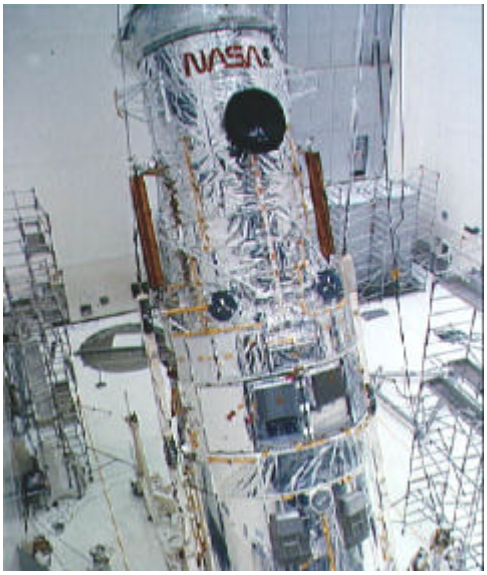
In Accordance With
NASA-STD-8739.3
December 1997

NASA Training Program



Student Workbook for Hand Soldering

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National Aeronautics and
Space Administration

In Accordance With
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NASA Training Program
Student Workbook for
Hand Soldering

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December 1998

National Aeronautics and
Space Administration

HAND SOLDERING

This document was prepared by the Jet Propulsion Laboratory, California Institute of Technology, and the Goddard Space Flight Center under a contract with the National Aeronautics and Space Administration.

CONTENTS

INTRODUCTION

NASA has designated Goddard Space Flight Center/Unisys/Hernandez Engineering and the Jet Propulsion Laboratory as the Manufacturing Technology Transfer Centers for the Eastern Region and Western Region, respectively, of the United States. The NASA Manufacturing Technology Transfer Centers specialize in the development and implementation of technical training courses for space flight and ground support equipment.

The courses conform to released NASA Technical Standards and are recognized by NASA.

The intent of this Hand Soldering is to train personnel who instruct, fabricate, or inspect space flight hardware to NASA Standard *Soldered Electrical Connections* (NASA-STD-8379.3). This is a hands-on course. Instruction is accomplished through videotapes, written documentation, demonstrations, and actual construction of variety of solder joints. This document specifies the methods and techniques required in the production of reliable soldered connections.

The purpose of this course is to assure that each individual who trains, solders, or inspects is appropriately skilled in the types of connection involved in his/her work. This course provides the student with the theory and hands-on experience to produce or inspect quality solder connections. Hands-on training programs with qualified instructors are essential in training personnel to perform these tasks consistently.

POLICY MATTERS ON TRAINING

Questions regarding policy matters on training should be directed to the attention of the Manager of the Jet Propulsion Laboratory Manufacturing Technology Transfer Center or the Goddard Space Flight Manufacturing Technology Transfer Center, whichever is appropriate.

ENTRANCE REQUIREMENTS

A vision and color test is required as a prerequisite to the soldering course. All personnel who perform training or soldering, or who inspect soldered electrical connections, must meet the vision and color test requirements as described in paragraph 5.2. A copy of the eye test results must be available the first day of class.

COMPLETION OF TRAINING

Upon completion of the course, students will be issued a diploma and a wallet-size card showing completion of training. All documents contain information as to the type of course, classification (operator, inspector, or instructor) date of expiration, and authorizing signatures.

Certification of trained personnel shall be provided by the supplier based upon successful completion of training. See NASA-STD-8739.3, paragraph 5.3 for further details.

RETRAINING

Retraining is based on performance and application of theory, with passing grades of classroom work in accordance with course requirements. Retraining shall be accomplished prior to the training expiration date shown on the wallet-size identification card. Failure to successfully complete retraining requires the student to attend a full training course.

GUIDELINES TO FOLLOW FOR SOLDERING ELECTRICAL CONNECTIONS

Soldered electrical connections must perform reliably under such conditions as vibration, vacuum, radiation, thermal cycling, and shock. General principles of assuring and controlling reliable connections are: proper design, control of tools, material, and work environments; and good workmanship by trained personnel. Some general factors and rules controlling reliability can be found in NASA-STD-8739.3, paragraph 4.3.

COURSE REQUIREMENTS

Students will be required to fabricate and inspect soldered electrical connections. A written examination covering materials from NASA-STD-8739.3 and from class lectures will also be given. Each attendee will be graded for performance of his/her work accomplished during the class. The minimum requirements to pass the course are:

Field of Employment	Testing Activity	Grade
Operators	PWB Fabrication	85%
	Written Test	80%
	PWB Inspection	80%
Inspectors	PWB Fabrication	80%
	Written Test	80%
	PWB Inspection	85%

COURSE AGENDA

The hand soldering training course consists of five (5) 8-hour days for a total of 40 hours. The agenda for each day is outlined in this workbook. Retraining consists of two (2) 8-hour days for operators and inspectors.

Instructor training requires an additional 2 days of specialized classroom methods and teaching techniques. Retraining consists of two (2) 8-hour days.

HAND SOLDERING CLASS AGENDA

MONDAY

8:00 — 8:45 **Introduction**
- A. General Information
- B. Hours
- C. Grading
- D. Comparison (3A-2) vs (8739.3)

8:45 — 9:30 **Wire Stripping and Pot Tinning**
- A. Video
- B. Slides
- C. Solder Theory
- D. Workbook
- E. Thermal Wire Stripping Demo
- F. Mechanical Wire Stripping Demo
- G. Solder Pot Tinning Demo
- H. Microscope Use Demo
- I. Application
- J. Inspection

9:30 — 9:45 *Break*

9:45 — 10:15 **Solder Iron Tinning**
- A. Video
- B. Iron: Cleaning, Conditioning, Care, Sponge, Tinning Demo
- C. Workbook
- D. Wire Tinning with 10 Steps Demo
- E. Application
- F. Inspection

10:15 — 11:30 **Hook Terminal**
- A. Video
- B. Slides
- C. Hook Terminal Demo
- D. Workbook
- E. Application
- F. Inspection

11:30 — 12:15 *Lunch*

HAND SOLDERING CLASS AGENDA

***MONDAY** (continued)*

12:15 — 1:15	**Pierced Terminal** A. Video B. Slides C. Pierced Terminal Demo D. Workbook E. Application F. Inspection
1:15 — 2:00	**Turret Terminal** A. Video B. Slides C. Turret Terminal Demo D. Workbook E. Application F. Inspection
2:00 — 2:15	*Break*
2:15 — 3:00	**Bifurcated Terminal** A. Video B. Slides C. Bifurcated Terminal Demo D. Workbook E. Application F. Inspection
3:00 — 3:45	**Connector Pin** A. Video B. Slides C. Connector Pin D. Workbook E. Application F. Inspection
3:45 — 4:00	*Clean-up*

HAND SOLDERING CLASS AGENDA

TUESDAY

8:00 — 8:30	**Quiz/Review**
8:30 — 9:00	**Electrostatic Discharge (ESD)** A. Video B. Demo/Lecture
9:00 — 9:15	*Break*
9:15 — 11:30	**Printed Wiring Board (PWB)** A. Video on Swaging, Axial Lead Bend, Stud and Vertical Mount, Clinched Leads B. Slides C. Terminal Swaging, Soldering, Lead Bending and Mounting Demo D. Workbook E. Application F. Inspection
11:30 — 12:15	*Lunch*
12:15 — 2:00	**PWB Dual-Inline Package (DIP), Interfacial Connection** A. Video B. Slides C. DIP Interfacial Connection Demo D. Workbook E. Application F. Inspection
2:00 — 2:15	*Break*
2:15 — 3:45	**PWB Lapped Terminations - Flat Pack** A. Video on Flat Pack B. Slides C. Workbook D. Flat Pack Demo E. Application F. Inspection
3:45 — 4:00	*Clean-up*

HAND SOLDERING CLASS AGENDA

WEDNESDAY

8:00 — 8:30	**Quiz/Review**
8:30 — 9:00	**PWB Continuous Run Wrap: Bifurcated/Turret** A. Video B. Slides C. Run Wraps Demo D. Workbook E. Application F. Inspection
9:00 — 9:15	*Break*
9:15 — 11:30	**(Continue with PWB)**
11:30 — 12:15	*Lunch*
12:15 — 2:00	**PWB High-Voltage Termination** A. Video B. Slides C. High-Voltage Termination Demo D. Workbook E. Application F. Inspection
2:00 — 2:15	*Break*
2:15 — 3:45	**(Continue with PWB)**
3:45 — 4:00	*Clean-up*

HAND SOLDERING CLASS AGENDA

THURSDAY

8:00 — 8:15	**Quiz/Review**
8:15 — 9:00	**Inspection Quiz (Slides)**
9:00 — 9:15	*Break*
9:15 — 11:30	**Start Final PWB**
11:30 — 12:15	*Lunch*
12:15 — 12:50	**Wave Solder**
12:50 – 2:00	**Continue Assembly**
2:00 — 2:15	*Break*
2:15 — 3:45	**Continue Assembly**
3:45 — 4:00	*Clean-up*

HAND SOLDERING CLASS AGENDA

FRIDAY

8:00 — 8:15	**Review**
8:15 — 9:00	**Continue Assembly**
9:00 — 9:15	*Break*
9:15 — 11:30	**Continue Assembly**
11:30 — 12:15	*Lunch*
12:15 — 12:45	**Written Test**
12:45 — 1:30	**Inspection Test**
1:30 — 2:00	**Student Inspection of Fabricated PWB**
2:00 — 2:15	*Break*
2:15 — 3:30	**Instructor Evaluation of Students**
3:30 — 3:45	*Clean-up*
3:45 — 4:00	**Student Evaluation of Course**

HAND SOLDER RETRAINING AGENDA

DAY ONE

8:00 – 8:15	**Introduction**
8:15 – 8:30	**Comparison (3A-2) vs (8739.3)**
8:30 – 9:00	**Solder Theory, Terminals**
9:00 – 9:30	**Practical** Solder Pot Use Solder Iron Use Turret Bifurcated Cup Terminal
9:30 – 9:45	*Break*
9:45 – 10:45	**Swage, Axial Mounted Parts, Stud Mounted Parts, Clinched**
10:45 – 11:30	**Practical** Swage Axial Mounted Part Stud Mounted Part Clinched Leads
11:30 – 12:15	*Lunch*
12:15 – 1:00	**Wave Solder Video**
1:00 – 1:45	**Practical (PWB)**
1:45 – 2:15	**Planar/Lap, Continuous Run, High Voltage, Interfacial Connections**
2:15 – 2:30	*Break*
2:30 – 3:45	**Practical**
3:45 – 4:00	*Clean-up*

HAND SOLDER RETRAINING AGENDA

DAY TWO

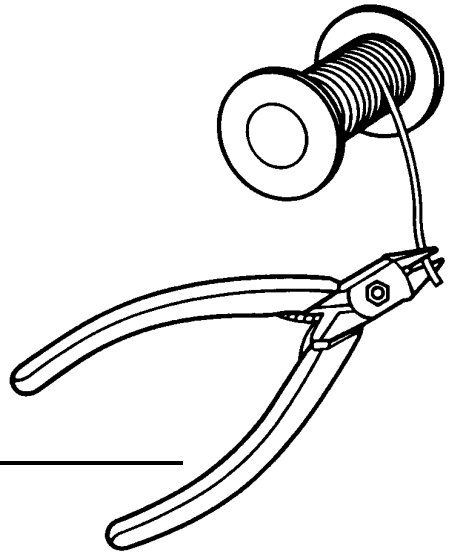
8:00 – 9:00	**Written Exam**
9:00 – 9:15	*Break*
9:30 – 11:30	**PWB (continued)**
11:30 – 12:15	*Lunch*
12:15 – 2:00	**Inspection** Student Board Test Board
2:00 – 2:15	*Break*
2:30 – 3:30	**PWB (continued)**
3:30 –3:45	**Critique**
3:45 – 4:00	*Clean-up*

T

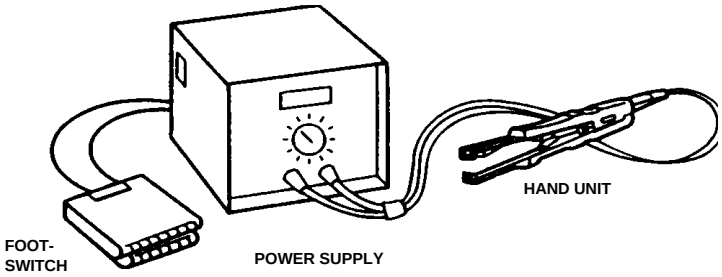
WIRE STRIPPING

STEP 1. WIRE PREPARATION

Prepare a wire by cutting an appropriate length using side cutters.

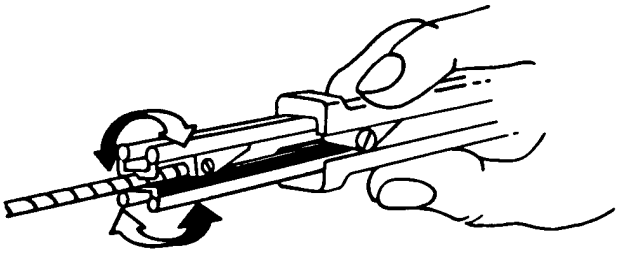


STEP 2. USING A THERMAL WIRE STRIPPER



STEP 2a. WIRE STOP SETTING

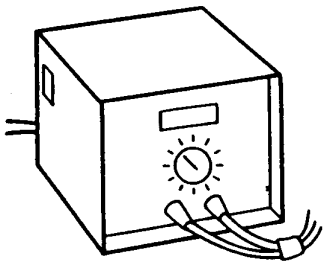
Adjust the wire stop to the desired strip dimension. Always measure the insulation strip dimension from the outside edge of the electrode tips.



THERMAL STRIPPER HAND UNIT

STEP 2b. TEMPERATURE SETTING

Turn the power switch ON. Set the knob to the correct temperature for the type of insulation of the wire.



POWER SUPPLY

WIRE STRIPPING

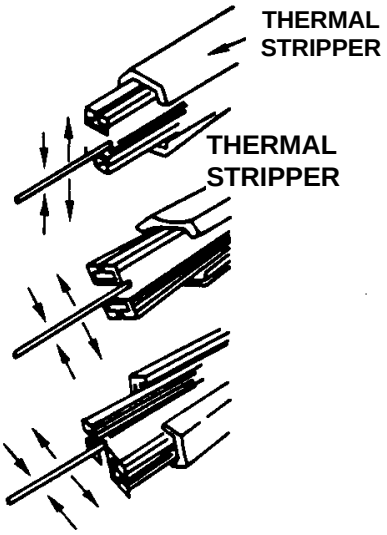
STEP 2c. THERMAL WIRE STRIPPING

Hold the footswitch down to allow the electrodes to reach the operating temperature. Keep the switch depressed.

Holding the wire in one hand and the thermal stripper in the other hand, insert the wire until the cut end contacts the wire stop.

CLOSE the electrodes on the wire to melt the insulation. Now OPEN the electrodes and rotate them about 30 degrees, and again CLOSE the electrodes to melt another portion of the wire. Repeat the CLOSE to melt, OPEN to rotate operation until a complete ring has been melted around the insulation on the wire.

Remove the wire from the stripper.
Release the footswitch.
Place the thermal strippers where the electrodes will not cause any damage while they are cooling.

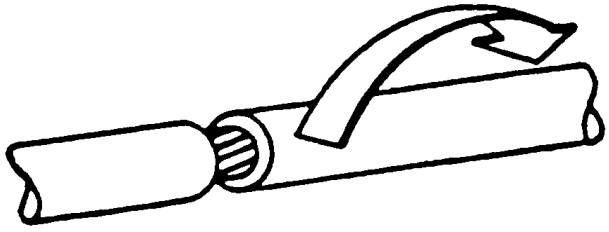


**WHEN STRIPPER IS RED-HOT
CLOSE JAWS TO MELT INSULATION
OPEN, TURN STRIPPER, CLOSE, OPEN.**

STEP 2d. REMOVING THE INSULATION

Holding the wire in one hand, grasp the separated portion of the insulation with the thumb and forefinger of the other hand. Remove this portion with a smooth, even motion in the direction of the lay of the wire.

Clean the stripped end with an approved solvent, being careful not to disturb the lay of the wire.



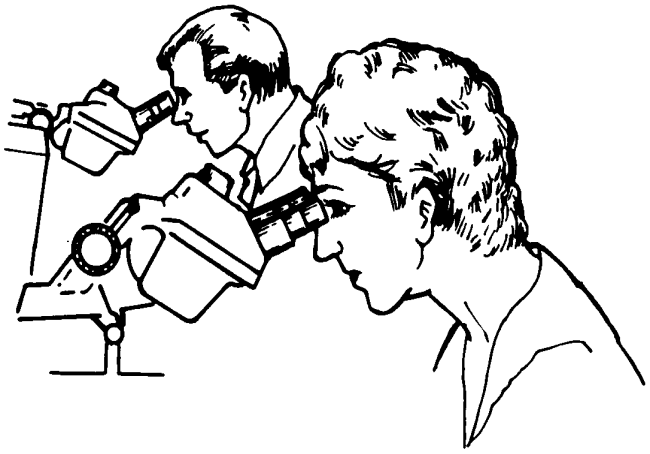
- *If disturbed, the lay of wire strands shall be restored as nearly as possible to the original lay.*

— Paragraph 7.2-4

WIRE STRIPPING

STEP 2e. INSPECTION

Inspect in accordance with STEP 4.



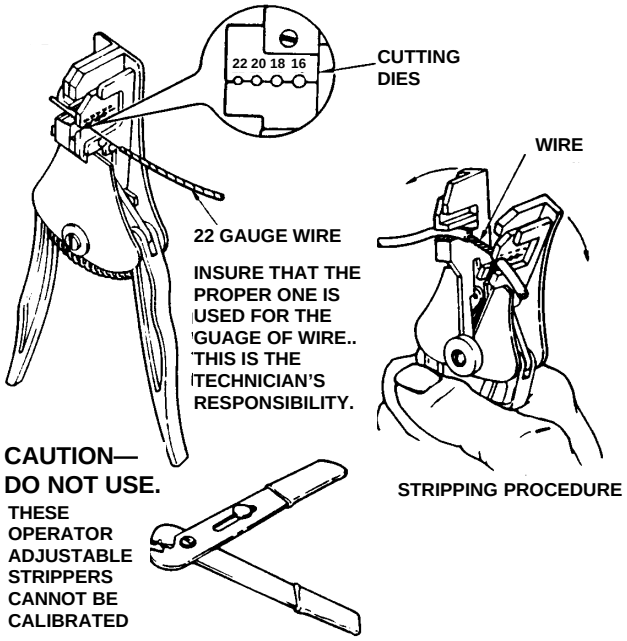
STEP 3. MECHANICAL WIRE STRIPPING

With the jaws open, place the wire in the appropriate die corresponding to the wire size being stripped.

Squeeze the handles to partially cut and separate the insulation only a short distance. Slightly release the pressure on the handles.

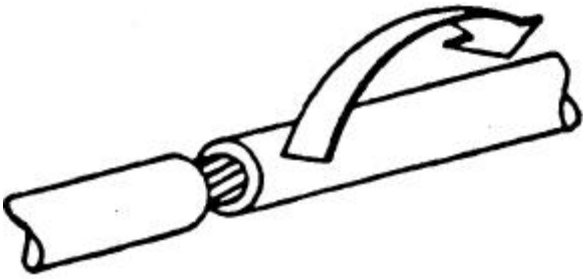
Remove the wire, close the strippers, and set the strippers down.

- *Mechanical strippers must not be operator adjustable, must be in calibration, and must not damage the wire or unstripped insulation.*
  — Paragraph 6.6-2



STEP 3a. REMOVE THE INSULATION PER STEP 2d

- *If disturbed, the lay of wire strands shall be restored as nearly as possible to the original lay.*
  — Paragraph 7.2-4

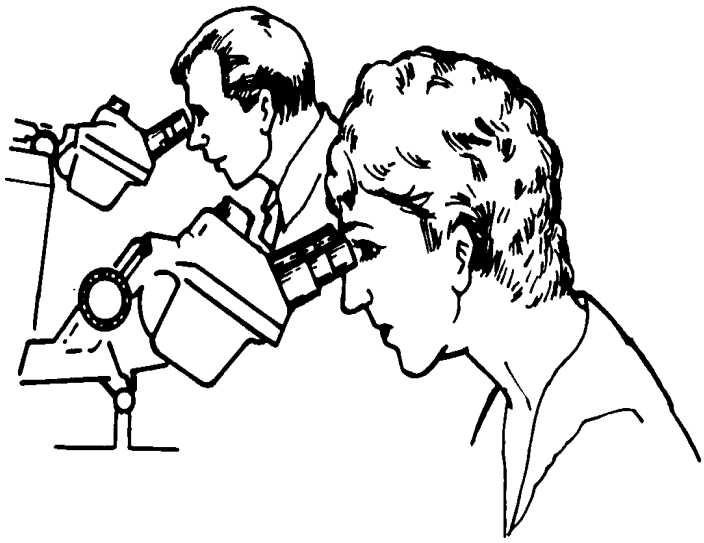


STEP 4. INSPECTION

Inspect under 4X to 10X magnification.

- *Conductors and parts rejections include: nicks, cuts, and crushing or charring of insulation (slight discoloration from thermal stripping is acceptable).*
  — Paragraph 13.6-2a(8)
  — Paragraph 7.2-3

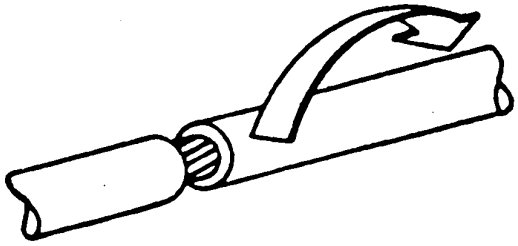
- *After insulation removal, the conductor shall not be: cut, nicked, stretched, or scraped leads or wires exposing base metal (except smooth impression marks resulting from bending tool holding forces).*
  — Paragraph 13.6-2a(1)
  — Paragraph 7.2-2



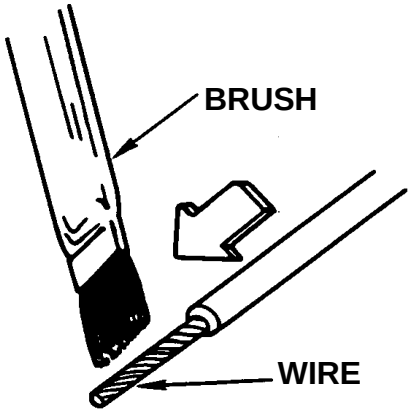
TINNING: SOLDER POT

STEP 1. STRIP THE WIRE

Strip the wire according to Procedure 1.

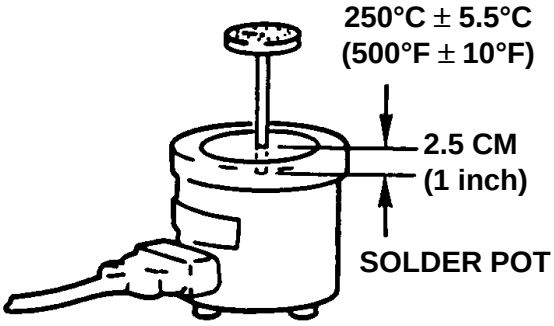


STEP 2. CLEAN THE WIRE



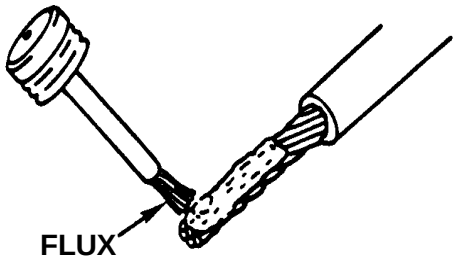
STEP 3. CHECK SOLDER POT TEMPERATURE

Check the temperature of the solder pot by immersing a calibrated thermometer approximately 2.5 cm (1 in.) into the solder at the center of the pot. The reading should be 260°C ±5.5C (500°F ±10°F).



STEP 4. ADD FLUX

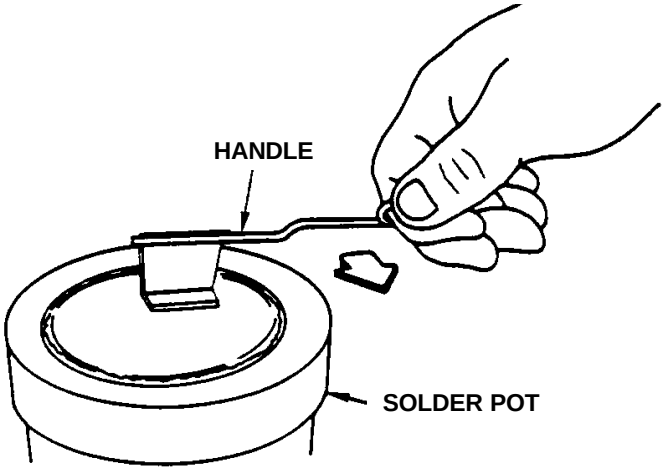
Place type R or RMA flux on the end of the stripped wire to be tinned.



TINNING: SOLDER POT

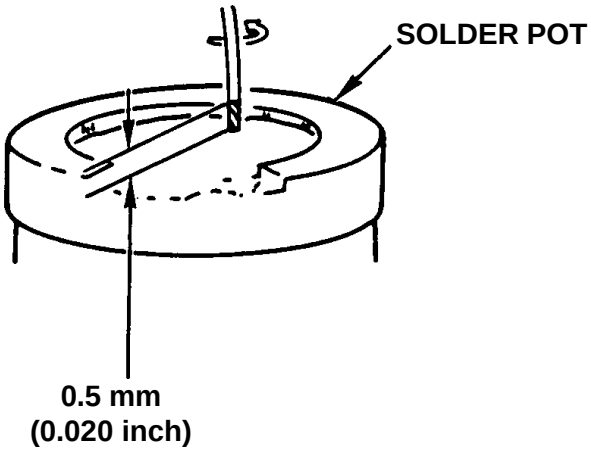
STEP 5. REMOVE DROSS

Remove the dross from the solder surface with an approved tool.



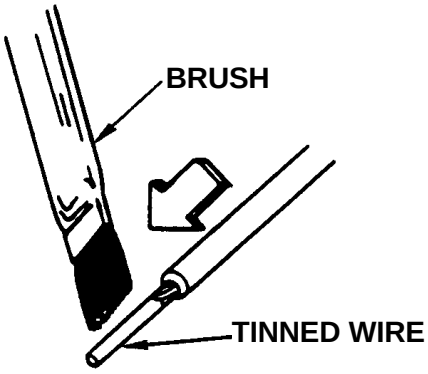
STEP 6. TIN THE LEAD

Dip the prepared wire into the molten solder within 0.5 mm (0.020 in.) of the insulation. Slowly rotate the wire for no more than 5 seconds, and then slowly remove the wire from the solder.



STEP 7. CLEAN THE WIRE

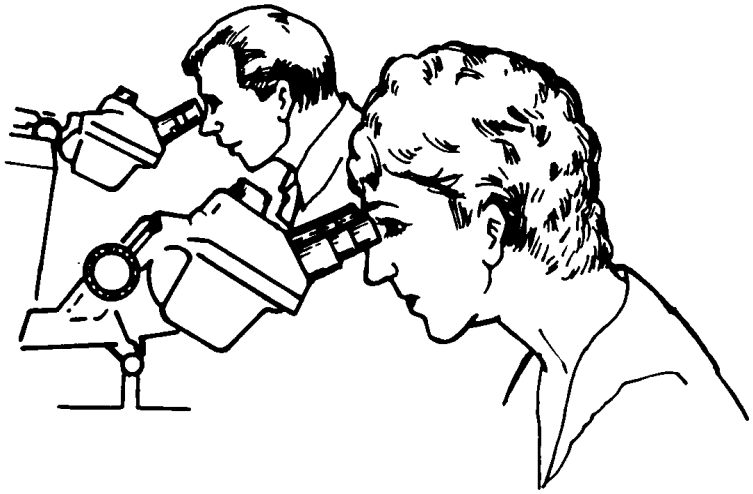
Clean the flux from the tinned portion of the wire with an acid brush; use the approved solvent and a shopwipe.



TINNING: SOLDER POT

STEP 8. INSPECTION

Inspect the tinned wire under 4 X to 10 X magnification.



- *Conductor tinning personnel shall ensure that the tinned surfaces exhibit 100% coverage. Wire strands shall be distinguishable.*
  — Paragraph 7.2-6

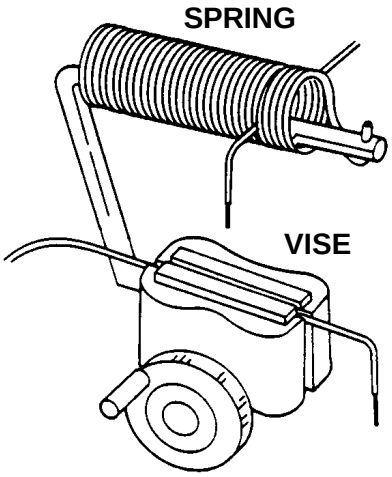
- *The appearance of the solder joint surface shall be smooth, nonporous, undisturbed, and shall have a finish that may vary from satin to bright depending on the type of solder used.*
  — Paragraph 13.6-1

TINNING: SOLDER IRON

STEP 1. POSITION THE WIRE

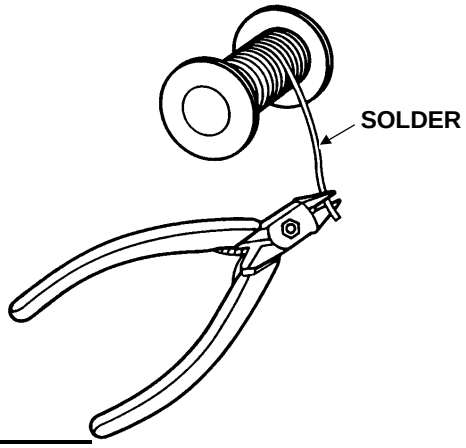
Place the stripped wire in a vise or spring to hold it in a vertical position.

Clean the wire with a soft brush, using the approved solvent and a shopwipe.



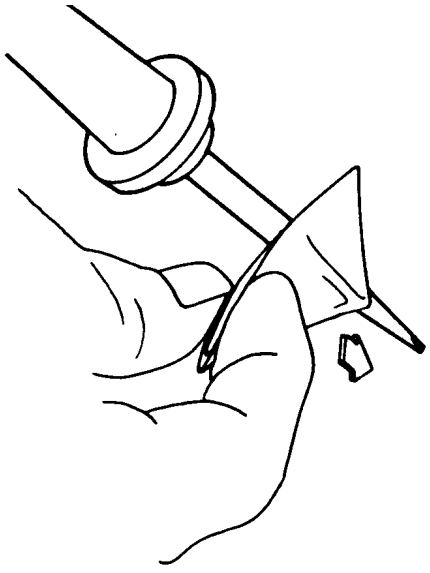
STEP 2. PREPARE THE SOLDER

Prepare the solder by cutting the end (to expose the flux in the core) and clean with an approved solvent.



STEP 3. PREPARE THE IRON

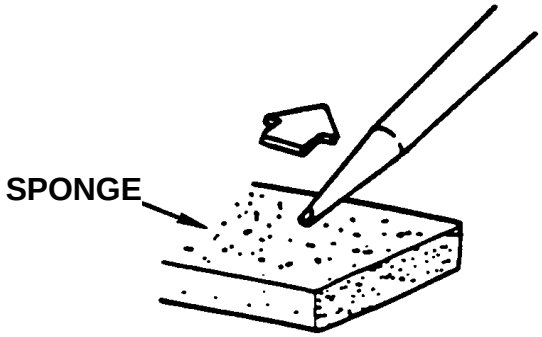
Prepare the iron by wiping the solder from the tip with a shopwipe.



TINNING: SOLDER IRON

STEP 4. CLEAN THE IRON TIP

Lightly wipe the tip of the iron on the moist sponge to remove the oxides.

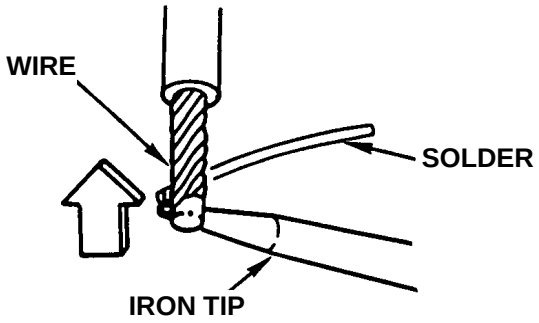


STEP 5. TIN THE WIRE

Place the soldering iron tip against the wire near the cut end.

