



Soldering Guidelines

Office of 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: common hazards include fumes from the rosin and lead (when hard soldering or brazing techniques are used).
- Electrical hazards

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 involved 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 area

The following guidelines were developed following guidelines from the Canadian Centre for Occupational Health and Safety, and several Universities (University of Cambridge, Stanford, Carnegie Mellon University, and University of Alberta).

Scope

This guideline applies to all University of Toronto staff where soldering is a part of their job tasks. It also applies to external workers or visitors (e.g. contractors drivers, 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, the Office of 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.
- Develop, document, implement and maintain appropriate work procedures, measures, inspections, and precautions to control the hazards that may be present using these guidelines.
- Ensure that a Job Safety Analysis (JSA) or written work procedure is completed where necessary and that they are readily available to workers.
- Ensure controls identified in the JSA or other work procedures are followed for safe work when soldering.
- Ensure that workers who conduct soldering are provided with the equipment, personal protective equipment (PPE), appropriate training or other resources as identified by the JSA or other 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 supervisors.
- Participate in appropriate training for soldering techniques.
- Review and be familiar with applicable JSA or other work procedures before start of work.
- Follow safety procedures and use equipment and/or PPE as defined in 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.

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- 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. Substitution/Engineering controls
- B. Administrative controls and work practices
- C. Personal protective equipment (PPE)

A: Substitution/Engineering Controls

Substitution

Depending on the type of metal bases to be joined (piping, drains, etc), use couplings or plastic piping if possible to avoid soldering. Otherwise, if feasible, use pressing tools. If soldering is necessary, lead-free or low lead solder should be used where possible.



Ventilation

Soldering should be performed in a well-ventilated space where possible. Avoid breathing fumes/smoke by keeping your head to the side of, not above, your 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.

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 structured to avoid eddy currents and inefficient flow and the construction and materials 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.

Special local exhaust ventilation systems are to have sufficient capture velocities to entrain the chemical being released. To be effective in protecting the employee(s), it is important that it is fit for purpose, is regularly maintained and the system's performance is monitored.

Examples of LEV:

- 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, e.g. e.g. an extraction unit attached to a solder gun.

B: Administrative Controls and Work Practices

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

- Soldering guns and irons should be UL (or equivalently) classified/listed
- Do not permit food or drinks in soldering areas.
- Review Safety Data Sheet (SDS) for the solder to be used.
- Inspect soldering equipment for damage before each use.
- Solder in an area free of flammable materials.
- Avoid contact with the soldering iron tip.
- Always return the soldering iron to its stand when not in use. Never put it down on the workbench.
- Always wash hands with soap and water after soldering.
- Turn off or unplug the soldering iron when it is not in use.
- Ensure that workers are trained on soldering techniques, standard operating procedures, and correct use of ventilation systems.

Soldering Cleanup and Waste of Lead Solder is used:

- Clean all surfaces after soldering. If lead containing solder is used, treat cleaning materials, including sponges or rags used to clean, as hazardous waste.



- Do NOT rinse sponges, rags, etc. in sinks.
- Keep hazardous waste containers closed unless depositing materials into them.

C: Personal Protective Equipment

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.

D: Training

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

- WHMIS training
- Lead in building materials: evaluating and controlling the hazard