Tools And Techniques

Copyright 2004
D. L. Gould & Niagara College

Niagara College - Technology
Judged By Your Tools

- Your choice and care of the tools you select for the mechanical and electrical work you do will reflect your work habits.
- Select tools that are of good quality with life time warranties.
- Never substitute one tool for another.
Screwdrivers

- **Common types**: (manual & power)
  - Blade
  - Phillips
  - Allen
  - Torx
  - Robertson

- **Alignment between the screwdriver and the head of the screw must be exact**
Screwdrivers

- Variations:
  - Jewelers
  - Stubby
  - Offset
  - Magnetic
  - Ratchet

- Shank, driver style & size, may also vary.
Nutdrivers

Shank  Insulated Handle

● Common Styles: (manual & power)

Hollow Shaft
Magnetic Insert
**Wrenches**

- **Adjustable** - distance between the jaws can be adjusted to various sizes. The pulling force is always applied to the stationary jaw.

- **Open-End** - primarily used on square nuts. Allows adjustments to be made in confined areas.

- **Box-End** - minimizes shearing or rounding providing a snug grip on hex hardware.

- **Allen Wrench** - a hexagonal bar of steel which fits the socket of a screw or bolt.
- **Long-Nose** - positioning of small parts on the printed circuit board & setting bend allowance.
- **Slip-Joint** - to grip large hardware that may be inserted in a chassis.
- **Rib-Joint** - uses a larger jaw opening to grip large hardware that may be inserted in a chassis.
- **Needle-Nose** - for positioning extremely delicate small parts in very tight places.
Diagonal Cutters & Wire Strippers

- **Diagonal Cutters** - to remove excess component lead length, and wire length after soldering a component or wire to a printed circuit board. (10 cm diagonal cutter will cut 24 AWG and smaller)

- **Wire Strippers** - to remove insulation from wires, to prepare the wire for electrical connection during assembly or service of electronic equipment.
Layout Tools

- **Combination Square** - to assist in the transfer of dimensions from the chassis layout drawing to the chassis

- **Center Punch** - used to make a conical indentation on the metal chassis to locate the center of a hole for a drill bit.
Tools For The Chassis And The Printed Circuit Board

- **Ball Peen Hammer** - used for driving center punches, and shaping and straightening thin metal.

- **Reamer** - used to expand the diameter of a drilled hole to make it slightly larger.
Tools For The Chassis And The Printed Circuit Board

- **Files** - used to improve the appearance of a hole in a chassis, and eliminate burrs and sharp edges.

- **Chassis Punch** - to make holes in a chassis larger than 13 mm up to 76 mm with precision and negligible burr.
Tools For The Chassis And The Printed Circuit Board

- **Hacksaw** - used to cut small shafts, pipes and thin pieces of metal.

- **Nibbler** - a miniature hand shear used to cut internal openings in a chassis.
Tools For The Chassis And The Printed Circuit Board

- **Drill Bits** - made of high-speed steel used to cut round holes of 1mm to 13mm in a metal chassis.

- **Hand Drill** - used with a drill bit to drill holes in a metal chassis. Variable speed control, auto forward/reverse, chuck capacity of 9.5mm and a grounded three-wire cord are essential.

- **Drill Press** - used with a drill bit to drill holes in a metal chassis. Variable speed control, chuck capacity of 13mm and a grounded three-wire cord are essential.
Tools For The Chassis And The Printed Circuit Board

- **Dremel Tool** - to drill printed circuit boards to allow components to be mounted on the board. A high speed drill that uses drill bits ranging in size from #80 to #30.

- **Third Hand** - to hold the circuit board during project assembly.
Soldering and Desoldering

- **Soldering Iron** (for printed circuits.)
  a.) wattage - 35 or temp controlled
  b.) tip style and size - 3 mm blunt chisel
  c.) grounded tip - 3 wire iron
  d.) cool grip handle

- **Soldering Guns** - for large electrical connections and metal chassis. *(never used on printed circuits)*
Soldering Techniques

- **Soldering** - to join two metals together to form an electrically mechanically secure bond using heat and a third metal alloy known as solder.

- **Solder** - a metal alloy of tin and lead (60/40) with a low melting point of 187°C & rosin core.

- **Solder Properties** -
  a.) melting point
  b.) mechanical resistance to fractures
  c.) cost
Soldering Techniques

- **Wetting Action** - a metal solvent action that takes place when sufficient heat is applied to a connection allowing the solder to liquefy combining the molecules of all the materials in the bond.

  Solder

  Copper Foil
Soldering Procedure

- Safety Glasses
- Clean all parts to be soldered
- Plug in the iron to allow it to reach temp
- Apply a small amount of solder to the iron tip
- Heat the connection with the iron
- Apply solder to the connection opposite the iron
- Allow the solder to completely wet the connection
- Remove the solder & the iron tip from the connection
- Allow the solder to cool and solidify undisturbed
- Use diagonal cutters to remove the excess lead
- Remove flux residue from the connection
A typical cross section of a printed circuit board, with a plated through hole.

A) Solder
(B) Intermetallic Layer
(C) Plated Hole
(D) P.C. Board
(E) Lead
Poor Solder Connections

- **Fractured Joint** - movement of the joint during the plastic state of the solder.
- **Rosin Joint** - insufficient heat to melt the solder so that the joint is coated with flux only.
- **Wicking** - (solder creep) the capillary action of liquid solder solidifying a stranded wire.
- **Cold Solder Joint** - a dull-gray, grainy appearance of solder that has not properly wetted the joint.
**Poor Solder Connections**

- **Excessive Solder Joint** - too much solder applied to the joint resulting in shorts between adjacent terminal pads.
- **Insufficient Solder Joint** - portions of the joint have not been alloyed with the solder and remain visible.
- **Excessive Heat** - causes the foil traces and pads to be lifted from the insulating base of the printed circuit board.
- **Solder Peaking** - a sharp point of solder protruding from the connection, caused by the rapid removal of the soldering iron from the joint.
Desoldering Techniques

- Desoldering - to remove the solder from a connection without damaging the component or the printed circuit board (wire or the terminal).

Solder Sucker (Pullet)  Solder Wick (Dry Wick)
Desoldering Procedure

- Safety Glasses
- Plug in the iron to allow it to reach temp
- Remove excess solder on the iron tip with a damp sponge
- Charge the “Solder Sucker”
- Place the tip of the iron on the joint to be desoldered
- Once the solder on the joint liquefies, insert the tip of the “Solder Sucker” into the molten solder and trigger it
- Use “Solder Wick” to remove the last residue of solder
- Use a screw driver & long nose pliers to help remove the component or wire from the printed circuit or terminal
Summary

- Tools and electrical/electronic projects
- Layout tools for chassis fabrication
- Tools for the chassis and the printed circuit
- Tools for soldering and desoldering
Where to get more information

- Electronic Fabrication Second Edition
  by Gordon Shimizu
- Electronic Project Design and Fabrication Third Edition
  by Ronald A. Reis
- Electronic Techniques Shop Practices and Construction Fifth Edition
  by Robert S. Villanucci.
- Antex Soldering Products
- Soldering Tips
- How to Solder
- Steps to Better Soldering