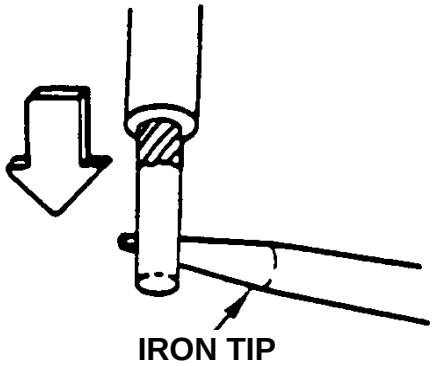
Add solder at the junction of the tip and the wire, forming a thermal (solder) bridge that will transfer the heat from the iron to the wire.

Simultaneously move the iron up the wire, adding solder to the wire until the tinning has reached no closer than 0.5 mm (0.020 in.) to insulation.



STEP 6. REMOVE THE IRON

Slide the iron down and off the end of the wire, adding solder only as needed.

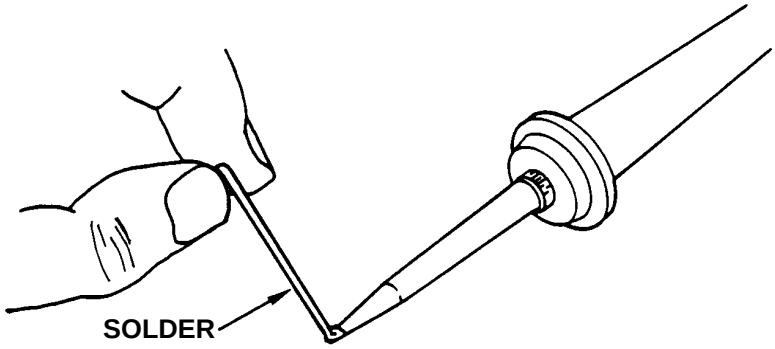


TINNING: SOLDER IRON

STEP 7. TIN THE IRON

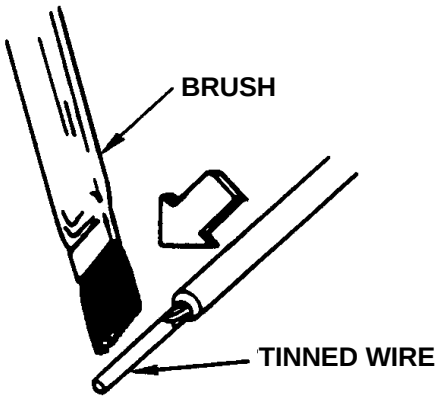
Tin the iron tip, while the connection is cooling at room temperature. A small amount of solder should remain on the tip.

Return the iron to the holder.



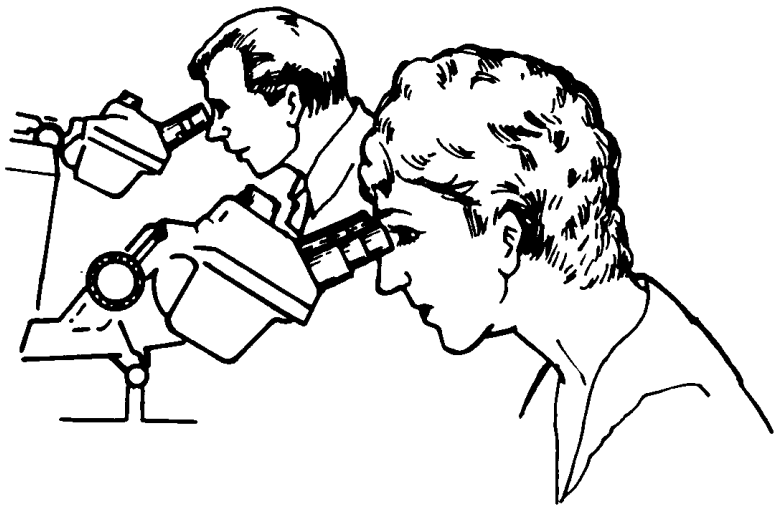
STEP 8. CLEAN THE WIRE

Clean the flux from the tinned portion of the wire with an acid brush, using the approved solvent and a shopwipe.



STEP 9. INSPECTION

Inspect the tinned wire under 4 X to 10 X magnification.



- *Conductor tinning personnel shall ensure that tinned surfaces exhibit 100% coverage. Wire strands shall be distinguishable.*
  — Paragraph 7.2-6

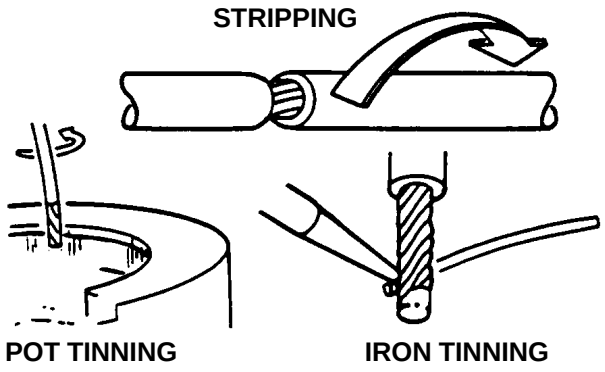
- *The appearance of the solder joint surface shall be smooth, nonporous, undisturbed, and shall have a finish that may vary from satin to bright depending on the type of solder used.*
  — Paragraph 13.6-1a

- *Flow (wicking) of solder along the conductor is permitted. Solder shall not make presence of the individual wire strands indistinguishable.*
  — Paragraph 10.2-3

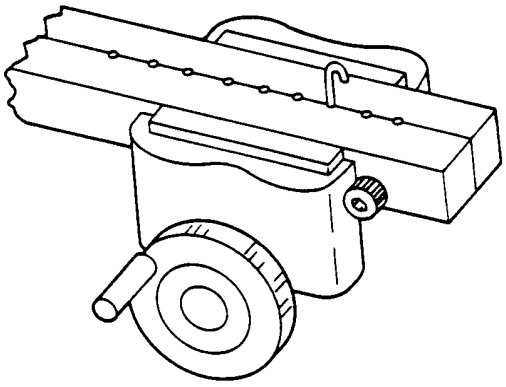
HOOK TERMINAL

STEP 1. PREPARE THE CONNECTION

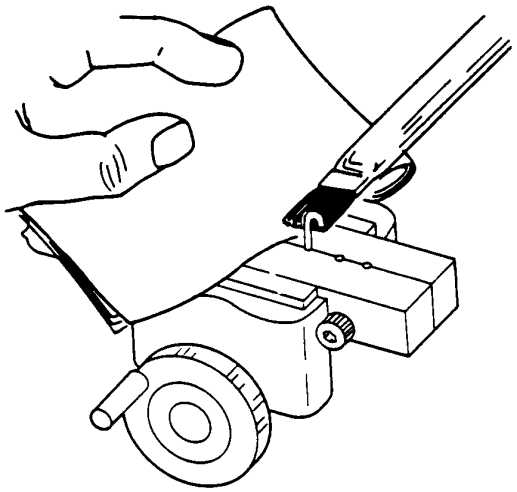
1a. Prepare a stranded wire in accordance with Procedures 1 and 2A/2B on Stripping and Tinning, respectively.



1b. Insert a terminal into a phenolic block (or equivalent). Secure the block in a vise.

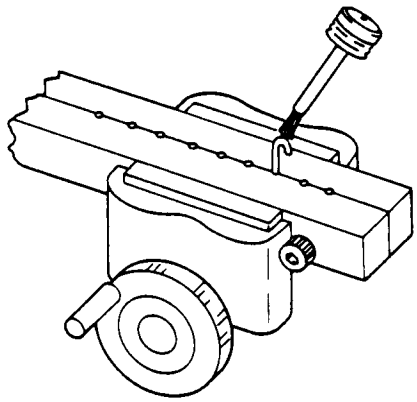


1c. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.



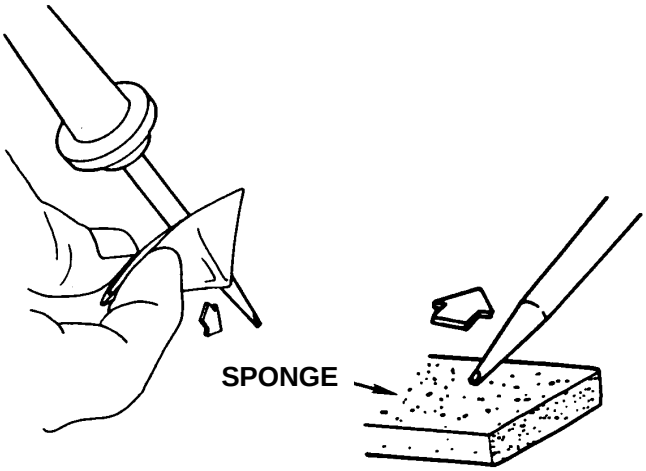
HOOK TERMINAL

1d. If necessary, add flux on the portion of the terminal to be tinned.



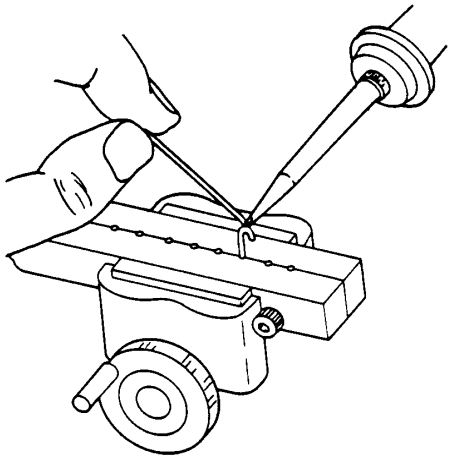
1e. Clean the iron by wiping the tip with a dry shopwipe.

Lightly wipe the tip on a moist sponge to remove the oxides.



1f. Tin the terminal by positioning the iron as shown and adding solder to form a solder bridge. Add solder as necessary.

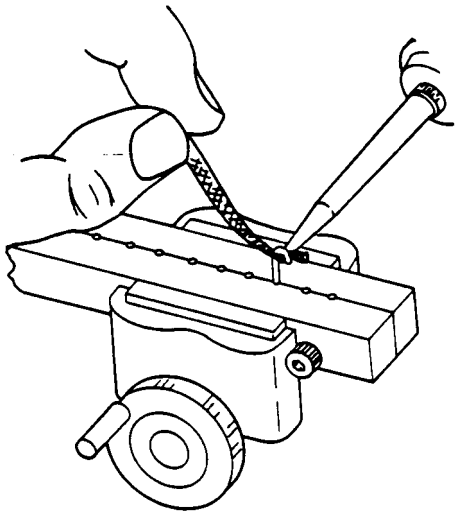
CAUTION: Allow time for the terminal to cool before proceeding.



HOOK TERMINAL

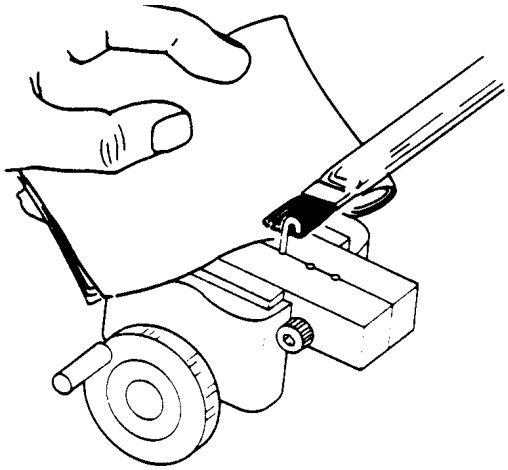
1g. Place the solder wick on the solder.

Place the solder iron on top of the wick to remove the solder from the terminal.



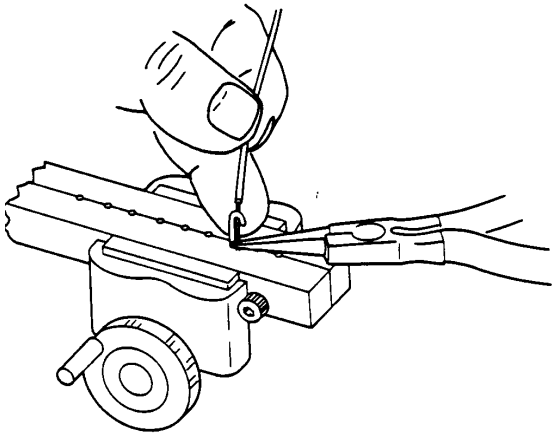
1h. Clean the tinned terminal with an acid brush, using the approved solvent and a shopwipe.

Inspect for a uniform layer of solder.



1i. Grasp the end of the stripped and tinned wire with a pair of pliers.

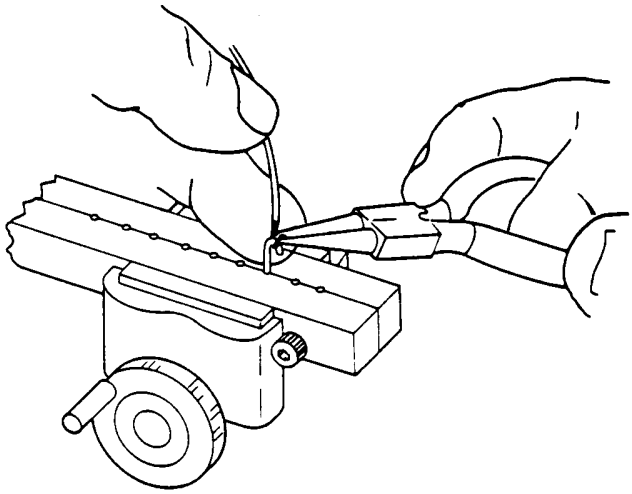
Place the wire up against the bottom of the hook.



HOOK TERMINAL

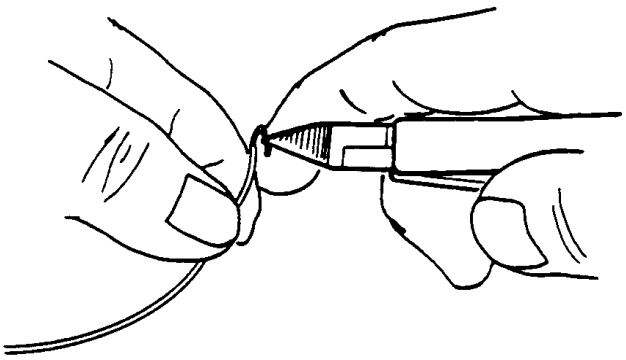
1j. With a lifting motion on both sides, wrap the wire tightly around the terminal, being aware of the proper insulation clearance.

- *The insulation shall not be embedded in the solder joint, and shall be less than two wire diameters, including insulation.*
  — Paragraph 9.1-1 and 2



1k. Slide the wire off the terminal. Using wire cutters, flush cut the bent wire so that it will only make contact with the terminal for 180 degrees minimum (1/2 turn) to 270 degrees maximum (3/4 turn).

26 AWG and smaller wire shall be 180 degrees minimum (1/2 turn) but less than one full turn 360 degrees maximum (1 turn).

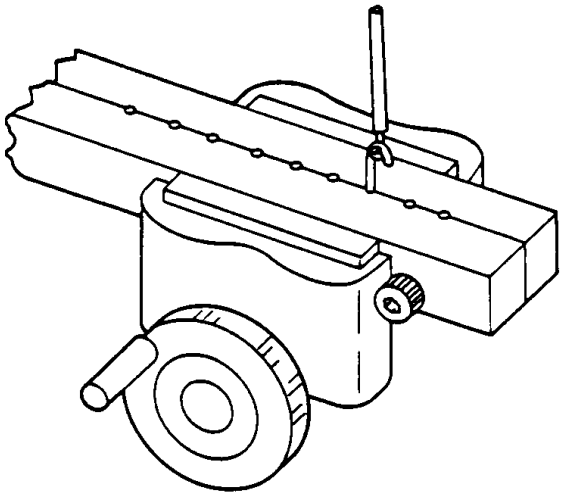


HOOK TERMINAL

1l. Hold the cut wire against the terminal to check the wrap dimension.

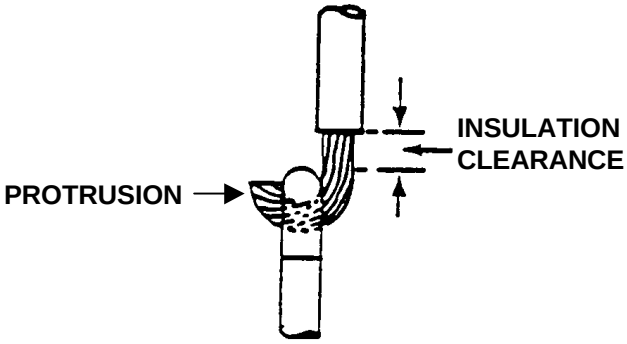
The wire shall contact the terminal for the full turn for which it is cut.

Recut the end of the wire as necessary.



- *The insulation shall not be imbedded in the solder joint, and shall be less than 2 wire diameters, including insulation.*
  — Paragraph 9.1-1 and 2

- *Protrusion of the conductor ends shall be controlled to avoid damage to the insulation sleeving.*
  — Paragraph 9.4

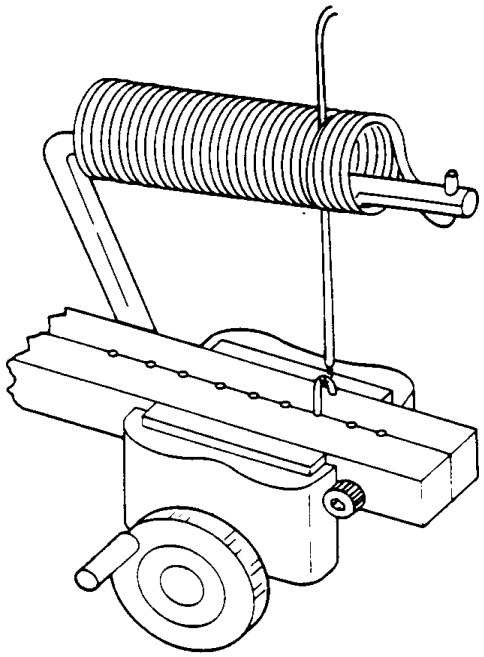


HOOK TERMINAL

STEP 2. POSITION THE WIRE

Attach the wire from the terminal to the spring, which will hold it during the soldering.

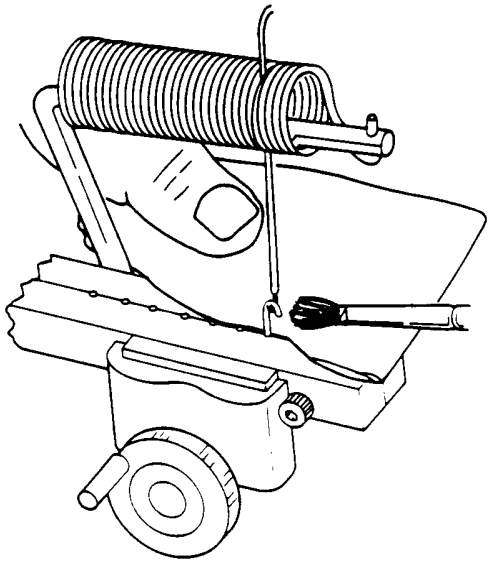
Adjust the wire for the proper tension, centering, and position.



STEP 3. CLEAN THE CONNECTION

Clean the connection with a soft brush using the approved solvent and a shopwipe.

Do not disturb the position of the wire.

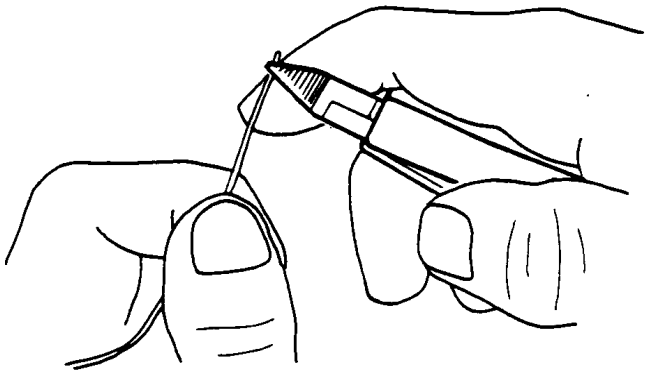


HOOK TERMINAL

STEP 4. CUT THE SOLDER

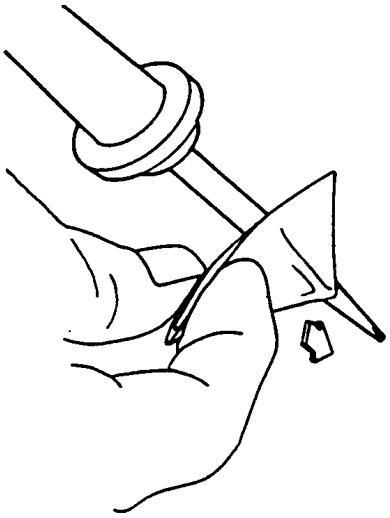
Cut the end of the solder to expose the flux in the core of the solder.

Wipe the solder with a shopwipe and solvent to remove any contaminants.

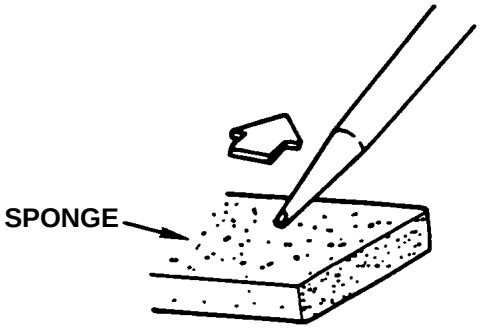


STEP 5. CLEAN THE SOLDERING IRON

Prepare the iron by wiping the tip with a shopwipe.



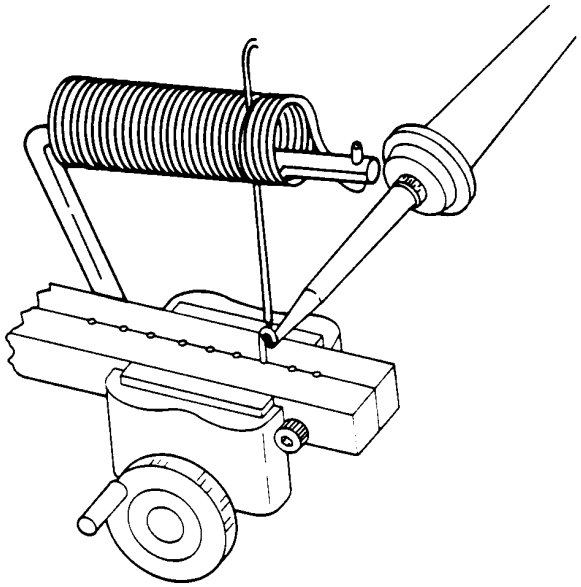
Lightly wipe the tip on a moist sponge to remove the oxides.



HOOK TERMINAL

STEP 6. POSITION THE IRON

Place the clean soldering iron tip against the bottom of the wire so as to contact both the wire and the terminal at the same time.



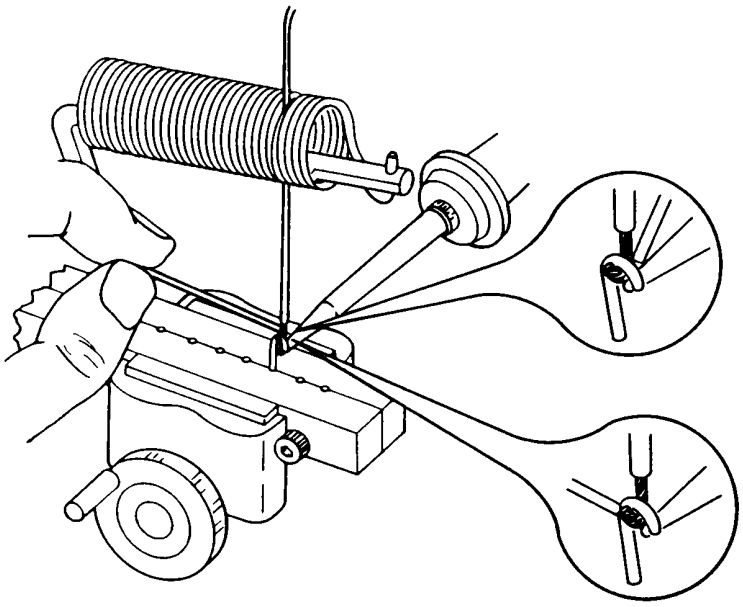
STEP 7. APPLY SOLDER

Apply a small amount of solder to the junction where the wire, terminal, and tip meet to make a solder bridge.

Now touch the solder to the end of the cut wire to cover the exposed copper.

Add solder as needed to complete the soldered connection.

Remove the solder; remove the iron.

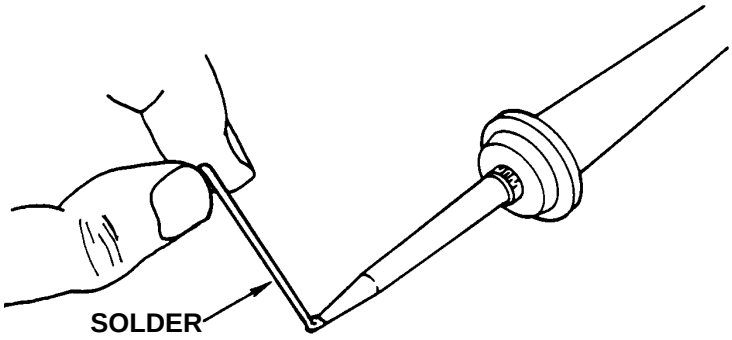


HOOK TERMINAL

STEP 8. TIN THE IRON

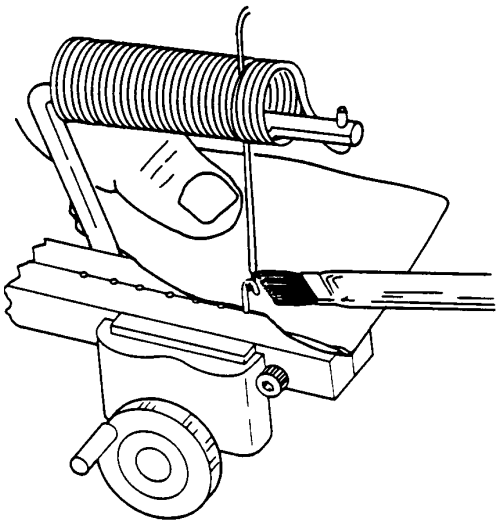
Tin the iron tip, while the connection is cooling at room temperature. A small amount of solder should remain on the tip.

Return the iron to the holder.



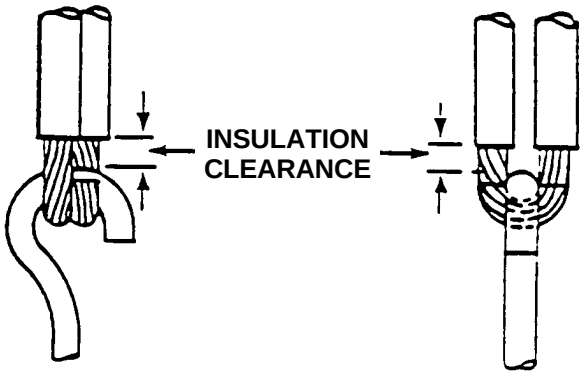
STEP 9. CLEAN THE CONNECTION

Clean the flux from the soldered connection with an acid brush, using the approved solvent and shopwipe.



- *When more than one conductor is connected to the terminal, the direction of the bend of each additional conductor shall alternate.*

  — Paragraph 9.4



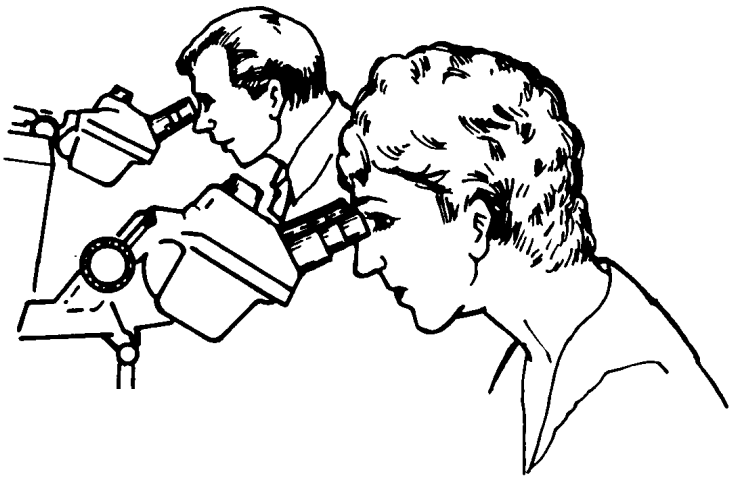
HOOK TERMINAL

STEP 10. INSPECT THE CONNECTION

Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

- *Conductor bend shall be 1/2 (180°) to*

— Paragraph 9.4



- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*

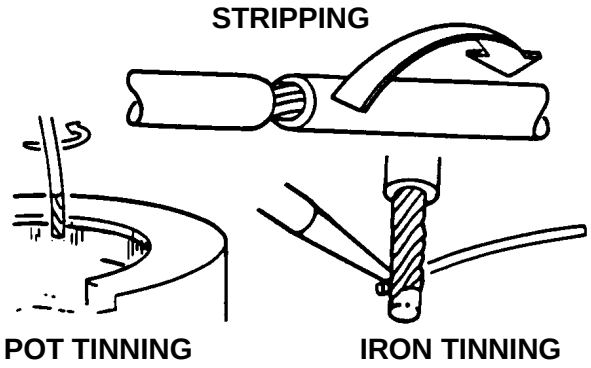
— Paragraph 13.6

For detailed inspection criteria refer to NASA-STD-8739.3 and Appendix A of 8739.3.

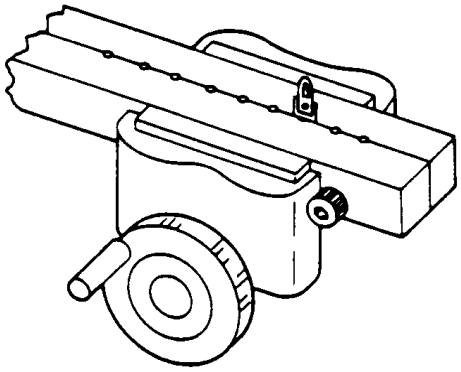
PIERCED TERMINAL

STEP 1. PREPARE THE CONNECTION

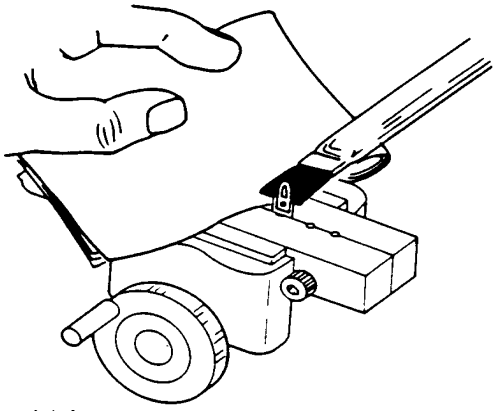
1a. Prepare a stranded wire in accordance with Procedures 1 and 2A/2B on Stripping and Tinning, respectively.



1b. Insert a terminal into a phenolic block (or equivalent). Secure the block in a vise.

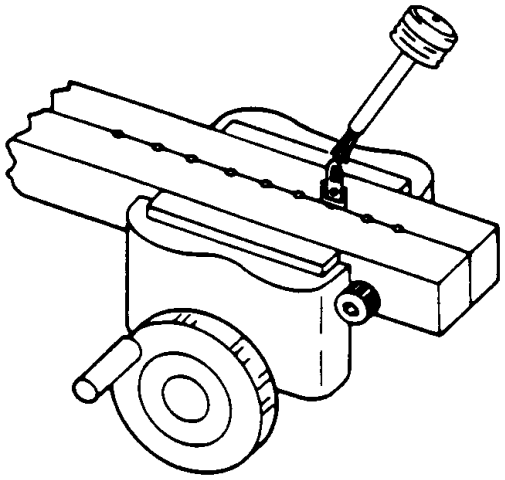


1c. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.



