

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 ± 0.13 [.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 requirements for application of AMP* Universal Serial Bus Type A and Type B Plug Connectors. The Type A plug connector components consist of one set of four adjacent (side by side) insert molded contacts and one stamped and formed backshell. The Type B plug connector components consist of two sets of two opposing insert molded contacts and one stamped and formed backshell.

The USB plug connector components are designed to be terminated to the four conductors of the cable by soldering and the shell assembled and terminated to the braided cable shield by crimping. The cable plug subassembly is then overmolded by injection molding whereby the individual conductors and their respective solder terminations are encapsulated internal to the backshell. At the same time, an overmolded plug body and optional cable strain relief is formed around the outside of the backshell and cable jacket.

All USB Type A plug connectors mate with USB Type A receptacle assemblies. All USB Type B plug connectors mate with USB Type B receptacle assemblies.

When corresponding with AMP personnel, use the terminology provided on this specification to help facilitate your inquiry for information. Basic terms and features of components are provided in Figure 1.

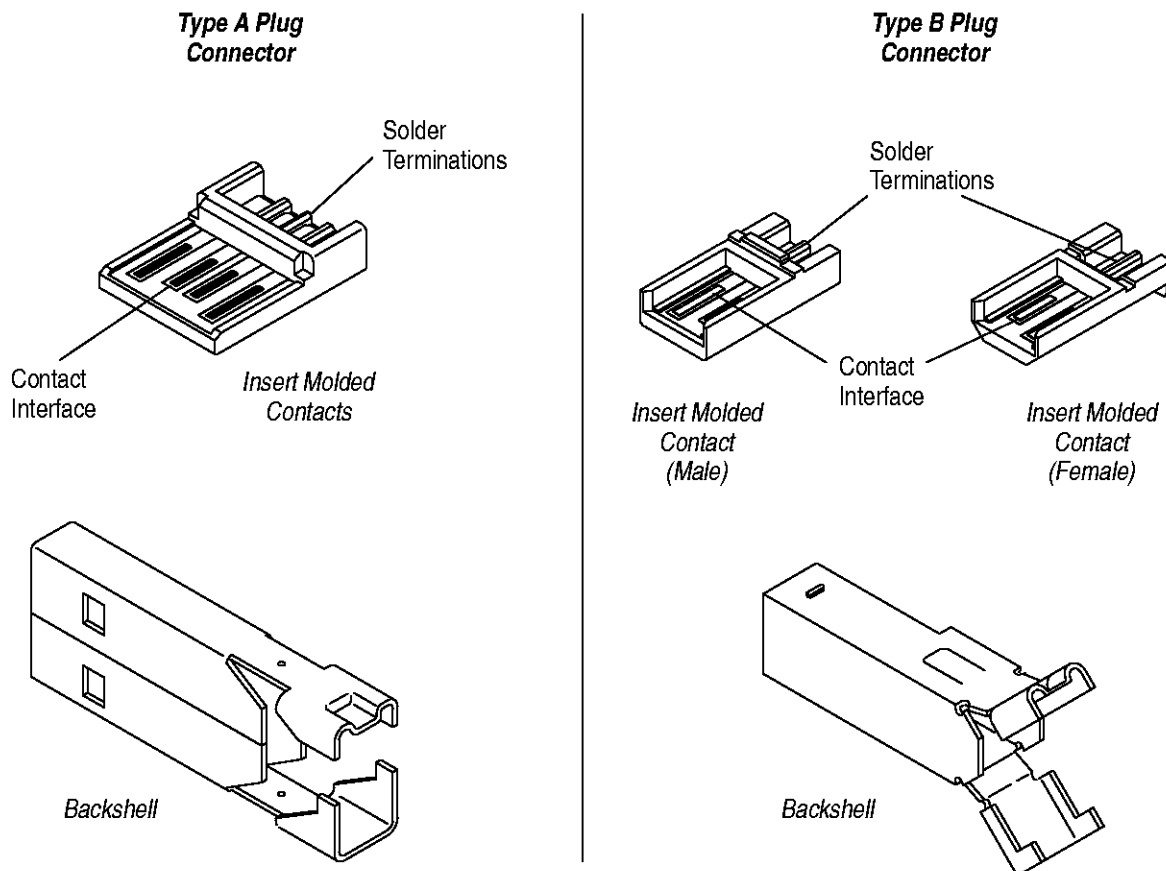


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

Per EC 0990–0170–99:

- Initial release of application specification

2.2. Customer Assistance

Reference Part Numbers 796002 and 796007 and Product Code 3941 are representative numbers of AMP Universal Serial Bus Type A and Type B Plug Connectors. Use of these numbers will identify the product line and expedite your inquiries through an AMP service network established to help you obtain product and tooling information. Such information can be obtained through a local AMP Representative (Field Sales Engineer, Field Applications Engineer, etc) or, after purchase, by calling the Tooling Assistance Center or the AMP FAX/Product Information Center number at the bottom of page 1.

