

**NOTE** All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of  $\pm 0.13$  [ $\pm .005$ ] and angles have a tolerance of  $\pm 2^\circ$ . Figures and illustrations are for identification only and are not drawn to scale.

**1. INTRODUCTION**

This specification covers the requirement for application of AMP\* Modular Plug Connectors for voice and data applications. The modular plugs are available in standard and small conductor, unshielded or shielded, with 2, 4, 6, 8, or 10 terminals on 1.02 [.040] centerline spacing. These plugs are also available in offset, line, and keyed housing styles. The plugs contain solid wire terminals or stranded wire terminals; each terminal design optimized for its specific application.

The plugs accept flat oval (“silver satin”) cable or round jacketed, unshielded or shielded cable with 2, 4, 6, 8, or 10 conductors. Specific wire approved is tinsel wire size 28 AWG, 7- and 19-strand wire, stranded wire sizes 28 through 24 AWG, and solid wire sizes 26 through 24 AWG. Wire size 24 AWG is approved provided the insulated conductor outside diameter is less than or equal to 0.99 [.039].

Each plug features two internal strain reliefs to protect the plug-to-cable and terminal-to-conductor interface from damage when subjected to pulling or bending forces—the primary strain relief grips the jacket and the secondary strain relief acts on the conductors. These plugs are terminated using the insulation piercing technique. The plugs are available in loose piece for terminating with manual or pneumatically-powered tools, and continuous strip form for terminating with semi-automatic machines.

When corresponding with personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

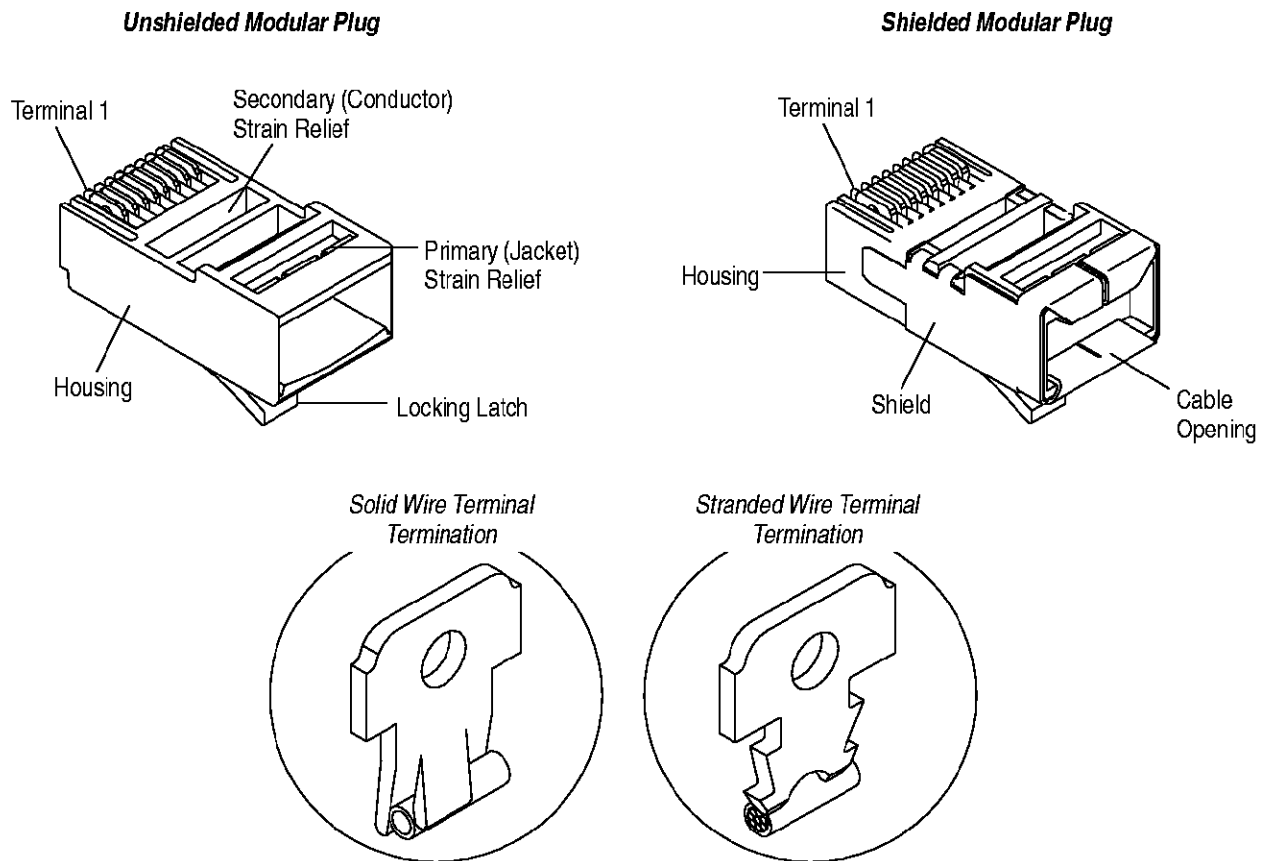


Figure 1

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

Revisions to this application specification per EC 0990-0268-00 include:

- Updated document to corporate requirements
- Changed title of document
- Modified Sections 1, 5, and 6
- Modified Figures 1, 2, 3, 4, 8, and 9
- Combined and modified Figures 5, 6, and 7
- Modified Paragraphs 2.1, 2.2, 2.4, 2.3, 2.5, 3.4, 3.5, and 3.6
- Added Paragraphs 3.1, 3.2, 3.3, 3.7, 3.8, and 3.9
- Added Section 4
- Added Figures 6 and 7

### 2.2. Customer Assistance

Product Part Number 554739 and Product Code 1423 are representative of Modular Plug Connectors (standard and small conductor). Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local Representative (Field Service Engineer, Field Applications Engineer, etc.) or, after purchase, by calling the Product Information Center at the number at the bottom of page 1.

