

Fox Valley Technical College

10605106 Solder Rework & Repair-IPC Prep

Course Outcome Summary

Course Information

Description	Teaches students the skills on how to produce high-quality soldered connections that meet the IPC standard regarding materials, methods, and verification through inspection.
Career Cluster	Science, Technology, Engineering and Mathematics
Instructional Level	Associate Degree
Total Credits	1.00
Total Hours	36.00

Types of Instruction

Instruction Type	Credits/Hours
Lab	1 credit/36 hours

Course History

Revised By	Gary Herlache (herlache)
Last Approval Date	11/10/2014

Textbooks

Quality Hand Soldering and Circuit Board Repair
H. (Ted) Smith
Delmar Cengage Learning
ISBN: 9781111642662
6th Edition

Learner Supplies

TK-15-J-STD-001 Certified IPC Specialist Soldering Kit
Vendor: Omni Training
www.omnittraining.com

TK-18 or equivalent
<http://www.omnittraining.com/>

Employability Essentials

1. **Act Responsibly - Apply ethical standards in both personal and professional behavior.**
Status Active
2. **Adapt to Change - Anticipate changes and positively respond to them.**
Status Active
3. **Communicate Effectively and Respectfully - Apply appropriate writing, speaking, and listening skills across various settings to engage diverse audiences.**
Status Active
4. **Think Critically and Creatively - Apply independent and rigorous reasoning that leads to informed decisions, innovation and personal empowerment.**
Status Active
5. **Work Collaboratively - Work collaboratively with others to complete tasks, solve problems, resolve conflicts, provide information, and offer support.**
Status Active

Program Outcomes

1. **Apply electronic theory to practice.**
Status Active

Summative Assessment Strategies

- 1.1. TSA

Criteria

- 1.1. You mathematically analyze a circuit or system
- 1.2. You simulate a circuit or system
- 1.3. You construct a circuit or system according to schematics or other documentation
- 1.4. You perform circuit or system measurements to collect data
- 1.5. You analyze data to validate predicted outcome

2. **Operate test equipment.**
Status Active

Summative Assessment Strategies

- 2.1. TSA

Criteria

- 2.1. You demonstrate measurement of electrical and/or electronic signals
- 2.2. You demonstrate measurement of electrical and/or electronic quantities
- 2.3. You demonstrate measurement of electrical and/or electronic components
- 2.4. You use test equipment to generate electrical and/or electronic signals
- 2.5. You apply appropriate safety precautions

3. **Build electronic circuits and systems.**
Status Active

Summative Assessment Strategies

- 3.1. TSA

Criteria

- 3.1. You assemble a prototype for operation
- 3.2. You demonstrate soldering and de-soldering techniques
- 3.3. You apply appropriate antistatic precautions
- 3.4. You identify appropriate interfaces
- 3.5. You set up programmable devices and/or systems
- 3.6. You apply appropriate safety precautions

4. Evaluate the operation of electronic circuits or systems.

Status Active

Summative Assessment Strategies

4.1. TSA

Criteria

- 4.1. You determine the correct operation of circuits or systems
- 4.2. You identify incorrect operation of circuits or systems
- 4.3. You isolate causes of failures in circuits or systems
- 4.4. You correct failures in circuits or systems

5. Communicate technical information.

Status Active

Summative Assessment Strategies

5.1. TSA

Criteria

- 5.1. You interpret electrical and/or electronic diagrams
- 5.2. You create electrical and/or electronic diagrams
- 5.3. You interpret technical reports and documents
- 5.4. You use appropriate terminology in speaking and writing
- 5.5. You interpret documentation of electronic devices and systems
- 5.6. You locate necessary resources and pertinent information to perform work functions

Course Competencies

1. Investigate IPC specifications for soldering, repair, and modifications of electronic components and assemblies

Status Active

Assessment Strategies

1.1. by classifying the 3 types of electronic assemblies into a list

Criteria

You will know you are successful when:

