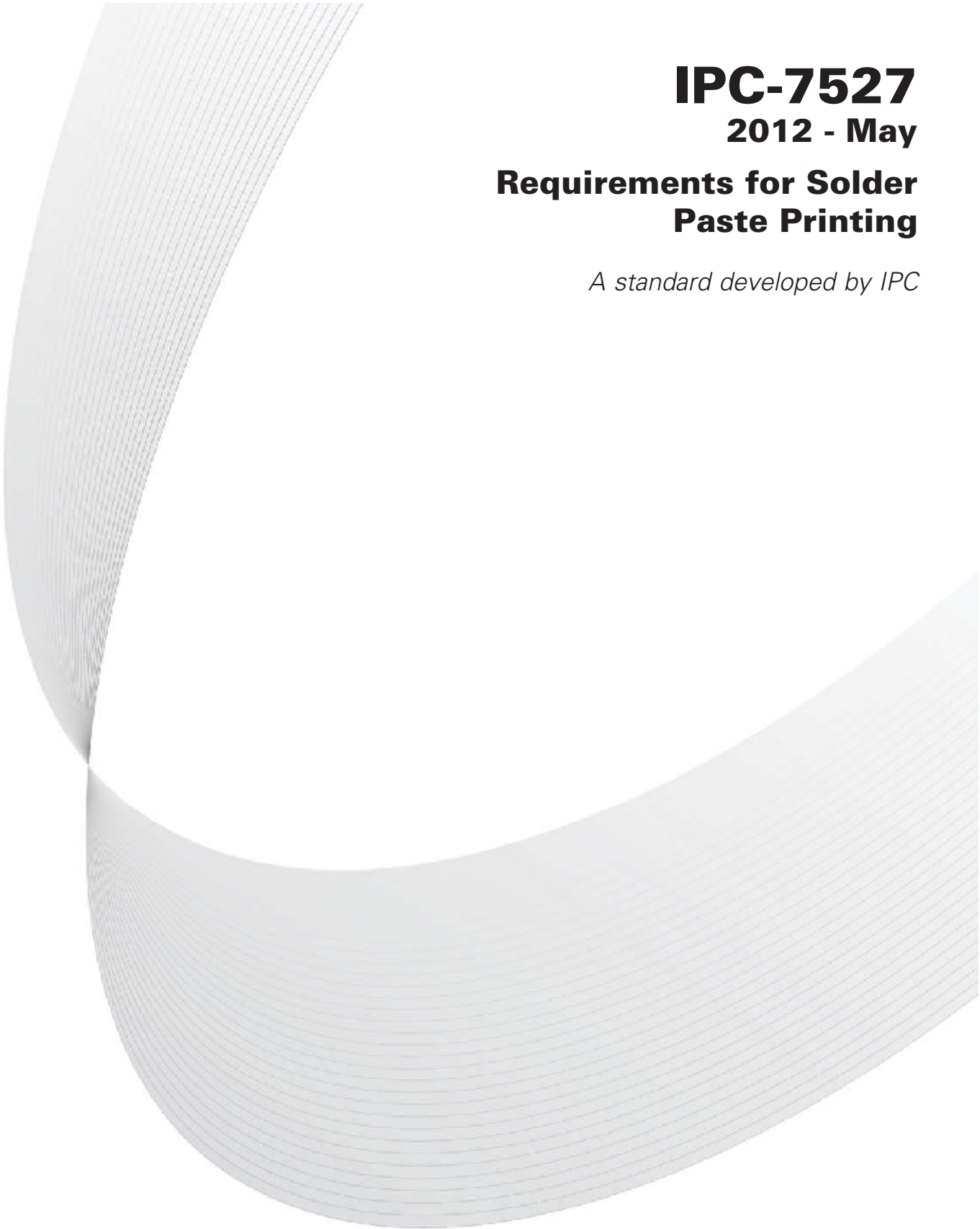




IPC-7527

2012 - May

Requirements for Solder Paste Printing

A standard developed by IPC

Association Connecting Electronics Industries



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Requirements for Solder Paste Printing