### 2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, call the Product Information Center at the number at the bottom of page 1.

### 2.4. Specifications

Product Specification 108-1163 provides product performance and test information.

Application Specification 114-6053 provides product description and application requirements for high performance modular plug connectors, and 114-2048 (through hole) and 114-6040 (surface mount) provides product description and application requirements for mating modular jack assemblies.

### 2.5. Instructional Material

Instruction Sheets (408-series) provide assembly instructions and operation procedures. Documents available which pertain to this product are:

- |           |   |
|-----------|---|
| 408-3151  | Modular Plug Connector Chordal Hand Tool 231648-1 (For 2-, 4-, and 6-Position Plugs)                        |
| 408-3172  | Modular Plug Connector Chordal Hand Tool 231649-1 (For 4-Position Handset Plugs)                            |
| 408-4093  | PRO-CRIMPER* II Hand Tool Assembly 58560-1 (For 10-Position Plugs)  |
| 408-4167  | PRO-CRIMPER II Hand Tool Assembly 224928-1 (For External Strain Relief Application)                         |
| 408-4246  | Modular Plug Adapter 318510-1   |
| 408-4321  | Straight Action Holder Assemblies 356304-1 (Logic) and 189928-1 (Non-Logic)                                 |
| 408-4389  | Crimp Height Gage 904170-1  |
| 408-8057  | Miniature Quick Change Applicators 469268-[ ]   |
| 408-9743  | Terminating Modules 856196-[ ] for Use with Dual Modular Plug Terminators 1320840-[ ]                       |
| 408-9767  | Modular Plug (Premium Grade) Hand Tool 231652-[ ] (Includes Die Set 853400-[ ]) for Modular Plug Connectors |
| 408-9919  | Modular Plug Single Terminators 354711-[ ] and Tooling Kits 354714-[ ]                                      |
| 409-5842  | AMP-O-ELECTRIC* Model "G" Terminating Machines 354500-[ ]   |
| 409-5862  | 626 Pneumatic Tooling Assemblies 189721-[ ] and 189722-[ ]  |
| 409-10010 | Modular Plug Terminator 1320840-[ ]   |

### 3. REQUIREMENTS

#### 3.1. Material

Plug housings are made of flame retardant polycarbonate, UL94-V-0. The terminals are made of phosphor bronze under-plated with nickel; terminal area is plated with gold, and insulation piercing tips are plated with gold flash. Shields are made of brass plated with bright tin-lead and under-plated with copper. External strain reliefs are made of brass plated with tin and under-plated with copper.

#### 3.2. Storage

##### A. Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the plug material.

##### B. Shelf Life

The plugs should remain in the shipping containers until ready for use to prevent plating damage to the terminals. The plugs should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

#### 3.3. Chemical Exposure

Do not store plugs near any chemical listed below as they may cause stress corrosion cracking in the terminals.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur	Nitrites	Tartrates

#### 3.4. Cable Selection

Standard plugs accept cable with insulated conductor outside diameter range of 0.74 through 0.99 [.029 through .039].

Small conductor plugs accept cable with insulated conductor outside diameter range of 0.74 through 0.86 [.029 through .034]. These plug housings are tinted blue to differentiate from standard plugs.

**NOTE**

*Not all standard plugs have a small conductor plug equivalent.*

##### A. 2- and 4-Conductor Cable

Conductor sizes: 28, 26, or 24 AWG with insulation outside diameter of 0.74 through 0.99 [.029 through .039]. For the plug to accept the conductor, the maximum diameter (0.99 [.039]) must not be exceeded

Conductor types: tinsel (28 AWG only), 28 through 26 AWG 7-strand wire, or 26 through 24 AWG solid wire

Cable jacket insulation types:

1. Flat oval
  - Height:  $2.29 \pm 0.25$  [.090 $\pm$ .010]
  - Width for 2-conductor:  $3.81 \pm 0.13$  [.150 $\pm$ .005]
  - Width for 4-conductor:  $4.83 \pm 0.25$  [.190 $\pm$ .010]
2. Round
  - Maximum outside diameter: 2.54 [.100]

**B. 6-Conductor Cable**

Conductor sizes: 28, 26, or 24 AWG with insulation outside diameter of 0.74 through 0.99 [.029 through .039]. For the plug to accept the conductor, the maximum diameter (0.99 [.039]) must not be exceeded.

Conductor types: unshielded: 7-strand wire for sizes 28 through 26 AWG or solid wire for sizes 26 through 24 AWG, shielded: 7-strand wire, 5 conductors for sizes 28 through 26 AWG and 1 drain wire sizes 24 through 22 AWG or 6-conductor cable with drain wire

Cable jacket insulation types:

1. Unshielded flat oval  
Height: 2.29±0.25 [.090±.010]  
Width: 6.60±0.25 [.260±.010]
2. Shielded flat oval  
Height: 2.79 [.110] max  
Width: 6.86 [.270] max
3. Round: 4.57 [.180] max outside diameter

Shield type: metalized polyester foil

**C. 8- and 10-Conductor Cable**

Conductor sizes: 28, 26, or 24 AWG with insulation outside diameter of 0.74 through 0.99 [.029 through .039]. For the plug to accept the conductor, the maximum diameter (0.99 [.039]) must not be exceeded.

