Metal-Shell Micro Circular Connectors

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 ±2°. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the requirements for application of Metal-Shell Micro Circular Connectors with Pin and Socket or Spring Probe Contacts. These high density connectors are primarily used for military, aerospace, outdoor, and industrial applications where limited space is a factor. This environmentally sealed (IP67) and shielded connector system is available as a cable-to-cable, cable-to-board, in a jam-nut style rear panel-mount configuration. This connector system consists of a 7-position (shell size M11), 8-position (Ethernet configuration), or a 19-position (shell size M14) plug connector, and a mating receptacle 7-, 8-, or 19-position connector. See Figure 1.

The screw-machine solder-cup contacts will accept a wire size range of 30-24 AWG and are available in pin and socket or spring probe to pad interface. No assembly or application tooling is required to terminate or assemble these connectors. Optional ancillary items are also available for your application requirements. See Figure 1 and Paragraph 3.16.

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.

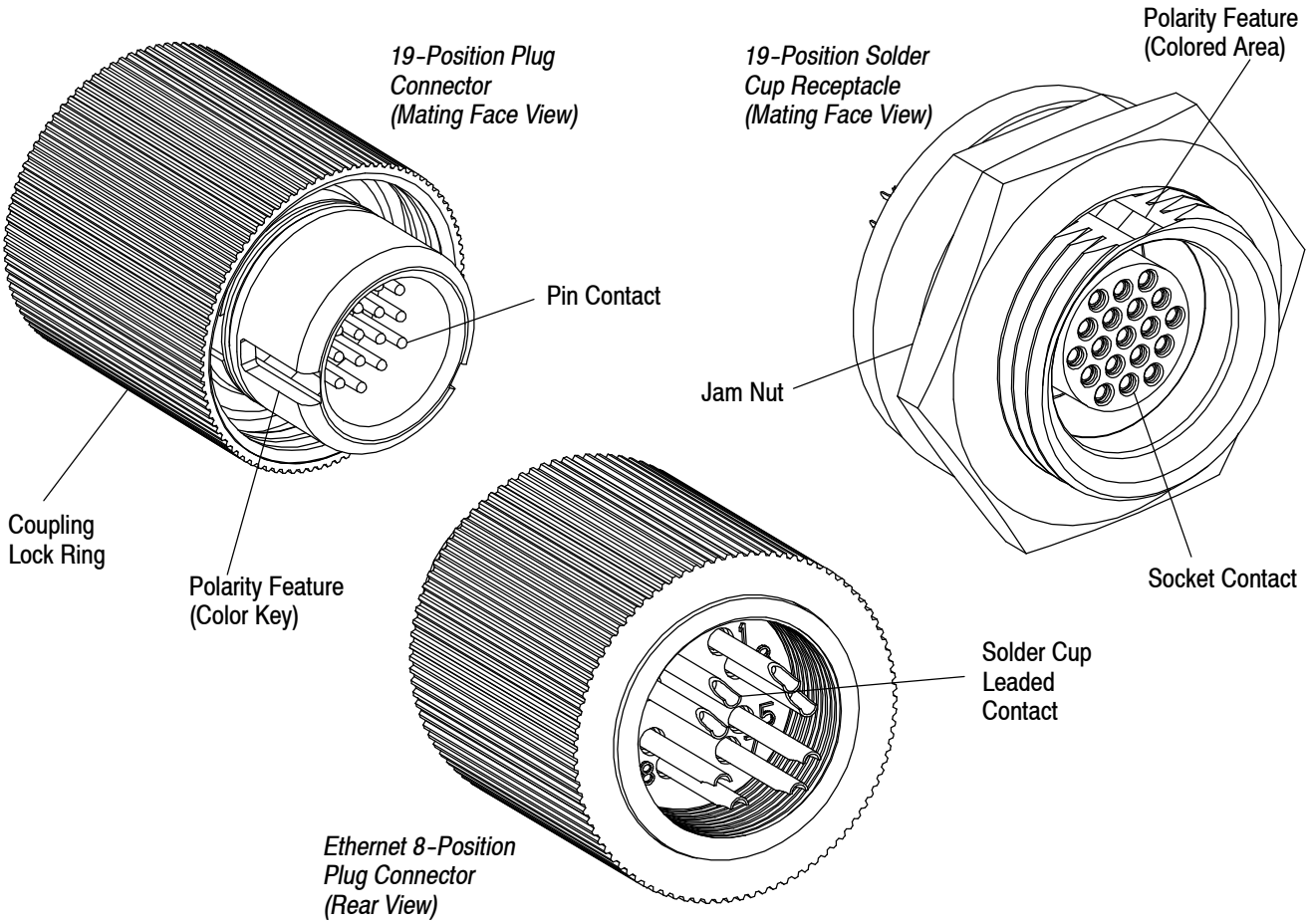


Figure 1 (cont'd)

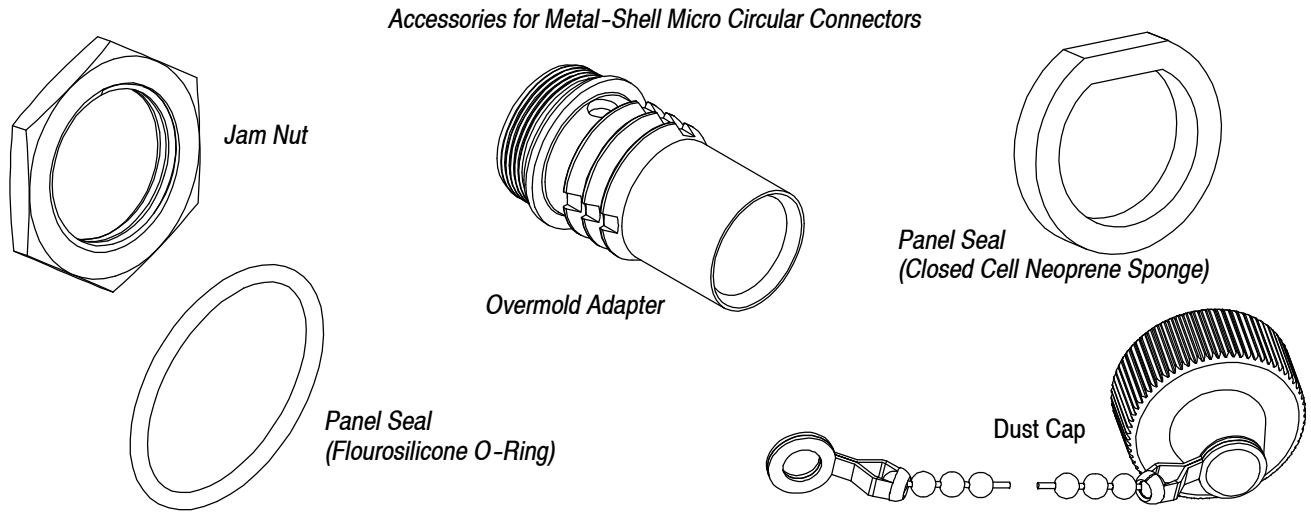


Figure 1 (end)

2. REFERENCE MATERIAL

2.1. Revision Summary

- Updated document to corporate requirements and new logo

2.2. Customer Assistance

Reference Base Product Part Numbers 1738552, 1738553, 1877007, 1877255, and Product Code K341 are representative of Metal-Shell Micro Circular Connectors. 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 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. Manuals

Manual 402-40 is available upon request and can be used as a guide in soldering. This manual provides information on various flux types and characteristics along with commercial designations and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

2.5. Standards and Publications

IPC/EIA S-STD-001 (Requirements for Soldered Electrical and Electronic Assemblies) describes materials, methods, and verification criteria for producing high quality soldered interconnections. IPC/WHMA-A-620 (Requirements and Acceptance for Cable and Wire Harness Assemblies) describes acceptability criteria for crimped, mechanically secured and soldered interconnections.

