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IEC 61190-1-3

Edition 3.0 2017-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Attachment materials for electronic assembly –
Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solder for electronic soldering applications

Matériaux de fixation pour les assemblages électroniques –
Partie 1-3: Exigences relatives aux alliages à braser de catégorie électronique et brasure solide fluxée et non-fluxée pour les applications de brasage électronique

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2daea7f6b9ff/iec-61190-1-3-2017

IEC 61190-1-3:2017-12(en-fr)

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ICS 31.190

ISBN 978-2-8322-5127-0

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ATTACHMENT MATERIALS FOR ELECTRONIC ASSEMBLY –

Part 1–3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solder for electronic soldering applications

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International Standard IEC 61190-1-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

This third edition cancels and replaces the second edition, published in 2007 and Amendment 1:2010. This edition constitutes a technical revision.

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

a) The maximum impurity level of Pb has been revised and the table of lead free solder alloys includes some additional lead free solder alloys.

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

FDIS	Report on voting
91/1468/FDIS	91/1488/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.

A list of all parts in the IEC 61190 series, under the general title *Attachment materials for electronic assembly*, can be found on the IEC website.

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 website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

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KR PAT No.10-0445350
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ATTACHMENT MATERIALS FOR ELECTRONIC ASSEMBLY –

Part 1–3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solder for electronic soldering applications

1 Scope

This part of IEC 61190 prescribes the requirements and test methods for electronic grade solder alloys, for fluxed and non-fluxed bar, ribbon, powder solders and solder paste, for electronic soldering applications and for "special" electronic grade solders. For the generic specifications of solder alloys and fluxes, see ISO 9453. This document is a quality control document and is not intended to relate directly to the material's performance in the manufacturing process.

Special electronic grade solders include all solders which do not fully comply with the requirements of standard solder alloys and solder materials listed herein. Examples of special solders include anodes, ingots, preforms, bars with hook and eye ends, and multiple-alloy solder powders.

2 Normative references

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IEC 60194:2015, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 61189-5-2:2015, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 5-2: General test methods for materials and assemblies – Soldering flux for printed board assemblies*

IEC 61189-5-3:2015, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 5-3: General test methods for materials and assemblies – Soldering paste for printed board assemblies*

IEC 61189-5-4:2015, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 5-4: General test methods for materials and assemblies – Solder alloys and fluxed and non-fluxed solid wire for printed board assemblies*

IEC 61190-1-1:2002, *Attachment materials for electronic assembly – Part 1-1: Requirements for soldering fluxes for high-quality interconnections in electronics assembly*

IEC 61190-1-2, *Attachment materials for electronic assembly – Part 1-2: Requirements for soldering pastes for high-quality interconnects in electronics assembly*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194 and the following 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
acceptance tests
tests deemed necessary to determine the acceptability of a product and as agreed to by both purchaser and vendor

[SOURCE: IEC 60194:2015, 92.0004]

3.2
alloy
substance having metallic properties and being composed of two or more chemical elements of which at least one is an elemental metal

3.3
base metal
<solder> underlying metal surface to be wetted by solder

[SOURCE: IEC 60194:2015, 46.1491

3.4
corrosion
<chemical/electrolytic corrosion> attack of chemicals, flux, and flux residues on base metals

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[SOURCE: IEC 60194:2015, 76.0299]

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3.5
density
<material> mass of a substance per unit volume

Note 1 to entry: The density is usually expressed in grammes per cubic centimetre.

3.6
dewetting
condition that results when molten solder coats a surface and then recedes to leave irregularly shaped mounds of solder that are separated by areas that are covered with a thin film of solder and with the base metal not exposed

[SOURCE: IEC 60194:2015, 97.0370, modified – Reference to Figure 36 has been deleted.]

3.7
eutectic, noun
alloy having the composition indicated by the eutectic point on an equilibrium diagram or an alloy structure of intermixed solid constituents formed by an eutectic reaction

3.8
eutectic, noun
<solder> alloy composition whereby a solder alloy melts/freezes completely without going through a pasty (partially solid) phase

[SOURCE: IEC 60194:2015, 75.1391, modified – definition of eutectic by using the eutectic point]

3.9
eutectic, adjective
isothermal reversible reaction in which, on cooling, a liquid solution is converted into two or more intimately mixed solids, with the number of solids formed being the same as the number of components in the system

[SOURCE: IEC 60194:2015, 75.1392]

3.10
flux
chemically and physically active compound that, when heated, promotes the wetting of a base metal surface by molten solder by removing minor surface oxidation and other surface films and and that protects protecting the surfaces from re-oxidation during a soldering operation

[SOURCE: IEC 60194:2015, 75.0538, modified – The admitted term "soldering flux" has been deleted.]

3.11
flux characterization
series of tests that determines the basic corrosive and conductive properties of fluxes and flux residues

[SOURCE: IEC 60194:2015, 76.0542]

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3.12
flux residue
flux related contaminant that is present on or near the surface of a solder connection

[SOURCE: IEC 60194:2015, 76.0543]

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3.13
liquidus
<solder> temperature at which a solder alloy is completely melted

[SOURCE: IEC 01964:2015, 75.1906]

3.14
nonwetting
<solder> partial adherence of molten solder to a surface that it has contacted and where basis metal remains exposed

[SOURCE: IEC 60194:2015, 75.1189, modified – The definition has been changed and the reference to Figure 63 has been deleted.]

