QUIZ

1. The Whooper Alarm has _____ oscillators.
2. The low frequency oscillations are generated by transistors _____ and _____.
3. The high frequency oscillations are generated by transistors _____ and _____.
4. When the power is first turned on, the voltage at the base of Q2 is _____.
5. When the power is first turned on, the voltage across C1 is _____.
6. Capacitor C1 charges through resistor _____ and discharges through resistor _____.
7. The charge to discharged ratio on C1 is _____.
8. Capacitor C3 causes transistor Q3 and Q4 to _____.
9. The frequency of oscillation of Q3 and Q4 is about _____ cycles per second.
10. The speaker is driven by transistors _____ and _____.

Answers: 1) two; 2) Q1, Q2; 3) Q3, Q4; 4) 5.4V; 5) zero; 6) R2, R8; 7) 22:1; 8) oscillate; 9) 1,000; 10) Q4, Q5

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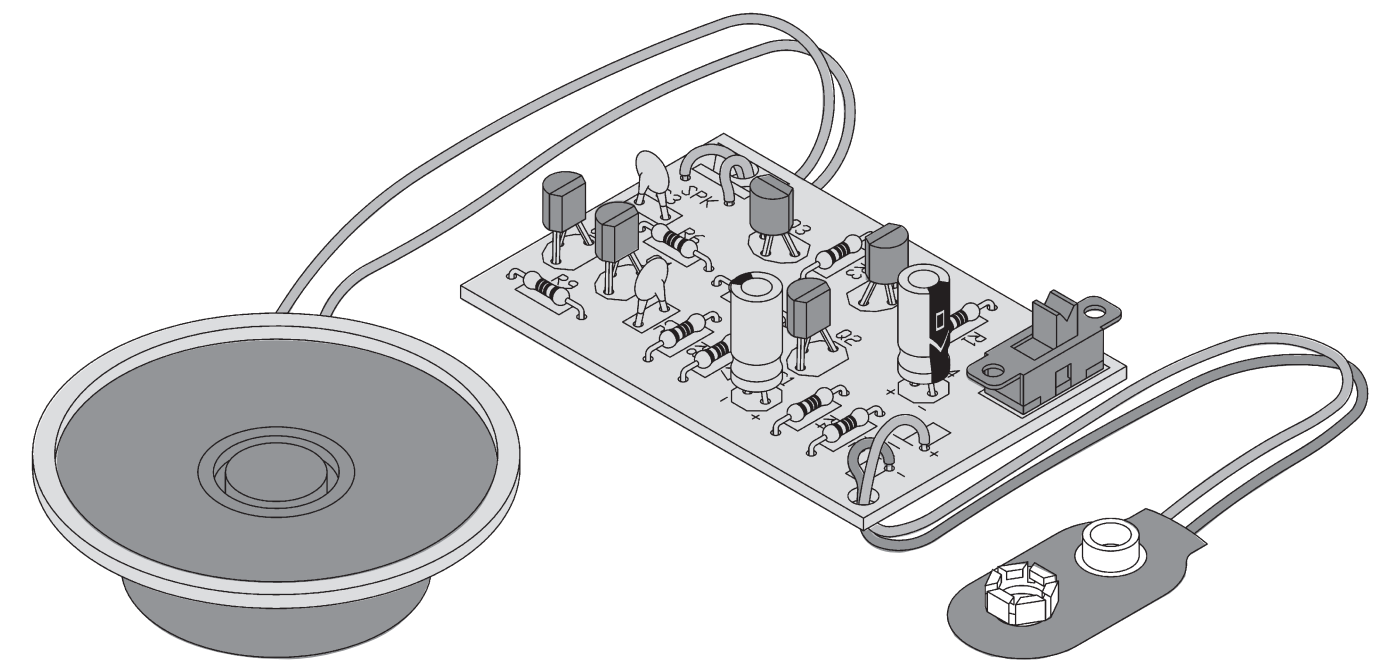
WHOOPER ALARM KIT

MODEL K-24



Instruction & Assembly Manual

Elenco® Electronics, Inc.

