



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



**HIGH-VOLTAGE - MORTAL DANGER**

- This connector is intended for use in high-voltage applications. Special care must be applied to ensure that the connector functions as intended.
- If you suspect that the connector has been modified, damaged, contaminated, or otherwise compromised, please discontinue its use immediately.
- This connector should only be serviced by a trained and qualified technician.

**1. INTRODUCTION**

This specification covers the requirements for application of the Sealed Two-Position AMP+ HVA280-2phm Plug High-Voltage Connector. The AMP+ HVA280 system is designed for a metric wire size range of 2.5 mm<sup>2</sup> to 4 mm<sup>2</sup>. The connector incorporates conductive EMI shields to reduce radiated emissions in the application.

The AMP+ HVA280 connector system is available in five different keying or polarizing configurations with an integrated High Voltage Inter-Lock (HVIL) mechanism. Un-mating of the connector system is a multiple step process which enables the system to meet a delayed un-mate sequence.

The AMP+ HVA280 connector system incorporates up to two 2.8 mm receptacle contacts and up to two 0.63 mm pin contacts in the plug connector which mates with up to two 2.8 mm blade contacts and up to two 0.63 mm receptacle contacts in the header assembly. Termination tooling is available for all of the contacts. The connector housing is molded in orange to denote a high voltage system.



*These high-voltage connectors must NOT be mated with any other type of connector.*

When corresponding with TE Connectivity 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.

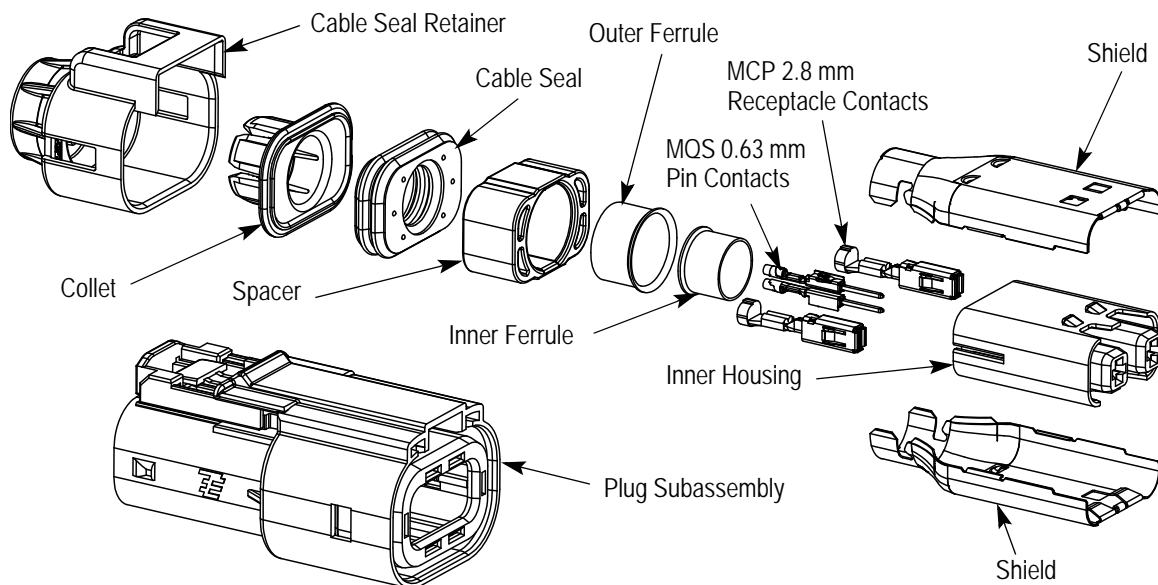


Figure 1

## 2. REFERENCE MATERIAL

### 2.1. Revision Summary

- Added new text to title and Paragraph 2.2
- Added new document to Paragraph 2.6 and new NOTE to Paragraph 3.6.1
- Added collet tool to Figure 28 and related information to table in Figure 28

### 2.2. Customer Assistance

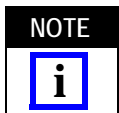
Reference Base Product Part Number 2103163, 2103436, and Product Code K994 are representative numbers of the AMP+ HVA280-2phm High-Voltage Plug Connector with Pass Through HVIL and 2-Stage Latching. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local TE Representative or, after purchase, by calling the Product Information Center number at the bottom of page 1.

### 2.3. Drawings

#### A. Customer 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, the Customer Drawing takes preference.

#### B. Reference Drawings



*These Reference Drawings (C-2103163) and (C-2103436) are available for part number relationships only and are not saleable items. Refer to drawings only for compatible part numbers for customer inquiry. For more information on Reference Drawings, call PRODUCT INFORMATION at the number at the bottom of page 1.*

### 2.4. Specifications

Application Specification 114-18148-1 provides termination procedures and application requirements for the MCP 2.8 mm receptacle terminals. Application Specification 114-18021 provides termination procedures and application requirements for the MQS 0.63 mm pin contacts.

### 2.5. Cable and Subcomponent Specification (Figure 2)

The following cable and subcomponent combinations have been validated by TE and should be used together to ensure optimum connector performance. Alternative cables may be used with the AMP+ HVA280 connector after ensuring performance through validation testing.

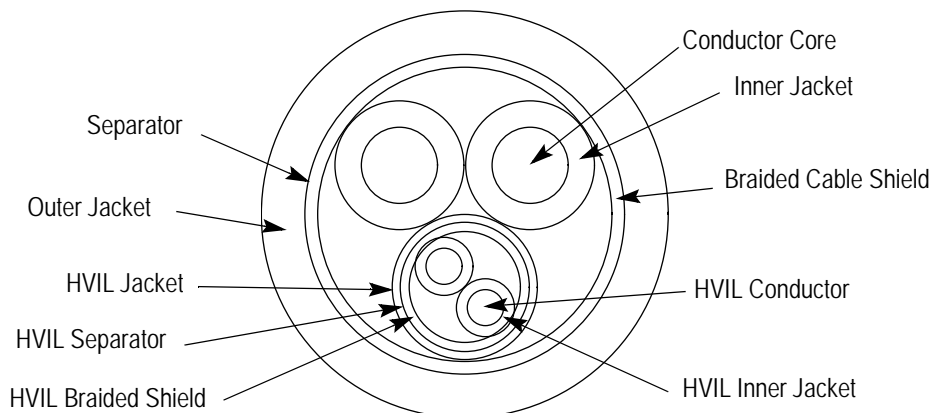


Figure 2

#### **Cable Option**

Cable supplier: KROMBERG & SCHUBERT  
 Cable Construction: 2X 4.0 mm<sup>2</sup> and 2X 0.5 mm<sup>2</sup>  
 Supplier cable part number: 64994093

KROMBERG & SCHUBERT is a trademark.

*Recommended subcomponents:*

- 1-968853-3 MCP Receptacle contact, 2.8 mm
- 963716-2 MQS Pin contact, 0.63 mm
- 2103157-1 Shield, plug
- 1587723-3 Inner ferrule
- 1587724-3 Outer ferrule
- 2103154-1 Cable seal
- 2103013-1 Cable seal retainer
- 2103155-1 Collet

**2.6. Instructional Material**

The following list includes available instruction sheets (408-series) that may provide assembly procedures for product, operation, maintenance and repair of tooling, and customer manuals (409-series) that provides setup, operation, and maintenance of machines.

<u>Document Number</u>	<u>Document Title</u>
408-2498	Crimping Head Cross Reference for Pneumatic Tools
408-4070	Pneumatic Head Assembly 679304-1
408-4303	Pneumatic CERTI-CRIMP* Tool Holder Assembly 356302-1
408-7424	Checking Terminal Crimp Height Gaging Die Closure
408-9930	PRO-CRIMPER* III Hand Crimping Tool Frame Assembly 354940-1
408-10441	Sealed Two-Position AMP+ HVA280 Header High-Voltage Connector System
408-32128	AMP+ HVA280 Collet Tool 2280054-[ ]
409-5862	626 Pneumatic Tooling Assemblies 189721-[ ] and 189722-[ ]
411-18087	ERGO CRIMP* Hand Tool 539635-1
411-18100	ERGO CRIMP Die 539682-2
411-18169	ERGO CRIMP Die 539723-2
411-18284	ERGO CRIMP Die 3-1579001-5

**3. REQUIREMENTS**

**3.1. Safety**

Do not stack contact packages so high that the shipping containers buckle or deform.

**3.2. Shelf Life**

The contacts should remain in the shipping containers until ready for use to prevent deformation to the contacts and/or damage to the housings. The products should be used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmissions.

**3.3. Chemical Exposure**

Do not store contacts near any chemicals listed below, as they may cause stress corrosion cracking in the contacts.

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

**3.4. Material**

The connector assemblies are made of thermoplastic materials and the terminals and shields are tin and silver-plated copper alloy.

**3.5. Circuit Identification**

The terminal cavities are numbered on the inner housing of each connector at the wire entry end.

**3.6. Assembly Procedures**

The following procedures show the details of the cable assembly and insertion instructions of the cable assembly into the plug subassembly.

**NOTE** Refer to Figure 2 for the various components of the cable as shown in an end view of the cable.



1. In the orientation shown in Figure 3, slide the cable seal retainer onto the cable first, then the collet, cable seal, spacer, then finally the outer ferrule.