Developed by the Solder Paste Printing Task Group Nordic (5-21JND) of the Component Mounting Subcommittee (5-21) of the Assembly and Joining Committee (5-20) of IPC

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Table of Contents

1 GENERAL	1	Figure 5-6	Centered Deposit	5
1.1 Scope	1	Figure 5-7	Centered Deposit	5
1.2 Purpose	1	Figure 5-8	Offset – Acceptable	5
1.3 Background	1	Figure 5-9	Offset – Acceptable	5
1.4 Terms and Definitions	1	Figure 5-10	Offset – Acceptable	5
1.4.1 Classification	1	Figure 5-11	Offset – Acceptable	5
1.4.2 Disposition*	1	Figure 5-12	Offset – Acceptable	6
1.4.3 Slumping	1	Figure 5-13	Offset – Acceptable	6
1.4.4 Combined Conditions	1	Figure 5-14	Offset – Defect	6
1.4.5 Designed Volume	1	Figure 5-15	Shorting – Defect	6
1.5 Specialized Designs	1	Figure 5-16	Offset – Defect	6
1.6 Verification of Dimensions	2	Figure 5-17	Area – Target	7
1.7 Magnification Aids	2	Figure 5-18	Area – Target	7
1.8 Lighting	2	Figure 5-19	Area – Acceptable	7
2 APPLICABLE DOCUMENTS	2	Figure 5-20	Area – Acceptable	7
2.1 IPC	2	Figure 5-21	Area – Defect	7
2.2 ASTM	2	Figure 5-22	Height – Target	8
3 CHOICE OF TECHNOLOGY	2	Figure 5-23	Height – Target	8
4 MEASUREMENT OF SOLDER PASTE DEPOSITS	3	Figure 5-24	Height – Process Indicator	8
5 SHAPE OF SOLDER PASTE DEPOSIT	4	Figure 5-25	Height – Defect	8
5.1 Solder Paste Deposit – Misalignment	4	Figure A-1	Solder Paste Printing with Squeegee Blades	9
5.1.1 Slump	4	Figure A-2	Solder Paste Printing with Enclosed Head System	9
5.1.2 Misregistration of Solder Paste Deposits	5	Figure A-3	Plastic from Packaging	9
5.1.3 Solder Paste Deposit – Area	7	Figure A-4	Glass Fiber from PCB	10
5.1.4 Solder Paste Deposit – Height	8	Figure A-5	Effect of Solder Mask	10
Appendix A Guideline for Operator Troubleshooting in the Solder Paste Screen Printing Process	9	Figure A-6	Effect of Silk Screen	10
		Figure A-7	Effect of Solder Paste	10
		Figure A-8	Result of Silk Screen Interference	10
		Figure A-9	Saddle Shape Deposit	10
		Figure A-10	Roof Top Shape Paste Deposit	10
		Figure A-11	Spikes on Paste Deposit	11
		Figure A-12	Increased Deposit Quantity	11
		Figure A-13	Decreased Quantity	11
		Figure A-14	Slumping/Smearing	11
		Figure A-15	Paste Residues	12
		Figure A-16	Long Smear	12
		Figure A-17	Offset	12
		Figure A-18	Excess Residue Along Direction of Travel	12
		Figure A-19	Residue Across Direction of Travel	13
		Figure A-20	Solder Balls	13
		Figure A-21	Close Up of Solder Balls	13
			Tables	
		Table 1-1	Inspection Magnification (Land Width)	2

Figures

Figure 3-1	Squeegee Blade	2
Figure 3-2	Enclosed Paste Print Head	3
Figure 3-3	Needle Dispense	3
Figure 3-4	Paste Jet Dispense	3
Figure 4-1	Sample of an Automated Machine Readout	3
Figure 4-2	Sample of an Automated Inspection Result	3
Figure 4-3	Weighing Solder Paste	3
Figure 5-1	Full Shape	4
Figure 5-2	Saddle Shape	4
Figure 5-3	Roof Top Shape	4
Figure 5-4	Pyramid Shape	4
Figure 5-5	Full Shape	4

Tables

Table 1-1	Inspection Magnification (Land Width)	2
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Requirements for Solder Paste Printing

1 GENERAL

1.1 Scope This standard is a collection of visual quality acceptability criteria for solder paste printing.

1.2 Purpose The purpose of this guideline document is to support the user in the visual evaluation of the solder paste printing process, which makes subsequent process optimizing possible.