Revised 2009 REV-F 753224

PARTS LIST

If you are a student, and any parts are missing or damaged, please see instructor or bookstore.
If you purchased this Whooper Alarm Kit from a distributor, catalog, etc., please contact Elenco® Electronics (address/phone/e-mail is at the back of this manual) for additional assistance, if needed. **DO NOT** contact your place of purchase as they will not be able to help you.

RESISTORS

Qty.	Symbol	Description	Color Code	Part #
❒ 1	R8	100Ω 5% 1/4W	brown-black-brown-gold	131000
❒ 2	R3, R6	1kΩ 5% 1/4W	brown-black-red-gold	141000
❒ 1	R2	2.2kΩ 5% 1/4W	red-red-red-gold	142200
❒ 1	R5	6.8kΩ 5% 1/4W	blue-gray-red-gold	146800
❒ 2	R1, R9	15kΩ 5% 1/4W	brown-green-orange-gold	151500
❒ 1	R4	22kΩ 5% 1/4W	red-red-orange-gold	152200
❒ 1	R7	27kΩ 5% 1/4W	red-violet-orange-gold	152700

CAPACITORS

Qty.	Symbol	Value	Description	Part #
❒ 2	C2, C3	.047µF (473)	Discap	244780
❒ 2	C1, C4	100µF	Electrolytic	281044

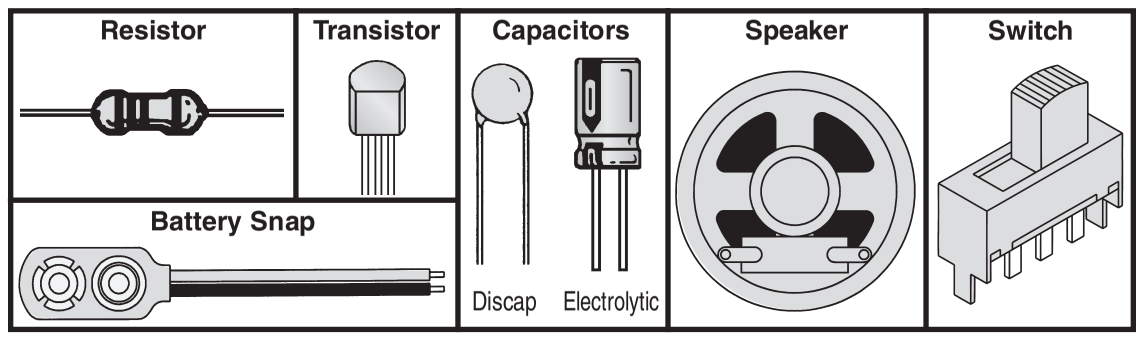
SEMICONDUCTORS

Qty.	Symbol	Value	Description	Part #
❒ 3	Q1, Q3, Q4	2N3904	Transistor	323904
❒ 1	Q2	2N3906	Transistor	323906
❒ 1	Q5	MPS6531	Transistor	326531

MISCELLANEOUS

Qty.	Symbol	Description	Part #	Qty.	Symbol	Description	Part #
❒ 1		PC Board	518000	❒ 1	B1	Battery Snap 9V	590098
❒ 1	S1	Switch Slide SPDT	541102	❒ 1	SPK1	Speaker 8Ω	590102
❒ 1		Solder Roll 24”	551124	❒ 2		Wire 4” Blue	814620

PARTS IDENTIFICATION



BATTERIES

- Do not short circuit the battery terminals.
- Never throw battery in a fire or attempt to open it.
- Use only 9V type (not included).
- Insert battery with correct polarity.
- Non-rechargeable batteries should not be recharged.
- Remove battery when it is used up.
- Batteries are harmful if swallowed, so keep away from small children.

