

### 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  $\pm 0.13$  [ $\pm 0.005$ ] 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 standard and small conductor 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 [0.40] centerline spacing. These modular plugs are also available in line and keyed housing styles. The modular plugs contain solid wire terminals or stranded wire terminals; each terminal design optimized for its specific design.

The modular 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 [0.39].

Each modular plug features two internal strain reliefs to protect the modular 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 modular plugs are terminated using the insulation piercing technique. The modular plugs are available in loose piece for terminating with manual or pneumatically-powered tools.

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.

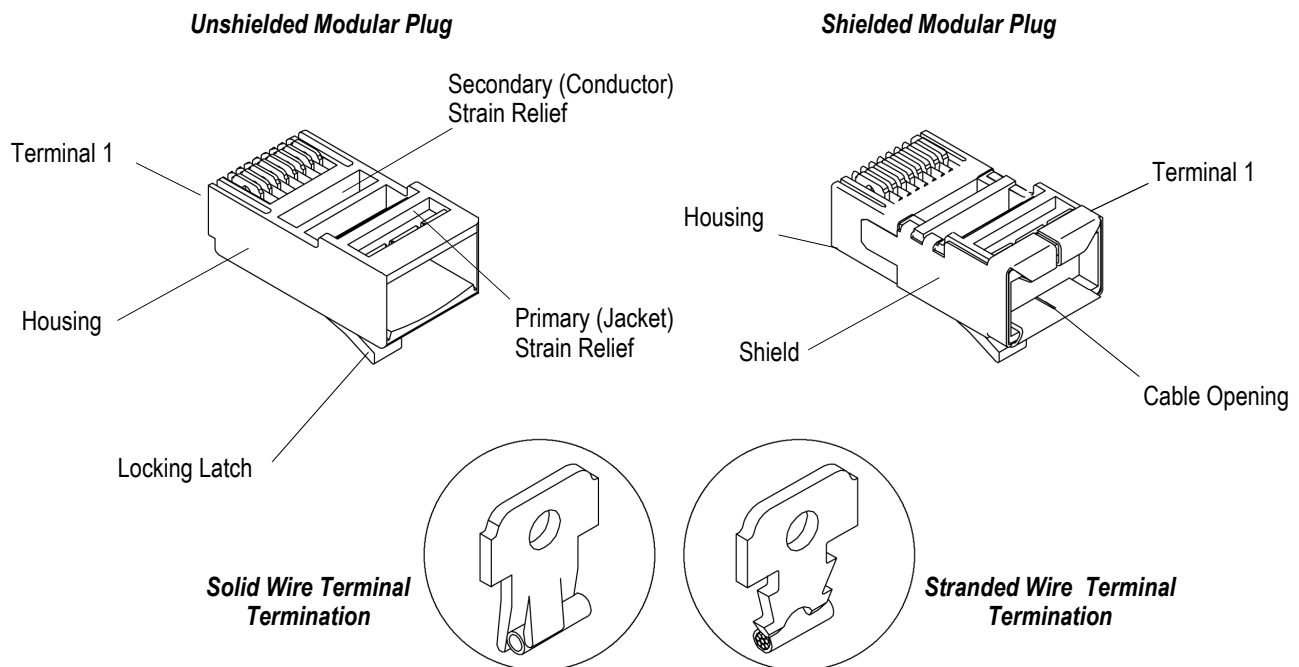


Figure 1

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## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

Since the previous release of this document, the new company logo has been applied.