The purpose of this guideline is not to inspect and evaluate the quality of the solder paste. For information on the evaluation of solder paste, see J-STD-005, *Requirements for Soldering Pastes* and IPC-HDBK-005.

The purpose is not to define requirements to stencil design. For information on stencil design, see IPC-7525, *Stencil Design Guideline*.

Appendix A provides different error types and suggested solutions are listed. The guideline is intended to help/improve the optimizing process for paste printing.

In the case of a discrepancy, the description or written criteria always takes precedence over the illustrations.

1.3 Background Standards such as J-STD-001 and IPC-A-610 provide tools that help to promote quality within the electronics industry. However, the standards do not include requirements of visual appearance of the paste deposit. The industry has, for some time, expressed a wish for a standard to support the users in the solder paste printing process. IPC-7527 will help improve the quality in this very sensitive process.

1.4 Terms and Definitions Other than those terms listed below, the definitions of terms used in this standard are in accordance with IPC-T-50. Terms quoted from IPC-T-50 are marked with *.

1.4.1 Classification

CLASS 1 General Electronic Products

Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired, but not critical. Typically the end-use environment would not cause failures.

CLASS 3 High Performance Electronic Products

Includes products where continued high performance or performance-on-demand is critical, equipment downtime

cannot be tolerated, or the end-use environment may be uncommonly harsh.

Target Condition A condition that is close to perfect/preferred, however, it is a desirable condition and not always achievable and may not be necessary to ensure reliability of the assembly in its service environment.

Acceptable Condition Indicates a condition that, while not necessarily perfect, will maintain the integrity and reliability of the assembly in its service environment.

Defect Condition A condition that may be insufficient to ensure the form, fit, or function of the assembly in its end use environment. Defect conditions **shall** be dispositioned by the manufacturer based on design, service, and customer requirements. Disposition may be to rework, repair, scrap, or use as is. Repair or use as is may require customer concurrence.

A defect for Class 1 automatically implies a defect for Class 2 and 3. A defect for Class 2 implies a defect for Class 3.

1.4.2 Disposition* The determination of how defects should be treated. Dispositions include, but are not limited to, rework, use as is, scrap, or repair.

1.4.3 Slumping Solder paste flows out after it is applied. See more in IPC-HDBK-005.

1.4.4 Combined Conditions There may be situations where a combination of maximum deviations in form, placement, coverage, and height can result in lack of soldering or wrong amount of solder paste. The manufacturer is responsible for identification of such conditions.

1.4.5 Designed Volume The designed volume is equal to the area of the stencil aperture times the stencil thickness (volume = length x width x height). Volume is not a visually inspectable condition.

1.5 Specialized Designs This standard, as an industry consensus document, cannot address all of the possible components and product design combinations. Where uncommon or specialized technologies are used, it may be necessary to develop unique acceptance criteria. However, where similar characteristics exist, this document may provide guidance for product acceptance criteria. Often, unique definition is necessary to consider the specialized characteristics while considering product performance criteria. The development should include customer involvement or consent. For Class 3, the criteria **shall** include agreed definition of product acceptance.

Whenever possible these criteria should be submitted to the IPC Technical Committee to be considered for inclusion in upcoming revisions of this standard.

1.6 Verification of Dimensions The actual measurements provided in this document (i.e., specific part mounting and solder fillet dimensions and determination of percentages) are not required except for referee purposes. All dimensions in this standard are expressed in SI (System International) units (with Imperial English equivalent dimensions provided in brackets). All specified limits in this standard are absolute limits as defined in ASTM E29.