TROUBLESHOOTING

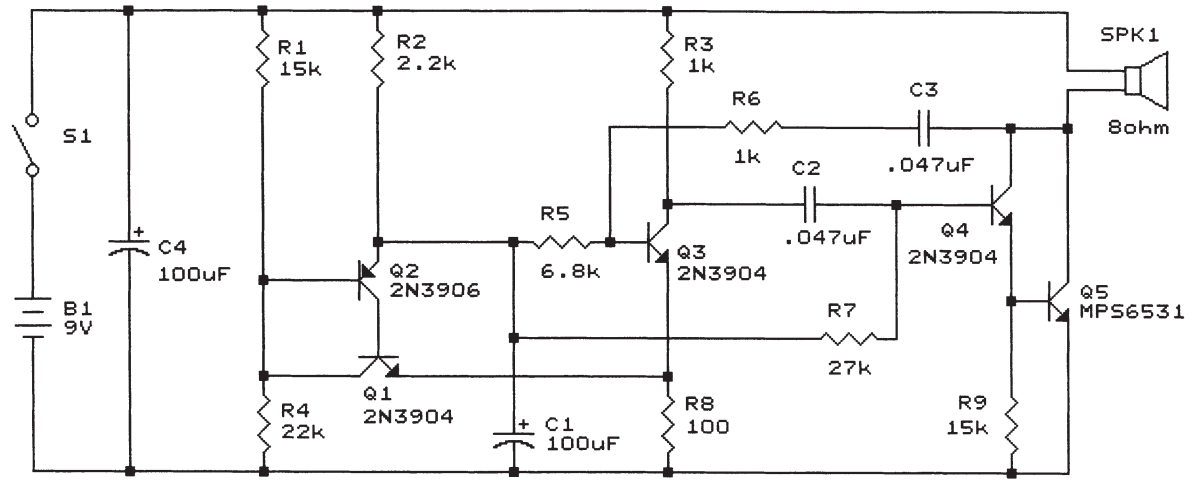
Consult your instructor or contact Elenco® Electronics if you have any problems. **DO NOT** contact your place of purchase as they will not be able to help you.

1. One of the most frequently occurring problems is poor solder connections.
   a) Tug slightly on all parts to make sure that they are indeed soldered.
   b) All solder connections should be shiny. Resolder any that are not.
   c) Solder should flow into a smooth puddle rather than a round ball. Resolder any connection that has formed into a ball.
   d) Have any solder bridges formed? A solder bridge may occur if you accidentally touch an adjacent foil by using too much solder or by dragging the soldering iron across adjacent foils. Break the bridge with your soldering iron.

COMPONENT CHECK

1. Be sure that all of the components have been mounted in their correct places.
2. Be sure that the electrolytic capacitors C1 and C4 have been installed correctly. These capacitors have polarity, the negative and positive leads must be in the correct holes, as shown on the top legend of the PC board.
3. Be sure that transistors Q1 - Q5 have been installed correctly. The flat side should be in the same direction as shown on the top legend.
4. Use a fresh 9 volt battery.
5. Read the circuit operation lesson manual to familiarize yourself with the workings of the circuit.

SCHEMATIC DIAGRAM



ASSEMBLE COMPONENTS TO THE PC BOARD

☐ Q3 - 2N3904 Transistor (see Figure A)

☐ SPK - Speaker (see Figure B)

☐ C3 - .047µF (473) Discap

☐ R6 - 1kΩ 5% 1/4W Resistor (brown-black-red-gold)

☐ Q5 - MPS 6531 Transistor (see Figure A)

☐ R9 - 15kΩ 5% 1/4W Resistor (brown-green-orange-gold)

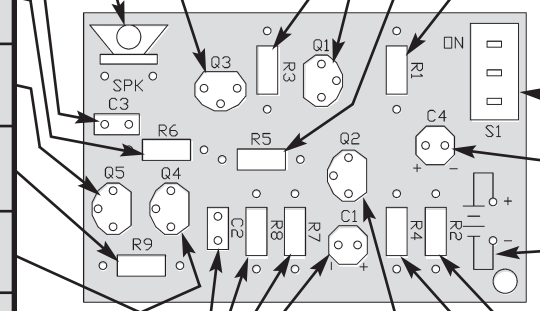
☐ Q4 - 2N3904 Transistor (see Figure A)