2.3. Drawings

AMP Customer Drawings for specific products are available from the service network. The information contained in Customer Drawings takes priority if there is a conflict with this specification or with any technical documentation supplied by AMP Incorporated.

2.4. Bulletins

AMP Corporate Bulletin 401–52 is available upon request and can be used as a guide in soldering. This bulletin provides information on various flux types and characteristics along with the commercial designation and flux removal procedures. A checklist is attached to the bulletin as a guide for information on soldering problems.

2.5. Specifications

AMP Product Specification 108–1586 provides product performance requirements and test information. AMP Application Specification 114–40054 provides information on 4– and 8–position USB connectors. AMP Manufacturing Process Specification 106–4 provides information on hand soldering of electrical connections. IPC Specification ANSI/IPC–A–610, Section 10.2.6 provides information on solder joint acceptability for round or flattened leads on electronic assemblies.

2.6. Instructional Material

The following list includes available AMP instruction sheets (408–series) that provide assembly procedures for product, operation, maintenance and repair of tooling, as well as setup and operation procedures of applicators.

<u>Document Number</u>	<u>Document Title</u>
408–4518	Backshell Crimper Assembly 1214695–1
408–6923	AMP Manual Arbor Frame Assembly 58024–1
408–7777	AMP Manual Arbor Frame Assembly 91085–2

3. REQUIREMENTS

3.1. Storage

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

3.2. Exposure Limitations

A. Ultraviolet Light

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

B. Chemical Exposure

Do not store housings or connectors near any chemicals listed below, as they may cause stress corrosion cracking in the components.

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

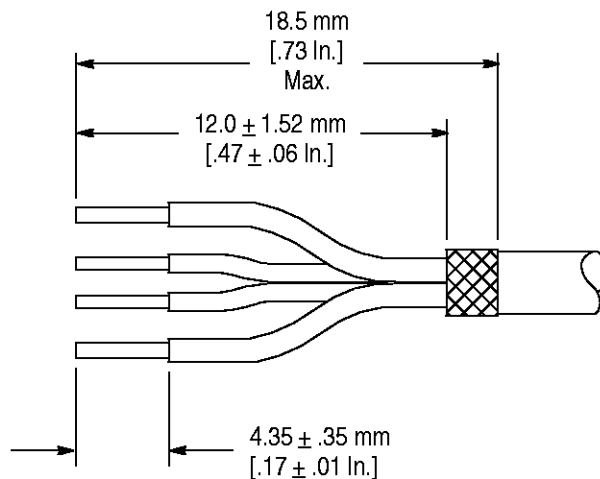
NOTE

Where the above environmental conditions exist, phosphor–bronze contacts are recommended instead of brass if available.

3.3. Cable/Wire Preparation

A. Cable Preparation

1. Strip off cable jacket to expose 12 mm [.47 in.] of the braided shield.
2. Roll the braid back over the jacket.
3. Wrap braid with copper tape.
4. Strip individual wires to the dimensions referenced in Figure 2 and pre-tin with solder.



NOTE: *Not to scale.*

Figure 2

B. Wire Preparation

USB Plug Contacts accept a wire size range of 20 – 28, 22 – 28, 24 – 28, 26 – 28, or 28 – 28 AWG and may be terminated to either stranded or solid wire.

NOTE

When stripping the wire, care must be taken to avoid scraping, nicking, or cutting the conductor. Care must also be used when handling the wire during stripping and crimping to prevent cracking or breaking of the conductor and insulation.

3.4. Wire Termination

1. For Type B connectors only, singulate wire pairs for each set of contacts. Black and green wires to the male set; red and white wires to the female set.
2. For both Type A and Type B connectors, arrange wires according to required color sequence shown in Figure 3.
3. Position wires on appropriate solder pads.
4. Solder the wires. Refer to Paragraph 3.5, Soldering. Hold the wire and contact in position as heat and solder is applied to each wire and solder pad to make a connection.
5. For Type B connectors only, Steps 2, 3, and 4 may be performed separately for each set of contacts.