1.7 Magnification Aids For visual inspection, some individual specifications may call for magnification aids for examining solder paste print.

The tolerance for magnification aids is $\pm 15\%$ of the selected magnification power. Magnification aids, if used for inspection, **shall** be appropriate for the item being inspected. Unless magnification requirements are otherwise specified by contractual documentation, the magnifications in Table 1-1 are determined by the item being inspected.

Referee conditions are used to verify product rejected at the inspection magnification power. For assemblies with mixed land widths, the greater magnification may be used for the entire assembly.

Table 1-1 Inspection Magnification (Land Width)

Land Widths or Land Diameters	Magnification Power	
	Inspection Range	Maximum Referee
>1.0 mm [0.0394 in]	1.5X to 3X	4X
>0.5 to $\leq$ 1.0 mm [0.0197 to 0.0394 in]	3X to 7.5X	10X
$\geq$ 0.25 to $\leq$ 0.5 mm [0.00984 to 0.0197 in]	7.5X to 10X	20X
<0.25 mm [0.00984 in]	20X	40X

1.8 Lighting Lighting **shall** be adequate for the item being inspected.

Illumination at the surface of workstations should be at least 1000 lm/m² [approximately 93 foot candles]. Light sources should be selected to prevent shadows.

Note: In selecting a light source, the color temperature of the light is an important consideration. Light ranges from 3000-5000° K enable users to distinguish various solder paste printing features and contaminants with increased clarity.

2 APPLICABLE DOCUMENTS

The following documents currently in effect form a part of this specification to the extent specified herein.

2.1 IPC¹

IPC-J-STD-005 Requirements for Soldering Pastes

IPC-HDBK-005 Guide to Solder Paste Assessment

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

IPC-A-610 Acceptability of Electronic Assemblies

IPC-7525 Stencil Design Guidelines

IPC-7526 Stencil and Misprinted Board Cleaning Handbook

2.2 ASTM²

ASTM E29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3 CHOICE OF TECHNOLOGY

The requirements in this standard have been developed for solder paste printing. Since the requirements are referred to as general, it is also possible to evaluate other application methods according to this standard. However, it may be necessary to develop specific acceptance requirements for the chosen application method.

Various methods can be used when solder paste is applied to the PCB (printed circuit board). Four methods are illustrated here:

- Squeegee Blade (Figure 3-1)
- Enclosed Print Head (Figure 3-2)
- Needle Dispense (Figure 3-3)
- Paste Jet Dispense (Figure 3-4)