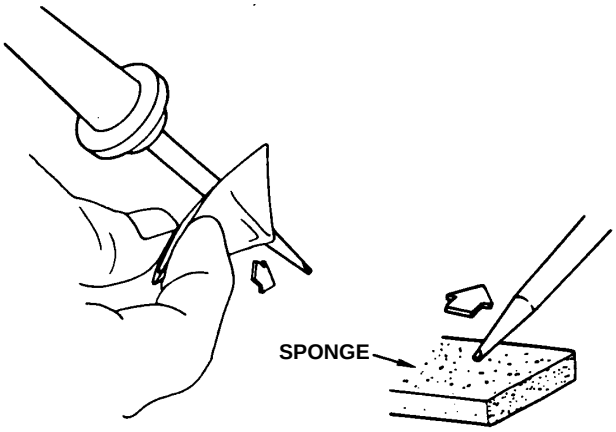
PIERCED TERMINAL

1d. If necessary, add flux on the portion of the terminal to be tinned.



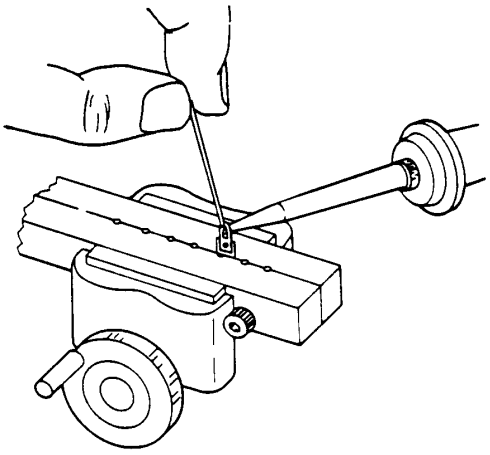
1e. Clean the iron by wiping the tip with a dry shopwipe.

Lightly wipe the tip on a moist sponge to remove the oxides.



1f. Tin the terminal by positioning the iron as shown and add solder to form a thermal (solder) bridge. Add solder as necessary.

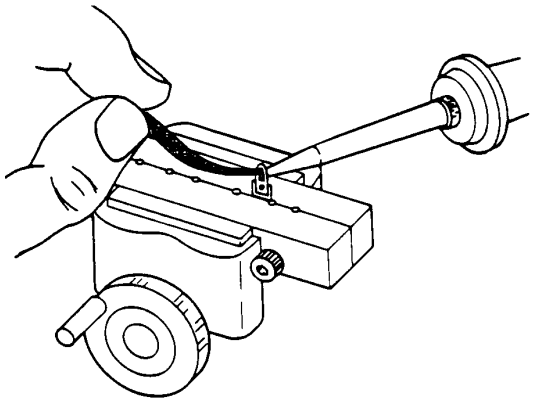
CAUTION: Allow time for the terminal to cool before proceeding.



PIERCED TERMINAL

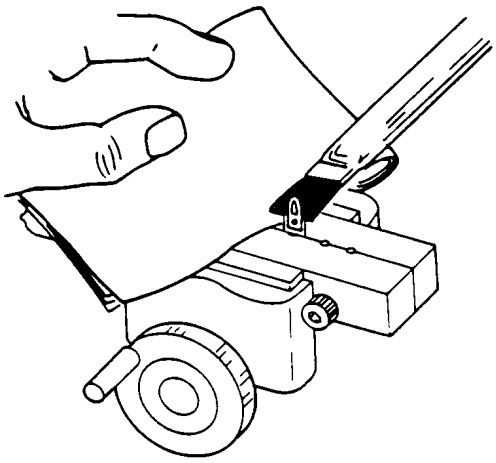
1g. Place the solder wick on the solder.

Place the solder iron on top of the wick in order to clean the solder from the terminal.



1h. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.

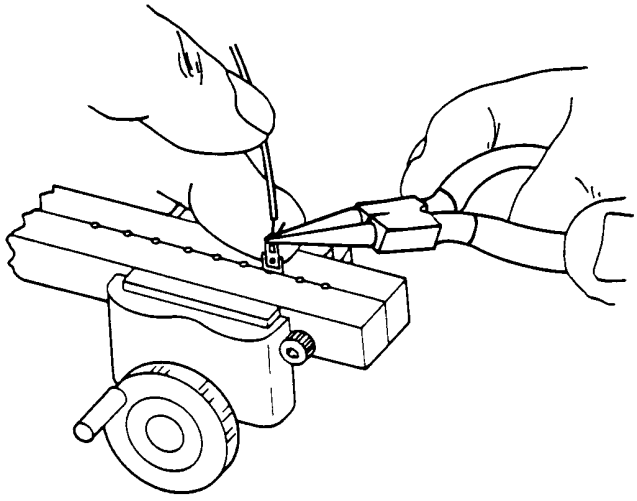
Inspect for a uniform layer of solder



1i. To bend the wire 180 degrees (1/2 turn) for the END ENTRY, place the wire through the eyelet and grasp the end of the stripped and tinned wire with a pair of pliers.

While holding the end of the wire with the pliers, bend the insulated portion of the wire up with your fingers. Now hold the insulated portion firmly with your fingers, and bend the wire end up with the pliers.

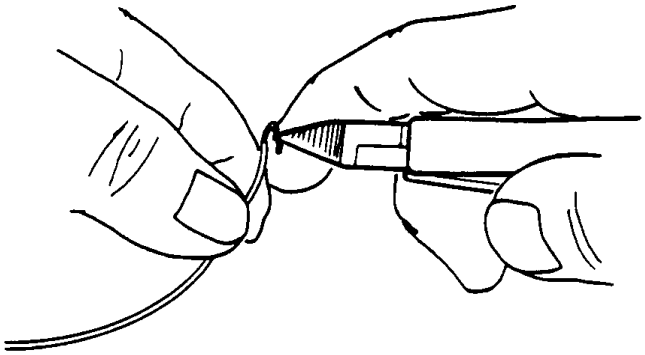
- *The insulation shall not be imbedded in the solder joint, and shall be less than 2 wire diameters, including insulation.*
  — Paragraph 9.1-1 and 2



PIERCED TERMINAL

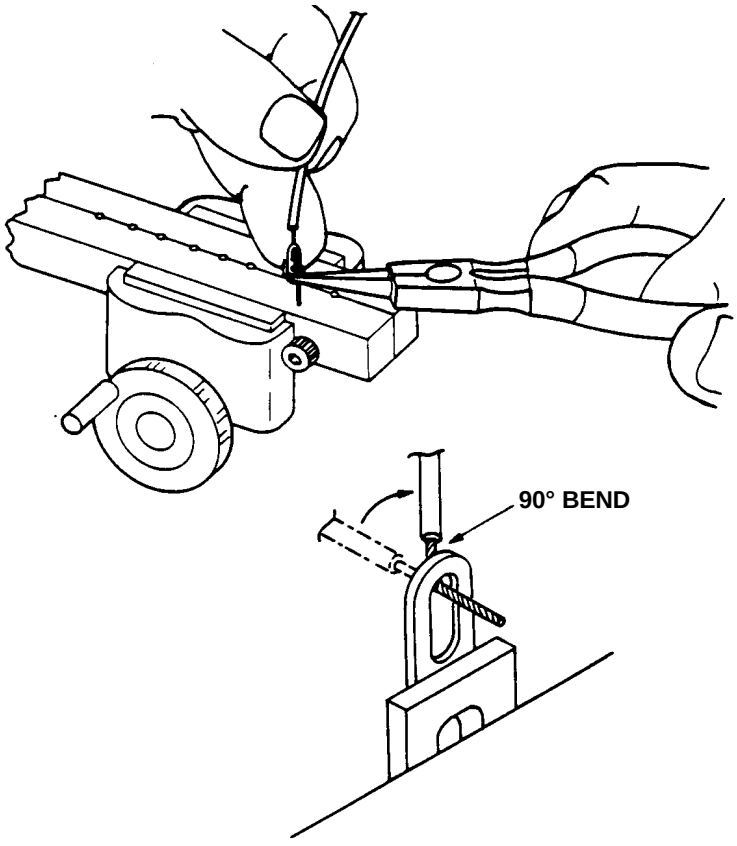
1j. Remove the wire from the terminal.

Using wire cutters, cut the bent wire so that it will only make contact with the terminal for 180 degrees (1/2 turn).



[ALTERNATE BEND 1]

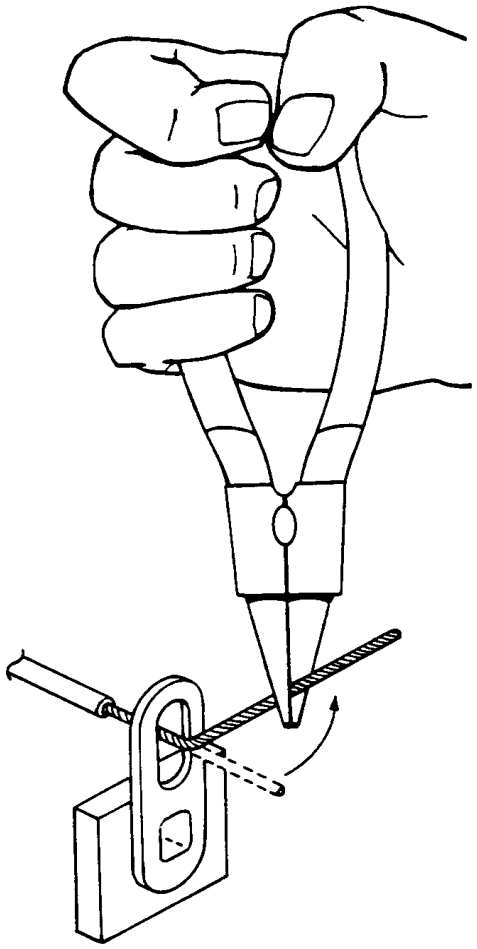
To bend the wire 90 degrees (1/4 turn) for END ENTRY, place the wire through the eyelet and grasp the end of the stripped and tinned wire with a pair of pliers. Bend the insulated portion of the wire up tightly against the terminal with your fingers, while holding the wire (with the pliers) in place. Be aware of the proper insulation clearance.



PIERCED TERMINAL

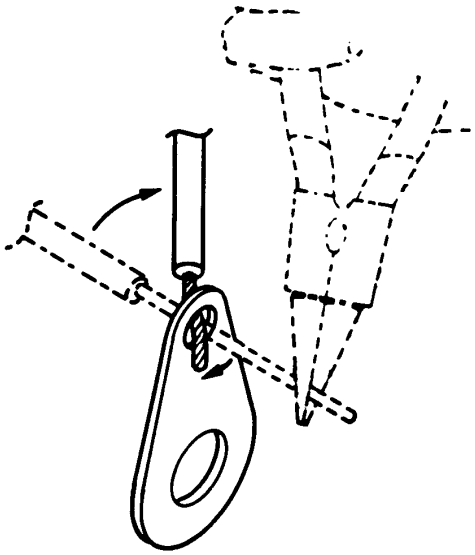
[ALTERNATE BEND 2]

To bend the wire 90 degrees (1/4 turn) for SIDE ENTRY, place the wire through the terminal and grasp the end of the stripped and tinned wire with a pair of pliers. While holding the insulated portion with the fingers, bend the wire held with the pliers tightly against the terminal to a right angle (1/4 turn), being aware of the insulation clearance.



[ALTERNATE BEND 3]

To bend the wire 90 + 90 degrees (Z-bend) for the END ENTRY, place the wire through the terminal and grasp the end of the stripped and tinned wire with a pair of pliers. While holding the wire in place (with the pliers), bend the insulated wire with your fingers to a right angle (1/4 turn). Cut the end of the wire and bend opposite the direction of the first bend. Be aware of the insulation clearance.

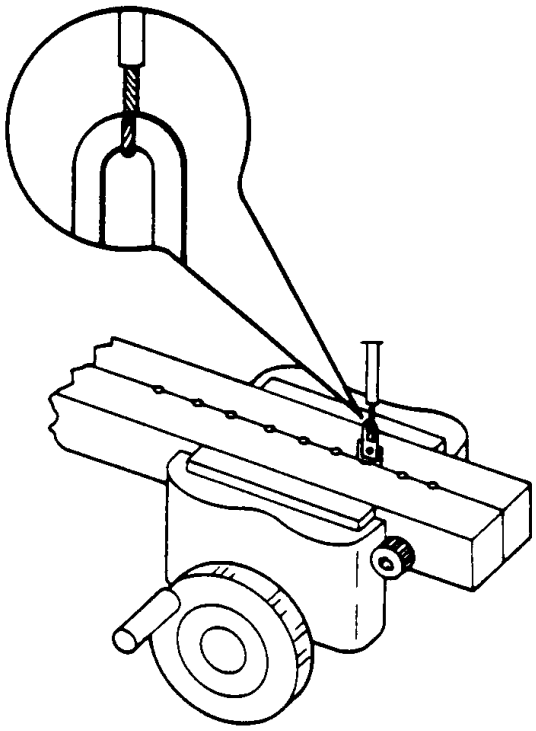


PIERCED TERMINAL

1k. Hold the cut wire against the terminal to check the cut.

The wire shall contact the terminal for the full turn for which it is cut.

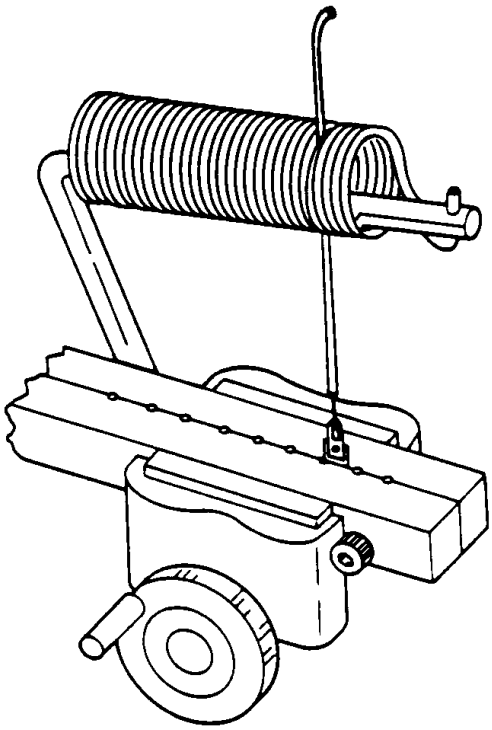
Re-cut the end of the wire as necessary.



STEP 2. POSITION THE WIRE

Attach the wire from the terminal to the spring, which will hold it during the soldering.

Adjust the wire for the proper tension, centering, and position.

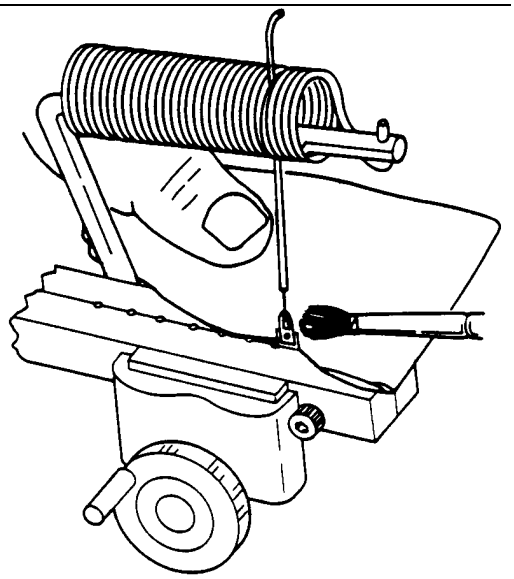


PIERCED TERMINAL

STEP 3. CLEAN THE CONNECTION

Clean the connection with a soft brush, using the approved solvent and a shopwipe.

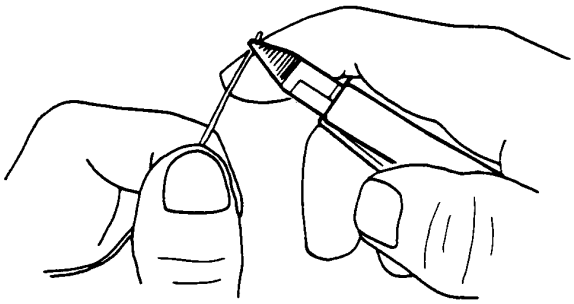
Do not disturb the position of the wire.



STEP 4. CUT THE SOLDER

Cut the end of the solder to expose the flux in the core of the solder.

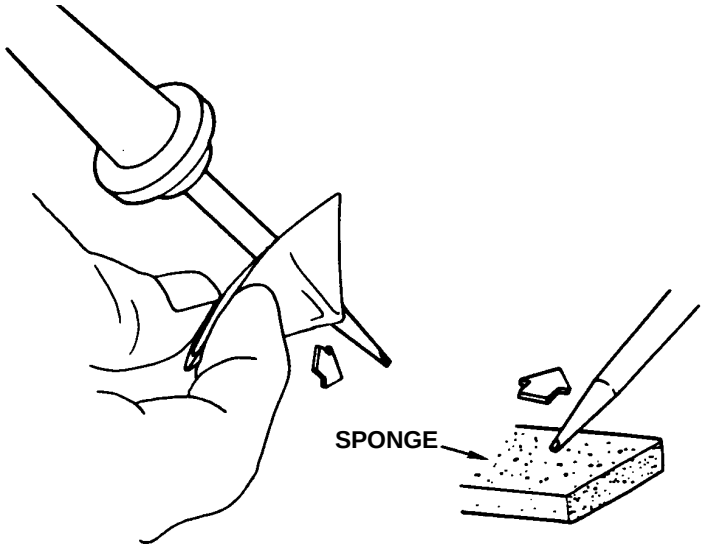
Wipe the solder with a shopwipe and solvent to remove any contaminants.



STEP 5. CLEAN THE SOLDERING IRON

Prepare the iron by wiping the tip with a dry shopwipe.

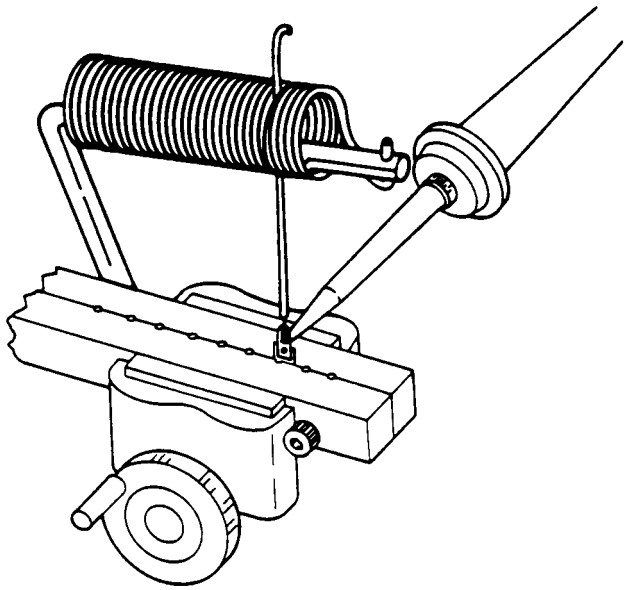
Lightly wipe the tip on a slightly moist sponge to remove the oxides.



PIERCED TERMINAL

STEP 6. POSITION THE IRON

Place the clean soldering iron tip against the terminal so as to contact both the wire and the terminal at the same time.



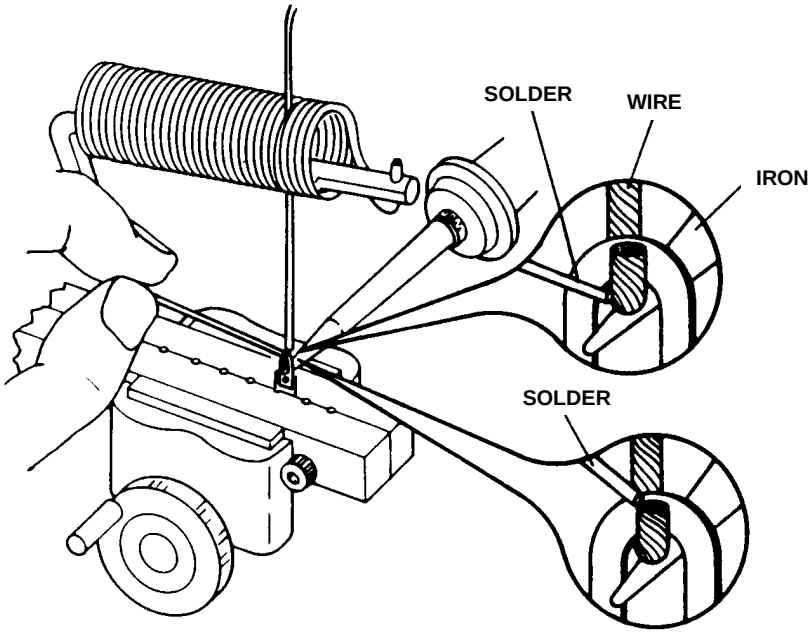
STEP 7. APPLY SOLDER

Apply a small amount of solder to the junction where the wire, terminal, and iron meet in order to form a thermal (solder) bridge.

Now touch the solder to the end of the cut wire to cover the exposed copper.

Add solder as needed to complete the soldered connection.

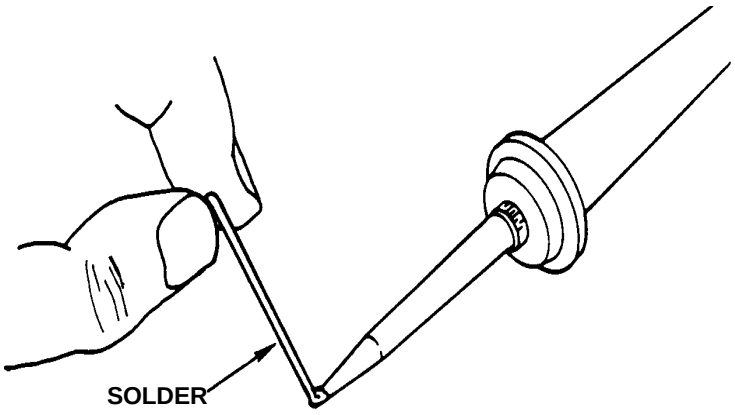
Remove the solder; remove the iron.



PIERCED TERMINAL

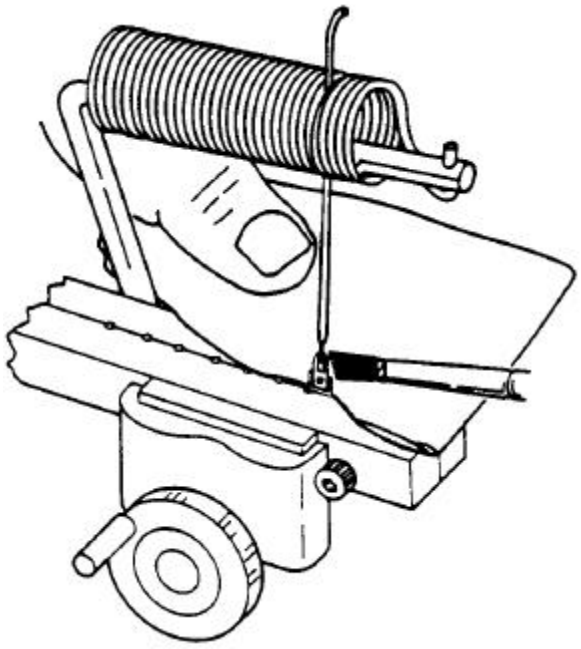
STEP 8. TIN THE IRON

Tin the iron tip while the connection is cooling at room temperature. A small amount of solder should remain on the tip. Return the iron to the holder.



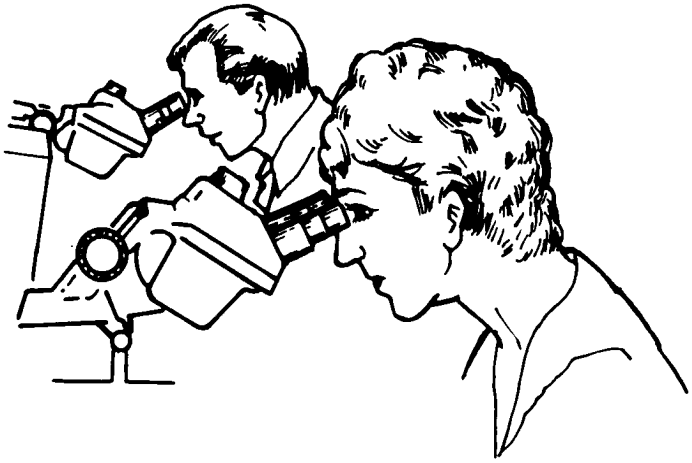
STEP 9. CLEAN THE CONNECTION

Clean the flux from the soldered connection with an acid brush, using the approved solvent and a shopwipe.



PIERCED TERMINAL

STEP 10. INSPECT THE CONNECTION



Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

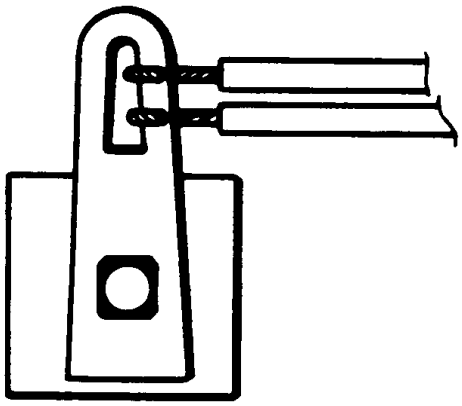
- *Conductor bend shall be 1/4 (90°) to*

— Paragraph 9-5

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin too bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*

— Paragraph 13.6

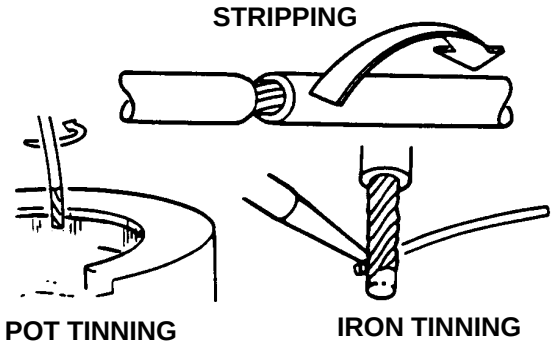
For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 16.6 and Appendix A.



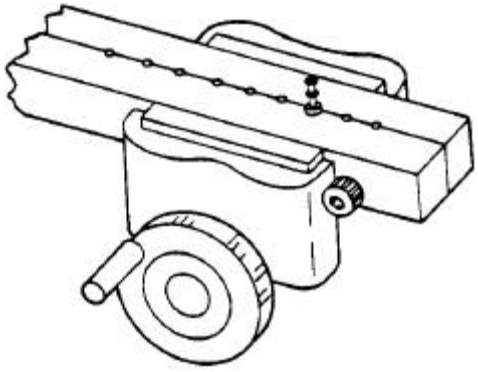
TURRET TERMINAL

STEP 1. PREPARE THE CONNECTION

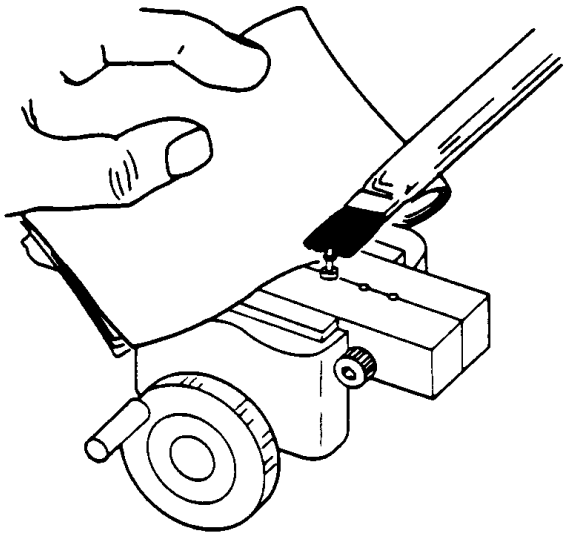
1a. Prepare a stranded wire in accordance with Procedures 1 and 2A/2B on Stripping and Tinning, respectively.



1b. Insert a terminal into a phenolic block (or equivalent). Secure the block in a vise.

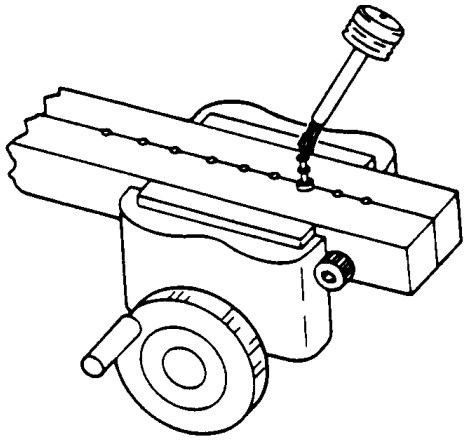


1c. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.



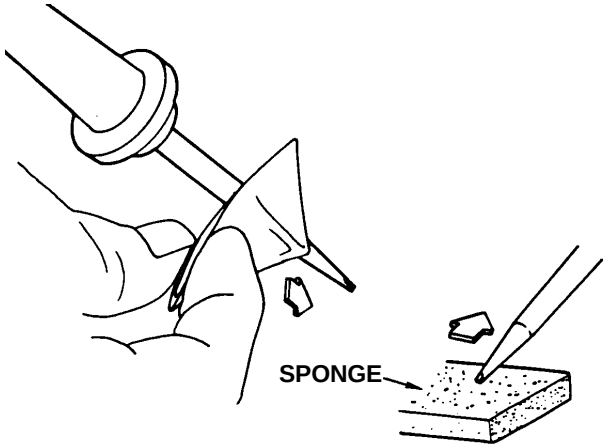
TURRET TERMINAL

1d. If necessary, add flux on the portion of the terminal to be tinned.



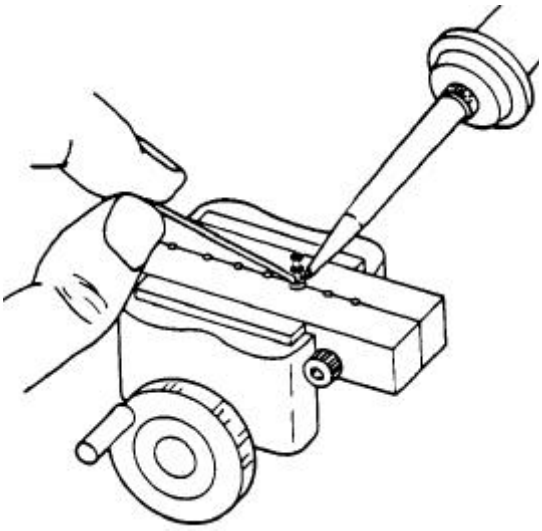
1e. Clean the iron by wiping the tip with a dry shopwipe.

Lightly wipe the tip on a moist sponge to remove the oxides.



1f. Tin the terminal by positioning the iron as shown and adding solder to form a solder bridge. Add solder as necessary.

CAUTION: Allow time for the terminal to cool before proceeding.

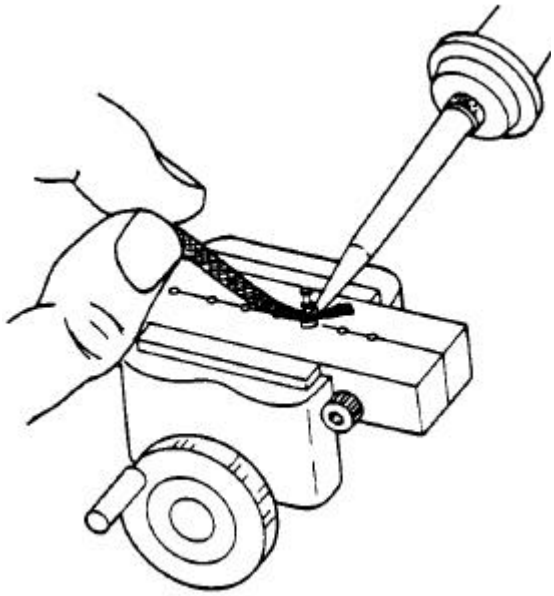


TURRET TERMINAL

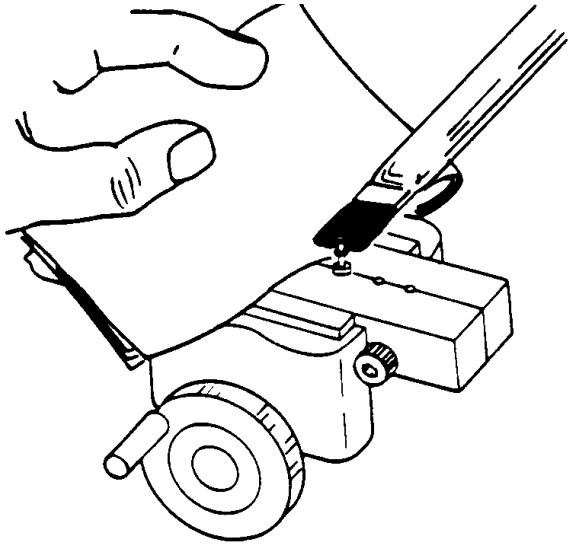
1g. Place the solder wick on the solder.

