Soldering

Introduction

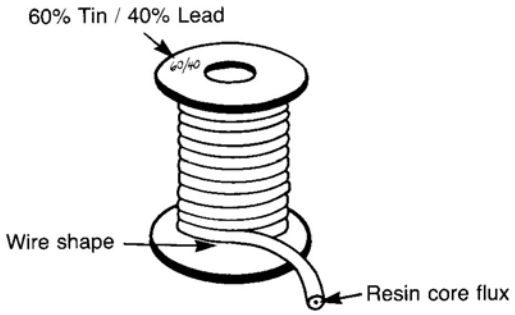

Figure 1

All electrical splices should be soldered. Soldering involves applying a thin coat of solder to the splice. Soldering improves the mechanical strength of the splice. It also helps to lower the electrical resistance of the splice by increasing the contact area between the conductors and preventing any corrosion or oxidation of the copper. Solder is an alloy made up of tin and lead and has a low melting point. The tin/lead ratio determines the strength and melting point of the solder. For most electrical and electronic work, 60/40 type solder with a resin flux core is recommended (Figure 1 & 2).

Flux and Oxidization

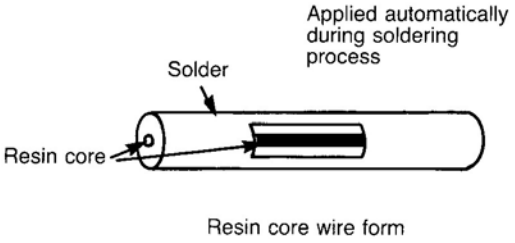

Figure 2

When soldering, the copper surfaces being soldered must be free from dirt and oxide otherwise the solder will not adhere to the splice. Wires should be cleaned by lightly scraped or sanded to remove any dirt before they are made into splices. Heating the copper splice for application of the solder increases the oxidation process. For this reason a soldering flux or paste (Figure 3) must be applied to the splice when soldering. The flux prevents oxidation of the copper surfaces by insulating the surface from the air, for both acid and resin based fluxes are available. It is important to note that acid based fluxes should not be used in electrical work as they tend to corrode the copper wires. Resin flux is available in paste form or as a continuous core inside solder wire.

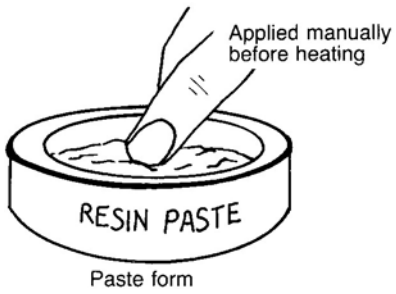

Figure 3

Common Heat Sources


Figure 5

The most common method of applying heat to a splice is by means of a soldering gun (Figure 4) or soldering iron (Figure 5). Other common heating methods used are the butane pocket iron, propane torch and a copper iron. Heat in a soldering gun is produced by means of transformer action. The soldering gun heats up very quickly but has a short duty cycle. Heat in a soldering iron is produced by means of a heating element similar to that found in a toaster. The soldering iron heats up at a slower rate but has a longer duty cycle.

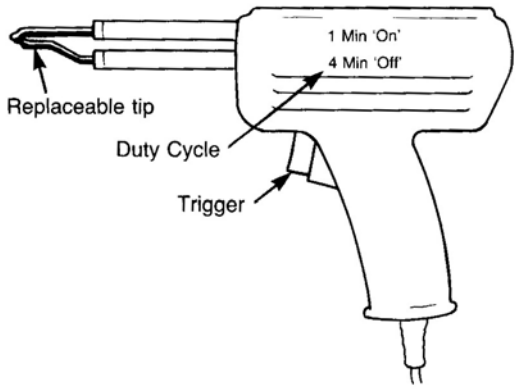

Figure 4

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Soldering Tips

For the best soldering results, the copper heating tip of the soldering iron or gun must be kept clean and well tinned. New tips must be tinned before they can be used for the first time. This can be accomplished by applying solder to the heated tip and wiping it clean. A wet paper towel is sufficient, for wiping the solder tip clean, but always be careful as you can burn yourself very easily. A well tinned tip, will conduct the maximum amount of heat, from the tip to the surface being soldered. Safety glasses should be worn during both the tinning and soldering processes to provide adequate eye protection.