2.6. Specifications

Product Specification 108-2169 (Standard), and 108-2169-1 (Gigabit Ethernet) provides product performance and test information for Metal-Shell Micro Circular Connectors. Product Specification 108-1943 provides product performance and test information for the Spring Probe to Pad Contacts, and 108-2080 for Pin to Socket Contacts. Workmanship Specification 101-573 for Solder Cup Contacts covers unacceptable conditions for the inspection of solder conditions for wire into solder cup contacts.

3. REQUIREMENTS

3.1. Safety

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

3.2. Storage

A. Ultraviolet Light

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

B. Shelf Life

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

C. Chemical Exposure

Do not store connectors near any chemical 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

3.3. Materials

The connector components are made from the following materials:

- Spring Probe Pin: Brass w/gold finish over nickel on mating end, tin–lead over nickel on solder cup/tail
- Spring Probe Pad and Pin Contact: Brass with gold finish over nickel on entire contact
- Socket Contact: BeCu inner clip with gold finish over nickel and brass body with tin–lead over nickel
- Connector Shell: Black chrome plated (with nickel–plated brass option)
- Insulator: High temperature white thermoplastic
- O–Rings: Fluorosilicone

3.4. Operating Temperature

The maximum operating temperature for this connector system is 150°C [302°F].

3.5. Adapters

The following table in Figure 2 provides information on the usage of various adapters.

OVERMOLD OR SHRINK TUBE WITH OR WITHOUT SHIELD TERMINATION BRASS ADAPTERS - MSMC						
TYPE	**PLUG CONN SHELL SIZE**	**OVERMOLD OR SHRINK TUBE BRASS ADAPTER**	**CABLE OD MAX**	**OVERMOLD OR SHRINK TUBE WITH SHIELD TERMINATION BRASS ADAPTER**	**CABLE OD MAX**	**SHRINK BOOT REFERENCE●**
CRIMP	M11	1604366-4	4.8 [.189]	1604366-7 with Crimp Ferrule■	5.44 [.214]	Versafit Series or RW 175 Series (High Temp)
		1604366-5	6.25 [.246]			
TINEL RING●	M11	TXS165XX00-1405A1	4.8 [.189]	TXS165XX00-1405A1 with Tinel Ring TC03A1	4.8 [.189]	202K1XX Series, 202D1XX Series, 202D2XX Series, or 202C6XX Series
BANDSTRAP●	M11	BNS165XX00-1103A	4.8 [.189]	BNS165XX00-1103A with Bandstrap BND-1225S/P	4.8 [.189]	
SHRINK BOOT●	M11	SCA16511-XXX	---	---	---	
CRIMP	M14	1604366-3	7.1 [.280]	1604366-11 with Crimp Ferrule■	7.1 [.280]	Versafit Series or RW 175 Series (High Temp)
TINEL RING●	M14	TXS166XX00-1405A1	7.9 [.311]	TXS166XX00-1405A1 with Tinel Ring TC05A1	7.9 [.311]	202K1XX Series, 202D1XX Series, 202D2XX Series, or 202C6XX Series
BANDSTRAP●	M14	BNS166XX00-1103A	7.1 [.280]	BNS166XX00-1103A with Bandstrap BND-1225s/p	7.1 [.280]	
SHRINK BOOT●	M14	SCA16611-XXX	---	---	---	

■Cable needs to be defined for crimp ferrule, contact TE numbers at bottom of page 1.
●RAYCHEM* supplied parts, contact RAYCHEM for detailed information.

Figure 2

3.6. Cable Selection and Preparation

A. Cable Selection

Select the desired cable with a wire size range of 0.06–0.2 mm^2 [30–24 AWG]. Cut overall length to production requirements. Cable OD is dependent upon the adapter used with the plug connector, refer to Paragraph 3.5 and Figure 2.