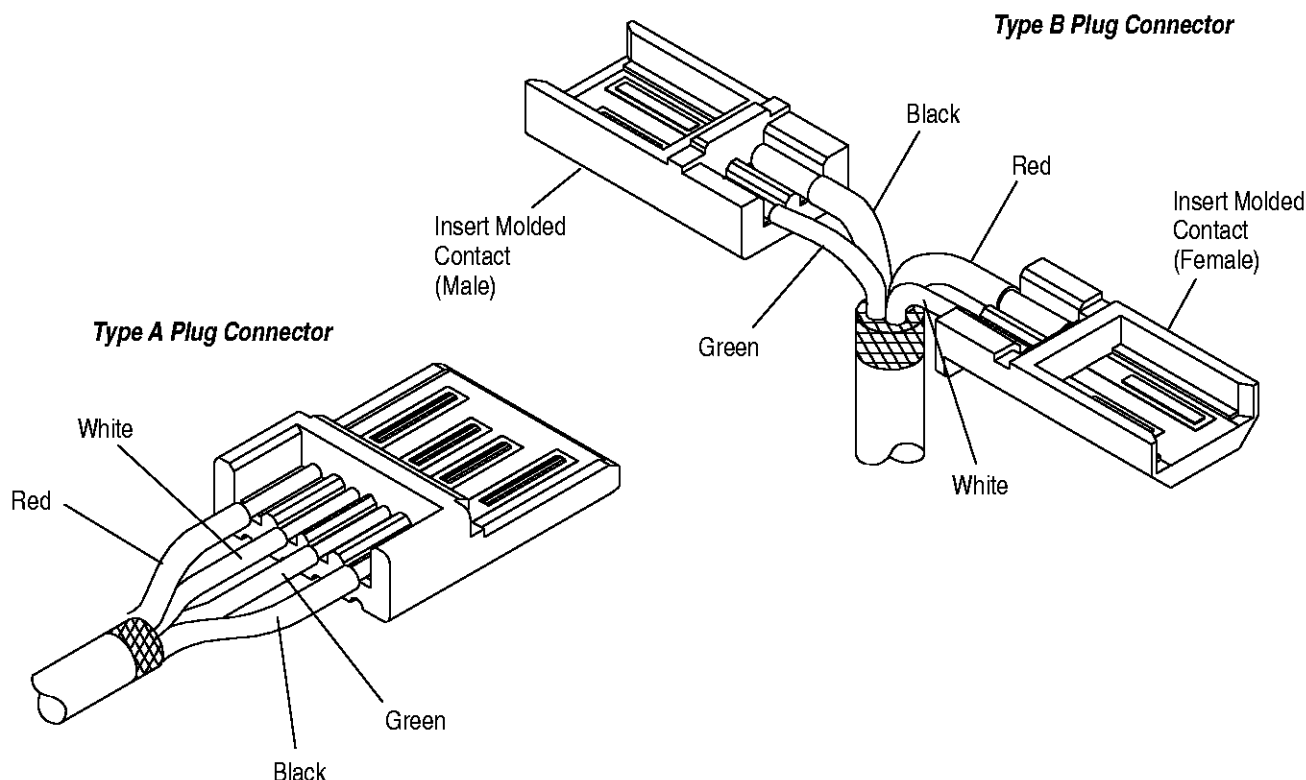


Figure 3

3.5. Soldering

A. Flux Selection

The contact solder pads must be fluxed prior to soldering with a mildly active, rosin base flux. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements. Call the Product Information phone number at the bottom of page 1 for consideration of other types of flux. Some fluxes that are compatible with these connectors are provided in Figure 4.

FLUX TYPE	ACTIVITY	RESIDUE	COMMERCIAL DESIGNATION	
			KESTER ⁸⁸	ALPHA [■]
Type RMA (Mildly Activated)	Mild	Noncorrosive	186	611

⁸⁸ Product of Kester Solder Co.

■ Product of Alphametals Inc.

Figure 4

B. Cleaning

After soldering, removal of fluxes, residues, and activators is necessary. Consult with the supplier of the solder and flux for recommended cleaning solvents. The following is a listing of common cleaning solvents that will not affect the connectors for the time and temperature specified. See Figure 5.

DANGER

Consideration must be given to toxicity and other safety requirements recommended by the solvent manufacturer. Refer to the manufacturer's Material Safety Data Sheet (MSDS) for characteristics and handling of cleaners. Trichloroethylene and Methylene Chloride can be used with no harmful affect to the connectors; however AMP does not recommend them because of the harmful occupational and environmental effects. Both are carcinogenic (cancer-causing) and Trichloroethylene is harmful to the earth's ozone layer.

NOTE

If you have a particular solvent that is not listed, contact the Tooling Assistance Center or Product Information number at the bottom of page 1.