Conductor types: unshielded: 7-strand wire for sizes 28 through 24 AWG or solid wire for sizes 26 through 24 AWG, shielded: 7-strand wire, 7 conductors for sizes 28 through 24 AWG and 1 drain wire sizes 24 through 22 AWG or 8-conductor cable with drain wire

Cable jacket insulation types:

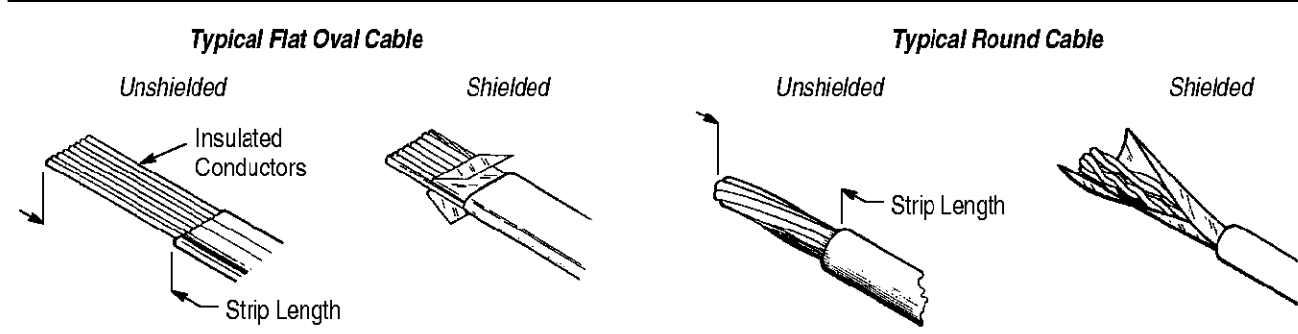
1. Unshielded flat oval  
Height: 2.29±0.25 [.090±.010]  
Width: 8.89±0.25 [.350±.010]
2. Shielded flat oval  
Height: 2.79 [.110] max  
Width: 9.02 [.355] max
3. Round: 5.46 [.215] max outside diameter

Shield type: metalized polyester foil only, braided shield should not be used

**3.5. Cable Preparation**

Proper strip length is necessary to properly insert the cable into the plugs. The strip length for the cable, and specific cable and plug combinations is shown in Figure 2.

**NOTE** Reasonable care shall be taken not to nick or cut the cable conductor insulation during the stripping operation.



MODULAR PLUG		CABLE				
TYPE	POSITION/ TERMINAL	FLAT OVAL		ROUND		STRIP LENGTH
		Stranded	Solid	Stranded	Solid	
Unshielded, Handset	4/4	✓	✓	—	—	6.35–7.14 [.25–28]
Unshielded, Keyed	8/8	✓	✓	✓	—	12.7–14.3 [.25–56]
	10/10	—	—	✓	—	
Unshielded, Line	6/2	✓	—	—	—	6.35–7.14 [.25–28]
	6/4	✓	✓	—	—	
	6/6	✓	✓	✓	—	
	8/4	✓	—	—	—	12.7–14.3 [.50–56]
	8/8	✓	✓	✓	✓	
	10/10	—	—	✓	—	
Unshielded, Small Conductor (Blue)●	6/4, 6/6, 8/8	✓	✓	—	—	6.35–7.14 [.25–28]
	10/10	✓	✓	✓	—	6.35–7.14 [.25–28]
Unshielded, Offset	6/6	✓	✓	✓	—	6.35–7.14 [.25–28]
Unshielded, Offset, Wide Cable Entry	6/6	✓	—	—	—	6.35–7.14 [.25–28]
Unshielded, Long Body	6/6	✓	✓	✓	—	14.3 [56]
Shielded, Line	8/8	✓	—	✓	✓	14.3 [56]
Shielded, Long Body	6/6	✓	—	✓	—	14.3 [56]
	8/4	✓	—	—	—	
Shielded, Line, Keyed	8/8	—	—	✓	—	14.3 [56]
	8/8	—	—	✓	✓	
Shielded, Small Conductor (Blue)●	8/8	—	—	✓	✓	14.3 [56]

● For conductor outside insulation diameter range of 0.74 through 0.86 [.029 through .034]

Figure 2

**A. Flat Oval Shielded Cable**

This cable must be prepared according to the following. Refer to Figure 3:

1. Insert blade tip between the conductors and shield. Slit the jacket and shield  $14.29 [9/16]$  back from the end along one edge of the cable. Repeat on the opposite cable edge.
2. Pull the slit ends away from the conductors. Separate the shield from the slit ends of the jacket.
3. Cut off the slit ends of the jacket  $14.29 [9/16]$  from the end of the conductors. Care should be taken not to cut shield ends.
4. Fold each shield end back on itself to approximately one-half of its length.
5. Bend each folded shield back on top of the jacket. The shield must extend approximately  $9.52 [3/8]$  back on the jacket and the exposed conductors must be approximately  $14.29 [9/16]$  in length.
6. If the drain wire is to be terminated within the plug, insert the drain wire into the wire circuit of the plug, and terminate according to the instructions packaged with the applicable tooling.

If the drain wire is to be terminated to the plug shield, bend the drain wire back tightly across the center of the cable shield on the side of the cable that will face the locking latch side of the plug when the cable is inserted. Cut the drain wire to the same length as the cable shield. Terminate the plug according to the instructions packaged with the applicable tooling.