NOTE

The 24 AWG wire size is solid or 7-strand only.

B. Cable Preparation

1. After cutting overall length, place heat shrink tubing (approximately 76.2 mm [3.00 in.] in length, crimp ferrule (if applicable), and the overmold/shield termination adapter onto the cable. See Figure 3.

Figure 3

NOTE

Wrapping masking tape around the cable (or other suitable methods) works well at holding the components out of the way until needed. However, these components may be placed onto the opposite end of the cable at their time of need if the opposite end is unterminated.

2. Strip off 12.7 mm [.50 in.] of the outer cable jacket. See Figure 4.

CAUTION

Take care so as to not cut through the shield or the individual discrete wires or conductors.

Figure 4

3. Fold the metal foil or the braid shield, (if applicable) back onto the cable jacket. If present, cut away any tape and/or other filler material down to where the braid is folded over, taking care not to damage or cut through the discrete wires or conductors. See Figure 5.

CAUTION

Do NOT cut the drain wire, if present.

Figure 5

NOTE

For cable with individual conductors: Separate the individual conductors, and strip the insulation back 2.54 mm [.100 in]. For cable with twisted pair wires: Separate the wire pairs from one another, but KEEP the wire pairs twisted to within 9.52 mm [.375 in.] of termination. Strip the insulation back 2.54 mm [.100 in.]. See Figure 6.

4. Dip ends of exposed conductors into a mild non-residue flux, and pre-tin ends by dipping into a hot solder pot.

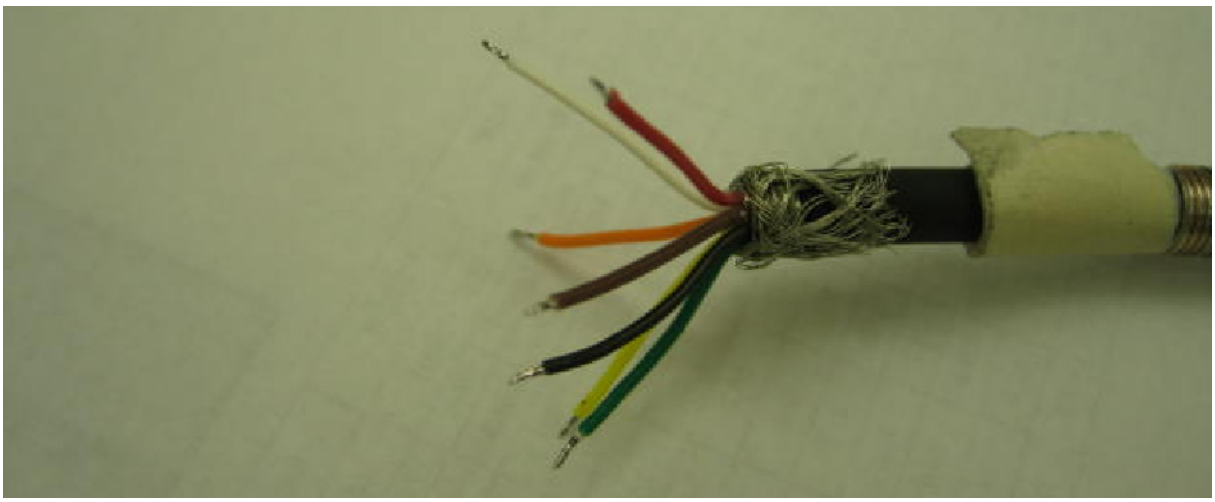


Figure 6

3.7. Soldering Discrete Wires

NOTE

When soldering the individual wires and conductors, be sure to develop a class 3 solder joint. In order to determine what represents a good solder joint, refer to IPC/WHMA-A-620 to generate your class 3 solder joint.