Place the solder iron on top of the wick to remove the solder from the terminal.

Inspect for a uniform layer of solder.



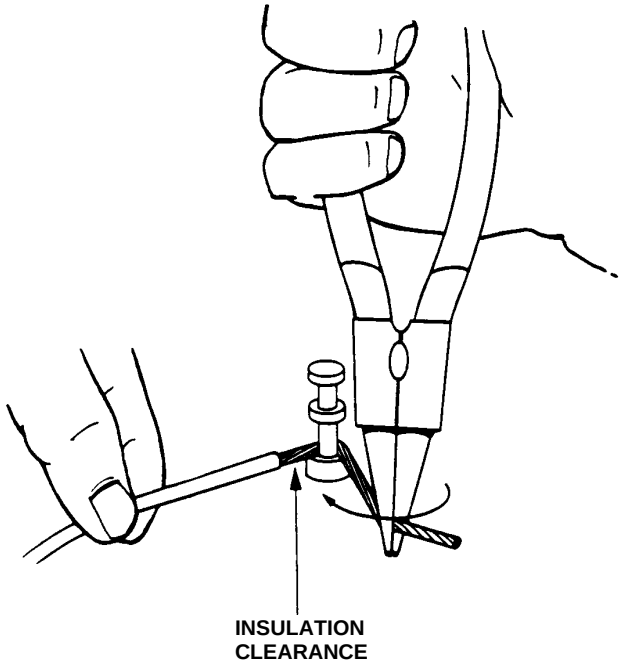
1h. Clean the tinned terminal with an acid brush, using the approved solvent and a shopwipe.



TURRET TERMINAL

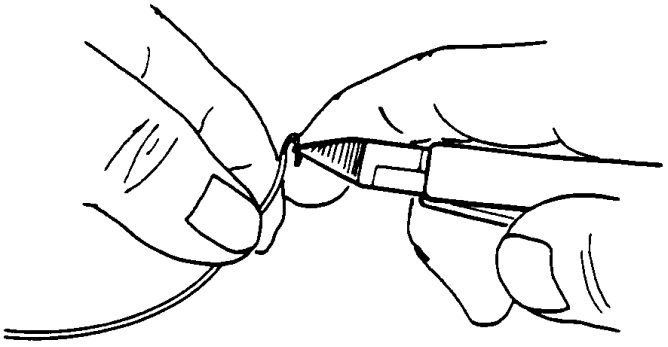
1i. To bend the wire around the terminal, grasp the end of a stripped and tinned wire with a pair of pliers.

Place the wire on the base of the turret. Holding the wire in place with your fingers, move the pliers to wrap the wire tightly around the terminal, being aware of the proper insulation clearance.



1j. Remove the wire from the terminal. Using wire cutters, flush cut the bent wire so that it will only make contact with the terminal from 180 degrees minimum (1/2 turn) to 270 degrees maximum (3/4 turn).

26 AWG and smaller wire shall be 180 degrees minimum (1/2 turn) but less than one full turn 360 degrees maximum.



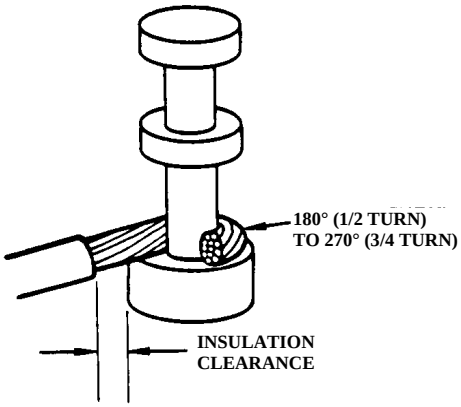
TURRET TERMINAL

1k. Hold the cut wire against the terminal to check the wrap dimension.

The wire shall contact the terminal for the full turn for which it is cut.

Recut the end of the wire as necessary.

- *The insulation shall not be imbedded in the solder joint, and shall be less than 2 wire diameters, including insulation.*
  — Paragraph 9.1-1 and 2

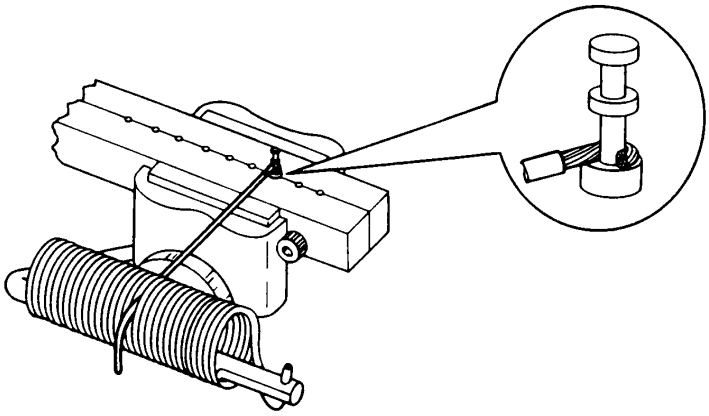


STEP 2. POSITION THE WIRE

Attach the wire from the terminal to the spring to hold it during the soldering.

The wire is mounted in the bottom guide slot and shall stay in contact with the base.

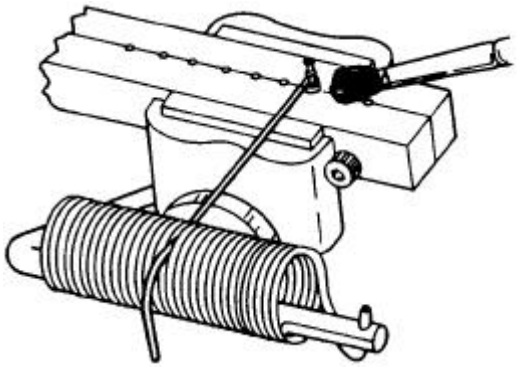
Adjust the wire for the proper tension, centering, and position.



STEP 3. CLEAN THE CONNECTION

Clean the connection with a soft brush, using the approved solvent and shopewipe.

Do not disturb the position of the wire.

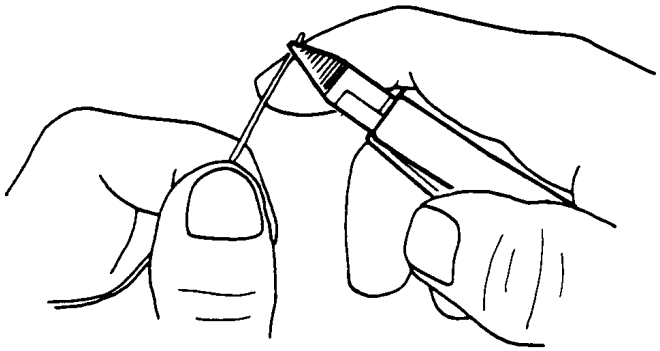


TURRET TERMINAL

STEP 4. CUT THE SOLDER

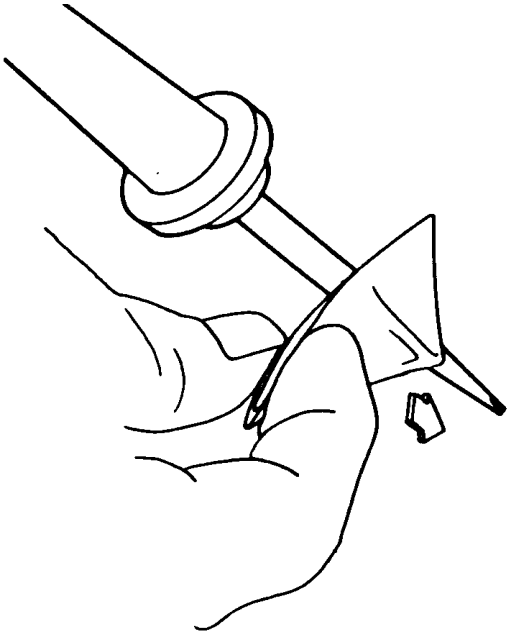
Cut the end of the solder to expose the flux in the core of the solder.

Wipe the solder with a shopwipe and solvent to remove any contaminants.

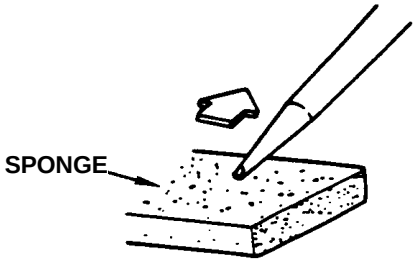


STEP 5. CLEAN THE SOLDERING IRON

Prepare the iron by wiping the tip with a dry shopwipe.



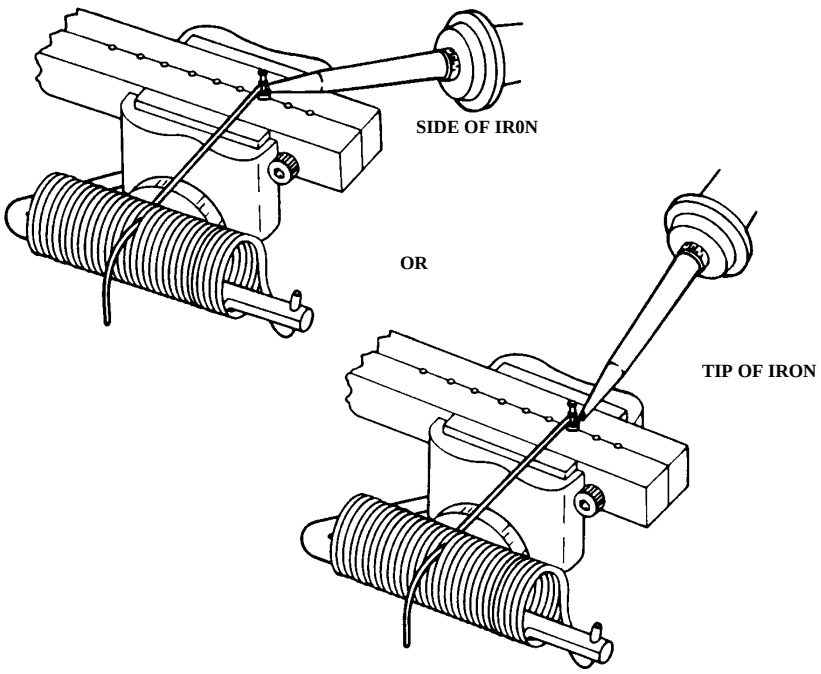
Lightly wipe the tip on a slightly moist sponge to remove the oxides.



TURRET TERMINAL

STEP 6. POSITION THE IRON

Place the clean soldering iron tip against the turret base so as to contact both the wire and the terminal at the same time.



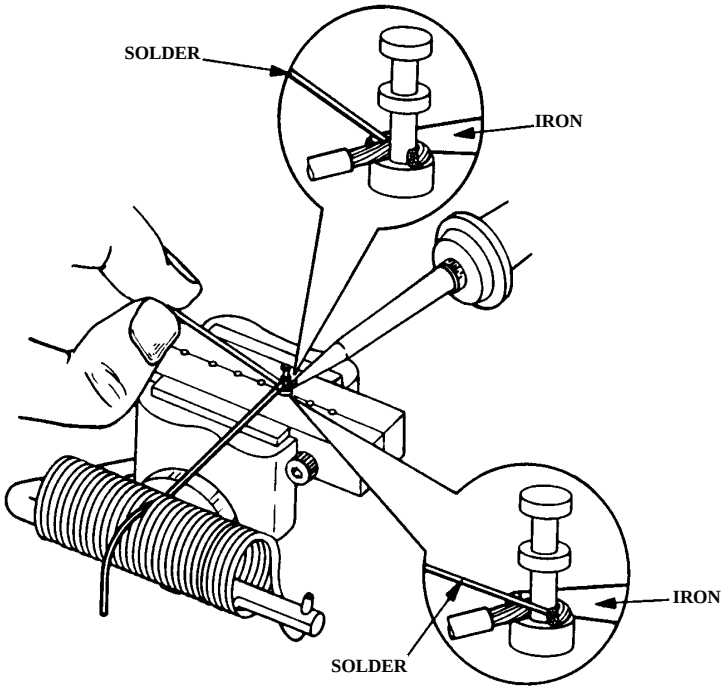
STEP 7. APPLY SOLDER

Apply a small amount of solder to the junction where the wire, terminal, and iron meet to form a thermal (solder) bridge.

Now touch the solder to the end of the cut wire to cover the exposed copper.

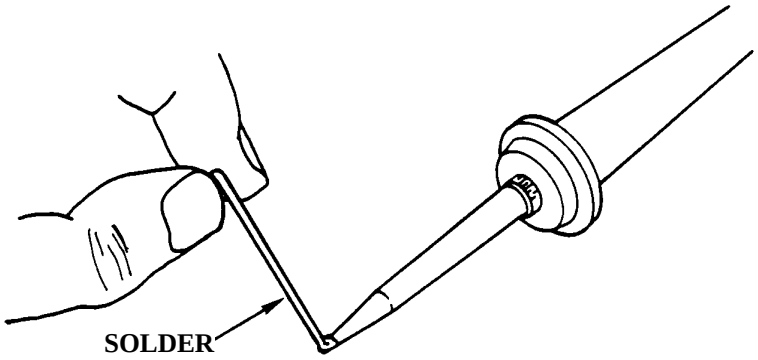
Add solder as needed to complete the soldered connection.

Remove the solder; remove the iron.



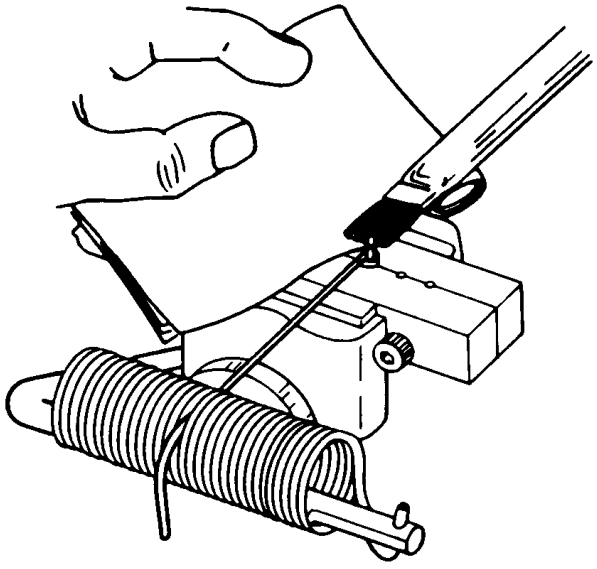
STEP 8. TIN THE IRON

Tin the iron tip, while the connection is cooling at room temperature. A small amount of solder should remain on the tip. Return the iron to the holder.



STEP 9. CLEAN THE CONNECTION

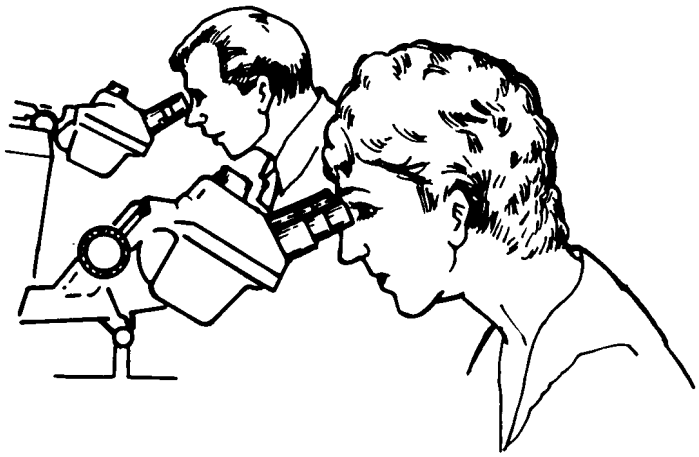
Clean the flux from the soldered connection with an acid brush, using the approved solvent and a shopwipe.



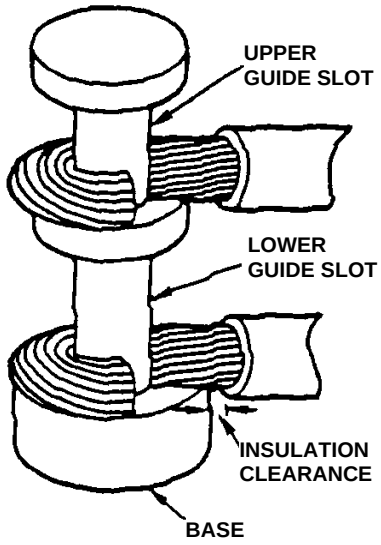
TURRET TERMINAL

STEP 10. INSPECT THE CONNECTION

Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.



- *Conductor bend shall be 1/2 (180°) to 3/4 (270°) turn for conductors larger than AWG 26.*
  — Paragraph 9.2-1a
- *Conductor bend shall be wrapped more than 1/2 (180°) but less than 360° for conductors AWG 26 and smaller.*
  — Paragraph 9.2-1b
- *All conductors shall be confined to guide slots.*
  — Paragraph 9.2-1c
- *Conductors shall be maintained in contact with the post for the full curvature of the wrap and the conductor ends shall not extend beyond the base of the terminal.*
  — Paragraph 9.2-1d
- *More than one conductor may be installed in a single slot of sufficient width, provided each conductor is wrapped on the terminal post and not on another conductor.*
  — Paragraph 9.2-1e
- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin too bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*
  — Paragraph 13.6

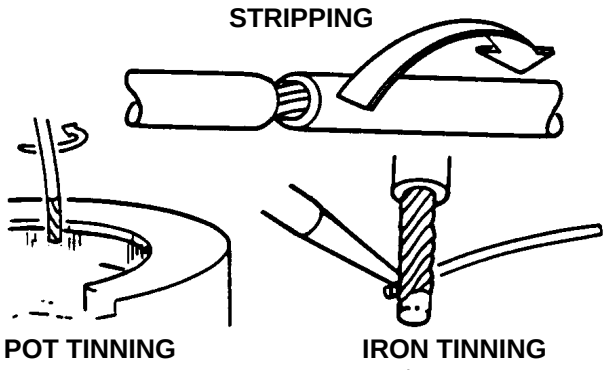


For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

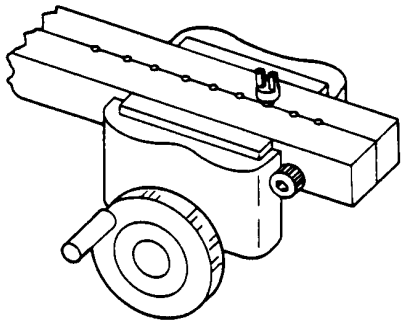
BIFURCATED TERMINAL

STEP 1. PREPARE THE CONNECTION

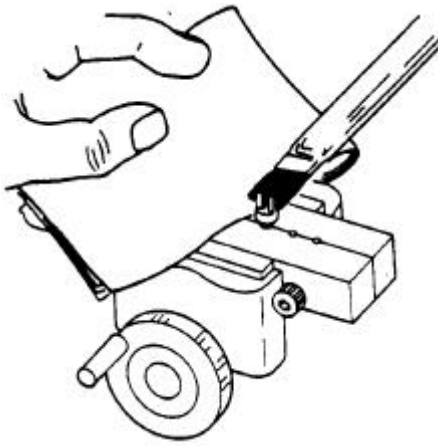
1a. Prepare a stranded wire in accordance with Procedures 1 and 2A/2B on Stripping and Tinning, respectively.



1b. Insert a terminal into a phenolic block (or equivalent). Secure the block in a vise.

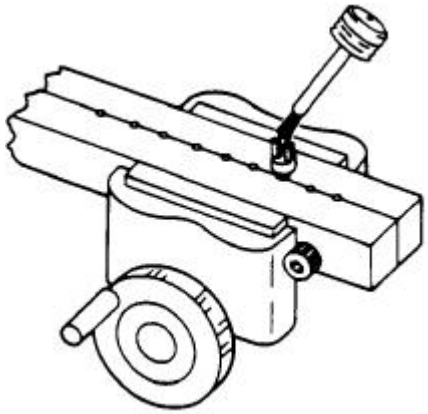


1c. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.



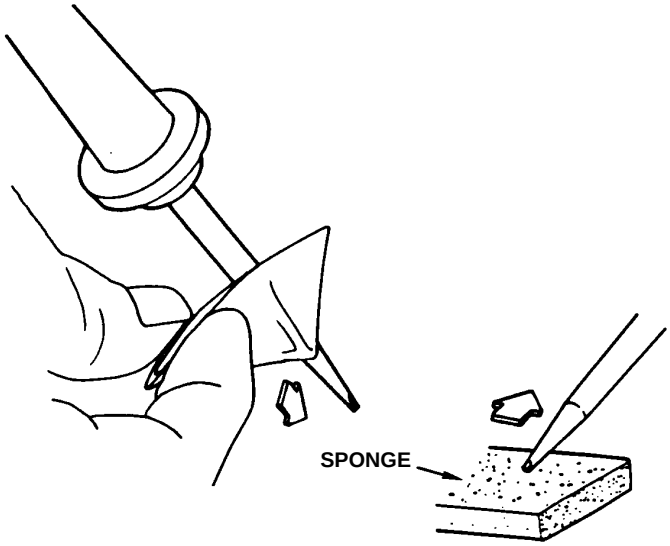
BIFURCATED TERMINAL

1d. If necessary, add flux on the portion of the terminal to be tinned.



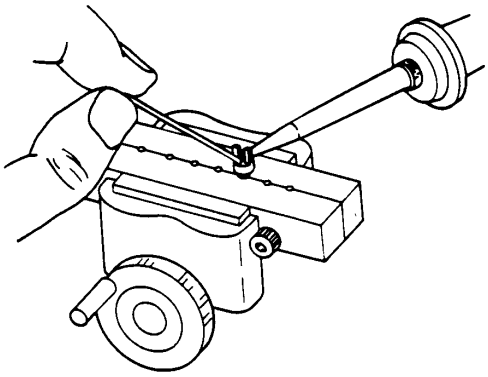
1e. Clean the iron by wiping the tip with a dry shopwipe.

Lightly wipe the tip on a moist sponge to remove the oxides.



1f. Tin the terminal by positioning the iron as shown and adding solder to form a thermal (solder) bridge. Add solder as necessary.

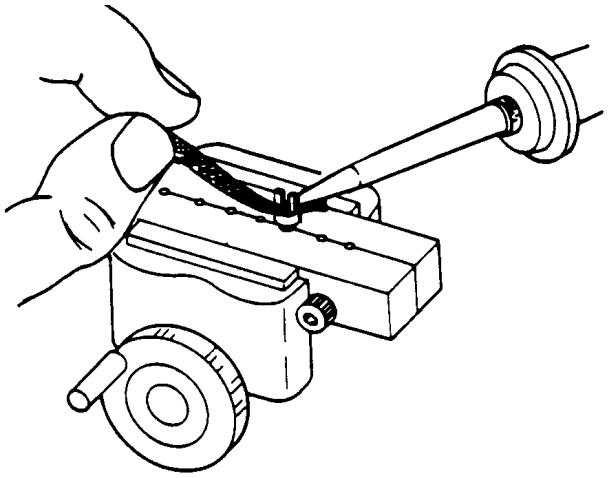
CAUTION: Allow time for the terminal to cool before proceeding.



BIFURCATED TERMINAL

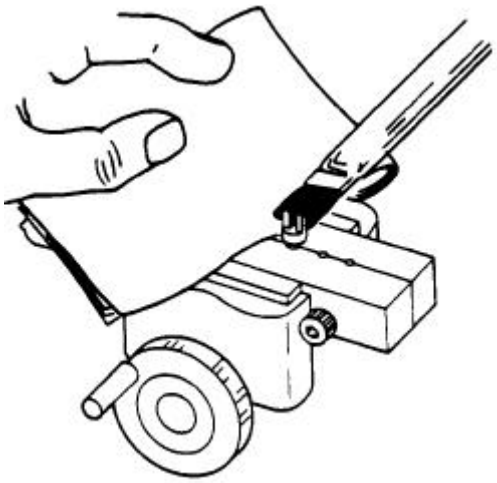
1g. Place the solder wick on the solder.

Place the solder on top of the wick in order to clean the solder from the terminal.



1h. Clean the terminal with an acid brush, using an approved solvent and a shopwipe.

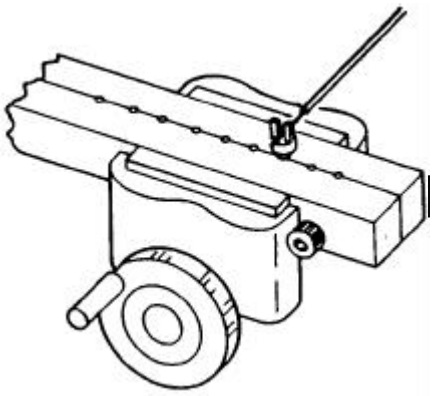
Inspect for a uniform layer of solder.



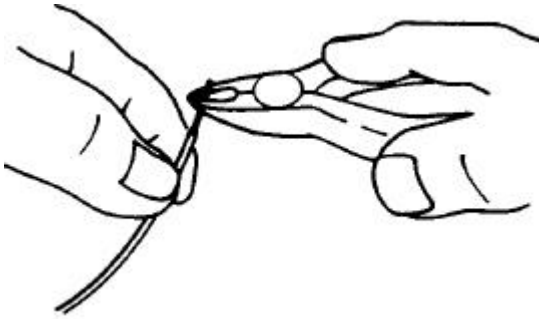
1i. For side entry, place the end of the stripped and tinned wire into the slot between the posts.

Gently hold the wire with wire cutters at the desired length to cut off the wire.

- *The insulation shall not be imbedded in the solder joint, and shall be less than 2 wire diameters, including insulation.*
  — Paragraph 9.1-1 and 2



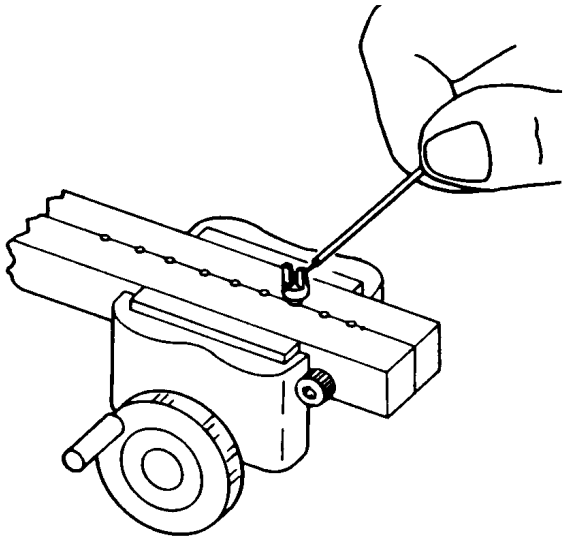
1j. Slide the wire out of the posts. Using wire cutters, now flush cut the wire.



1k. Hold the cut wire against the terminal to check the wrap connection.

The wire shall enter the mounting slot perpendicular to the posts, be in contact with the terminal surface, and not extend beyond the diameter of the base.

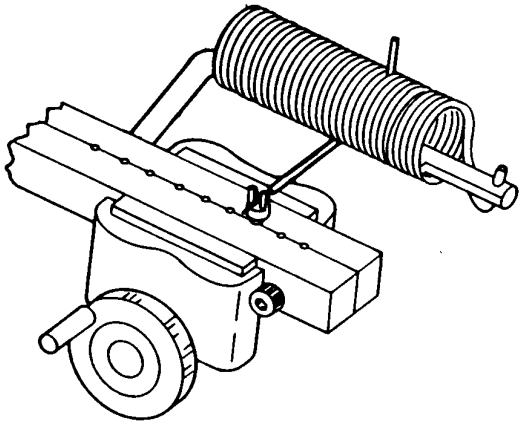
Recut the end of the wire as necessary.



STEP 2. POSITION THE WIRE

Attach the wire from the terminal to the spring, which will hold it during the soldering.

Adjust the wire for the proper tension, centering, and position.

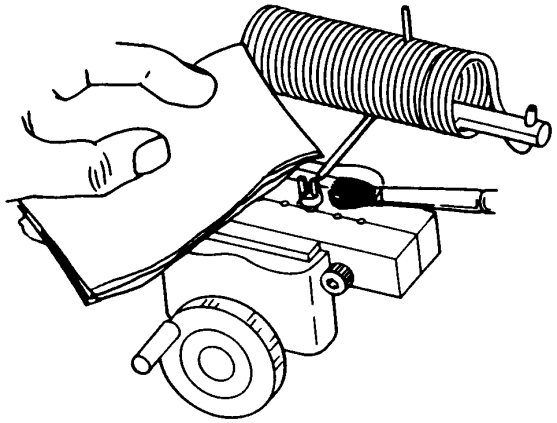


BIFURCATED TERMINAL

STEP 3. CLEAN THE CONNECTION

Clean the connection using a soft brush, using the approved solvent and a shopewipe.

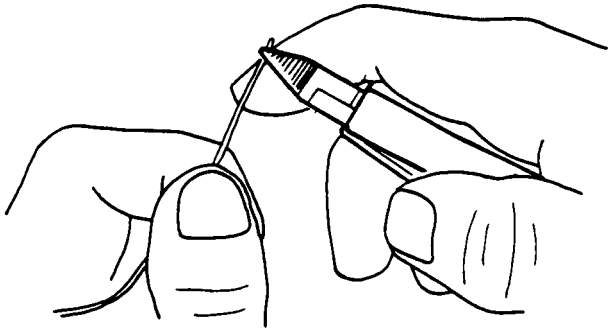
Do not disturb the position of the wire.



STEP 4. CUT THE SOLDER

Cut the end of the solder to expose the flux in the core of the solder.

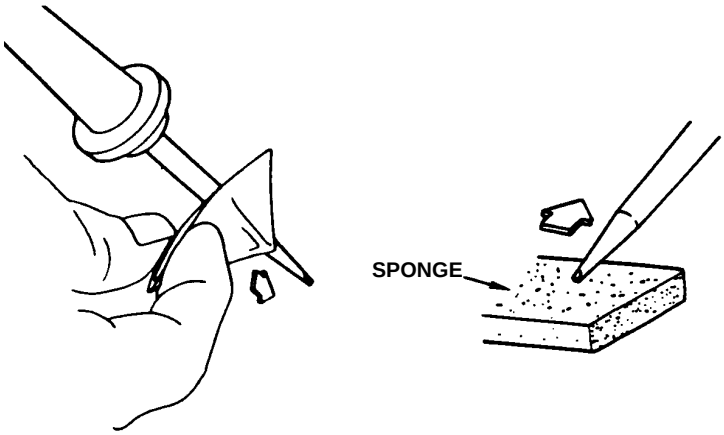
Wipe the solder with the shopwipe and solvent to remove any contaminants.



STEP 5. CLEAN THE SOLDERING IRON

Prepare the iron by wiping the tip with a dry shopwipe.

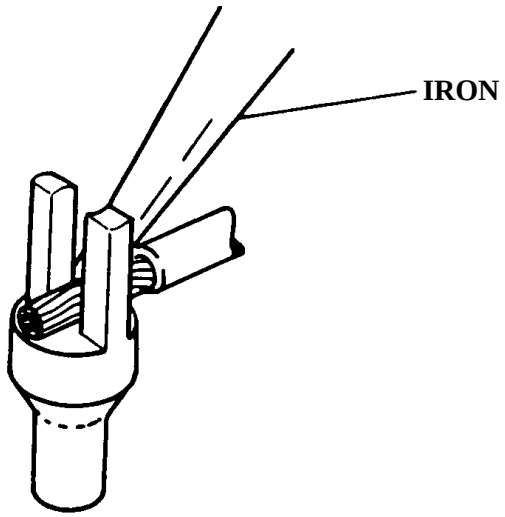
Lightly wipe the tip on a moist sponge to remove the oxides.



