

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Review Questions

1. Minimum end joint width for castellated terminations on a Class 2 product is _____.
- A. 100% (W).
 - B. 25% (W).
 - C. 50% (W).**
 - D. 75% (W).

C, Clause 7.5.6 Table 7-6, Page 29

2. For Class 3, a chip component with exposed deposited electrical element that is mounted with the element towards the printed board surface is a _____.

Process Indicator, Clause 7.5.4, Page 27

3. The minimum side joint length (D) for “J” leads on a Class 2 assembly is _____.
- A. an unspecified parameter
 - B. 150% (W).**
 - C. 50% (W).
 - D. Wetting is evident.

B, Clause 7.5.9 Table 7-9, Page 32

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

4. Minimum solder thickness for bottom only terminations on Class 3 assemblies is ____.
- A. an unspecified parameter.
 - B. wetting is evident.**
 - C. 50% (H).
 - D. 75% (W).

B, Clause 7.5.3 Table 7-3 Note 3, Page 26

5. Components which have been configured for surface mounting on Class 2 assemblies utilizing butt connections may have a maximum side overhang of ____.
- A. 50% (W).
 - B. 25% (W).
 - C. 75% (W).
 - D. 0%, side overhang is not permitted.**

D, Clause 7.5.10 Table 7-10, Page 33

6. Lead deformation (unintentional bending) may be allowed provided ____.
- A. there shall be no evidence of a short or potential short existing.**
 - B. solder shall not touch the package body or end seal.
 - C. maximum toe overhang shall not violate minimum electrical clearance.
 - D. properly wetted fillet shall be evident.

A, Clause 7.1.1 a, Page 23

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

7. The minimum end joint width on an inward formed L-shaped ribbon lead for Class 2 is _____.

50% W, Clause 7.5.13 Table 7-13, Page 36

8. The minimum toe (end) fillet height on a BTC for a Class 2 product is _____.

Not Required, Clause 7.5.15 Table 7-17, Note 5, Page 39

9. A Flattened Post connection with 75% termination overhang for Class 2 on a square solder land is _____.

- A. Defect
- B. Acceptable
- C. Target
- D. Process Indicator

A, Clause 7.5.17 Table 7-19, Page 41

10. When the outer, lower edge of land areas are lifted greater than twice the thickness (height) of the land, the condition is considered:

- A. a process indicator for all product classes
- B. a defect for Class 3 only
- C. acceptable Class 1, Process Indicator Class 2, and Defect Class 3
- D. **a defect for all Product Classes**

D, Clause 9.1.4, Page 44

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

11. Bow and twist after soldering should not exceed _____ for through-hole, or for surface mount printed circuit board applications and shall not cause damage during post solder assembly operations or use.

1.5%, 0.75%, Clause 9.3, Page 44

12. Blistering or delamination(s) more than _____ of the distance between plated- through holes or internal conductors is classified a defect for all product classes.

25%, Clause 9.1.1, Page 43

13. Measled areas in laminate substrates greater than 50% of the physical space between internal conductors on a class 3 assembly is _____.

- A. Acceptable**
- B. Process Indicator
- C. Defect
- D. Not permitted

A, Clause 9.1.10, Page 44

14. The minimum-maximum thickness of silicone conformal coating material is _____.

- A. 0.03-0.13 mm
- B. 0.05-0.21 mm**
- C. 0.01-0.05 mm
- D. 0.10-0.25 mm

B, Clause 10.1.2.1, Page 45

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

15. Visual inspection of conformal coating may be performed _____.

- A. at 4X to 6X magnification
- B. at 2X to 4X magnification
- C. without magnification**
- D. at 10X to 40X magnification

C, Clause 10.1.3, Page 46

16. Dimensions of masked areas shall not be decreased in length, width, or diameter by more than _____ by application of conformal coating.