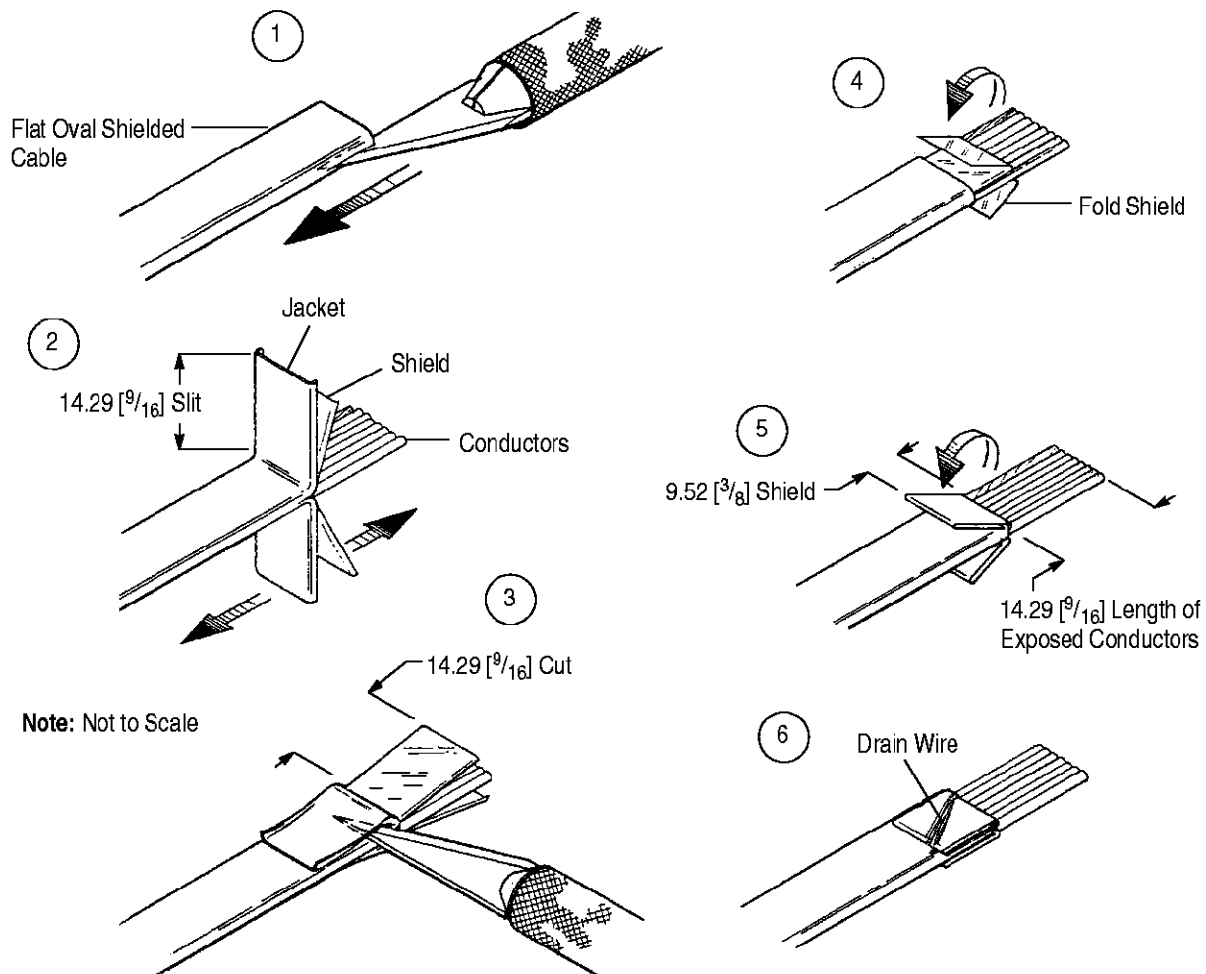


Figure 3

**B. Round Shielded Cable**

This cable must be prepared according to the following. Refer to Figure 4:

1. Insert blade tip between the shield and jacket. Slit the jacket  $15.88 [5/8]$  back from the end.
2. Pull the jacket away from the shield, and fold back over the cable. Cut off slit portion of the jacket  $15.88 [5/8]$  from the end of the conductors. Care shall be taken not to cut the shield.
3. Find the overlap seam in the shield, and pull the shield away from the conductors while being careful not to damage the shield.
4. Fold the shield back over the cable.
5. Trim the shield to approximately  $9.52 [3/8]$  in length. Form the shield smoothly around the outside of the cable. Untwist the conductors and orient them in desired sequence. Trim the conductors evenly to  $14.29 [9/16]$  in length.

6. If the drain wire is to be terminated within the plug, insert the drain wire into the wire circuit of the plug, and terminate according to the instructions packaged with the applicable tooling.

If the drain wire is to be terminated to the plug shield, bend the drain wire back tightly across the center of the cable shield on the side of the cable that will face the locking latch side of the plug when the cable is inserted. Cut the drain wire to the same length as the cable shield. Terminate the plug according to the instructions packaged with the applicable tooling.

