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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Withdrawn

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

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

IEC 61190-1-3:2007

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ATTACHMENT MATERIALS FOR ELECTRONIC ASSEMBLY –

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

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For Sn96Ag2,5Bi1Cu,5:

US PAT No. 4879096
Cookson Electronics Assembly Materials
600 Route 440 Jersey City,New Jersey 07304

For Sn96,5Ag3Cu,5, Sn95,8Ag3,5Cu,7 and Sn95,5Ag3,8Cu,7:

US PAT No. 5527628
Iowa State University Research Foundation, Inc.
310 Lab of Mechanics
Ames, Iowa 50011-2131, U.S.A.

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For Sn88In8Ag3,5Bi,5:
JP PAT No. 3040929
For Sn96,5Ag3Cu,5, Sn95,8Ag3,5Cu,7 and Sn95,5Ag3,8Cu,7:
JP PAT No. 3027441
Matsushita Electric Industrial Co., Ltd.
Matsushita IMP Building 20F 1-3-7, Shiromi, Chouh-ku, Osaka, 540-6319, Japan

For Sn92In4Ag3,5Bi,5
JP PAT No. 2805595
Mitsui Mining & Smelting Co., Ltd.
Gate City Ohsaki-West Tower 19th Fl. 1-11-1 Osaki, Shinagawa-ku, Tokyo, 141-8584, Japan

For Sn96,5Ag3Cu,5, Sn95,8Ag3,5Cu,7, Sn95,5Ag3,8Cu,7 and Sn95,5Ag4,0Cu,5
JP PAT No. 3027441
Senju Metal Industry Co., Ltd.
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International Standard IEC 61190-1-3 has been prepared by IEC technical committee 91: Electronics assembly technology.

This second edition cancels and replaces the first edition, published in 2002, and constitutes a technical revision. The main changes with regard to the first edition concern a definition of lead-free solder alloy and an amendment to Table B.1 concerning lead-free solder alloys.

This bilingual version, published in 2008-05, corresponds to the English version.

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

FDIS	Report on voting
91/647/FDIS	91/679/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.

The French version of this standard has not been voted upon.

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

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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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
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ATTACHMENT MATERIALS FOR ELECTRONIC ASSEMBLY –

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

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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, ISO 9454-1 and ISO 9454-2. This standard 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, multiple-alloy solder powders, etc.

2 Normative references

The following referenced documents are indispensable for the application 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 60194, *Printed board design, manufacture and assembly – Terms and definitions*

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

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

IEC 61189-5, *Test methods for electrical materials, interconnection structures and assemblies – Part 5: Test methods for printed board assemblies*

IEC 61189-6, *Test methods for electrical materials, interconnection structures and assemblies – Part 6: Test methods for materials used in manufacturing electronic assemblies*

ISO 9001, *Quality management systems – Requirements*

ISO 9453, *Soft solder alloys – Chemical compositions and forms*

ISO-9454-1:1990, *Soft soldering fluxes – Classification and requirements – Part 1: Classification, labelling and packing*

ISO-9454-2:1998, *Soft soldering fluxes – Classification and requirements – Part 2: Performance requirements*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194, as well as the following apply. Terms marked with an asterisk (*) are taken from IEC 60194 and are reprinted here for convenience.

3.1
acceptance tests *
those tests deemed necessary to determine the acceptability of a product and as agreed to by both purchaser and vendor

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
basis metal *
metal upon which coatings are deposited, also referred to as base metal

3.4
corrosion (chemical/electrolytic) *
attack of chemicals, flux, and flux residues on base metals

3.5
density (phototool) *
mass of a surface per unit volume, usually expressed in grams 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 basis metal not exposed

3.7
eutectic (n.) *
alloy having the composition indicated by the eutectic point on an equilibrium diagram or an alloy structure of intermixed solid constituents formed by a eutectic reaction

3.8
eutectic (adj.) *
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

3.9
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 by protecting the surfaces from reoxidation during a soldering operation

3.10
flux characterization *
series of tests that determines the basic corrosive and conductive properties of fluxes and flux residues

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3.11
flux residue *
flux-related contaminant that is present on or near the surface of a solder connection

3.12
liquidus
temperature at which a solder alloy changes from a paste form to a liquid form

3.13
nonwetting (solder) *
partial adherence of molten solder to a surface that it has contacted and where basis metal remains exposed

3.14
lead-free solder
solder alloy the lead content of which is equal to, or less than 0,10 % by mass

3.15
solder *
metal alloy with a melting temperature that is below 450 °C.