- A. 0.75 mm**
- B. 0.50 mm
- C. 0.05 mm
- D. 0.25 mm

A, Clause 10.1.1, Page 45

17. When coating or encapsulation materials are applied to glass body components, the components shall be _____ to prevent cracking.

Sleeved, Clause 10.3 e, Page 46/47

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

18. Magnification up to _____ may be used for referee purposes when inspection conformal coating.
- A. 2X
 - B. 10X
 - C. 4X -10X
 - D. 4X**

D, Clause 10.1.3, Page 46

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

**SURFACE MOUNT COMPONENTS SOLDERING
DEMONSTRATION**

Note: The use of Lead Free Solder is at the discretion of the instructor.

**SURFACE MOUNT COMPONENTS SOLDERING
DEMONSTRATION**

Hand out Paperwork and Explain:

- PCB Drawing
- SMT PCB Skill building and Workmanship Critique Forms/Grading

PCB Preparation

- Solder Deposition (Wire Solder)

Component Mounting

- Leaded Component Positioning
- Leadless Component Positioning

Soldering

- Point to Point Soldering Leadless Components
- Tack Soldering Leaded Components
- Point to Point Soldering Leaded Components

Cleaning

Inspection and Documentation

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Introduce the students to the content of the workstation

Display and discuss the tools you will be using, explaining the purpose of each.

Tools:

- Workstation
- Illumination source
- Magnification aid/Scope
- Soldering iron with appropriate tip(s)
- Workpiece holder/vice
- Acid brush
- Soldering Aids
- Tweezers

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Materials:

- PCB (2) (Workmanship and Skill building)
- Components
 - 4 – 0805 Resistors
 - 4 – 1206 MELF Diodes
 - 4 – 1206 Capacitors
 - 4 – 1206 Resistors
 - 2 – 14-Pin SOIC
 - 2 – 20-Pin PLCC
 - 2 – 100 Pin QFP
- Wire solder
- Liquid flux (optional)
- Cleaning Solvent (If required)

Note: When soldering using lead free solder the PCB and components need to be compatible.

Review:

- Material Safety Data Sheets for hazardous materials that they will be in contact with
- Facility Safety Equipment Locations (Fire Extinguishers, emergency eye-wash stations, etc.)
- Personal safety practices around solder pots, soldering irons, and cleaning solvents
- Assure that all student have/use protective eye-wear

