**College of Engineering Laboratory Procedure**

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|---|---|---|
| **GENERAL SOLDERING PROCEDURE.** | | |
| **Dept: MSE, etc** | **Laboratory: Enter Lab Name** | **Rm: MEC 213, etc** |
| **Authored by:** | Ralph Anderson, Research Assistant Date: | |
| **Reviewed and Approved by:** | Dr. Pam Innovative, PI Date: | |
| **Filename:** | COEN Lab Procedure 14-Sep-09.doc | **Revision:** 1.2 |

**Comment [DS1]:** Highlight the title field, rt. Mouse click, select Edit Field, then overwrite with the title of your procedure.

Then delete the (.). This will also delete this comment.

**Comment [DS2]:** Store with filename that includes Procedure title and date. Then right mouse click this field at right and select Update Field.

| | |
|---|---|
| **Procedure Type** | ☒ Process/Protocol ☐ Chemical ☐ Hazard Class |
| **Brief Overview & Scope** | This procedure provides general instructions on how to solder or de-solder using a soldering iron in the lab environment.<br>It does not cover use of more specialized soldering tools or equipment. |
| **Potential Hazards** | Thermal (burns to skin), fire, inhalation of toxic vapors (solder and flux); ingestion of lead residue if hands are not washed. |
| **Engr. Controls** | Desk fan as needed |
| **PPE** | Safety glasses |
| **Equipment, Tools:** | Soldering station with soldering iron holder, de-soldering tool, ESD mat (opt.), ESD wrist strap (opt.) |
| **Mat'ls, Supplies:** | Solder, separate flux (optional), de-soldering wick |
| **Add'l Training Requirements** | none |
| **Special Requirements:** | |
| **Handling & Facilities** | Uncluttered work area, fire-resistant work surface. |
| **Spill & Incident** | n/a |
| **Decontamation/ Waste Disposal** | Wash hands with soap and water after soldering. Complete waste pickup form and contact EH&S to dispose of lead solder. |

**Comment [DS3]: Cut and paste from master list below or add as needed:** chemical, thermal, electrical, radiation, biological, fire, explosion, mechanical, pinch, physical, slip/trip/fall, pneumatic, asphyxiation, hydraulic, noise, dust, flying particles, toxic, carcinogenic, mutagen, environmental, biohazard, laser

**Comment [DS4]: Cut and paste from master list below or add as needed:** fume hood, local exhaust, splash shield, sharps container, building ventilation, biosafety cabinet, flammables cabinet, corrosive cabinet, radiation shielding, glove box, gas cabinet

**Comment [DS5]: Cut and paste from master list below or add as needed**: safety glasses, safety goggles, face shield, gloves, gloves- nitrile, gloves- neoprene, gloves- leather, acid apron, lab coat, close-toed shoes, steel-toed shoes, hearing protection, dust mask, respirator, leg coverings, tyvek suit, tyvek sleeves

**REVISION HISTORY**

| Rev. | Revision Description | Date: |
|---|---|---|
| 1.0 | As issued | 06-25-09 |
| 1.1 | Adapted soldering iron procedure to use as template example content | 09-10-09 |
| 1.2 | Added revision block to track document changes. | 09-14-09 |

Certification of Hazard Assessment

# `GENERAL SOLDERING PROCEDURE

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**Comment [DS6]:** Delete if you do not feel a TOC is needed

**Comment [DS7]:** ▪The Table of Contents above is included to act as a template TOC appropriate for long procedures.
▪Including a TOC is optional.
▪Delete TOC if procedure is not overly lengthy or not desired.

# `GENERAL SOLDERING PROCEDURE

**WARNINGS:**

a. This is a general procedure for performance typical soldering or de-soldering operations. It does not apply to specialized soldering processes or equipment.

b. This procedure is for environments where soldering is on an occasional basis by one or two people at a time. Continuous soldering operations or those involving more people may a different procedure.

c. Many solders used in laboratories may contain lead. **DO NOT breathe fumes generated while soldering.**

d. Beware of hot soldering irons and components. Make sure others are aware of hot tools.

e. Be aware of the location of your soldering iron or iron while it is hot, or cooling. Make sure you place the hot iron in an appropriate holder to prevent heat or fire damage.

f. Switch off and/or unplug soldering tools when not in use.

g. Allow soldering tool to cool before storing.

h. **Wash your hands after using solder and soldering tools.**

**DESCRIPTION OF SYSTEM**

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| TASKS | |
|---|---|
| **Hazard, EC and PPE information listed below applies to the following tasks and sub-tasks unless otherwise noted.** | |
| **Hazards** | thermal, inhalation of toxic vapors (tin, lead, flux), exposure to heavy metals (tin, lead) |
| **Engineering Controls** | desk fan as needed |
| **PPE** | safety glasses, lab-coat, close-toed shoes |

**1. Setting Up Work Area**

a. Ensure adequate ventilation. If multiple people are soldering in a concentrated area, set up a fan to gently blow fumes and vapors away from you and your co-workers.

b. Keep area clean around workplace at all times.

c. When working with statically sensitive components (most active devices such as ICs, FETs, transistors, etc.), be sure to use a anti-static mat to work on and wear an anti-static wrist strap to minimize risk of electrostatic discharge (ESD) damage.

