STANDARD OVERHAUL PRACTICES MANUAL

REMOVAL AND REPLACEMENT OF SURFACE MOUNTED DEVICES

PART NUMBER NONE

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STANDARD OVERHAUL PRACTICES MANUAL

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To: All holders of REMOVAL AND REPLACEMENT OF SURFACE MOUNTED DEVICES 20-11-07.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

The STANDARD OVERHAUL PRACTICES MANUAL is furnished either as a printed manual, on microfilm, or digital products, or any combination of the three. This revision replaces all previous microfilm cartridges or digital products. All microfilm and digital products are reissued with all obsolete data deleted and all updated pages added.

For printed manuals, changes are indicated on the List of Effective Pages (LEP). The pages which are revised will be identified on the LEP by an R (Revised), A (Added), O (Overflow, i.e. changes to the document structure and/or page layout), or D (Deleted). Each page in the LEP is identified by Chapter-Section-Subject number, page number and page date.

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	NO HIGHLIGHTS

STANDARD OVERHAUL PRACTICES MANUAL

A = Added, R = Revised, D = Deleted, O = Overflow

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All revisions to this manual will be accompanied by transmittal sheet bearing the revision number. Enter the revision number in numerical order, together with the revision date, the date filed and the initials of the person filing.

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INTRODUCTION

1. General

A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.

B. This manual is divided into separate sections:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) Effective Pages

(5) Contents

(6) Revision Record

(7) Record of Temporary Revisions

(8) Introduction

(9) Procedures

C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.

D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

REMOVAL AND REPLACEMENT OF SURFACE MOUNTED DEVICES

1. INTRODUCTION

A. The data in this subject comes from Boeing process specification BAC5128 (which supersedes BAC5214, BAC5215, BAC5216 and BAC5224) for removal and replacement of surface mounted devices.

B. This data is general. It is not about all situations. Use this data as a guide to help you write minimum requirements.

C. A surface mounted device (SMD) can be a small outline integrated circuit (SOIC) or a chip capacitor or resistor. SOICs are plastic packaged ICs which have leads that can be soldered to circuit pads on top of the printed circuit board. Chip capacitors and resistors are made of ceramic-like material and have metal caps on the two ends. These end caps are soldered to the circuit pads on the printed circuit board. Some of the SMDs have many leads, very near to each other, frequently 20 to 50 in one inch of component length. Examples are plastic leaded chip carriers (PLCC), plastic quad flat packs (PQFP).

D. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. EQUIPMENT

NOTE: Equivalent substitutes can be used.

A. Solder systems

(1) Sta-Temp Solder System STSS-001, V47882

(a) Tips (required as a minimum) – SMTC-001 thru 005, STTC-026

(b) Talon tweezer tool with tips

(2) Pace MBT-250 SMT rework/repair station, V17794

B. Tweezer tool – Pace Thermotweeze unit, V17794 (a component removal device equivalent to two soldering irons hinged together at the handles)

C. Special soldering iron tips

(1) Slotted tips (with a groove that fits chip components)

(2) Specialty tips (for removal of specified components, such as 44-lead PLCCs or 132-pin PQFP's. Available from tool vendors, such as Pace, Inc. (V17794) and Metcal, Inc. (V47882), to fit their tools.

D. Hot air wand – A hand-held device, in the shape of a soldering iron, to supply hot air at controlled temperature and flow rates for heating and soldering tools

E. Tweezers, manual

F. Scraping tool

3. MATERIALS

NOTE: Equivalent substitutes can be used.

A. Solvents (SOPM 20-60-01)

(1) Ethyl alcohol

(2) Isopropyl Alcohol, TT-I-735, Grade A

(3) Aliphatic Naphtha, TT-N-95

B. Cotton tipped applicators (SOPM 20-60-04)

C. Solder – Non Activated Rosin Cored Wire, Sn60 WRP2 or P3 or Sn63 WRP2 or P3.

D. Adhesive

(1) Type 52 or 69 (SOPM 20-50-12)

(2) Type 625 VT (light weld) with activator 535, V1T842

E. Desoldering braid – Soder Wick, V34605

4. PREPARATION

CAUTION: IF YOU USE THE STA-TEMP SYSTEM, TURN OFF THE POWER BEFORE YOU CHANGE THE TIP. IF THE POWER IS ON WITH NO TIP INSTALLED, THERMAL RUNAWAY AND POSSIBLE AUTOMATIC SHUTDOWN CAN OCCUR.