CLEANER		TIME (Minutes)	TEMPERATURES (Maximum)	
NAME	TYPE		CELSIUS	FAHRENHEIT
Alpha 2110■	Aqueous	1	132	270
Bioact EC-7◆	Solvent	5	100	212
Butyl Carbitol●	Solvent	1	Room Ambience	
Isopropyl Alcohol	Solvent	5	100	212
Kester 5778⚡	Aqueous	5	100	212
Kester 5779⚡	Aqueous	5	100	212
Loncoterger 520●	Aqueous	5	100	212
Loncoterger 530●	Aqueous	5	100	212
Terpene Solvent	Solvent	5	100	212

■ Product of Fry's Metals, Inc. ◆ Product of Petroferm, Inc. ● Product of Union Carbide Corp. ⚡ Product of Litton Systems, Inc.

Figure 5

C. Drying

When drying cleaned assemblies and printed circuit boards, make certain that temperature limitations are not exceeded: –55° to 105°C [–67° to 221°F] for standard temperature products and –55° to 215°C [–67° to 419°F] for high temperature products. Excessive temperatures may cause housing degradation.

D. Soldering Guidelines

AMP USB PC Board Connectors can be soldered using wave, vapor phase (VPR), double sided non-focused infrared reflow processes (IR) or equivalent soldering techniques. Housing material Polybutylene Terephate (PBT) is for wave soldering and liquid crystal polyester is for vapor phase/infrared reflow soldering. The temperatures and exposure time shall be within the ranges specified in Figure 6. We recommend using SN60 or SN62 solder for these connectors.

NOTE AMP Corporate Bulletin 401–52 provides some guidelines for establishing soldering practices. Refer to Paragraph 2.4, Bulletins.

NOTE For hand soldering guidelines, refer to AMP Manufacturing Process Specification 106–4, Hand Soldering of Electrical Connections.

NOTE For solder joint acceptability, refer to IPC Specification ANSI/IPC–A–610, Acceptability of Electronic Assemblies, Section 10.2.6, Round or Flattened (Coined) Leads.

SOLDERING PROCESS	TEMPERATURE		TIME (At Max Temperature)
	CELSIUS	FAHRENHEIT	
WAVE SOLDERING	260⚡	500⚡	5 Seconds
VAPOR PHASE SOLDERING	215	419	5 Minutes
INFRARED REFLOW SOLDERING	230	446	5 Minutes

⚡ Wave Temperature

Figure 6

3.6. Shield Termination

Slide the housing into the rear of the backshell until it is fully bottomed and housing is flush with the mating face of the backshell. For USB Type A plug connectors, the bottom of the housing should be oriented toward the shell seam in order for the housing to latch into the shell properly. For USB Type B plug connectors, mate the male and female halves and slide housing into the rear of the backshell, making sure the “D” profile of the front of the housing matches the “D” profile of the front of the shell. See Figure 7. Squeeze the crimp area of the backshell closed and crimp over the braid, copper tape, and cable using the tooling listed in Section 5, TOOLING.