**NOTE**



*Optional: The appropriate collet tool listed in Figure 28 can be used to ease sliding the collet down the cable.*

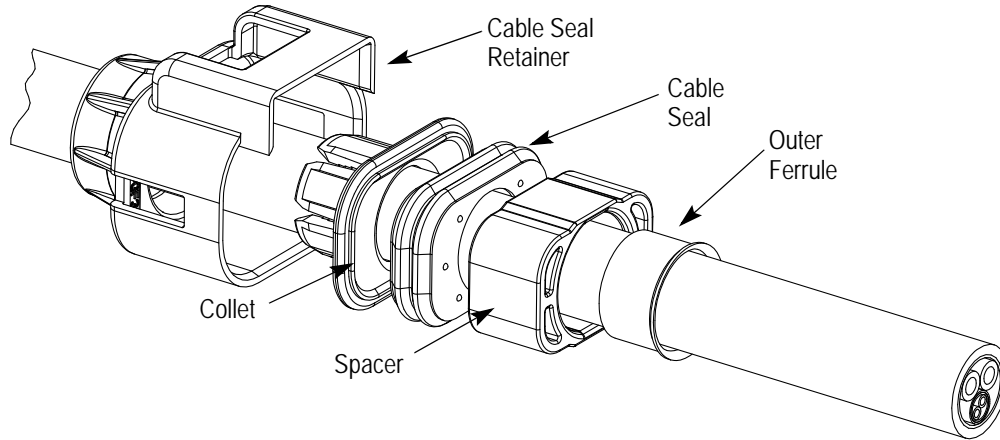


Figure 3

2. Strip and remove the outer cable jacket and separator (if present) from the end, exposing the braided cable shield as shown in Figure 4.

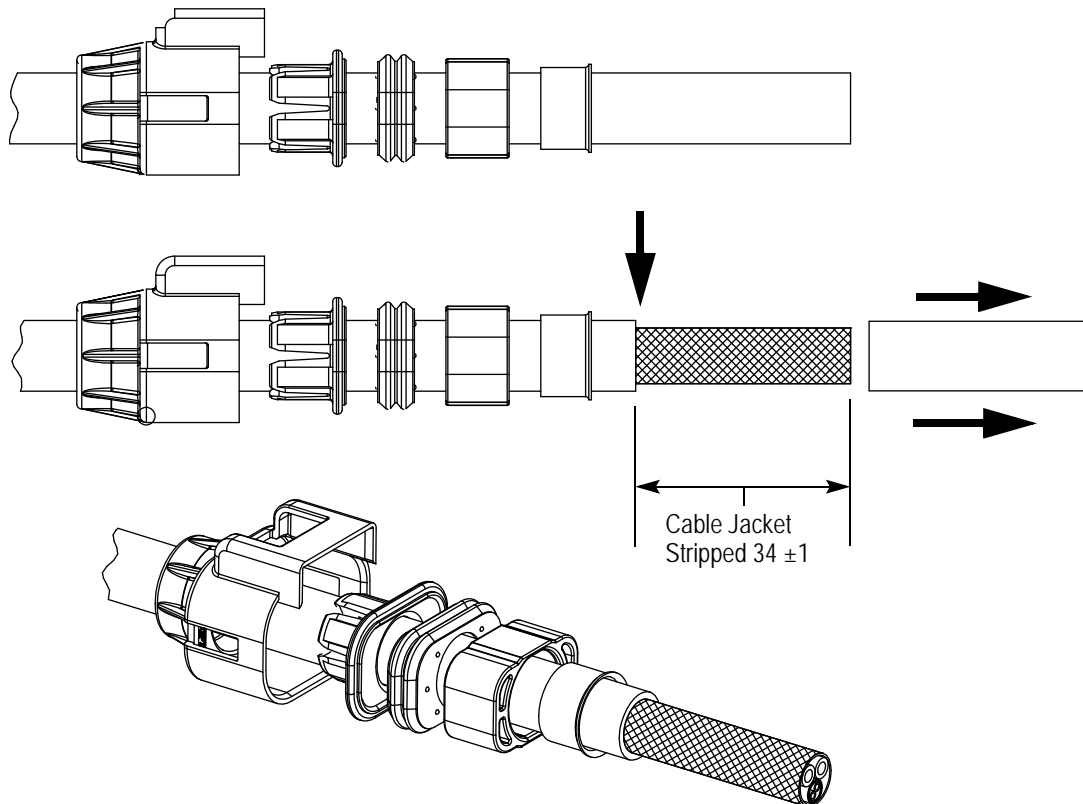


Figure 4

3. Insert the inner ferrule over the cable shield until it stops against the outer jacket as shown in Figure 5.

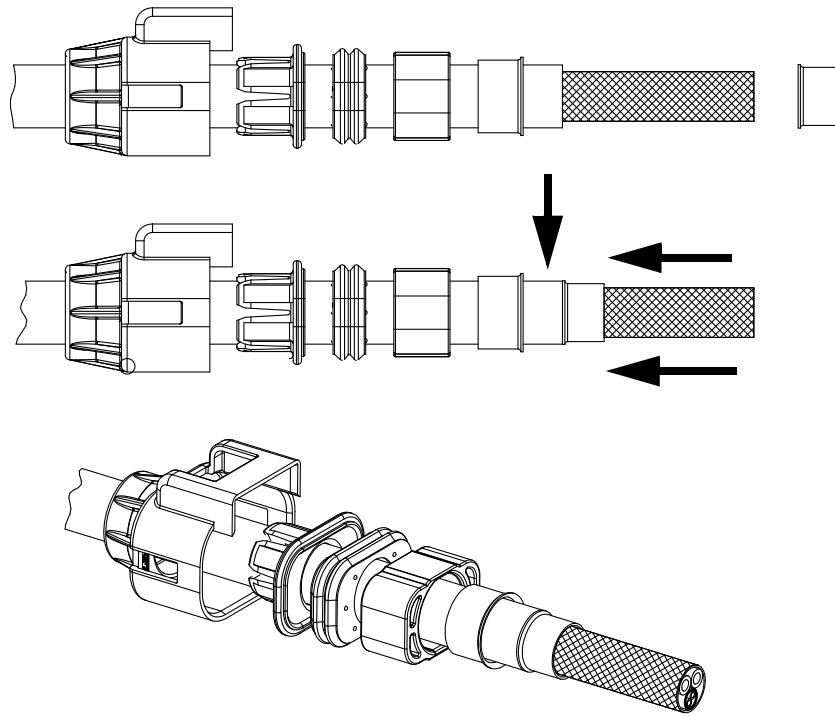


Figure 5

4. Fold the braided cable shield back over the inner ferrule and trim as shown in Figure 6. Remove filler and separator (if present).

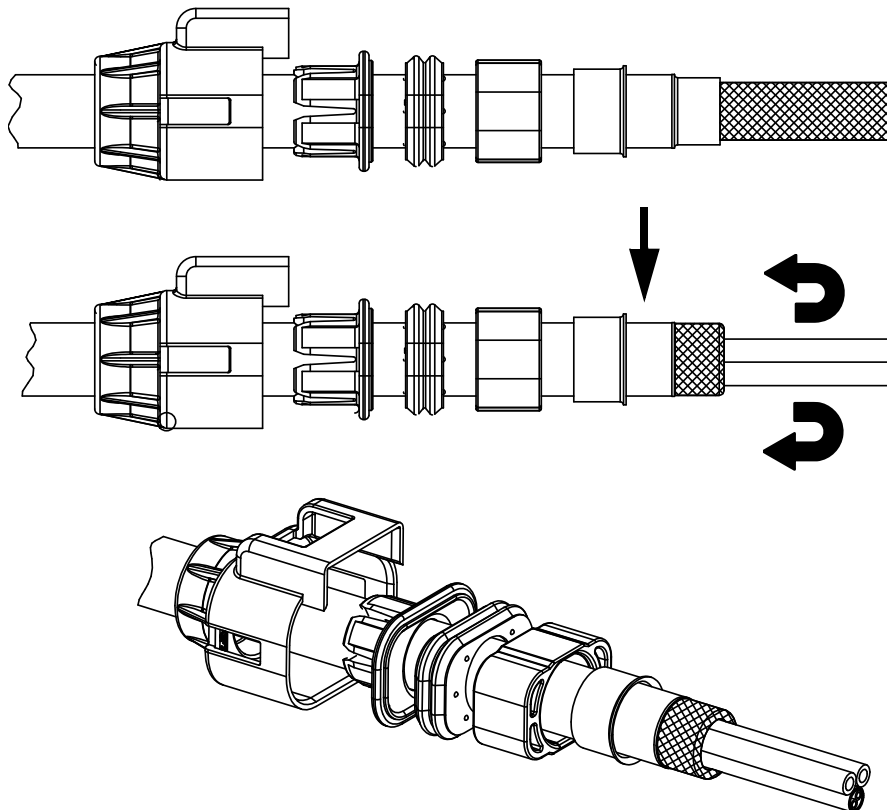


Figure 6

5. If present, strip and remove the HVIL shield jacket and separator from the end, exposing the braided HVIL shield as shown in Figure 7.