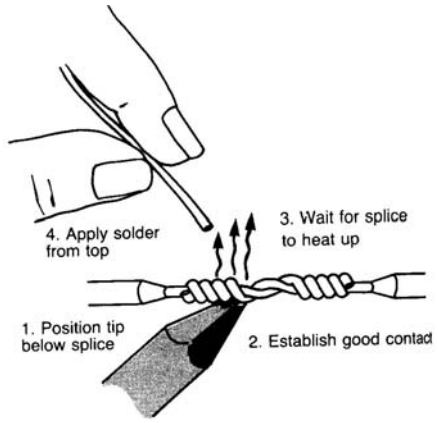

Figure 7

To do the actual soldering, position the heated copper tip below the splice and establish a good contact between the tip and splice (Figure 6). Wait until the splice is hotter than the melting point of the solder before beginning to solder. If the joint is not heating up quick enough, i.e. it is melting the insulation then a solder bridge must be used. A solder bridge is a small amount of solder that is applied to the solder iron, and the work. This gives more surface contact to the object being soldered. By increasing the solder area contact, this will allow more heat to transfer faster to the joint, therefore allowing you to complete the soldering job before the insulation starts to melt. Once the joint is hot enough (test by touching the joint momentarily) apply the solder from the top. Gravity and adhesion will cause the flux and solder to reach all parts of the splice.

A good soldered splice should be covered entirely with a thin coat of glossy solder. An example of a good solder joint (figure 7b) will show the solder completely around the conductor. A bad solder joint will have the solder only around the outside of the joint. Poor workmanship can also be seen, by thick and sloppy solder deposits.

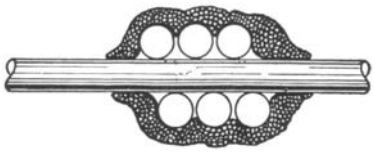

Figure 6a

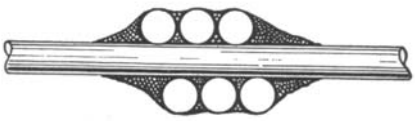

Figure 7b

Detailed Steps to Soldering

1. Start with safety glasses and a safe and clean working area.
2. Plug the solder iron into an electrical outlet and set it on the soldering stand.
3. Place a small amount of soldering flux (paste) all over the splice.
4. Test the solder iron from time to time with a piece of wire solder (60/40). The iron should be hot enough to melt the solder quickly.
5. When the solder iron is hot enough, place the tip under the splice, as shown in Figure 6, until the paste has melted and run down through all parts of the splice.
6. Test the joint from time to time to see if the joint is hot enough (use solder bridge if needed) to melt the solder quickly.
7. Once the joint is hot enough, touch the solder to the top of the splice until it melts and runs down through all parts of the splice.
8. Shake or wipe the excess solder from the splice if needed. It is not necessary or desirable to fill all the cracks or holes in the splice. If enough heat is used, the excess solder will run out.

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Review Questions

All questions must be answered before practical work is done. Answer questions neatly in the space provided.

1. What three precautions must be taken when removing insulation from a wire conductor?

   _____

   _____

   _____

2. State the purpose of soldering.

   _____

   _____

3. Why must all electrical splices be both electrically and mechanically secure before they are soldered?

   _____

   _____

4. What composition of solder should be used for soldering electrical joints and splices?

   _____

5. Why must flux paste be used when soldering a joint?

   _____

   _____

6. What is meant by duty cycle on a solder iron and a solder gun?

   _____

   _____

7. Why is it important to have a clean solder iron tip and what would you use to clean the tip?

   _____

   _____

   _____

8. What types of flux must be avoided when soldering electrical connections and why?

   _____

   _____

Mark Breakdown Column

Q#	A
1	3
2	2
3	2
4	1
5	1
6	1
7	3
8	1
9	4
10	2
11	2
12	3
13	2
14	1
15	6
T=	34

9. Name four methods by which heat may be applied for soldering electrical work.

_____

_____

_____

10. Why is it important to apply proper heat to a splice when soldering?

_____

_____

_____

11. Name two safety concerns that you must be aware of when soldering.

_____

_____

12. If when trying to solder a joint, you find that it is taking a long time to heat up, and the insulation is melting what three things could you do to maximize the heating?

_____

_____

_____

13. Explain what a good solder joint should look like and what characteristics it should not have.

_____

_____

_____

14. For best solder results, what must be done?

_____

_____

15. In your own words, list in 6 short points of what steps you would take to solder a joint properly.

_____

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Mark Breakdown Column

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