A. Install the tip on the desoldering tool before you make it hot.

B. Make sure that leads and pads are clean and have no oxides or contaminants.

C. If bonded components are a problem, the adhesive can be made soft if you heat the assembly board for 20-40 minutes at 94°C (200°F).

5. REMOVAL OF SURFACE MOUNTED DEVICES

NOTE: Soldering iron temperatures can usually be lower for SMD work than for devices mounted on holes through the circuit board. A tip temperature of 550°F is sufficient.

A. Chip components (capacitors, resistors, diodes, etc.)

(1) Soldering iron method

(a) Hold the body of the part with tweezers. Heat one end of the component, then the other, until the two solder joints are melted at the same time.

(b) Twist the body of the part to break the adhesive bond and remove the part.

(2) Slotted soldering iron tip method

(a) Get a slotted tip made for the size of the component to be removed. Install it on the iron and heat it up.

(b) Fill the tip with new solder.

(c) Apply the tip to the component. When the solder melts, twist to break the adhesive bond and remove the part.

(d) Remove the part from the tip.

(3) Hot tweezer tool method

(a) Heat up the tweezer tool and use it to hold the component until the solder melts.

(b) When the solder melts, twist to remove the part.

(4) Hot air wand method

(a) Heat the component with hot air until the solder melts.

(b) Twist and remove the part with manual tweezers.

B. SMDs with leads (flat packs, PLCCs, PQFPs, etc.)

(1) Soldering iron method

(a) Use desoldering braid to remove as much of the solder as you can.

(b) Heat and lift each lead from the circuit board with a dental pick or equivalent tool.

(2) Special soldering iron tip method

(a) Get and install on the iron the special tip made for the part to be removed.

(b) Heat the tip. Clean and tin it with new solder.

(c) Apply a large quantity of solder to make a bridge across all of the component leads and to let the heat flow easily from the iron to the component.

(d) Apply the tip to the component and push down lightly.

(e) When the solder melts, carefully twist and remove the component.

(3) Cut-the-leads method

(a) Cut through the leads with a diagonal cutters or a razor knife. Remove the component body.

(b) Remove the leads from the board surface with a soldering iron, desoldering braid or a vacuum tool.

(4) Hot tweezer tool method

(a) Get and install on the tool the tips made for the component to be removed.

(b) Apply a large quantity of solder to make a bridge across all of the component leads and to let the heat flow easily from the tool to the component.

(c) Apply the tweezer tool to the component.

(d) When the solder melts, carefully twist and remove the part.

(5) Hot air wand method

(a) Get and install the tip or nozzle good for the component to be removed.

(b) Heat the component leads and the circuit board pads. Be quick to remove the component immediately when the solder melts. Be careful not to let the circuit board get too hot. Too much heat will change the color of the board or burn it.

C. RF devices and other metal packages soldered directly to the circuit board surface

(1) Use the hot tweezer tool or a special soldering iron tip if you can.

(2) Remove as much solder as you can from leads, mounting tabs, etc. and move them away from their circuit board pads.

(3) Get and install tips on the tool that best fits the part to be removed. Heat the tip, clean and tin them.

(4) Use the highest temperature you can, up to 700°F.

(5) Apply the tool to the component.

(6) When the solder melts, remove the component.

6. PREPARATION FOR SURFACE MOUNTED DEVICE REPLACEMENT

A. Remove solder, flux residue, and coating material from the area of the circuit board where the component will be installed. Use desoldering braid or a vacuum tool to remove the solder. Use isopropyl alcohol to remove the flux. Use heat, a razor knife, or isopropyl alcohol to remove other coatings.

7. ADHESIVE APPLICATION (OPTIONAL)

NOTE: This adhesive is not necessary when you solder surface-mounted components to printed circuit foils. You can hold the component in position with something mechanical, such as tweezers, while you apply the solder.

A. Do not let the adhesive get on the circuit pads, or the solder will not bond correctly. See Figure 1 for adhesive placement recommendations.

B. Remove the cotton tip from an applicator. Use the stick part as an adhesive applicator. Apply a quantity of 625 adhesive that will fill most of the space between the SMD and the board when the SMD is in position. Apply a thin layer of activator 535 on the side of the SMD which will touch the adhesive.