NOTE Metal alloy with a melting temperature less than 450 °C is classified as "soft solder".

3.16
solderability *
ability of a metal to be wetted by molten solder

3.17
solidus
temperature at which a solder alloy changes from a solid to a paste form

3.18
wetting, solder *
formation of a relatively uniform, smooth, unbroken, and adherent film of solder to a basis metal.

4 Classification

Soldering materials covered by this standard shall be classified by alloy composition, solder form, flux type, flux percentage and by other characteristics peculiar to the solder material form.

4.1 Alloy composition

The solder alloys covered by this standard are the alloys listed in Tables B.1, B.2 and 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 chemical symbol and nominal percentage by mass. They terminate with an arbitrarily assigned alloy variation letter (A, B, C, 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.4), the nominal percentage of that element in the alloy and the arbitrarily assigned alloy variation letter.

Tables B.1, B.2 and B.3 identify 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 9453 to alloy names.

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4.2 Solder form

Table 1 shows the forms of solder materials covered by this standard 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

4.3 Flux type

The flux types used in/on solders covered by this standard 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 wt. % 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 (0,15–2,0)	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 – 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 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 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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4.4 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).

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Table 3 – Flux percentage

Design symbol	Nominal %	Allowable range %	Design symbol	Nominal %	Allowable range %	Design symbol	Nominal %	Allowable range %
0	None		5	2,5	2,2 – 2,8	A	5,0	4,7 – 5,3
1	0,5	0,2 – 0,8	6	3,0	2,7 – 3,3	B	5,5	5,2 – 5,8
2	1,0	0,7 – 1,3	7	3,5	3,2 – 3,8	C	6,0	5,7 – 6,3
3	1,5	1,2 – 1,8	8	4,0	3,7 – 4,3	D	6,5	6,2 – 6,8
4	2,0	1,7 – 2,3	9	4,5	4,2 – 4,8			

4.5 Other characteristics

Standard bar solders are further classified by unit mass. Wire solders are further classified by wire size (outside diameter) and unit mass. Ribbon solders are further classified by thickness, width and unit mass. Powder solders are further classified by powder particle size distribution and unit mass.

5 Requirements

5.1 Materials

Materials shall be used which permit the solder product to conform to the specified requirements. The use of recovered or recycled materials is encouraged. Recovered or recycled materials shall conform to or exceed comparable standards for virgin raw materials.

5.2 Alloys

The solder alloy shall be as specified (see Annex B). For the purposes of this standard, electronic grade solder alloys are all those listed in Tables B.1, B.2 and B.3, including pure tin (Sn99) and pure indium (In99). The elements listed in Tables B.1, B.2 and B.3 for an alloy are considered to be the component elements of that alloy. Only the component elements of an alloy are desirable and all other elements are impurities for that alloy. To the maximum extent feasible and unless otherwise specified, solder alloy metal, including solder powder, shall be a homogenous mixture of the component elements of the alloy, such that each particle of the metal is the same alloy. Unless otherwise specified, the percentage by mass of impurity elements in alloys which are identified with an “A”, “B”, or “C” suffix shall not exceed the following values and the values listed in 5.2.1, 5.2.2, and 5.2.3 respectively, and the percentage by mass of impurity elements in alloys which are identified with a “D” suffix shall conform to the requirements in 5.2.4.

Ag: 0,05	Au: 0,05	Cu: 0,05	Ni: 0,01	Sn: 0,25
Al: 0,001	Bi: 0,10	Fe: 0,02	Pb: 0,10	Zn: 0,001
As: 0,03	Cd: 0,002	In: 0,10		

The percentage of each element in an alloy shall be determined by any standard analytical procedure. Wet chemistry shall be used as the referee procedure.

5.2.1 Variation A alloys

In alloys which are identified with an “A” suffix, the percentage by mass of antimony (Sb) as an impurity element shall not exceed 0,50.

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5.2.2 Variation B alloys

In alloys which are identified with a “B” suffix, the percentage by mass of antimony as an impurity element shall not exceed 0,20.

5.2.3 Variation C alloys

In alloys which are identified with a “C” suffix, the percentage by mass of antimony as an impurity element shall not exceed 0,05.

