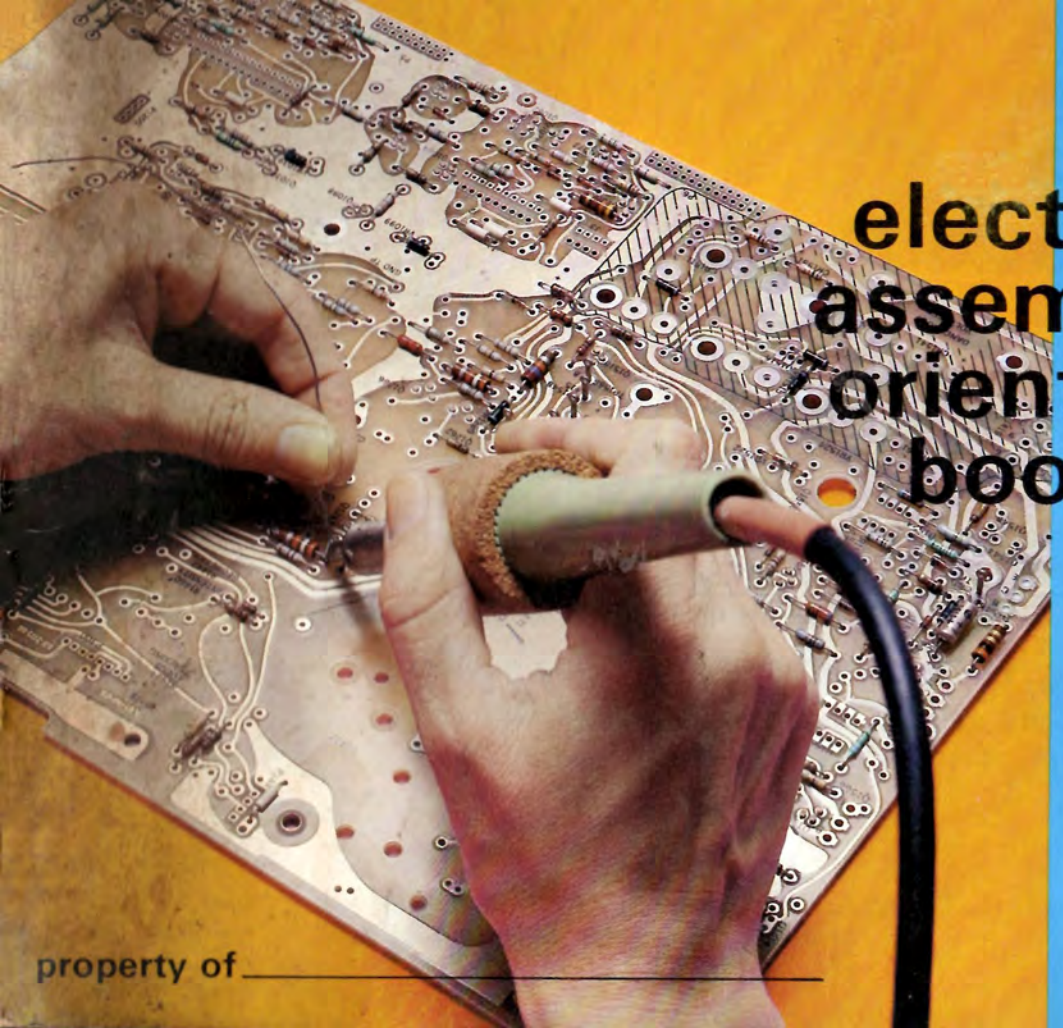


TEKTRONIX®
committed to technical excellence

electronic assemblers' orientation booklet

- personal information
- introduction
- safety
- component recognition
- color codes
- assembly handtools
- solder
- soldering
- what's next?

property of _____

personal information . . .

My

employee number is _____

responsibility number is _____

cost center is _____

manager is _____

manager's telephone number is _____

assigned work area is: building number _____

delivery address _____

EMERGENCY INFORMATION

Refer to the Emergency Red Tab section of the phone book and to pages 25 & 26 of the Tektronix Employee's Handbook.

introduction . . .

Our goal is to give you all the information that you need to get started as an Electronics Assembler. As a beginning, you will participate in a video-tape presentation called "Introduction to Electronic Assembly." You will be asked to refer to the booklet during the showing, and do the review exercises after each learning segment.