**2. Preparing Workpiece**

a. Clamp work securely while performing soldering or de-soldering. Use a vise or other approved clamping systems to keep your hands free to work.

b. Use heat sinks to protect thermally-sensitive circuit components.

c. When working with used circuit boards, make sure the areas you will be soldering or de-soldering are clean and free of dust or grease before applying heat.

d. When soldering wire connections, make sure the wires are tightly connected. Use appropriate covering like heat shrink tubing or twist-on connectors to protect the splice. Do not use wires with melted insulation or exposed conductors.

**3. Selecting A Solder and Flux**

a. <u>Solder</u>

Solder commonly used in most laboratory environments contains tin and lead. A common alloy for non-production electronics use is the eutectic mixture of 63% tin and 37% lead due to its low melting point. This alloy melts at 361 F / 183 C.

Solder used in mass-produced items almost universally are now lead free due to the toxicity issues with lead. Lead-free solders melt at a higher temperature and require more skill to use than lead-based solders.

Be sure to understand what solder is appropriate for your task.

b. <u>Flux</u>

Flux is an agent that inhibits oxidation and helps the solder flow more easily. For electronics applications, rosin flux or no-clean fluxes are used.

Rosin fluxes are available in non-activated (R), mildly activated (RMA) and activated (RA) versions. RA and RMA fluxes include an activating compound to increase solderabilty through oxide removal. This compound is typically an acid. The residue from RA fluxes is corrosive and must be removed after the joint is soldered. When using RMA flux, the residue is less corrosive, and cleaning is recommended but not required.

Acid fluxes are typically not needed or desired in electronics due to their corrosivity and need to thorough cleaning to avoid board and component damage.

**4. Setting Up the Soldering Station**

a. Select the proper sized solder tip for your work. As trace and pad size decrease, soldering tip size must also decrease.

b. Turn the soldering station ON and set the temperature appropriate to the solder composition you are using.
Note: higher temperatures lead to more rapid formulation of oxidation on soldering tip and will shorten tip life.

c. Make sure the solder tip is cleaned and tinned.

**5. Tinning Soldering Tip**

a. Allow the soldering iron to reach temperature.

b. Apply flux to the tip first and then liberally apply solder to tip. Note: flux-core solder may not require application of flux.

c. Wipe off excess solder on sponge.

d. A properly tinned tip will be shiny and free of oxidation.

e. It is normal to have to re-tin a tip from time to time as oxidation builds up on the tip.

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**6. Soldering**

a. Hold the soldering iron like a pen, near the base of the handle.

b. Touch the soldering iron onto the joint to be made.
Make sure it touches both the component lead and the track. Hold the tip there for a few seconds to heat the joint.

c. Unroll the solder and bring the end to the joint to be soldered near the soldering iron tip. The solder should melt and smoothly flow onto the components to be soldered (component lead, pcb trace, etc). Be sure to apply the solder to the joint, not the iron.

d. Remove the solder, then the iron, while keeping the joint still.
Allow the joint a few seconds to cool before you move the circuit board.

e. Inspect the joint closely. Be sure that the solder joint is good, as described below.

f. Solder joints may be cleaned <u>after they have cooled</u> using isopropyl alcohol and a Q-tip or similar cotton swab.

**7. Solder Joint Evaluation**

a. Good Solder Joints

A good solder joint:

- will be shiny and concave in nature.
- will be clean and free of dirt and voids.
- will fully cover the pad the component lead lays on or passing through.

A good solder joint is shown to the right.

b. Cold Solder Joints

Joints that are dull or convex are potentially “cold” solder joints. Cold solder joints do not make a good electrical or mechanical connection.

Cold solder joints can be remedied by removing existing solder, ensuring both the soldering tip is hot and tinned and area to be re-soldered is clean and free of oxidation and has ample flux. The joint then can be re-soldered.

A cold solder joint is shown to the right.

**8. De-soldering**

De-soldering is done to remove components that have been soldered together. Two common forms of de-soldering are done through the use of a vacuum plunger device (solder sucker) or by applying a braided wick to the joint that pulls solder away through capillary action.

a. Use of Vacuum Plunger

- To use a vacuum plunger, cock the plunger by depressing it fully until it latches.
- Bring the vacuum plunger to the location of the joint to be de-soldered.
- Heat the joint with the tip of the soldering iron.
- When the solder has melted, press the trigger of the device, which will pull the solder out of the joint.
- Two or more tries may be needed to fully remove the solder from the joint.
- On occasion, it is actually helpful to add solder to the joint to provide addition thermal mass and uniform heating to the joint. This can assist in complete melting of the solder in the joint.

b. Use of Solder Wick

- Solder wick is typically a ribbon of braided fine copper wire with rosin core flux impregnated into it.
- To use solder wick, lay the wick over the joint to be de-soldered.
- Apply the heated tip of the soldering iron to allow the wick to be heated and melt the solder in the joint.
- The solder will flow out of the joint and into the wick through capillary action.