SECTION 2
CHAPTER 3

PREPARING WIRE AND CABLE

INTRODUCTION

1. Before wire and cable can be installed in aircraft and connected to components it must be prepared by cutting to the appropriate lengths and preparing the wire ends for attachment to connectors, terminal lugs or solder splices, etc.

CUTTING WIRE AND CABLE

General

2. Cut all wires and cables to lengths given on drawings or wiring diagrams. Cut wire and cable so that cut is clean and square and wire is not deformed (refer Figure 3–1). After cutting, reshape large diameter wire with pliers, if necessary.

CAUTION
Make sure that blades of cutting tools are sharp and free from nicks. A dull blade will deform and extrude wire ends.

Cutting Copper Wire and Cable

3. To cut heavy gauge copper wires or cables, use a fine tooth hacksaw. A fine tooth hacksaw has 20 or more teeth per inch. See Figure 3–2 Wire Cutting Tools for use of hack saw and saw vice which protects heavy wire during cutting. Heavy or light copper wires can also be cut with bench shears.

4. To cut a few light gauge copper wires, use diagonal pliers as shown in Figure 3–2. Do not attempt to cut wires larger than AWG-8 with diagonal pliers.

Cutting Aluminium Wire

5. Be careful when cutting aluminium wire to avoid deforming the conductors. Aluminium wire is more brittle than copper, and if deformed, aluminium wire should be reshaped carefully.

CAUTION
Never cut aluminium wire with tools that have reciprocating motion, such as a hack saw. Reciprocating cutting action “work hardens” aluminium. This will lead to broken and torn strands.

CAUTION
If cutting tool has been used for other metals, wipe blades clean before cutting aluminium. Copper or steel chips will cause aluminium to corrode.

6. Special cable shears with concave cutting edges such as pruning shears may also be used to cut aluminium wire.

Figure 3- 1 Wires After Cutting
STRIPPING WIRE AND CABLE

7. Before wire can be assembled to connectors, terminals, splices, etc., the insulation must be stripped from connecting ends to expose the bare conductor. For attachment to solder type connectors, enough insulation must be stripped so that the conductor will bottom in the solder cup and leave a small gap between the top of the solder cup and cut end of the insulation. Stripping dimensions for MS connectors are found in Section 2, Chapter 10, for RF connectors in Section 2, Chapter 12, and for terminals in Section 2, Chapter 6.

Stripping Methods for Copper Wire

8. Copper wire may be stripped in a number of ways depending on size and insulation.

Stripping Methods for Aluminium Wire

9. Strip aluminium wires very carefully. Take extreme care not to nick aluminium wire as strands break very easily when nicked.

General Stripping Instructions

10. When stripping wire observe the following precautions:

a. When using a hot blade stripper, make sure blades are clean. Clean blades with a brass wire brush as necessary. The hot blade stripper will not strip wire with glass braid or asbestos insulation.

b. Make sure all stripping blades are sharp and free from nicks, dents, etc.

c. When using any type of wire stripper, hold wire perpendicular to cutting blades.
d. Adjust automatic stripping tools carefully. Follow manufacturer’s instructions to avoid nicking, cutting, or otherwise damaging any strands. This is especially important for all aluminium wires and for copper wires smaller than No. 10. Examine stripped wires for damage and adjust tool as necessary. Cut off and restrip (if length is sufficient); or reject and replace any wires with more than the allowable number of nicked or broken strands given in Table 3–1.

Table 3–1 Allowable Nicked or Broken Strands

<table>
<thead>
<tr>
<th>Wire Size (AWG)</th>
<th>Nicked or Broken Strands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td></td>
</tr>
<tr>
<td>22 – 12</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>8 – 4</td>
<td>4</td>
</tr>
<tr>
<td>2 – 0</td>
<td>12</td>
</tr>
<tr>
<td>Aluminium, all sizes</td>
<td>None</td>
</tr>
</tbody>
</table>

e. Ensure insulation is clean-cut with no frayed or ragged edges. Trim if necessary.

f. Ensure all insulation is removed from stripped area. Some types of wires are supplied with a transparent layer between the conductor and primary insulation. If this is present, remove it.

g. When using hand plier strippers to remove lengths of insulation longer than 19mm, it is easier to do in two or more operations.

h. Retwist copper strands by hand or with pliers if necessary to restore natural lay and tightness of strands.

i. Precision hand pliers have die type blades that are designed for a specific insulation wall thickness and type of conductor. Table 3–2 lists manufacturers part numbers for one acceptable model. Equivalent tools may be used.