☐ C2 - .047µF (473) Discap

☐ R8 - 100Ω 5% 1/4W Resistor (brown-black-brown-gold)

☐ R7 - 27kΩ 5% 1/4W Resistor (red-violet-orange-gold)

☐ C1 - 100µF Electrolytic Cap. (see Figure C)



☐ R3 - 1kΩ 5% 1/4W Resistor (brown-black-red-gold)

☐ Q1 - 2N3904 Transistor (see Figure A)

☐ R5 - 6.8kΩ 5% 1/4W Resistor (blue-gray-red-gold)

☐ R1 - 15kΩ 5% 1/4W Resistor (brown-green-orange-gold)

☐ S1 - Slide Switch

☐ C4 - 100µF Electrolytic Cap. (see Figure C)

☐ B1 - Battery Snap (see Figure D)

☐ R2 - 2.2kΩ 5% 1/4W Resistor (red-red-red-gold)

☐ R4 - 22kΩ 5% 1/4W Resistor (red-red-orange-gold)

☐ Q2 - 2N3906 Transistor (see Figure A)

Figure A

Mount the transistor with the flat side in the same direction as shown on the PC board. Solder and cut off the excess leads.

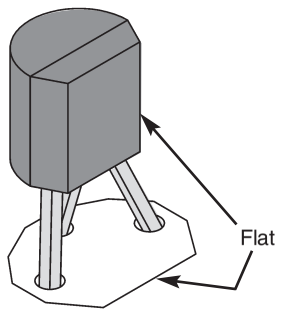


Figure B

Cut two 4" wires and strip 1/8" of insulation off of both wires. Solder a wire to each lug of the speaker and then insert the other end of the wires through the hole in the PC board, and solder in the place shown on the top legend.

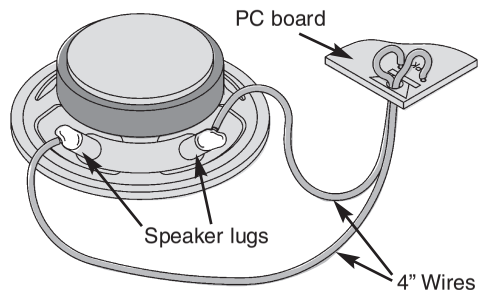


Figure C

Electrolytic capacitors have polarity. Be sure to mount them with the negative (–) lead (marked on side) in the correct hole.

Warning:

If the capacitor is connected with incorrect polarity, it may heat up and either leak, or cause the capacitor to explode.

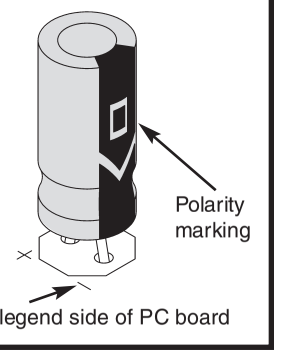
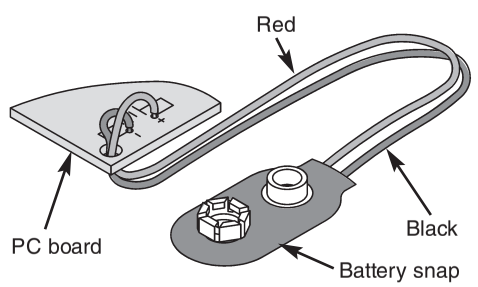
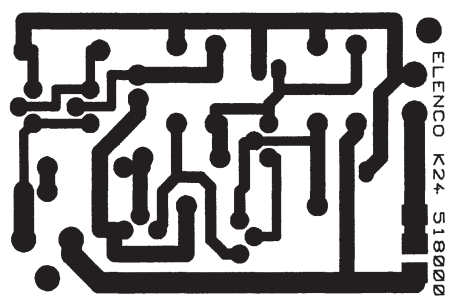


Figure D

Insert the red and black wires through the hole in the PC board as shown. Insert the red wire into the positive (+) hole and the black wire into the negative hole. Solder and cut off the excess leads.