1. Create a fixture to support the connector so that the operator has both hands free for the soldering operation. See Figure 7.

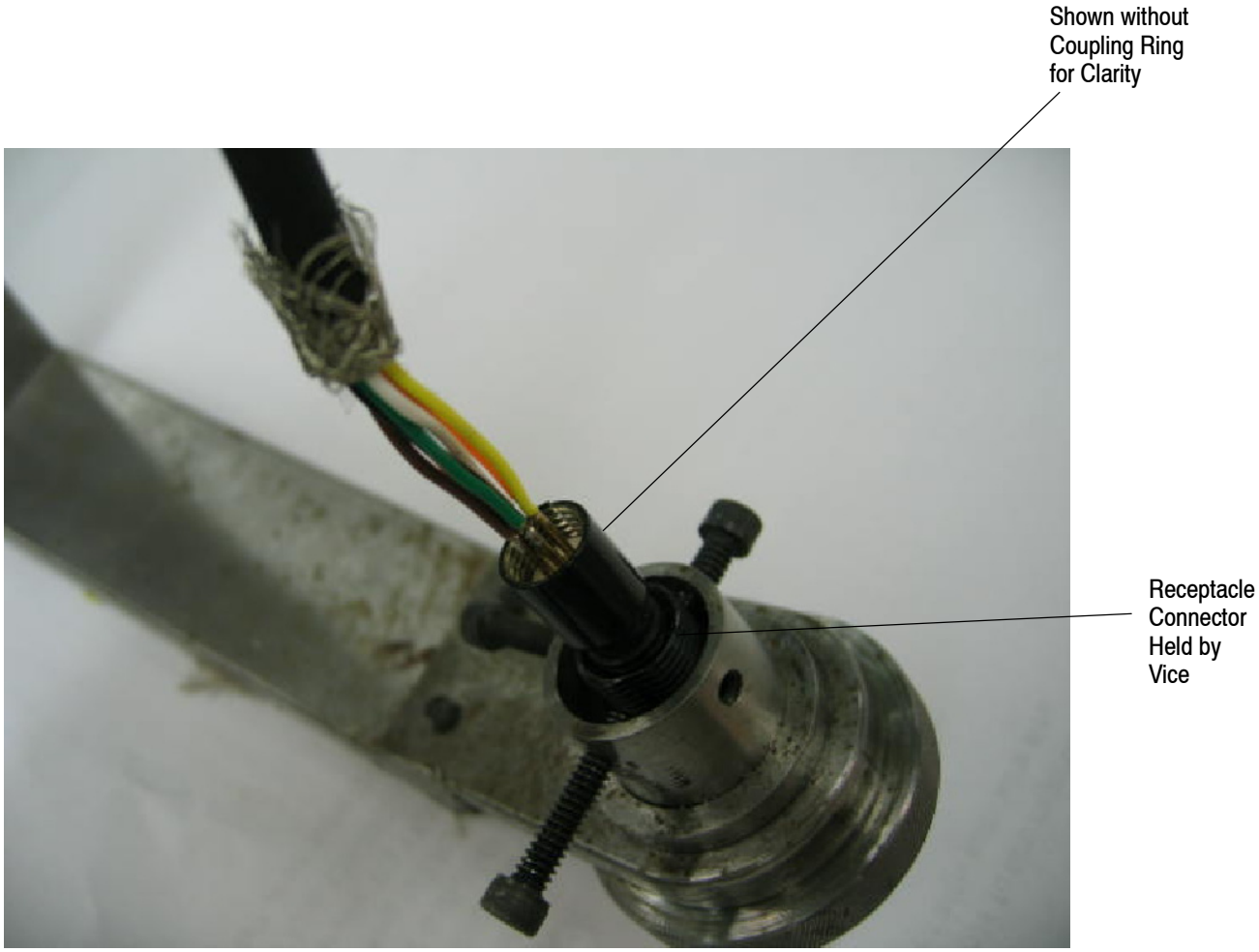


Figure 7

2. Perform the soldering operation under a microscope at a desired level of magnification for best visibility.

NOTE

This will aid in avoiding solder bridging or other undesirable solder joint results.