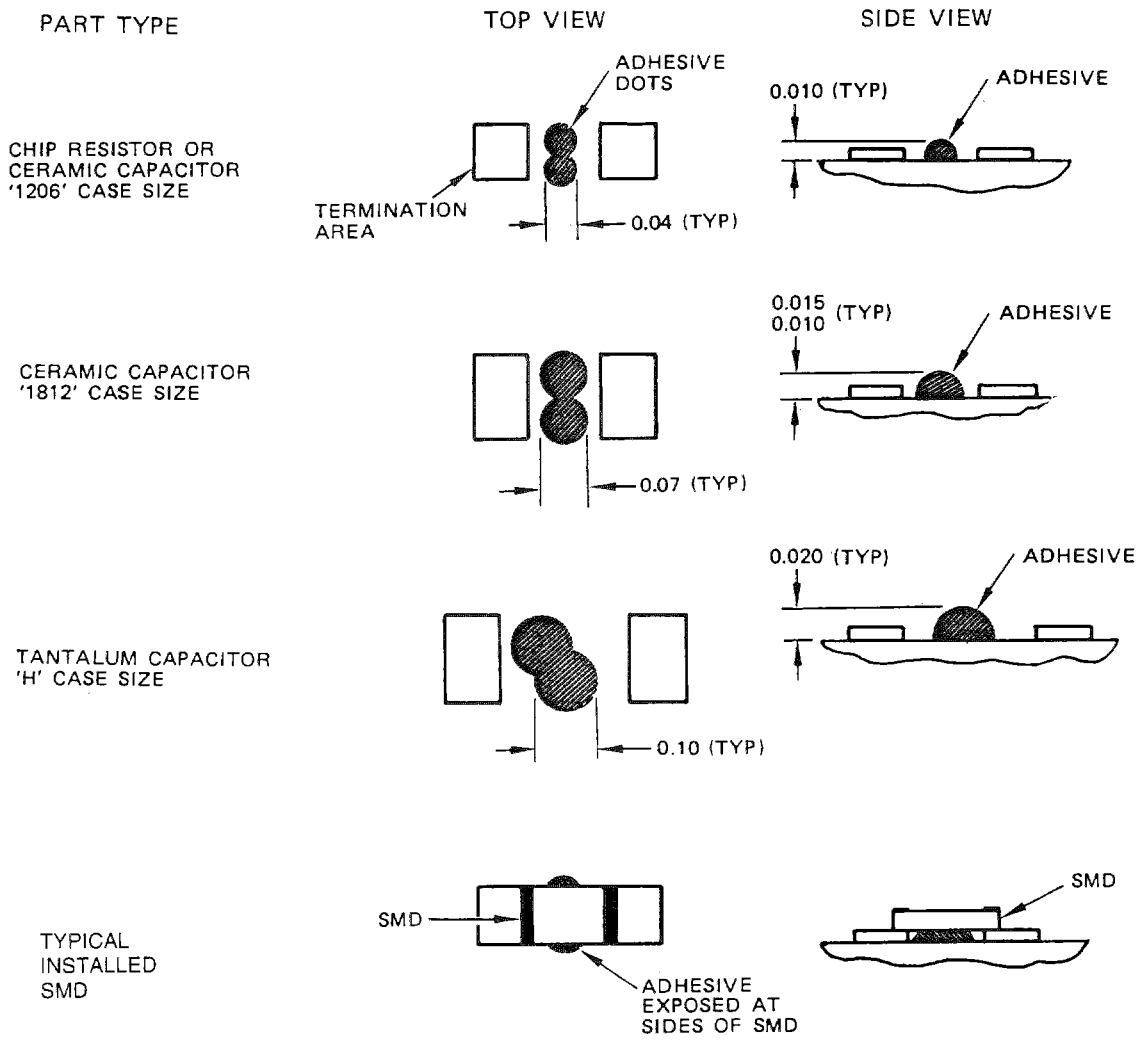
C. Put the SMD in position within 1 minute of adhesive application. Then wait 60 seconds before soldering.

D. If adhesive gets on the circuit pads:

(1) Remove the component (if it was in position) with tweezers or some other tool.

(2) Remove adhesive with cotton tipped applicators wet with solvent.

(3) Let the cleaned area air dry.



Adhesive Placement Recommendations
Figure 1

8. INSTALLATION OF THE SURFACE MOUNTED DEVICE

NOTE: Repair of a surface mounted solder termination is limited to no more than 10 times.

A. Be careful not to mix parts that have the same shape, size and color, because many of these small chip components have no part identification and could have different functions or values.