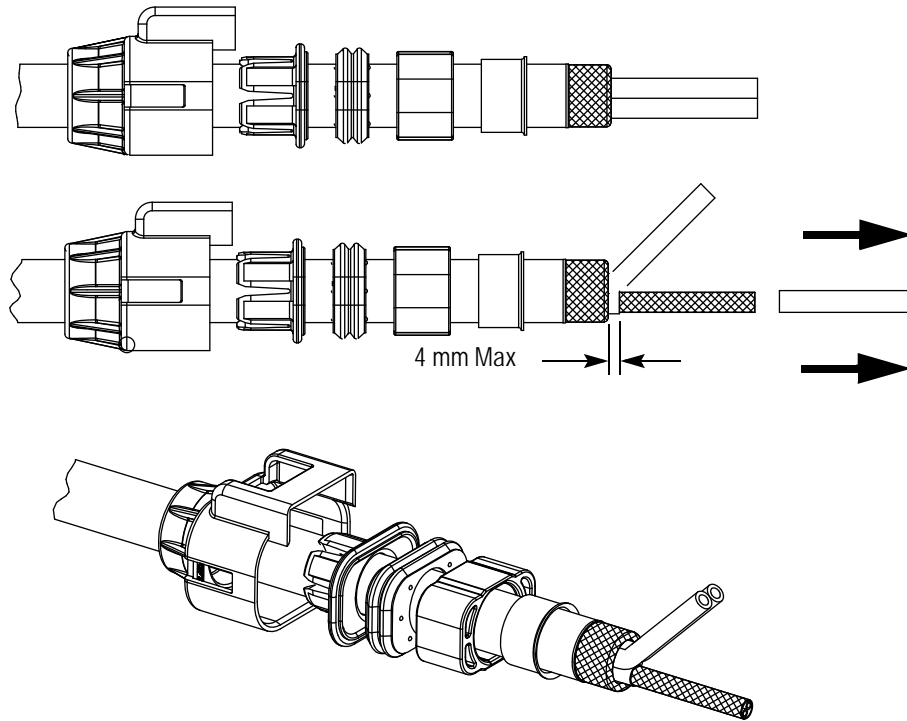


Figure 7

6. If present, fold the HVIL braided shield back over the inner ferrule and trim as shown in Figure 8.

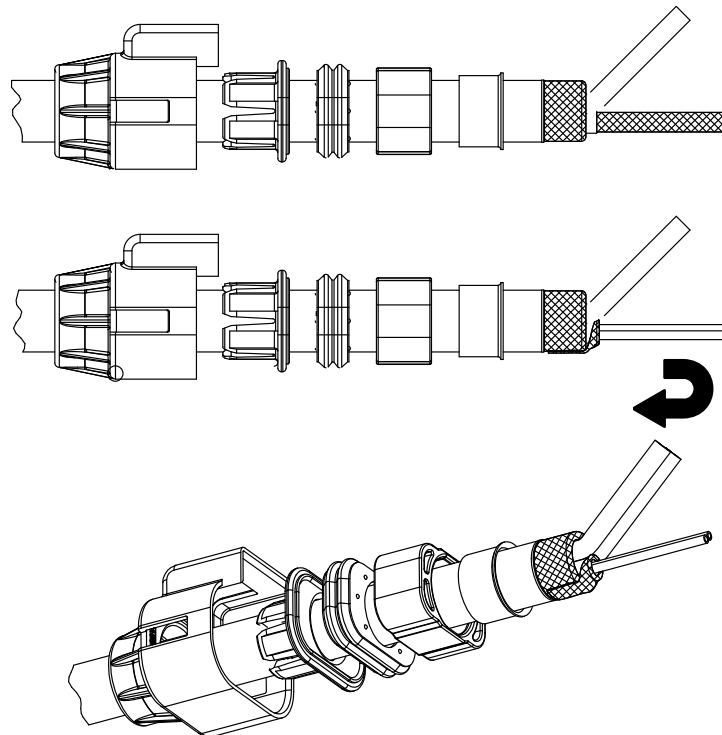


Figure 8

7. Trim back the HVIL conductors as shown in Figure 9.

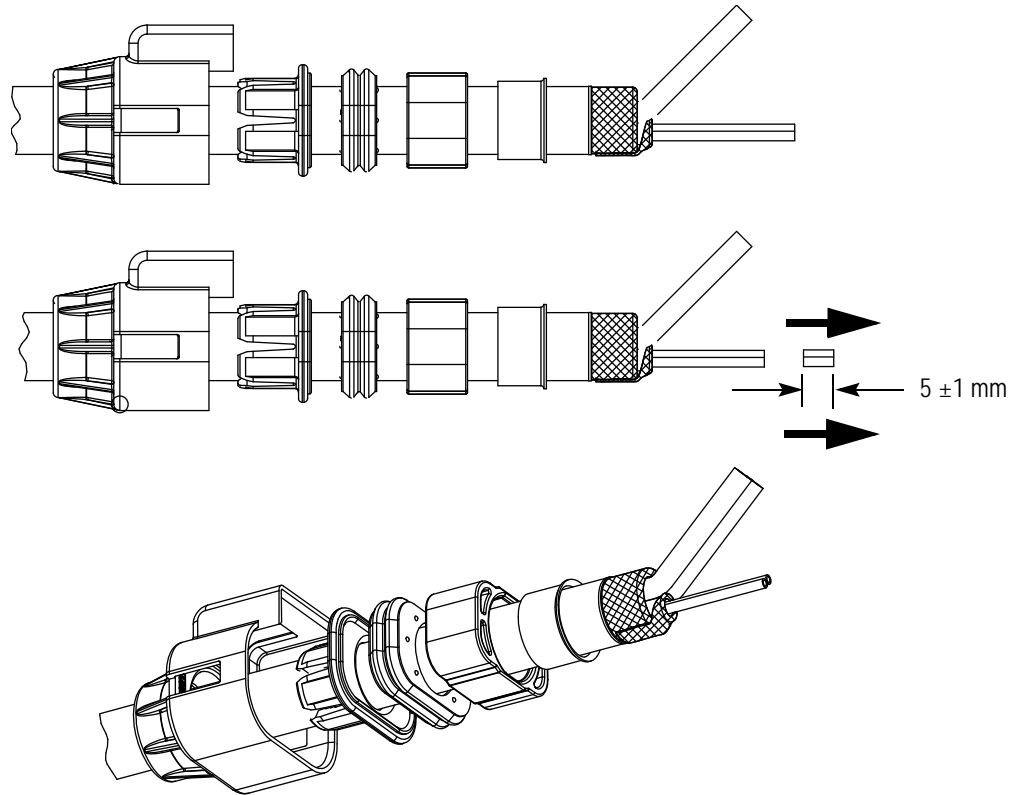


Figure 9

8. Separate the HVIL conductors and strip to length as shown in Figure 10. Refer to Application Specification 114-18021 for strip length.

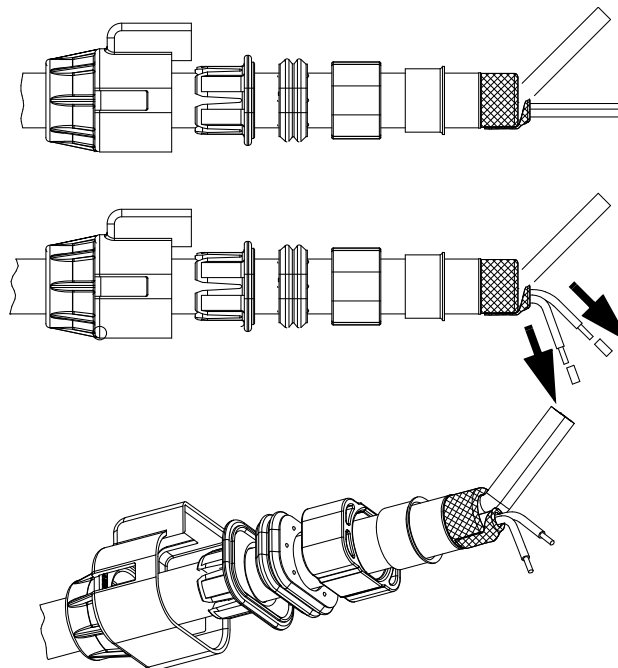
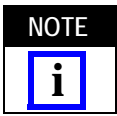


Figure 10

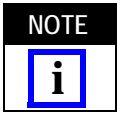
9. Insert the pin contacts over the exposed HVIL conductor strands and crimp as shown in Figure 11. Refer to application specification 114-18021 for specific crimp information.



Wire insulation barrel shall NOT be cut or broken during the crimping operation, nor shall the insulation be crimped into the contact wire barrel. Reasonable care should be taken by tooling operators to provide undamaged wire terminations.



Periodic inspections must be made to ensure crimped contact formation is consistent as shown.



Care should be taken to apply the contacts in such a way that minimal strain is required to orient the contact for insertion into the inner housing in the correct order (180° from each other).

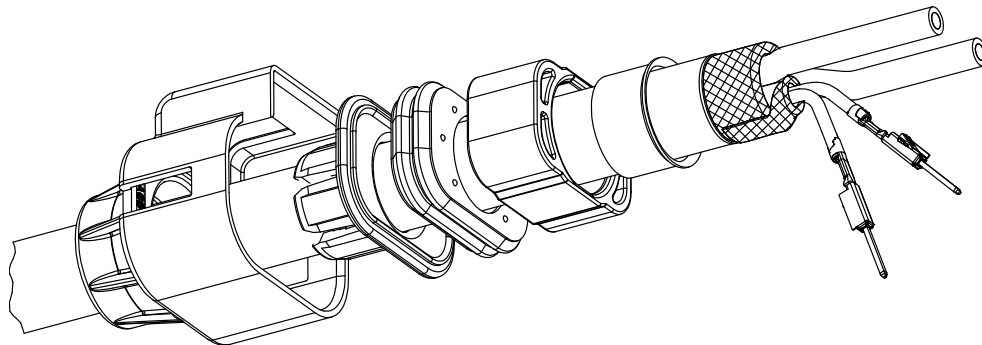


Figure 11

10. Separate the larger conductors and strip to length as shown in Figure 12. Refer to Application Specification 114-18148-1 for strip length.

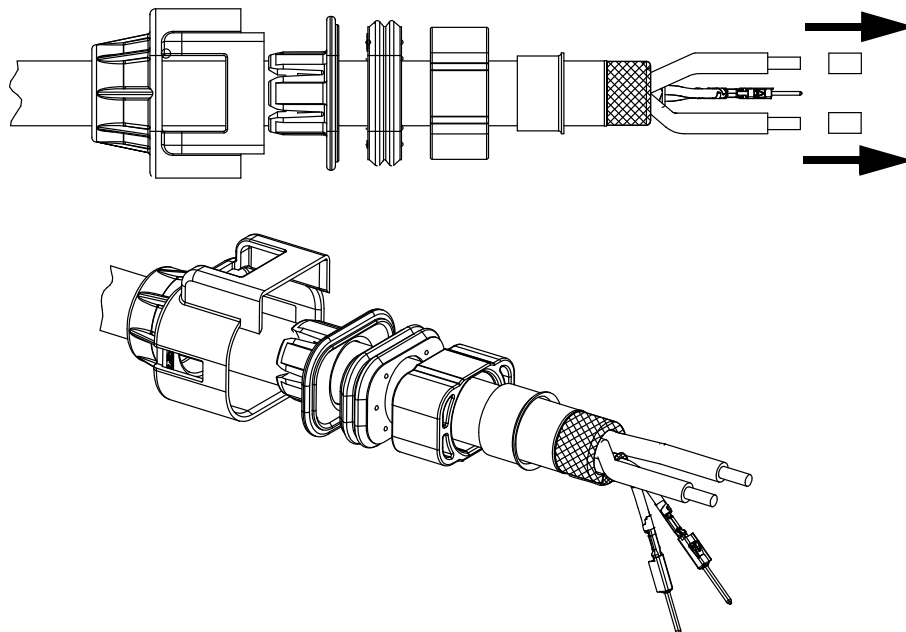


Figure 12

11. Insert the receptacle contacts over the exposed conductor strands and crimp as shown in Figure 13. Refer to Application Specification 114-18148-1 for specific crimp information. Locate the contact to be crimped in the appropriate tooling according to the instructions packaged with that tooling. Detailed instructions covering the placement of contacts in the tooling and the use of such tooling is packaged with each tool. See Section 5, TOOLING.