5.2.4 Variation D alloys

Alloys identified with a “D” suffix are ultra-pure alloys that are intended for use in barrier-free die attachment applications. In alloys identified with a “D” suffix, the combined total percentage by mass of all impurity elements shall not exceed 0,05 and the combined total percentage by mass of each of the following sets of impurity elements shall not exceed 0,000 5:

Set 1: Be, Hg, Mg, and Zn. Set 2: As, Bi, P, and Sb.

5.3 Solder forms

This standard covers solders in the form of bars, wires, ribbons, and powders, and special solders. Normally bar solders and solder powder are not fluxed, and wire, ribbon, and special solders may be non-fluxed, flux-cored, flux-coated, or both flux-cored and flux-coated. Users should determine from prospective sources the standard solder form characteristics that are available and should specify standard characteristics to the maximum extent feasible.

5.3.1 Bar solder

The nominal cross-section area, the nominal length, and the nominal mass shall be as specified (see Clause A.2 c)). Unless otherwise specified (see Clause A.2 d)), the actual cross-section area shall not vary from the nominal value by more than 50 %, the actual length shall not vary from the nominal value by more than 20 %, and the actual mass shall not vary from the nominal value by more than 10 %. Bars with special end configurations, such as hooks or eyes, are classified as special solders.

5.3.2 Wire solder

The wire size, flux type, and flux percentage shall be as specified (see Clause A.2 e)). Unless otherwise specified (see Clause A.2f)), wire solders shall have a circular cross-section, the wire size shall indicate the nominal outside diameter of the wire and the actual outside diameter shall not vary from the nominal diameter by more than ±5 % or ±0,05 mm, whichever is greater.

5.3.3 Ribbon solder

The ribbon thickness and width, flux type, and flux percentage shall be as specified (see Clause A.2 g)). Unless otherwise specified (see Clause A.2 h)), ribbon solders shall have a rectangular cross-section, and the actual thickness and width shall not vary from their nominal values by more than ±5 % or ±0,05 mm, whichever is greater.

5.3.4 Solder powder

The powder size and shape shall be as specified (see Clauses A.2 i)) and A.2 j)). The characteristics of six standard solder powders, sizes 1 through 6, are listed in Table 4. When shape is not specified, solder powder shall be spherical. Solder powder shall be smooth and bright and free of adhering small particles and oxides to the maximum extent possible.

NOTE Solder powders made with high-lead alloys are not “bright” by nature, but they should not appear unusually dark. Solder powders which contain more than one solder alloy (multiple-alloy powders) are classified as special solders.

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Table 4 – Standard solder powders

Powder size symbol	Percentages of powder by mass				
	None larger than µm	Less than 1 % larger than µm	At least 80 % between µm	At least 90 % between µm	Less than 10 % smaller than µm
1	160	150	150 – 75		20
2	80	75	75 – 45		20
3	50	45	45 – 25		20
4	40	38		38 – 20	20
5	28	25		25 – 15	15
6	18	15		15 – 5	5

5.3.4.1 Powder size

Maximum particle size shall be determined in accordance with IEC 61189-6, Test method 6X04. Powder particle size distribution shall be determined in accordance with IEC 61189-6, Test methods 6X01, 6X02 or 6X03.

5.3.4.2 Powder shape

Solder powder shape shall be determined by visual observation using a binocular microscope with sufficient magnification, by the light beam scatter method, or by a suitable microscopic imaging analysis method. Solder powders visually determined to have at least 90 % of the particles with a length to width ratio of 1:2 or less shall be classified as spherical powders. Solder powders having a light beam scatter deviation result or an image analysis result that is equivalent to the above visual results shall be classified as spherical powders. All other powders shall be classified as non-spherical.

5.3.5 Special solder

All pertinent characteristics and tolerances for special form solders shall be specified (see Clause A.2 k)). Special solders include all solders which do not fully conform to another solder classification identified herein or in IEC 61190-1-2. Special solders include, but are not necessarily limited to, anodes, bars with hook or eye ends, chips, ingots, multiple-alloy powders, pellets, preforms, rings, sleeves, etc.

5.4 Flux type and form

The flux type and form shall be as specified (see Clause A.2 l)). Fluxes used in the manufacture of solder products shall conform to the requirements of IEC 61190-1-1. Fluxes shall have been fully tested and characterized in accordance with IEC 61190-1-1, and shall have not been altered since being tested except for the addition of inert plasticizers.

5.4.1 Flux percentage

The percentage by mass of flux in/on solders shall be as specified (see Clause A.2 m)). For fluxed solders other than solder paste, the flux percentage is identified in accordance with Table 3. The flux percentage of flux-coated and/or flux-cored solder shall be determined in accordance with IEC 61189-6, Test method 6C09.