### 2.2. Customer Assistance

Reference Product Base 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 or, after purchase, by calling PRODUCT INFORMATION 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 PRODUCT INFORMATION 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 product assembly instructions or tooling setup and operation procedures and Customer Manuals (409-series) provide machine setup and operating 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 Line Modular Plugs)
- 408-4093 PRO-CRIMPER\* III Hand Tool Assembly 58560-1  
(For 10-Position Modular Plugs)
- 408-4167 PRO-CRIMPER III Hand Tool Assembly 224928-1  
(For External Strain Relief Application)
- 408-4389 Crimp Height Gage 904170-1
- 408-9743 Terminating Modules 856196-[ ] for Use with Modular Plug Dual Terminators 1320840-[ ]
- 408-9767 Modular Plug Hand Tools (Premium Grade) 231652-[ ]
- 408-9919 Modular Plug Single Terminators 354711-[ ] and Tooling Kits 354714-[ ]
- 409-10010 Modular Plug Dual Terminators 1320840-[ ]

## 3. REQUIREMENTS

### 3.1. Material

Modular plug housings are made of flame retardant polycarbonate rated Underwriter Laboratories, Inc. (UL) 94 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 modular plug material.

#### B. Shelf Life

The modular plugs should remain in the shipping containers until ready for use to prevent plating damage to the terminals. The modular 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 modular 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 modular plugs accept cable with insulated conductor outside diameter range of 0.74 through 0.99 [.029 through .039].

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

#### NOTE

*Not all standard modular plugs have a small conductor modular 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 modular 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

##### 1. Cable jacket insulation types:

Flat oval

Height: 2.29+0.25 [.090+.010]

Width for 2-conductor: 3.81+0.13 [.150+.005]

Width for 4-conductor: 4.83+0.25 [.190+.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 modular 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 modular 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 modular plugs. The strip length for the cable and specific cable and modular plug combinations is shown in Figure 2.

**NOTE**

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



#### A. Flat Oval Shielded Cable

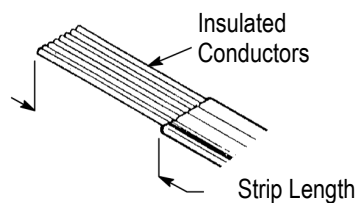
This cable must be prepared according to the following. Refer to Figure 3:

1. Insert a 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 modular plug, insert the drain wire into the wire circuit of the modular plug, and terminate according to the instructions packaged with the applicable tooling.

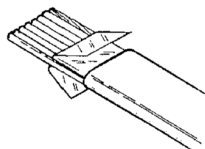
If the drain wire is to be terminated to the modular plug shield, bend the drain wire back tightly across the center of the cable shield on the side of the cable that will face the locking latch side of the modular plug when the cable is inserted. Cut the drain wire to the same length as the cable shield.

### Typical Flat Oval Cable

Unshielded

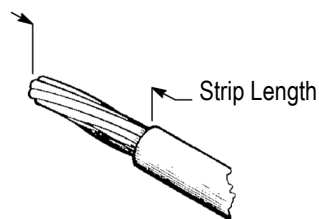


Shielded



### Typical Round Cable

Unshielded



Shielded



| MODULAR PLUG                       |                       | CABLE     |       |          |       |                              |
|------------------------------------|-----------------------|-----------|-------|----------|-------|------------------------------|
| TYPE                               | POSITION/<br>TERMINAL | FLAT OVAL |       | ROUND    |       | STRIP<br>LENGTH              |
|                                    |                       | Stranded  | Solid | Stranded | Solid |                              |
| Unshielded, Handset                | 4/4                   | ✓         | ✓     | --       | --    | 6.35 - 7.14<br>[.25 - .28]   |
| Unshielded, Keyed                  | 8/8                   | ✓         | ✓     | ✓        | --    | 12.7 - 14.3<br>[.25 - .56]   |
|                                    | 10/10                 | --        | --    | ✓        | --    |                              |
| Unshielded, Line                   | 6/2                   | ✓         | --    | --       | --    | 6.35 - 7.14<br>[.25 - .28]   |
|                                    | 6/4                   | ✓         | ✓     | --       | --    |                              |
|                                    | 6/6                   | ✓         | ✓     | ✓        | --    |                              |
|                                    | 8/4                   | ✓         | --    | --       | --    | 12.7 14.3<br>[.50 - .56]     |
|                                    | 8/8                   | ✓         | ✓     | ✓        | ✓     |                              |
|                                    | 10/10                 | --        | --    | ✓        | --    |                              |
| Unshielded Small Conductor (Blue)* | 6/4, 6/6, 8/8         | ✓         | ✓     | ✓        | ✓     | 6.35 - 7.14[.<br>[.25 - .28] |
|                                    | 10/10                 | ✓         | ✓     | ✓        | --    | 6.35 - 7.14[.<br>[.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]                   |
| Shielded, Line, Keyed              | 8/4                   | ✓         | --    | --       | --    | 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

