

**Knowledge domain: Mechanical**  
**Unit: Attachment**  
**Skill: Soldering Brass/Copper tubes**

**Tools and Parts Required:**

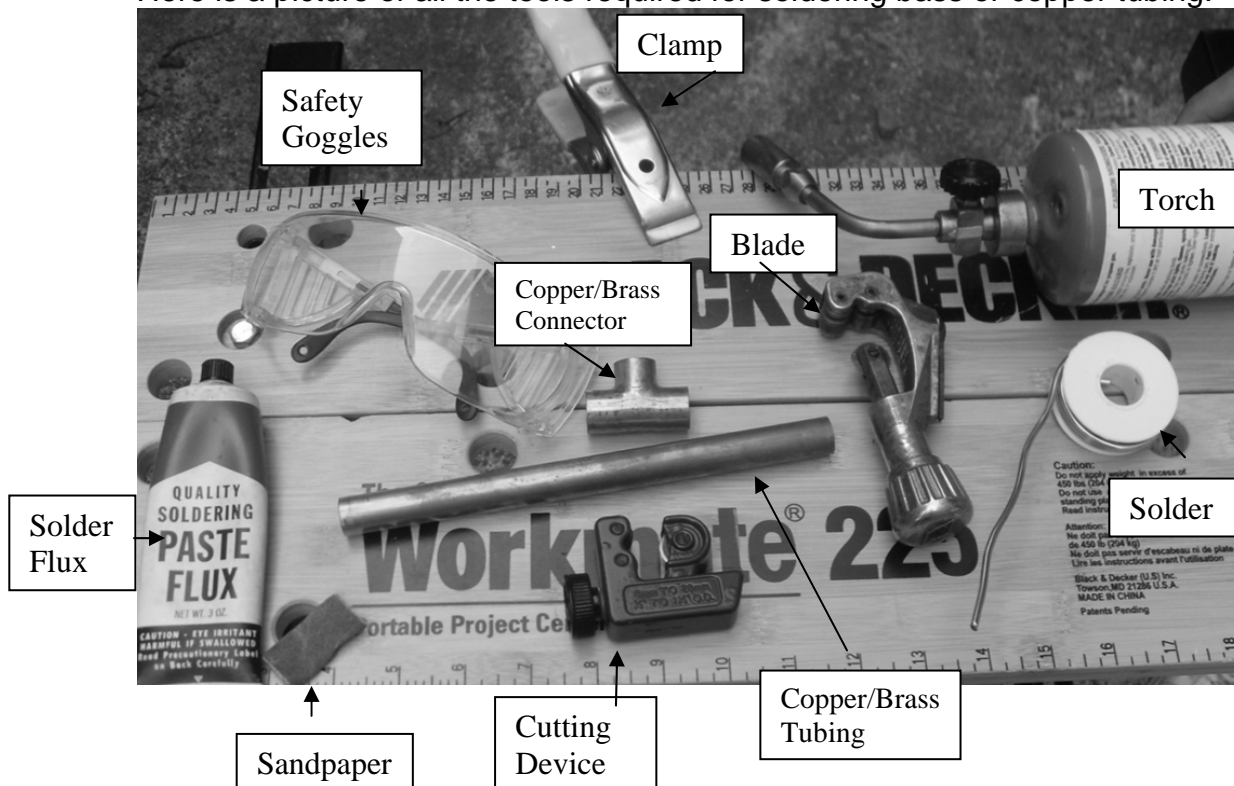
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|------------------------------------|--|
| 1. Butane Torch                    | 8. Blade                                   |
| 2. Solder                          | 9. Work Gloves (heat resistant)            |
| 3. Sandpaper                       | 10. Safety Goggles                         |
| 4. Brass or Copper Tube            | 11. Mask                                   |
| 5. Brass or Copper Connector       | 12. Clamp                                  |
| 6. Solder Flux                     | 13. Rubber sheet for insulation (optional) |
| 7. Hacksaw or other cutting device |  |

**Introduction**

Soldering joins metal items together. Solder is a metal that is heated onto the joint. Electronic components are assembled with solder. Soldering also connects brass and copper tubes.

**Example**

Here is a picture of all the tools required for soldering brass or copper tubing.



**Identification and Diagnosis**

Soldering will connect brass or copper tubing used for plumbing. A broken solder joint in tubing will leak gas or liquid. A broken solder joint may be loose. A broken solder joint may turn copper tubing near the joint green. Soldering may be used to make one long copper tube out of two shorter pieces.

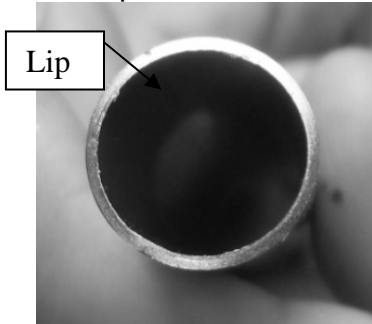
## Procedure

Fumes from soldering may be unhealthy. Work in an area with adequate ventilation. Work outside if possible.

1. Wear safety goggles. Wear a mask to prevent fume inhalation. Wear gloves for further protection.
2. Place the metal tubing in a clamp. Tighten the clamp around the metal tubing.
3. Cut the end of the tube to be soldered. Cut the metal tubing with a hacksaw or other cutting device. The cut end has a smooth edge that makes a better connection.