BIFURCATED TERMINAL

STEP 6. POSITION THE IRON

Place the clean soldering iron tip on the base of the terminal so as to contact both the wire and the terminal at the same time.



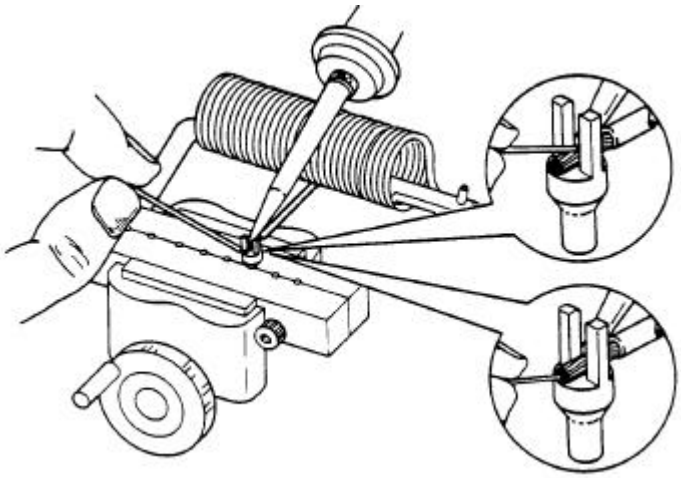
STEP 7. APPLY SOLDER

Apply a small amount of solder to the junction where the wire, terminal, and tip meet to make a solder bridge.

Now touch the solder to the end of the cut wire to cover the exposed copper.

Add solder as needed to complete the soldered connection.

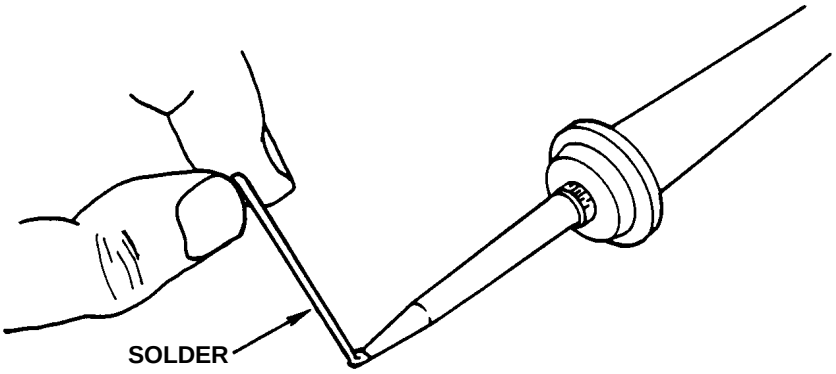
Remove the solder; remove the iron.



STEP 8. TIN THE IRON

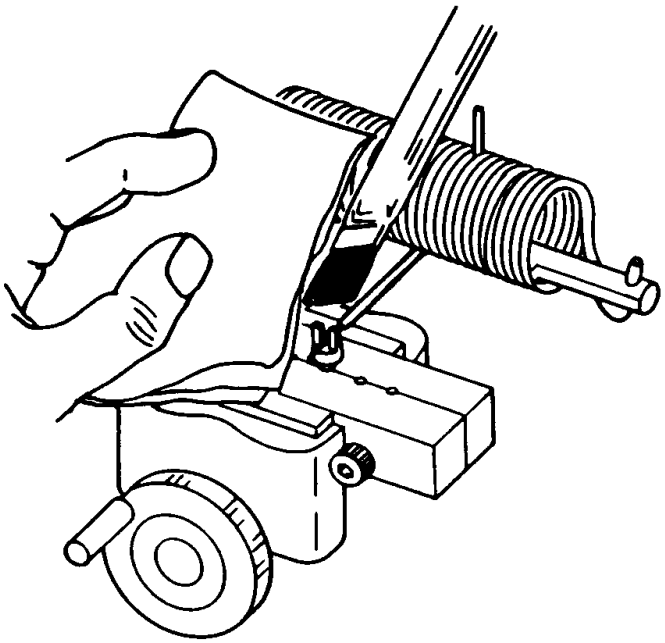
Tin the iron tip while the connection is cooling at room temperature. A small amount of solder should remain on the tip.

Return the iron to the holder.



STEP 9. CLEAN THE CONNECTION

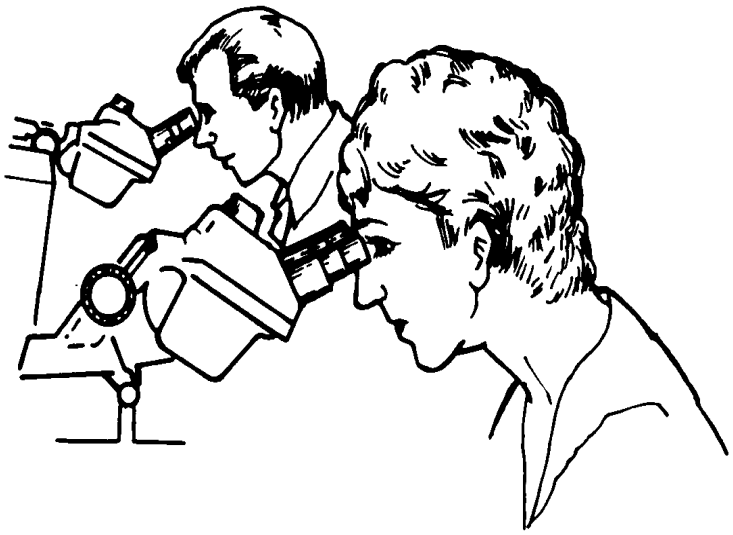
Clean the flux from the soldered connection with an acid brush, using the approved solvent and a shopwipe.



BIFURCATED TERMINAL

STEP 10. INSPECT THE CONNECTION

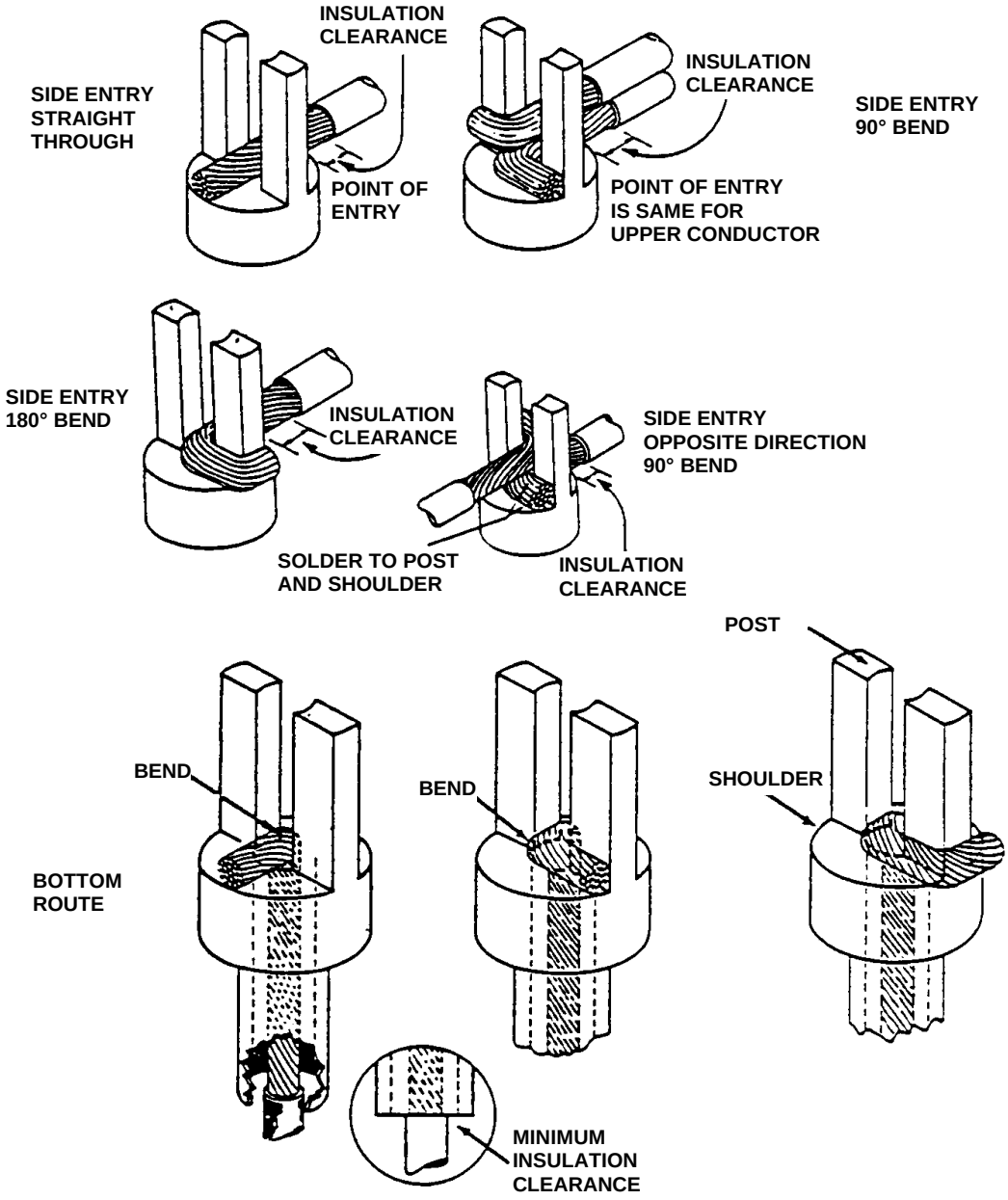
Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.



- *Side route conductors shall enter the mounting slot perpendicular to the posts.*
  — Paragraph 9.3-2a
- *A conductor may lay straight through a terminal slot provided the conductor surface remains in contact with the terminal surface. _ Paragraph 9.3-2b*
- *Conductor bend shall be 1/4 (90°) to 1/2*
  — Paragraph 9.3-2b
- *More than one conductor may be installed on a single terminal post provided each conductor is wrapped on the terminal post and not on another conductor, and the direction of the bend shall alternate.*
  — Paragraph 9.3-2c and d
- *Conductors shall not extend beyond the diameter of the base except where physical clearance will not adversely affect environmental or electrical characteristics.*
  — Paragraph 9.3-2e
- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*
  — Paragraph 13.6

For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

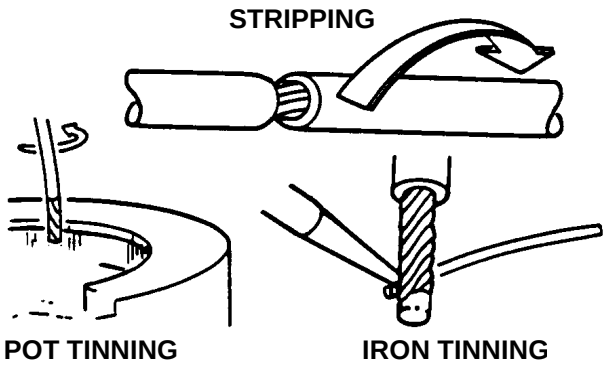
ALTERNATE METHODS
OF MOUNTING THE BIFURCATED TERMINAL



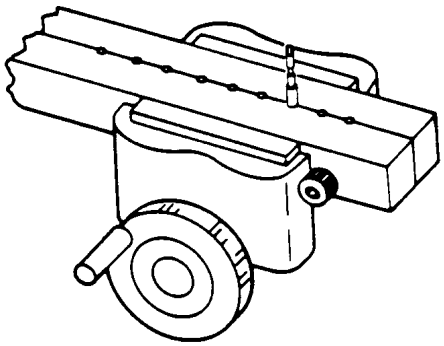
CONNECTOR PIN

STEP 1. PREPARE THE CONNECTION

1a. Prepare a stranded wire in accordance with Procedures 1 and 2A/2B on Stripping and Tinning, respectively.



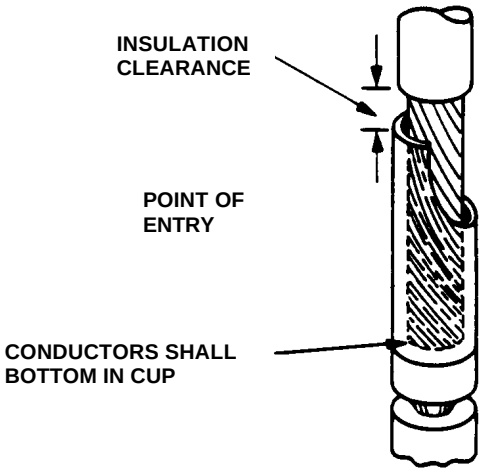
1b. Insert a terminal into a phenolic block (or equivalent). Secure the block in a vise.



1c. Place the end of the stripped and tinned wire into the cup.

- *The insulation shall not be imbedded in the solder joint, and shall be less than 2 wire diameters, including insulation.*

  — Paragraph 9.1-1 and 2



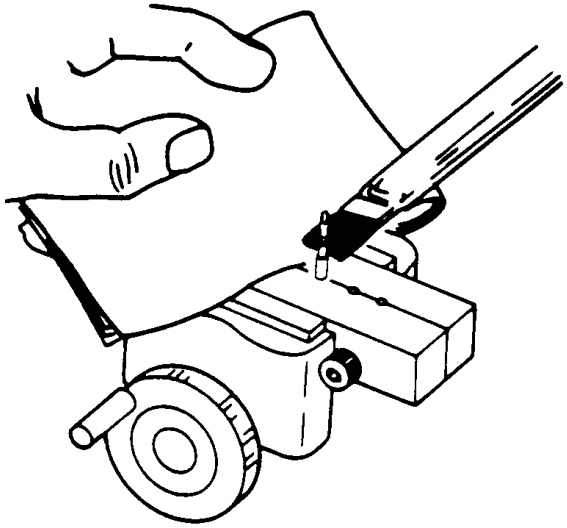
Remove the wire and use wire cutters to cut the wire to the desired length. Re-cut the end of the wire as necessary.

- *Conductors entering from the top shall be in contact with the inner wall of the cup and shall bottom in the cup or on the bottom conductor.*

  — Paragraph 9.7

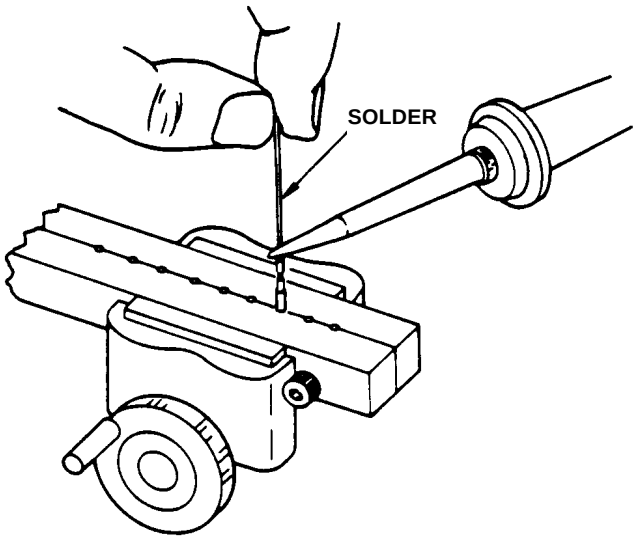
CONNECTOR PIN

1d. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.



1e. Tin the terminal by inserting the end of the solder into the cup and placing the iron so that it touches the solder and the side of the terminal at the same time.

Fill the cup with solder to cover all of the inside surface.



- *Solder along the outside surface of the solder cup is permissible to the extent that it approximates tinning and does not interfere with the assembly or function of the connector.*

  — Paragraph 10.2-3b

CONNECTOR PIN

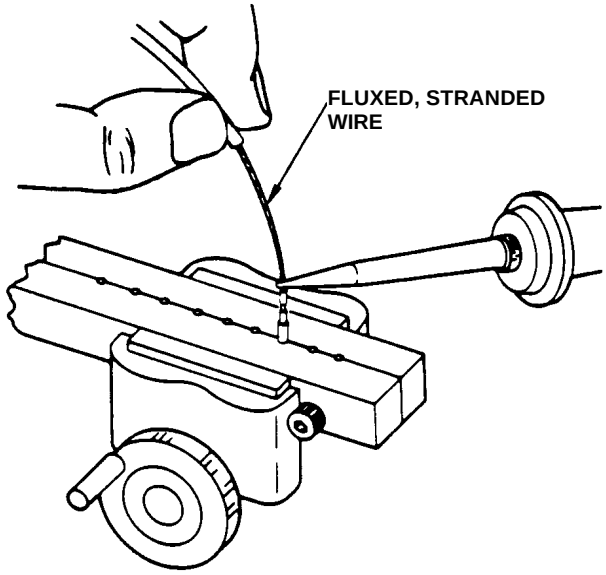
1f. To wick the solder from the terminal, insert a stranded wire that has been coated with flux.

Position the iron tip against the wire. The wire will get hot and melt the solder, which will then wick up into the strands of wire.

Cut off the wire that has the solder wicked into it.

Repeat the wicking process until there is no solder left to remove. The inside of the terminal will show a tinned surface.

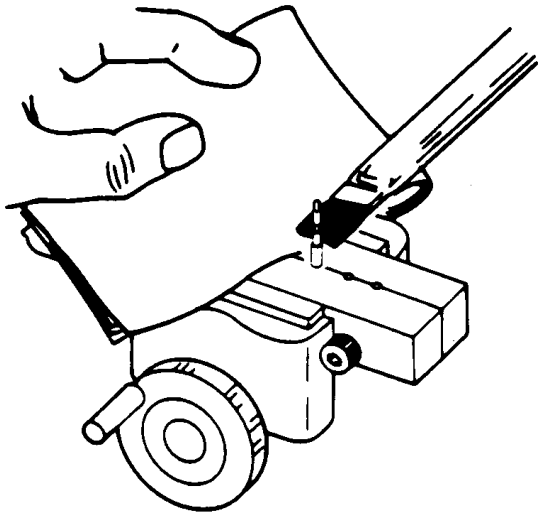
Repeat tinning and wicking until all gold is removed.



- *Gold plating on all surfaces, which becomes a part of the finished solder connections, shall be removed by two or more successive tinning operations, or by other processes demonstrated to have equivalent effectiveness.*

  — *Paragraph 7.2-5c*

1g. Clean the terminal with an acid brush, using the approved solvent and a shopwipe.

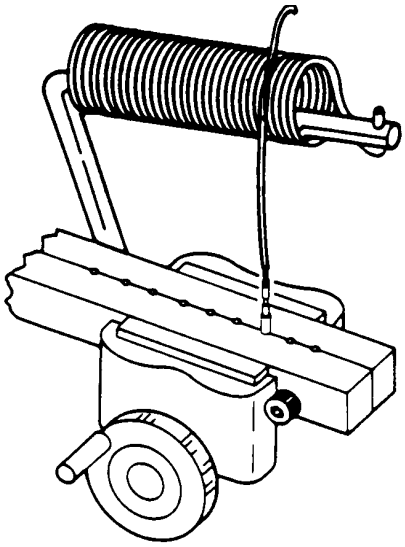


CONNECTOR PIN

STEP 2. POSITION THE WIRE

Attach the wire from the terminal to the spring, which will hold the wire during the soldering.

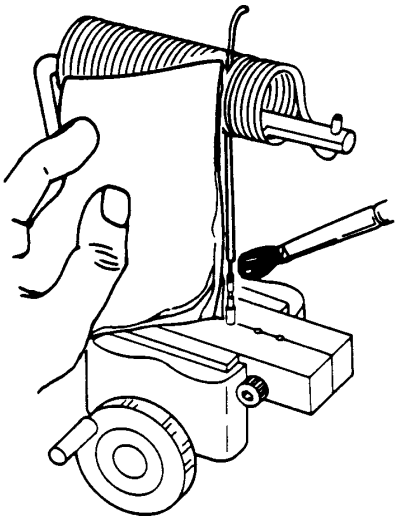
Adjust the wire for the proper tension, centering, and position.



STEP 3. CLEAN THE CONNECTION

Clean the connection with a soft brush, using the approved solvent and a shopwipe.

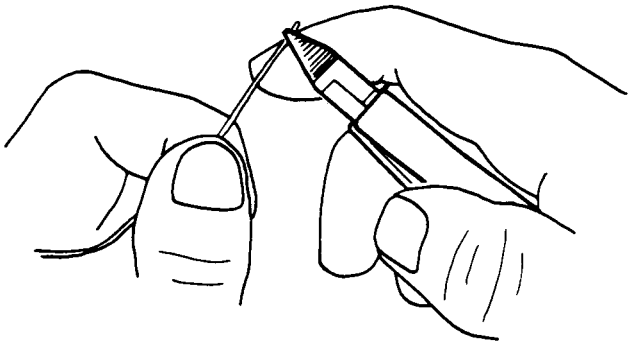
Do not disturb the position of the wire.



STEP 4. CUT THE SOLDER

Cut the end of the solder to expose the flux in the core of the solder.

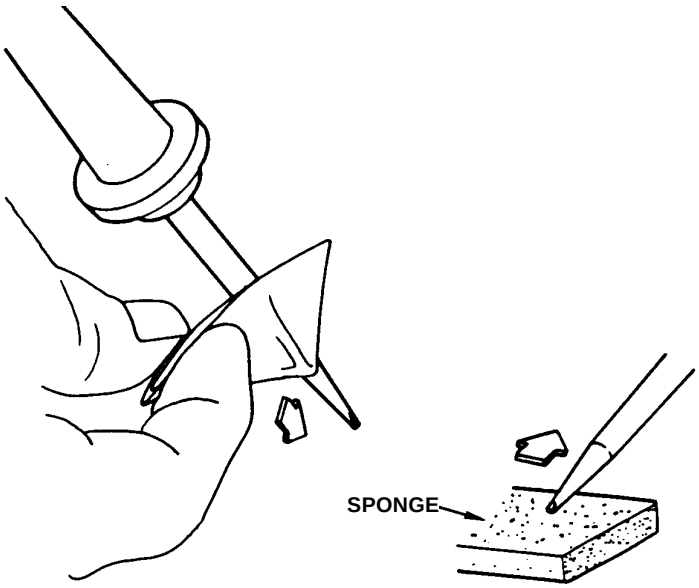
Wipe the solder with a shopwipe and solvent to remove any contaminants.



STEP 5. CLEAN THE SOLDERING IRON

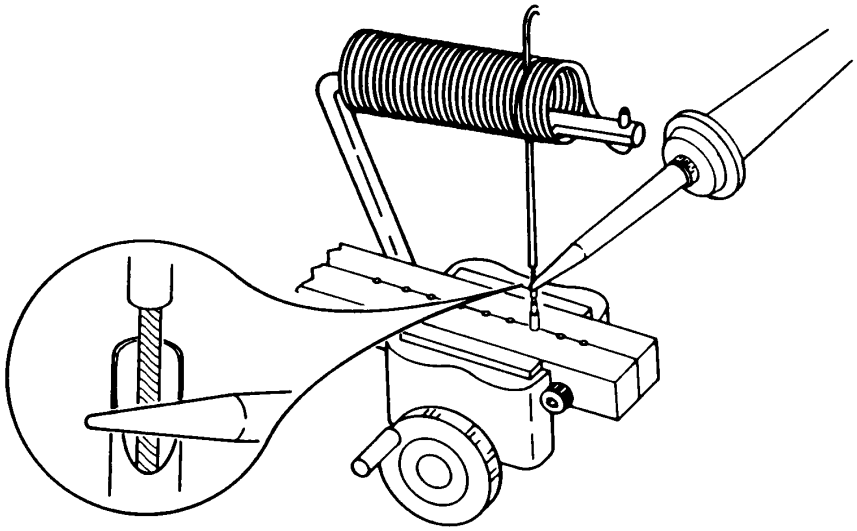
Prepare the iron by wiping the tip with a dry shopwipe.

Lightly wipe the tip on a moist sponge to remove the oxides.



STEP 6. POSITION THE IRON

Place the clean soldering iron tip against the terminal so as to contact both the wire and the terminal at the same time.



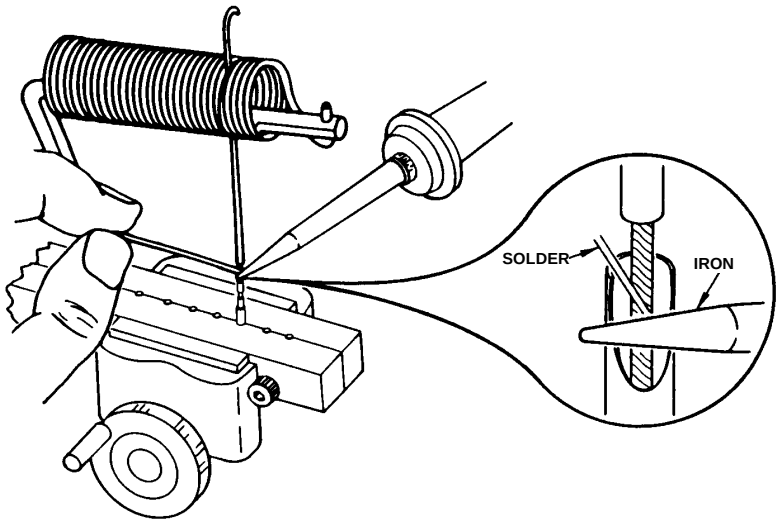
CONNECTOR PIN

STEP 7. APPLY SOLDER

Apply a small amount of solder to the junction where the wire, terminal, and tip meet in order to make a solder bridge.

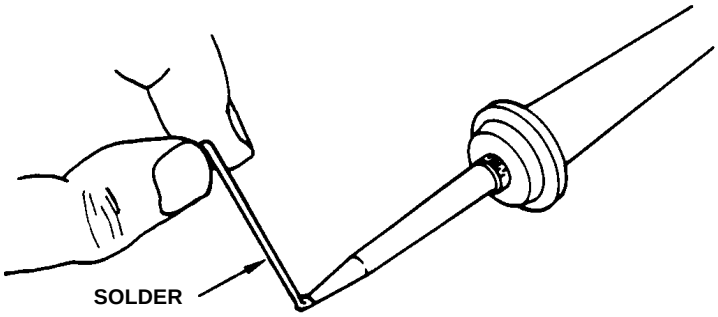
Add solder as needed to complete the soldered connection.

Remove the solder; remove the iron.



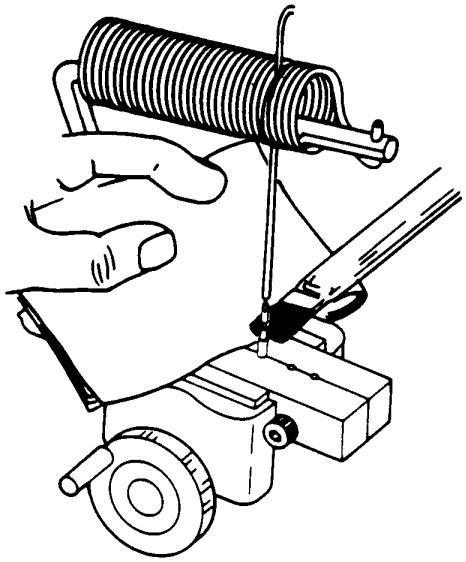
STEP 8. TIN THE IRON

Tin the iron tip while the connection is cooling at room temperature. A small amount of the solder should remain on the tip. Return the iron to the holder.



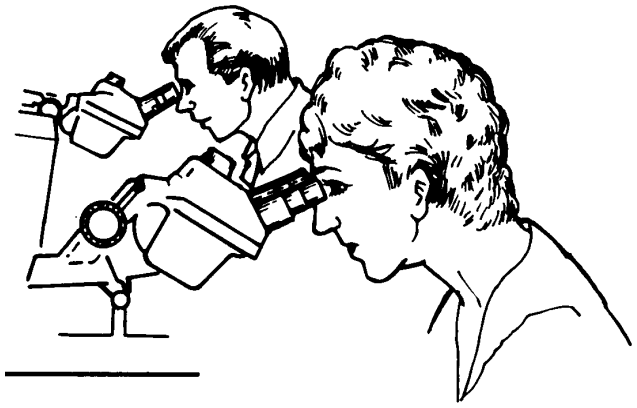
STEP 9. CLEAN THE CONNECTION

Clean the flux from the soldered connection with an acid brush, using the approved solvent and a shopwipe.



CONNECTOR PIN

STEP 10. INSPECT THE CONNECTION



Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

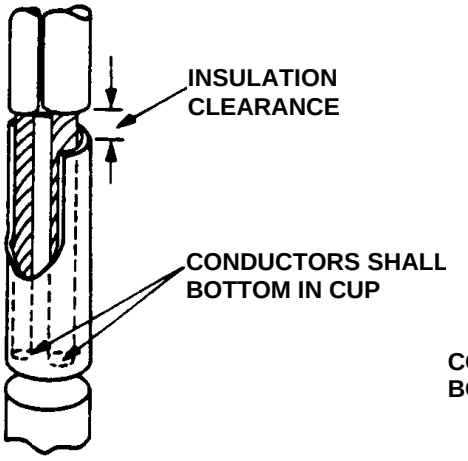
- *The maximum number of conductors shall be limited to those that can be in contact with the full height of the inner wall of the cup.*

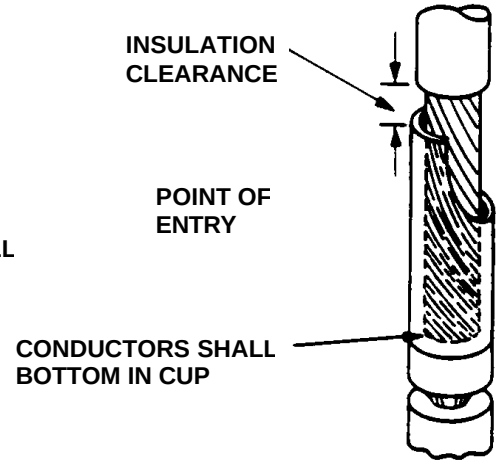
  — *Paragraph 9.6*

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin too bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*

  — *Paragraph 13.6*

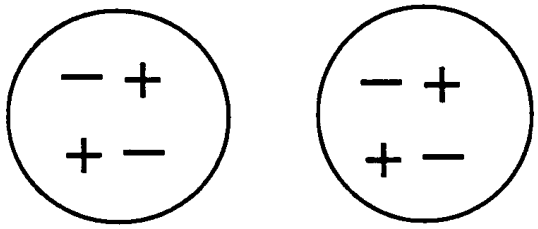
For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 6 and Appendix A.



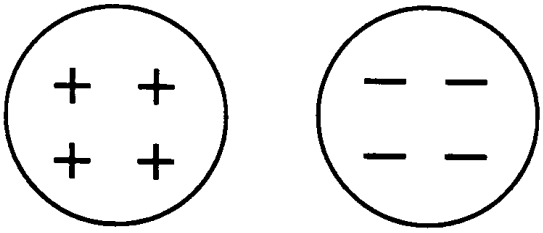


ELECTROSTATIC DISCHARGE

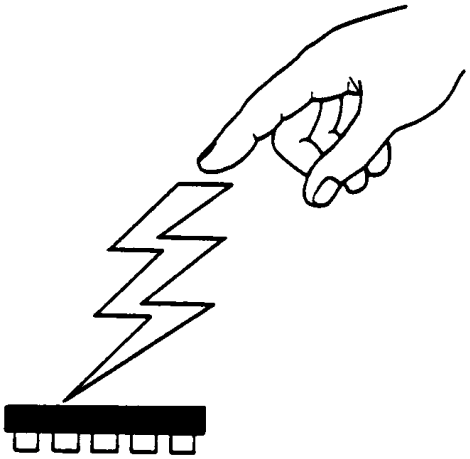
All materials contain both positive and negative electrical charges. If the charges are equal, we say they are neutral or uncharged.



Activities such as rubbing or simply separating matrials will generally cause charges to be transferred, leaving both items charged.



Electrostatic discharge (ESD) is the abrupt discharge of stored static electricity. On a human body, voltages of approximately 3,500 volts or more can be seen and felt. But even at voltages as low as 50 volts or less, where it cannot be seen and felt, ESD is still a threat and can even damage a device such that it fails in flight.