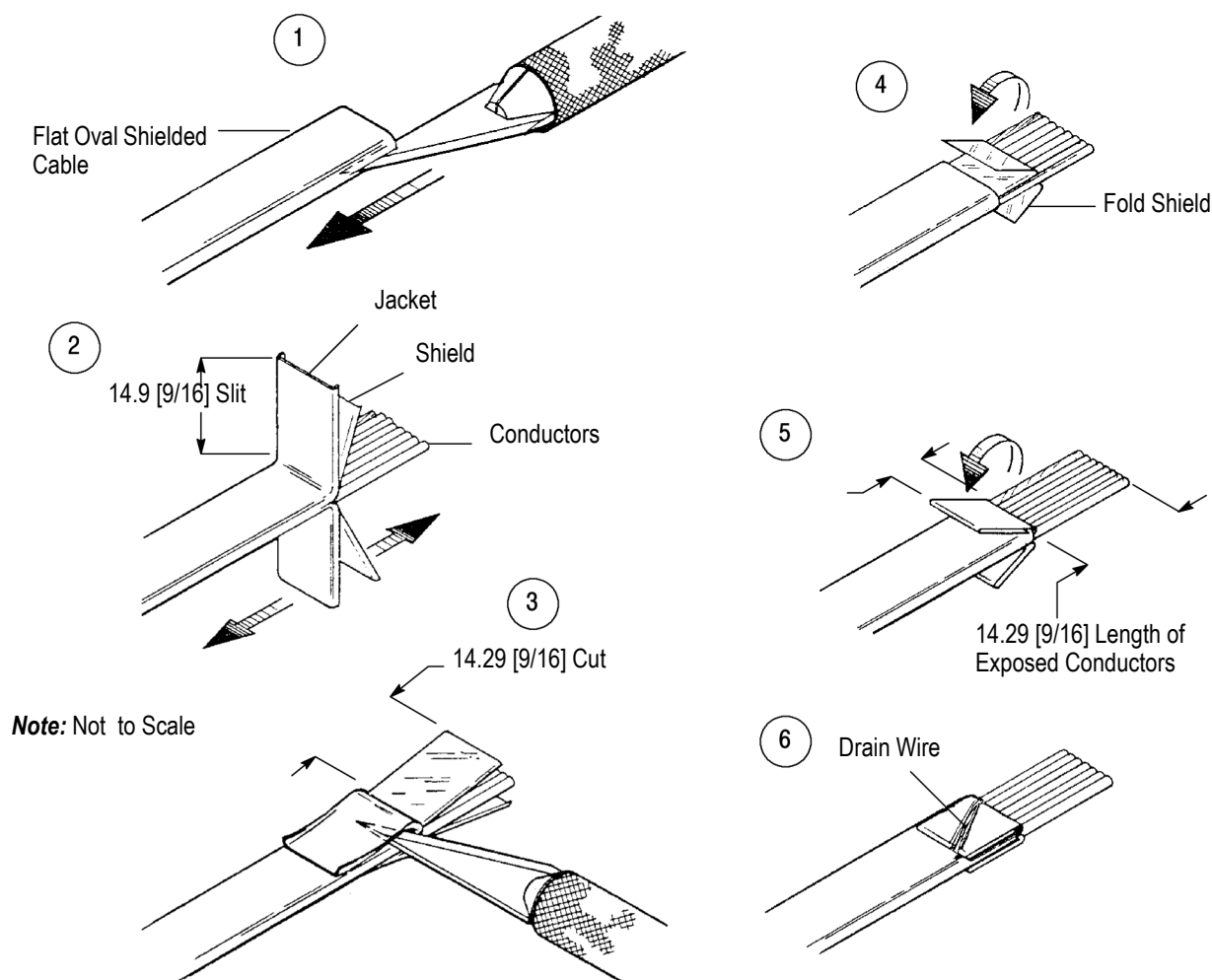


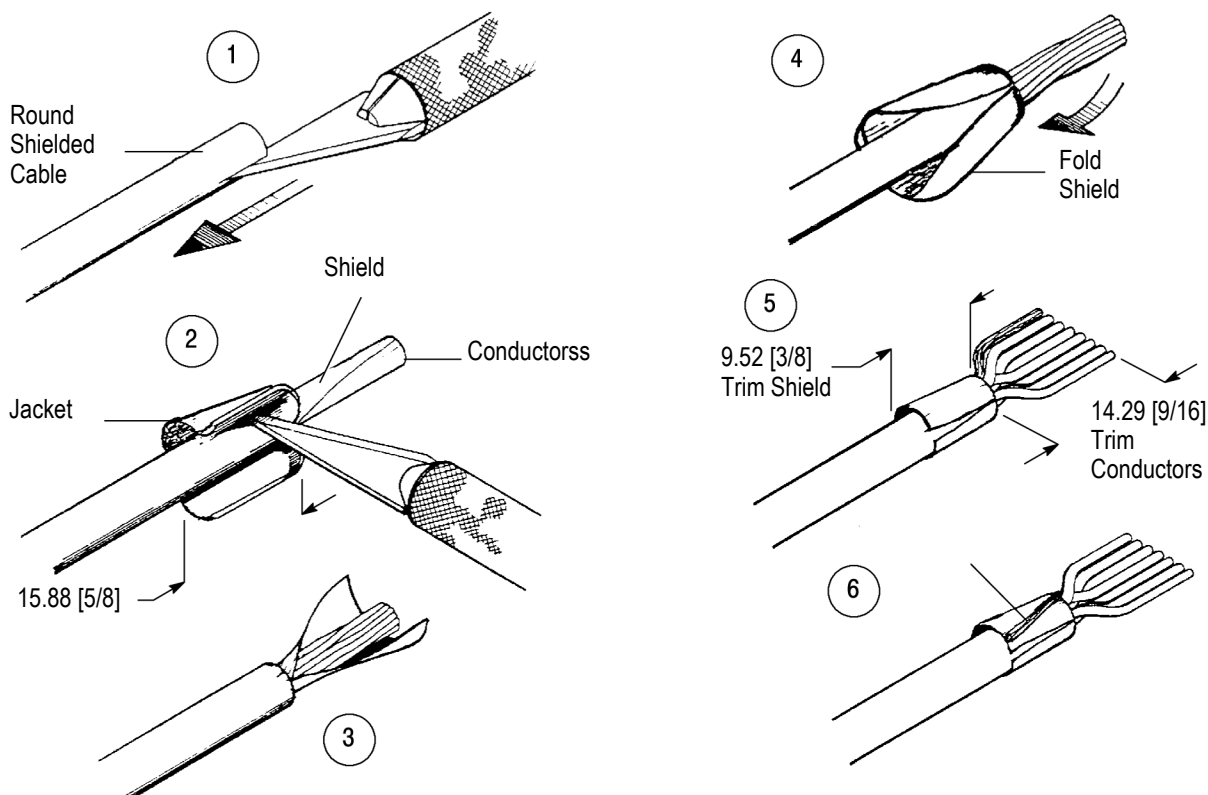
Figure 3

## B. Round Shielded Cable

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

- 1) Insert a 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 it back over the cable. Cut off the 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 modular plug, insert the drain wire into the wire circuit of the modular plug, and terminate according to the instructions packaged with the applicable tooling.

If the drain wire is to be terminated to the modular 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 modular plug when the cable is inserted. Cut the drain wire to the same length as the cable shield.



**Note:** Not to Scale

Figure 4

### 3.6. Termination Requirements

#### A. Conductor Location

Conductors must be fully inserted into the proper wire circuit of the modular 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 modular 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 modular plug, the primary and secondary strain reliefs can be visually inspected through the side of the housing.