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

DEMONSTRATE CHIP COMPONENT SOLDERING

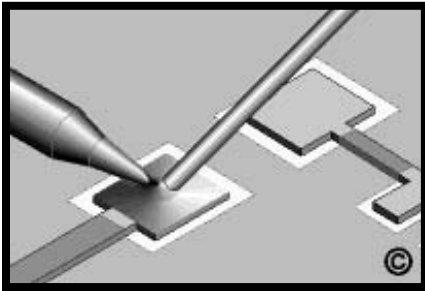


Figure 1

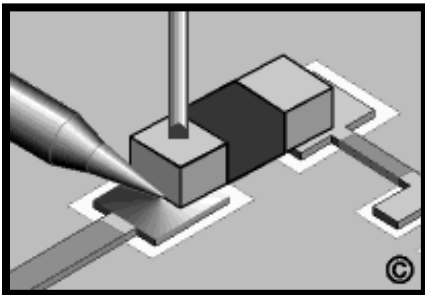


Figure 2

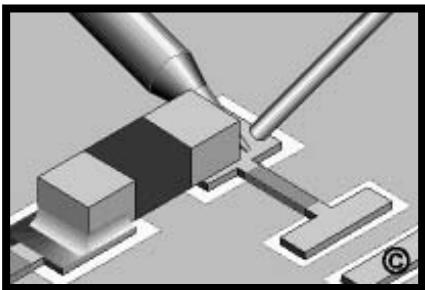


Figure 3

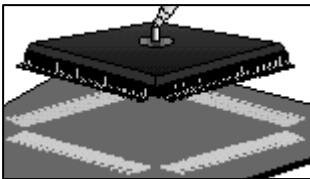
DEMONSTRATE CHIP COMPONENT SOLDERING

PROCEDURE

1. Install soldering iron tip in handpiece.
2. Start with tip temperature of approximately 315°C and change as necessary.
3. Apply flux to one land (optional).
4. Thermal shock tip with damp sponge.
5. Prefill one land with solder. (See Figure 1.)
6. Place the component in position and hold it with a wooden stick or tweezers.
7. Apply flux to both lands.
8. Place the tip at the junction between the prefilled land and termination area of component.
9. Observe complete solder melt. This is evident by component dropping down onto land. area. (See Figure 2.)
10. Pause briefly for solder to solidify
11. Solder remaining side by applying additional solder as needed. (See Figure 3.)
12. Re-tin tip end with solder and return handpiece to its stand.
13. Clean lands as required for component replacement.

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

**DEMONSTRATE GULL WING LEAD COMPONENT
SOLDERING**



**Figure 1: Position
Component**

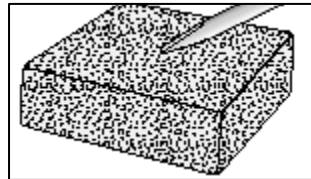


Figure 4: Clean Tip

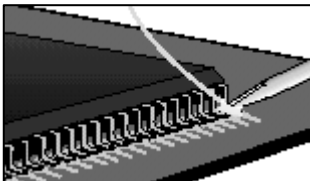
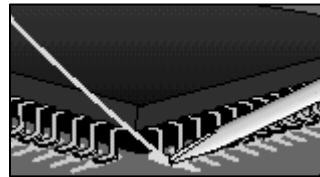
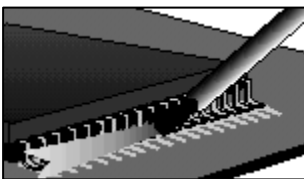


Figure 2: Tack Lead



**Figure 5: Solder
Leads**



**Figure 3: Apply
Flux**

**DEMONSTRATE GULL WING LEAD COMPONENT
SOLDERING**

PROCEDURE

1. Install tip into soldering handpiece.
2. Start with temperature of approximately 315°C and change as necessary.
3. Position component ensuring proper lead-to-land alignment. Hold component in place using the vacuum pick up tool or tweezers. (See Figure 1.)
4. Apply flux and tack solder opposing corner leads. (See Figure 2.)
5. Apply flux to remaining lead/land areas of the row to be soldered. (See Figure 3.)
6. Clean tip using a damp sponge. (See Figure 4.)
7. Position tip on lead. Apply solder to the lead/land area to form proper solder fillet. (See Figure 5.)
8. Repeat step 7 on remaining leads of component.
9. Re-tin tip with solder.
10. Clean, if required, and inspect.

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

DEMONSTRATE J-LEAD COMPONENT SOLDERING

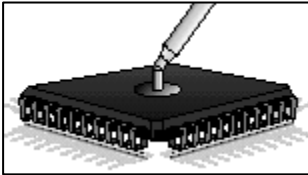


Figure 1: Position Component.

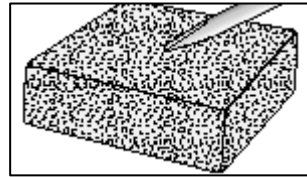


Figure 4: Clean Tip.

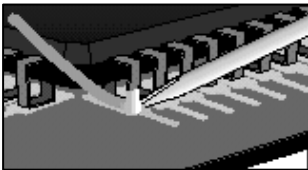


Figure 2: Tack Lead.

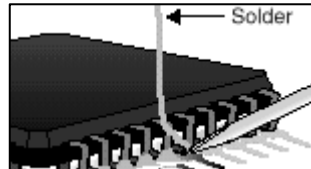


Figure 5: Solder Leads.