CAUTION

Due to the differences in the diameter of “General Purpose” and “Small Diameter” conductors, the blade set used should be the one specified for the wire being stripped.

j. Precision Blade Wear - Although these blades are hardened to provide long life, they will wear in time. When the blade no longer provides a satisfactory removal of insulation when used with the correct size and type of wire, it should be replaced.

k. Cleaning Wire Gripping Surfaces of Precision Tools - Wire gripping surfaces on precision strippers can become loaded with insulating material in time. This condition causes the wire to slip in the grippers and results in an unsatisfactory strip. Clean these gripping surfaces with a stiff brush as needed.

l. Wire Cutters - Shear type wire cutters (PN 45-123 or equivalent) are recommended for cutting wire prior to stripping. Standard diagonal cutting pliers will crush and deform the ends of the conductors and increase the force necessary to slide the slug of insulation off the wire. Smooth cut round ends are also easy to insert into the crimp wells of terminals and contacts.

Stripping Wire with Hot-Blade Stripper

CAUTION

Ensure adequate ventilation is provided when a hot-blade stripper is used to strip TFE-insulated wire.

11. The procedure for stripping a wire with a hot-blade stripper is as follows:

a. Adjust blades to correct opening for size of wire to be stripped.

b. Adjust stop by means of knurled brass nut on top of hood for desired stripping length between 6.5 and 38mm.

c. Adjust each blade to proper heat by testing on sample pieces of wire. Use minimum heat that will remove insulation satisfactorily without damaging strands.

d. Insert wire until it butts against stop.

e. Press foot pedal to bring heated blades against insulation.

f. Twist wire with lay of strands about 90 degrees and pull out.

NOTE

Polytetrafluoroethylene (PTFE) which includes all teflon based insulation materials is an inert plastic material that decomposes at approximately 400°C. At this temperature, the Teflon particles become airborne and, if inhaled, can cause a type of poisoning known as POLYMER FUME FEVER, which has influenza like symptoms. The symptoms occur for several hours after exposure and usually subside within 24 to 48 hours.

WARNING

Do not smoke in areas where PTFE materials are used. Do not carry cigarettes or tobacco into PTFE work areas as contamination of these products may occur. After working with PTFE material wash hands thoroughly before smoking. Do not incinerate PTFE waste.

NOTE

Longitudinal scratches in copper wire are not considered cause for rejection or rework.
Stripping Kapton Wire with a Hand Stripper

12. The procedure for stripping Kapton wire or cable with a hand stripper is as follows (see Figure 3-3):
   a. Insert wire into exact centre of correct cutting slot for wire size to be stripped. (Each slot is marked with wire size).
   b. Close handles together as far as they will go.
   c. Partially release handles so that the jaws of the stripper remain open and the blades and gripper pads also open to permit removal of the wire.
   d. Remove stripped wire.
   e. Continue to release handles so that the jaws snap closed and the stripper is ready to use again.

Inspection after Stripping

13. When visually inspecting multi-stranded wire, determine if any of the conditions illustrated in Figure 3-3 exist.

14. When one or more of the conditions below exist but are within tolerance, correct and reshape conductor strands by twisting the strands in the direction of the natural lay of the wire. Do not overtight.

15. When the conditions in Figure 3-3 exist, but are out of tolerance, cut off the stripped portion and start the procedure again. If the wire length does not permit, restart with a new length of wire.

**WARNING**
Care should be exercised when smoothing insulation or twisting conductors as nicked, frayed, or broken strands can cause injury.

![Figure 3-3 Examples to look for when Stripping Multi-Stranded Wire]

Stripping Coaxial Cable Using A Knife

16. Cut dimensions are detailed in the manufacturer’s instructions.

17. The first cut is to remove the desired length of the outer jacket. After placing the cable on a solid surface, position the knife blade at the desired strip point and press gently, using sufficient pressure to score the jacket without damaging the inner shielding. Cut dimensions are detailed in the manufacturer’s instructions or local instructions.

18. The first cut is to remove the desired length of the outer jacket. After placing the cable on a solid surface, position the knife blade at the desired strip point and press gently, using sufficient pressure to score the jacket without damaging the inner shielding. Figure 3-4 illustrates this process.