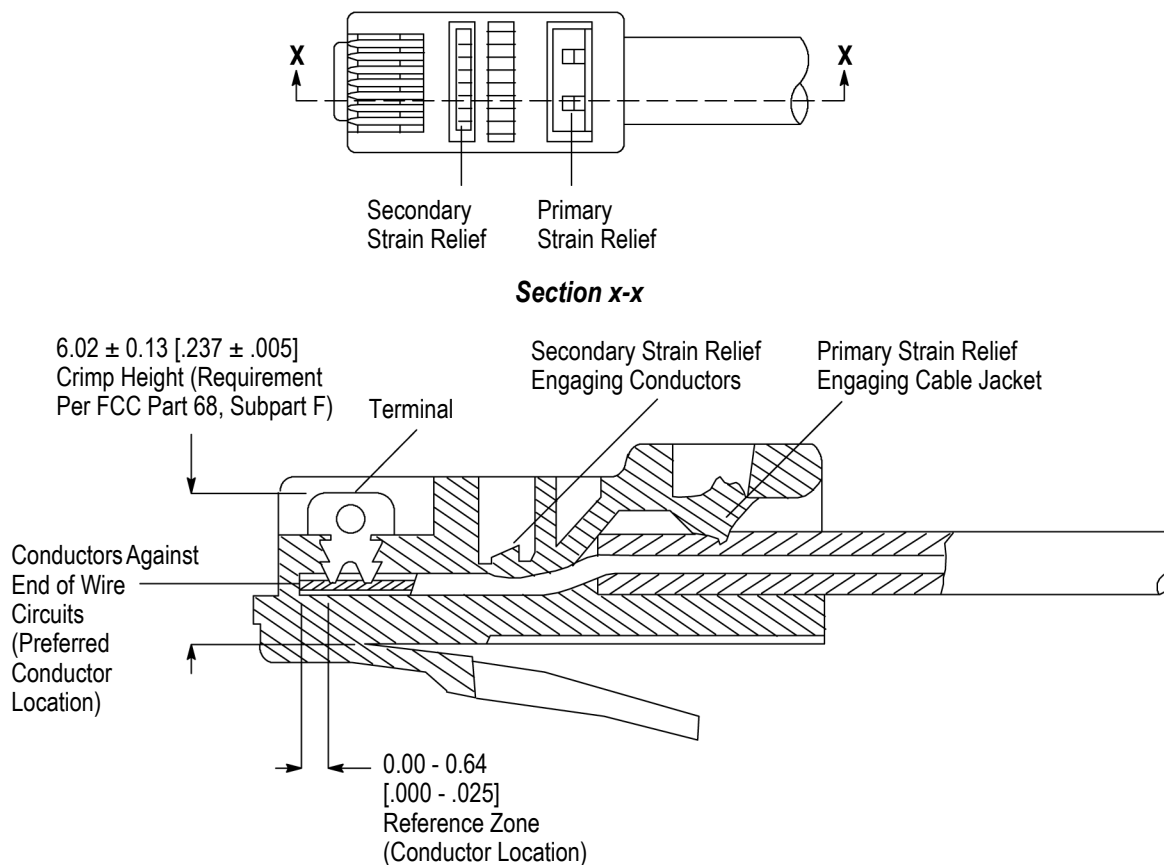


Figure 5

### 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) modular 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 modular plugs, the external strain relief also provides a secure grip on the foil shield and a chassis ground through the modular 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 modular plug must meet the requirements shown in Figure 6.