Minimum steps to protect ESD-sensitive devices are:

- *Always work at a grounded workstation*
- *Use only ESD-approved materials*
- *Handle ESD-sensitive devices only at static-safe workstations*
- *Always use a conductive wrist strap before handling ESD-sensitive devices*
- *Use an ESD bag or container to store or carry parts in.*

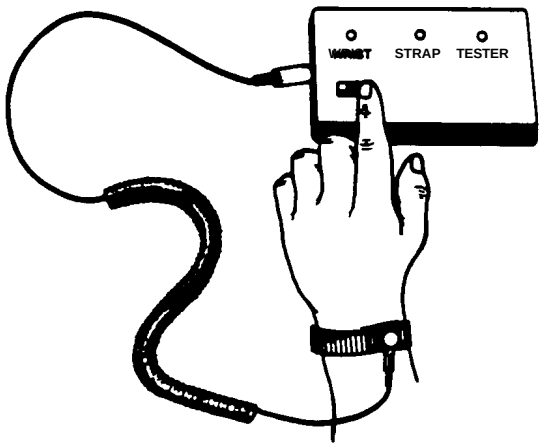
ELECTROSTATIC DISCHARGE

STEP 1. WRIST STRAP PROCEDURE

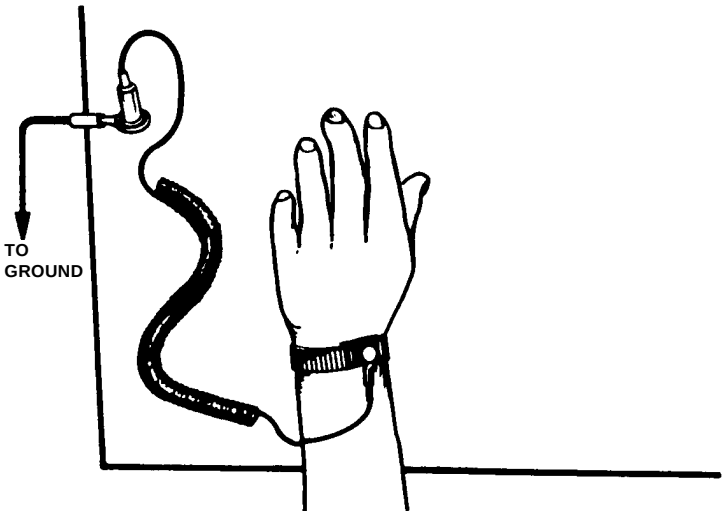
1a. Inspect the wrist strap daily for wear. Replace as necessary.

1b. Insure that the wrist strap fits snugly around the wrist, and that the strap's conductive side is in direct contact with the skin.

Use the wrist strap checker daily to test the strap and cord.



1c. Attach the cord to a grounded workbench before handling ESD-sensitive devices.



ELECTROSTATIC DISCHARGE

STEP 2. WORK AREA PROCEDURES

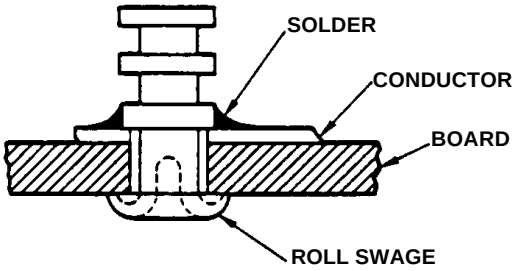
- When leaving the workstation, the PWA and static-sensitive parts must be placed in an ESD bag or container.
- Do not allow a non-grounded person to touch your PWA or static-sensitive parts.
- Caution persons entering the work area that there are ESD rules to be followed.

TERMINAL SWAGING

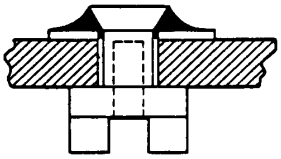
STEP 1. VERIFICATION TEST

1a. Verify the proper swaging tools for the terminal to be swaged.

- *Swage type terminals in Non-PTH's, designed to have the terminal shoulder soldered to the printed wiring conductor, shall be secured to the PWB by a roll swage.*
  — Paragraph 8.2-2

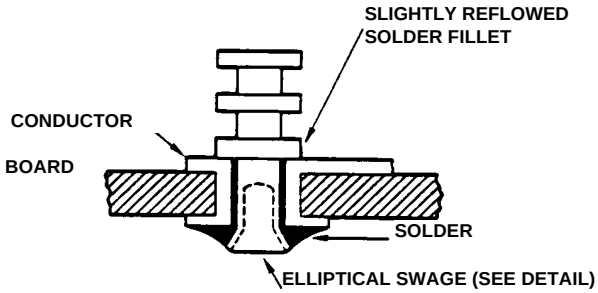


ROLL FLANGE TERMINAL



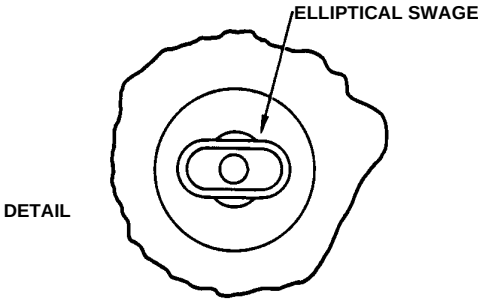
V-FUNNEL TYPE SWAGE

- *PWB designs calling for soldering of the swaged end of the terminal to the printed wiring conductor on a single-sided PWB shall have the terminal secured with a V-funnel swage.*
  — Paragraph 8.2-3



ELLIPTICAL TYPE SWAGE

- *Swage type terminals that are mounted in a PTH shall be secured to the PWB by a V-funnel swage or an elliptical funnel swage. The elliptical funnel swage is the preferred method for attachment. Terminals shall be swaged such that they can be rotated under finger force.*
  — Paragraph 8.2-4



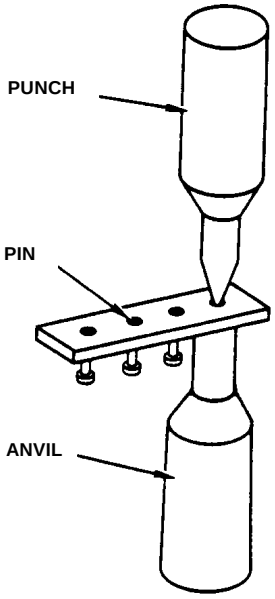
ELLIPTICAL TYPE SWAGE
(VIEW OF BOTTOM)

TERMINAL SWAGING

1b. After the swaging press has been adjusted, use a sample board and swage a terminal.

The swage, or flaring, should be inspected for the proper mounting according to the type of terminal.

Elliptically swaged terminals shall be swaged such that they can be rotated under finger force.

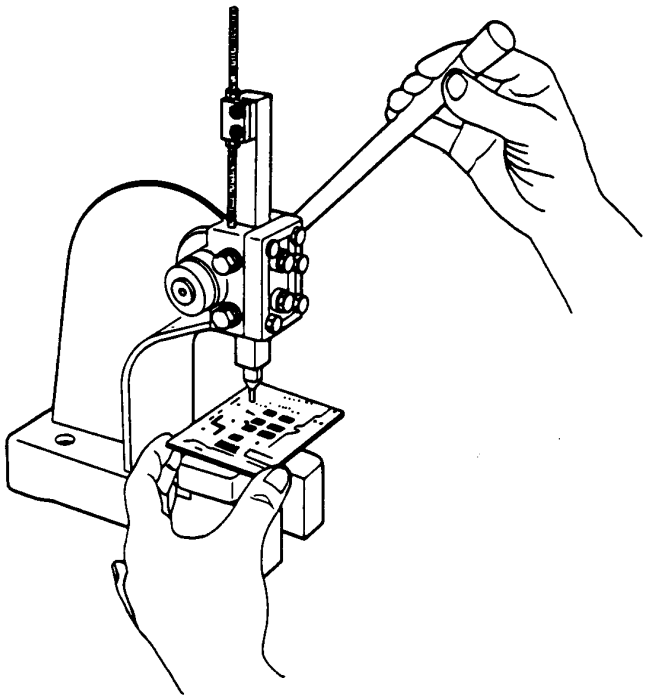


STEP 2. SWAGE THE TERMINAL

2a. Insert a terminal into the anvil.

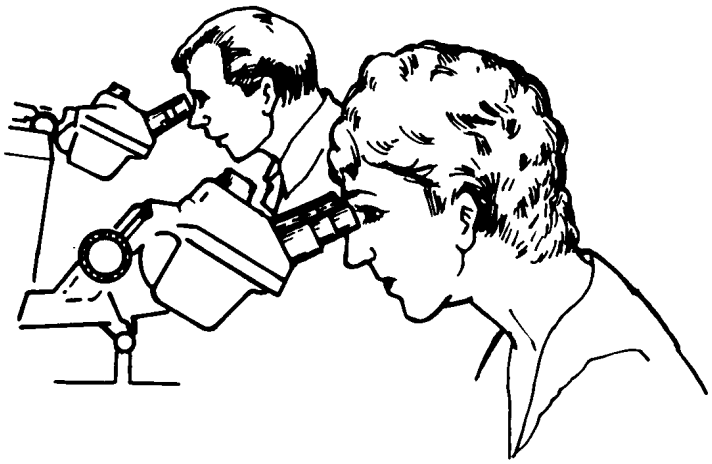
2b. Position the PWB on the terminal.

2c. To swage the terminal, support the PWB while pulling the handle down to the stop.



STEP 3. INSPECT THE SWAGE

Inspect the swaged terminals under 4 X to 10 X magnification to the specified requirements.



- *Swaging of terminals shall be performed in a way that does not damage the PWB.*
- *After swaging or flaring, the rolled area of the flange shall be free of circumferential splits or cracks, but may have a maximum of three radial splits or cracks provided that the splits or cracks are separated by at least 90° and do not extend beyond the coiled or flared area of the terminal.*

  — *Paragraph 8.2-1a and b*

- *Elliptical swages can be rotated under finger force.*

  — *Paragraph 8.2-4*

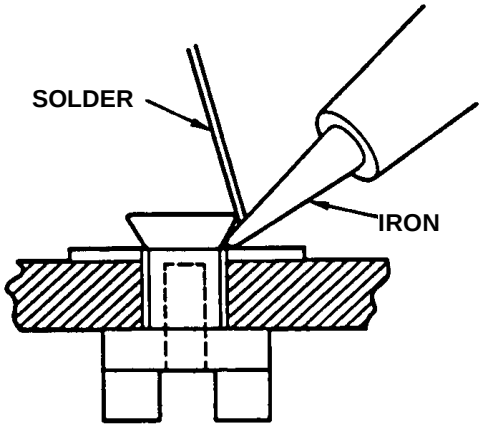
STEP 4. SOLDER THE SWAGED TERMINAL

Position the soldering iron tip so as to touch both the swage and the printed wiring pad at the same time.

Apply solder to the junction where the iron and swage meet in order to make the solder bridge.

Add solder as needed to complete the soldered connection.

Remove the solder; remove the iron.

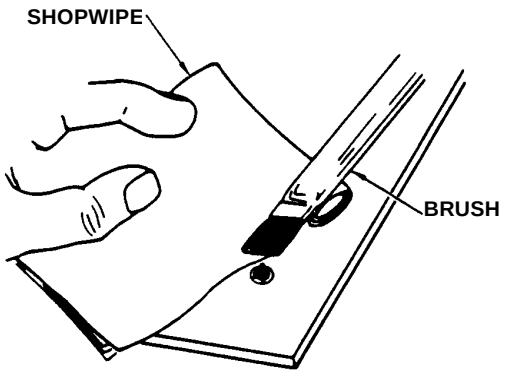


V-FUNNEL TYPE SWAGE

TERMINAL SWAGING

STEP 5. CLEAN THE CONNECTION

Clean the flux from both sides of the soldered connection with an acid brush, using the approved solvent and a shopwipe.

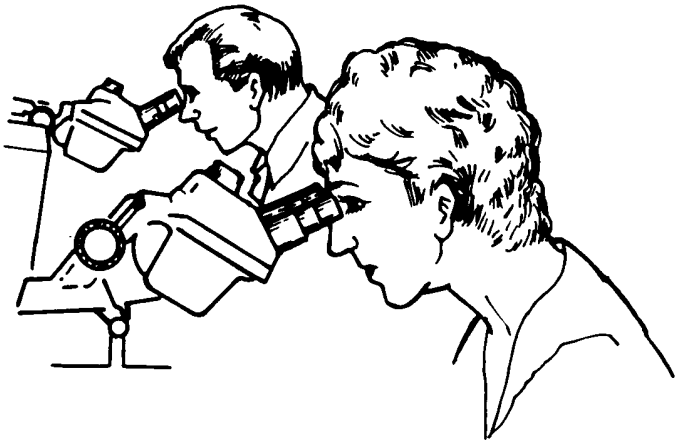


STEP 6. INSPECT THE SOLDERING

Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The solder shall flow through a plated-through hole and bond to the lead and the solder pad on both sides of the PWB.*
- *A slight recessing or shrinkback of the solder onto the PTH below the solder pad is acceptable, providing the solder has wet the lead and on to the solder pad.*
- *Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is not cause for rejection.*

— Paragraph 13.6



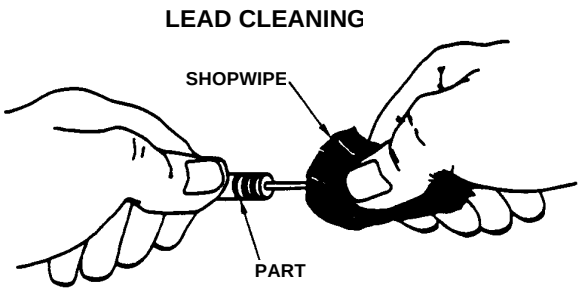
For detailed inspection criteria refer NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

AXIAL LEAD (Straight Through/Clinch — Resistor, Diode, Polarized Capacitor)

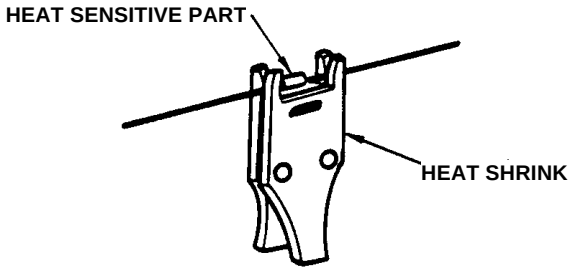
STEP 1. PREPARE THE LEAD

- *All part leads should be tinned and formed before mounting the part.*

  — *Paragraph 8.1-6c*



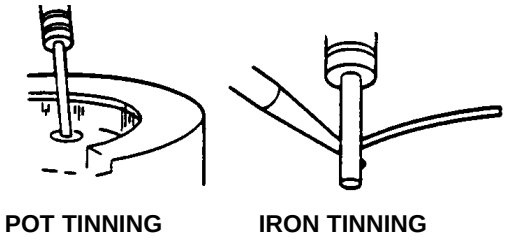
Prepare the part lead by wiping it with a shopwipe and solvent to remove the oxides.



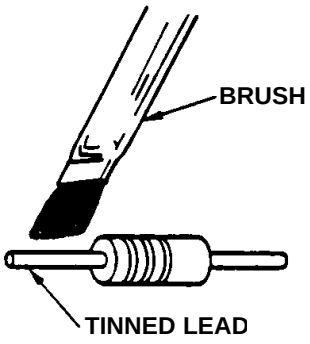
Attach a heat sink to those parts that require it.

If necessary, apply flux to the surface to be tinned.

Tin the lead either in the solder pot or by use of the soldering iron.



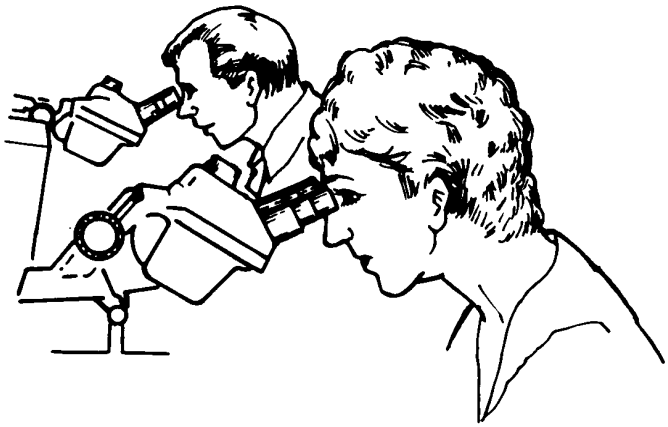
Clean the tinned lead with an acid brush, using the approved solvent and a shopwipe.



AXIAL LEAD (Straight Through/Clinch — Resistor, Diode, Polarized Capacitor)

1a. Inspect the lead tinning.

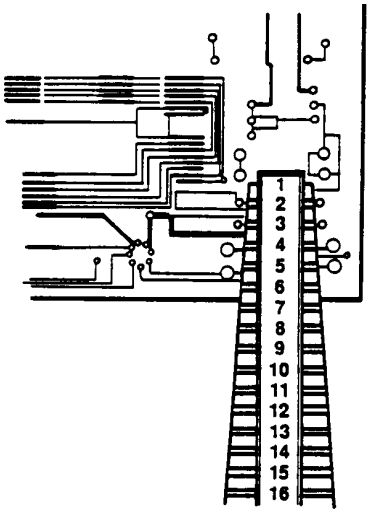
- *Hot tinning of solid conductors and part leads should not extend closer than 0.5mm (0.020 inch) to part bodies, end seals, or insulation unless the part configuration and mounting configuration dictate it.*
  — Paragraph 7.2-5a
- *Conductor tinning personnel shall ensure that the tinned surfaces exhibit 100% coverage.*
  — Paragraph 7.2-6



STEP 2. BEND THE LEAD

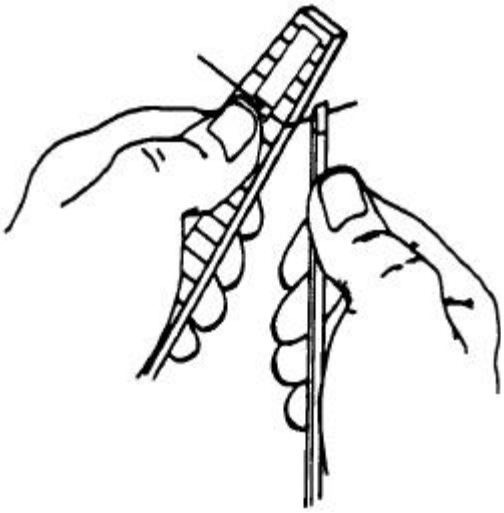
2a. With a Lead Bending Tool

To find the correct measurement, place the bending tool between the holes into which the part is to be inserted.



Position the part into the proper slot for bending.

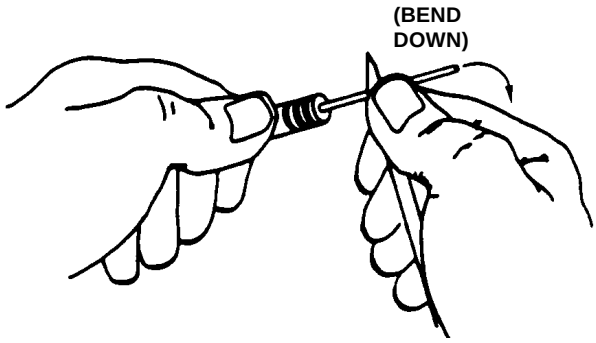
While holding the part body in the slot of the bender, use an orange stick to bend the lead.



2b. With Orange Stick

Hold the part in one hand. With an orange stick (sharpened to a point) held against the lead to be bent, place the thumb of the other hand on top of the wire. Now bend the lead to the proper angle as needed.

LEAD BENDING WITH ORANGE STICK



- *The minimum distance from the part body or seal to the start of the bend of a part lead shall be 2 lead diameters for round leads and 0.51 mm (0.020 in.) for ribbon leads.*
- *The stress relief shall not be less than the lead diameter or ribbon thickness.*
- *Where the lead is welded the minimum distance is measured from the weld.*

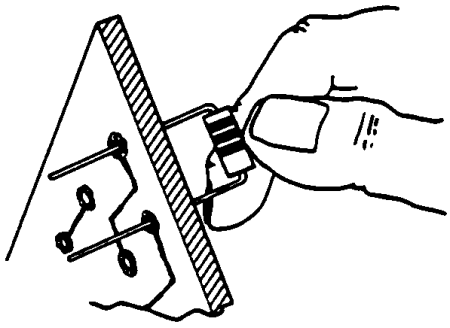
— Paragraph 8.1-6a

STEP 3. INSERT THE PART

Insert the leads into the holes of the PWB, and gently push the part until it bottoms against the PWB.

- *Part leads shall be formed so that they may be installed into the holes in the PWB without excessive deformation that can stress the part body or end seals.*

— Paragraph 8.1-6b

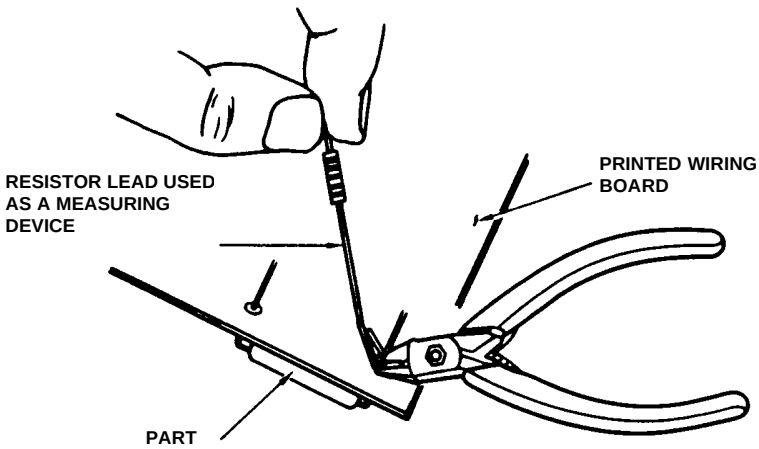


INSERT

STEP 4. TRIM THE LEAD

Turn the PWB part side down.

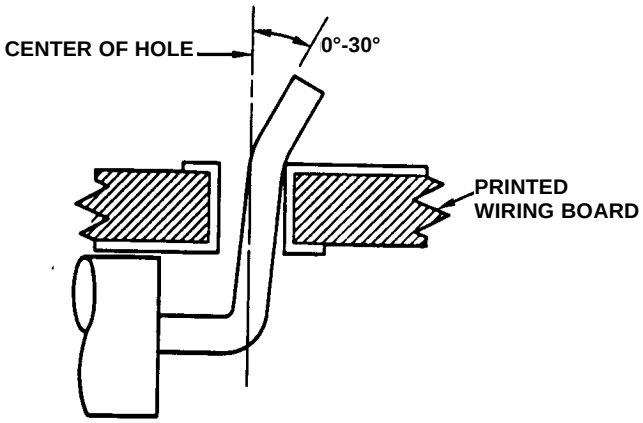
Place a measuring device on the PWB next to the lead in order to obtain the proper lead length.



Cut the lead.

- *Straight-through leads may be bent up to 30 degrees from a vertical plane to retain parts during the soldering operation.*
- *Part leads terminated straight through the PWB shall extend a minimum of 0.51 mm (0.020 in.) and a maximum of 2.29 mm (0.090 in.).*

— Paragraph 8.5-3

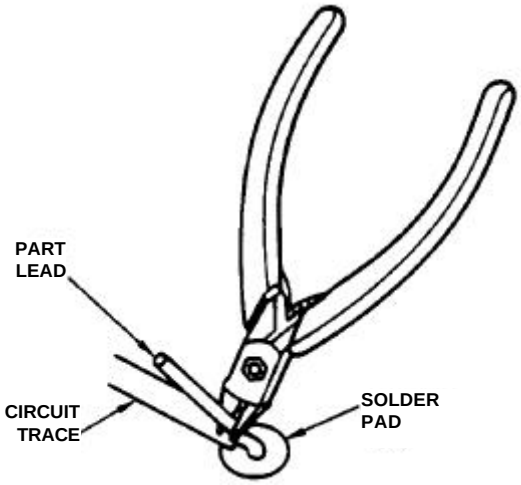


Clean the lead with a soft brush, using the approved solvent and a shopwipe.

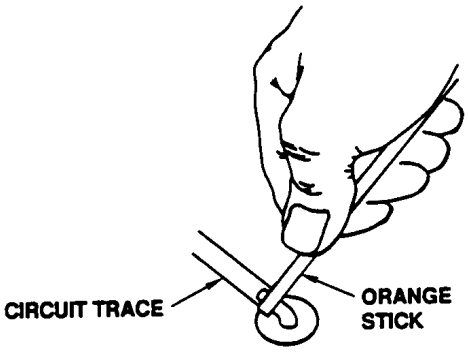
STEP 4a. CLINCH THE LEADS

Partially bend the lead in the direction of the trace.

Cut the lead.

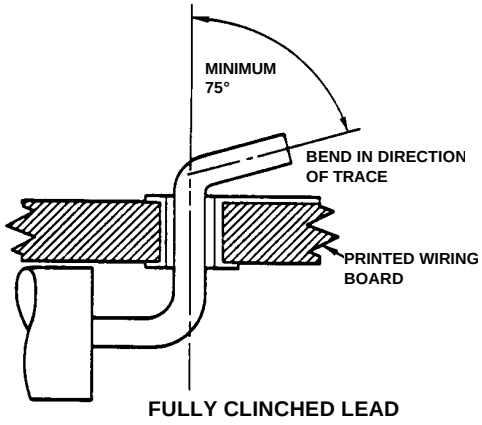


Using an orange stick, complete the bend.



- *The length of the clinched portion of the part lead shall be at least 1/2 the largest dimension of the solder pad or 0.78 mm (0.031 in.), whichever is greater.*
- *Fully clinched leads are defined as leads bent between 75 degrees and 90 degrees from a vertical line perpendicular to the PWB.*

— Paragraph 8.5-2



STEP 5. SOLDER THE LEAD

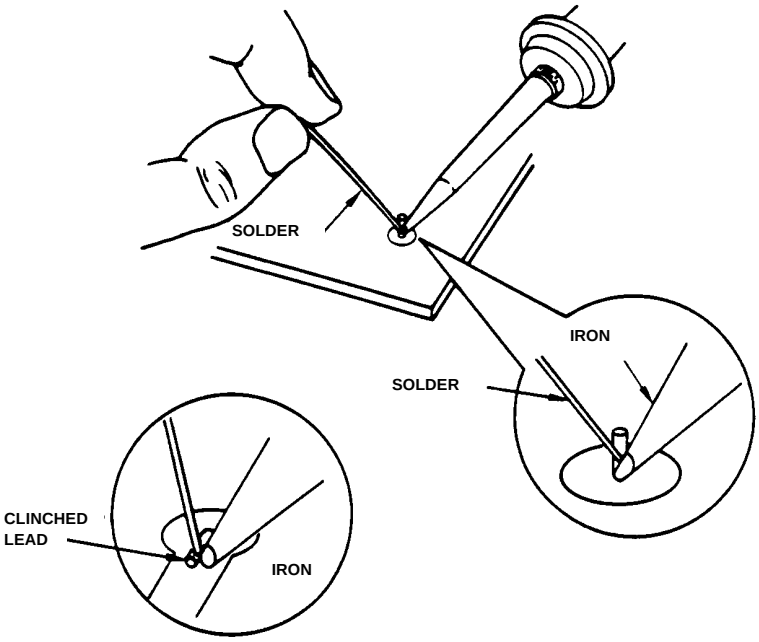
Position the soldering iron tip so as to touch both the lead and the printed wiring pad at the same time.

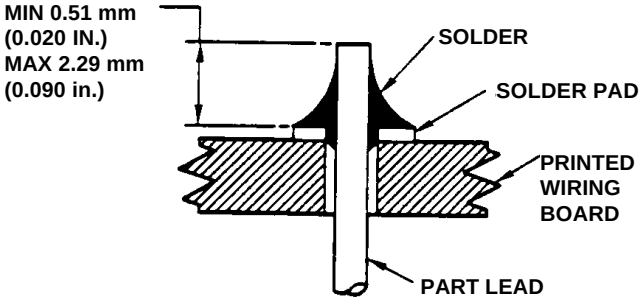
Apply solder to the junction where the iron and lead meet in order to produce a thermal (solder) bridge.

Touch the solder to the end of the cut lead to cover the exposed copper.

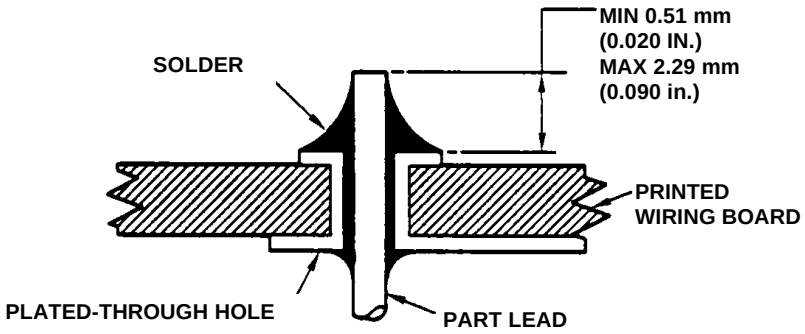
Add solder as needed to complete the soldered connection.

Remove the solder; remove the iron.





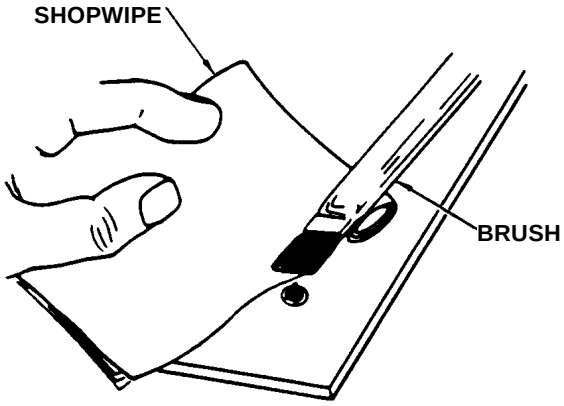
NONPLATED-THROUGH HOLE



PLATED-THROUGH HOLE

STEP 6. CLEAN THE CONNECTION

Clean the flux from both sides of the soldered connection with an acid brush, using the approved solvent and a shopwipe.

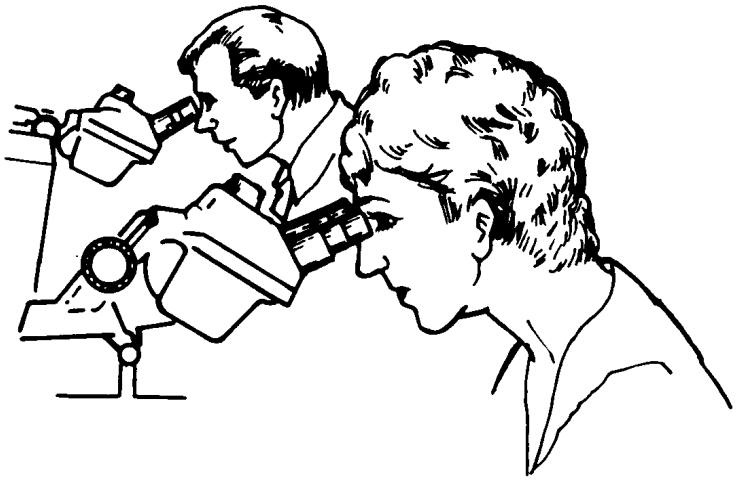


- *Ultrasonic cleaning shall not be used for cleaning assemblies that contain electronic parts.*
- *After cleaning, there shall be no visible evidence of flux residue or other contamination when examined.*

— Paragraph 10.4-2

STEP 7. INSPECTION

Inspect the solder connections under 4 X to 10 X magnification to the specified requirements.