3. Again, apply a mild non-residue flux (by dipping or brushing) onto the pre-tinned conductors.

4. Using tweezers (or an other suitable instrument) for ease of handling, insert the wire into a solder cup contact.

5. With a free hand, melt a small amount of solder onto the tip of the solder iron. Place the tip of the solder iron onto the wire and solder cup, and fill the solder cup with solder. See Figure 8.

Figure 8

NOTE

Solder iron temperature should be 315.6°C [600°F] for lead-based solder and 426.7°C [800°F] for lead-free solder.

CAUTION

The iron should not be held in this position for more than three seconds to avoid over heating the contact and/or pulling solder away from the wire.

6. Flux can be cleaned off soldered contacts with Isopropyl Alcohol (IPA) and a soft brush.

CAUTION

Be careful not to damage solder contact leads while cleaning.

7. Test continuity of the terminated cable at this point.

NOTE

"Optional Step" - Apply for additional strength.

8. Under a microscope, apply a small amount of potting compound to the terminated conductors for additional strength. There are commercially available UV or heat curable acrylics/epoxies such as Master Bond's UV15-7TK1A or Loctite's Hysol EO1016, or an equivalent encapsulant/sealant may be applied. A UV Cured Acrylic (ACS-3 TE proprietary urethane/acrylate blend) is shown in Figure 9.

Master Bond and Loctite are trademarks of their respective owners.

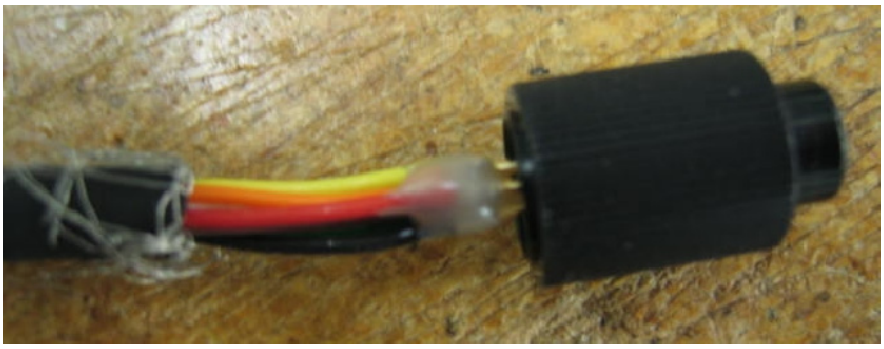


Figure 9

CAUTION

Do not add so much potting compound that the overmold/shield termination adapter cannot be placed correctly.

9. Screw the overmold/shield termination adapter into the rear of the connector and test continuity to make sure there is no shorting against the adapter.

10. Remove the overmold/shield termination adapter.

11. Under a microscope, you may choose to apply a small amount of Loctite 262 or Permabond E04 (2-part epoxy) onto the external threads of the overmold/shield termination adapter or onto the internal threads located at the rear of the plug connector, in order to retain the adapter inside the plug connector. A Permabond E04 parts A&B is shown in Figure 10.