B. Do not put too much tension or compression on devices during installation.

C. Put the part in position within 1 minute of adhesive/activator application.

D. Install film chip resistors with the colored, protective glass film up (away from the board).

E. Ceramic chip capacitors can be installed with either side down.

F. Tantalum chip capacitors can be installed either side down unless the epoxy coating covers one side of the negative termination. Then this side must be up. Polarity is indicated by a small stub on the positive end.

G. Carefully hold the SMD in position above the circuit pads before you move it down to touch the pads. Tweezers can be used to help.

H. Use a minimum amount of pressure to move the component down to touch the pads. Do not damage the board or the pads with tools or restraining devices. Be sure the leads touch the circuit pads.

I. Do not move components laterally after they are in position on the board, or adhesive could be pushed on the circuit pads and prevent soldering.

J. Examine the circuit board for the following (Figure 2, Figure 3, Figure 4):

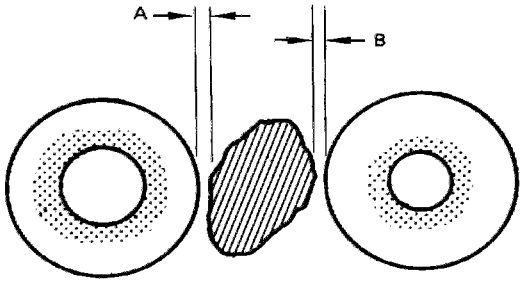
(1) The circuit board or pads must not be damaged. Reject a damaged or melted board that exposes glass fibers and reduces the spacing between conductors to less than 0.010 inch (Figure 2). Reject a board with lifted circuit pads.

(2) Parts must not be turned horizontally more than 25% of the part width.

(3) Parts must not be turned vertically (raised at one end).

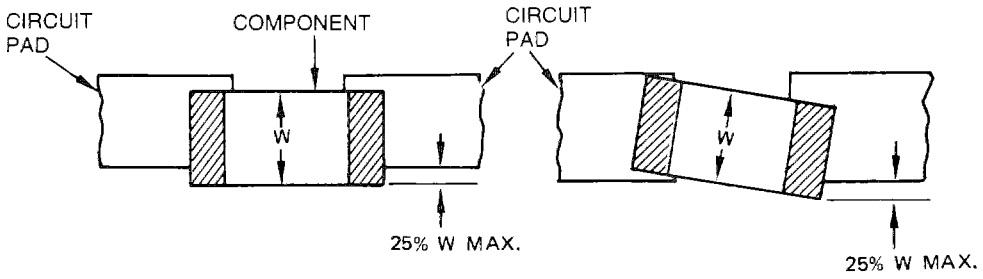
(4) When examined at 3X magnification, circuit and part terminations must have no adhesive. If you find adhesive on these areas, remove it with cotton-tipped applicators wet with solvent. Then let the cleaned area dry.

(5) SMDs with leads must have no more than 25% of the lead width off the solder pad (Figure 4).