The booklet will also serve you as a continuing reference to basic assembly techniques, component recognition, and safety practices as long as you need it. We wish you success.

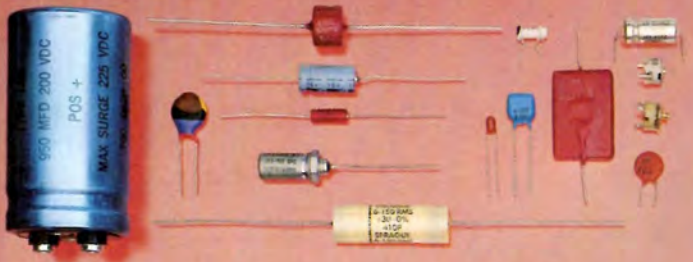
safety . . .

is for everybody — and safety must be practiced. Here are some do's and don'ts that will help you do your part:

1. Keep your soldering iron holder within easy reach. Put your iron on the holder when you're not using it.
2. Always assume that the tip of your iron is hot—pick it up only by the handle.
3. Don't bump or startle anyone using a soldering iron or other hazardous tools.
4. Never flip solder off your iron—wipe it off.
5. If a wire is under strain, grasp it firmly with pliers while unsoldering it.
6. Don't smoke while using flammable solvents. Keep only a minimum of solvent at hand and store it in a safety container.
7. Immediately wipe up all spilled liquids.
8. Don't use a tool to do work that it wasn't designed for.
9. Keep your tools in proper containers and holders. Never let tools or materials hang over the edge of a bench.
10. Reel out only the length of compressed-air hose that you need; keep the hose out of the aisle.
11. Use only approved air nozzles and the least air pressure needed to do the job. Don't blow air at other people and don't use compressed air to clean off clothing.
12. Keep your work area neat and clean. Put waste into proper receptacles.

WEAR YOUR EYE PROTECTION
IN DESIGNATED AREAS

CAPACITORS:



component recognition . . .

RESISTORS:

fixed

potentiometers

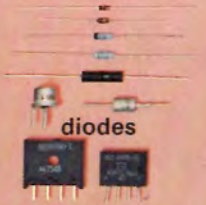
INDUCTORS:

transformers

coils

SEMICONDUCTORS:

transistors



diodes

rectifiers

integrated circuits

CATHODE RAY TUBE:

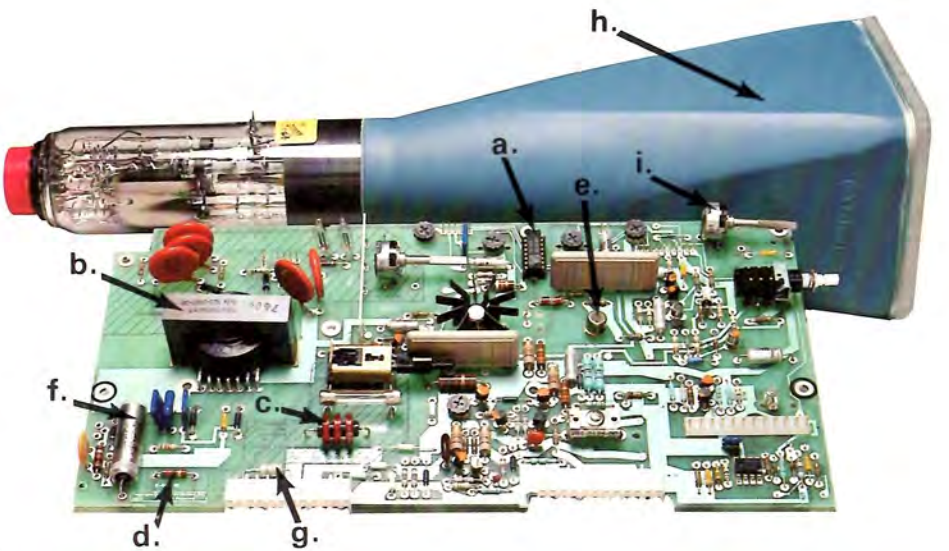
Electrical components are the parts that make up an electronic circuit. If the circuit is to work, the right components must be in the right place. As an Electronics Assembler, you will learn to tell one part from another and be able to name them.