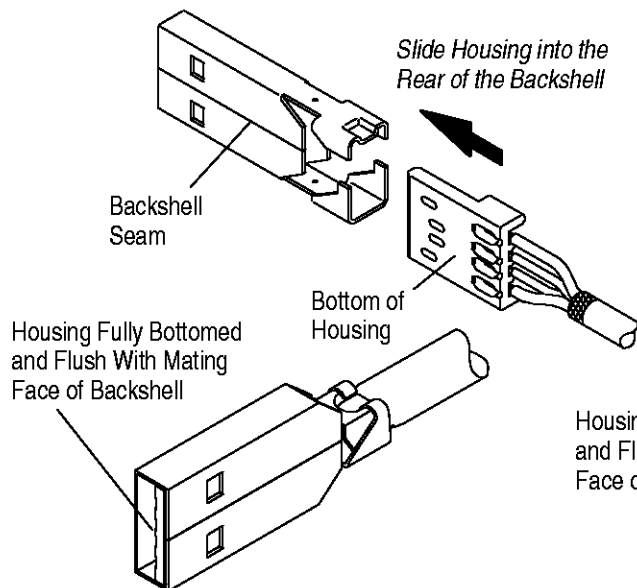
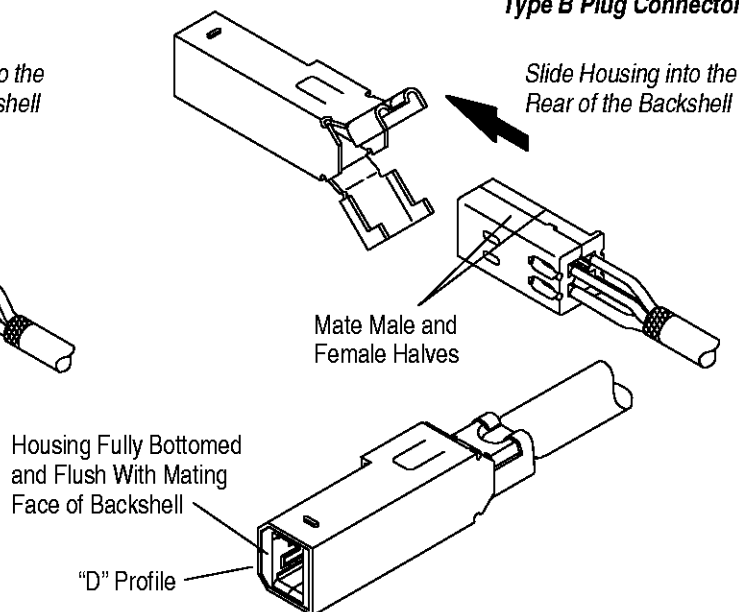
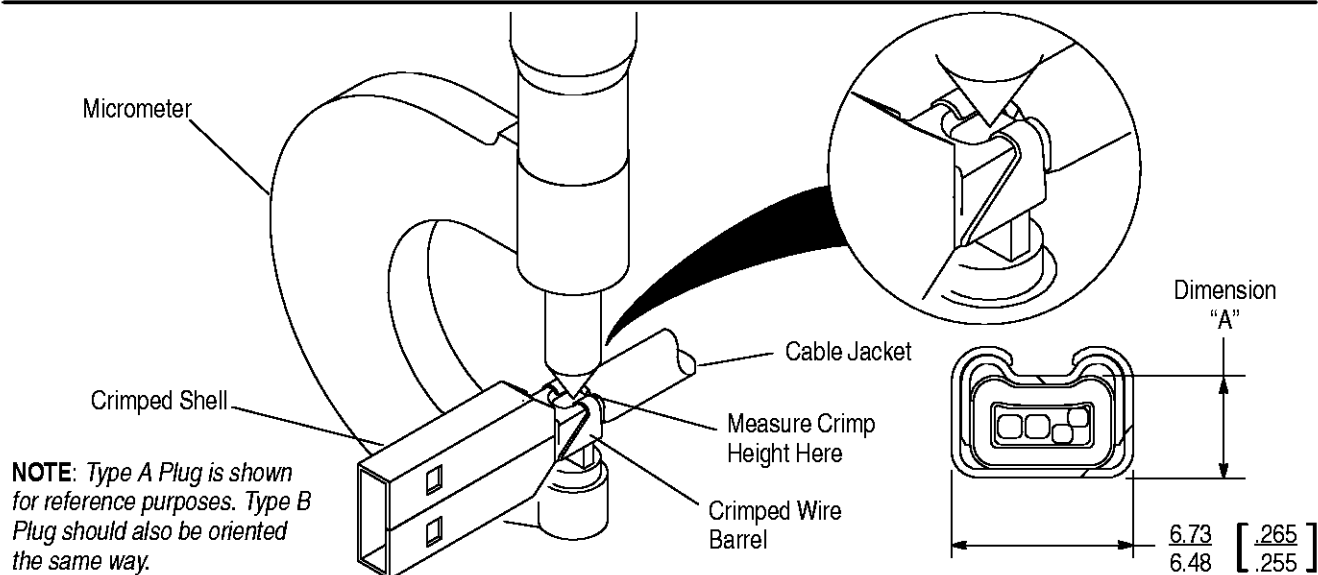
Type A Plug Connector**Type B Plug Connector**

Figure 7

3.7. Checking Cable Crimp Height

Based on the cable size terminated, use the following table to check cable crimp height. The crimp height is measured at the point shown in Figure 8.



USB SHELL CABLE CRIMP HEIGHT

WIRE SIZE, AWG	DIMENSION "A"	CABLE DIAMETER	CRIMP SETTING
20 – 28	4.19 – 4.45 [.165 – .175]	5.33 [.210]	A
22 – 28	4.19 – 4.45 [.165 – .175]	5.08 [.200]	A
24 – 28	3.94 – 4.19 [.155 – .165]	4.95 [.195]	B
26 – 28	3.94 – 4.19 [.155 – .165]	4.70 [.185]	B
28 – 28	3.68 – 3.94 [.145 – .155]	3.40 – 4.57 [.134 – .180]	C

Figure 8

3.8. Repair/Removal

Once a wire has been soldered to the insert molded contact, it cannot be removed and a new insert molded contact must be used. When a housing has been inserted into the backshell, it cannot be removed and a new housing must be used. If the housing is damaged, it must be replaced.

