TECHNICAL TRAINING SOLUTIONS

ELECTRICAL COURSES | INSTRUMENTATION COURSES | MECHANICAL COURSES

LEARNING BY DOING

SOLDERING

COURSE 560: 3 DAYS: Max 8 Candidates

This course provides all the skills necessary to work on modern electronic printed circuit boards. It is intended for candidates who have an understanding of electronics principles, but have little or no experience of working on modern electronic systems or equipment down to component level. It complements the Electronics Fault Finding (Course 570).

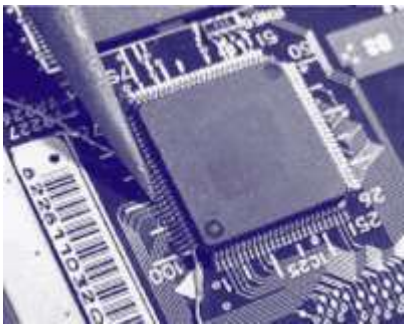
Throughout the course best practice will be observed as described in International Standards (such as IPC610).

PARTICIPANTS

This course is essential for anyone involved in repair and maintenance of electronic systems and equipment, including those who are responsible for supervising the repair and quality of electronic systems and equipment.

COURSE PRESENTATION

The course is presented throughout by reference to best practice (such as IPC610) and generous amounts of practical work. Comprehensive notes are provided along with all the necessary soldering and rework equipment.



COURSE OBJECTIVES

On completion of the course, participants will have a thorough understanding of the requirements involved in the repair and maintenance of printed circuit boards to the IPC-A-610 Standard. Candidates will:

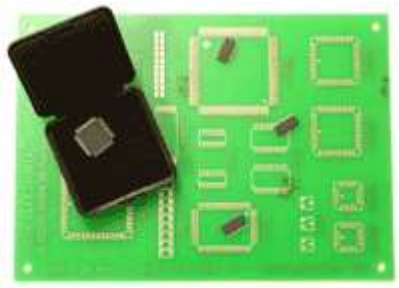
- apply safe working practices
- understand the problems of electrical over stress (EOS) and electrostatic discharge (ESD)
- identify the various types of components used: Through-hole, SMT QFP DIL LCC Gull-Wing etc
- determine component values from case markings
- prepare wires for soldering
- select the correct grades of solder
- understand the hazards and use of fluxes and cleaning solvents
- correctly solder unsupported and supported through-hole PCB components
- correctly solder surface mount devices (SMD), including QFP, DIL, LCC, Gull-Wing etc to PCBs
- remove and replace solder joints and components on PCBs using: solder wick, soldering irons, heated tweezers and hot air rework stations
- inspect PCBs to ensure compliance with industry standards.

Successful completion of the course leads to the award of the Technical Training Solutions Certificate of Competence 560: Soldering.

What do candidates on the Soldering course actually do?

We begin the course with a review of the components used in industrial, commercial and military electronics. Then an overview of the substrate materials used to produce the circuit boards. The main emphasis is on the most common material – fibre reinforced (FR4), but others such as ceramic and metal clad poly-imide are also discussed.

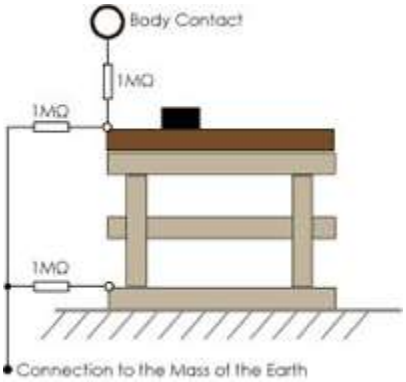
Some of the leaded components used on the soldering course



Some of the Surface Mount (SMD / SMT) components used on the soldering course

One of our demonstration PCB boards, illustrating examples of surface mount and leaded components on a modern PCB

The management of static electricity (ESD) and thermal shock is demonstrated, and candidates are provided with the necessary tools to enable best practice to be used. Work where ESD could present a problem is done at an ESD workstation. The candidate's notes contain details on how such a workstation can be constructed at their own place of work.



An illustration taken from the soldering course notes, helping to explain how ant-static workstations are configured

The candidates are reminded about the anti-static precautions that should be taken throughout the course

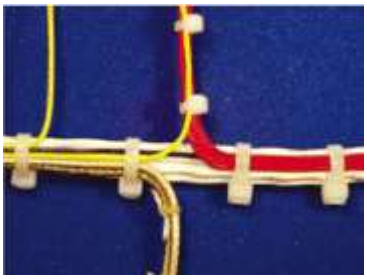
Explanations are provided on how wrist straps, heel straps and ant-static testing stations work on the soldering course

The various methods of minimising exposure to noxious fumes is studied and proper fume extraction is used whilst soldering on the rework station. A variety of industry-standard soldering irons and rework stations are used on the course, allowing candidates to gain practice using a range of different standards of iron.

