Subject: Component Board Assembly

APPROVED BY Manager, Hardware Engineering

STATUS Maintenance Revision

PURPOSE Defines the requirements for the mounting and wiring of components, such as resistors, capacitors, diodes, and wires, on phenolic and glass-epoxy component boards. This instruction shall be utilized by Manufacturing for the assembly of component boards.

AFFECTED FUNCTIONS
Hardware Engineering
Manufacturing

REFERENCES
LMS 1-1 Identification Marking
LMS 11-3 Hand Soldering, Electrical

DEFINITIONS

Bus wire**.** Wire used to connect two or more terminals. Generally bare, solid, copper wire is used in this function, although insulated wire is acceptable.

Component lead. A component lead is a solid or stranded wire that serves as a connection and, in some cases, as a mechanical support for small electronics parts of assemblies.

Component mounting board. A component mounting board is a phenolic or glass epoxy base material used for the mounting of discrete components. Components are normally connected to terminals and interconnected with discrete wires.

Jumper wire. A short length of wire, usually stranded and insulated, used for connecting circuit points.

Terminals. A terminal is a tie point device used for the purpose of making electrical connections. Solder type terminals in common use include turret, bifurcated (slotted), hook, eye, tab, and solder cups.

1. Requirements

1.1 Mounting of turret terminals. Turret terminals which extend on both sides of the board should be swaged from the same side of the board to maintain uniformity.

a. Turret terminals which extend from only one side of the board may be swaged from either side, depending upon the design of the board.

b. Turret terminals shall be swaged sufficiently to prevent a loose fit. A terminal shall fit tightly enough so that it will not move axially under normal finger force and such that there is no cracking, chipping, or delamination of the base material of the terminal board.

c. After swaging, the flange shall be free of circumferential splits or cracks, but may have a maximum of three radial splits or cracks, provided the splits or cracks are separated by at least 90 degrees and do not extend beyond the rolled area of the terminal.

1.2 Wiring of boards.

a. Bus wiring shall be run before mounting electrical components to the board. This will make it possible to remove or replace a component without interference to other wiring. Jumper wiring should be as direct and as short as possible without being taut, and should not be routed over or under the body of other components.

b. When three or more terminals in a row are to be electrically common, a solid bus wire may be wrapped around the middle terminals 360 degrees, while the end terminals are wrapped a minimum of 180 degrees or a maximum of 350 degrees. (See Figure 1.)

c. Jumper wires shall have sufficient slack to prevent mechanical strain at the soldered connections.

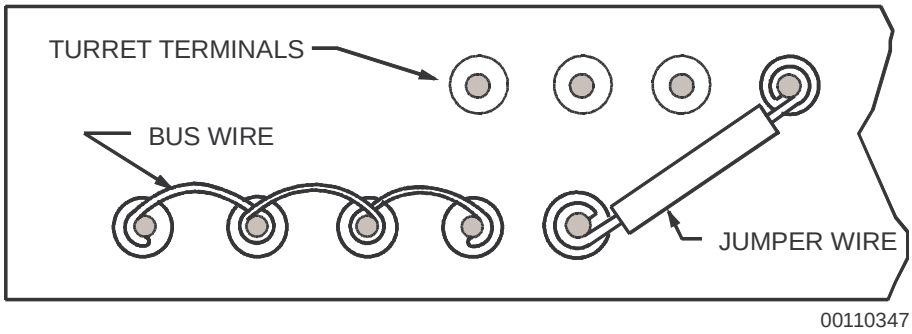


Figure 1 Turret Terminal Wiring

d. Lead, bus, and jumper wires shall be wrapped around a terminal a minimum of 180 degrees and a maximum of 350 degrees, as shown in Figure 2, part A.

e. Component leads shall not be used as a bus wire or connected to any other conductor unless the junction is supported by a fixed terminal.

f. Terminals with more than one wire should be wrapped side by side, in the same direction, on the terminal with the largest wire on the bottom, as shown in Figure 2, part B.

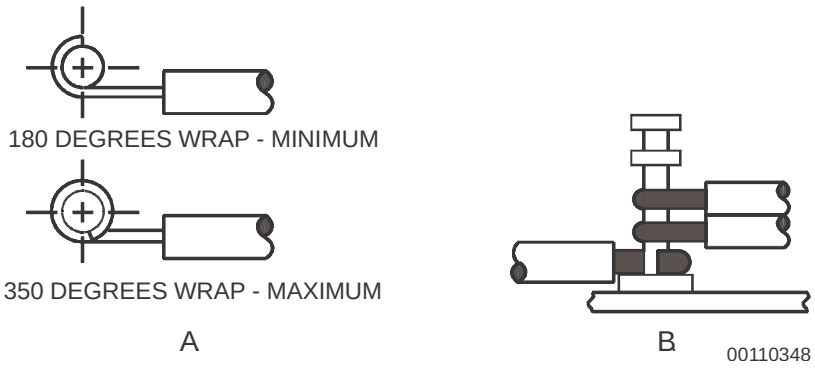


Figure 2 Terminal Wire Wrap

g. Insulation clearance. Clearance between the solder of the connection and the end of either separable or fixed insulation on the wire in the connection shall be as follows:

(1) Minimum clearance. The insulation may abut the solder. It shall not, however, be embedded in or surrounded by the solder. The insulation shall not be melted, charred, seared, or diminished in diameter.