- 1.1. you research the different classifications of electronic assemblies and can explain the difference between them
- 1.2. you list the criteria for a class 3 solder joint for a through hole component
- 1.3. you describe what minimum electrical clearance is
- 1.4. you list the possible conditions for damaged to a PCB
- 1.5. you list the steps necessary to replace a defective component either through hole or surface mount
- 1.6. you list methods to fix a damaged land or conductor
- 1.7. you list the different kinds of fluxes and select the least corrosive flux
- 1.8. you list the different categories of solders and identify which one to use in electronic repair causing the least amount of possible corrosion
- 1.9. you list the problems that can be caused by improper lead formation

Learning Objectives

- 1.a. Differentiate between the 3 classifications of electronic equipment, Class 1, 2, and 3
- 1.b. Review the various kinds of fluxes used in soldering
- 1.c. Differentiate the classification of through hole component solder joints for Class 1, 2, and 3
- 1.d. Differentiate the classification of surface mount component solder joints for Class 1, 2, and 3

2. Prepare soldering workstation and work area

Status Active

Assessment Strategies

2.1. be aware of the safety concerns related to working with high temperatures, working with heavy metals

- and eye protection
- 2.2. collect soldering aids and tools needed for the soldering processes you are about to undertake
- 2.3. determine if you will be working with static sensitive devices and if so, what steps you need to take

Criteria

You will know you are successful when:

- 2.1. you clean the work area of any debris or food materials
- 2.2. you verify access to the various soldering tips you may need
- 2.3. you verify you have flux available
- 2.4. you verify you have cleaning materials and solvents as needed
- 2.5. you install the first tip you will be using based on the components you will be soldering
- 2.6. you power up the soldering station and set to 600 degrees Fahrenheit
- 2.7. you clean the tip so the complete area of the tip appears shiny and is coated with solder
- 2.8. you adjust lighting, magnification, and ventilation as needed

3. Demonstrate soldering of through hole and surface mount components using IPC J STD-001E specifications

Status *Active*

Assessment Strategies

- 3.1. in the Soldering laboratory
- 3.2. with the proper preparation of the work area and setup of the soldering station
- 3.3. without the use of references [or with the use of a specific job aid]

Criteria

You will know you are successful when:

- 3.1. you follow safety procedures
- 3.2. you wear personal protective equipment
- 3.3. you insert the component parallel with the PCB, verify polarity, and clinch the leads over to hold the component in place
- 3.4. you inspect the component body to confirm it is parallel to the PCB and tight against the board
- 3.5. you solder the through hole component and tin a wire to class 3 IPC specifications
- 3.6. you perform an inspection to confirm a class 3 solder joint
- 3.7. you present the PCB to the instructor for inspection
- 3.8. you pre-tin the land for a surface mount component
- 3.9. you tack 1 to 2 leads of the SMT component depending on type of component and you must conform to class 3 specifications
- 3.10. you solder all leads conforming to class 3 specifications
- 3.11. you inspect the finished work confirming class 3 solder joints
- 3.12. you clean the board of all flux residue

Learning Objectives

- 3.a. Tin wire
- 3.b. Tin an axial leaded component
- 3.c. Form the leads of an axial component
- 3.d. Solder a minimum of 6 axial leaded components to a dual sided PCB to class 3 specifications
- 3.e. Form the leads of a wire to match the terminal to be soldered too
- 3.f. Solder a wire to a terminal to the level of class 3
- 3.g. Solder 6 different types of SMT components, gull wing, MELF, fine pitch

4. Demonstrate replacement of through hole and surface mount components using IPC 7711 and 7721 specifications

Status *Active*

Assessment Strategies

- 4.1. Demonstrate correct removal and replacement of both through hole and SMT components
- 4.2. the PCB will need to be cleaned prior to re-installation of components

Criteria

You will know you are successful when:

- 4.1. you have successfully removed the targeted component without damage to it or the PCB
- 4.2. you clean the PCB of any flux or debris using 2 approved methods for solder removal
- 4.3. you replace the component using class 3 processes
- 4.4. you inspect the component verifying Class 3 solder joints

Learning Objectives

- 4.a. Remove 5 through hole components and 5 surface mount components with out damaging the PCB
- 4.b. Clean the PCB
- 4.c. Replace the components and solder
- 4.d. Inspect all joint to confirm class 3 solder joint specifications, rework as needed