3.9. Overmolding/Strain Relief

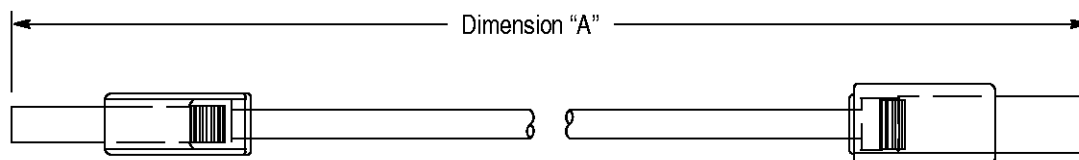
The overmolding operation occurs after the termination of the shield. Strain relief is optional.

A. Type A Plug

General external dimensions of the USB Type A plug overmolding should be no greater than 8 mm [.31 in.] high by 16 mm [.63 in.] wide to expose a minimum of 11.75 mm [.46 in.] of the front of the plug. Length of overmold is determined by the customer. For allowable length of cable assemblies, see Figure 9.

B. Type B Plug

General external dimensions of the USB Type B plug overmolding should be no greater than 10.5 mm [.41 in.] high by 11.5 mm [.45 in.] wide to expose a minimum of 11.75 mm [.46 in.] of the front of the plug. Length of overmold is determined by the customer. For allowable length of cable assemblies, see Figure 9.



WIRE SIZE, AWG	MAXIMUM CABLE LENGTH DIMENSION "A"	WIRE SIZE, AWG	MAXIMUM CABLE LENGTH DIMENSION "A"
20 – 28	5.00 m [16.4 ft.]	26 – 28	1.31 m [4.3 ft.]
22 – 28	3.33 m [10.9 ft.]	28 – 28	0.81 m [2.7 ft.]
24 – 28	2.08 m [6.8 ft.]		

Figure 9

3.10. Cross-Section View

Figure 10 shows a cross-section view of a completely terminated and overmolded Type A and Type B Plug Connector.

Type A Plug Connector

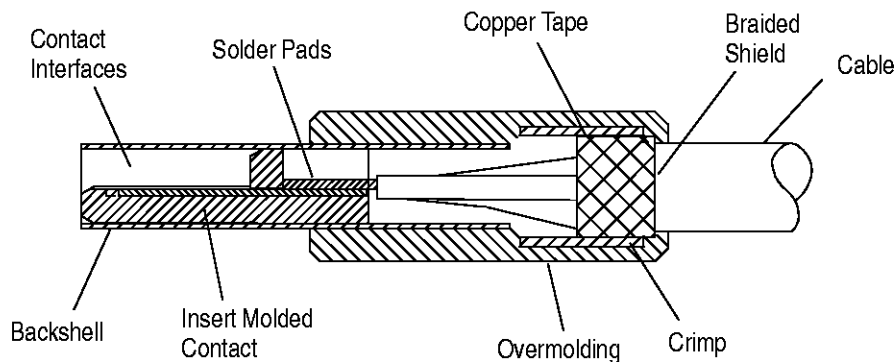


Figure 10 (cont'd)

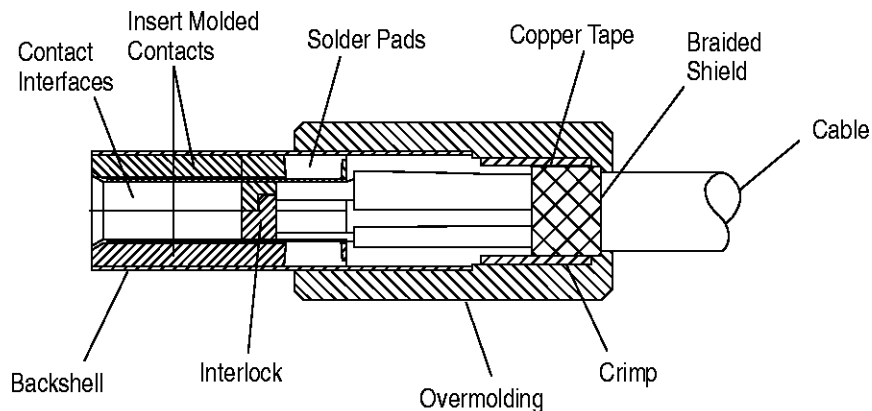
Type B Plug Connector

Figure 10 (end)

4. QUALIFICATIONS

Universal Serial Bus Connectors have been component recognized by Underwriters' Laboratories, Inc. (UL) under File No. E81956 and also certified to Canadian Standards by UL under the same file number.

