**Soldering Iron Safety**

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| |  | | --- | | The soldering iron transfers heat and melts the solder to create a **joint**. A soldering iron can pose several safety hazards, so make sure to use it with caution. A typical soldering iron can reach temperatures of up to 700° F (371° C). To avoid potentially severe burns, it is extremely important never to touch the hot end of the soldering iron, which can happen easily if you are not paying attention.  Never point a hot soldering iron at another person, or hold it your hand, gesturing, while you talk. If you are not soldering, a hot soldering iron should be in its holder.  You must also use the proper work surface when soldering. Make sure the surface on your worktable is heat-resistant or covered with a heat-resistant mat, so that the heat from the soldering iron will not cause the surface to ignite. Always devote your full attention to the task at hand when soldering.  **Working Safely with Solder** | |
| |  | | --- | | **Solder** is the substance used to join components. Working with solder can be hazardous due to the heat of the substance and the fumes that can be emitted. Avoid breathing these flumes as much as possible.  When working with solder, always remember that it is very hot and can burn your skin on contact. Make sure to handle the equipment carefully to avoid flying drops of solder. Wear clothing that covers your arms and legs so that your skin is not exposed. Some types of soldering irons allow you to adjust the iron's temperature, so always solder at the recommended temperature for the application. Soldering at too high of a temperature can cause the solder to spatter and could also damage sensitive components. In addition, always wear **safety glasses** when soldering to protect your eyes.   Because the chemicals contained in solder may be **toxic**, never touch your hands to your face or eyes at any time when working with solder. If you have any cuts on your hands, make sure they are covered with bandages before soldering, or you may wish to wear **safety gloves** while soldering to protect your hands. When finished working, wash your hands thoroughly to remove any harmful chemicals. | |

**Dangers of Lead Exposure**

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| |  | | --- | | Many solders used today contain **lead**, which is known to cause serious health problems. When the solder is melted, as shown in Figure 1, lead fumes can be released. The **Occupational Safety and Health Administration** (OSHA) states that lead exposure is one of the most common causes of workplace illness. As an assembler, you must be aware of the potential for illness caused by lead and take precautions to avoid exposure.  Lead can have various damaging and even deadly effects on your health, as illustrated in Figure 2. Lead primarily affects the nervous system, and some workers who have been exposed for long periods of time have reported decreased nervous system function. Lead exposure can also cause increased blood pressure, anemia, brain and kidney damage, or even death in severe cases. Pregnant women who are exposed to high levels of lead can also suffer miscarriage.  Your employer has a responsibility to provide you with a safe working environment, including safety precautions such as **personal protective equipment** (PPE). However, it is your responsibility to be aware of the dangers of lead and take precautions to protect yourself. | |

**Avoiding Toxic Fumes**

When soldering, you may encounter **fumes** from materials such as **solder** or **flux**, which is shown in Figure 1. Solder often contains dangerous lead fumes, and some fluxes also contain chemicals that can be toxic if inhaled. The **Material Safety Data Sheet** (MSDS) for the solder or flux you are working with provides information about the chemicals contained in the material. Your employer should keep this valuable resource in an easily accessible location, as shown in Figure 2.  
  
One of the most common ways lead enters the body is through inhalation. To avoid breathing toxic fumes, only solder in a well-ventilated area. In most shops, each workstation will be equipped with a **benchtop fume extractor**, designed to draw smoke and toxic fumes away from the soldering workstation. Figure 3 shows a soldering workstation with a benchtop fume extractor.  
  
Symptoms of exposure to toxic fumes from flux can include watery or itchy eyes, a runny nose, sore throat, coughing or wheezing. Long-term exposure to fumes may even lead to the development or worsening of asthma. If you suspect you are suffering health problems due to exposure, talk to your supervisor immediately.

**Reducing Risk from Electricity**

When working with electronic components, there is the risk of **electrostatic discharge** (ESD), which can cause a fire or damage components. Your workstation can be configured to reduce the risk of energy release due to static electricity, as indicated by the safety sign in Figure 1.  
  
Some soldering stations and materials are designated as **ESD-safe**. This means the soldering station is designed with a material that transfers the static energy from your body to the ground instead of the tip of the soldering iron, where it can cause sparks or damage components. Other materials such as **bench mats** and **wrist straps** can be used to reduce the risk of ESD. Some assemblers wear special smocks and shoes designed to avoid generating static electricity. You should also avoid wearing jewelry such as bracelets or rings that could conduct electricity. Different work environments require different types of devices, so ask your supervisor what is used in your shop.  
  
There are additional steps you can take to reduce your risk of injury from electricity when soldering. You can plug your soldering iron into a **grounded outlet** (Figure 2), which contains an additional hole for the **grounding prong** on the plug (Figure 3). Also, make sure that multiple devices are not plugged into the same outlet through use of extension cords. Too much electricity flowing to one outlet can cause it to overload and potentially cause an electrical fire.