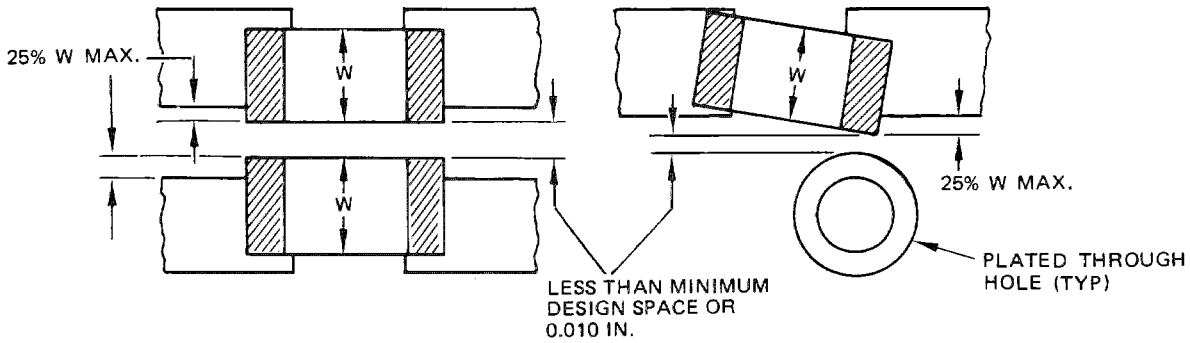


A+B MUST NOT BE LESS
THAN 0.010 INCH

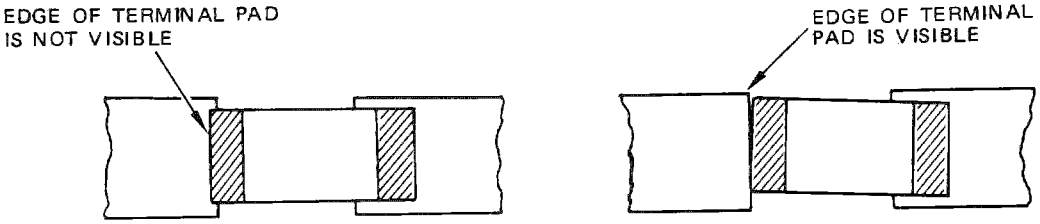
Acceptable Surface Damage Limits
Figure 2



ACCEPTABLE CHIP OVERHANG

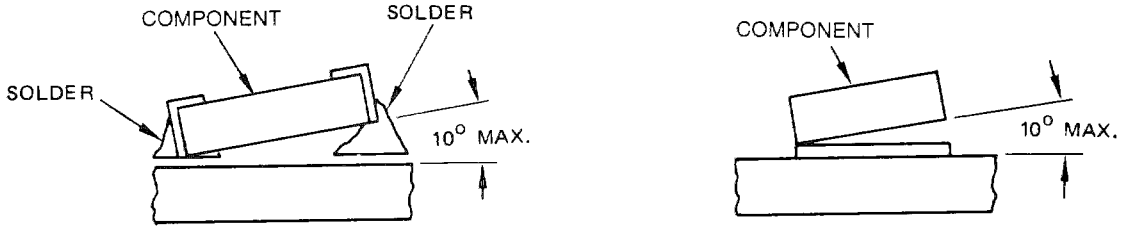


UNACCEPTABLE CHIP OVERHANG



MAXIMUM ACCEPTABLE OVERLAP

UNACCEPTABLE OVERLAP

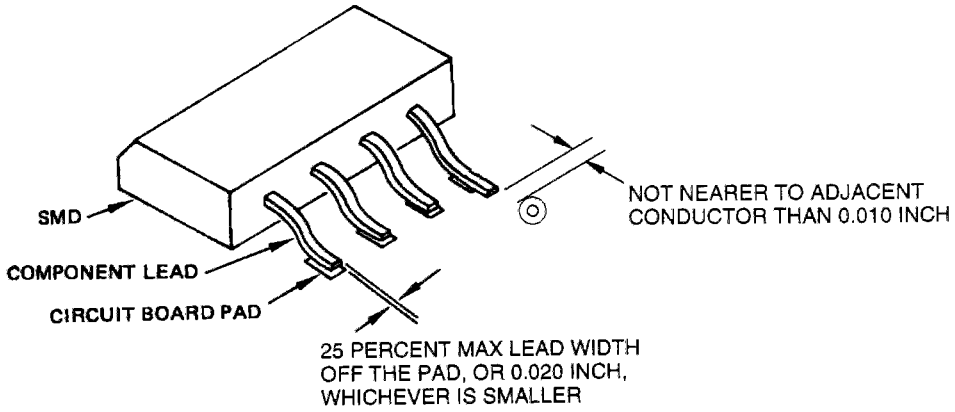


SIDE VIEW

END VIEW

MAXIMUM CHIP COMPONENT CANTING

Acceptable Alignment Limits for SMDs Without Leads
Figure 3



Acceptable Alignment Limits for SMDs with Leads
Figure 4

9. SOLDERING

A. Chip components (capacitors, resistors, diodes, etc.)

NOTE: Ceramic parts could crack if heated too quickly. We recommend you preheat such components to 200-300°F in an oven, with a hot plate, or with a hot air gun.

(1) Soldering iron method

(a) Apply new solder to one circuit pad. Let it become solid.

(b) Apply flux to the component.

(c) Heat the solder on the circuit pad until it is melted and immediately install the component, straight and level. Let it cool for 30 seconds.

(d) Solder the other end of the component.

(2) Hot air wand method

(a) Apply new solder to the two circuit pads. Let it become solid.

(b) Apply flux to the component.

(c) Hold the component with tweezers. Heat the component and the circuit pads with a flow of hot air.

(d) When the solder melts again, put the component on the board in the correct position, remove the heat, and hold the component in position until the solder becomes solid.