5. TOOLING

Figure 11 provides tool part numbers and instructional material related to USB Type A and Type B Connectors.

NOTE

AMP Tool Engineers have designed machines for a variety of application requirements. For assistance in setting up prototype and production line equipment, contact AMP Tool Engineering through your local AMP Representative or call the Tooling Assistance Center number at the bottom of page 1.

- **Manual Arbor Frame Assembly and Backshell Crimper Assembly**

The backshell crimper assembly is used in conjunction with the manual arbor frame assembly to crimp USB Type A and B backshells onto cable with USB connectors.

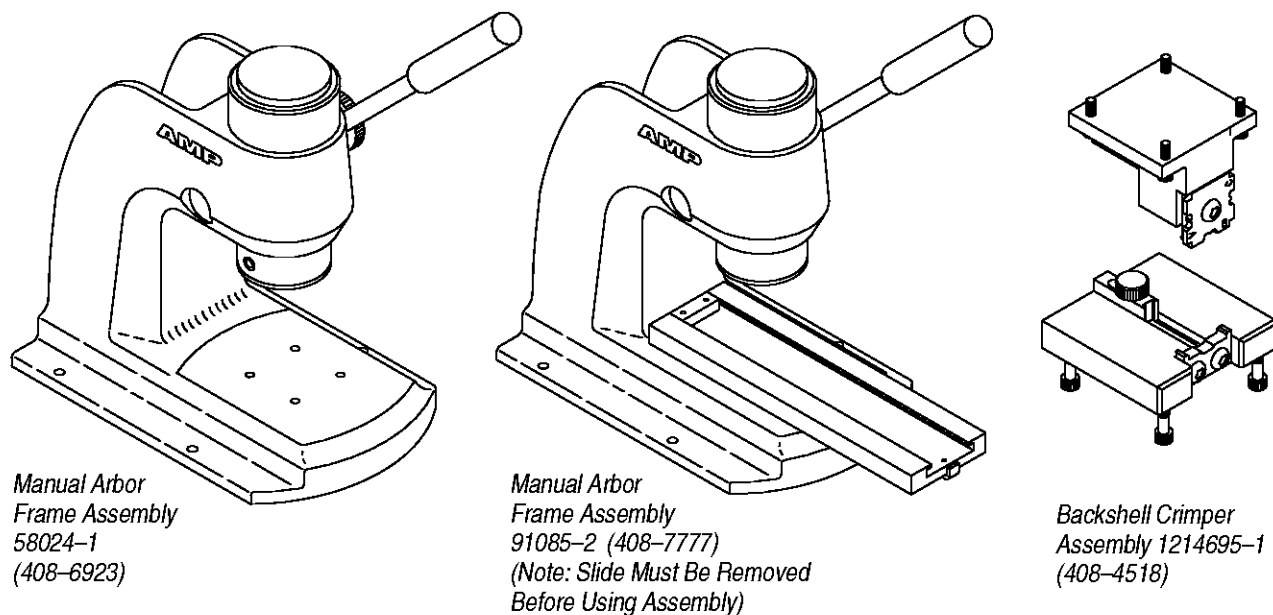
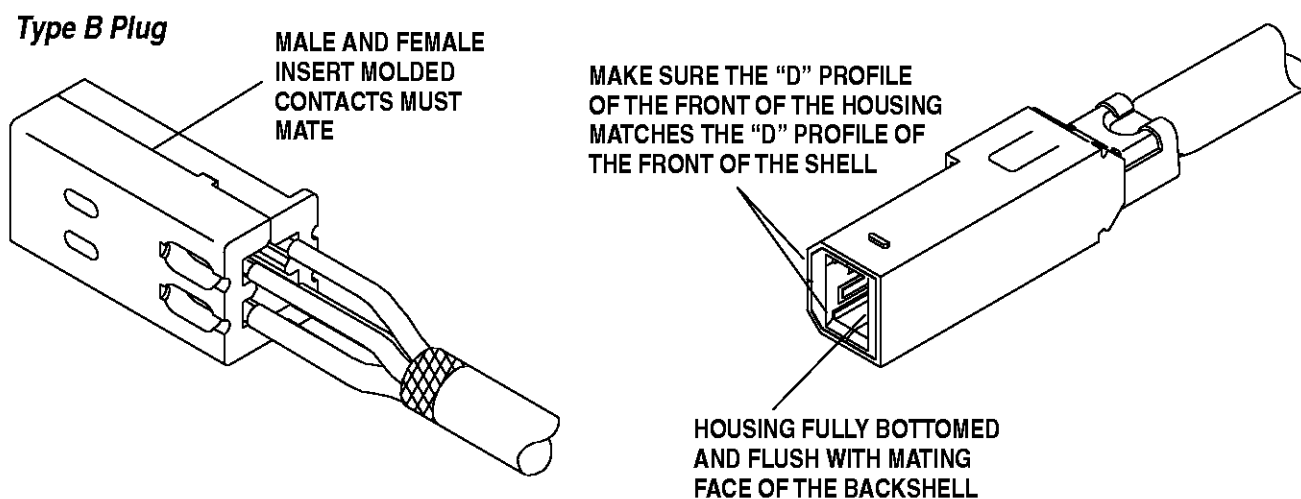
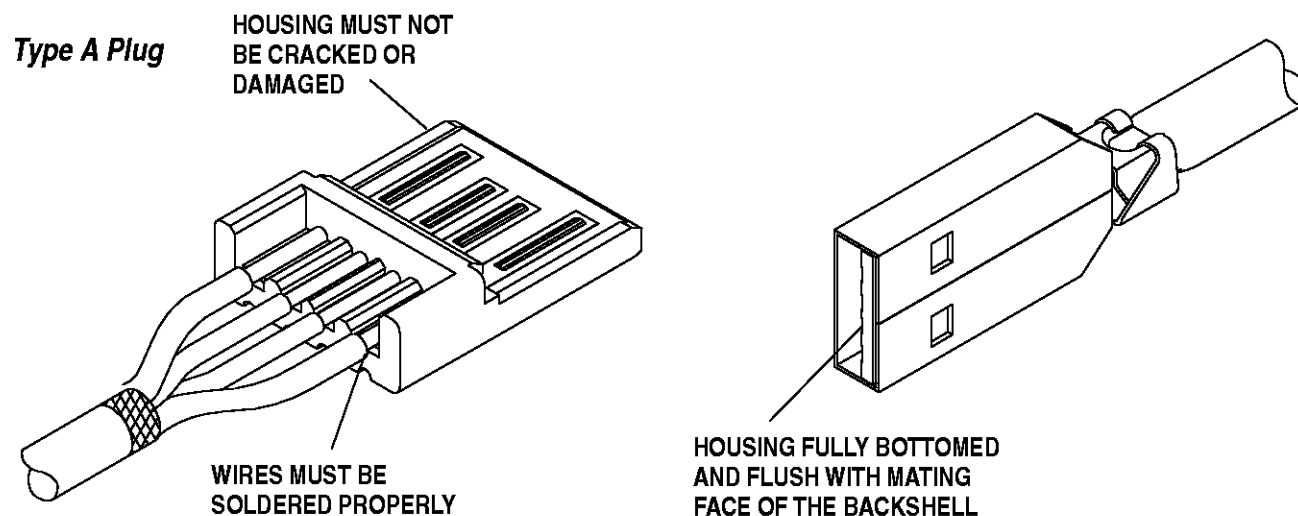