- *The minimum distance from the part body or seal to the start of the bend of a part lead shall be 2 lead diameters for round leads and 0.51 mm (0.020 in.) for ribbon leads. The stress relief shall not be less than the lead diameter or ribbon thickness.*

— Paragraph 8.1

- *The length of the clinched portion of the part lead shall be at least 1/2 the largest dimension of the solder pad or 0.78 mm (0.031 in.), whichever is greater.*

— Paragraph 8.5-2

- *Part leads terminated straight through the PWB shall extend a minimum of 0.51 mm (0.020 in.) and a maximum of 2.29 mm (0.090 in.).*

— Paragraph 8.5-3

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *The solder shall flow through a plated-through hole and bond to the lead and the solder pad on both sides of the PWB.*
- *A slight recessing or shrinkback of the solder onto the PTH below the solder pad is acceptable, providing the solder has wet the lead and on to the solder pad.*
- *Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is not cause for rejection.*

— Paragraph 13.6

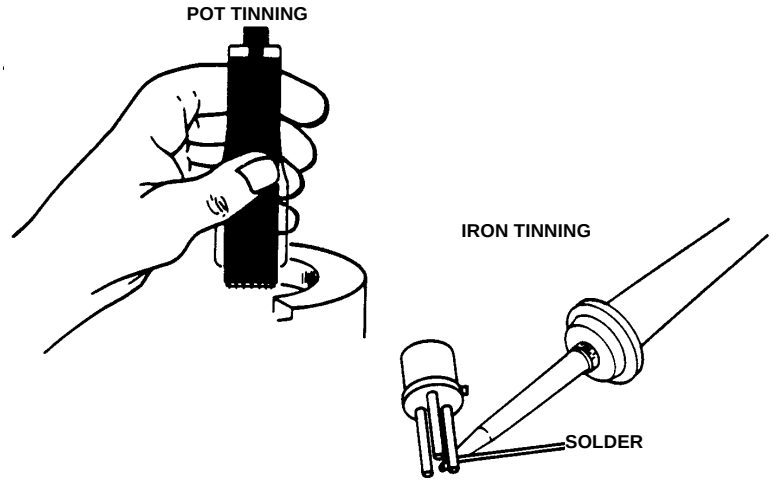
For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

VERTICAL MOUNT (TRANSISTOR, DISK CAPACITOR, DIP)

STEP 1. PREPARE THE LEADS

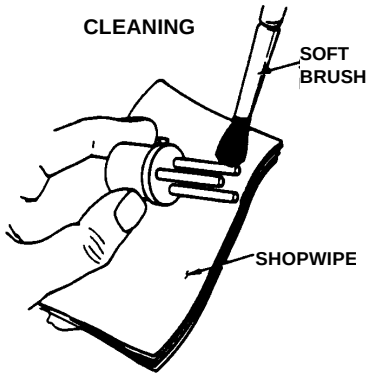
Clean the leads.

If necessary, add flux to the leads to be tinned.



Tin the leads using a solder pot or solder iron.

Clean the flux from the leads.



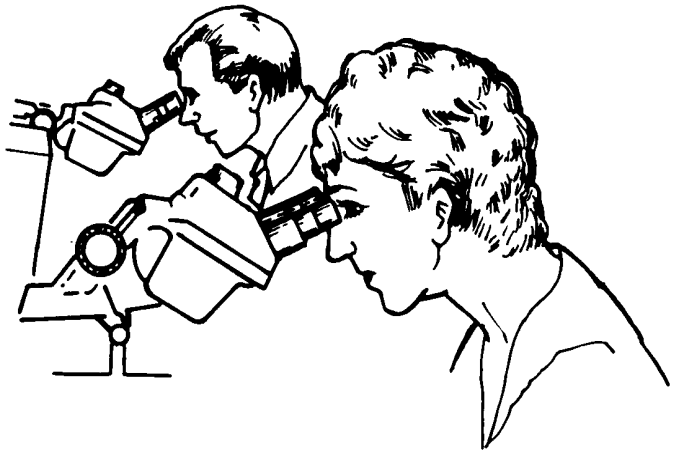
1a. Inspect the lead tinning.

- *Hot tinning of solid conductors and part leads should not extend closer than 0.020 inch (0.51 mm) to part bodies, end seals, or insulation unless the part configuration and mounting configuration dictate it.*

  — Paragraph 7.2-5a

- *Conductor tinning personnel shall ensure that the tinned surfaces exhibit 100% coverage.*

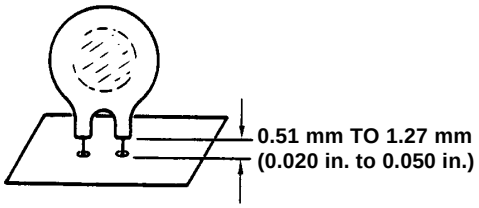
  — Paragraph 7.2-6

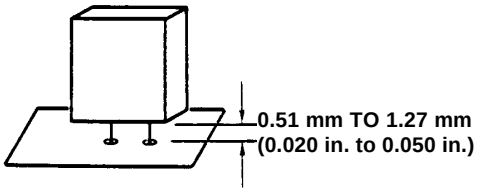


VERTICAL MOUNT (TRANSISTOR, DISK CAPACITOR, DIP)

STEP 2. MOUNT THE PART

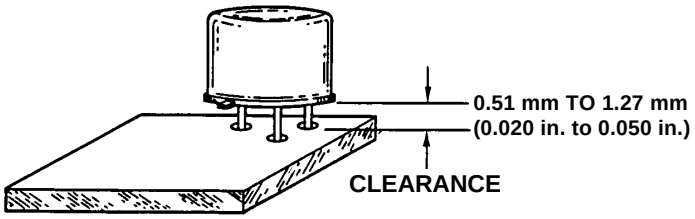
2a. Insert the tinned leads through the proper holes in the PWB.





- *PLATED-THROUGH HOLE.*
  The end of the part body must be mounted with at least 0.51 mm (0.020 in.) to a maximum of 1.27 mm (0.050 in.) clearance above the PWB surface. The end of the part is defined to include any extensions such as coating meniscus, solder seal, or weld bead.

  — Paragraph 8.4-2b(1)



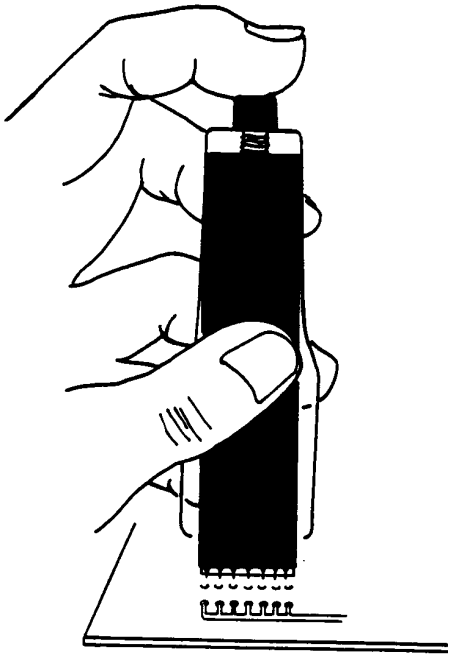
2b. DIP Insertion

Insert the dual-in-line package (DIP) into an approved ESD insertion tool, if required.

Align pin 1 on the DIP with pin 1 on the PWB.

Now insert the DIP pins into the PWB.

Remove the insertion tool.

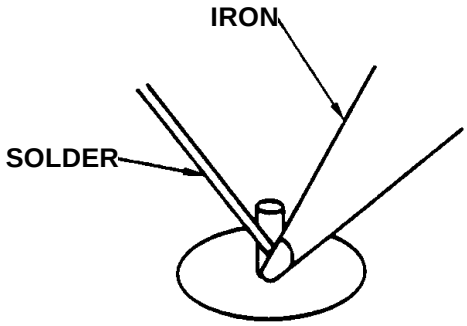


VERTICAL MOUNT (TRANSISTOR, DISK CAPACITOR, DIP)

STEP 3. SOLDER THE LEADS

3a. Clean the lead and PWB.

3b. Place the PWB with part side down.



Touch the soldering iron tip to the circuit pad and the lead at the same time.

Apply solder to form the thermal (solder) bridge.

Feed enough solder to fill the plated-through hole and have a fillet on both sides of the board.

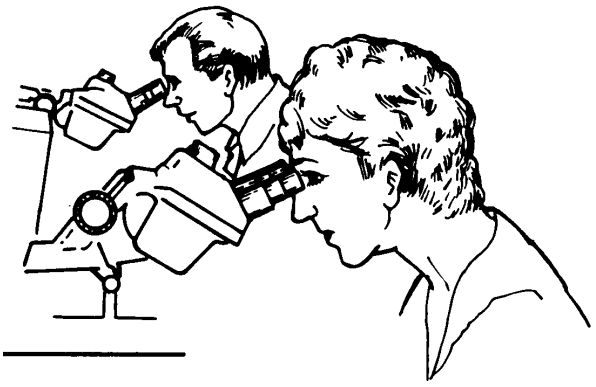
3c. After soldering the first lead of the DIP, inspect the lead on the part side of the PWB that the solder has flowed onto the lead and pad.

Return to the bottom side of the PWB and solder a lead on the opposite side of the DIP to keep from overheating the part or the PWB.

Continue this technique of soldering leads on the opposite side for each DIP.

STEP 4. CLEAN THE SOLDERED CONNECTIONS

STEP 5. INSPECTION



Inspect the solder connections under 4 X to 10 X magnification to the specified requirements.

- *The minimum distance from the part body or seal to the start of the bend of a part lead shall be 2 lead diameters for round leads and 0.51 mm (0.020 in.) for ribbon leads.*

— Paragraph 8.1-6a

- *The length of the clinched portion of the part lead shall be at least 1/2 the largest dimension of the solder pad or 0.78 mm (0.31 in.), whichever is greater.*

  — Paragraph 8.5-2

- *Part leads terminated straight through the PWB shall extend a minimum of 0.51 mm (0.020 in.) and a maximum of 2.29 mm (0.090 in.).*

  — Paragraph 8.5-3

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be undisturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *The solder shall flow through a plated-through hole and bond to lead and solder pad on both sides of PWB.*
- *A slight recessing or shrinkback of the solder onto the PTH below the solder pad is acceptable, providing the solder has wet the lead and onto the solder pad.*
- *Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is not cause for rejection.*

  — Paragraph 13.6

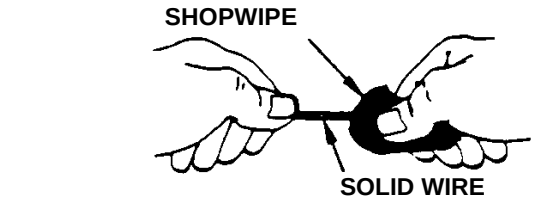
For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

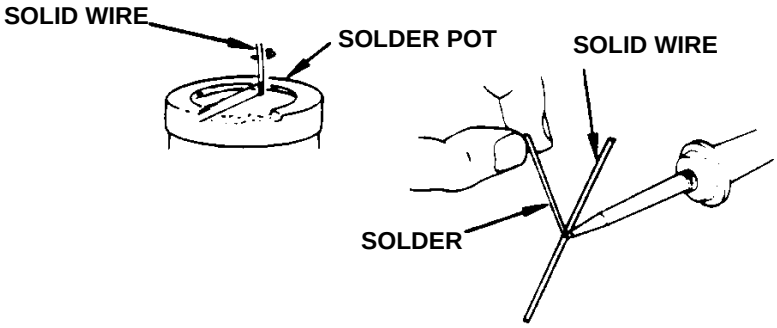
INTERFACIAL CONNECTION

STEP 1. PREPARE THE WIRE

Clean, flux, tin, and clean the solid wire.

Repeat the tinning process as needed to assure a properly tinned wire.





STEP 2. INSERT THE WIRE

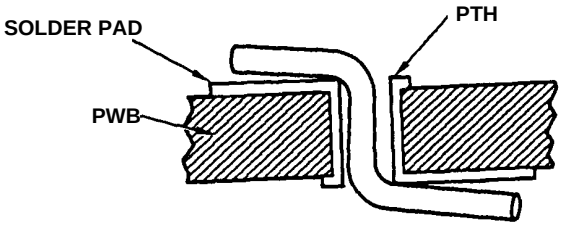
2a. Insert the wire through the hole of the PWB.

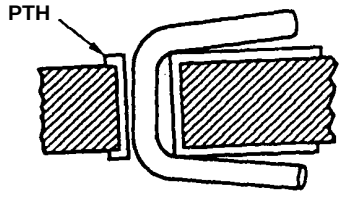
Bend the wire over on both sides of the PWB onto the pad.

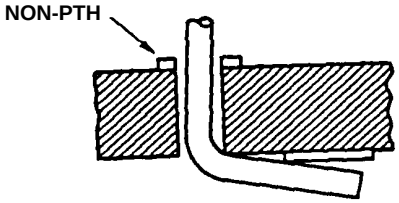
Cut the ends of the wire to the proper distance.

- *The round lead shall overlap the solder pad a minimum of 3.5 times the lead diameter to a maximum of 5.5 times the lead diameter, but in no case less than 1.27 mm (0.050 in.).*
- *The cut-off end of the lead shall be no closer than 1/2 the lead diameter to the edge of the solder pad.*
- *A heel fillet is mandatory.*

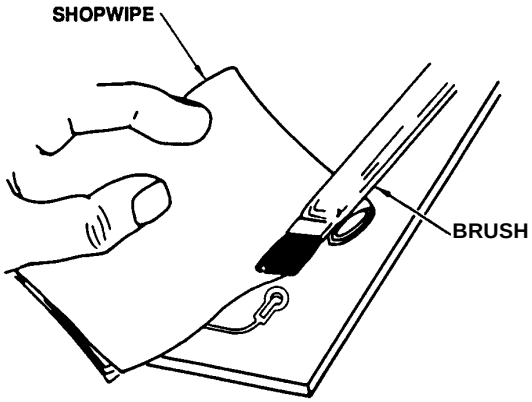
— Paragraph 8.5-1a





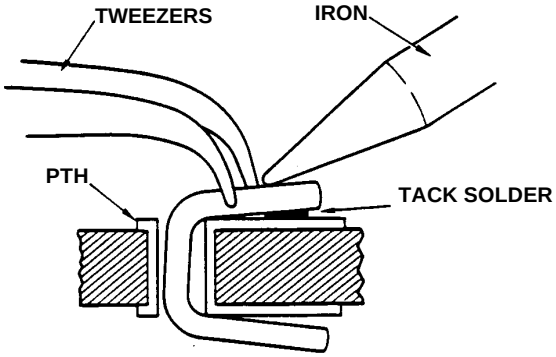


2b. Clean the lead and trace.



2c. Use tweezers to hold the lead in place.

Tack solder one lead into place.



STEP 3. SOLDER THE WIRE

3a. Turn the PWB over.

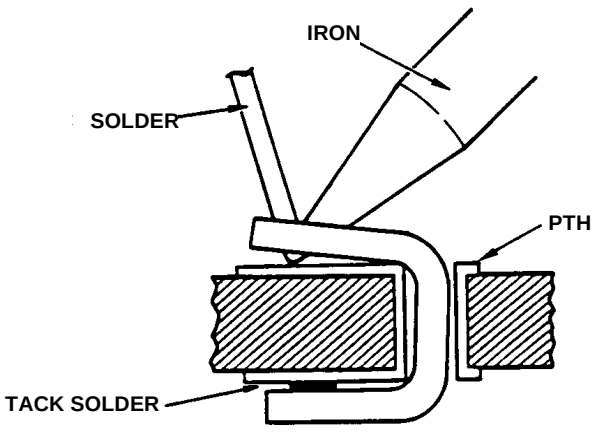
Clean the lead on trace.

Clean the iron.

Solder the wire on this side.

Tin and replace the iron.

Clean the solder joint.



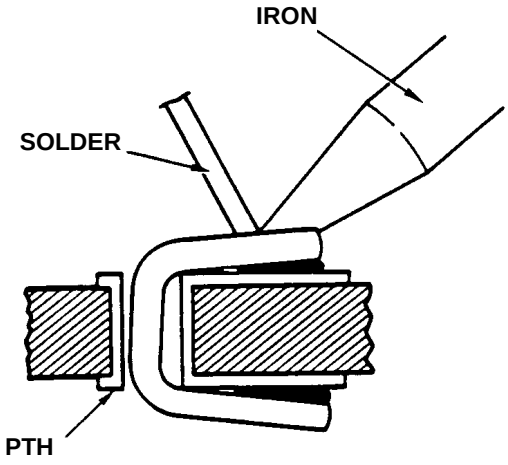
3b. Return to the first side of the PWB.

Clean the iron.

Solder the wire.

Tin and replace the iron.

Clean both sides of the PWB.



STEP 4. INSPECT THE CONNECTION

Inspect the solder joints under 4 X to 10 X magnification to the specified requirements:

Solder quantity.

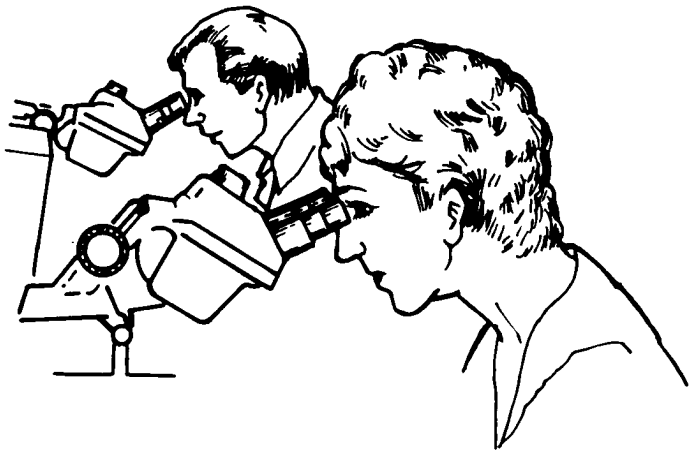
Tinning of leads.

Flux residue or other contaminants.

Overlapped lead length.

Proper wetting.

For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

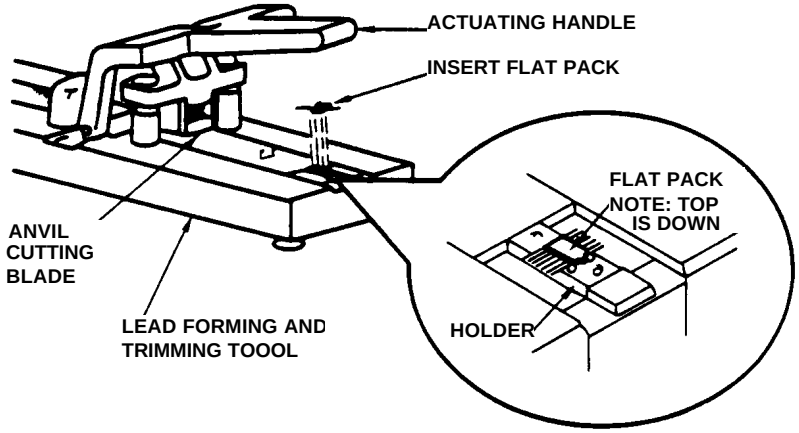


LAPPED TERMINATIONS (Flat Pack, Resistor)

STEP 1. PREPARE THE LEADS

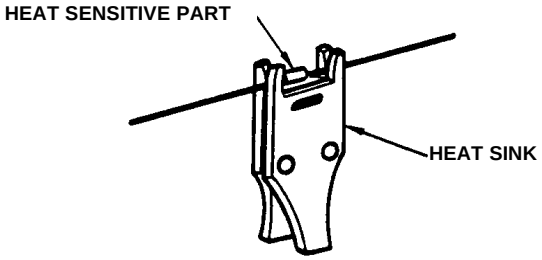
1a. BEND THE LEADS

Bend the leads by machine or bending fixture if possible.



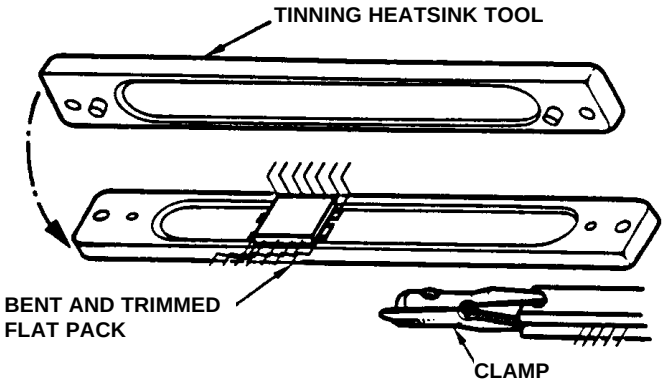
1b. TIN THE LEADS

Attach a heat sink to those parts that require it.



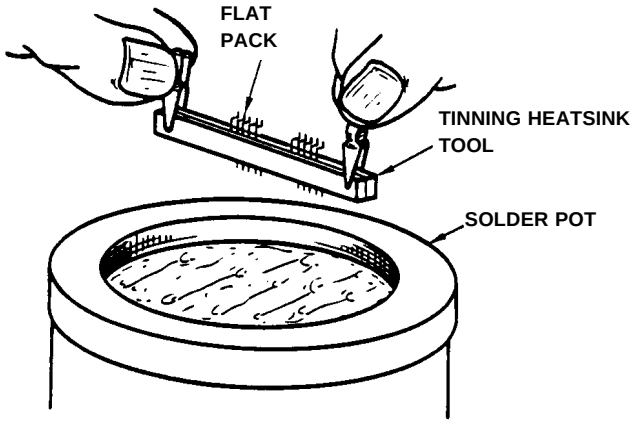
Clean the leads.

If necessary, apply flux to the leads to be tinned.



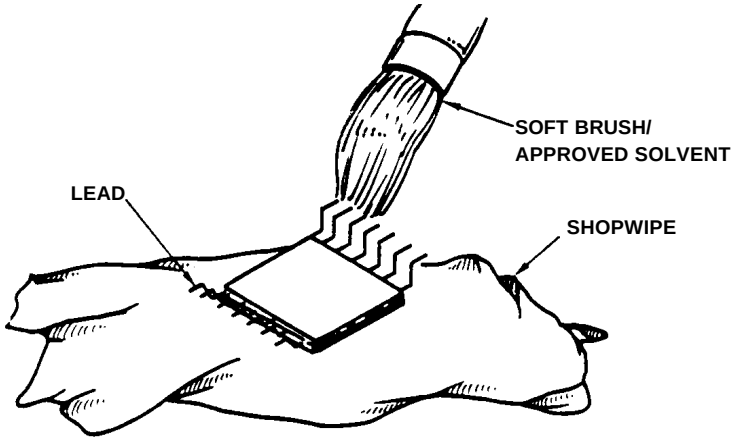
Tin the leads by solder pot.

Axial leaded parts may be tinned with a soldering iron.



STEP 2. CLEAN THE LEADS

Clean the leads with a soft brush, using the approved solvent and a shopwipe.



LAPPED TERMINATIONS (Flat Pack, Resistor)

STEP 3. MOUNT THE PART

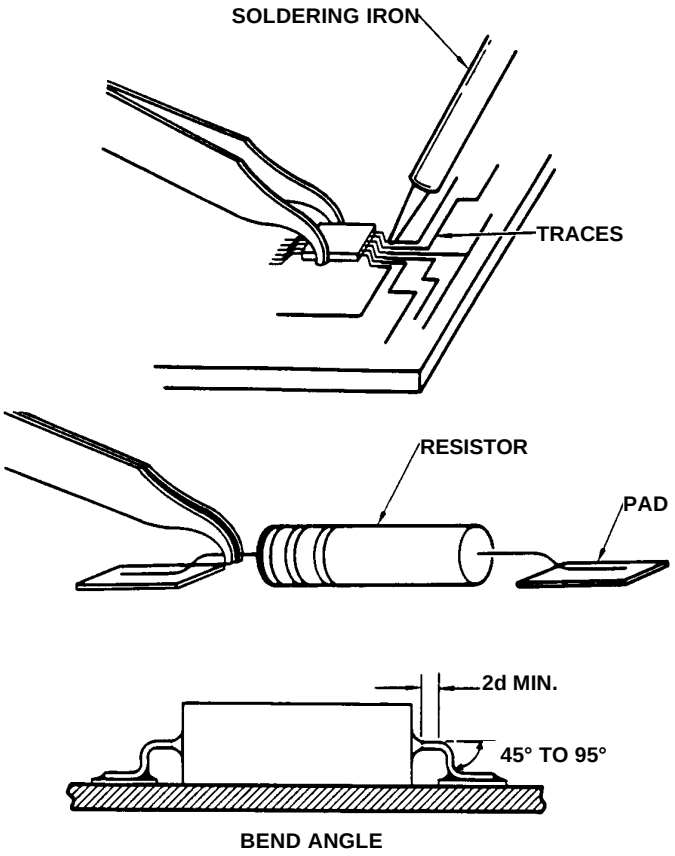
Position the part near the place to be mounted.

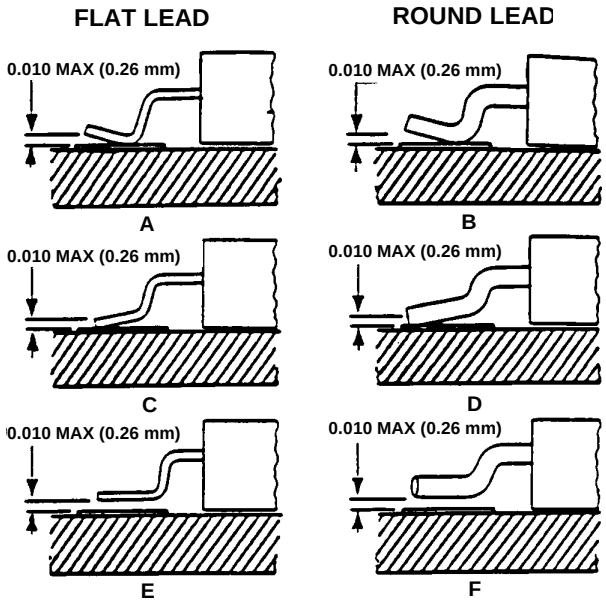
Clean the soldering iron by wiping the tip with a dry shopwipe. Wipe the tip on a moist sponge to remove the oxides.

Pick up the part with tweezers and position it on the pads where it is to be mounted.
DO NOT put pressure on the top of a part that might bend the leads.

While holding the part in the center of the mounting pad, touch the iron tip to one lead on each corner in order to reflow (tack) the solder.

Release the part, tin the iron tip, and replace the iron in the holder.





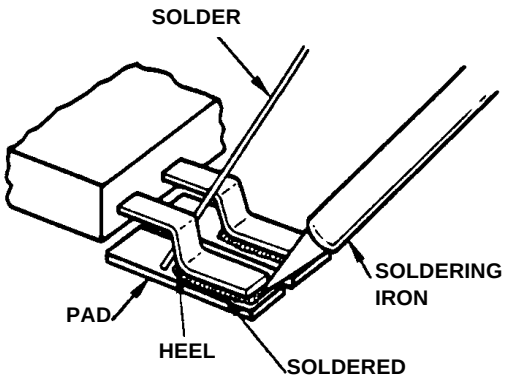
- *Stress relief shall be provided by forming the part leads at a bend angle to the PWB of not more than 95° nor less than 45°.*
  — Paragraph 8.4-6

- *The round lead shall overlap the solder pad a minimum of 3.5 times the lead diameter to maximum of 5.5 times the lead diameter, but in no case shall the length be less than 1.27 mm (0.050 in.).*
  — Paragraph 8.5-1a

STEP 4. SOLDER THE LEADS

Choose a lead that has not been tack soldered.

With a clean iron, position the tip to touch the lead and the trace at the same time.



Position the solder to touch the back of the heel and the trace at the same time.

When the solder has bridged between the heel and the trace, remove the solder. Add solder as necessary to form a concave solder fillet between the trace and edges of the lead.

Remove the solder; remove the iron.
Wipe the iron on a sponge.

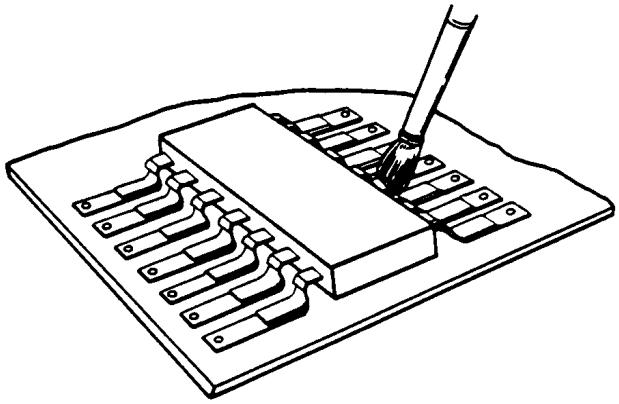
Solder the rest of the leads, alternating sides.

CAUTION: DO NOT SOLDER ADJACENT LEADS DUE TO HEAT BUILD-UP OF PWB AND PART.

Tin the iron, and return it to the holder.

STEP 5. CLEAN THE CONNECTION

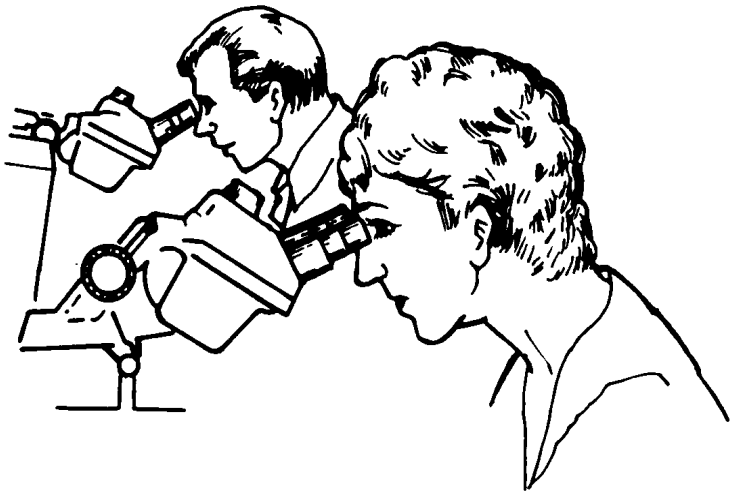
Clean the flux from the soldered connection with a soft brush, using the approved solvent and a shopwipe.



LAPPED TERMINATIONS (Flat Pack, Resistor)

STEP 6. INSPECTION

Inspect the solder connection under 4 X to 10 X magnification to the specified requirements.



- *The minimum distance from the part body or seal to the start of the bend of a part lead shall be 2 lead diameters for round leads and 0.55mm (0.020 in.) for ribbon leads.*
- *The stress relief shall not be less than the lead diameter or ribbon thickness.*

— Paragraph 8.1-6a

- *Free of flux residue and other contaminants.*
- *The surface shall be clean, smooth, and nonporous.*
- *It shall be undisturbed and have a bright finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *A heel fillet is mandatory for lap soldered joints.*
- *Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is not cause for rejection.*
- *Part marking shall be visible.*

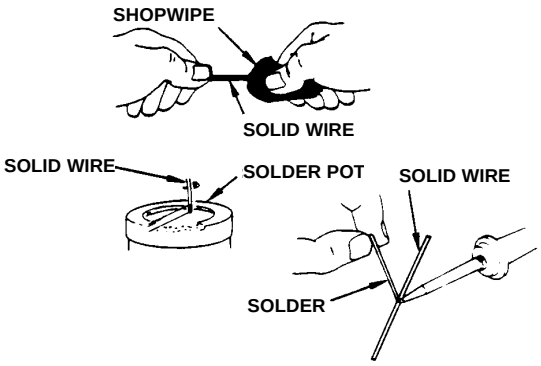
— Paragraph 13.6

For detailed inspection criteria refer to NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

CONTINUOUS RUN WRAP — BIFURCATED

STEP 1. PREPARE THE CONNECTION

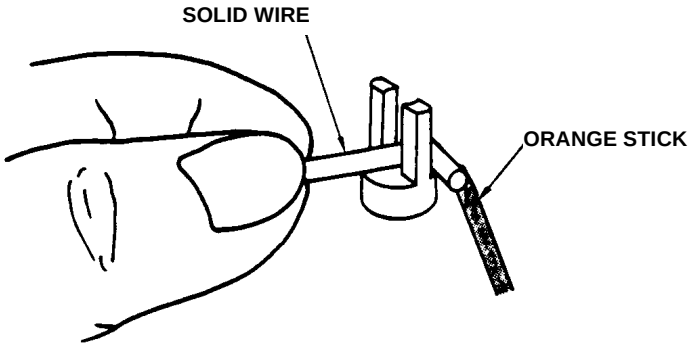
1a. Clean and tin the solid wire.



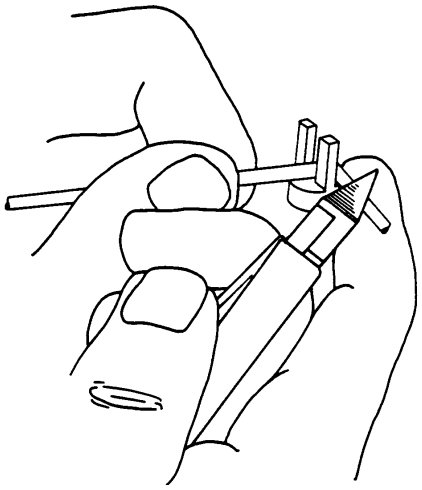
1b. Clean the wire and the terminal.