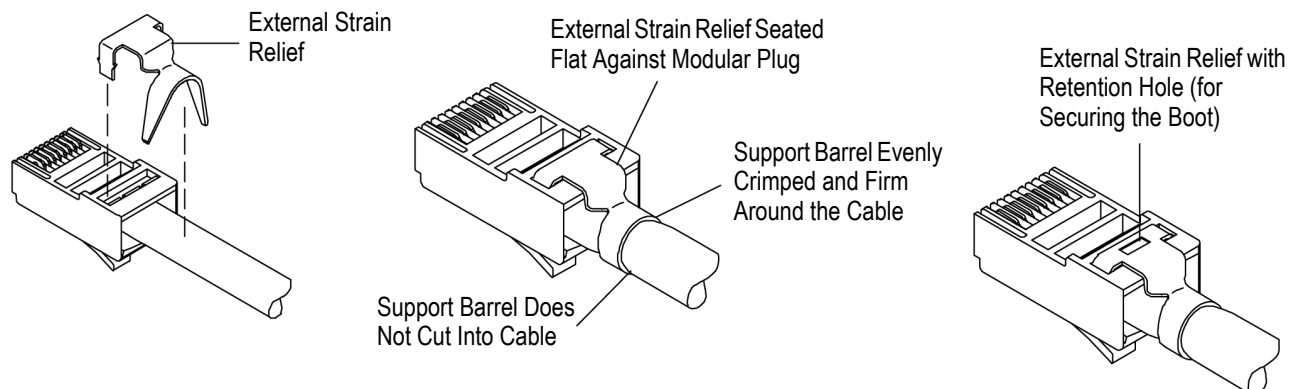


Figure 6

## B. Boot

A boot is used to prevent the cable from kinking and bending too sharp at the modular plug cable opening. The boot is available with or without a hood. The hooded boot also prevents the modular 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 modular plugs and 5.72 [.225] for shielded modular 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.

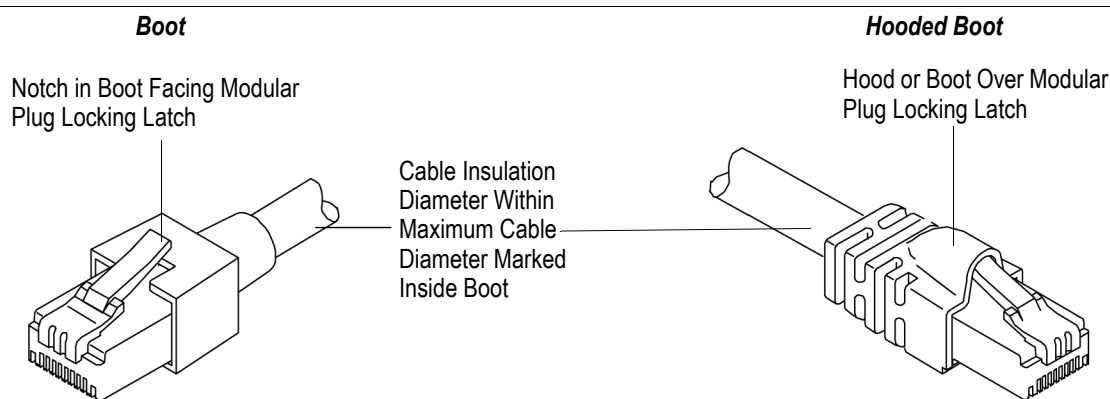


Figure 7

## 3.8. Mating

The modular plug must be inserted into the mating jack until it bottoms. When fully inserted, the modular plug locking tab will engage the jack housing and prevent the connectors from separating. The connectors will not unmate unless the modular plug locking latch is fully depressed. After mating, there will be a small amount of axial movement (travel) between the mated modular plug and jack, and with some combinations, depending on tolerance variations between original equipment manufacturers (OEM), could be up to 0.76 [.030].

## 3.9. Repair

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

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## 4. QUALIFICATION

Standard and small conductor Modular Plug Connectors are Component Recognized by Underwriters Laboratories Inc. (UL) in File E81956 (DUXR2), and Certified by CSA International in 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 premium grade modular plug hand tool terminates these modular plugs to all types of cable indicated in this document. The tool also cuts and strips unshielded flat oval cable. This tool is designed for field application, installation, and repair.