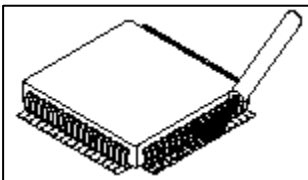


Figure 3: Apply Flux.

DEMONSTRATE J-LEAD COMPONENT SOLDERING

PROCEDURE

1. Install tip into soldering handpiece.
2. Start with tip temperature of approximately 315°C and change as necessary.
3. Position component ensuring proper lead-to-land alignment. Hold component in place using the vacuum pick-up tool or tweezers. (See Figure 1.)
4. Apply flux and tack solder opposing corner leads. (See Figure 2.)
5. Apply flux to remaining lead/land areas of the row to be soldered. (See Figure 3.)
6. Clean tip using a damp sponge. (See Figure 4.)
7. Position tip at intersection of lead and land. Apply solder to the lead/land area to form proper solder fillet. (See Figure 5.)
8. Repeat step 7 on remaining leads of component.
9. Re-tin tip with solder.
10. Clean, if required, and inspect.

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Inspection of Assembly

**CONDUCT A VISUAL INSPECTION OF THE
DEMONSTRATION ASSEMBLY (Use Magnification
Aids as appropriate).**

- Review Appendix A Summary of Criteria Requiring Disposition to Nonconforming Conditions and identify the defects that would apply.

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
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CERTIFIED IPC SPECIALIST (CIS)**

**STUDENT SKILLS DEVELOPMENT AND
DEMONSTRATION LABORATORY**

**STUDENT SKILLS DEVELOPMENT AND
DEMONSTRATION LABORATORY**

During the student laboratory period the Instructor is to circulate through the laboratory monitoring the progress of students, answering questions, providing constructive criticism and praising the activities of the students.

The Instructor must inspect and grade the workmanship sample submitted by each student. The Instructor must inspect each workmanship sample previously inspected by each student and, in addition to grading the student inspection skill, critique and counsel the student regarding inappropriate inspection calls.

The acceptance criteria of J-STD-001E for Class 3 products shall be used to evaluate all samples.

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Inspection Grading

SMT(80%)

Assembly = 162

Solder = 162

R3 = 3

R4 = 3

C3 = 3

C4 = 3

CR3 = 3

CR4 = 3

R5 = 3

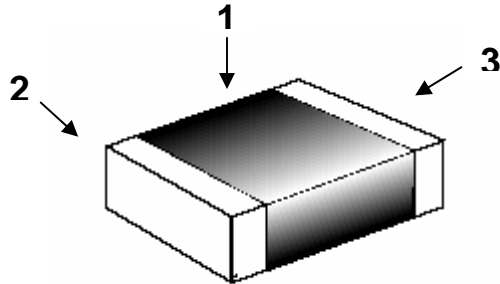
R6 = 3

U3 = 15

U4 = 101

U5 = 21

PCB = 1



Inspection Grading

Using the J-STD-001 PCB Kit the normalizing number is as shown. Reminder you have both assembly and solder calculations. Each student must have 80% or greater in all areas.

The following are a few grading examples. See Next Page.

Example 1: If a student has a defect (in this case solder) and they identify the defect correctly they would receive a -1 for the defect but 0 for the inspection.

Example 2: If a student has a defect and they do not identify it then they would receive -1 for the defect and -1 for inspection.

Example 3: If a student identifies a defect (either assembly or solder) incorrectly and there is no defect then they receive a -1 on inspection.