STEP 2. POSITION THE WIRE

1a. Use an orange stick to tightly wrap the wire against the end terminal post.



Cut the end wires to 90° or 180°.



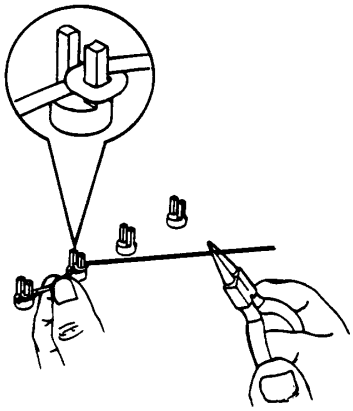
CONTINUOUS RUN WRAP — BIFURCATED

2b. Hold the solid wire with a finger and thumb between the two terminals.

Allow the wire to loop between the terminals for a stress relief.

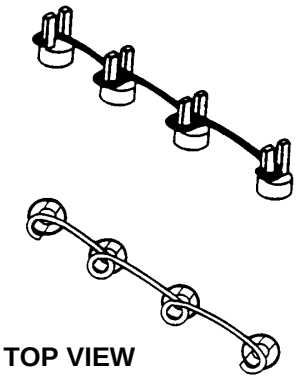
Wrap the wire around the post of the terminal where it is to be soldered.

Grasp the end of the wire with pliers and tighten the wrapped wire.



Complete the wrapping of the terminals.

2c. Wrap and cut this end terminal as in STEP 2a.



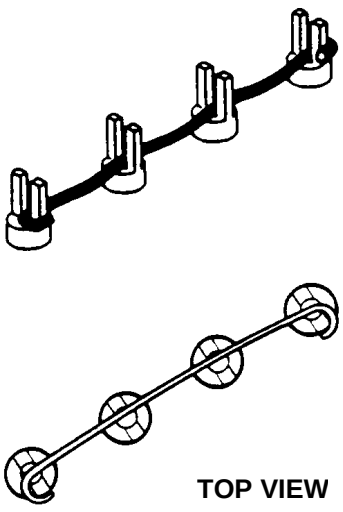
ALTERNATE PROCEDURE

Place the tinned bus wire between the terminals as shown.

Clean the terminal and wire.

Solder the terminals.

Clean and inspect.



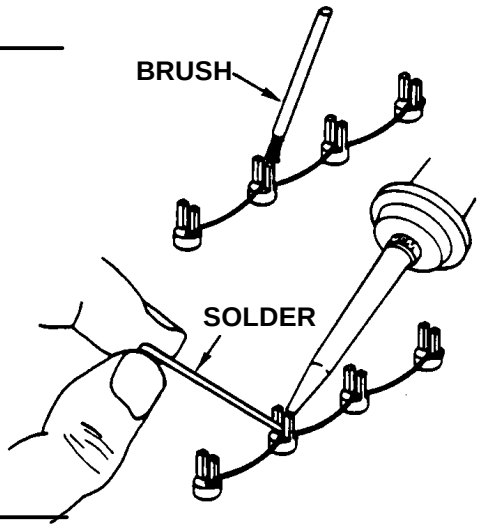
CONTINUOUS RUN WRAP — BIFURCATED

- *Hookup wire, solid or stranded, shall be supported by a means other than the solder connections or conformal coating if wire length exceeds 25.4 mm (1 in.). Attachment to a surface by staking with resin is adequate support.*

— Paragraph 8.1-5

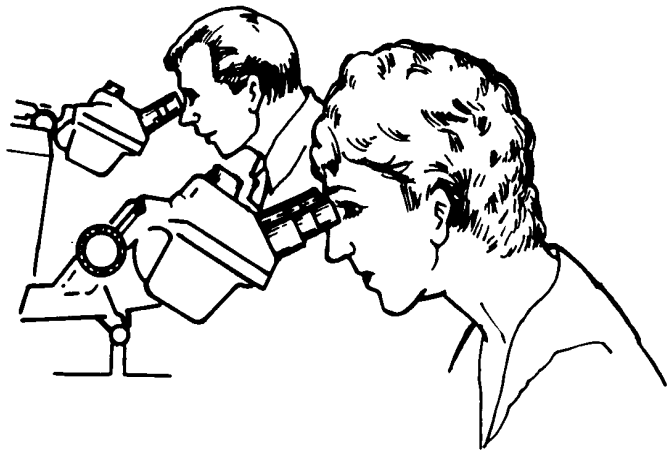
STEP 3. CLEAN AND SOLDER THE CONNECTIONS

Follow the steps in PROCEDURE 6 to solder and clean the wraps.



STEP 4. INSPECT THE CONNECTIONS

Inspect the solder joints under 4 X to 10 X magnification to the specified requirements.



- *Side route conductors shall enter the mounting the slot perpendicular to the posts.*
- *A conductor may lay straight through a terminal slot provided the conductor surface remains in contact with the terminal surface.*
- *Conductors shall not extend beyond the diameter of the base except where physical clearance will not adversely affect environmental or electrical characteristics.*
- *Conductor bend shall be 1/4 (90°) to 1/2 (180°) turn.*

— Paragraph 9.3

CONTINUOUS RUN WRAP — BIFURCATED

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be disturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*
- *Proper insulation clearance.*

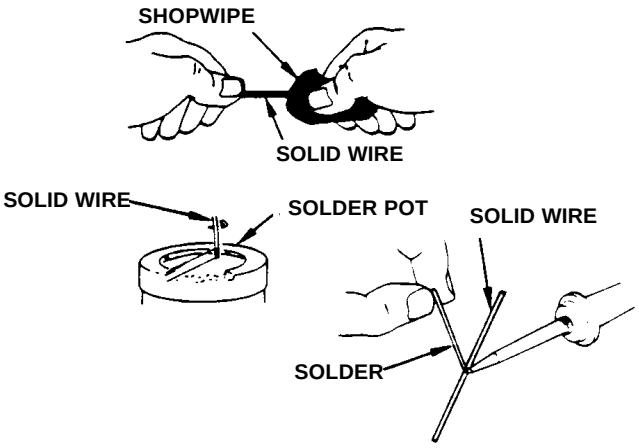
— *Paragraph 13.6*

For detailed inspection criteria refer to NASA-STD-8739-3, Paragraph 13.6 and Appendix A.

CONTINUOUS RUN WRAP — TURRET

STEP 1. PREPARE THE CONNECTION

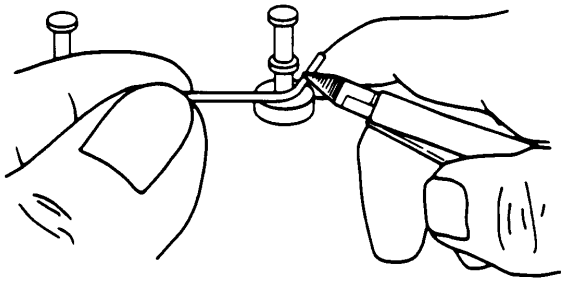
1a. Clean and tin the solid wire.

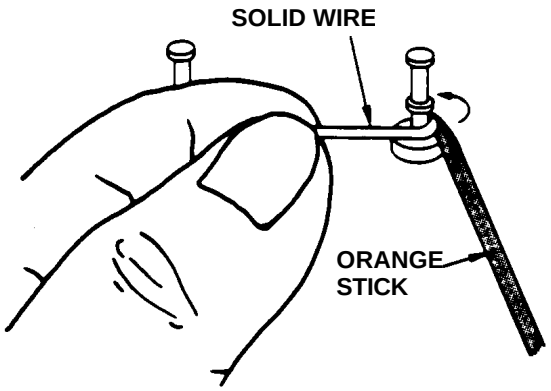


1b. Clean the wire and the terminal

STEP 2. POSITION THE WIRE

2a. Cut the wire 180° to 270°. Use an orange stick to tightly wrap the wire against the end terminal post.





CONTINUOUS RUN WRAP — TURRET

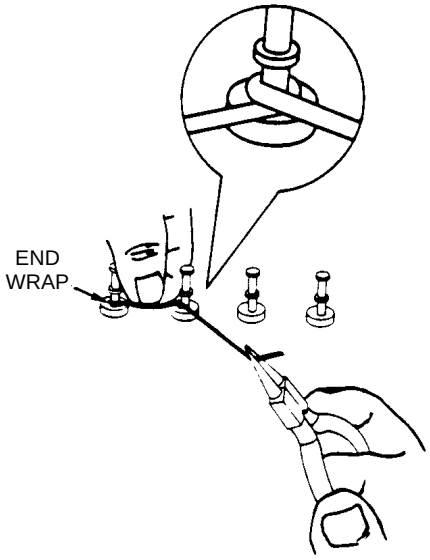
2b. Hold the solid wire with a finger and thumb between the two terminals.

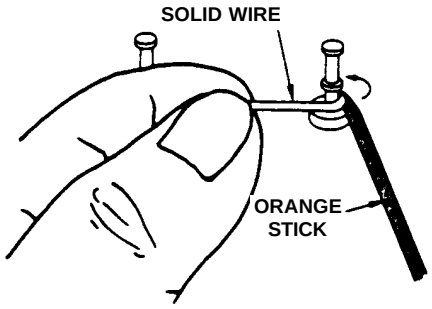
Allow the wire to loop between the terminals for a stress relief.

Wrap the wire around the terminal where it is to be soldered.

Grasp the end of the wire with pliers and tighten the wrapped wire.

Complete the wrapping of the terminals.

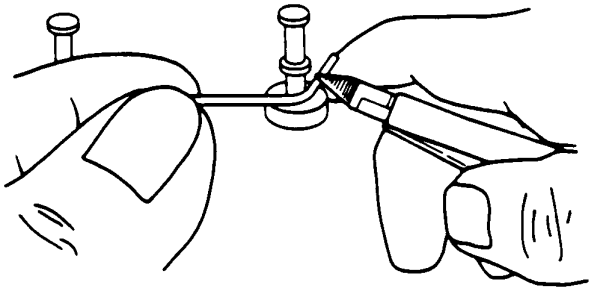


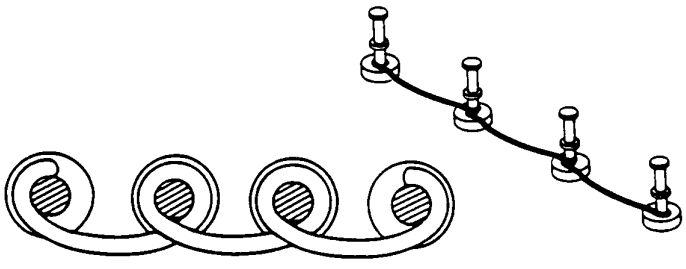


2c. Wrap and cut this end terminal as in STEP 2a.

- *Hookup wire, solid or stranded, shall be supported by a means other than the solder connections or conformal coating if wire length exceeds 25.4 mm (1 in.). Attachment to a surface by staking with resin is adequate support.*

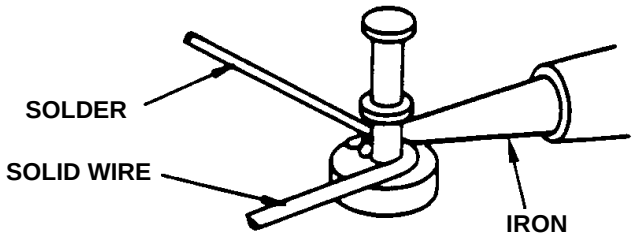
  — Paragraph 8.1-5





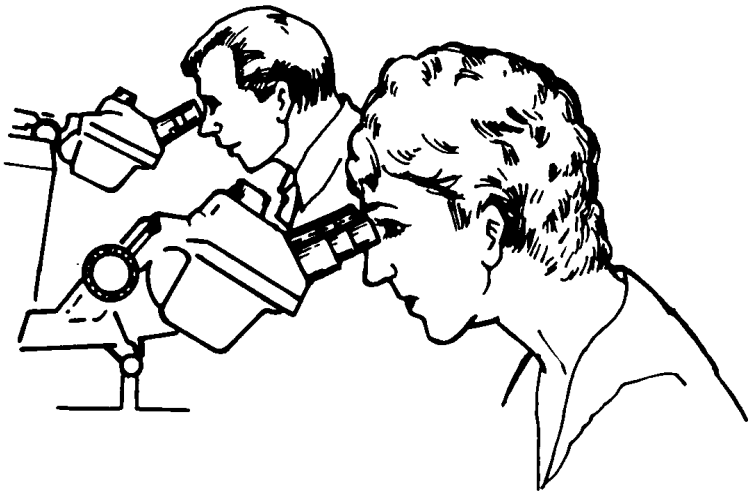
STEP 3. CLEAN AND SOLDER THE CONNECTIONS

Follow the steps in PROCEDURE 5 to solder and clean the wraps.



STEP 4. INSPECT THE CONNECTIONS

Inspect the solder joints under 4 X to 10 X magnification to the specified requirements.



- *Conductor bend shall be 1/2 (180° to 3/4 (270°) turn for conductors larger than AWG 26.*
- *Conductor bend shall be wrapped more than 1/2 (180°) but less than 1 (360°) turn for conductors AWG 26 and smaller.*
- *All conductors shall be confined to the guide slots.*
- *Conductors shall be maintained in contact with the post for the full curvature of the wrap and the conductor ends shall not extend beyond the base of the terminal.*
- *More than one conductor may be installed in a single slot of sufficient width, provided each conductor is wrapped on the terminal post and not on another conductor.*

— Paragraph 9.2

- *Free of flux residue and other contaminants.*
- *The surface shall be smooth and nonporous.*
- *It shall be disturbed and have a finish that may vary from satin to bright.*
- *The solder shall wet all elements of the connection.*
- *The solder shall fillet between connection elements over the complete periphery of the connection.*
- *The lead contour shall be visible.*

— Paragraph 13.6

For detailed inspection criteria refer to and NASA-STD-8739.3, Paragraph 13.6 and Appendix A.

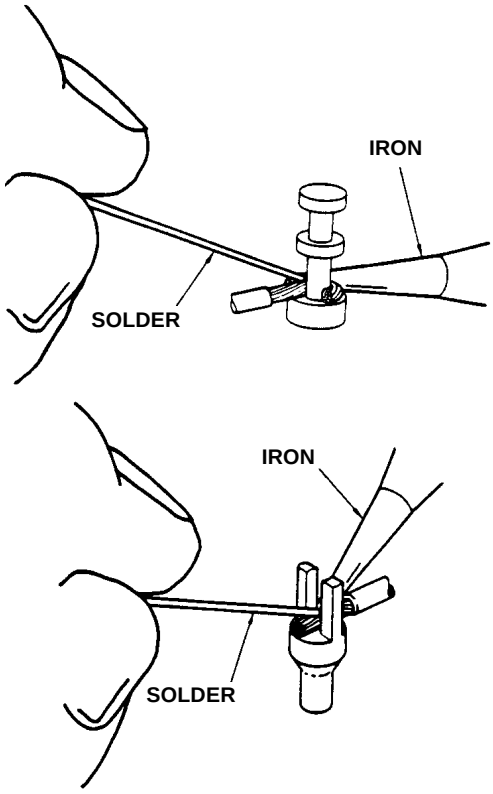
HIGH-VOLTAGE SOLDER JOINTS

STEP 1. PREPARE THE CONNECTION

Completely tin the terminal, and then solder a part lead or wire to a turret terminal in accordance with PROCEDURE 5 or to a bifurcated terminal in accordance with PROCEDURE 6.

Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

NOTE: The terminal shall have no sharp peaks.

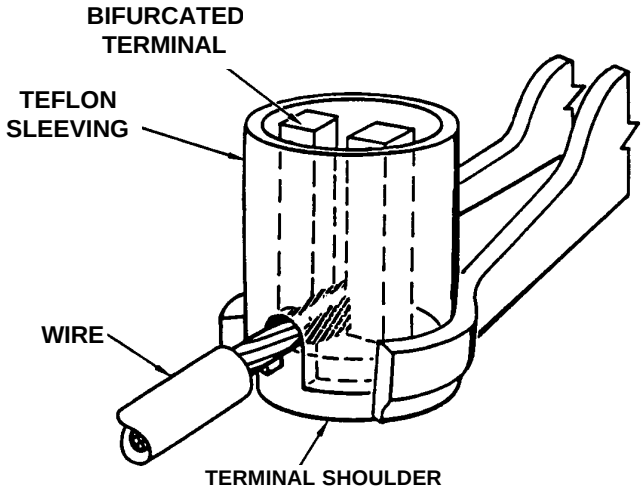


STEP 2. PREPARE THE TUBING

Cut a piece of Teflon tubing long enough to fit over the terminal and down to the PWB.

Now slot the tubing to fit around the wire.

Position the Teflon tube over the terminal and attach a clamp at the base to hold it into place for soldering.



HIGH-VOLTAGE SOLDER JOINTS

STEP 3. SOLDER THE TERMINATION

Clean the iron.

Wipe the tip on a sponge.

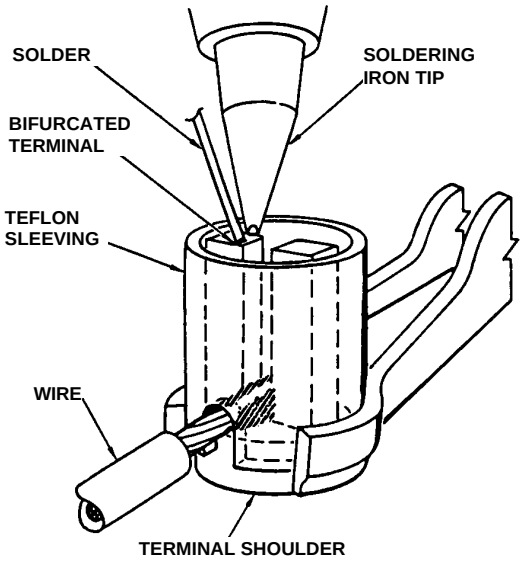
Position the iron in the end of the tube to touch the terminal.

Add solder to completely cover the terminal.

Remove the solder.

Wait until the solder thoroughly wets the terminal and visibly drops, then remove the iron.

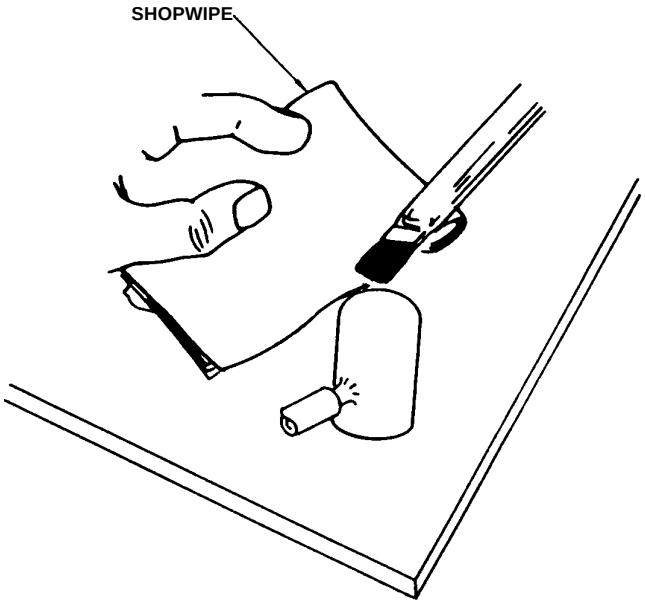
CAUTION: DO NOT OVERHEAT THE PWB.



STEP 4. CLEAN THE CONNECTION

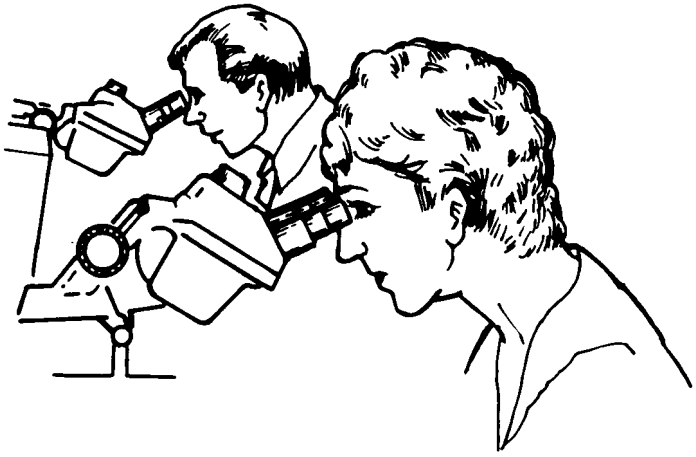
Remove the clamp and the Teflon tubing.

Clean the flux from the soldered connection with an acid brush, using the approved solvent and a shopwipe.



HIGH-VOLTAGE SOLDER JOINTS

STEP 5. INSPECT THE CONNECTION



Inspect the solder joint under 4 X to 10 X magnification to the specified requirements.

- *All elements of the termination shall be covered by a smooth fillet, free of discontinuity or severe change in contour.*
- *There shall not be any projections from part leads or solder spikes.*

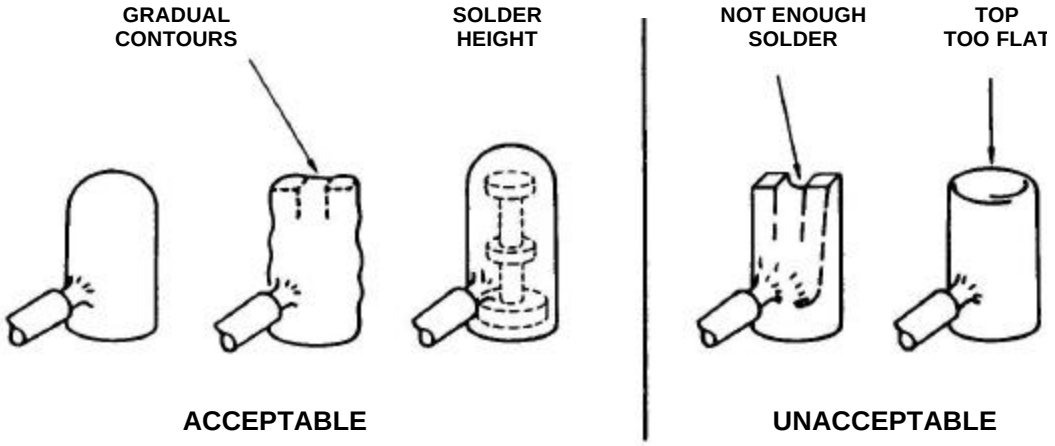
— Paragraph 11.1-8

- *Cold solder connection.*
- *Overheated solder connection.*
- *Fractured or disturbed solder connection.*
- *Poor wetting.*
- *Blowholes, pinholes, voids, and pits.*
- *Insufficient solder.*
- *Splattering of flux or solder on adjacent areas.*
- *Rosin solder joint.*
- *Contamination.*
- *Dewetting.*
- *Nonwetting.*
- *Part body in solder joint.*

— Paragraph 13.6-2b

NOTE 1: Smooth webbing fillet between leads is acceptable.

NOTE 2: To rework the connection, wick the solder off and restart this procedure.



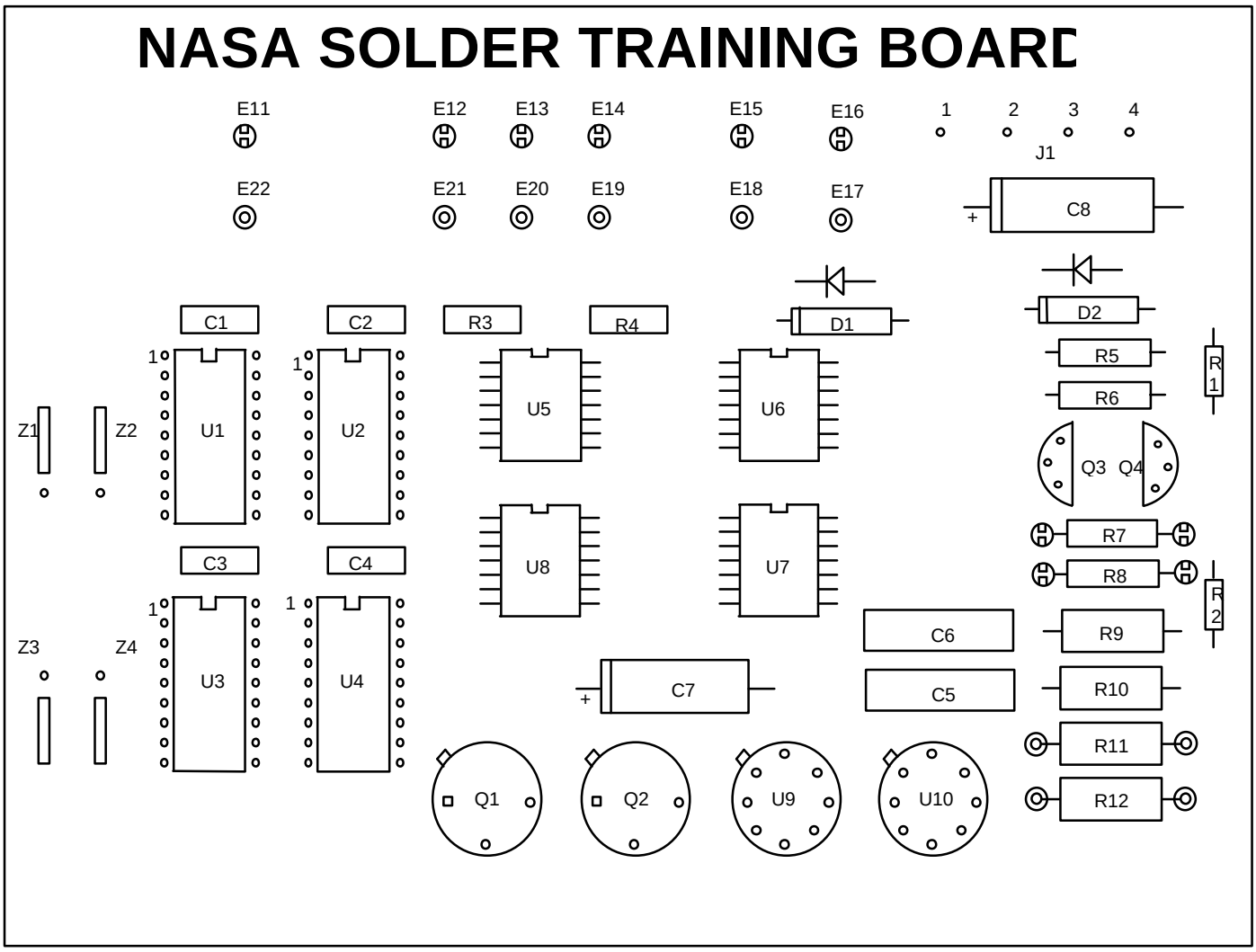
APPENDICES

A. PRINTED WIRING DIAGRAM

B. PARTS LIST

C. SOLDERING PROCEDURE

D. HINTS ON SOLDER INSPECTION TECHNIQUES


NASA SOLDER TRAINING BOARD
E11
E12
E13
E14
E15
E16
1
2
3
4
J1
E22
E21
E20
E19
E18
E17
C8
C1
C2
R3
R4
D1
D2
R5
R6
U5
U6
Z1
Z2
U1
U2
Q3
Q4
R7
R8
U8
U7
C3
C4
Z3
Z4
U3
U4
C6
R9
C7
C5
R10
R11
R12
Q1
Q2
U9
U10

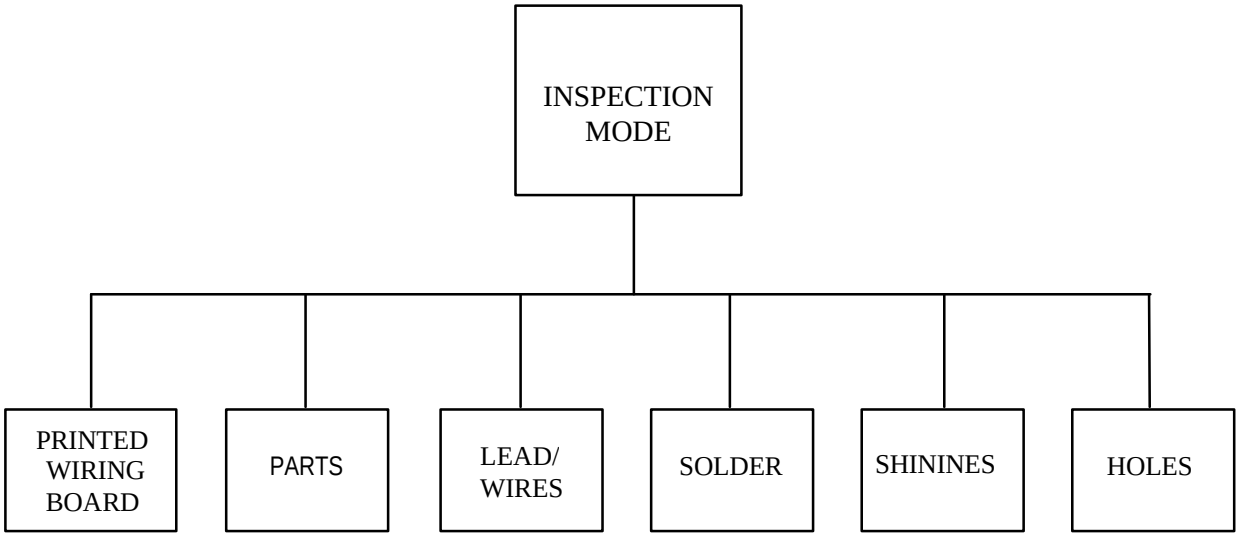
PARTS LIST

Item No.	Part Number	Circuit Symbol or Zone	Nomenclature or Description	Rev.
1		U1, U2	14-pin DIP	
2		U3, U4	16-pin DIP	
3		U5, U6	14-pin flat pack	
4		U7, U8	16-pin flat pack	
5		U9, U10	OP AMP (8 lead can)	
6		Q1, Q2	TO-05 transistors	
7		Q3, Q4	TO-92 transistors	
8		D1, D2	Diode, D1 case	
9		C1. C2, C3, C4	Ceramic capacitors (CK06)	
10		C5, C6	Disk capacitors	
11		C7, C8	Electrolytic capacitor (B case with strain relief)	
12		R1, R2	1/8 W resistor, single sided circuitry mtg.	
13		R3, R4	1/8 W resistor, mtg. with surface lap termination and strain relief	
14		R5, R6	¼ W resistor, clinched lead mtg.	
15		R7, R8	¼ W resistor, mtg. with bifurcated terminal and strain relief	
16		R9, R10	½ W resistor, mtg. using double-sided circuitry	
17		R11, R12	½ W resistor, mtg. with turret terminal and strain relief	
18		E11 - E16	Bifurcated terminals	
19		E17 - E22	Turret terminals	
20		J1	Stranded edge wire terminations	
21		Z1, Z2	Interfacial connections, single-sided and non-PTH PWB	
22		Z3, Z4	Interfacial connections, double-sided and PTH PWB	

SOLDERING PROCEDURE

1. PREPARE CONNECTION
2. POSITION CONNECTION
3. CLEAN CONNECTION
4. CUT AND CLEAN SOLDER
5. CLEAN IRON
6. POSITION IRON
7. SOLDER THE CONNECTION
8. TIN IRON
9. CLEAN CONNECTION
10. EXAMINE CONNECTION

HINTS ON SOLDER INSPECTION TECHNIQUES



PRINTED WIRING BOARD	PARTS	LEAD/ WIRES	SOLDER	SHININES	HOLES
* MEASLES	* PROPERLY MOUNTED	* EXCESS/INSUFFICIENT LENGTH	* EXCESSIVE	* GRAY	
* LIFTED PAD	* CENTERED	* CENTERED	* INSUFFICIENT	* ROUGH	* VOID
* DELAMINATION	* PROPER TYPE	* CORRECT FORMING	* STRESS LINES	* FROSTY	* PINHOLE
* CLEANLINESS OF PWB/PWA	* DAMAGE		* OVERHEATED	* GRAINY	* BLOWHOLE
* DAMAGE DUE TO IMPROPER TOOL USE	* IDENTIFICATION	* EXPOSED BASE METAL	* COLD JOINT	* SATIN	
	* ORIENTATION	* TINNING	* SOLDER IN BEND RADIUS	* SHINY	
		* BIRDCAGING	* SPIKES		
			* BRIDGING		
			* SOLDER SPLATTER/BALLS		
			* PROPER WETTING		