

**IPC J-STD-006B**  
**Amendments 1 & 2**  
**September 2009**

Supersedes Amendment 1 – June 2008

# ***JOINT INDUSTRY STANDARD***

Requirements for  
Electronic Grade  
Solder Alloys  
and Fluxed and  
Non-Fluxed Solid  
Solders for Electronic  
Soldering Applications

Amendments 1 & 2



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- Focus on end product performance
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# Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications

## 1.1 Scope

Replace all of this section with the following:

This standard prescribes the nomenclature, requirements and test methods for electronic grade solder alloys; for fluxed and non-fluxed bar, ribbon, and powder solders, for electronic soldering applications; and for “special” electronic grade solders. This is a quality control standard and is not intended to relate directly to the material’s performance in the manufacturing process. Solders for applications other than electronics should be procured using ASTM B-32.

This standard is one of a set of three joint industry standards that prescribe the requirements and test methods for soldering materials for use in the electronics industry. The other two joint industry standards are:

**IPC/EIA J-STD-004** Requirements for Soldering Fluxes

**IPC/EIA J-STD-005** Requirements for Soldering Pastes

Additionally, marking requirements for lead-free materials and assemblies is addressed in this document by direct application of text from IPC/JEDEC J-STD-609, *Lead-Free and Leaded Marking, Symbols and Labels* (see 6.5).

## 2.1 Joint Industry Standards<sup>1</sup>

Replace all of this section with the following:

**IPC/EIA J-STD-004** Requirements for Soldering Fluxes

**IPC/EIA J-STD-005** Requirements for Soldering Pastes

**IPC/JEDEC J-STD-609** Lead-Free and Leaded Marking, Symbols and Labels

## 3.3 Alloy Impurities

Replace all of this section with the following:

Elements not listed as components that make up the composition of an alloy are considered impurities for that alloy. An alloy variation designator **shall** be used to specify the allowable impurity level of a solder product being offered, in the case of a manufacturer; or the allowable impurity level of a solder product required, in the case of a user. The alloy variation designator will be added to the end of the alloy name and become part of the name (see 6.3).

**NOTE:** Alloys for barrier-free die attachment applications have a different alloy impurity requirement (see 3.3.1).

Unless otherwise specified, the percentage by mass of impurity elements in alloys **shall not** exceed the following values. The percentage by mass of impurity elements in variation D alloys **shall** conform to the requirements in 3.3.1.

Ag: 0.10	Cd: 0.002	Pb: 0.07
Al: 0.005	Cu: 0.08	Sn: 0.25
As: 0.03	Fe: 0.02	Zn: 0.003
Au: 0.05	In: 0.10	Sb: 0.20
Bi: 0.10	Ni: 0.01	

## 3.4.4 Solder Powder

Replace all of this section with the following:

The powder size and shape shall be as specified per J-STD-005. Solder powders which contain more than one solder alloy (multiple-alloy powders) are classified as special solders (see 3.4.6).

**3.4.4.1** Delete this section.

**3.4.4.2** Delete this section.

## 3.8 Workmanship

Replace all of this section with the following:

**a. General** Solder products shall be made uniform in quality and free from defects in accordance with this standard.

**b. Solder Paste Products** Solder paste products **shall** be in accordance with J-STD-005.

**Table 3-1** Delete this table including footnote.

## 6 NOTES

Add the following as a new, last section:

**6.5 Labeling for Lead-Free and Leaded Marking, Symbols and Labels** In response to changes in the electronic assembly industry, more assemblies are being assembled with lead-free materials. IPC/JEDEC J-STD-609, *Lead-Free and Leaded Marking, Symbols and Labels* addresses this issue.

In addition to the IPC/JEDEC J-STD-609 requirements, solder material manufacturers have designated lead-free products by using a number of labeling/formatting options. Examples include triangular shaped bars for bar solder, green plastic containers for solder paste products as well as

other labeling practices including the use of the lead-free symbol that is recommended in the IPC/JEDEC J-STD-609 document (see Figure 6-1). Because specific designations are not called out by this standard, solder manufacturers should mark lead-free products so as to differentiate them from lead-containing solder products.

IPC/JEDEC J-STD-609 states that the Figure 6-1 symbol is utilized as a replacement for the phrase: "Pb-free." It means that the homogeneous product shall contain a maximum concentration of Pb (lead) of 0.1%, by weight. In turn, this conforms to EU RoHS requirements. Specific applications may require the maximum concentration of Pb (lead) to be <0.1%, by weight.

**NOTE:** This document requires that a virgin solder alloy designated as being Pb-free **shall** contain a maximum concentration of lead to be 0.07%, by weight.