Figure 11

6. VISUAL AID

Figure 12 shows typical applications of Universal Serial Bus Type A and Type B 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.



Overmolding

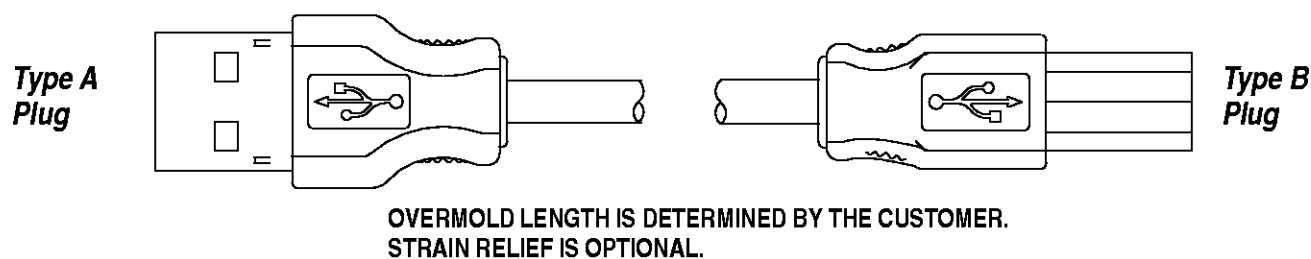


FIGURE 12. VISUAL AID