5. Repair PCB wiring and assemblies using IPC 7711 and 7721 specifications

Status *Active*

Assessment Strategies

- 5.1. You will be provided a PCB with a damaged trace and a burned portion of the PCB
- 5.2. Use of polyimide tape will be explained for the repair of traces

Criteria

You will know you are successful when:

- 5.1. you will repair a damaged PCB circuit trace
- 5.2. you will test the trace for adherence to the PCB using a tape pull test
- 5.3. you will remove the burned portion of the PCB using a dremel tool with a ball bit
- 5.4. you will cut a slot into the base of the ground out section around the perimeter of the hole using a saw blade in the dremel tool
- 5.5. you will use an epoxy mix to fill the hole being care to use slightly more epoxy than is needed to fill the hole
- 5.6. you inspect the cured epoxy to be flush with the surface of the PCB, if not grind off excess and clean as needed

Learning Objectives

- 5.a. Create a splice on a 22 gauge wire to class 3 specifications
- 5.b. Repair a broken circuit path
- 5.c. Repair a burned area on a PCB
- 5.d. Clean the PCB assembly
- 5.e. Inspect the repairs for compliance

Grading Information

SYLLABUS:

Course: Solder Rework and Repair – IPC Prep class

IPC Requirements for Soldered Electrical and Electronic Assemblies, along with Repair of Electronic Assemblies and circuit boards has emerged as the preeminent authority for electronics assembly manufacturing worldwide. The standards describes materials, methods and verification criteria for producing high-quality soldered leaded and lead-free interconnections as well as the repair of those components and circuit boards. It emphasizes process control and establishes industry consensus requirements for a broad range of electronic connections.

This course teaches IPC industry-approved techniques on through hole and surface mount soldering techniques. Also covered in the course will be the repair of land, conductor, and laminate PCB repair. The training will be based on a scaled down version the procedures from IPC certifications of both the IPC- IPC J-STD-001D Requirements for Soldered Electrical and Electronic Assemblies and the 7711A/772A Rework of Electronic Assemblies/Repair and Modification of Printed Boards and Electronic Assemblies.

The course is intended to provide an overview of IPC methods and will teach the basic techniques to be able to perform soldering and repair at a high quality level. The time allotted for this course will not be enough to complete IPC certification requirements but will cover the basics of the certifications. Successful students will be able to perform tasks at very high levels and are encouraged to pursue certifications.

Course Topics:

- General requirements such as safety, tools and electrostatic discharge (ESD)
- Wire- and terminal-assembly requirements, demonstrations and labs
- Through-hole technology requirements, demonstrations and labs
- Surface mount technology requirements, demonstrations and labs
- General soldered connection acceptance requirements (including lead free)
- Test methods and related standards
- Statistical process control methodology
- Inspection skills
- Product classifications, skill levels, tools and materials
- Basic surface mount and through hole component removal
- Land preparation and component installation
- Primary heating methods: conductive, convective and others
- Handling electronic assemblies
- Wire splicing procedures
- Through hole component removal and installation
- Chip and MELF rework procedures
- SOIC/SOT, J-lead and QFP rework
- Printed wiring board circuit and laminate repair
- Conformal coating removal

Competencies

Safety

The student will be able to identify proper safety equipment and demonstrate proper safety techniques while soldering terminals and components.

Identify the Classes of Electronic Assemblies

The student will be capable of identifying soldering proficiencies/deficiencies in all 3 classifications levels.

Research flux criteria

Students will be able to research different flux classifications and develop a basic understanding of the function of fluxes in general and the individual characteristics of the different classifications.

Able to correctly identify components

Students will be able to identify different types of electronic components, lead configurations, correct orientation, and lead formation needs.

Soldering

Students will be able to demonstrate soldering skills at class 3 standards on: wire terminals, through hole, and surface mount components.

Research soldering acceptance criteria

Students will be able to research IPC criteria in standards documents and correctly identify compliance for all 3 classes and in each of the soldering skills areas.

Rework

The student will be capable of reprocessing non-complying articles, through the use of original or equivalent processing, in a manner that assures full compliance of the article with applicable drawings or specifications.