There are five basic categories of electrical components: capacitors; resistors; inductors; semiconductors such as diodes, transistors, and integrated circuits; and cathode ray tubes. Here are some pictures to help you identify them.

As you work with these components, you will also learn their reference designators. Refer to the center fold of this booklet.

test yourself . . .

(review exercise)



Match these component names with the letters in the picture.

1. Capacitor _____
2. Resistor _____
3. Coil _____
4. Transformer _____
5. Transistor _____
6. Diode _____
7. Integrated circuit _____
8. Cathode-ray tube _____
9. Potentiometer _____

the color code . . .

(and how to break it)

Many of the smaller electrical components don't have values printed on them in numbers and letters. Instead, they are marked with color bars, dots, or stripes. Each color has a numerical value, and once you know the code, you will be able to read the colors as easily as the printed number.

The center fold of this booklet contains the EIA color code, which also is the basis for marking other components such as capacitors and inductors. Learn the resistor code first, and you will find that the other component codes will come easily.

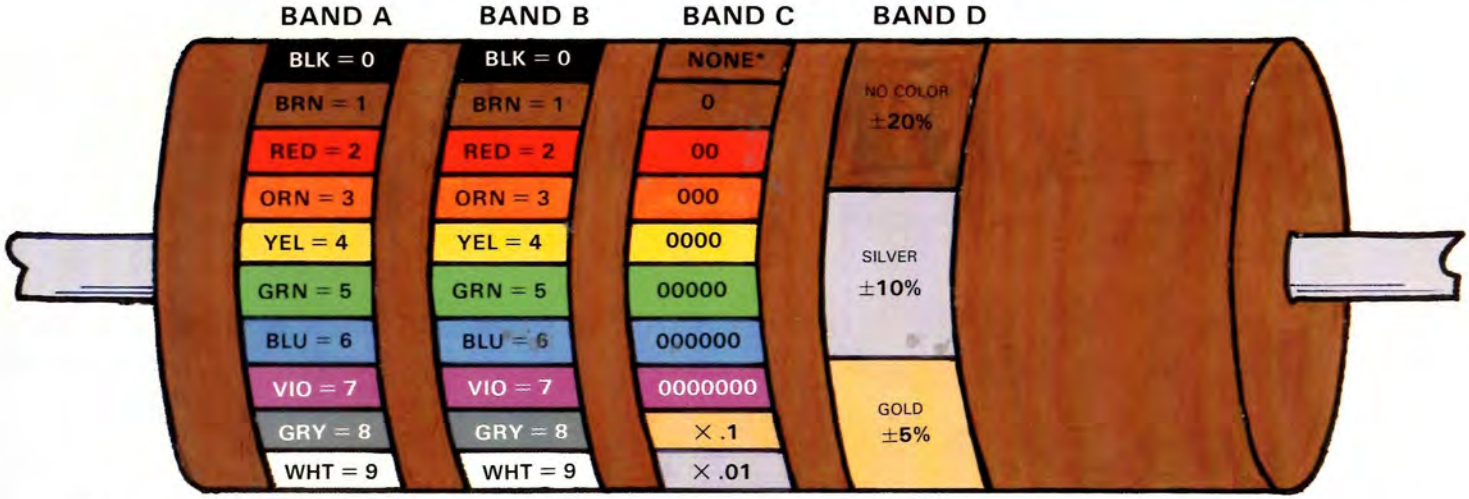
test yourself . . .

(review exercise)

Below are some resistor values for you to calculate. Write in the space provided.

BAND A	BAND B	BAND C	BAND D	VALUE	TOLERANCE
1. Orange	Blue	Green	Gold	_____ Ω	± ____ %
2. Red	Orange	Red		_____ Ω	± ____ %
3. White	Gray	Yellow	Silver	_____ Ω	± ____ %
4. Brown	Black	Silver	Gold	_____ Ω	± ____ %
5. Violet	Violet	Green		_____ Ω	± ____ %
6. Red	Red	Gold	Silver	_____ Ω	± ____ %
7. Yellow	Violet	Black		_____ Ω	± ____ %

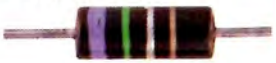
carbon resistor color code . . .