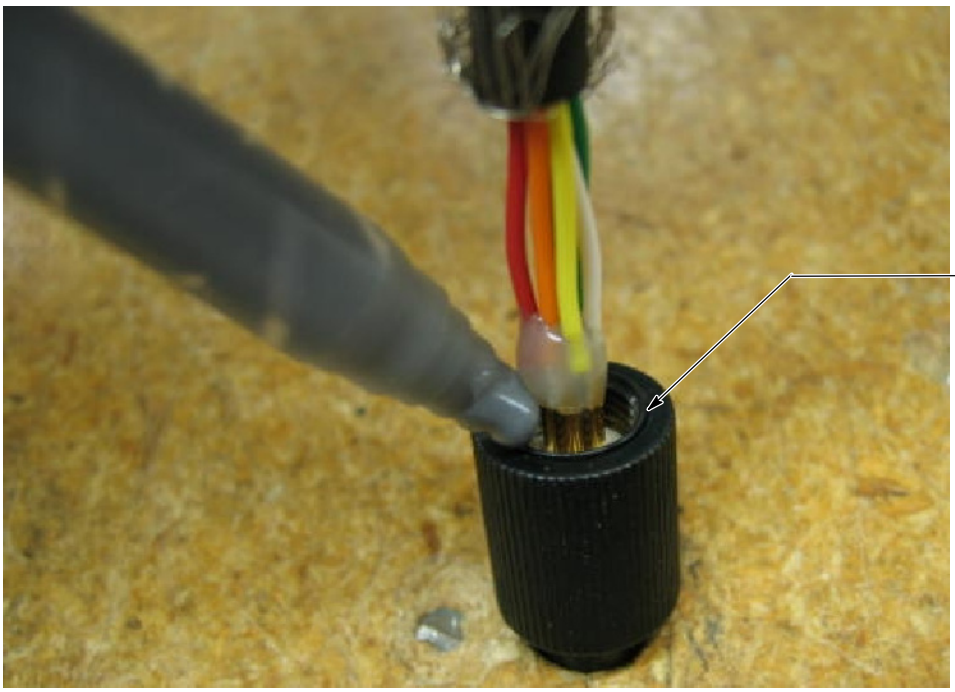


Figure 10

CAUTION

NO thread lock material should be allowed to seep under the connector's Coupling Ring since it will also lock it in place and render the connector unusable.

Loctite and Permabond are trademarks of their respective owners.

12. Test the continuity of the cable assembly at this point.
13. Screw the overmold/shield termination adapter into the rear of the connector. See Figure 11.

Figure 11

NOTE

"Optional Step" - Apply for additional strength.

14. Apply enough 2-part epoxy into the rear of the adapter in order to add more strain relief to the terminated conductors. A Permabond E04 Parts A & B is shown in Figure 12.

Figure 12

15. Test the continuity of the cable assembly at this point.

Permabond is a trademark.

16. Fold the metal foil or the braid shield, along with the drain wire (if present) onto the extended area at the rear of the overmold/shield termination adapter. See Figure 13.

Figure 13

17. Slide the crimp ferrule, (if applicable) over the braid shield and onto the extended area at the rear of the overmold/shield termination adapter. See Figure 14.

Figure 14

18. Crimp the ferrule onto the braid shield using the appropriate crimp tooling as specified with the ferrule. See Figure 15.

Figure 15

CAUTION

If a pneumatic machine is used, care should be taken that the connector and/or adapter are not damaged during the crimping process.

19. Slide the heat shrink tubing to the rear of the connector and heat its' perimeter with a heat gun until it is shrunk onto the cable. See Figure 16.

Figure 16

20. Perform a final continuity test on the cable assembly.

3.8. Strain Relief and Wire Dress

When bending or forming wires, hold the wire bundle at least ten times (10X) the diameter beyond the back of the connector before bending in any direction. Wires must remain perpendicular to the connector and avoid an excessively sharp bend radius.

3.9. Panel Mounting

A. Cutout

The maximum panel thickness shall be 3.25 mm [.128 in]. The panel must be cut using the dimensions provided in Figure 17.