Foil Side of PC Board

IDENTIFYING RESISTOR VALUES

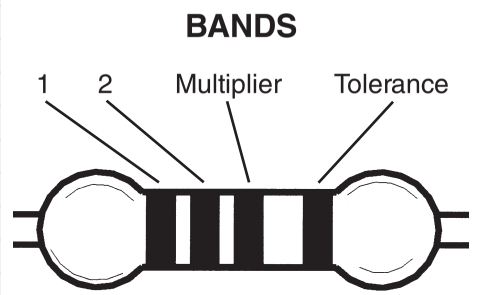
Use the following information as a guide in properly identifying the value of resistors.

BAND 1 1st Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

BAND 2 2nd Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	**Multiplier**
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	**Tolerance**
Silver	±10%
Gold	±5%
Brown	±1%
Red	±2%
Orange	±3%
Green	±0.5%
Blue	±0.25%
Violet	±0.1%

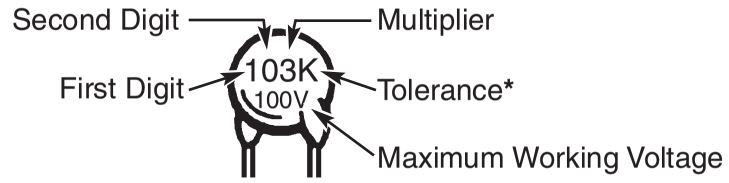


IDENTIFYING CAPACITOR VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or µF (microfarads). Most capacitors will have their actual value printed on them. Some capacitors may have their value printed in the following manner. The maximum operating voltage may also be printed on the capacitor.

Electrolytic capacitors have a positive and a negative electrode. The negative lead is indicated on the packaging by a stripe with minus signs and possibly arrowheads.

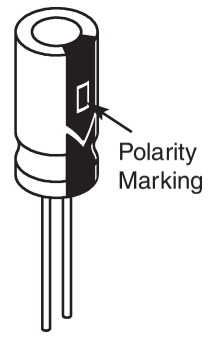
Multiplier	For the No.	0	1	2	3	4	5	8	9
	Multiply By	1	10	100	1k	10k	100k	.01	0.1



The value is 10 x 1,000 = 10,000pF or .01µF 100V

Warning:

If the capacitor is connected with incorrect polarity, it may heat up and either leak, or cause the capacitor to explode.



*The letter M indicates a tolerance of ±20%
The letter K indicates a tolerance of ±10%
The letter J indicates a tolerance of ±5%

Note: The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3

METRIC UNITS AND CONVERSIONS

Abbreviation	Means	Multiply Unit By	Or
p	pico	.000000000001	10^{-12}
n	nano	.000000001	10^{-9}
µ	micro	.000001	10^{-6}
m	milli	.001	10^{-3}
–	unit	1	10^{0}
k	kilo	1,000	10^{3}
M	mega	1,000,000	10^{6}

1. 1,000 pico units	= 1 nano unit
2. 1,000 nano units	= 1 micro unit
3. 1,000 micro units	= 1 milli unit
4. 1,000 milli units	= 1 unit
5. 1,000 units	= 1 kilo unit
6. 1,000 kilo units	= 1 mega unit

MINIATURE RADIO TRANSMITTER

The Whooper Alarm puts out a wavering sound that is sure to startle an intruder. It can be used independently or as an accessory to the Burglar Alarm Kit K-23.

The Whooper Alarm circuit consists of two oscillators, a low frequency oscillator which drives a higher frequency unit at a predetermined rate. The high frequency oscillator drives an output transistor which powers the speaker.

CIRCUIT OPERATION

Figure 1 shows the circuits of the low frequency oscillator. When the power is first applied to this circuit, transistors Q1 and Q2 will not conduct. This is because the base of transistor Q2 is about 5.4V while the emitter is at zero volts.

