the total luminous transmittance of transparent materials – Part 2: Double-beam instrument*

ISO 13565-2:1996, *Geometrical Product Specification (GPS) – Surface texture: Profile method; Surfaces having stratified functional properties – Part 2: Height characterization using the linear material ratio curve*

ISO 13655, *Graphic technology – Spectral measurement and colorimetric computation for graphic arts images*

ISO 14782, *Plastics – Determination of haze for transparent materials*

ISO 15105-1, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 1: Differential-pressure methods*

ISO 15105-2:2003, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 2: Equal-pressure method*

ISO 15106-1*, Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 1: Humidity detection sensor method*

ISO 15106-2*, Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 2: Infrared detection sensor method*

ISO 15106-3, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 3: Electrolytic detection sensor method*

ISO 15106-4, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 4: Gas-chromatographic detection sensor method*

ISO 15184, *Paints and varnishes – Determination of film hardness by pencil test*

ISO 15512, *Plastics – Determination of water content*

ISO 15359, *Paper and board – Determination of the static and kinetic coefficients of friction – Horizontal plane method*

ISO 15754, *Paper and board – Determination of z-directional tensile strength*

ISO 15989, *Plastics – Film and sheeting – Measurement of water-contact angle of corona-treated films*

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

INTRODUCTION

The IEC 62899-20x series relates mainly to evaluation methods for materials of printed electronics. The series also includes storage methods, packaging and marking, and transportation conditions.

The IEC 62899-20x series is divided into parts for each material. Each part is prepared as a generic specification containing fundamental information for the area of printed electronics.

The IEC 62899-20x series consists of the following parts:

Part 201: Materials – Substrates

Part 202: Materials – Conductive ink

Part 203: Materials – Semiconductor ink[1]

(Subsequent parts will be prepared for other materials.)

Furthermore, sectional specifications, blank detail specifications, and detail specifications for each material will follow these parts.

This part of IEC 62899 is prepared for substrate used in printed electronics and contains the test conditions, the evaluation methods and the storage conditions.

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1 Under consideration.

PRINTED ELECTRONICS –

Part 201: Materials – Substrates

1 Scope

This part of IEC 62899 defines the terms and specifies the evaluation method for substrates used in the printing process to form electronic components/devices. This international standard is also applied to the substrates which make surface treatment in order to improve their performance.

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 60050 (all parts), *International Electrotechnical Vocabulary* (available at www.electropedia.org)

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60216-1:2013, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60216-3, *Electrical insulating materials – Thermal endurance properties – Part 3: Instructions for calculating thermal endurance characteristics*

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1:* Ageing *ovens – Single-chamber ovens*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60216-6, *Electrical insulating materials – Thermal endurance properties – Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method*

IEC 60243-1:2013, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60674-2:1988, *Specification for plastic films for electrical purposes – Part 2: Methods of* test
IEC 60674-2:1988/AMD1:2001

IEC 60674-3-1:1998, *Plastic films for electrical purposes – Part 3: Specifications for individual materials – Sheet 1: Biaxially oriented polypropylene (PP) films for capacitors*
IEC 60674-3-1/AMD1:2011

IEC 60695-11-10, *Fire hazard testing – Part11-10: Test flames – 50W horizontal and vertical flame test methods*

IEC 60721-3-1, *Classification of environmental conditions – Part 3 Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 61189-2:2006, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61189-3:2007, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 3: Test methods for interconnection structures (printed boards)*

IEC 62321-3-1, *Determination of certain substances in electrotechnical products – Part 3-1: Screening – Lead, mercury, cadmium, total chromium and total bromine using X-ray fluorescence spectrometry*

IEC 62899-202-5, *Printed electronics – Part 202-5: Materials – Conductive ink – Mechanical bending test of a printed conductive layer on an insulating substrate*

ISO 5-2, *Photography and graphic technology – Density measurements – Part 2: Geometric conditions for transmittance density*

ISO 5-3, *Photography and graphic technology – Density measurements – Part 3: Spectral conditions*

ISO 62, *Plastics – Determination of water absorption*

ISO 175:2010*, Plastics – Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 187, *Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 216, *Writing paper and certain classes of printed matter – Trimmed sizes – A and B series, and indication of machine direction*

ISO 217, *Paper – Untrimmed sizes – Designation and tolerances for primary and supplementary ranges, and indication of machine direction*

ISO 291, *Plastics – Standard atmospheres for conditioning and testing*

ISO 472, *Plastics – Vocabulary*

ISO 489:1999, *Plastics – Determination of refractive index*

ISO 527-1:2012, *Plastics – Determination of tensile properties – Part 1: General principles*

ISO 527-2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-4, *Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 527-5, *Plastics – Determination of tensile properties – Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

ISO 534, *Paper and board – Determination of thickness, density and specific volume*