Hold the resistor with the color bands reading from the left end, as shown. Band A shows the first figure of the value. Band B shows the second figure. Band C indicates the number of zeros to add. Band D (not included on all resistors) indicates tolerance: silver for ± (plus or minus) 10%, gold for ±5%, and no band at all for ±20%. Values stated in abbreviated form use the letter k for 1,000 and M for 1,000,000.

*Some may show a black band, to indicate no multiplier.

EXAMPLE 1:



7	5	× .01	ohms	GOLD ±5%
A	B	C		D

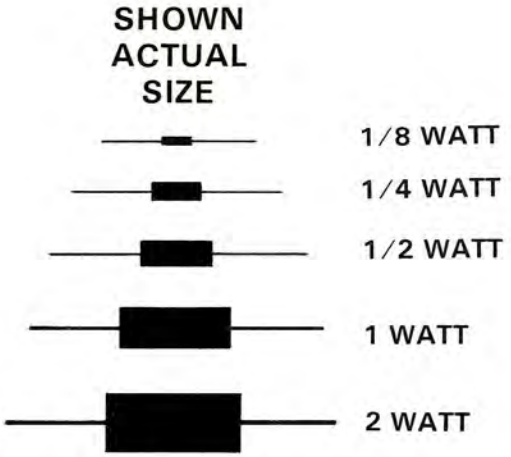
= .75 ohms ±5%

EXAMPLE 2:

5	6	000	ohms	GOLD ±5%
A	B	C		D

= 56,000 (56k) ohms ±5%

carbon resistor sizes and values . . .



REFERENCE DESIGNATORS

These prefix letters designate component types. They are used on schematic diagrams, parts lists, circuit boards, and other assemblies.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DL	Delay Line
DS	Indicating device (lamp)
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
Q	Transistor or silicon-controlled rectifier
P	Connector, movable portion
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

Tear this page out and post it for reference.

assembly hand tools . . .

Here are some of the hand tools that you will be using. It is important to you as an assembler that you learn their names and know what they are to be used for.

These tools were designed to do **specific** jobs; don't use them for anything else. The wrong tool for the job can cause damage to the tool, your work, and worse, to yourself.

Microshear ® is a registered trademark of Plato Products, Inc.

test yourself . . .

(review exercise)

1. Name tool generally used for bending component leads. _____

2. 

This tool is designed for:

a. bending
b. cutting
c. prying
d. all of the above

3. 

What tool is used for this type of screw application? _____

_____

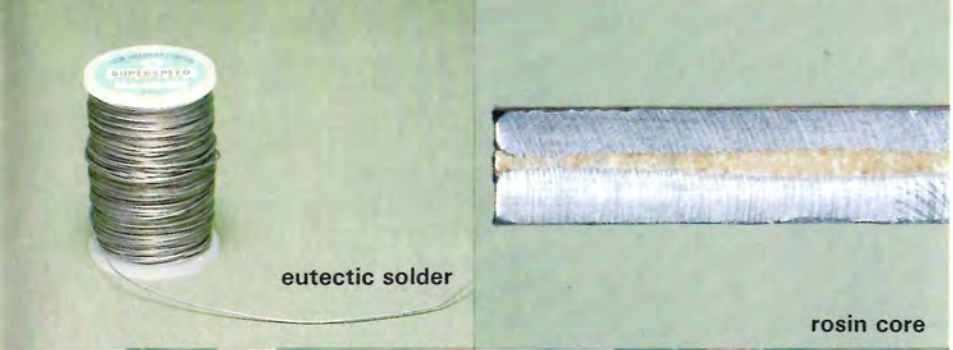
4. 