(2) Maximum clearance. The maximum clearance shall be two wire diameters (including insulation) or .063 inch (1.6 mm), whichever is larger, but shall not be such that it permits shorting between adjacent conductors.

h. Wires terminating in hollow-stud terminals. Leads and wires terminated in hollow-stud terminals shall extend completely through the terminal and protrude a maximum of .063 inch (1.6 mm). As a minimum, the end of the lead shall be discernible in the solder. The lead end may be straight or may be bent to retain the component prior to soldering. The solder shall completely surround the lead or wire end, without voids. Although soldering is to be accomplished at the end protruding from the terminal, it shall not be rejectable if the solder has run through the terminal and is visible at the component end of the terminal. (See Figure 3.)

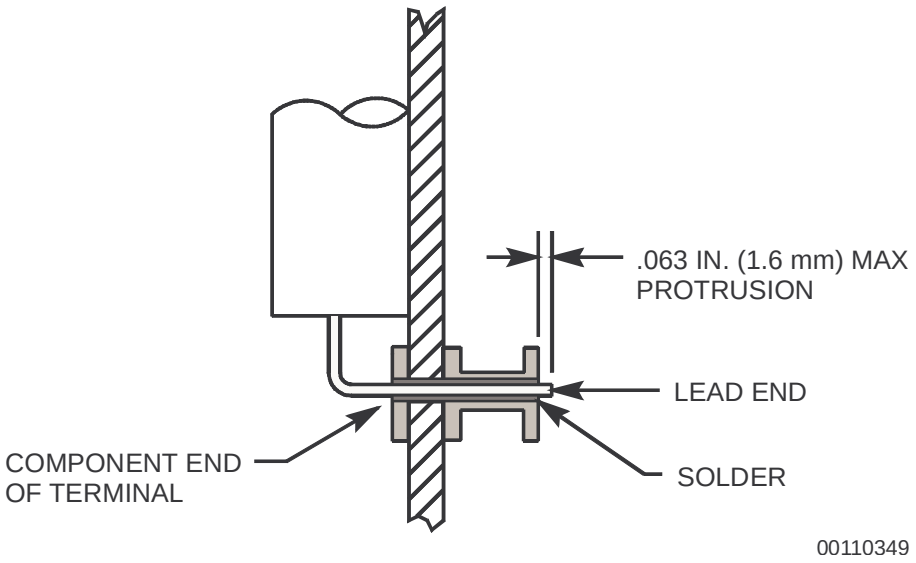


Figure 3 Hollow Stud Terminals

i. Sleeving

(1) When solid, bare, copper wire (used for jumper wires) is called out on drawings, with insulation sleeving, it shall be permissible to exchange teflon-insulated, silver-coated copper, solid wire of like gauge. The teflon insulation shall be of the 250° C, extruded type. Part numbers for the teflon insulated wire are:

20 AWG - M16878/4BGA9
22 AWG - M16878/4BFA9
24 AWG - M16878/4BEA9

(2) Any uninsulated wire, including lead wires, which can come in contact with anything on the board and thereby cause a malfunction shall be protected by a piece of teflon insulating sleeving of an appropriate size.

1.3 Component mounting.

a. Components should be mounted, whenever possible, so that their identifying markings can be read from left to right or top to bottom, without removal or relocation of the component or other components, parts, or wires.

b. If practicable, location and wiring of components, jumper and bus wires, and cables should be mounted so that a component can be removed or replaced without having to remove another part or wire.

c. Wiring shall be routed so that all switches and potentiometers are easily accessible for adjustment.

d. Where practicable, components should be approximately centered between the terminal studs as shown in Figure 4.

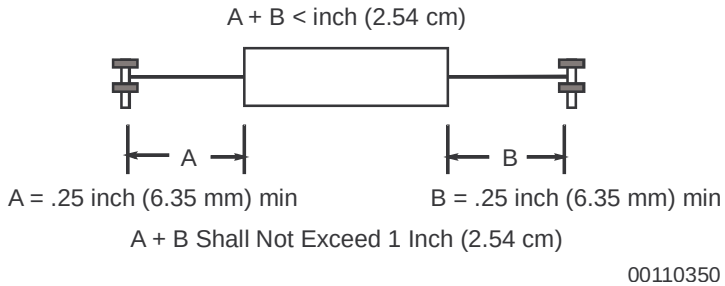


Figure 4 Component Spacing

e. To prohibit the discoloration of the mounting board from heat dissipated by resistors, the following spacing criteria in Table I shall be used:

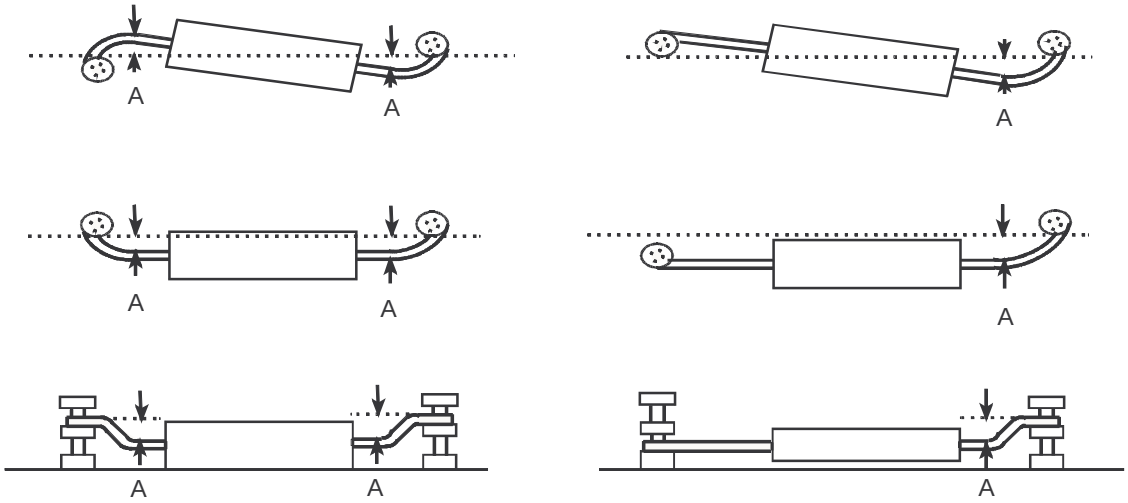
Table I Resistor Mounting

POWER RATING	SINGLE RESISTOR	GROUPS OF 2 OR MORE
1/2 watt and under.	May be mounted touching the board.	May be mounted touching the board.
3/4 watt to 2 watts.	Space .125 inch (3.175 mm above the board.	Space .125 inch (3.175 mm above the board.
5 watts to 10 watts.	Space .125 inch (3.175 mm) above the board.	Space .125 inch (3.175 mm) above the board.
10 watts and higher.	Do not mount without a heatsink.	Do not mount without a heatsink.

f. Resistors rated at 1/2 watt and under, and other components, may also be mounted .12 inch (3.05-mm) off the board to facilitate use of a standard .12-inch (3.05-mm) spacer inserted under a row of adjacent resistors or components.

g. Stress relief. Axial or opposed lead devices with leads terminating at a connection point shall have a minimum lead-connection-to-body offset of at least 2 lead diameters or thicknesses, but not less than .030 inch (0.75 mm). Where the component body will not be secured to the mounting surface by bonding, coating, or other means, the lead(s) on only one of the opposing sides of the component need be so configured. Typical examples of stress relief are included in Figure 5.

h. To maintain even spacing between terminals, adjacent parts shall have their leads flexed in the same direction, where practicable. (See Figure 6.)



Device with bodies either secured or unse cured to mounting surface.

Alternate method for devices with bodies unsecured to the mounting surface.

Measurement "A" is equal to or greater than two times lead diameter or thickness but not less than .030 inch (0.75 mm).

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Figure 5 Typical Stress Relief Bends

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Figure 6 Component Spacing

1.4 Component insulation. The following type of components (Figure 7) are known to have a lead common to the case. When called for on the drawing, transparent vinyl sleeving shall be used to provide insulation by inserting sleeving over alternate or adjacent components. Staggering of these units does not provide adequate insulation.

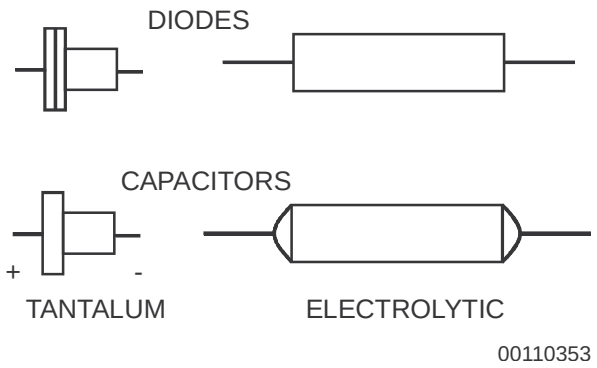

Figure 7 Component Insulation

1.5 All soldering shall be performed in accordance with **LMS 11-3** Hand Soldering, Electrical.

1.6 Markings. Marking shall be in accordance with **LMS 1-1** Identification Marking, and the assembly drawing. The marking shall be legible and withstand the cleaning solvents for removing solder flux.

2. Quality Assurance Provisions

2.1 The Quality Assurance Organization shall be responsible for assuring that the workmanship meets the requirements specified herein.

3. Preparation For Delivery (Not Applicable)

4. Notes (Not Applicable)