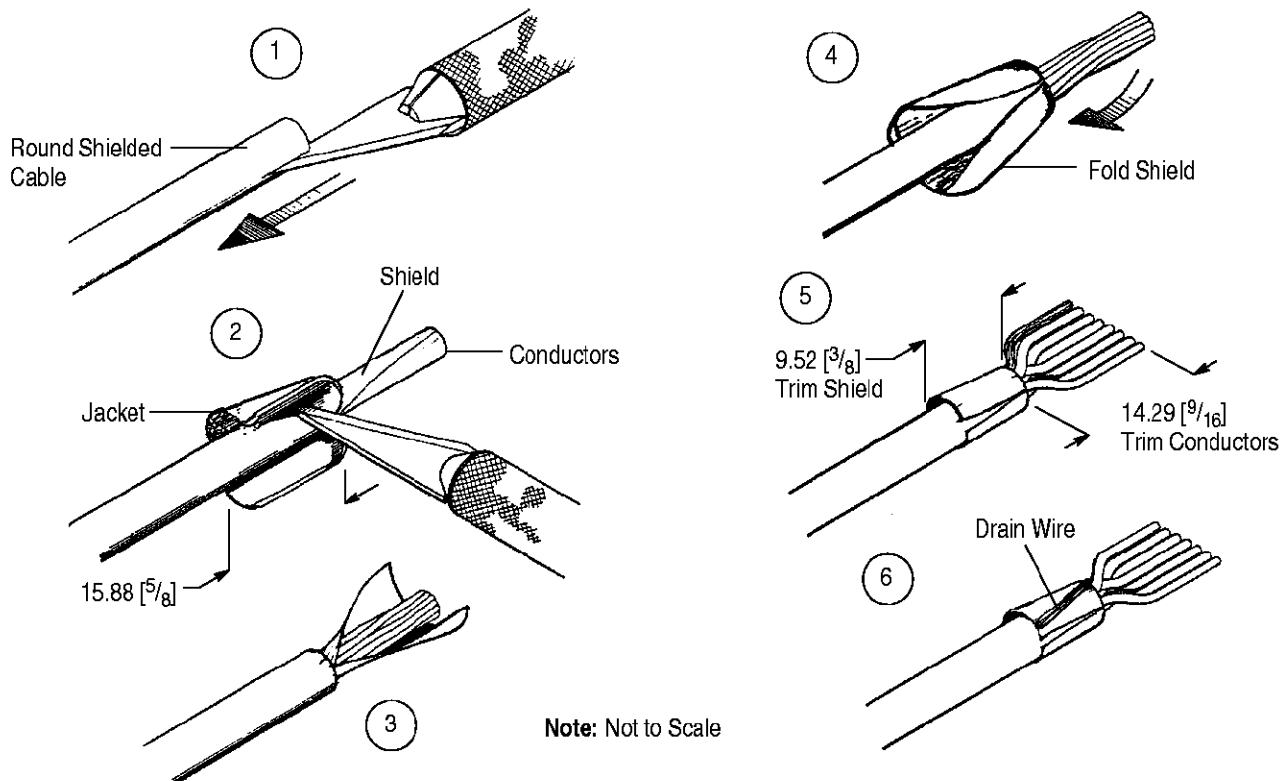


Figure 4

### 3.6. Termination Requirements

#### A. Conductor Location

Conductors must be fully inserted into the proper wire circuit of the plug to ensure that the terminals pierce a sufficient wire area. It is preferred that all conductors be visually bottomed against the end of the wire circuits. If individual conductors are not completely inserted after termination, they must be inserted at least past the terminal and into the reference zone to ensure a proper electrical interface. See Figure 5.

#### B. Crimp Height

The crimp height shall be measured from the top of the terminals to the bottom of the housing (not including locking tab) and must be within the dimension provided in Figure 5.

**NOTE** All terminals must be at approximately the same height. A crimp height gage is available for measuring plug crimp height (refer to Section 5 for part number and description).

#### C. Internal Strain Reliefs

The primary strain relief must be fully engaged on the cable jacket, and the secondary strain relief must be fully engaged on the cable conductors. Both strain reliefs must be fully engaged to isolate the termination area from external forces applied to the cable. It is acceptable for the primary strain relief to cut into the jacket as long as the conductor insulation is not compromised. See Figure 5.

**NOTE** For unshielded plug, the primary and secondary strain reliefs can be visually inspected through the side of the housing.