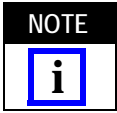




Wire insulation shall NOT be cut or broken during the crimping operation, nor shall the insulation be crimped into the contact wire barrel. Reasonable care should be taken by tooling operators to provide undamaged wire terminations.



Periodic inspections must be made to ensure crimped contact formation is consistent as shown.



Care should be taken to apply the contacts in such a way that minimal strain is required to orient the contact for insertion into the inner housing in the correct order.

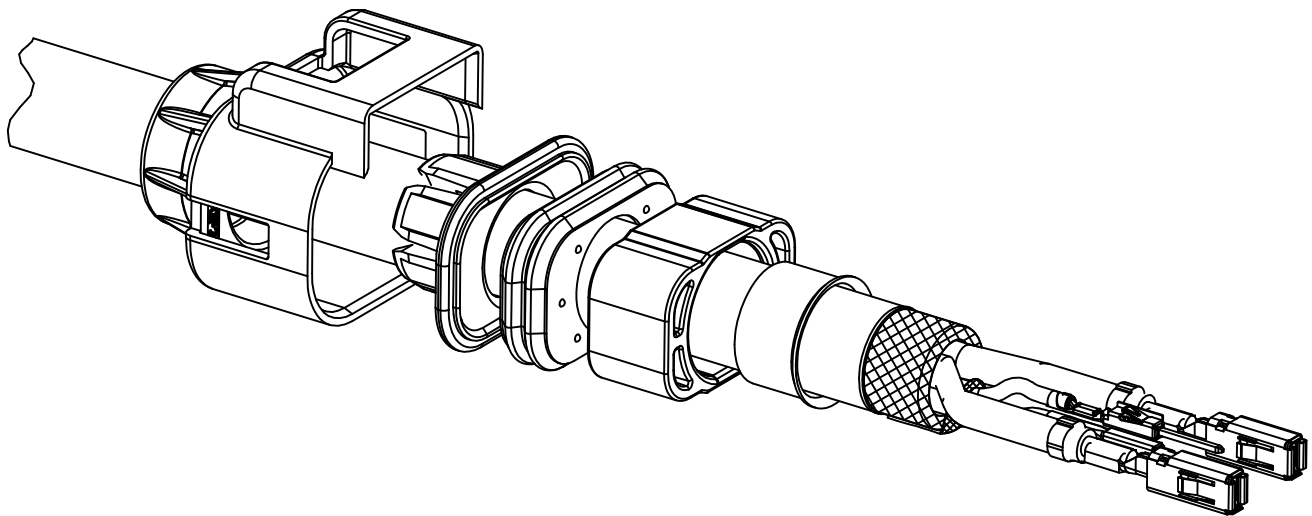
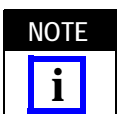


Figure 13

12. The following items at a minimum must be inspected and verified:

- No loose conductor strands
- No loose cable shield strands
- Crimped in correct location
- No excess metallic foil or filler
- All components are present (cable seal retainer, collet, cable seal, spacer, outer ferrule, inner ferrule, receptacle contacts, pin contacts)

13. Pre-bend the conductors as shown in Figure 14A to align the terminals with the cavities and prevent damage to the conductor jacket during shield assembly. Note the cavity number on the cable entry end of the inner housing (Figure 14B). Simultaneously insert the receptacle contacts (larger conductors) and pin contacts (HVIL circuits) in correct orientation into the inner housing until they are fully locked. Verify that the contact is completely inserted as shown in Figure 14C by gently pulling back on the conductor.



Make sure that the correct conductor color is matched with the correct inner housing cavity number.



It is essential that there are no mistakes in this step because there will be no chance to re-work the parts once the connector shield is crimped in place.



Care should be taken to avoid bending the pin contacts when inserting them into the inner housing.

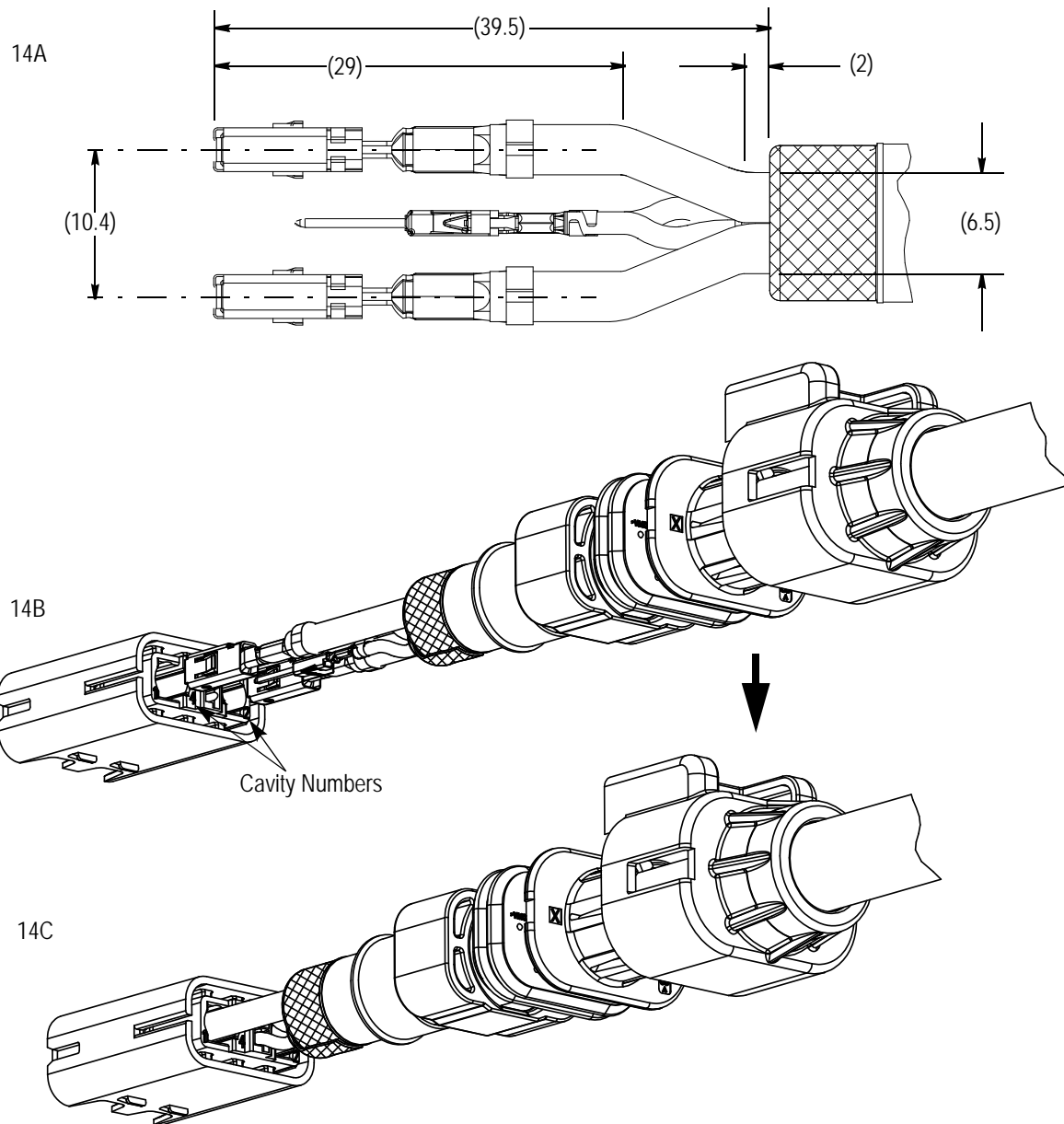


Figure 14

14. Assemble the first connector shield by positioning the inward facing shield tab in the positioning slot of the inner housing on the side shown in Figure 15A. Do not completely lock the other side of this shield at this time. Position the wires away from the shield as shown in the top view of Figure 15A. Assemble the second shield in the forward position of the positioning slot of the inner housing on the side shown in Figure 15B first then rotate until the opposite side shield tab locks into place. Complete the shield assembly process by locking in the other shield tab of the first shield. Make sure the overlapping tabs in the shield transition and crimp areas are overlapping correctly and the front shield curl is in the correct position as shown in Figure 15C.



Wire insulation shall NOT be cut or broken during the shield assembly process.