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

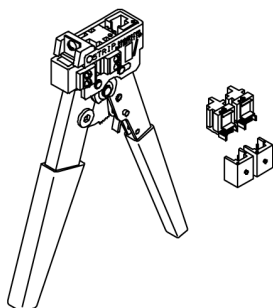
The chordal hand tool is an "economy" grade tool used to strip the cable and terminate the modular plugs. This tool is designed for occasional use and low-volume application.

### 5.2. Terminators

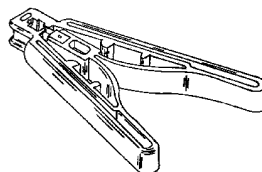
The terminators are pneumatically powered, bench-mounted tools controlled by a foot valve to terminate modular plugs to create a cable assembly. Terminating modules fit interchangeably into the dual terminators. During termination, the dual terminators test the assembly for electrical circuit continuity.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

### 5.3. Crimp Height Gage

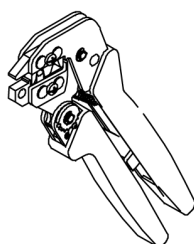
The crimp height gage is used to measure the crimp height of the terminated modular plug. The crimp height gage is used for 2-, 4-, 6-, 8-, and 10-position modular plugs. Take note that the gage cannot be used for 4-position handset modular modular plugs. The gage consists of a connector nest and a GO/NO-GO spanner.



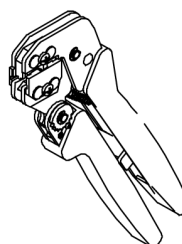
Modular Plug Hand Tools  
(Premium Grade) 231652-[]  
with Die Sets 853400-[]  
(408-9767)



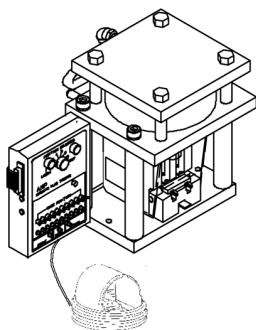
Modular Plug Connector Chordal  
Hand Tool 231648-[] (For 2-, 4-,  
and 6-Position Line Modular Plugs)  
(408-3151)



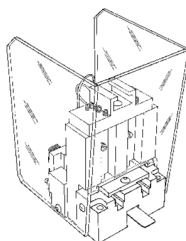
PRO-CRIMPER III Hand Tool  
Assembly 224928-1 with  
Die Assembly 224928-2  
(For External Strain Relief Application)  
(408-4167)



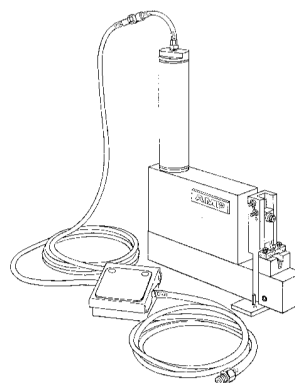
PRO-CRIMPER III Hand Tool  
Assembly 58560-1 with Die  
Assembly 58560-2  
(For 10-Position Modular Plugs)  
(408-4093)



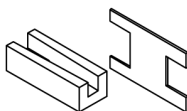
Modular Plug Dual Terminators  
1320840-[] (409-10010)



Terminating Modules  
856196-[] (408-9743)