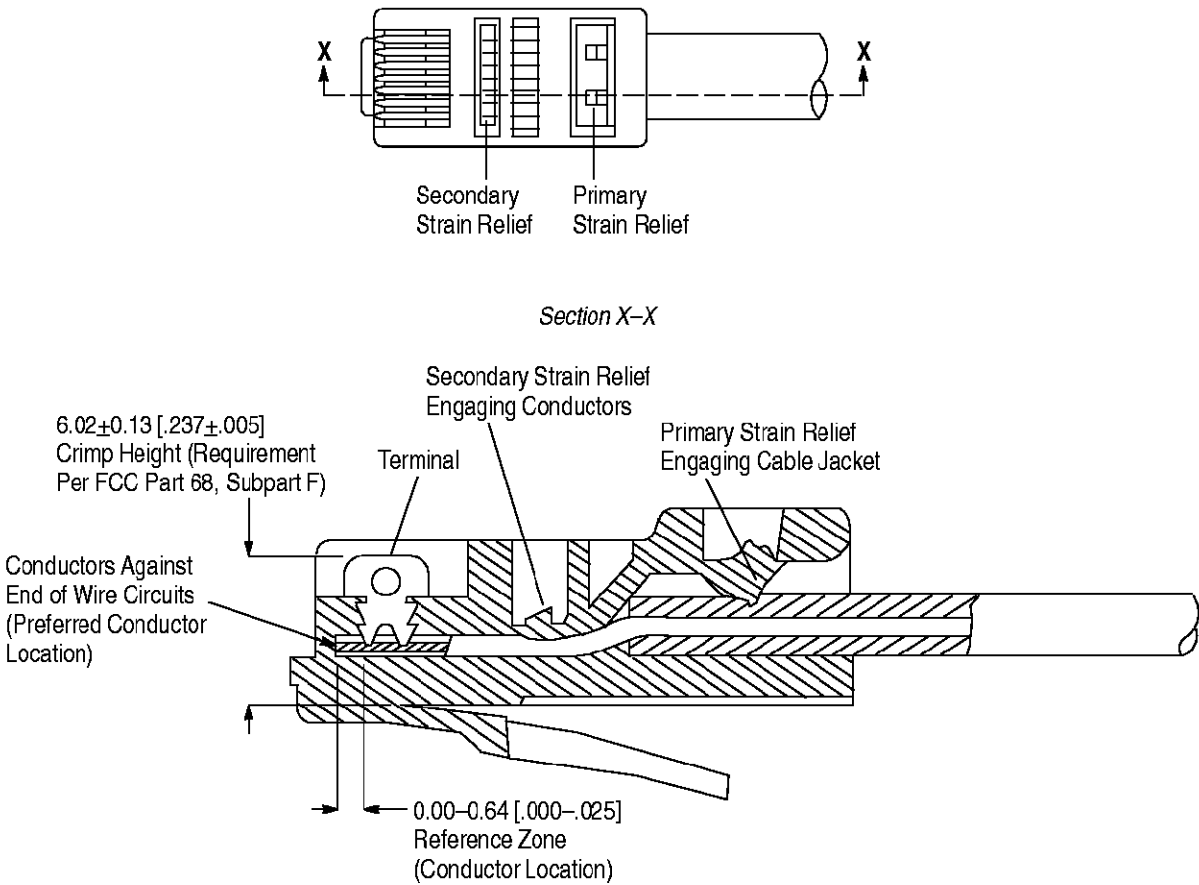


Figure 5



### 3.7. Ancillary Items

#### A. External Strain Relief

**NOTE** *The external strain relief can only be used with 8- and 10-position (shielded and unshielded) plugs.*

The external strain relief provides a secure grip (360° wrap) on the cable jacket for extraordinary strain relief on the cable and a redundant low impedance ground path to equipment. For shielded plugs, the external strain relief also provides a secure grip on the foil shield and a chassis ground through the plug shield. If a boot is used, an external strain relief containing a retention hole for securing the boot is available (the boot must be installed after the external strain relief with retention hole).

**NOTE** *Using the boot and the external strain relief with retention hole will provide optimum strain relief performance.*

Assembly of the external strain relief onto the plug must meet the requirements shown in Figure 6.

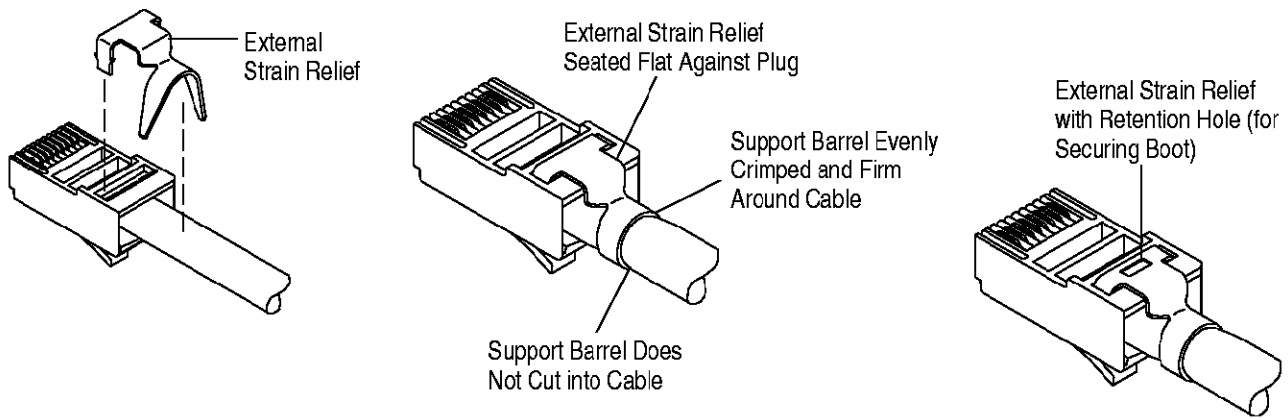


Figure 6

#### B. Boot

A boot is used to prevent the cable from kinking and bending too sharp at the plug cable opening. The boot is available with or without a hood. The hooded boot also prevents the plug locking latch from snagging other locking latches or cables.

The boots are available to fit maximum cable insulation diameters of 5.33 [.210] for unshielded plugs and 5.72 [.225] for shielded plugs. The maximum cable diameter is marked on the inside of each boot. The boots are colored to provide a color-coded cable configuration to ensure appropriate connections. The boot must be installed, small diameter end first, onto the cable before the stripping procedure. Boots are made of elastomer polyolefin. Refer to Figure 7.