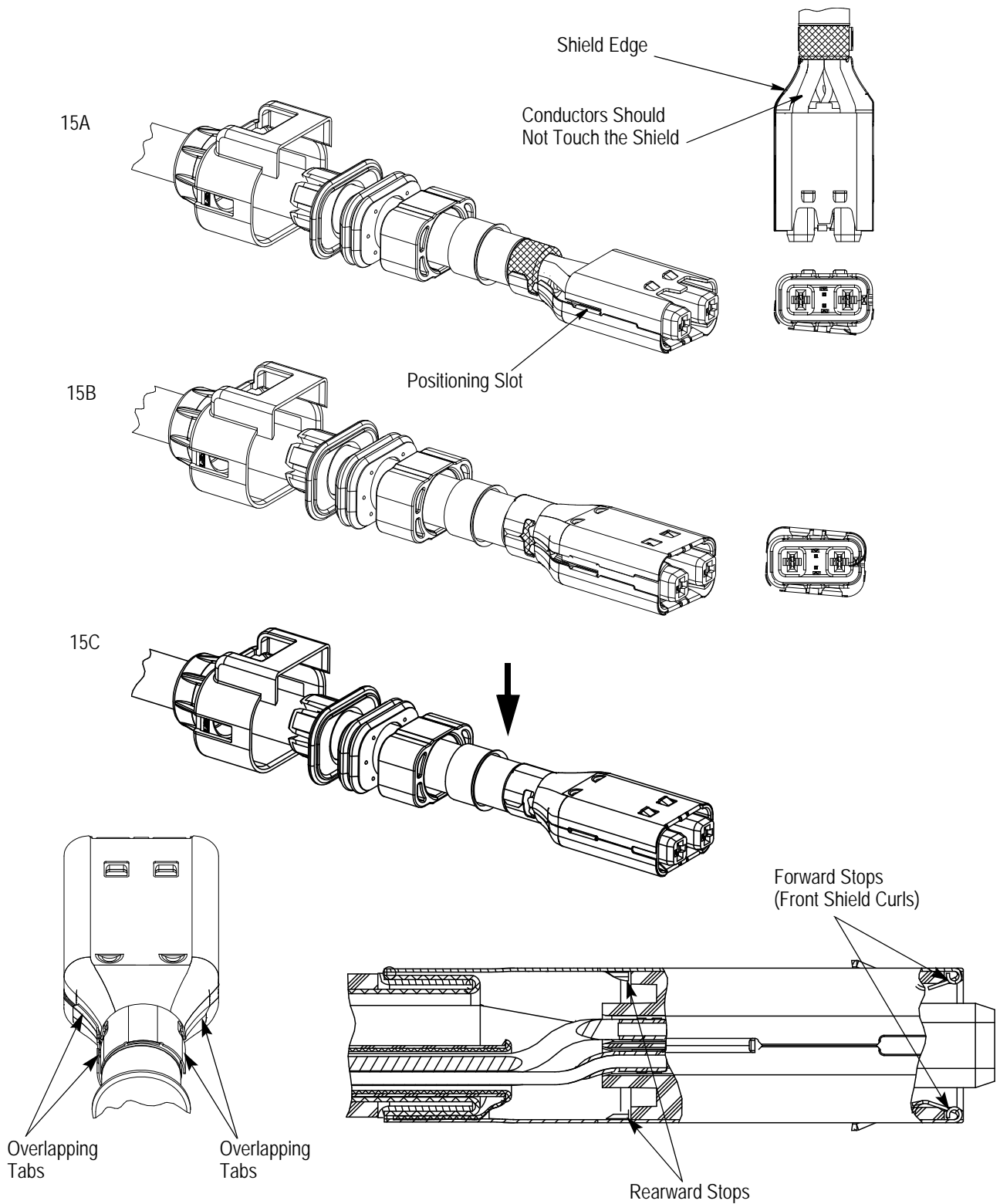


Figure 15

15. Slide the outer ferrule forward into position over the overlapping ends of the connector shields as shown in Figure 16.

16. Crimp outer ferrule to the connector shields in the area shown in Figure 17 using hex crimp tooling as shown in Figure 28.

17. The following items at a minimum must be inspected and verified:

- Hex crimp dimensions per Figure 18
- No large burrs/flash on the ferrule crimp
- No visible cracking of the ferrule or shields
- No loose or detached braid strands
- The cable insulation in close proximity to the ferrule crimp is not pinched, abraded, or cut
- The cable insulation is up against inner ferrule

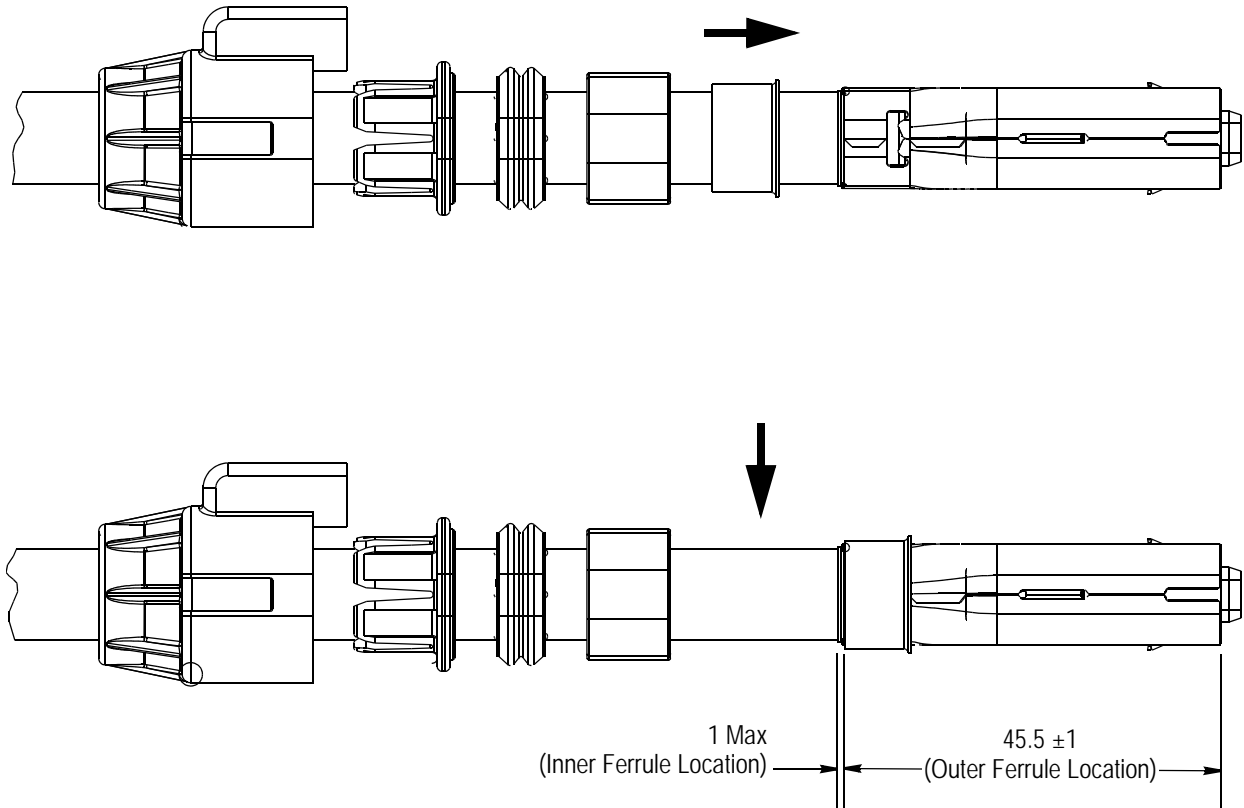


Figure 16

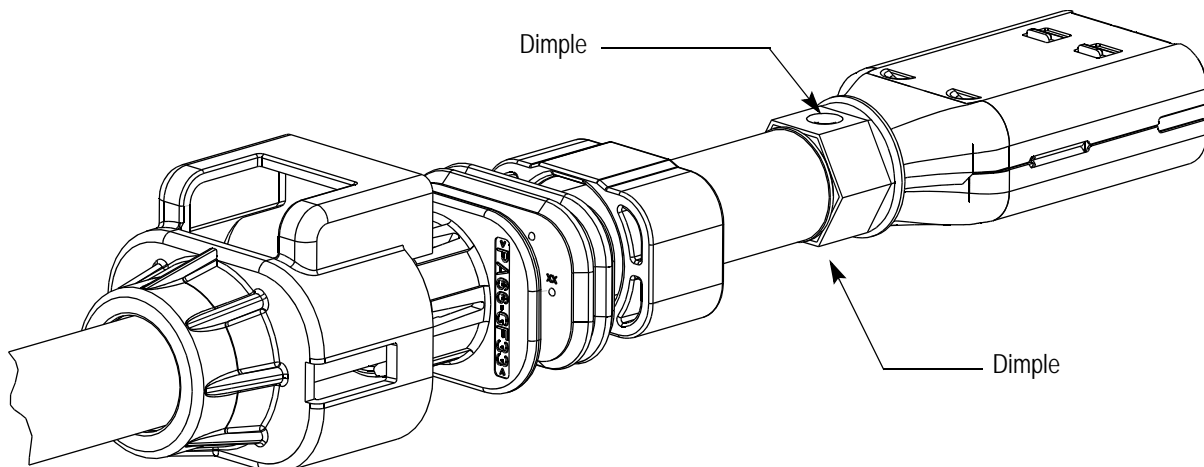
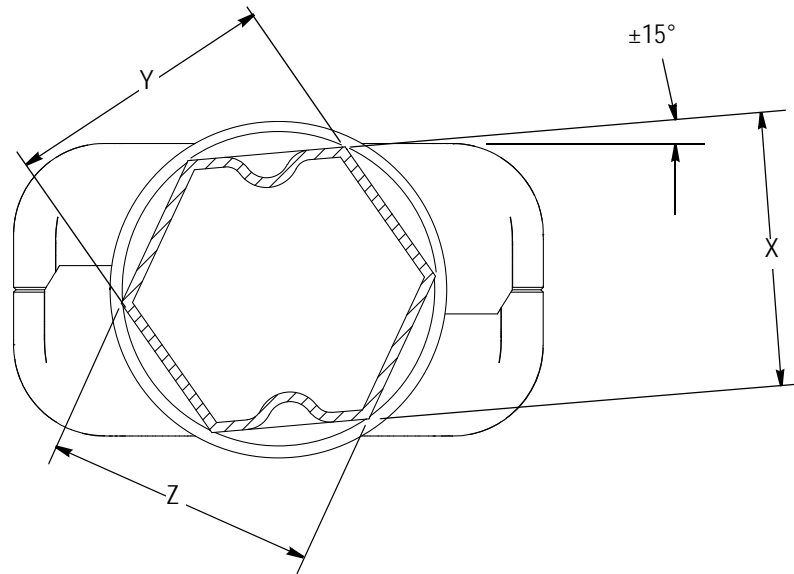


Figure 17

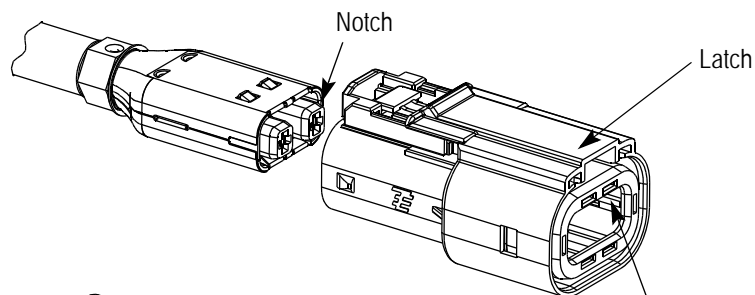


CABLE	DIM X $\pm 0.1$	DIM Y	DIM Z
KROMBERG & SCHUBERT 64994093	11.8	11.95 Max	11.95 Max

Figure 18

18. Note the notch on the inner housing subassembly and the rail on the plug assembly housing (Figure 19A). With the notch and rail aligned, insert the inner housing assembly into the plug subassembly until it is fully locked. Verify that the inner housing assembly is completely inserted as shown in Figure 19B by gently pulling back on the cable.