19. Without damaging the inner shielding, carefully slit the outer jacket, as shown in Figure 3-5.
20. Peel away the outer jacket to expose the shielding (Figure 3-5).

21. Using the knife, repeat step two removing the insulation surrounding the inner conductor. The finished cable will appear as depicted in Figure 3-6.

22. Cut away the excess braiding using side cutters to expose the insulated inner conductor. Be careful not to damage the insulation of the inner conductor with the cutters. Using the knife, repeat step two removing the insulation surrounding the inner conductor. The finished cable will appear as depicted in Figure 3-8.
### Table 3-4 Identification of Precision Stripper and Blades

<table>
<thead>
<tr>
<th>Wire Type</th>
<th>Gage</th>
<th>Stripper PN</th>
<th>Blade PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-W-22759 /9,10</td>
<td>16-26</td>
<td>45-174</td>
<td>L5563</td>
</tr>
<tr>
<td>/11,12 /22,23</td>
<td>10-14</td>
<td>45-173</td>
<td>L5562</td>
</tr>
<tr>
<td>/16,17,32, /33,34,35, /41,42,43</td>
<td>16-26</td>
<td>45-1987</td>
<td>45-1987-1</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-1611</td>
<td>45-1611-1</td>
</tr>
<tr>
<td>/18,19</td>
<td>16-26</td>
<td>45-1551</td>
<td>45-1551-1</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-1608</td>
<td>45-1608-1</td>
</tr>
<tr>
<td>/44,45,46</td>
<td>16-26</td>
<td>45-1513</td>
<td>45-1513-1</td>
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<tr>
<td></td>
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<td>45-1611</td>
<td>45-1611-1</td>
</tr>
<tr>
<td>MIL-W-81044 /6,7</td>
<td>16-26</td>
<td>45-171</td>
<td>L5211</td>
</tr>
<tr>
<td>/9,10</td>
<td>10-14</td>
<td>45-170</td>
<td>L5210</td>
</tr>
<tr>
<td>/12,13</td>
<td>28-30</td>
<td>45-178</td>
<td>L5661</td>
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<td></td>
<td>16-26</td>
<td>45-1513</td>
<td>45-1513-1</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-1611</td>
<td>45-1611-1</td>
</tr>
<tr>
<td>/16,17</td>
<td>16-26</td>
<td>45-1610</td>
<td>45-1610-1</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-1611</td>
<td>45-1611-1</td>
</tr>
<tr>
<td>MIL-DTL-81381 /1,2,5,6, /7,8,9,10</td>
<td>16-26</td>
<td>45-1551</td>
<td>45-1551-1</td>
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<td>45-1609</td>
<td>45-1609-1</td>
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<td>16-26</td>
<td>45-1610</td>
<td>L5663</td>
</tr>
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<td>10-14</td>
<td>45-1611</td>
<td>L5662</td>
</tr>
<tr>
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<td>45-1654</td>
<td>45-1654-1</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-1608</td>
<td>45-1608-1</td>
</tr>
<tr>
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<td>16-26</td>
<td>45-1672</td>
<td>45-1672-1</td>
</tr>
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<td>/21</td>
<td>16-26</td>
<td>45-1523</td>
<td>45-1523-1</td>
</tr>
<tr>
<td>MIL-C-85485 /5,6,7,8,9, /10,11,12</td>
<td>16-26</td>
<td>45-1924</td>
<td>45-1924-1</td>
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<tr>
<td></td>
<td>10-14</td>
<td>45-1925</td>
<td>45-1925-1</td>
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<tr>
<td>Wire Wrap</td>
<td>30</td>
<td>45-179</td>
<td>L7625</td>
</tr>
<tr>
<td>Solid Wire</td>
<td>24-30</td>
<td>45-169</td>
<td>L9300</td>
</tr>
<tr>
<td>General Purpose</td>
<td>26-30</td>
<td>45-172</td>
<td>L5436</td>
</tr>
<tr>
<td></td>
<td>16-26</td>
<td>45-171</td>
<td>L5211</td>
</tr>
<tr>
<td></td>
<td>10-14</td>
<td>45-170</td>
<td>L5210</td>
</tr>
</tbody>
</table>

Note: Specification MIL-W-81381A and the various commercial specifications used for procuring aerospace wire provide for various wall thickness of insulation. The stripper part numbers identify the strippers and blades for each variation.