ISO 535, *Paper and board – Determination of water absorptiveness – Cobb method*

ISO 536, *Paper and board – Determination of grammage*

ISO 868, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1924-2, *Paper and board – Determination of tensile properties – Part 2: Constant rate of elongation method (20 mm/min)*

ISO 1924-3, *Paper and board – Determination of tensile properties – Part 3: Constant rate of elongation method (100 mm/min)*

ISO 1974, *Paper – Determination of tearing resistance – Elmendorf method*

ISO 2039-1, *Plastics – Determination of hardness – Part 1: Ball indentation method*

ISO 2039-2, *Plastics – Determination of hardness – Part 2: Rockwell hardness*

ISO 2471, *Paper and board – Determination of opacity (paper backing) – Diffuse reflectance method*

ISO 2493-1, *Paper and board – Determination of bending resistance – Part 1: Constant rate of deflection*

ISO 2493-2, *Paper and board – Determination of bending resistance – Part 2: Taber-type tester*

ISO 2578:1993, *Plastics – Determination of time-temperature limits after prolonged exposure to heat*

ISO 2758, *Paper – Determination of bursting strength*

ISO 2759, *Board – Determination of bursting strength*

ISO 3274, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments*

ISO 3664, *Graphic technology and photography – Viewing conditions*

ISO 3696, *Water for analytical laboratory use – Specification and test methods*

ISO 3781, *Paper and board – Determination of tensile strength after immersion in water*

ISO 3783, *Paper and board – Determination of resistance to picking – Accelerated speed method using the IGT-type tester (electric model)*

ISO 4287, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 4288:1996, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Rules and procedures for the assessment of surface texture*

ISO 5626, *Paper – Determination of folding endurance*

ISO 5635, *Paper – Measurement of dimensional change after immersion in water*

ISO 6383-1, *Plastics – Film and sheeting – Determination of tear resistance – Part 1: Trouser tear method*

ISO 6383-2, *Plastics – Film and sheeting – Determination of tear resistance – Part 2: Elmendorf method*

ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method*

ISO 6588-1, *Paper, board and pulps – Determination of pH of aqueous extracts – Part 1: Cold extraction*

ISO 6588-2, *Paper, board and pulps – Determination of pH of aqueous extracts – Part 2: Hot extraction*

ISO 7991*, Glass – Determination of coefficient of mean linear thermal expansion*

ISO 8791-2, *Paper and board – Determination of roughness/smoothness (air leak methods) – Part 2: Bendtsen method*

ISO 8791-4, *Paper and board – Determination of roughness/smoothness (air leak methods) – Part 4: Print-surf method*

ISO 9220:1988, *Metallic coatings – Measurement of coating thickness – Scanning electron micro-scope method*

ISO 9773:1998, *Plastics – Determination of burning behaviour of thin flexible vertical specimens in contact with a small-flame ignition source*
ISO 9773:1998/AMD1:2003

ISO 11359-2:1999, *Plastics – Thermomechanical analysis (TMA) – Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ISO 11556, *Paper and board – Determination of curl using a single vertically suspended test piece*

ISO 11664-4, *Colorimetry – Part 4: CIE 1976 $L^*a^*b^*$ Colour space*

ISO 11798, *Information and documentation – Permanence and durability of writing, printing and copying on paper – Requirements and test methods*

ISO 12192, *Paper and board – Determination of compressive strength – Ring crush method*

ISO 13468-1:1996, *Plastics – Determination of the total luminous transmittance of transparent materials – Part 1: Single beam instrument*

ISO 13468-2:1999*, Plastics – Determination of the total luminous transmittance of transparent materials – Part 2: Double-beam instrument*

ISO 13565-2:1996, *Geometrical Product Specification (GPS) – Surface texture: Profile method; Surfaces having stratified functional properties – Part 2: Height characterization using the linear material ratio curve*

ISO 13655, *Graphic technology – Spectral measurement and colorimetric computation for graphic arts images*

ISO 14782, *Plastics – Determination of haze for transparent materials*

ISO 15105-1, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 1: Differential-pressure methods*

ISO 15105-2:2003, *Plastics – Film and sheeting – Determination of gas-transmission rate – Part 2: Equal-pressure method*

ISO 15106-1*, Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 1: Humidity detection sensor method*

ISO 15106-2*, Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 2: Infrared detection sensor method*

ISO 15106-3, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 3: Electrolytic detection sensor method*

ISO 15106-4, *Plastics – Film and sheeting – Determination of water vapour transmission rate – Part 4: Gas-chromatographic detection sensor method*

ISO 15184, *Paints and varnishes – Determination of film hardness by pencil test*

ISO 15512, *Plastics – Determination of water content*

ISO 15359, *Paper and board – Determination of the static and kinetic coefficients of friction – Horizontal plane method*

ISO 15754, *Paper and board – Determination of z-directional tensile strength*

ISO 15989, *Plastics – Film and sheeting – Measurement of water-contact angle of corona-treated films*