



## **Soldering Guidelines**

Environmental Health and Safety

### **1.0 Introduction**

This document provides workers and supervisors with guidance on the hazards that may be present when soldering and controls that should be followed to minimize the hazard. Soldering takes place at lower temperatures than welding and does not involve the melting of base metals. As such, it is considered less hazardous than welding, but controls should still be used to reduce exposure.

Hazards associated with soldering, bonding materials and other can include, but are not limited to:

- Heat hazards: heated materials, soldering iron, or torch may cause burn injuries if contacted directly. Flammable materials may catch fire.
- Chemical hazards: common hazards include hazardous dust and fumes from the rosin (flux) and lead (when hard soldering or brazing techniques are used). Rosin produces solder fumes that, if inhaled, can result in occupational asthma or worsen existing asthmatic conditions; as well, rosin can cause eye and upper respiratory tract irritation.
- Electrical hazards: Soldering units with frayed or damaged electrical wiring may cause electrical shock injury, or cause fire.

#### Types of soldering

- Soft Soldering: this method is used to create electrical connections and bond electronic components onto circuit boards. It is also a technique used to join copper pipe and connectors. A tin-lead alloy is typically used as the solder.
- Hard Soldering: this technique is used to join pieces of copper, brass or silver, and involves higher temperatures (use of blowtorch instead of soldering iron). Typically, an alloy that contains silver is used as the solder. The metal to be bonded (base metals), is heated to a point at which the silver solder melts, creating a strong joint as it cools.
- Brazing: A similar technique to hard soldering but involves using solder materials that melt at a higher temperature. Typically, an alloy that contains brass is used as the solder.

Examples of people and areas who do soldering include but are not limited to: plumbers, steamfitters, tinsmiths, machinists, laboratories, machine shops, and non-lab areas.

The following guidelines were based on guidelines from: [University of Cambridge](#), [Stanford](#), and [Carnegie Mellon University](#).

#### Scope

This guideline applies to all University of Toronto staff and faculty, where soldering is a part of their job tasks. It also applies to students, external workers or visitors (e.g., contractors, etc.) who may conduct soldering.



## 2.0 Responsibilities

The roles and responsibilities for management, supervisors and workers are documented below. Workers should report concerns to their supervisors and at any time. Environmental Health and Safety (EHS) can be contacted for assistance or consultation.

### Supervisors/Management/Principal Investigators

- Identify workers or work activities where workers may be required to conduct soldering.
- Identify and anticipate any hazards that may be present for soldering work activities.
- Develop, document, implement and maintain appropriate work procedures, measures, inspections, and precautions to control the hazards that may be present by applying these guidelines and any other applicable resources (e.g., equipment/manufacturer instruction manuals).
- Ensure written work procedures are readily available and communicated to workers. A [Job Safety Analysis \(JSA\)](#) can be used to identify hazards and facilitate the development of written procedures, including emergency procedures.
- Ensure controls identified in the JSA or work procedures are followed when soldering.
- Ensure that workers who conduct soldering are provided with the equipment, personal protective equipment (PPE), appropriate training/instruction or other resources as identified by the JSA or work procedures.
- Where work is contracted to external parties, equivalent procedures should be followed.

### Workers

- Report health and safety hazards or concerns, including unsafe soldering practices or damaged equipment to their supervisor.
- Participate in appropriate training/instruction for soldering techniques.
- Review and be familiar with applicable JSA or work procedures before start of work.
- Follow safety procedures and use equipment and/or PPE per the JSA or work procedure.
- Where requested, assist supervisors in identifying situations with potential soldering hazards and participate in the development of the JSA or work procedure.

### Environmental Health & Safety (EHS)

- Provide consultation and assist as needed.
- Update and maintain these guidelines on a regular basis and/or when new information becomes available.

## 3.0 General Controls for Soldering

Controls for soldering fall into 3 categories:

- A. Elimination
- B. Substitution
- C. Engineering controls
- D. Administrative controls and work practices



E. Personal protective equipment (PPE)

## **A: Substitution/Engineering Controls**

### Elimination

Depending on the type of metal bases to be joined (piping, drains, etc.), use couplings or plastic piping, if possible, to avoid soldering. Use of pressing tools is another alternative to soldering.

### Substitution

Use a lead-free and rosin-free solder where possible. Contact EHS if you lead soldering is required for your tasks to discuss alternatives where feasible.

### Ventilation

Soldering should be performed in a well-ventilated space. Avoid breathing fumes/smoke by keeping your head to the side of, not above, the work. Portable/stationary local exhaust ventilation (LEV) can be used to prevent exposure to fumes generated by rosin fluxes when working on an open bench/area. Where this is not possible, the addition of a small fan that blows from behind the worker across the work area can help move fumes away from the breathing zone; avoid blowing onto breathing zone of other adjacent workers in the immediate area.