A current is flowing in resistor R2 charging capacitor C1. When the voltage across C1 reaches 6V, transistor Q2 starts sending a current in the collector of Q1. The current in the collector of Q1 is mulitplied by the gain of transistor Q1 and this rapidly turns on transistor Q2. Capacitor C1 quickly discharges through resistor R8 as shown in Figure 2. Note that C1 charges through a 2200Ω resistor R2, but discharges through a 100Ω resistor R8. Thus, the charge to discharge ratio is 22:1. When C1 is discharged, Q1 and Q2 turn off and the whole cycle repeats itself.

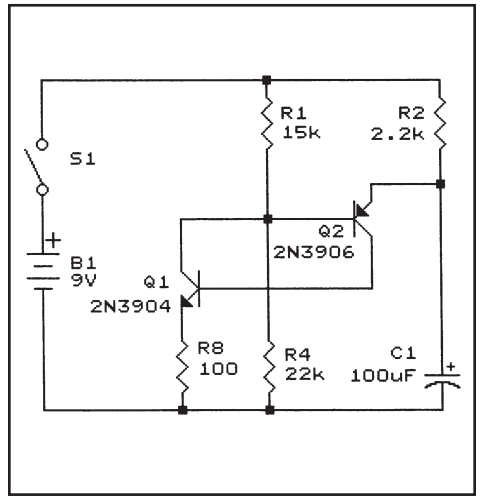


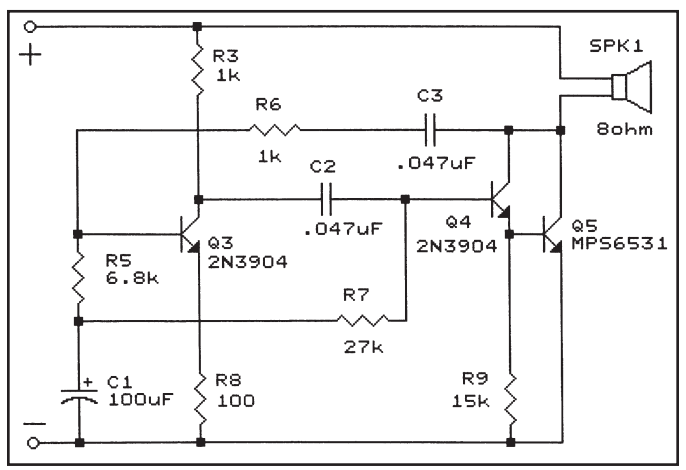
Figure 1

HIGH FREQUENCY OSCILLATOR

The circuit of the high frequency oscillator is shown in Figure 3. Transistors Q3 and Q4 are wired as amplifier stages. The bias for these amplifiers are controlled by the sawtooth of Figure 2. These amplifiers normally would amplify the low frequency pulses, except for the addition of capacitor C3. This capacitor takes the output of Q4 and feeds it in phase to the input of Q3. This causes the circuit to oscillate. The frequency of oscillation is controlled by the RC time constants of C3 and R6. The frequency of oscillation is about 1,000 cycles per second. This frequency is modulated with the low frequency oscillations to produce the Whooper Alarm sounds. Transistor Q5 further amplifies the signals and drives the speaker.

Figure 2

Figure 3



CONSTRUCTION

Introduction

The most important factor in assembling your K-24 Whooper Alarm Kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25 - 40 watts is recommended. **The tip of the iron must be kept clean at all times and well tinned.**

Solder

For many years leaded solder was the most common type of solder used by the electronics industry, but it is now being replaced by lead-free solder for health reasons. This kit contains lead-free solder, which contains 99.3% tin, 0.7% copper, and has a rosin-flux core.

Lead-free solder is different from lead solder: It has a higher melting point than lead solder, so you need higher temperature for the solder to flow properly. Recommended tip temperature is approximately 700°F; higher temperatures improve solder flow but accelerate tip decay. An increase in soldering time may be required to achieve good results. Soldering iron tips wear out faster since lead-free solders are more corrosive and the higher soldering temperatures accelerate corrosion, so proper tip care is important. The solder joint finish will look slightly duller with lead-free solders.