5.4.2 Solder cores

Unless otherwise specified (see Clause A.2 n)), the core(s) of flux-cored solders may be of any construction, provided it is (they are) continuous, uniform in cross-section, and symmetrically disposed in the solder. When appropriate, the core(s) in the solder should be sealed at both ends by a suitable means to prevent flux from leaking out.

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5.4.3 Solder coatings

Unless otherwise specified (see Clause A.2 o)), the coatings on flux-coated solders shall be dry and tack-free such that individual pieces do not stick together when the temperature and humidity are maintained at, or below, 25 °C and 60 % RH.

5.5 Flux residue dryness

When specified (see Clause A.2 p)), the dryness characteristics of the reflowed residue of fluxed solders shall be determined in accordance with IEC 61189-5, Test method 5X12. When a fluxed solder is tested in accordance with Test method 5X12, the flux residue of “no-clean” solders and, when specified, other flux type solders, shall be free of tackiness (‘not tacky’).

5.6 Spitting

When specified (see Clause A.2q)), the spitting characteristics of flux-cored wire and ribbon solders shall be determined in accordance with IEC 61189-5, Test method 5X13.

5.7 Solder pool

When specified (see Clause A.2 r)), the solder pool characteristics of fluxed solder shall be determined in accordance with IEC 61189-5, Test method 5X14. When fluxed solder is tested in accordance with test method 5X14, the flux shall promote the spreading of molten solder over the coupon to form integrally thereon a coat of solder which shall feather out to a thin edge. There shall be no evidence of dewetting or nonwetting. Neither shall there be any evidence of spattering, as indicated by the presence of flux and/or flux residue particles outside the main pool of residue. Irregularly shaped solder pools do not necessarily indicate dewetting or nonwetting.

5.8 Labelling for product identification

Unless otherwise specified (see Clause A.2 s)), solder bars shall be marked with the alloy name or alloy short name and the manufacturer's name or commonly accepted symbol. Unless otherwise specified, spools, packages, and containers of wire, ribbon, and powder solders, and written documentation accompanying bar and special solders shall be marked with the following information:

a) the manufacturer's name and address;

b) the number and revision designation of this standard;

c) the solder product description, and the manufacturer's designation of the solder product;

d) the net mass of the solder (and nominal unit mass of bar solder);

e) the batch number(s);

f) the date(s) of manufacture;

g) expected useful life of solder product, if applicable;

h) all applicable health and safety markings including lead free marking or lead containing marking;

i) any other information which may be pertinent to the particular solder form;

j) any other markings or labelling specified in the contract or purchase order.

5.9 Workmanship

Solder products shall be made uniform in quality and free from defects which limit service life or affect the serviceability or appearance.

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6 Quality assurance provisions

6.1 Responsibility for inspection and compliance

The user shall specify the qualification and quality conformance inspections (see Clause A.2 t)). The solder product manufacturer is responsible for the performance of qualification and quality conformance inspections. The manufacturer may use his own or any other facility for the performance of these inspections, unless the facility is disapproved by the user.

It is the responsibility of the manufacturer to ascertain that all solder products or supplies delivered to the user, or submitted for user acceptance, conform to the requirements of the contract or purchase order and Clause 5 above. The absence of any inspection requirements shall not relieve the vendor of this responsibility.

Materials covered by this specification shall meet all the requirements of Clause 5. The inspection(s) excluding the performance inspections defined in this specification shall become a part of the contractor's overall inspection system or quality programme. The vendor has responsibility for ensuring that all products or supplies submitted to the user for acceptance comply with all requirements of the purchase order contract.

6.1.1 Quality assurance programme

When required by the user, a quality assurance programme for material furnished under this specification shall be established and maintained in accordance with ISO 9001, or as otherwise agreed on between user and manufacturer, and shall be monitored by the qualifying activity.

6.1.2 Test equipment and inspection facilities

Test/measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection(s) shall be established and maintained or designated by the supplier. Establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with the general requirements of IEC 61189-5 and IEC 61189-6, as appropriate.

6.1.3 Inspection conditions

Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in Clause 5.

6.2 Classification of inspections

The inspections specified in this standard are classified as follows:

a) materials inspection (6.3);

b) qualification inspection (6.4);

c) quality conformance (6.5).