4. Look inside the cut end of the tube. There is a small lip on the inside rim of the tube. This lip must be removed. Use a blade to cut off the lip.



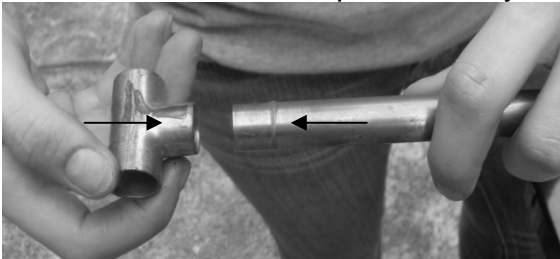
5. Rub the sandpaper on the outside of the metal tubing and the inside of the connector that will be soldered. Rub where the connection will be made. The sandpaper cleans the metal. Sanding increases the strength of the joint. The metal will shine after proper sanding.



6. Apply flux to the sanded end of the tube. Flux helps the solder stick to the metal.



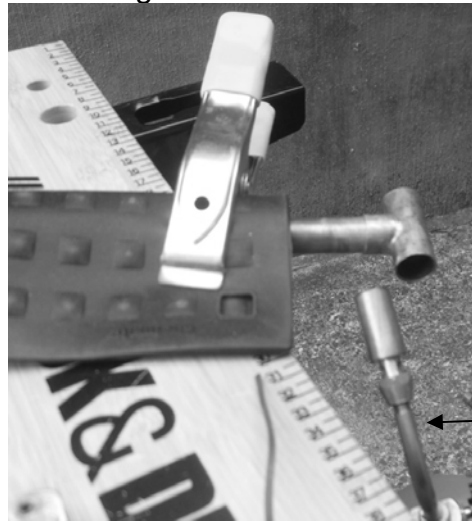
7. Insert the metal tubing into the connector. Rotate the tubing several times. This insures that the flux is spread evenly over the metal.



8. The tubing is ready to be soldered. Use clamps to secure the metal in place on your work bench.

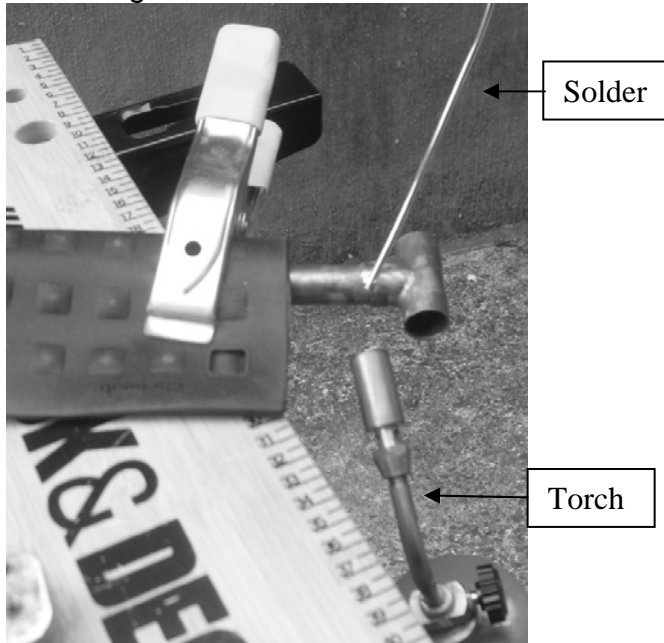
**CAUTION:** The metal is **EXTREMELY HOT** when soldering. Do not touch the tubing until it is completely cool.

9. Light the torch. Heat the copper or brass tubing with the torch for 60 seconds.

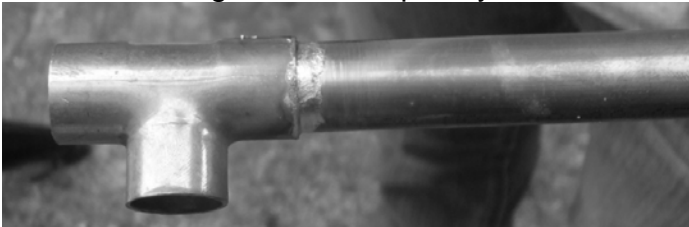


Torch

10. Touch the solder to the heated metal tubing. The hot tubing will melt the solder. The solder will flow around and into the joint. If the solder does not melt, continue heating the tubing with the torch.



11. When the solder melts onto the metal tubing, stop using the torch. Turn off the torch. Remove the torch from your work area. Touch the solder to the tubing again.
12. The solder will melt quickly (approximately 30 seconds). Remove the solder after it has flowed into the entire joint. You will need to look underneath the part to make sure the solder has flowed into the entire joint.
13. Allow the tubing to cool completely. Wait 15+ minutes before touching the metal.



### Exercise

Your instructor will give you a piece of brass or copper tubing and a connector. Use solder and a torch to join the metal tubing and the connector. Use caution when working with extreme heat.

Attempt to separate the pieces. They should be strongly connected. Fill the tube with water. It should not leak. Your instructor must verify your work before you continue.

### Preventative Maintenance and Calibration

Always calibrate every medical device before returning it to use.