One of the soldering stations used on the soldering course

One of the soldering rework stations used on the soldering course

Candidates practice making solder joints of wires to terminal pins in accordance with best practice. We look at how cables should be formed and laced for proper mechanical support with respect to the IPC610 requirements.



Examples of how cables should be formed are provided on the soldering course

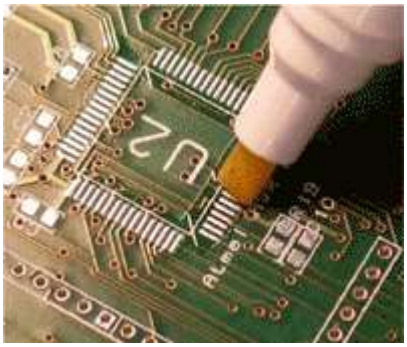
Examples of how terminal pins should be soldered to the IPC610 Standard are provided on the soldering course.

The candidates have a soldering to wire hooks exercise to complete to the IPC610 Standard.

We then practice pre-forming component leads to minimise stress from vibration during the operational life of the circuit board. Vertical and horizontal mounting of components is discussed and practiced.

Excessive heat can seriously damage circuit boards, especially flexible mylar film and multi-layer circuit boards, therefore the importance of temperature control and limiting heat exposure is stressed throughout the course.

Candidates are shown examples of how excessive heat can damage PCBs



We apply flux in various ways on the course, including using a flux pen

Candidates are shown examples of good and bad solder joints in a variety of situations with all the components they are likely to see.

Candidates spend time applying flux, aligning components and making solder joints to a range of leaded components before moving on to SMT devices. Emphasis is placed upon the quality of each joint - candidates are given examples of good / bad joints and how to inspect work to the Standards.

A range of SMT components are reviewed and the merits of the various connection methods are discussed, e.g. flat ribbon, gull wing, J-lead and ball-grid-arrays etc. Candidates spend time attaching all of the component types except the BGAs (these require specialist equipment and are beyond the scope of this course).

Throughout the course we refer to the course notes which provide lots of useful information about soldering and desoldering as well as the candidates' instructions for all the practical exercises that we do. The following are some example pages from the soldering course notes:

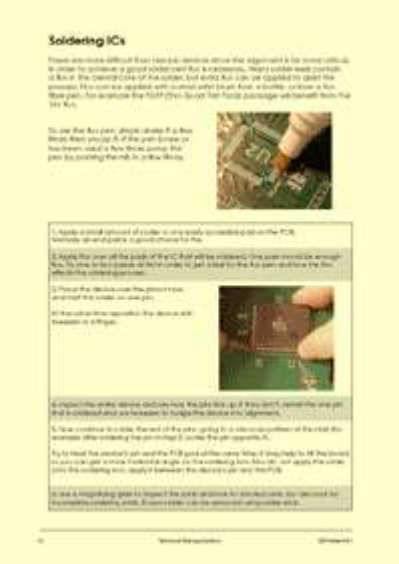
Soldering

Solder Alloys

Preparation of Wire Ends

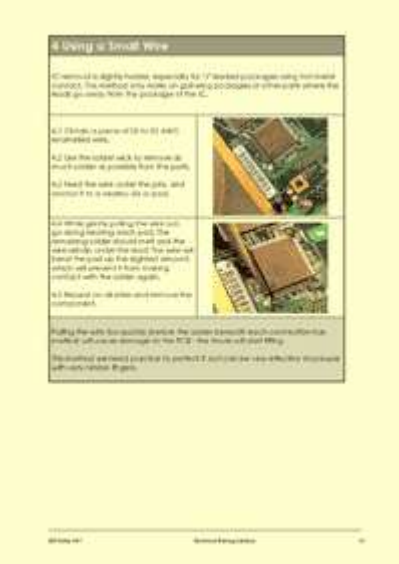
Tinning Components

Page 7 of the soldering and PCB repair course notes: The early pages of the soldering course looks at the general principles of how a good solder joint should be made



Soldering ICs

Page 10 of the soldering and PCB repair course notes: The middle part of the course looks at how modern multi-pinned and leadless surface mount devices should be soldered