19A



19B

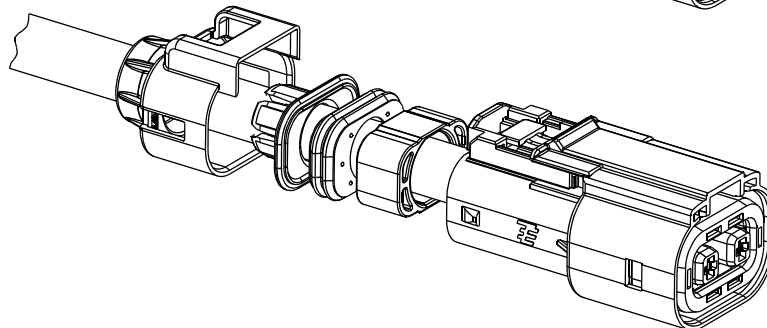


Figure 19

19. Slide the spacer forward on the cable and into the cable exit end of the connector assembly until it stops against the inside of the connector outer housing as shown in Figure 20.

KROMBERG & SCHUBERT is a trademark.

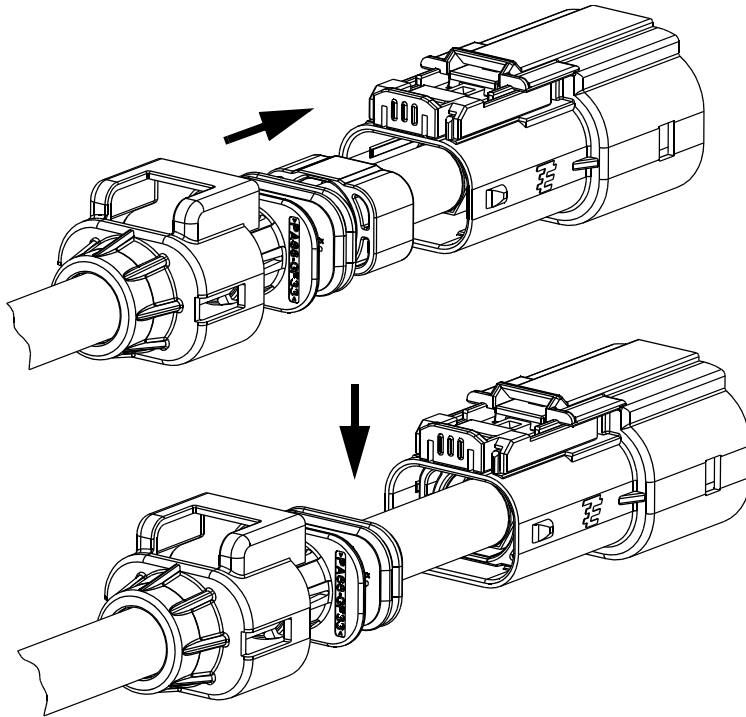


Figure 20

20. Slide the cable seal forward on the cable and into the cable exit end of the connector assembly until it stops against the spacer as shown in Figure 21.

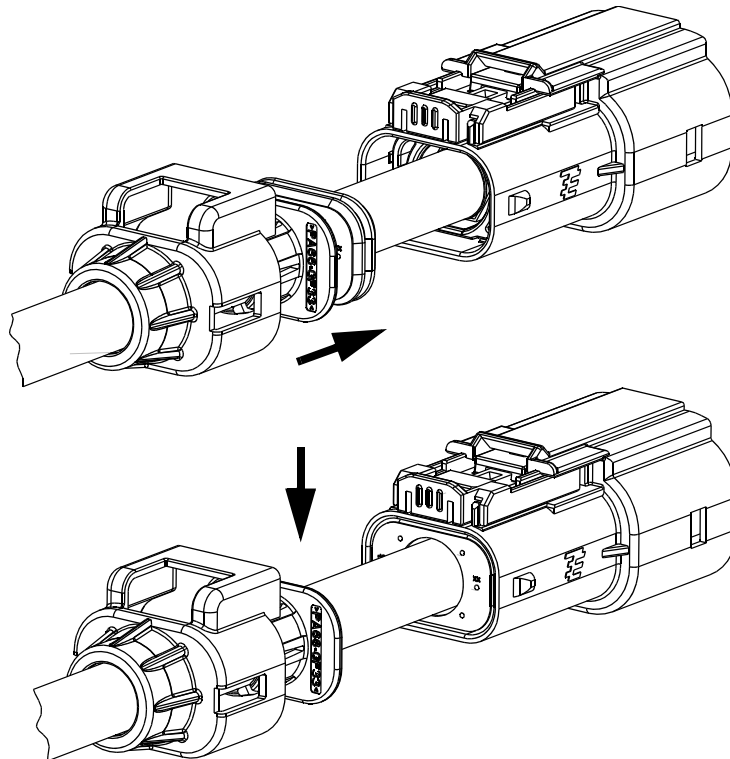


Figure 21

21. Slide the collet forward on the cable until it stops against the outer housing as shown in Figure 22.

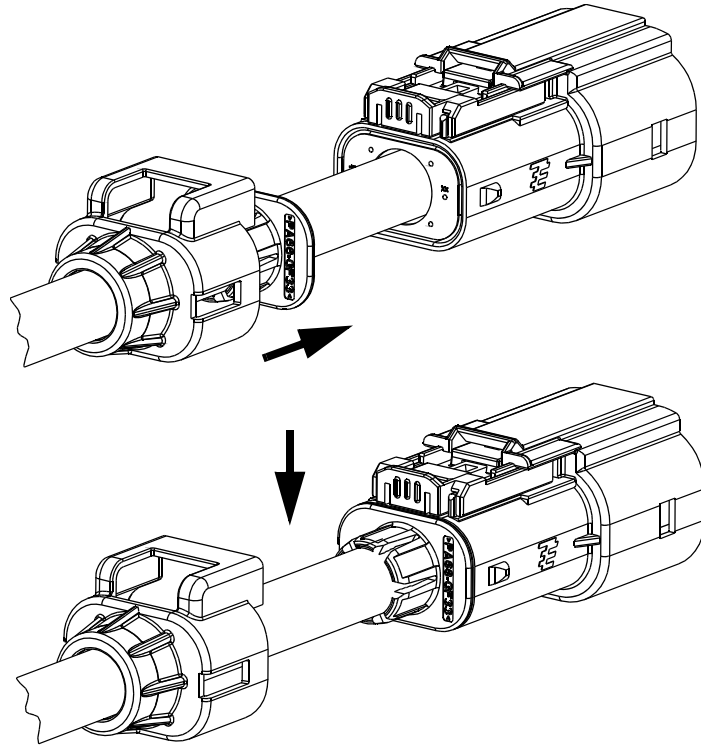


Figure 22

22. Slide the cable seal retainer forward on the cable and over the cable exit end of the connector assembly until it fully locks to the connector outer housing. A slight rotation of the cable seal retainer may be required to get the bridge portion over the CPA. Visually check to ensure that both locking features are engaged and the CPA is in the correct position as shown in Figure 23. Gently pull back on the cable seal retainer to check that it is fully locked in place.

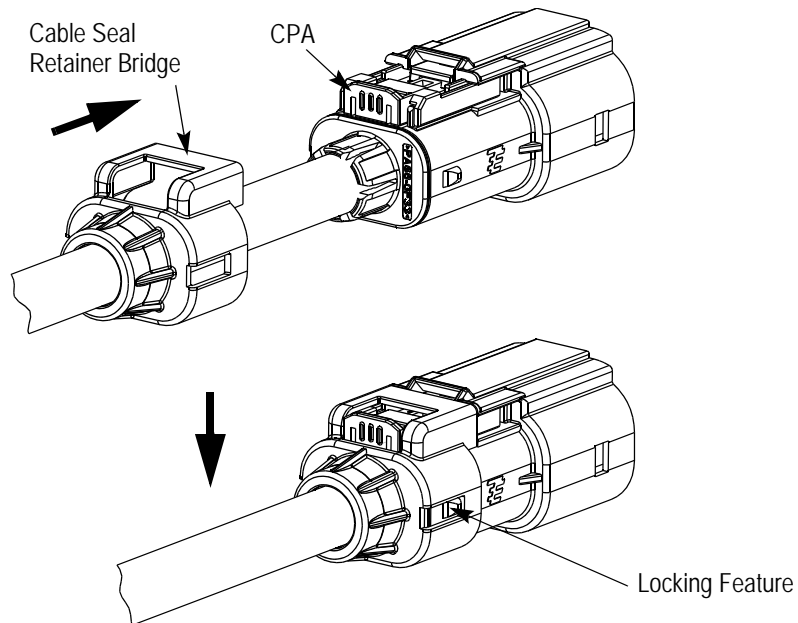


Figure 23

### 3.7. Contact Probing



Avoid probing the contact in an area that could damage the plating inside the receptacle contact. The best location for probing the receptacle contact is at the front as shown in Figure 24.