Figures 1 through 4 are suitable for, and recommended for, recording the results of alloy and of solid form solder inspections. Where applicable, definitive results should be entered on the report forms. Where definitive results are not required or appropriate, successful completion of inspections should be indicated by check marks on the report forms.

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Test report on solder alloy (for suffix A, B, and C alloys)

Enter appropriate information in top portion and requirements columns of report and complete report by entering the test results or checkmarks in the appropriate spaces.

Alloy designation: _____

Manufacturer's identification: _____

Manufacturer's batch number: _____

Date of manufacture: _____

Date inspection completed: _____ Overall results[1]: ___Pass ___Fail

Testing methods used: _____

_____

Inspection performed by: _____ Witnessed by _____

Elements	Required percentages		Percentage in sample	Pass/Fail[2]	Tested by and date
	As an alloy element	As an impurity element			
Ag		0,05 Max			
Al		0,001 Max			
As		0,03 Max			
Au		0,05 Max			
Bi		0,10 Max			
Cd		0,002 Max			
Cu		0,05 Max			
Fe		0,02 Max			
In		0,10 Max			
Ni		0,01 Max			
Pb		0,10 Max			
Sb[3]		___ 0,50 Max ___ 0,20 Max ___ 0,05 Max			
Sn		0,25 Max			
Zn		0,001 Max			

1. Overall results: Check "Pass" if the test results for all elements conform to the requirements, otherwise check "Fail."

2. Pass/Fail: Enter "P" for an element if test results conform to the actual requirement, otherwise, enter "F."

3. When antimony (Sb) is an impurity in the alloy being tested, check the appropriate Sb percentage requirement in column 3.

Comments: _____

_____

_____

_____

Figure 1 – Report form for solder alloy tests

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Test report on solder powder

Enter appropriate information in top portion and requirements columns of report and complete report by entering the test results or checkmarks in the appropriate spaces.

Alloy designation: _____ Powder size number _____

Manufacturer's identification: _____

Manufacturer's batch number: _____

Date of manufacture: _____

Date inspection completed: _____ Overall results[1]: ___Pass ___Fail

Testing methods used: _____

_____

Inspection performed by: _____ Witnessed by _____

Inspections	Requirements	Test results obtained	Pass/fail[2]	Tested by and date
Material				
Visual				
Alloy				
Max. powder size: 0 % larger than _____ µm				
Powder size: < 1 % larger than _____ µm				
≥ 80 % between ___ – ___ µm				
≥ 90 % between ___ – ___ µm				
< 10 % smaller than _____ µm				
Powder shape				

1. Overall results: Check "Pass" if the test results for all elements conform to the requirements, otherwise check "Fail."

2. Pass/Fail: Enter "P" for an element if test results conform to the actual requirement, otherwise, enter "F."

Comments: _____

_____

_____

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Figure 2 – Report form for solder powder tests

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Test report on non-fluxed solder

Enter appropriate information in top portion and requirements columns of report and complete report by entering the test results or checkmarks in the appropriate spaces.

Solder designation: _____

Inspection purpose: QPL I.D. Number: _____

____ Qualification Manufacturer's identification: _____

____ Quality conformance A Manufacturer's batch number: _____

____ Quality conformance B Date of manufacture: _____

____ Shelf-life extension Original USE-BY date: _____

____ Performance Revised USE-BY date: _____

Date inspection completed: _____ Overall results[1]: ___Pass ___Fail

Testing methods used: _____

_____

Inspection performed by: _____ Witnessed by _____

Inspections	Requirements	Test results obtained	Pass/Fail[2]	Tested by and date
Material				
Visual				
_____	_____	_____	_____	_____
___Diameter of wire or ___Width of ribbon or ___Length of bar				
_____	_____	_____	_____	_____
___Thickness of ribbon ___Cross-Sect. area-bar				
_____	_____	_____	_____	_____
Other visual tests				
Alloy				

1. Overall results: Check "Pass" if the test results for all elements conform to the requirements, otherwise check "Fail."

2. Pass/Fail: Enter "P" for an element if test results conform to the actual requirement, otherwise, enter "F."

Comments: _____

_____

_____

_____

Figure 3 – Report form for non-fluxed solder tests

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Test report on fluxed wire/ribbon solder

Enter appropriate information in top portion and requirements columns of report and complete report by entering the test results or checkmarks in the appropriate spaces.