**NOTE**

When the handles are partially released, the stripper jaws remain open so the wire can be removed without kinking the conductor. (refer to Fig 3-8, step c).

### Stripping Dimensions for Assembly to Connectors

23. Stripped length of wires that are to be attached to solder-type connectors should be such that when stripped conductor bottoms in solder cup there will be a gap of approximately 0.76 mm between the end of the cup and the end of the insulation, for inspection purposes.

![Figure 3-9 Stripping Wire With Hand Stripper](image)
TINNING COPPER WIRE AND CABLE

General
24. Before copper wires are soldered to connectors, the ends exposed by stripping are tinned to hold the strands solidly together. The tinning operation is considered satisfactory when the ends and sides of the wire strands are fused together with a coat of solder. Do not tin wires which are to be crimped to Class K (fireproof) connectors, wires which are to be attached to solderless terminals or splices, or wires which are to be crimped to removable crimp-style connector contacts.

Tinning Methods
25. Copper wires are usually tinned by dipping into flux and then into a solder bath. In the field, copper wires can be tinned with a soldering iron and rosin core solder.

Extent of Tinning
26. Tin conductor for about half its exposed length. This is enough to take advantage of the closed part of solder cup. Tinning or solder on wire above the cup causes wire to be stiff at point where flexing takes place. This will result in wire breakage.

WARNING
Ensure adequate ventilation and exercise care while using a solder pot. Solder Fumes are toxic and the hazard of severe burns exists.

Flux and Solder
27. The solder used is a mixture of 60% tin and 40% lead. Maintain the temperature of the solder pot between 235°C and 260°C, this will keep solder in a liquid state. Skim surface of solder pot as necessary with a metal spoon or blade to keep the solder clean and free from oxides, dirt, etc.

CAUTION
Do not use any other flux or solder for tinning copper wires for use in aircraft electrical systems.

Dip-Tinning Procedure
28. Dip-wires smaller than No. 8 about eight or ten at a time. Dip-wires size No. 8 and larger individually. (See Figure 3–10).

CAUTION
During tinning operation, take care not to melt, scorch or burn the insulation.

29. The procedure for dip tinning is as follows:
   a. Prepare flux and solder as described in paragraph 11.
   b. Ensure that exposed end of wire is clean and free from oil, grease, and dirt. Strands should be straight and parallel. Dirty wire should be re-stripped.
   c. Grasp wire firmly and dip into dish of prepared flux to a depth of about 3mm.
   d. Remove wire and wipe off excess flux.
   e. Immediately dip into molten solder. Dip only half of stripped conductor length into solder.
   f. Manipulate wire slowly in solder bath until it is thoroughly tinned. Watch the solder fuse to the wire. Do not keep the wire in bath longer than necessary.
   g. Remove wire if excess solder is noted and remove excess with solder sucker or equivalent.

Figure 3-10 Dip-Tinning in Solder Pot
NOTE
The thickness of the solder coat depends on the speed with which the wires are handled and the temperature of the solder bath. Never shake or whip wire(s) to remove excess flux or solder.

Soldering Iron Tinning Procedure

30. In the field, wires smaller than size No. 10 may be tinned with a soldering iron and rosin-core solder as follows (see Figure 3–11):
   a. Select a soldering iron having suitable heat capacity for wire size as listed in Table 3–3. Make sure that the iron is clean and well tinned.
   b. Prime by holding iron tip and solder together on wire until solder begins to flow.
   c. Move the soldering iron to the opposite side of the wire and tin half of the exposed length of conductor.

Table 3–3 Approximate Soldering Iron Sizes for Tinning

<table>
<thead>
<tr>
<th>Wire Size (AWG)</th>
<th>Soldering Iron Size (Heat Capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 16</td>
<td>65 Watts</td>
</tr>
<tr>
<td>14 &amp; 12</td>
<td>100 Watts</td>
</tr>
</tbody>
</table>

TERMINATING SHIELDED CABLE

General

31. Shielded cable has a metallic braid over the insulation to provide a barrier against electromagnetic interference. To obtain a satisfactory result from shielded cable, the shield must be unbroken and must extend to a point as near to the end of the conductor as practicable. Shielded cable is either grounded or dead-ended at each end as required by the individual installation.