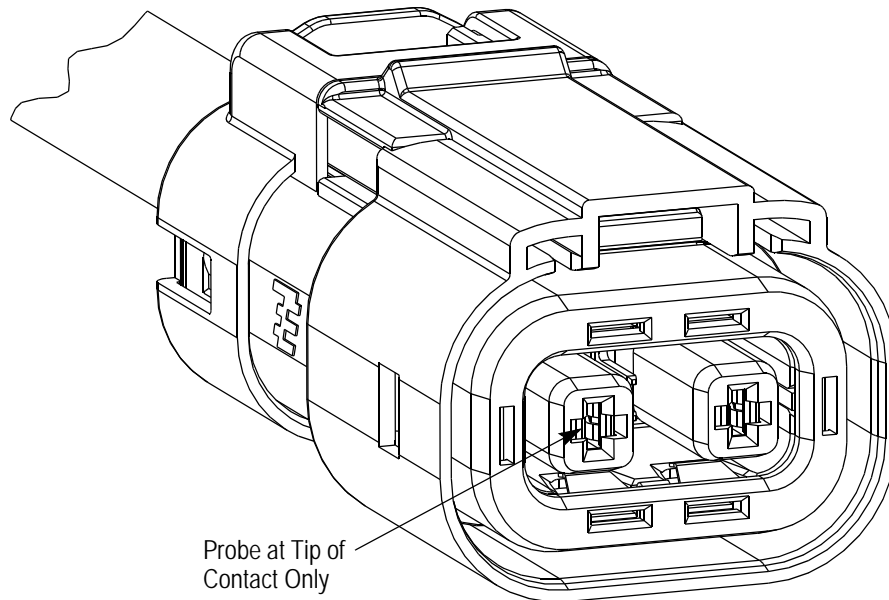


Figure 24

### 3.8. Connector Mating

1. Align plug and header connectors as shown in Figure 25A.
2. Push the connector halves together fully until they stop (two clicks will be heard).
3. Verify that the connectors are fully locked with a light tug and by visually verifying the thumb actuation pad has returned to its' upward position as shown in Figure 25B.
4. If present, push the red Connector Position Assurance (CPA) forward from the position shown in Figure 25B until it stops as shown in Figure 25C.

25A

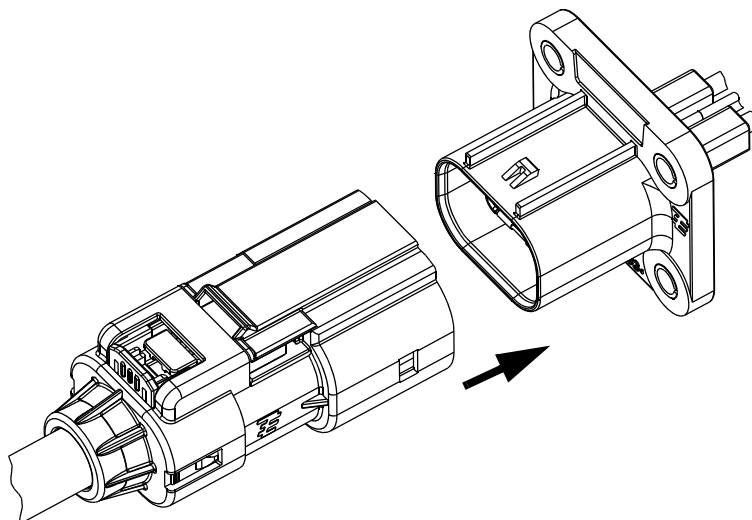
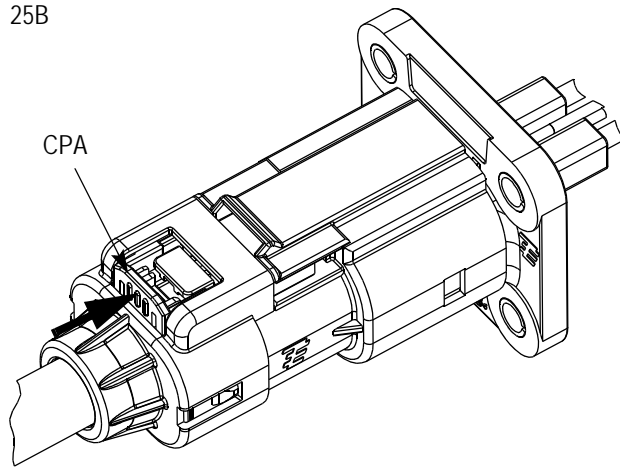


Figure 25 (Cont'd)



25B



25C

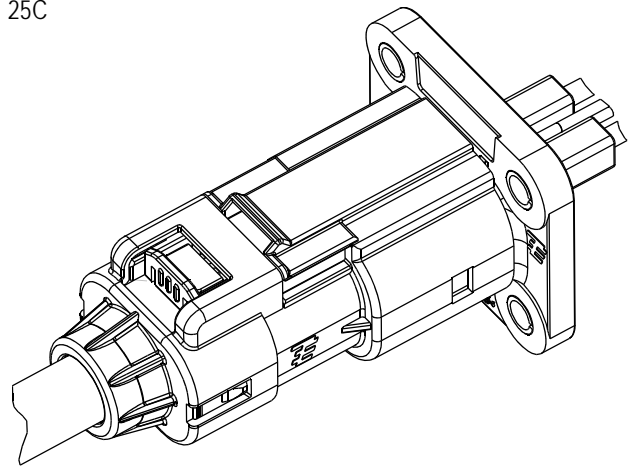


Figure 25 (End)

### 3.9. Connector Unmating

1. If present, pull the red CPA back from the position as shown in Figure 26A until it stops as shown in Figure 26B.
2. Fully depress the thumb actuation pad on the plug connector flexible latch (orange) shown in Figure 26B and pull the plug connector back (~6.2 mm) into the intermediate position. See Figure 26C. At this point, the HVIL circuit has been opened, but the HV terminals are still making contact.

**CAUTION** Do NOT pull on the wires.



3. Fully depress the actuation pad on the floating latch (black). See Figure 26D.
4. An alternate construction may not require a flat-bladed screwdriver. See Figure 26E.
5. Pull the plug connector until it is fully separated from the header. See Figure 26F.

**CAUTION** Do NOT pull on the wires.



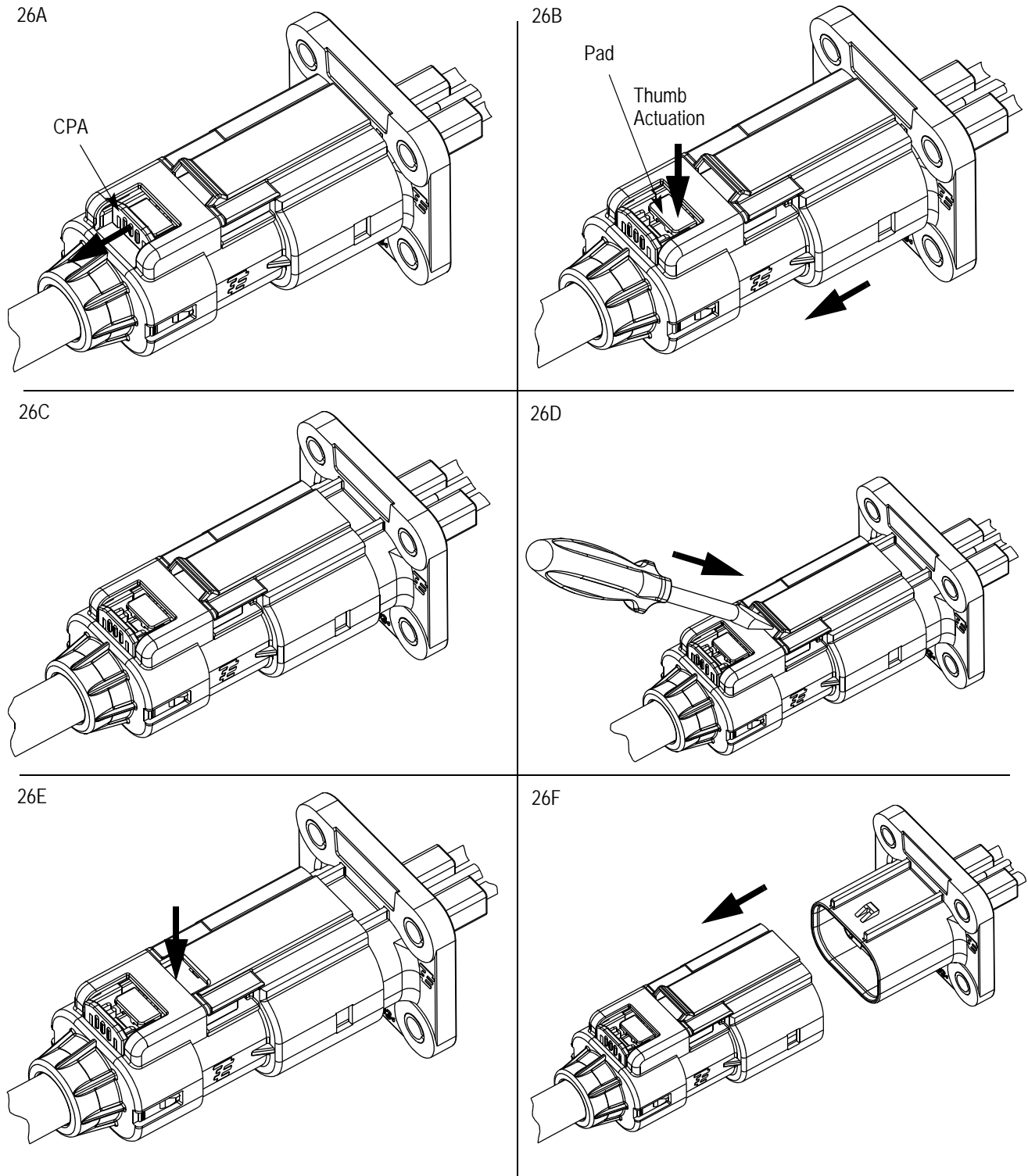


Figure 26

### 3.10. Cable Routing

Cable assembly should be restrained as shown in Figure 27.

