GuideSheet Soldering Safety

Electric hand soldering (iron and gun) poses fire, electrical, and health risks (e.g., burns, chemical exposure) to the user from improper application, poor technique, and unsafe work area (e.g., co-located combustibles, clutter). Elimination of these hazards ensures a secure environment for safe soldering operations.

Safe work practices for torch soldering are outlined in the Fire Safety & Emergency Planning (FSEP) Hot Work Safety Program.

Lead/Cadmium Solder

- Certain soldering alloys contain lead and/or cadmium. Lead is toxic and cadmium is exceptionally toxic.
  - Both are heavy metals with long half-lives in the body, accumulate on repeated exposure, and may cause serious health effects at low concentrations.
  - Potential effects of overexposure include reproductive problems, neurological defects, kidney damage, and cancer.
  - All routes of entry lead to toxic exposure, but most commonly by inhalation of fumes generated by oxidation of heated metal.

Email injuryprevention@usc.edu for consultation before working with lead/cadmium solder. Engineering safety controls (e.g., local exhaust ventilation) and exposure monitoring may be required.

Dispose of unused lead/cadmium solder as hazardous waste. Request a hazardous waste pickup via EHSA.

Rosin Flux

- Solder wire used for electronics purposes contains cores of rosin-based flux (non-corrosive to metal). However, a solder paste consisting of powdered solder in a semisolid flux base may be used.
  - Rosin flux is a skin sensitizer (i.e., repeated skin contact may induce an allergic reaction, causing dermatitis) in some individuals.
  - Fumes released by heated flux can irritate the eyes and the respiratory system. Refer to the Safety Data Sheet (SDS) of the solder for exposure information.
  - Heavy-duty soldering (e.g., of pipework) may involve liquid or paste fluxes containing zinc chloride or ammonium chloride, often in addition to rosin. These fluxes may be corrosive to eyes and irritant or corrosive to skin.

Personal Safety and PPE

1. Avoid direct skin contact with liquid or paste fluxes and with solder paste.
2. Wash hands thoroughly with soap and water if they become contaminated.
3. Avoid inhaling smoke from soldering operations and keep head/eyes out of smoke. Use local exhaust ventilation whenever possible, to remove fumes from soldering flux before it enters the breathing zone.
4. Wear appropriate PPE.
   a. Eye protection: safety glasses, goggles for splash hazards from liquid flux
   b. Hand protection: nitrile gloves, heat resistant gloves
   c. Flame resistant lab coat or apron
   d. Closed-toe shoes
   e. All skin below the waist shall be covered (i.e., long pants, or long skirts, with socks if needed to cover the ankles; see Minimum Requirements - PPE Standards).
   f. Solder pots may require additional PPE (e.g., face shield, heat resistant gloves). Email firesafety@usc.edu for additional guidance.

Soldering Safety

- Use **lead-free and cadmium-free solder** whenever possible.
- Pots or baths of molten solder are significantly more hazardous than a soldering iron. Email firesafety@usc.edu for safety guidance before use.
- Never touch the element or tip of the soldering iron or gun. It is very hot (about 750°F) and will burn tissue.
- While soldering, hold objects with tweezers, pliers, or clamps to avoid receiving burns from the hot objects.
- Keep the cleaning sponge wet during use.
- To the extent possible, conduct soldering on a solid, level surface and always return the soldering iron to its stand when not in use.
- Ensure that the iron is secure in its stand so it cannot inadvertently dislodge onto the work surface. Never put the hot iron down on the workbench.
- Turn unit off or unplug the iron when not in use.
- Soldering stations that feature an automatic shutoff not only extend the life of tip, iron, and station, but provide an additional measure of fire safety.

Work Area

- Protect work surface with a sheet of aluminum, steel, hardboard, plywood, or a non-combustible calcium silicate sheet to avoid damage from burns and solder splashes.
- Protect or remove combustibles in the surrounding area of the workbench (3 feet).
- DO NOT store flammable and/or combustible liquids (e.g., cleaning solvents) in the vicinity of soldering operations.
- Use local exhaust ventilation whenever possible to reduce exposure to fumes from fluxes.
  - Local exhaust ventilation is mandatory where lead- or cadmium-containing solder is used.

Electrical and Fire Safety

- Use soldering units that are UL (or equivalently) listed.
- It is best to use a soldering iron equipped with a grounding prong to reduce the risk of electrical damage if a short circuit occurs in the equipment.
  - Employ a ground fault circuit interrupter (GFCI) if there is potential contact with water.
- Examine equipment for frayed or cracked cords or missing ground prong before each use.
- Immediately take out of service any equipment that is not in good working order.
- Prevent damage to electrical cords during soldering. Keep them away from heated tips.
- Grasp the plug to disconnect the unit from an electrical outlet, not the cord.
- Ensure that a fire extinguisher is present in the area. Know its location and how to use it prior to performing any soldering work.
  - See fire extinguisher instructions here: https://fsep.usc.edu/fire-safety/how-to-use-a-fire-extinguisher/