Stripping Jacket on Shielded Cable

32. Most shielded cable has a thin extruded plastic coating over the shielding braid. Strip this off as far as necessary with a hot blade stripper, as described in paragraph 5. The length of the strip depends on the method of shield termination and type of wire connection. Strip the outer jacket back far enough for ease in working. If no hot-blade stripper is available, use plier type hand strippers for sizes No. 22 through No. 10 and a knife for sizes larger than No. 10. Be careful not to damage the shielding braid.

Coaxial Cable Strippers

33. As their name implies, coaxial cable strippers are used for preparing coaxial cable. Coaxial cable strippers are unique in that they have two blades located on each side of the tool and a round blade attached to the front, as can be seen in Figure 3–12.

34. There are several types of coaxial cable strippers available, so, where available, always make sure the tool instructions are referred to when selecting the correct tool for cable type.

35. As depicted in Figure 3–12, the two blades located on each side of the tool may be adjusted individually to vary the stripping dimension and the depth of the cut. The axial stripping blade attached to the front of the stripper is used to slit the cable axially (along the length of the cable).

Figure 3–12 Coaxial Cable Strippers

36. To strip coaxial cable using coaxial cable strippers:
   a. Adjust the blades to the applicable stripping dimensions, ensuring the depth of the blades is...
set so that the jacket will be scored without damage to the inner shielding.

b. Position the tool on the cable so that an excess length of cable will be left after the stripping operation is complete.

c. Spin the tool around the cable, as demonstrated in Figure 3-13 until the maximum cutting depth is obtained.

d. Slit the cable jacket by simply placing the cable in the front notch of the tool and pulling it through.

e. Peel off the jacket.

f. Steps one to three are repeated to strip the excess shielding. Be careful not to damage the inner dielectric.

g. Remove the excess shielding.

h. The dielectric may be stripped by hand using a knife or by repeating steps one to three.

i. To remove excess dielectric, flex the scored cut to separate the dielectric. Slide the excess dielectric off the inner conductor.

37. Coaxial cable strippers are particularly useful if a large quantity of cables need to be stripped. However, they require accurate setting up that can be time consuming. To strip individual cables, it is often quicker to use a knife.

Grounded Shield Termination

38. Grounded shield termination procedure is as follows:

a. Strip the shielded wire.

b. Comb out the exposed shielding and fold back over the jacket.

c. Ensure that the shield braid strands are flat and smooth.

NOTE
Solder sleeve terminations consist of a heat shrinkable insulation sleeve with an integral solder preformed with flux and thermal indicator, and two integral rings of sealing material. When the solder sleeve is placed over a cable and heated, the solder melts and flows connecting the ground lead to the shield. The outer sleeve shrinks and the thermoplastic insert melts, encapsulating the termination. The result is a soldered, strain relieved, environmentally protected termination. Solder sleeves are available with or without preinstalled leads.

WARNING
Use only hot air gun M83521/5-01 or equivalent on fuelled aircraft.
Use of nitrogen with hot air gun M83521/5-01 in an enclosed area can be hazardous. Ensure area is well ventilated.

CAUTION
Solder sleeves may only be used in areas where the temperature does not exceed 150°C.

NOTE
The heat shrinkable solder sleeves listed in Table 3–4 are qualified to SAE AS 83519 and are appropriate for terminating shielded cables, however they should not to be used in lieu of alternate methods detailed in specific aircraft maintenance publications, without prior engineering approval.

d. Measure the diameters “A, B and C” as shown in Figure 3–14.

e. Select the appropriate size sleeve from Table 3–4.

f. Position the solder sleeve over the assembly so that the solder ring is centred over the shielding as shown in Figure 3–14.

g. Install solder sleeves using approved tooling listed in Table 3–14.

h. Hold assembly horizontal and position sleeve in heat shield.

i. Rotate assembly while heating to achieve proper solder penetration and uniform sleeve shrinkage. About 10 to 30 seconds are required for complete solder melt and flow.

j. Continue to apply heat until solder brightens and starts to flow toward the thermoplastic inserts at either end of sleeve.
As soon as the solder flow is observed, withdraw the heat.

When the solder joint has been made, hold the work firmly in place until the joint has set. Disturbing the finished work will result in a joint mechanically weak, and with high electrical resistance. Allow solder joints to cool naturally. Do not use liquids or air blasts.