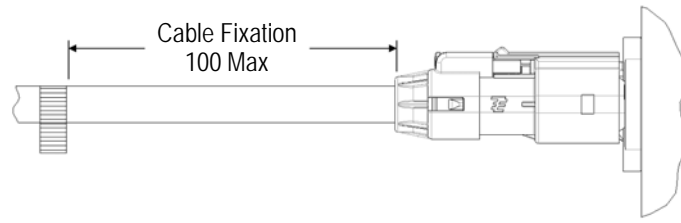


Figure 27

#### 4. QUALIFICATIONS

The AMP+ HVA280 connector system has been validated to the following specifications:

- IEC 60528: Degrees of Protection Provided by Enclosures (IP Code)

#### 5. TOOLING

A listing of tooling recommendations covering the full wire size range is provided in Figure 28. Modified designs and additional tooling concepts may be available to meet other application requirements. For additional information, contact one of the service groups at the bottom of page 1.

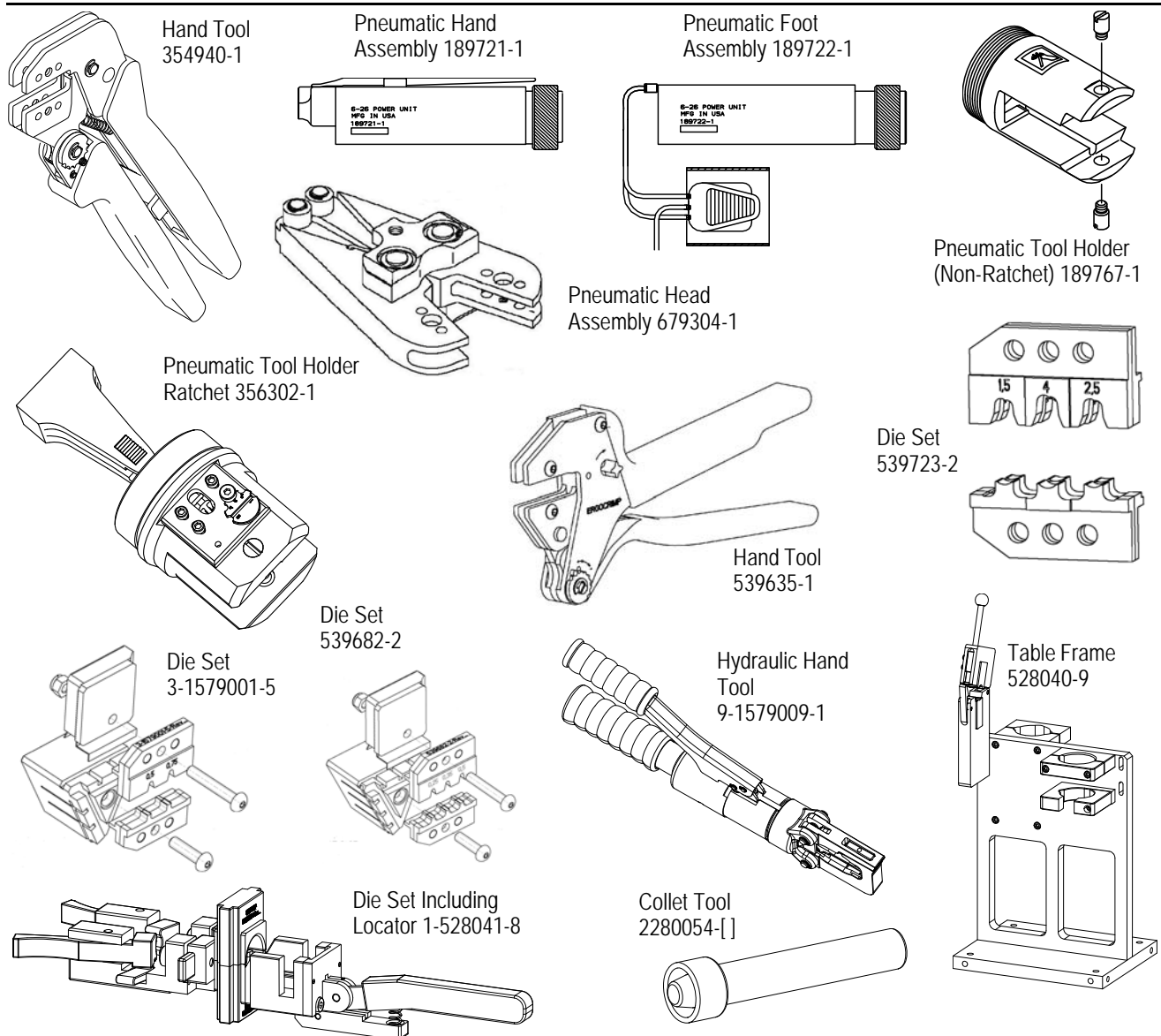


Figure 28 (Cont'd)

## APPLICATION TOOLING FOR FERRULES (DOCUMENT)

CABLE	DIE SET	MANUAL TOOLING (408-9930)	PNEUMATIC TOOLING					HYDRAULIC TOOLING		
			HAND ASSY (408-2498) (409-5862)	FOOT ASSY (408-2498) (409-5862)	TOOL HOLDER			DIE SET INCLUDING LOCATOR	HAND ASSY PLIERS	TABLE FRAME FOR PLIERS
					RATCHET (408-4303)	NON-RATCHET (408-2498)	HEAD ASSY (408-4070)			
KROMBERG & SCHUBERT 64994093	2063013-7	Hand Tool Frame Assy 354940-1†	189721-1	189722-1	356302-1	189767-1	679304-1	1-528041-8	9-1579009-1	528040-9

## APPLICATION TOOLING FOR RECEPTACLE CONTACTS AND PIN CONTACTS

CONTACT TYPE	WIRE SIZE RANGE	HAND TOOL (411-18087)	DIE SET (DOCUMENT)
Receptacle	2.5 mm <sup>2</sup>	539635-1	539723-2 (411-18169)
	4.0 mm <sup>2</sup>		
Pin Contact	0.20-0.50 mm <sup>2</sup>	539635-1	539682-2 (411-18100)
	0.50-0.75 mm <sup>2</sup>		3-1579001-5 (411-18284)

## APPLICATION TOOLING FOR COLLET ASSEMBLY

COLLET PART NUMBER	COLLET TOOL PART NUMBER (408-32128)
2103155-1	2280054-1

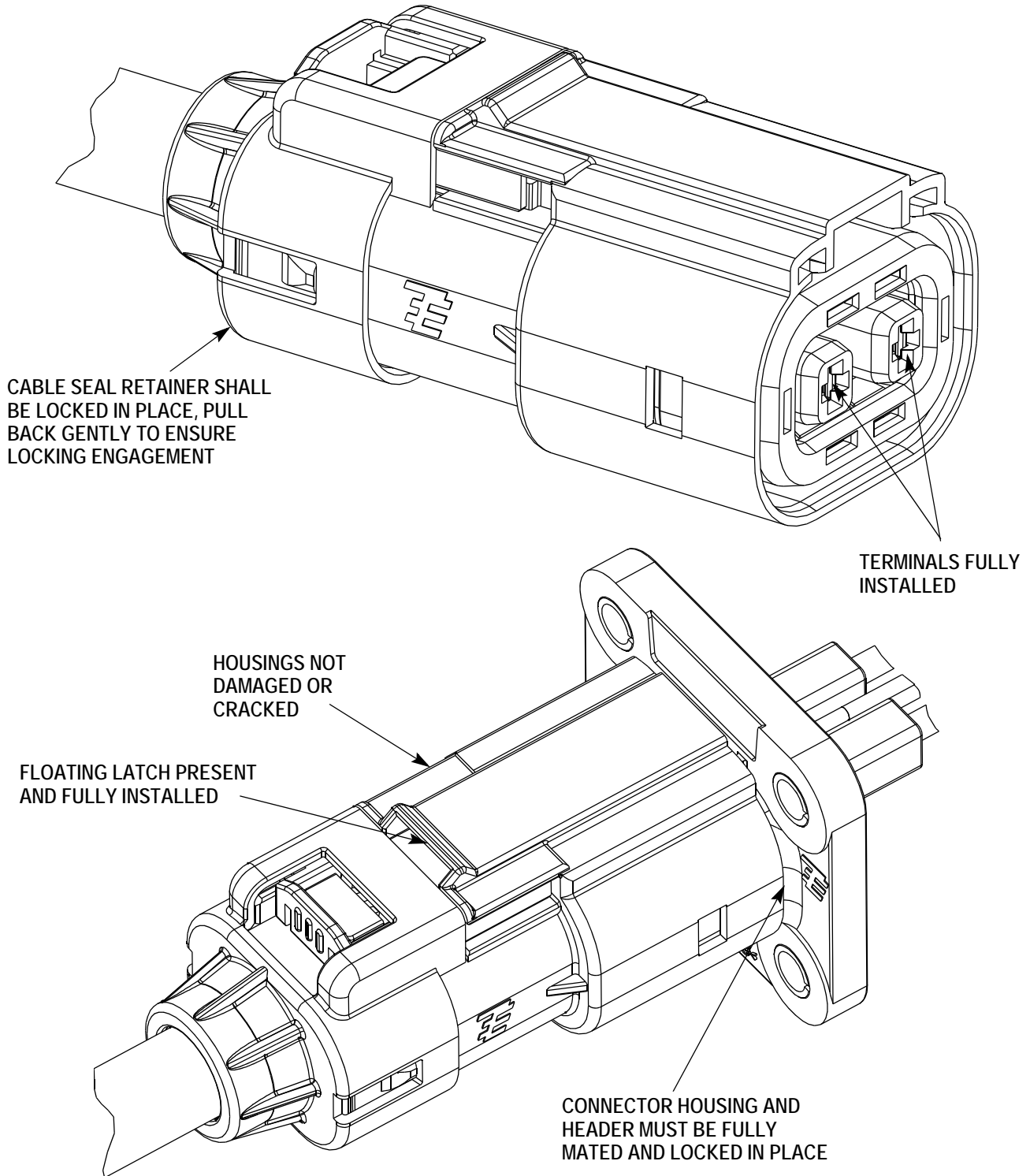
†With modifications.

Figure 28 (End)

KROMBERG &amp; SCHUBERT is a trademark.

## 6. VISUAL AID

The illustration below shows a typical application of this product. 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 29. VISUAL AID**