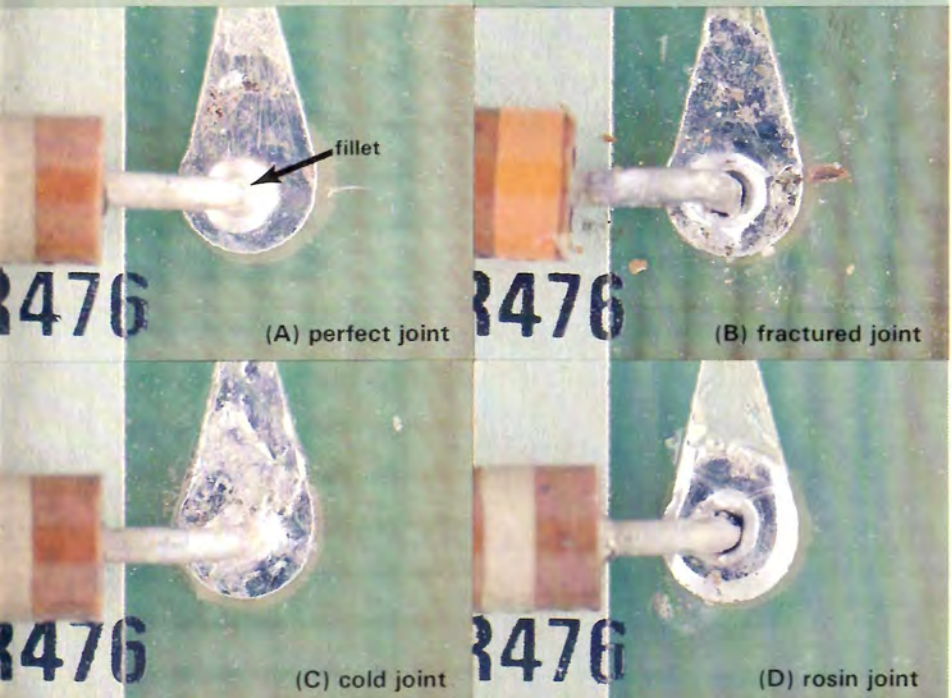
This blade screwdriver tip is unserviceable because it is:

a. dirty
b. worn out
c. wrong size
d. none of the above

5. A _____ is used to remove insulation from a wire.

6. A portable electrical device used for heating and melting solder is called a _____ _____ .





solder . . .

Solder is a metallic alloy used for joining other metal surfaces. In electronic assembly, you will use a "eutectic" alloy solder containing 63% tin and 37% lead, which has a core of rosin flux. Flux is the cleaner that prepares the surfaces to be joined.

Before starting to solder, learn what causes defective joints and what they look like. Compare the bad joints with the *good joint* in (A). The *fractured joint* in (B) was caused by moving the lead before the solder had set solid. The *cold joint* in (C) is due to insufficient heat (often from using an iron of inadequate wattage). In the *rosin joint* (D) a layer of *rosin* separates the solder from the members being joined, resulting in poor bonding.

test yourself . . .

(review exercise)

1. Solder is a metallic alloy containing specific percentages of _____ and _____ .

2. Eutectic type solder SN63 consists of _____% tin and _____ % lead and melts at exactly _____ degrees (F or C).

3. A good solder joint has a _____ non-_____ metallic appearance.

4. The solder _____ thins out to the edges and assumes the general contour of the wire or terminal.

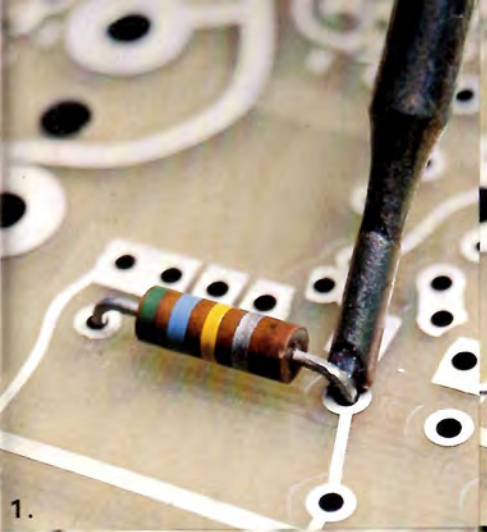
5. Movement of the intended connection before the solder has hardened causes a _____ joint.

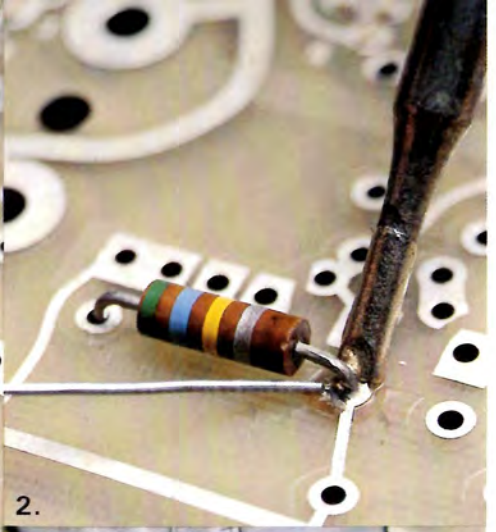
6. The application of too little heat when soldering will produce a _____ joint.