Repair

The student will be capable of restoring the functional capability of a defective article in a manner that precludes compliance of the article with applicable drawings or specifications.

Modification

The student will be capable of the revision of the functional capability of a product in order to satisfy new acceptance criteria. Modifications are usually required to incorporate design changes which can be controlled by drawings, change orders, etc.

Class Policies

Grading Policy:

The following are cutoff percentages for the grades listed.

- 92% > A
- 84% - 92% B
- 76% - 83% C
- 68% - 75% D
- 68% < F

A points system will be used for this course. Labs will be worth approximately 10 points, Tests 30, quizzes 10, and worksheets will vary depending on subject. I will keep a record of your points and a total point value as we go along. You can see your records at any time.

Attendance: Per district policy - Students can miss up to 10% of class and then will be dropped. In the event that you need to miss a class, please discuss this with your instructor and make arrangements for missed assignments. Please see

other students for notes for the class period you miss. If you contact the Instructor ahead of class, via e-mail or telephone with a legitimate reason for your absence, allowances will be made.

Course grade is dependent upon test scores, worksheets and participation in class. Quizzes may be given at any time and will also affect student grades.

Late assignments will be accepted, but points will be deducted. Make-up exams can be scheduled in the case of illness or emergency with the instructor's permission.

Requirements for successful completion of the course:

- Complete all work assignments
- Complete all tests
- Comply to attendance policies of the college

Lab rules:

- Students are free to leave if they need to.
- Students are encouraged to participate in lab discussions.
- Any experiences that can be related are welcomed.
- Tests are an individual effort unless specified by the instructor. Anyone violating this rule would have his or her test scored as a zero.
- If you have to miss lecture due to work let me know.

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Grant Award

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the

U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including, but not limited to, accuracy of information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

Auxiliary aids and services are available upon request to individuals with disabilities.

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Course Learning Plans and Performance Assessment Tasks

Type	Title	Source	Status
PAT	Lab 1: Overview of IPC	Course	Active
PAT	Lab 2: Setting up the Workstation	Course	Active
PAT	Lab 3: Setting up the Workstation	Course	Active
PAT	Lab 4: Soldering and Setting up the Workstation	Course	Active
PAT	Lab 5: Soldering through hole components	Course	Active
PAT	Lab 6: Introduction to the TK 18 soldering kit	Course	Active
PAT	Lab 7: Soldering/desoldering	Course	Active
PAT	Lab 8: Soldering SMT components on the TK 18	Course	Active
PAT	Lab 9: Soldering/Desoldering SMT Components	Course	Active
PAT	Lab 10: Soldering SMT Small Chip Components & ICs	Course	Active
PAT	Lab 11: SMT J Lead & Fine Pitch	Course	Active
PAT	Lab 12: Soldering SMT 100 Lead ICS on the TK 15	Course	Active
PAT	Lab 13: Component Removal on the TK 18	Course	Active
PAT	Lab 14: J Lead component removal	Course	Active
PAT	Lab 15: Through hole repairs and circuit path repa	Course	Active
PAT	Lab 16: Removal of Conformal Coating	Course	Active
PAT	Lab 17: Using Lead Free Solder	Course	Active
LP	Tool identification and the basics of Tinning	Course	Active
LP	IPC specifications for soldering, repair, and modifications	Course	Active
LP	Wire and Terminal Soldering	Course	Active
LP	Soldering and Setting up the Workstation	Course	Active
LP	Soldering through hole components	Course	Active

LP	Introduction to soldering kits	Course	Active
LP	Soldering/desoldering the through hole components	Course	Active
LP	Soldering SMT components	Course	Active
LP	Soldering/desoldering SMT components	Course	Active
LP	Soldering SMT small chip components and ICs	Course	Active
LP	Soldering SMT J lead and fine pitch ICs	Course	Active
LP	Soldering 100 lead ICs and begin component removal of SMTs	Course	Active
LP	Surface mount rework	Course	Active
LP	J Lead component removal	Course	Active
LP	Through hole repairs and circuit path repairs	Course	Active
LP	Removal of conformal coating and repairing a burned PCB	Course	Active
LP	Using Lead Free Solder	Course	Active