### LEV Design Considerations when soldering in laboratories or machine shops

When using LEV designed for soldering work consider the location of supply/exhaust ducts relative to soldering tasks (e.g., do not place task such that contaminants will be drawn into a worker's breathing zone). The unit should be leak-proof, the flow rate should be appropriate for the task, ducting should be structured to avoid eddy currents and inefficient flow and the construction and materials should be compatible with contaminants being extracted.

Consult with your facilities management group on ventilation appropriateness in the room and ensure there is no recirculation of air from hazardous processes to adjacent spaces. Ideally, exhaust should be vented outdoors.

Special local exhaust ventilation systems should have sufficient capture velocities to entrain the chemical being released. To be effective, it is important that it is designed for the purpose, is regularly maintained and inspected per the manufacturer's instructions. If using a tip extractor with filter boxes, both activated carbon and HEPA filters should be used. Maintenance of the units, including routine change of filters, should be logged/documented.

Examples of LEVs:

- LEV (fixed) – capturing hood, canopy, fume extractor arms
- LEV (portable/moveable) – capturing hood, fume extractor, downdraft table
- LEV (Low Volume High Velocity) - small capturing hoods, built-in extraction systems such as an extraction unit attached to a solder gun.

### Other



Soldering stations that feature an automatic shut off should be used as they not only extend the life of tip, iron and station, but provide an additional measure of fire safety.

Soldering units that are equipped with a grounding prong should be used to reduce the risk of electrical damage if a short circuit occurs. A ground fault circuit interrupter (GFCI) should be used if there is a potential contact with water. If the circuit is not hardwired with a GFCI, a portable unit should be used.

## **B: Administrative Controls and Work Practices**

Administrative controls include training, standard operating procedures, and equipment maintenance.

- All electrical equipment (including soldering guns and irons) must meet Canadian national safety standards and provincial codes and be certified by an accredited certification body such the Canadian Standards Association (CSA), the Underwriters Laboratories of Canada (ULC), etc. For a list of accepted electrical certification markings, please refer to the Electrical Safety Authority (ESA) webpage: <https://esasafe.com/electrical-products/recognized-certification-marks/>.
- Do not permit food or drinks in soldering areas.
- Review the Safety Data Sheet (SDS) for the solder to be used and rosin (if using).
- Inspect soldering equipment for damage before each use. Do not use if damage is observed and remove from service. Report it to your supervisor for replacement or repair.
- Identify the location of the closest eye wash and fire extinguisher and know how to use it. Facilities & Services (F&S)' Fire Prevention Team offers Fire Extinguisher Safety Training for staff and faculty: [How to Use A Fire Extinguisher](#).
- Solder in an area free of flammable materials.
- Keep soldering area clear of electrical cables to prevent damage from the heated tip.
- Always wash hands with soap and water after soldering.
- Ensure that workers are trained on soldering techniques, standard operating procedures, and correct use of ventilation systems.
- Soldering Iron
  - Always return the soldering iron to its stand when not in use. Never put it down on the workbench. Turn off or unplug the soldering iron when it is not in use.
  - Never touch the element of soldering iron (400 deg C).
  - Avoid contact with the soldering iron tip.
  - Hold wires to be heated with tweezers or clamps.
  - Keep the cleaning sponge wet during use.
- Practice good hand hygiene. Wash hands after soldering and before eating and drinking, especially if working with lead solder.

### Soldering Cleanup and Waste of Lead Solder is used:

- Clean all surfaces after soldering.
- All solder, flux, dross and cleaning solvents must be treated as hazardous chemical waste and must be collected and disposed of accordingly. Refer to <https://ehs.utoronto.ca/wp-content/uploads/2021/06/Bucket-List-Poster.pdf>
- Do NOT rinse sponges, rags, etc. in sinks. Treat used rags and sponges as hazardous waste.



- Containers used for hazardous waste (including used sponges and rags) should be kept closed unless depositing materials into them. Contact [UofT Environmental Protection Services](#) to arrange for pails, waste labels and/or schedule pick up for hazardous waste as needed at (416) 946-3473

### **C: Personal Protective Equipment (PPE)**

When soldering, appropriate PPE should be worn:

- Protective clothing to prevent burns from splashes of hot solder. Long sleeve shirts and pants that are made of natural fibers (cotton) and closed-toe shoes should be worn. Heat resistant gloves may also be used.
- Eye protection: safety glasses, goggles, or face shields should be used when soldering.
- If using lead solder, wear gloves when handling the solder.

### **D: Training**

The minimum training requirements for workers and their supervisors that solder include:

- Any department and equipment-specific work instructions/procedures on soldering
- WHMIS training
- Lead in building materials: evaluating and controlling the hazard (if using lead-containing solder)