![Figure 3-14 Combined Cable Diameter Measurements](image)

Table 3–4 Heat Shrink Solder Sleeves For Tin and Silver Plated Conductors
(Splice Temperature rating 150°C) Maximum

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Gauge of Pre-installed Ground Lead</th>
<th>A Maximum</th>
<th>B Minimum</th>
<th>C Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>M83519/1-1</td>
<td></td>
<td>-</td>
<td>2.7</td>
<td>0.9</td>
<td>0.5</td>
</tr>
<tr>
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<td>-</td>
<td>3.7</td>
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<tr>
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<td>1.3</td>
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<td>3.3</td>
<td>1.8</td>
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<td>2.2</td>
<td>1.3</td>
</tr>
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<td>0.9</td>
<td>0.5</td>
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<td>26</td>
<td>7.6</td>
<td>4.3</td>
<td>2.5</td>
</tr>
</tbody>
</table>

- All dimensions are in mm.
- When using a sleeve with a pre-installed lead (M83519/2-*), A is the diameter of the cable only.
- C is the minimum diameter on which the sleeve will seal.

Table 3–5 Heat Shrink Tooling

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>M83521/5-01</td>
<td>Heat Gun Electric</td>
<td>Installation of heat shrinkable items on fuelled aircraft.</td>
</tr>
<tr>
<td>IR500</td>
<td>Infrared Heat Gun</td>
<td>Installation of heat shrinkable items in workshops etc.</td>
</tr>
<tr>
<td>CV-5302</td>
<td>Hot Air Blower</td>
<td>Installation of heat shrinkable items in workshops etc.</td>
</tr>
<tr>
<td>PR13</td>
<td>Heat Reflector</td>
<td>Short lengths of tubing up to 6.4mm diameter and high temperature solder sleeves.</td>
</tr>
<tr>
<td>PR24</td>
<td>Heat Reflector</td>
<td>Smaller molded parts and tubing 25 to 40mm diameter.</td>
</tr>
<tr>
<td>PR24A</td>
<td>Heat Reflector</td>
<td>Larger molded parts and tubing over 12mm diameter.</td>
</tr>
</tbody>
</table>
Ungrounded (Floating) Shield Termination

39. Ungrounded (floating) shield termination procedure is as follows:
   a. Strip the shielded wire as shown in Figure 3–14.
   b. Comb out the exposed shielding and fold back over the jacket.
   c. Select the appropriate size solder sleeve from Table 3–4.
   d. Make sure that the shield strands are flat and smooth.
   e. Position the solder sleeve over the assembly so that the solder ring is centred over the folded back shielding.
### WARNING

Use only hot air gun M83521/5-01 or equivalent on fuelled aircraft.

Use of nitrogen with hot air gun M83521/5-01 in an enclosed area can be hazardous. Ensure area is well ventilated.

### CAUTION

Solder sleeves may only be used in areas where the temperature does not exceed 150°C.

f. Hold assembly horizontal and position sleeve in heat shield.

g. Rotate assembly while heating to achieve proper solder penetration and uniform sleeve shrinkage. About 10 to 30 seconds are required for complete solder melt and flow.

h. Continue to apply heat until solder brightens and starts to flow toward the thermoplastic inserts at either end of sleeve.

i. As soon as the solder flow is observed, withdraw the heat.

j. When the solder joint has been made, hold the work firmly in place until the joint has set. Disturbing the finished work will result in a joint mechanically weak, and with high electrical resistance. Allow solder joints to cool naturally. Do not use liquids or air blasts.

---

**Figure 3-16 Solder Sleeve Floating Shield Termination**

**Types of Solder Sleeves**

40. As with any component used to maintain aircraft, solder sleeves should conform to a specification. The Military Spec styles of solder sleeve termination are the M83519/1, and M83519/2.

41. The M83519/1, (shown in Figure 3-16) and the M83519/2, (shown in Figure 3-17), are identical in construction, function and use, except that the M83519/2 contains a pre-tinned ground lead.

---

**Figure 3-17**

The M83519/1 Type of Solder Sleeves

**Figure 3-18**

The M83519/2 Type of Solder Sleeves
Solder Sleeve Heating Tools

42. Proper application of heat is important to produce a reliable solder connection and sealing of the solder sleeve. The sleeves are designed to be installed using a hot air source or alternately an infra-red heating tool.

43. The type of tool selected will depend largely on the work environment; i.e., whether you are working in a workshop or on an aircraft. If working on an aircraft, the tool must be portable and present no risk of igniting fuel vapour.