B. SMDs with leads (flat packs, PLCCs, PQFPs, etc.)

NOTE: It is not easy to manually solder devices that have many leads very near to each other. We recommend drag soldering as the fastest, easiest method to solder these devices.

(1) Individual point soldering method

(a) Align the component with the circuit pads.

(b) Solder opposite corners with a very small amount of solder to hold the device in the correct position.

(c) Individually solder each lead to the circuit pads.

(2) Drag soldering method

(a) Align the component with the circuit pads.

(b) Solder opposite corners with a very small amount of solder to hold the device in the correct position.

(c) Apply flux to all leads of the component and their circuit pads.

(d) With a round, semi-chisel tip in the soldering iron, heat the tip and apply solder to the flat surface of the tip.

(e) Apply the edge of the tip to the circuit pads with the flat side of the tip away from the body of the component. Touch the tip to the pad and the end of the lead at the same time, and lightly drag the tip along each component lead and pad location in sequence. Solder will flow from the tip to each pad and make a fillet joint with the lead.

(f) As necessary, stop to put more solder on the tip.

(3) Hot air wand method

(a) Align the component with the circuit pads.

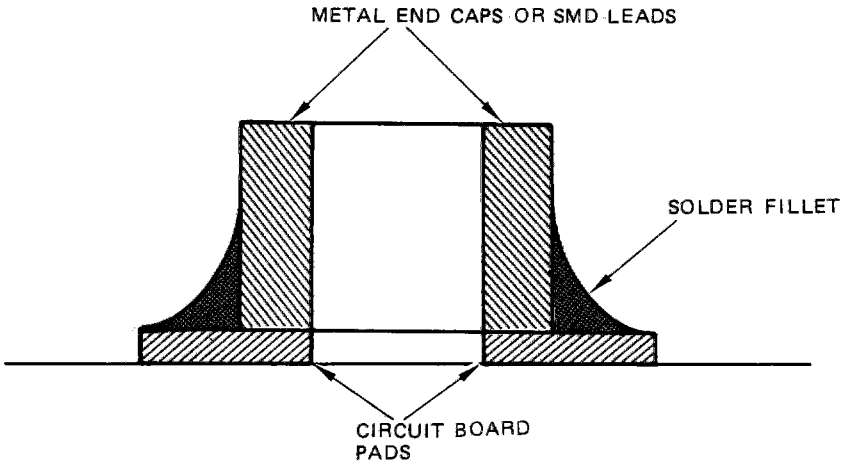
(b) Solder opposite corners with a very small amount of solder to hold the device in the correct position.

(c) Apply a continuous bead of solder paste across the area of the component leads that touches the circuit pads.

(d) Point a low-pressure flow of hot air at the solder paste from approximately 2-4 inches. Let the solder dry to a dull gray color.

(e) Hold the air tool to make the hot air come down at the part in a direction perpendicular to the circuit board surface. Be very careful to keep the flow vertical, or it could blow solder under the component and cause a short circuit. Move the airflow nearer to the component until the solder paste starts to melt and make solder joints. Move the air tool around the component until all leads are soldered.

(f) If solder bridges occur, remove them with increased airflow to make the solder melt and flow into the adjacent joints.



Proper Solder Fillets
Figure 5

10. INSTALLATION OF JUMPER WIRES

A. If the area has conformal coating (encapsulant), remove the coating a minimum of 0.10 inch around the terminal areas and along the routing of the jumper.

B. If the circuit board does not have conformal coating (encapsulant), apply a layer of Type 52 or 69 adhesive to the circuitry which the jumper wire will go across. Cure the adhesive layer (SOPM 20-50-12).

C. If the jumper wire will go to a soldered component connection, remove the solder fillet from the side adjacent to the jumper wire routing. Use vacuum or desoldering braid.

D. Bend and put the jumper wire in the location specified by the overhaul instructions. Use a routing that does not let jumper wires touch solder joints other than the ones where they terminate. Be careful not to damage wire insulation. Use the minimum wire length possible.

E. Bond or mechanically hold the jumper wire in position to prevent relative movement between parts and joints during the soldering operation. To bond the wire, clean the area with isopropyl alcohol and bond the wire with Type 52 or 69 adhesive (SOPM 20-50-12).

F. Hand solder the jumper wires to the terminal areas (SOPM 20-12-01). Remove flux residues with isopropyl alcohol.

G. If applicable, apply conformal coating (encapsulant) to the area.