3.15
lead-free solder

solder alloy whose lead content is equal to, or less than 0,10 % by mass

[SOURCE: IEC 60194:2015, 75.1904, modified – The definition has been changed.]

3.16
solder
metal alloy with a melting temperature below 427 °C

[SOURCE: IEC 60194:2015, 46.0956]

3.17
solderability
ability of a metal to be wetted by molten solder

[SOURCE: IEC 60194:2015, 75.0958]

3.18
solidus
temperature at which a solder alloy changes from a solid to a paste form

3.19
wetting
<solder> formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a base metal

[SOURCE: IEC 60194:2015, 75.1161]

4 Classification

4.1 General

Soldering materials covered by this document shall be classified by alloy composition, solder form, flux type, flux percentage and by other characteristics peculiar to the solder material form (see Annex A).

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4.2 Alloy composition

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The solder alloys covered by this document are the alloys listed in Table B.1, Table B.2 and Table B.3 and include pure tin and pure indium. Each alloy is identified by an alloy name composed of a series of alphanumeric characters. These characters identify the component elements in the alloy by a chemical symbol and nominal percentage by mass. They terminate with an arbitrarily assigned alloy variation letter (D). Alloys are also identified by an alloy short name. This is an alphanumeric designation composed of the chemical symbol for the key element in the alloy (see Clause A.5), the nominal percentage of that element in the alloy and the arbitrarily assigned alloy variation letter.

Table B.1, Table B.2 and Table B.3 identify the alloy composition, short name and temperature characteristics; Table B.4 cross-references solidus and liquidus temperatures to alloy names and Table B.5 cross references ISO alloy numbers and designations from ISO 9435 to allow names.

4.3 Solder form

Table 1 shows the forms of solder materials covered by this document listed with their single-letter designating symbols.

Table 1 – Solder materials

Identifying symbol	Solder form
F	Flux (only)
P	Paste (cream)
B	Bar
D	Powder
R	Ribbon
W	Wire
S	Special

4.4 Flux type

The flux types used in/on solders covered by this document are listed in Table 2. The requirements for fluxes are covered by IEC 61190-1-1.

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Table 2 – Flux types and designating symbols

Flux materials of composition [a]	Flux activity levels weight % halide [b]		IEC flux designator [c]	ISO flux designator [d]
Rosin (RO)	Low (<0,01)	L0	ROL0	1.1.1
	Low (<0,15)	L1	ROL1	1.1.2.W, 1.1.2.X
	Moderate (<0,01)	M0	ROM0	1.1.3.W
	Moderate (0,15 to 2,0)	M1	ROM1	1.1.2.Y, 1.1.2.Z
	High (<0,01)	H0	ROH0	1.1.3.X
	High (>2,0)	H1	ROH1	1.1.2.Z
Resin (RE)	Low (<0,01)	L0	REL0	1.2.1
	Low (<0,15)	L1	REL1	1.2.2.W, 1.2.2.X
	Moderate (<0,01)	M0	REM0	1.2.3.W
	Moderate (0, 15 to 2,0)	M1	REM1	1.2.2.Y, 1.2.2.Z
	High (<0,01)	H0	REH0	1.2.3.X
	High (>2,0)	H1	REH1	1.2.2.Z
Organic (OR)	Low (<0,01)	L0	ORL0	2.1., 2.2.3.E
	Low (<0, 15)	L1	ORL1	–
	Moderate (<0,01)	M0	ORM0	–
	Moderate (0, 15 – 2,0)	M1	ORM1	2.1.2, 2.2.2
	High (<0,01)	H0	ORH0	2.2.3.0
	High (>2,0)	H1	ORH1	2.2.2
Inorganic (IN)	Low (<0,01)	L0	INL0	Not applicable (Inorganic ISO flux is different)
	Low (<0, 15)	L1	INL1	
	Moderate (<0,01)	M0	INM0	
	Moderate (0, 15 – 2,0)	M1	INM1	
	High (<0,01)	H0	INH0	
	High (>2,0)	H1	INH1	

[a] Fluxes are available in S (solid), P (paste/cream) or L (liquid) forms.

[b] See 7.1 and 7.2 of IEC 61190-1-1:2002 for comparisons of RO, RE, OR and IN composition classes and L, M and H activity levels with the traditional classes such as R, RMA, RA, water soluble and low solids "no-clean."

[c] The 0 and 1 indicate absence and presence of halides, respectively. See 4.2.3 of IEC 61190-1-1:2002 for an explanation of L, M and H nomenclature.

[d] ISO designations are similar to IEC designators with minor differences in characteristics.

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4.5 Flux percentage and metal content

The nominal percentage of flux, by mass, in solid-form solder products is identified as the flux percentage. The flux percentage in/on solid solders is identified by a single alphanumeric character in accordance with Table 3. "Metal content" refers to the percentage of metal in solder paste (see IEC 61190-1-2).