44. The three heating tools in common use are:

- a. infrared heating tool,
- b. compressed air/nitrogen heating tool, and
- c. turbofan type heat gun.

Infrared Heating Tool

45. The infrared heating tool is a self-contained portable unit. The main components are labelled in Figure 3-19. Infrared heat tools offer several advantages over other methods of heating solder sleeves including faster shrinking and solder flow. Also being less complicated, they are easier to set up.

Compressed Air/Nitrogen Heating Tool

46. The compressed air/nitrogen heating tool (illustrated in Figure 3-20) is a portable source of heat for use with heat-shrinkable tubing and solder sleeves. As the unit is fully enclosed, it is approved for use on fuelled aircraft. To operate, the heating tool must be connected to an external source of compressed air/nitrogen and power.
47. When operating the compressed air/nitrogen heating tool, the following warnings apply:

**Warning**

The nozzle and output air from the heat gun get very hot. Use extreme care while operating the heat gun to avoid serious burns.

The use of nitrogen with the heat gun in an enclosed area can be hazardous. Discharge of nitrogen into a poorly ventilated area can result in asphyxiation.

Do not use electrical power from an aircraft under repair. Aircraft power should be off during repair of aircraft electrical systems. Use electrical power from a ground power unit.
Turbofan Type Heat Gun

48. The Thermogun Mark II heating tool, illustrated in Figure 3-21, is a rugged stand mounted or hand held hot air tool. The heating tool has been engineered with a turbo fan driven blower and a double jacketed element housing for heavy duty use. It has features such as adjustable side vents for limited temperature control, and a wide variety of hot air reflectors. The Thermogun provides precise control when terminating a broad range of heat shrinkable products including boots and tubing up to 75 mm in diameter.

49. There are numerous models and variations of the turbofan type heat guns available. The following description of operation is similar for most turbofan type heat guns.

Pre-operation

50. Before using the heating tool, carry out the following:
   a. Visually check the reflector for foreign material accumulation.
   b. If accumulation is found, remove the reflector by pulling it straight off the nozzle.
   c. Clean foreign material off reflector surfaces with a soft cloth and isopropyl alcohol.
   d. Install the reflector being careful not to touch the reflective surface.

Warning
Isopropyl alcohol is flammable. Do not use in the presence of sparks, heat or flame.

Reflector Selection

51. Heating tool attachments consist of a range of reflectors. These reflectors are attached to the nozzle of the heating tool and concentrate the heated output around the material. Note, the exact reflectors supplied will vary according to the make and model of the heating tool. A selection of the various reflectors you may encounter are as follows:
a. Termination sleeve reflector. Used for heating solder termination sleeves and shrinking small diameter tubing.

![Termination Sleeve Reflector](image)

Figure 3-22 Termination Sleeve Reflector

b. Miniature termination sleeve reflector. Used for heating small solder termination sleeves and making terminations in a confined area.

![Miniature Termination Sleeve Reflector](image)

Figure 3-23 Miniature Termination Sleeve Reflector

c. Boot and tubing reflector. Used for shrinking tubing and moulded components such as strain-relief boots and potting caps.

![Boot and Tubing Reflector](image)

Figure 3-24 Boot and Tubing Reflector

d. Needle point reflector. Used where a lower, more precise air-flow is required to terminate micro-miniature connectors, or to repair or modify low temperature insulated wire terminations.

![Needle Point Reflector](image)

Figure 3-25 Needle Point Reflector

e. Large boot and tubing reflector. Used for installing large diameter tubing and moulded parts.

![Large Boot And Tubing Reflector](image)

Figure 3-26 Large Boot And Tubing Reflector
Operation

52. To operate the heat guns, proceed as follows:

| Warning |
|------------------|------------------|
| Do not use heat guns with electric motors when working on aircraft that have not been defueled and purged. Sparks generated by the electric motors may ignite fuel vapour. |
| Nozzle and output air of heat guns get very hot. Use extreme care while operating a heat gun to avoid serious burns. |

- a. Select the appropriate reflector for the application.
- b. Install the reflector on the front of the heat gun nozzle by pushing the reflector straight on.
- c. Check the power requirement of the tool being used and plug the cord into the appropriate power supply.
- d. Prepare the assembly to be heated (this will be covered in detail in the next section).
- e. Turn the heating tool on and allow a short warm up period.
- f. Place the assembly into the heating area.
- g. Observe the assembly during the heating process. After the assembly has received sufficient heat, remove the assembly from the heating area and turn the heat gun off.
- h. Inspect the assembly for correct forming (this will also be covered in detail in the next section).