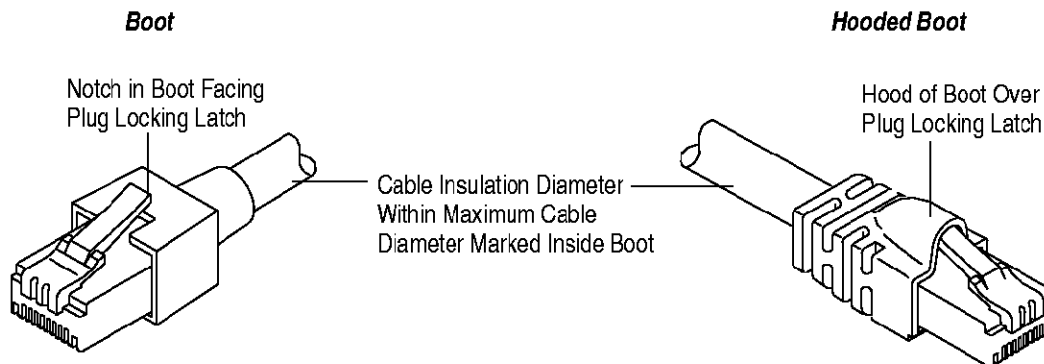


Figure 7

### 3.8. Mating

The plug must be inserted into the mating jack until it bottoms. When fully inserted, the plug locking tab will engage the jack housing and prevent the connectors from separating. The connectors will not unmate unless the plug locking latch is fully depressed. After mating, there will be a small amount of axial movement (travel) between the mated plug and jack, and with some combinations, depending on tolerance variations between original equipment manufacturers (OEM), could be up to 0.76 [0.30].

### 3.9. Repair

These plugs cannot be repaired; damaged plugs must be removed and discarded. The cable must be cut from the plug and re-terminated onto a new plug.

## 4. QUALIFICATION

Standard and small conductor Modular Plug Connectors are recognized component by Underwriters Laboratories Inc. (UL) under File E81956 (DUXR2), and Certified by Canadian Standards Association (CSA) under File LR 7189A.

## 5. TOOLING

Tooling part numbers and instructional material packaged with the tooling are shown in Figure 8.

### 5.1. Hand Tools

The modular plug hand tool terminates these plugs to all types of cable indicated in this document. The tool also cuts and strips unshielded flat oval cable. This tool is considered "premium" grade designed for field application, installation, and repair.

PRO-CRIMPER II hand tool assemblies are "commercial" grade tools designed primarily for field installation or repair. There is one available to terminate 10-position plugs and one to apply the external strain relief.

The chordal hand tool is an "economy" grade tool used to strip the cable and terminate the plugs. This tool is designed for occasional use and low-volume application.

### 5.2. 626 Pneumatic Tooling System

The pneumatic tooling system consists of a pneumatic power unit, tool holder assembly, adapter, and die assembly used to terminate the plug onto the cable. This tooling system was developed to reduce operator fatigue and provide interchangeability of die assemblies. The system is designed for prototype and medium-volume application of loose piece plugs.

### 5.3. Semi-Automatic Machine

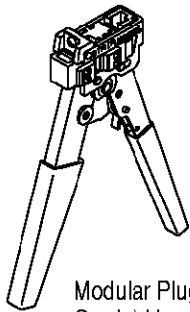
These power units provide the force required to drive applicators for terminating continuous strip plugs onto flat cable. They provide for medium-volume applications. These machines are designed to be bench mounted.

### 5.4. Terminators

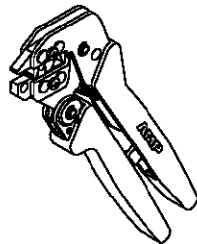
The terminators are pneumatically powered, bench-mounted tools controlled by a foot valve to terminate plugs to create a cable assembly. Terminating modules fit interchangeably into the dual terminators. During termination, the dual terminators test the assembly for electrical circuit continuity. The single terminators require a specific tooling kit to terminate one plug style and does not provide testing. These tools provide for high-volume applications.

### 5.5. Crimp Height Gage

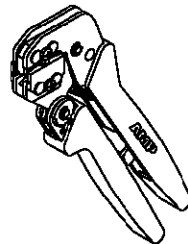
The crimp height gage is used for 2-, 4-, 6-, 8-, and 10-position plugs. Take note that 4-position handset and 6-position offset plugs are *not* included. The gage consists of a connector nest and a GO/NO-GO spanner.



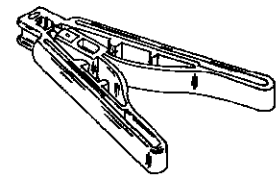
Modular Plug (Premium Grade) Hand Tool 2-231652-[ ] (Includes Die Set 853400-[ ]) (408-9767)



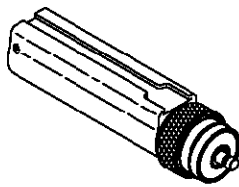
PRO-CRIMPER II Hand Tool Assembly 224928-1 (For External Strain Relief Application) (408-4167)



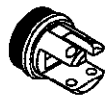
PRO-CRIMPER II Hand Tool Assembly 58560-1 (For 10-Position Plugs) (408-4093)



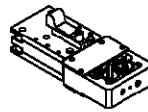
Modular Plug Connector Chordal Hand Tool 231648-1 (For 2-, 4-, and 6-Position Plugs) (408-3151)  
231649-1 (For 4-Position Handset Plugs) (408-3172)



626 Pneumatic Tooling Assemblies 189721-[ ] and 189722-[ ] (409-5862)



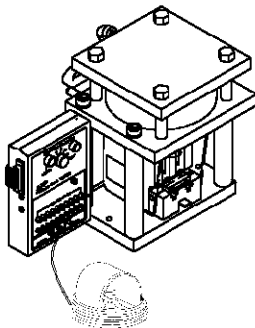
Straight Action Holder Assemblies 356304-1 (Logic) and 189928-1 (Non-Logic) (408-4321)



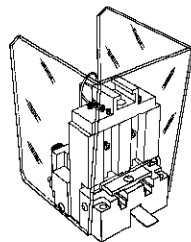
Modular Plug Adapter 318510-1 (408-4246)