7. _____ is a chemical cleaner which removes oxidation from metal surfaces.

8. Eutectic solder has a _____ core which contains _____ flux.

a) lead, b, flux, c) 37, d) 361°F or 182.7°C, e) fractured, f) cold, g) rosin, h) hollow, i) crystalline, j) tin, k) 63, l) fillet, m) bright.


1.


2.


3.


4.

soldering . . .

Soldering is the process of using heat to join metal surfaces with solder. Expert soldering comes after much practice and from learning the properties of solders and fluxes and the effects of temperature.

To make a solder joint that is electrically and mechanically sound, follow the sequence in the pictures:

1. Heat the whole joint first.
2. Apply solder to the iron tip and the joint.
3. Hold the lead steady until the solder is set solid. (Note the well-formed fillet on the board and the lead, a sure sign of a good solder joint.)
4. Clip off the excess lead.

Remember! . . .keep the iron tip clean.

test yourself . . .

(review exercise)

1. The two kinds of soldering tips are: _____ _____ and _____ .
2. The iron-plated tip is nothing more than an iron _____ over a copper tip.
3. Before soldering, be sure the tip is _____ with solder.
4. To remove scale and contaminants from the soldering iron tip wipe it on a _____ _____ several times.
5. Never _____ an iron-plated tip, or the _____ feature of the tip will be lost.
6. A solder joint should take approximately _____ seconds or less to complete.
7. The longer heat is applied to a wire or component, the greater the amount of _____ energy is built up within the _____ .
8. The proper soldering technique is in trying to heat only the _____ of a component along the desired connection point to solder _____ temperature.

a) wet, b) file, c) long-lasting, d) tinned, e) heat, f) damp sponge, g) iron-plated, h) cover, i) lead, j) component, k) melting, l) copper, m) two

what's next? . . .

Now you've completed the basic orientation course in electronic assembly. "What's next?" First, in order to develop your skill, **practice.** On the job you'll learn about new equipment and new methods of assembly, all the while increasing your skills.

As an electronics assembler, you'll be curious about the equipment and components you're assembling. A basic course in electronics will teach you the required fundamentals in order to understand and appreciate their functions.

There are several ways you can expand and improve your knowledge of electronic assembly (and other subjects, for that matter) at Tektronix. Tek offers many courses of instruction to help improve your education.

The opportunities are vast . . . take advantage of them.

answers . . .

COMPONENT RECOGNITION:

1. f
2. d
3. c
4. b
5. e
6. g
7. a
8. h
9. i

COLOR CODES:

1. 3,600,000 ohms (3.6 MΩ) ±5%
2. 2,300 ohms (2.3 kΩ) ±20%
3. 980,000 ohms (980 kΩ) ±10%
4. .10 Ω ±5%
5. 7,700,000 ohms (7.7 MΩ) ±20%
6. 2.2 Ω ±10%
7. 47 Ω ±20%

ASSEMBLY HANDTOOLS:

1. long-nose pliers
2. (b) cutting
3. Phillips or cross-point screwdriver
4. (b) worn out
5. wire stripper
6. soldering iron

SOLDER:

1. (j) tin, (a) lead
2. (k) 63, (c) 37, (d) 361°F or 182.7°C
3. (m) bright, (i) crystalline
4. (l) fillet
5. (e) fractured
6. (f) cold
7. (b) flux
8. (h) hollow, (g) rosin

SOLDERING:

1. (g) iron-plated, (l) copper
2. (h) cover
3. (d) tinned
4. (f) damp sponge
5. (b) file, (c) long-lasting
6. (m) two
7. (e) heat, (j) component
8. (i) lead, (k) melting

acknowledgements . . .

Manufacturing Engineering
Television/Film
Graphics
and
all manufacturing managers and personnel
who contributed their time and talent.

dedication . . .

in memory of
Luke Crumley, Manufacturing Manager,
a conscientious contributor
and inspiration for the program

congratulations! . . .
you're on the way
to being
an assembler . . .