006b-6-1

**Figure 6-1 Recommended Lead Free Marking Symbol**

## Appendix A Solder Alloys

Replace Table A-1, including footnotes, with the following:

**Table A-1 Composition, and Temperature Characteristics of Lead-free Solder Alloys<sup>1,5</sup>**

Alloy Name	Former Name <sup>2</sup>	Sn %	Ag %	Bi %	Cu %	In %	Sb %	Other Elements	(T <sub>s</sub> )	(T <sub>l</sub> )	(T <sub>s</sub> )	(T <sub>l</sub> )
In52Sn48		48.0	-	-	-	52.0	-	-	-	118 (e)	-	244.4 (e)
Sn42Bi58		42.0	-	58.0	-	-	-	-	-	138 (e)	-	284.4 (e)
Sn95Ag5		95.0	5.0	-	-	-	-	-	221	245	429.8	473.0
Sn96.3Ag3.7	Sn96	96.3	3.7	-	-	-	-	-	-	221 (e)	-	429.8 (e)
Sn96.5Ag3.5		96.5	3.5	-	-	-	-	-	-	221 (e)	-	429.8 (e)
Sn97Cu3		97.0	-	-	3.0	-	-	-	227	300	440.6	572.0
Sn99.3Cu0.7		99.3	-	-	0.7	-	-	-	-	227 (e)	-	440.6 (e)
Sn95Sb5 <sup>4</sup>	Sb5	95.0	-	-	-	-	4.0 - 6.0	-	235	240	455.0	464.0
Sn95.5Ag4.0Cu0.5	SAC405	95.5	4.0	-	0.5	-	-	-	217	219	422.6	426.2
Sn95.5Ag3.8Cu0.7	SAC387	95.5	3.8	-	0.7	-	-	-	217	221	422.6	430
Sn96.4Ag3.2Cu0.4		96.4	3.2	-	0.4	-	-	-	-	217 (e)	-	422.6 (e)
Sn96.5Ag3.0Cu0.5	SAC305	96.5	3.0	-	0.5	-	-	-	-	217 (e)	-	422.6 (e)
In2.5Sn92.0Ag3.0Bi2.5		92.0	3.0	2.5	-	2.5	-	-	207	211	417.2	424.4
In4.0Sn92.0Ag3.0Bi1.0		92.0	3.0	1.0	-	4.0	-	-	206	218	403	424
In7.0Sn89.0Ag3.0Bi1.0		89.0	3.0	1.0	-	7.0	-	-	202	206	396	403
In8.0Sn88.5Ag3.0Bi0.5		88.5	3.0	0.5	-	8.0	-	-	200	205	392	401
Sn96.0Ag2.5Cu0.5Bi1.0		96.0	2.5	1.0	0.5	-	-	-	214	218	417.2	424.4
Sn94.5Ag3.0 Cu0.5Bi2.0		94.5	3.0	2.0	0.5	-	-	-	210	215	410	419
In7.0Sn88.4Ag4.1Cu0.5		88.4	4.1	-	0.5	7.0	-	-	200	205	392	401
In4.0Sn91.4Ag4.1Cu0.5		91.4	4.1	-	0.5	4.0	-	-	203	208	397	406
In8.0Sn88.0Ag3.5Cu0.5		88.0	3.5	-	0.5	8.0	-	-	197	202	387	396
In6.0Sn90.0Ag3.5Cu0.5		90.0	3.5	-	0.5	6.0	-	-	201	206	394	403
Sn96.2Ag2.5Cu0.8Sb0.5		96.2	2.5	-	0.8	-	0.5	-	217	225	422.6	437
In5.5Sn93.3Cu0.7Ga0.5		93.3	-	-	0.7	5.5	-	Ga0.5	210	215	410	419
In8.0Sn88.0Ag3.0Cu0.5Bi0.5		88.0	3.0	0.5	0.5	8.0	-	-	197	202	387	396
Sn99.95 <sup>3</sup>		99.9	-	-	-	-	-	-	-	232 (mp)	-	449.6 (mp)

**NOTES:**

1. The Solidus (SOL) and Liquidus (LIQ) temperature values are provided for information only and are not intended to be a requirement in the formulation of the alloys. In the "LIQ" columns, an "e" indicates eutectic alloys and an "mp" indicates the tabulated solidus temperature represents the melting point for the elements. Although efforts have been made to document the correct solidus and liquidus temperatures for each alloy, users of this standard are advised to verify these temperature values before use.
2. The presence of a former alloy name indicates that the current alloy is substantially the same as the indicated QQ-S-571E alloy. Federal Standard QQ-S-571 is a cancelled specification used by the industry prior to the release of IPC J-STD-006.
3. Sn99.9 is included in this standard for use in replenishing tin in wave soldering baths and is NOT suitable for use as a stand-alone solder because of potential performance and reliability problems.
4. Sn95Sb5 has a nominal antimony (Sb) mass percentage of 5.0% and an allowable antimony percentage range of 4.0% to 6.0%.
5. This table is not meant to be all-inclusive. It is recognized that there may be other alloys available.

## Appendix B Examples of Inspection Report Format

### Appendix B-1 Test Report for Solder Alloy Composition and Impurity Level

Note the replacement of three separate element rows (1st, 11th and 12th, below):

Element	Required Percentages		Percentage in Sample	Results	Remarks
	As a Component Element	As an Impurity Element			
<i>Replace the first row (Ag) as follows:</i>					
Ag		0.10 Max		[ ] Pass [ ] Fail	
<i>Replace the eleventh row (Pb) as follows:</i>					
Pb <sup>1</sup>		0.07 Max		[ ] Pass [ ] Fail	
<i>Replace the twelfth row (Sb) as follows:</i>					
Sb <sup>2</sup>		0.20 Max		[ ] Pass [ ] Fail	