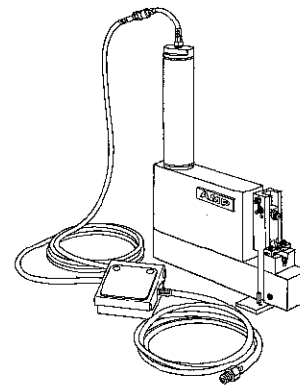
Die Set 853400-[ ] (408-9767)



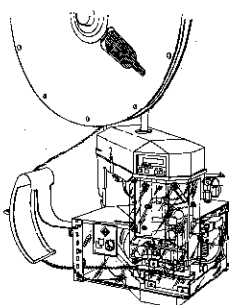
Dual Modular Plug Terminators 1320840-[ ] (409-10010)



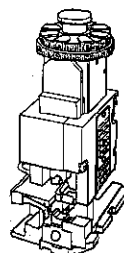
Terminating Modules 856196-[ ] (408-9743)



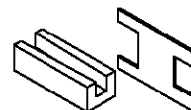
Modular Plug Single Terminators 354711-[ ] and Tooling Kits 354714-[ ] (408-9919)



AMP-O-ELECTRIC Model "G" Terminating Machines 354500-[ ] (409-5842)



Miniature Quick Change Applicators 469268-[ ] (408-8057)

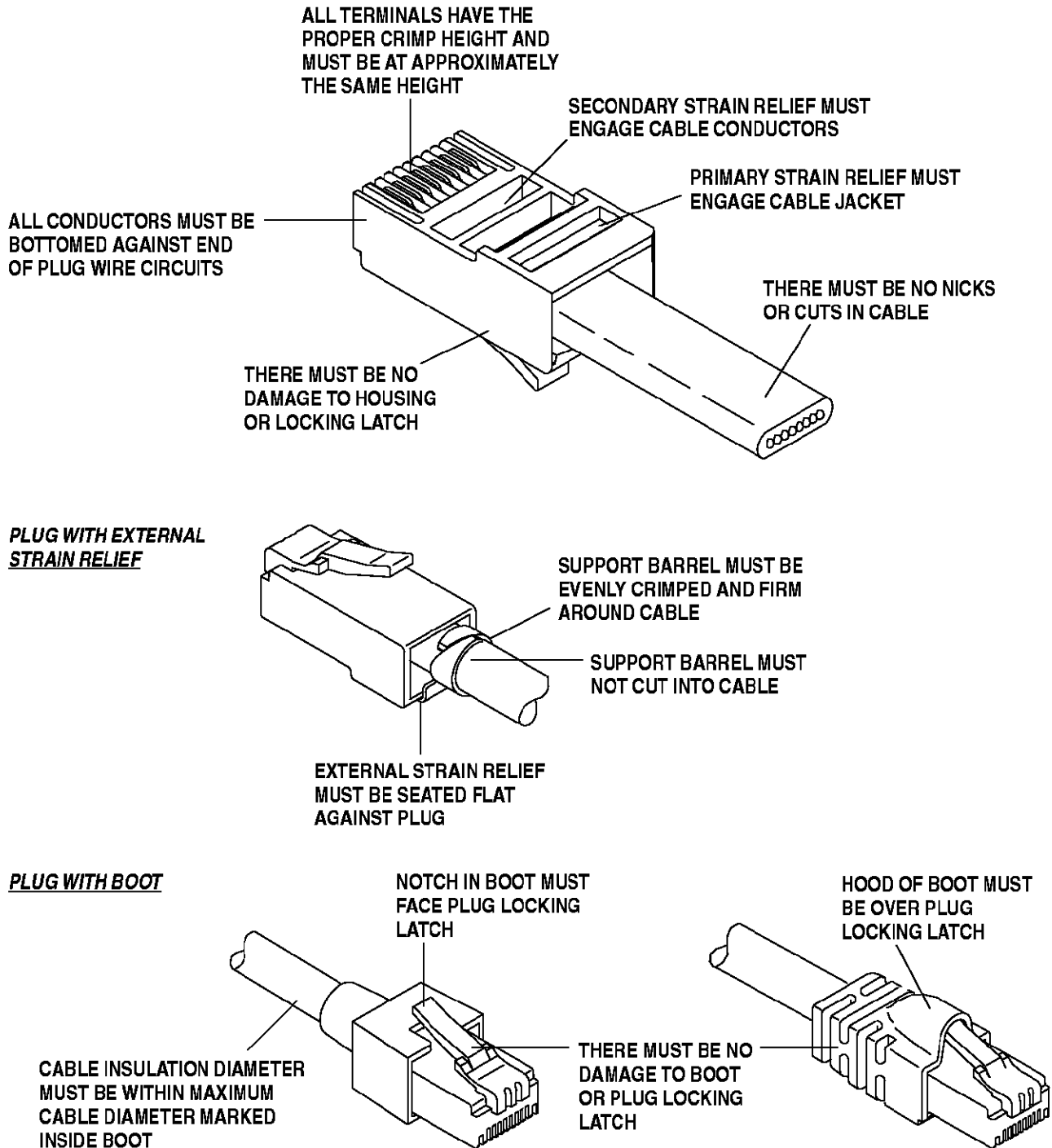


Crimp Height Gage 904170-1 (408-4389)

Figure 8

**6. VISUAL AID**

The illustration below shows a typical application of Modular Plug Connectors (standard and small conductor). This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.



**FIGURE 9. VISUAL AID**