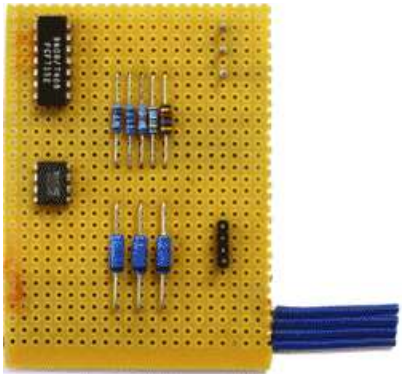


4 Using a Small Wire

Page 37 of the soldering and PCB repair course notes: The latter part of the course looks at how components should be removed from PCBs without damage, in this case showing how a small enamelled wire can be used to break the solder joints of a multi-pinned component

We then proceed to a series of practical exercises, where the candidates have to individually produce a set of test pieces using various soldering techniques:

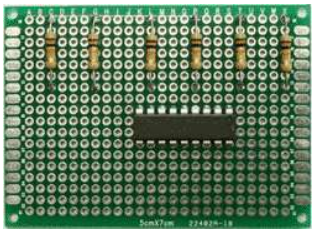
An example of one of the candidates' practical exercises: Tinning multi-strand wires and then making hook joints.



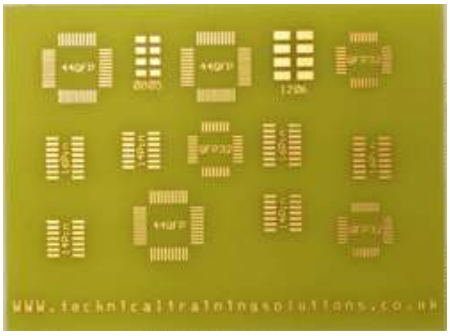
An example of one of the candidates' practical exercises: Single-sided basic component soldering.

An example of one of the candidates' practical exercises: Cupped termination that requires care and accuracy.

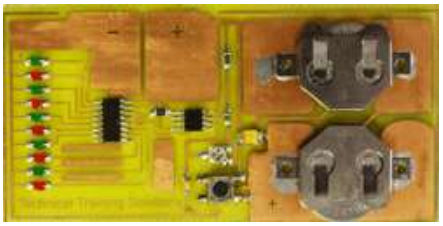
As the practical exercises progress they become more demanding and the next set of exercises require them to assemble through hole devices, surface mount components and a working test piece that they can take away with them. These exercises test the candidates' soldering skills to the full:



An example of one of the candidates' practical exercises: Practicing soldering and removal of through hole technology (aka supported hole).



An example of one of the candidates' practical exercises: The practice board for 0805, 1205, Dual In Line (DIL) and Quad Flat Pack (QFP) Surface Mount Devices (SMD). Candidates populate this board with these devices and then practice removal of them (simulating the removal of faulty components) without damaging the board.



This is the final test project: The candidates have to assemble all the components (and orientate the components properly) and we then test it for correct functionality. We're also keen to ensure that the candidates are producing high quality soldered joints at this stage of the course.

Flux and debris removal is an important part of the inspection process, and requires the use of solvents. Best practice and health and Safety is fundamental to all Technical Training Solutions' courses, therefore the correct solvents are used to minimise the personnel and environmental risks.

The repair of circuit boards is also given serious consideration, as the PCB is often the most expensive part of the system. Candidates are shown several ways to remove components while minimising damage to delicate circuit board tracks.

Solder removal is practiced where solder bridges occur, or excessive solder has been used.

Some of the desoldering wicks and desoldering tools used on the soldering course

One of the suction irons used on the soldering course

The heated tweezers used on the soldering course

Where track damage in unavoidable, the methods of repair are practiced. This part of the course is also valuable to those who may have to modify circuit boards because of errors or obsolete components.

The handling and application of epoxy resins and silicone based elastomers with regard to PCB repair is covered in some depth along with the application of conformal coatings.

Throughout the course the instructor will make a continuous assessment of the candidate's progress, and because of the small group size close guidance is ensured. Each candidate will produce a test piece in order to demonstrate their competence in the assembly and repair of electronic equipment. Candidates then inspect a range of PCBs, making extensive reference to IPC 610, noting any deviations.

If you would like to see some of the equipment used on the Soldering course for yourself, then please call us to arrange a visit to our offices in Kent. Alternatively, we can visit you anywhere in the British Isles.

CONTACT US

Tel: 01634 731470
Email: tech.training@zen.co.uk