

**Workshop 3 — Electronic Assembly**  
Wednesday, January 5, and Thursday, January 6, 2005  
38-600

## 1 Items to Bring

- RF Kit (in silvered Ziploc bag; containing the antenna)
- Soldering iron (optional, may be purchased from the 6.270 office)

## 2 Reading

Section 4.1 of course notes

## 3 Solder

When you solder something, the joint should look shiny—if it's not, the joint is not well-soldered, and you might want to resolder it. Try to make your joints look like Hershey Kisses, not balls. When the solder is sufficiently hot, it flows properly, giving the Hershey-Kiss appearance (Figure 1).

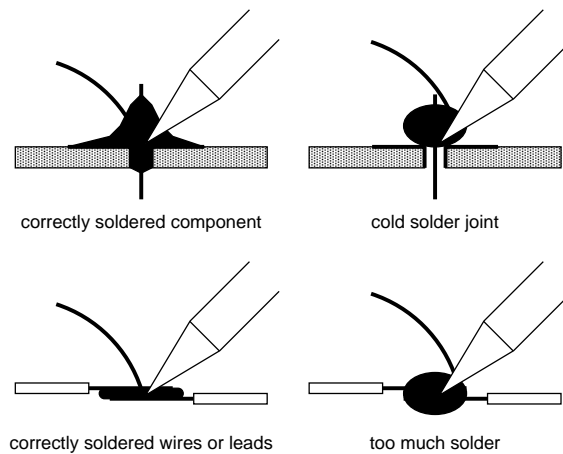


Figure 1: Soldering Joints

## 4 Purchasing and Using Lab Soldering Irons

6.270 has purchased a large quantity of soldering irons, and we have them available for purchase. We also have lab soldering irons as well. Purchasing a soldering iron gives you the freedom to work anywhere; using a lab soldering iron saves you a few bucks. In either case, we have solder in the lab that you're welcome to use, at no cost.

When using the soldering irons, try to keep them clean and well-maintained. Doing so will make them work better, making your life easier. To do this, be sure to keep your sponge wet, and keep the tip of the iron clean by wiping it on the sponge.

Also, make sure the tip of the soldering iron is tinned before use. The tips last longer. Immediately after use, the soldering iron *must* be cleaned off, or the solder hardens onto the tip and cannot be removed.

## 5 How to Solder PCBs

To solder components, stick the component through the PCB, and bend the leads if they are sufficiently long, so that the component stays attached to the board while you solder it. Turn the board upside down, so that the component is on the underside of the board, and you are soldering the top side of the board. Hold a piece of solder to the joint, and then use your soldering iron to heat the joint (do not use the soldering iron to melt the solder onto the joint!!), until touching the solder to the joint will melt it. Remember that your connection should be shiny and shaped like a Hershey Kiss—reheat the joint if it's not.

If the leads are long, after you have soldered the joint, cut the excess off with the diagonal cutters.

Please note: the ribbon cable available in lab is used for the motors and sensors only, not the expansion board. Also, do not try to use just one strand from the battery cable provided in your kit.

## 6 Soldering Motors and Sensors

Use the ribbon cable available in lab for your motors and sensors. Expose some of the wire, then twist the wire to keep the strands together. Tin the wire by coating it with a small amount of solder. Doing so will keep the wire from splitting, and it will make it easier to attach to motors and header.

Be sure to insert shrink wrap onto the wire before soldering the wire to the component. After the component has been soldered to the wire, use the heat gun to seal the shrink wrap around the connection. The shrink wrap insulates the connection and makes it less likely (although not impossible) to break. Use the 1/16" shrink wrap available in lab for ribbon cable.

## 7 When You Make a Mistake

- **Desoldering pump.** Get the desoldering pump and set it by pushing in the plunger. Heat the joint with the soldering iron until the solder is liquid, place the tip of the pump over the joint, and press the button on the pump. It should suck off the solder. You might have to do this a few times before you get all the solder off, especially if you used a large amount of solder. Do not take the desoldering pump without asking a staff member!
- **Desoldering wick.** Obtain a piece of desoldering wick from the lab. The desoldering wick is rolled inside a plastic case for easy use. Expose a small piece of the wick. Place it over the joint, and heat the joint by placing the soldering iron over the wick. Do not touch the wick itself, for it will get very hot very quickly. The wick should absorb the solder, removing the solder from the joint. Do not take the desoldering wick without asking a staff member!

## 8 General Tips

- The wires do begin to get hot after a while, so be careful about keeping the soldering iron on the wire or electrical component for too long. You can use pliers or the helping hands to hold the components and wires in place while you solder. When soldering header, keeping the soldering iron on the connector for too long may melt the plastic and lead to unaligned prongs, which will be a problem when you try to plug sensors, motors, or servos onto your expansion board or HandyBoard.

- Solder as quickly as possible. Sometimes if the wire gets too hot, the insulation on the wire will melt away and no longer be effective.
- Tinning stranded wires (battery pack cable, ribbon cable) before soldering to the component can make soldering easier.
- Helping Hands: while not necessary, they can do their job. Consider purchasing one from the 6.270 office. Helpful with male header and smaller PCBs like the beacon.
- When soldering the battery pack together, do *not* attempt to cut more than one wire at a time, especially if they are connected to the battery. You will be shocked. Do not accidentally touch the exposed leads either—you will be burned.
- Soldering the servo inputs on the expansion board is tricky. Be careful of the male header, because it will get hot once in contact with the soldering iron.
- One of the better ways to solder the expansion board is to place in the Handy Board the male header that interfaces with the expansion board. Then place the expansion board on top, and solder the joints. This prevents you from soldering the header at inaccurate angles such that it becomes very difficult to install and remove the expansion board from the Handy Board.
- *Keep the soldering tips clean, whether it is your soldering iron or the lab's.*
- *Make sure the sponge is wet with water.*
- DO NOT solder chips directly to the PCB. Instead, solder the sockets to the PCB and insert the chips.

## 9 Activity

Solder your RF Receiver Board. Follow the directions, which can be found at:

[http://web.mit.edu/6.270/www/contestants/handouts/rf\\_instructions.pdf](http://web.mit.edu/6.270/www/contestants/handouts/rf_instructions.pdf)

Feel free to ask staff members questions you may have about the directions or soldering in general.