Solder designation: _____

Inspection purpose: QPL I.D. number: _____

____ Qualification Manufacturer's identification: _____

____ Quality conformance A Manufacturer's batch number: _____

____ Quality conformance B Date of manufacture: _____

____ Shelf-life extension Original USE-BY date: _____

____ Performance Revised USE-BY date: _____

Date inspection completed: _____ Overall Results[1]: ___Pass ___Fail

Testing methods used: _____

_____

Inspection performed by: _____ Witnessed by _____

Inspections	Requirements	Test results obtained	Pass/Fail[2]	Tested by and date
Material				
Visual				
_____	_____	_____	_____	_____
___Diameter of wire or ___ Width of ribbon or ___Length of bar				
_____	_____	_____	_____	_____
___Thickness of ribbon ___ Cross-Sect. area-bar				
_____ Other visual tests	_____	_____	_____	_____
Alloy				
Flux				
Flux percentage				
Wetting				

1. Overall results: Check "Pass" if the test results for all elements conform to the requirements, otherwise check "Fail."

2. Pass/Fail: Enter "P" for an element if test results conform to the actual requirement, otherwise, enter "F."

Comments: _____

_____

_____

_____

Figure 4 – Report form for fluxed wire/ribbon solder tests

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6.3 Materials inspection

Materials inspection shall consist of certifications, supported by verifying data that the materials used in manufacturing solder products are in accordance with the applicable referenced specifications and standards prior to use. Certifications and verifying data applicable to qualification test samples should be made a part of the qualification test report.

6.4 Qualification inspections

Qualification inspections consist of examinations and tests of materials, processes and products needed to ascertain that a manufacturing facility has the necessary facilities and expertise to make acceptable solder products. In determining the acceptability of a manufacturing facility as a source for solder products, users are encouraged to utilize the documented results of product inspections previously performed by the manufacturing facility to the maximum extent possible in lieu of requiring new qualification inspections. Solder product samples, which have been produced using the materials, equipment, processes and procedures used in production, shall be subjected to the qualification inspections specified (see Clause A.2 t)). The standard qualification inspections for solder products covered by this standard are listed in Table 5. Unless otherwise specified (see Clause A.2 u)), the qualification inspections shall be conducted using the procedures specified in 6.5.

6.4.1 Sample size

Sample size should be appropriate for the solder being inspected and the inspection being performed.

6.4.2 Inspection routine

The sample shall be subjected to the inspection specified in Table 5.

Table 5 – Solder inspections

Inspections	Qualification	Quality conformance
Material	X	X
Visual	X	X
Alloy composition	X	X
Flux characterization	X	X
Flux characteristics	X	X
Flux percentage	X	X
Powder size	X	X
Maximum powder size	X	X
Powder shape	X	X
Flux residue dryness	X	
Solder pool	X	
Spitting	X	
Packaging	X	

6.5 Quality conformance

The material manufacturer shall perform those inspections necessary to insure that the process is in control and to insure that the product is within specification limit.

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6.5.1 Inspection routine

The material shall be subjected to the inspections specified in Table 5.

6.5.2 Sampling plan

Statistical sampling and inspection shall be in accordance with an agreed to (between user and supplier) quality programme (see 6.1.1).

6.5.3 Rejected lots

If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units and re-submit for re-inspection. Re-submitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as re-inspected lots.

6.6 Preparation of solder alloy for test

6.6.1 Core

Carefully remove five pieces (approximately 50 mm long) of flux-cored wire and ribbon solder at approximately 0,5 m intervals from each spool, coil, or cut length, as applicable, in accordance with the following methods. Using magnification as needed, visually examine both ends of each 50 mm piece for dimensional uniformity and for core continuity, homogeneity, and condition.

6.6.1.1 Wire solder up to approximately 6 mm diameter

Hold the wire solder under tension with the point desired for the separation over a luminous flame such as is emitted by a match. The solder will snap apart at the point of hot shortness providing clean breaks which will expose the flux core shapes as well as the flux continuity.

NOTE This method of solder separation should be tried on small diameter wire solders to see if it will work satisfactorily before using the method in 6.6.1.2.

6.6.1.2 Ribbon solder and wire solder larger than 6 mm diameter

Using a very sharp cutting edge, such as a strong razor blade, carefully cut the solder making special efforts to minimize the distortion in the solder by the cutting force.

7 Preparation for delivery – Preservation, packing and packaging

Unless otherwise specified in the contract or purchase order, the preservation, packing, packaging, and exterior marking of soldering products shall be equivalent to, or better than, the supplier's standard commercial practice.

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