Use these procedures to increase the life of your soldering iron tip when using lead-free solder:

- Keep the iron tinned at all times.
- Use the correct tip size for best heat transfer. The conical tip is the most commonly used.
- Turn off iron when not in use or reduce temperature setting when using a soldering station.
- Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. Use Dry Tip Cleaner (Elenco® #SH-1025) or Tip Cleaner (Elenco® #TTC1). If you use a sponge to clean your tip, then use distilled water (tap water has impurities that accelerate corrosion).

Safety Procedures

- **Always wear safety glasses or safety goggles to protect your eyes when working with tools or soldering iron, and during all phases of testing.**
- Be sure there is **adequate ventilation** when soldering.
- Locate soldering iron in an area where you do not have to go around it or reach over it. Keep it in a safe area away from the reach of children.
- **Do not hold solder in your mouth.** Solder is a toxic substance. Wash hands thoroughly after handling solder.

Assemble Components

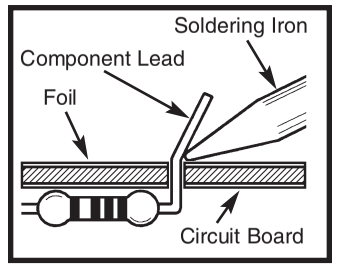
In all of the following assembly steps, the components must be installed on the top side of the PC board unless otherwise indicated. The top legend shows where each component goes. The leads pass through the corresponding holes in the board and are soldered on the foil side.
Use only rosin core solder.

DO NOT USE ACID CORE SOLDER!

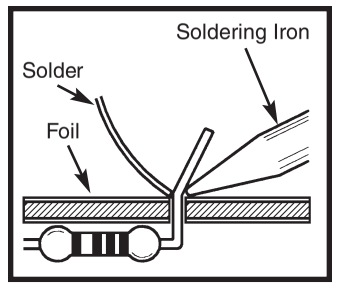
What Good Soldering Looks Like

A good solder connection should be bright, shiny, smooth, and uniformly flowed over all surfaces.

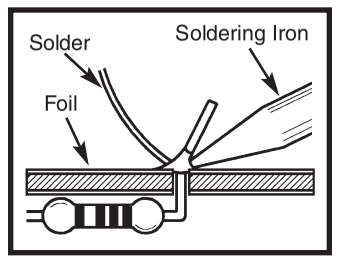
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



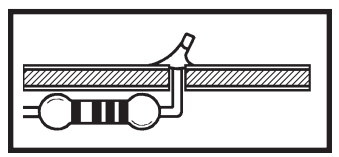
2. Apply a small amount of solder to the iron tip. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.



3. Allow the solder to flow around the connection. Then, remove the solder and the iron and let the connection cool. The solder should have flowed smoothly and not lump around the wire lead.

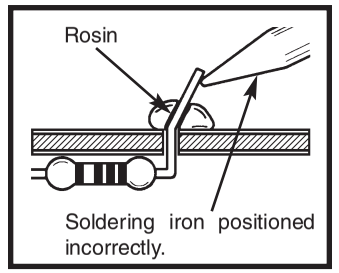


4. Here is what a good solder connection looks like.

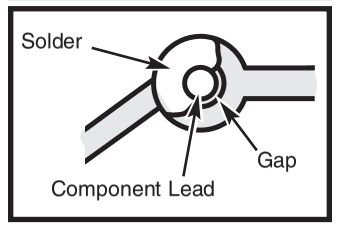


Types of Poor Soldering Connections

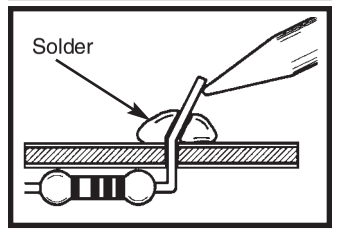
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



2. **Insufficient solder** - let the solder flow over the connection until it is covered.
Use just enough solder to cover the connection.



3. **Excessive solder** - could make connections that you did not intend to between adjacent foil areas or terminals.



4. **Solder bridges** - occur when solder runs between circuit paths and creates a short circuit. This is usually caused by using too much solder.
To correct this, simply drag your soldering iron across the solder bridge as shown.