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

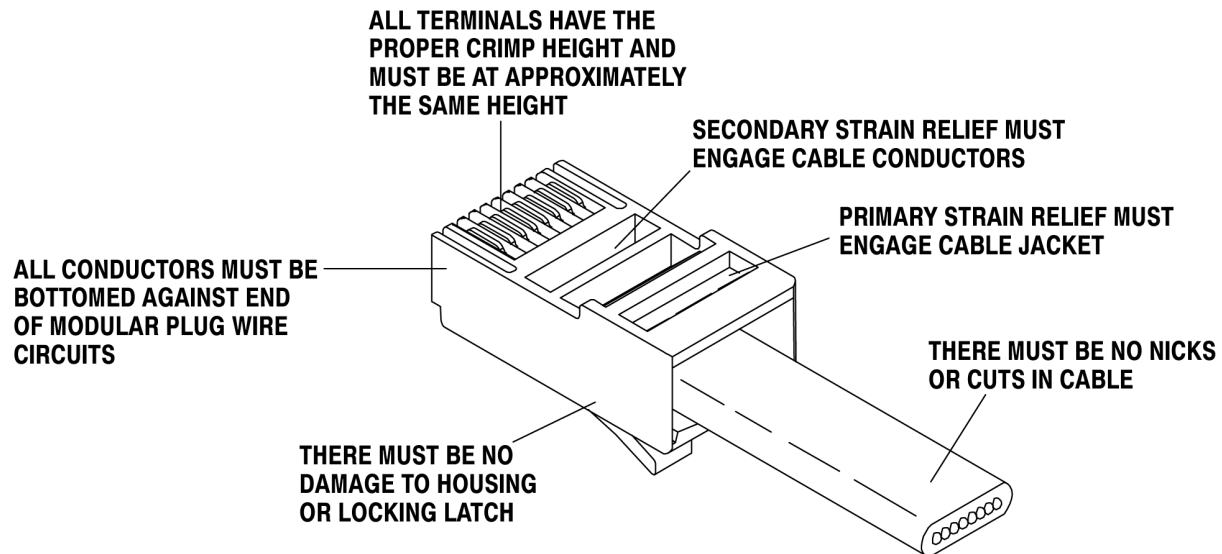


Crimp Height Gage  
904170-1 (408-4389)

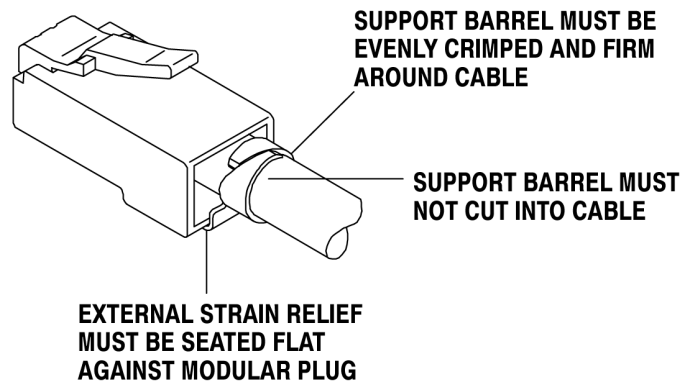
Figure 8

## 6. VISUAL AIDVISUAL AID

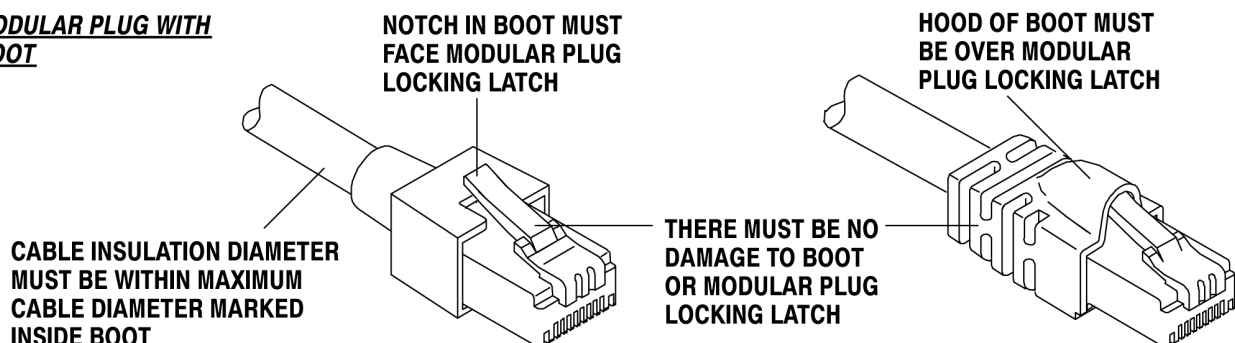
The illustration below shows a typical application of standard and small conductor Modular Plug Connectors. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding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



### **MODULAR PLUG WITH EXTERNAL STRAIN RELIEF**



### **MODULAR PLUG WITH BOOT**



**FIGURE 9. VISUAL AID**