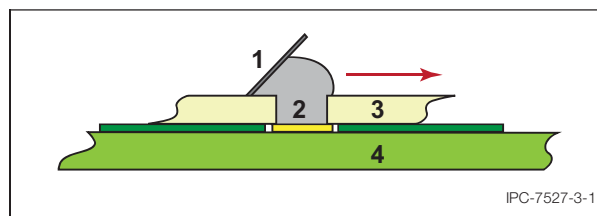


Figure 3-1 Squeegee Blade

1. Squeegee
2. Paste
3. Stencil
4. PCB

1. www.ipc.org
2. www.astm.org

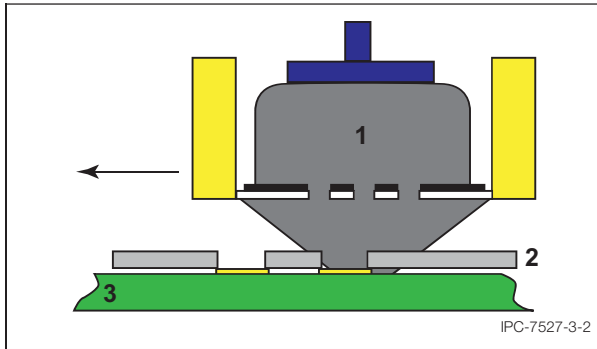


Figure 3-2 Enclosed Paste Print Head

1. Enclosed Paste Head
2. Stencil
3. PCB

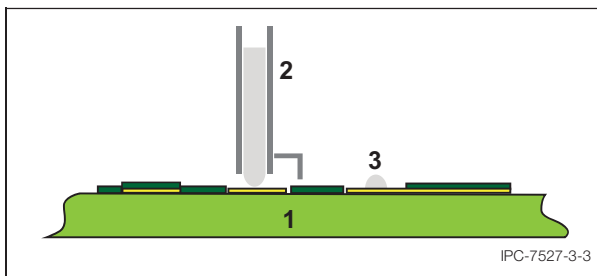


Figure 3-3 Needle Dispense

1. PCB
2. Needle Dispenser
3. Paste Deposit

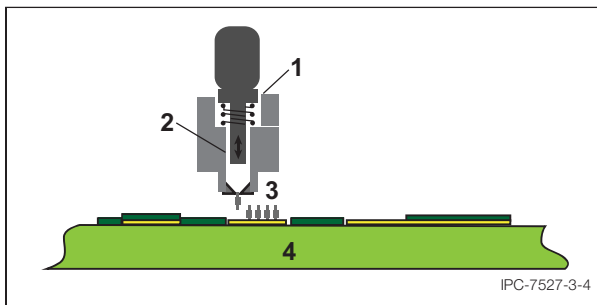


Figure 3-4 Paste Jet Dispense

1. Motor
2. Paste
3. Paste Deposit
4. PCB

4 MEASUREMENT OF SOLDER PASTE DEPOSITS

Various types of equipment can be used to measure the solder paste print. The measurement can be done manually or with an automatic inspection system. Figures 4-1 and 4-2 illustrate the results from two automated methods of paste measurement. It is often necessary to perform measurements in order to control the amount of solder paste. This paragraph is not a step by step process requirement, but an overview of technologies that can be implemented when measuring the amount of solder paste.

Follow the manufacturer's instructions when using automated measuring equipment. Each automated inspection

equipment manufacturer may use different equations to determine height, area, and volume of the solder deposit. It is up to the user of this standard to translate from this guideline to the individual automated inspection equipment.



Figure 4-1 Sample of an Automated Machine Readout
(Screen Capture Courtesy of CyberOptics Corporation)

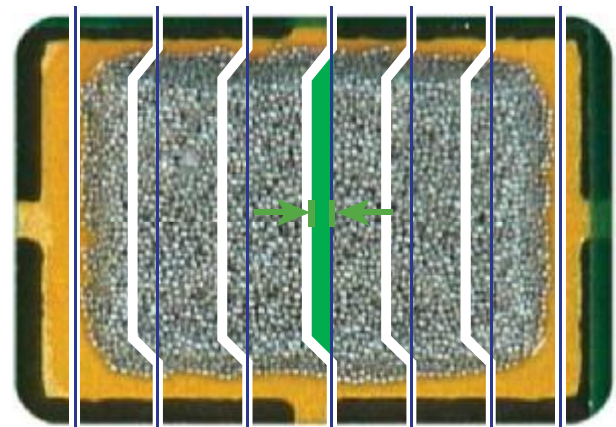


Figure 4-2 Sample of an Automated Inspection Result
(Image Courtesy of HYTEK)

Controlling the amount by weighing the PCB shows the total amount of solder paste on the board (Figure 4-3). By comparing the result with a PCB, with a correct amount of solder paste, you will get an exact indication of potential deviance.

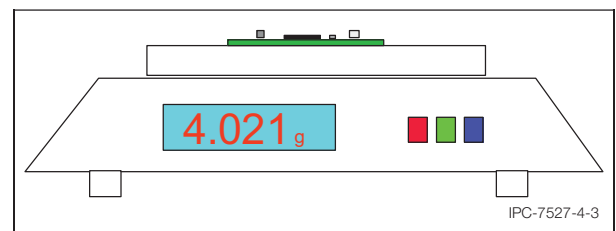


Figure 4-3 Weighing Solder Paste