Post Operation

53. After using the heating tool, proceed as follows:

- a. Disconnect the power connector from the power source.
- b. Allow a few minutes for the reflector to cool.
- c. Visually check the reflector for foreign material accumulation. If material is found, clean as described in the pre-operation procedure.

Cable Preparation

54. Before terminating the shielded wire, the cable needs to be prepared. To prepare the shielded cable, use one of the following methods applicable to the intended application:

- a. For centre stripped cables rated above 125°C, prepare as per dimensions illustrated in Figure 3-27.

![Figure 3-27](attachment://Figure_3-27.png)

Preparation of Centre Stripped Cable

- b. For end stripped cables rated above 125°C, prepare as per dimensions illustrated in Figure 3-28.
c. For cables rated between 105°C and 125°C, or to build up the diameter of small cables, fold back the braid and prepare as per dimensions illustrated in Figure 3-29.

![Figure 3-29 Preparation of End Stripped Braided Cable](image)

d. To provide proper sealing and connection, the solder sleeve must be selected by size and cable dimensions.

### Installation of the Mil Spec M83519/1 Solder Sleeve

55. The M83519/1 solder sleeve does not have a pre-installed ground lead so it will be required to prepare a ground lead prior to installation. The procedure to manufacture a ground lead and install the solder sleeve is as follows:

a. Select and prepare a ground lead suited to application from a relevant aircraft wiring publication. Strip one end to the dimension as illustrated in Figure 3-30.

![Figure 3-30 Installation of the M83519/1 Solder Sleeve](image)

<table>
<thead>
<tr>
<th>TERMINATOR SIZE</th>
<th>CABLE DIMENSIONS (mm)</th>
<th>IDENTIFICATION NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B&lt;sub&gt;max&lt;/sub&gt;</td>
<td>E&lt;sub&gt;max&lt;/sub&gt;</td>
</tr>
<tr>
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<td>7.6&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
b. Assemble the cable, ground lead, and solder sleeve ensuring no strands protrude to puncture the sleeve, as illustrated in Figure 3-31. Note, the ground lead can enter the sleeve from either side.

Figure 3-31 Examples of Solder Sleeve Assembles

![Center Stripped](image1.png)

![End Stripped](image2.png)

![Braid Fold Back](image3.png)

Figure 3-32 Installation of the M83519/1 Solder Sleeve

**Note**
The collapse of the solder preform does not indicate solder flow. Continue to apply heat until the solder flows and forms a fillet between the shield and the ground lead.

If necessary, heat each end of the sleeve to complete shrinkage of the tubing and inserts.

**Warning**
Do not handle the termination when hot as serious burns will result. Allow the termination to cool prior to handling.

56. Inspect the termination according to the following guidelines:

a. **Unacceptable Termination (Insufficient Heat)**
   - The thermal indicator is clearly visible as a dull red colour.
• The original shape of the solder preform is clearly visible.
• The sealing inserts have not flowed.
• The contour of the braid and/or lead is blocked by solder.

b. Acceptable Termination (Minimum Solder Flow)
• The thermal indicator shows slight traces of dull red colour.
• The solder has lost all its original shape.
• The sealant inserts have melted and flowed along the wires.
• The shield and lead contours are visible.
• A definite fillet is visible between lead and shield.

c. Acceptable Termination (Maximum Solder Flow)
• The dull red colour has disappeared from the thermal indicator.
• A definite fillet is clearly visible between the lead and shield.
• The joint area is visible despite the browning sleeve.

d. Unacceptable Termination (Overheated)
• The joint area is not visible because of severe darkening of the outer sleeve.
• The solder fillet is not visible along the lead and shield interface.
• Wire insulation is damaged outside of the sleeve.
• Re-shrink, if necessary, until acceptable conditions exist.
• If an overheated condition has occurred, cut out the damaged termination and start the procedure again.

e. Installation of the M83519/2 Solder Sleeve
• Installation of the M83519/2 solder sleeve is the same as the M83519/1 with the exception of the ground lead preparation not being required as it is pre-installed.