**Fire Prevention**

As with any application involving high temperatures, soldering poses the risk of fire. Workplace fires are one of the leading causes of worker injury and death. It is extremely important to minimize the risk of fire as much as possible.  
  
Before soldering, inspect your soldering equipment to make sure that it is in good repair and not defective, because faulty equipment could start a fire. For example, a frayed power cord on a soldering iron is a safety hazard. Figure 1 lists steps for fire prevention while soldering.  
  
Keep your workstation clean and free of any flammable items, such as loose paper or rags. A hot soldering iron that comes in contact with a piece of paper could easily start a fire. It is your responsibility to minimize this risk at your workstation. Replacing your soldering iron in its stand after use also greatly reduces the risk of fire at your workstation.  
  
Lastly, make sure that your soldering work surface is **nonflammable**. For example, soldering on a wooden table that is not covered with a heat-resistant surface is a safety hazard because the heat from the iron could ignite the wood.

**If Fire Occurs**

Even with the use of safety precautions, it is possible for fires to occur in the workplace. Your company should be prepared with a plan of action in case a fire does occur while you are working.  
  
A multi-purpose **dry chemical extinguisher**, shown in Figure 1, should be easily accessible to your work area. Your supervisor will tell you if employees are expected to use fire extinguishers in case of fire. If so, you should be trained on how to use the fire extinguisher. Most fire extinguishers operate using the **P.A.S.S. technique**:

1. PULL the pin to break the tamper seal.
2. AIM low by pointing the nozzle, horn, or hose at the base of the fire.
3. SQUEEZE the handle to release the extinguishing agent.
4. SWEEP from side to side at the base of the fire until it appears to be out. If the fire reignites, repeat steps 2-4.

Figures 2 and 3 illustrate the P.A.S.S. technique. If you have any doubt that you can put out a fire, evacuate the area immediately. You must also sound the fire alarm, call the fire department, and identify a safe evacuation path for yourself before engaging in firefighting.

**Workstation Safety**

One of the most important safety precautions you can take as an assembler is to make your workstation a safe place to work. To prevent fires, keep your workstation free of any clutter or flammable items, such as loose paper or plastic. Because it is possible to ingest toxins such as lead, avoid eating or drinking at your workstation, since toxic fumes and dust could settle on food or beverages, as indicated by the sign in Figure 1. Never smoke at your workstation, because in addition to being a fire hazard, smoking could cause you to inhale fumes from solder or flux.  
  
The floor of your workstation should be clean and free of items that can trap dust and fumes. Fumes from solder or flux can also settle in your work clothing. Wash your clothing often to avoid absorbing toxins through your skin or spreading them to other parts of your home or workplace.

**Ergonomics for Soldering**

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| |  | | --- | | **Ergonomics** is the study of designing workplaces and devices to optimize operator comfort and reduce fatigue. The job of soldering can present ergonomic difficulties due to the posture the assembler must maintain and the repetitive motion of soldering. However, there are steps that you can take to maximize your comfort in your work environment.  One factor contributing to assembler discomfort may be eye strain caused by poor lighting. Better lighting in the shop can reduce the need for straining. A device such as a magnifying lamp, shown in Figure 1, can also make it easier for assemblers to see the small components they are soldering, thereby reducing discomfort such as headaches and fatigue.  It is also possible to purchase ergonomically designed workbenches and workstations to help adjust your posture and reduce strain and fatigue during assembly. If your shop does not have this type of workstation, you can reduce discomfort by taking short breaks to stretch your muscles and relieve strain and fatigue. | |

**Summary**

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| |  | | --- | | The process of soldering requires certain safety precautions because many of the tools and processes used can pose safety hazards. A typical soldering iron can reach temperatures of up to 700°F (371°C). Solder is the substance used to join components. Working with solder can be hazardous due to the heat of the substance and the fumes that can be emitted.  Many solders used today contain lead, which is known to cause serious health problems such as increased blood pressure, anemia, brain and kidney damage, or even death. To avoid breathing toxic fumes, only solder in a well-ventilated area. When working with electronic components, there is the risk of electrostatic discharge (ESD), which can cause a fire or damage components. Materials such as bench mats and wrist straps can be used to reduce the risk of ESD. To reduce the risk of electrical fire, you can plug your soldering iron into a grounded outlet.  Workplace fires are one of the leading causes of worker injury and death. A multi-purpose dry chemical extinguisher should be easily accessible to your work area. To prevent fires, keep your workstation free of any clutter or flammable items, such as loose paper or plastic. Soldering can also present ergonomic difficulties due to the posture the assembler must maintain and the repetitive motion of the soldering. | |