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Examples

Item	Qty.	MIT/CIT Initials		Student Initials	MIT/CIT Initials		Student Initials
		SMT Assy.	SMT Insp.	SMT Assembly	SMT Solder	SMT Solder Insp.	SMT Solder Insp.
R3, 4 0805 Resistor	2	-0 <i>DL7</i>	-0 <i>DL7</i>	<i>MAS</i>	-1 <i>DL7</i>	-0 <i>DL7</i>	<i>MAS</i> NonWetting
C3, 4 1206 Capacitor	2	-1 >25% Side Overhang <i>DL7</i>	-1 >25% Side Overhang <i>DL7</i>	<i>MAS</i>	<i>DL7</i>	<i>DL7</i>	<i>MAS</i>
CR3, 4 1206 MELF Diode	2	No Damage <i>DL7</i>	-1 <i>DL7</i>	Damaged Component <i>MAS</i>	<i>DL7</i>	<i>DL7</i>	<i>MAS</i>

IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM

LESSON PLAN FOR TRAINING

CERTIFIED IPC SPECIALIST (CIS)

Calculating Student Grade:

SMT Assembly & Inspection

If a student's project has 6 assembly defects, subtract the number of defects from the normalizing number (in this case the Instructor Guide states that there are 162 assembly opportunities) to get $162 - 6 = 159$. To get the grading score divide 159 by 162 and multiply the answer by 100. This gives an **SMT assembly grade** of 96.29%. Record the SMT assembly Total Missed Opportunities number and Percentage grade on the bottom of the grade sheet.

The formula for calculating the **SMT inspection grade** is exactly the same as calculating the assembly grade. If the student correctly identifies all soldering defects the assembly inspection grade would be 100%. If the student only correctly identifies 3 of the 6 defects in this example, the assembly score doesn't change-it's still 96.29%-but the assembly inspection grade would be 95.38%. This was derived by subtracting the 3 missed defects from the normalizing number (162 assembly opportunities) = 159. Divide 159 by 162 and multiply the answer by 100 to get the SMT assembly inspection grade of 98.14%. Record the SMT assembly inspection Total Missed Opportunities number and Percentage grade on the bottom of the grade sheet.

SMT Soldering & Inspection

Soldering and soldering inspection grading is done the same way as assembly grading. In this example the project has 12 solder defects and the instructor guide has established that there are 162 soldering opportunities. $162 - 12 = 150$, divided by 162 and multiplied by 100 is an **SMT soldering grade** of 92.59%. Record the SMT soldering Total Missed Opportunities number and Percentage grade on the bottom of the grade sheet

If the student correctly identifies all soldering defects the SMT solder inspection grade would be 100%. If the student only identifies 8 out of the 12 defects correctly then the solder score is still 92.59% but the **solder inspection score** would be $162 - 4 = 158$, divided by 162 and multiplied by 100 = 97.53%. Record the SMT soldering inspection Total Missed Opportunities number and Percentage grade on the bottom of the grade sheet

Continued on next page.

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LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Calculation of Final SMT Workmanship and Inspection Grades

Final Workmanship Grade – Obtain the SMT assembly and solder percentages and add the two together. Take the total and divide by two to calculate the final SMT workmanship grade. Record this grade at the top of the grade sheet.

Final Inspection Grade - Obtain the SMT assembly inspection and solder inspection percentages and add the two together. Take the total and divide by two to calculate the final SMT inspection grade. Record this grade at the top of the grade sheet.

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
LESSON PLAN FOR TRAINING
CERTIFIED IPC SPECIALIST (CIS)**

Written Examination:

30 Question Open Book Test (only J-STD-001E may be used as reference material during the test).

It is recommended that a 1-hour period be allocated for the examination and review (40-minutes for the examination and 20-minutes for the review).

**IPC J-STD-001E TRAINING AND CERTIFICATION PROGRAM
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Written Examination

Administer the Module 4 Final Examination

- Grade the Examination.
- Discuss each missed question with the class, identifying the correct answer and discussing (if necessary/appropriate) the technical rationale for the answer.
- Perform Administrative Procedures.

Note: Certification is granted for each of the optional Modules 2-5 if the open book test score for each module is 70% or above and workmanship scores are satisfactory. The open book test scores for optional Modules 2-5 are not averaged.