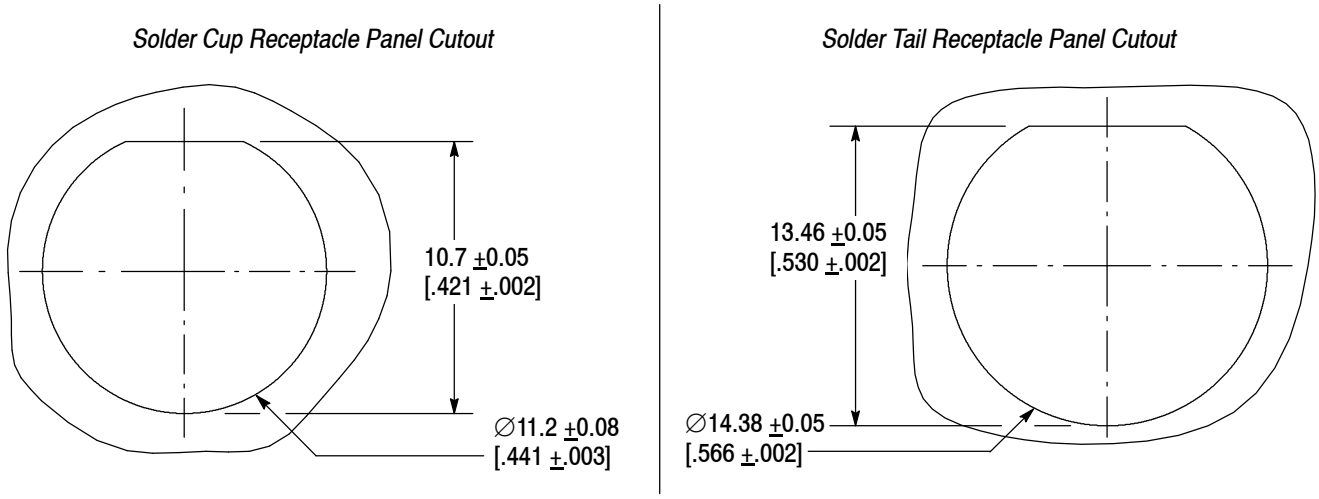


Figure 17

B. Mounting

The receptacle assembly can be rear panel mounted. The jam nut is threaded onto the front mating face of the receptacle assembly until it is flat against the panel. The jam nut must be tightened against the panel to 2.26–3.95 N●m [20–35 in–lbs]. See Figure18.

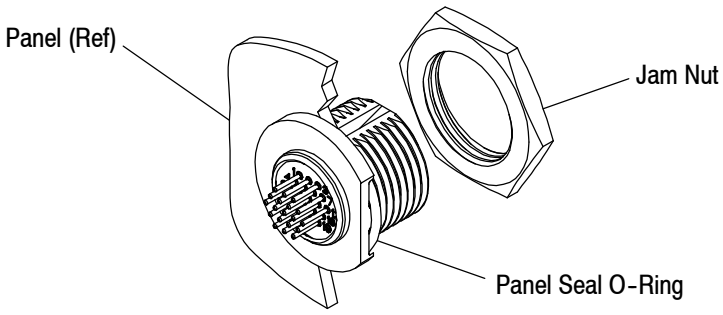


Figure 18

3.10. PC Board Mount Receptacle Assembly

Metal-Shell Micro Circular Connectors may be pc board mounted. The following procedures provide application information for this process.

A. Material and Thickness

1. PC Board material will be glass epoxy (FR-4, G-10).

2. The receptacle connector can be installed on 1.57 mm [.062 in.] thick pc boards. Board thickness may vary depending upon the application; however, contact tine length through the pc board becomes important for wave soldering operations. A recommended minimum of 0.76 mm [.030 in.] of the contact solder tine should protrude through the pc board.

NOTE

Contact the Product Information number at the bottom of page 1 for suitability of other pc board materials, thicknesses, specialized pc board designs, or applications.

B. Tolerance

Maximum allowable bow of the pc board shall be 0.13 mm [.005 in.] over the length of the receptacle connector.

C. PC Board Layout

The mounting and contact holes in the pc board must be precisely located to ensure proper placement and optimum performance of the connector. See Figure 19. The connectors are placed on the pc board manually.

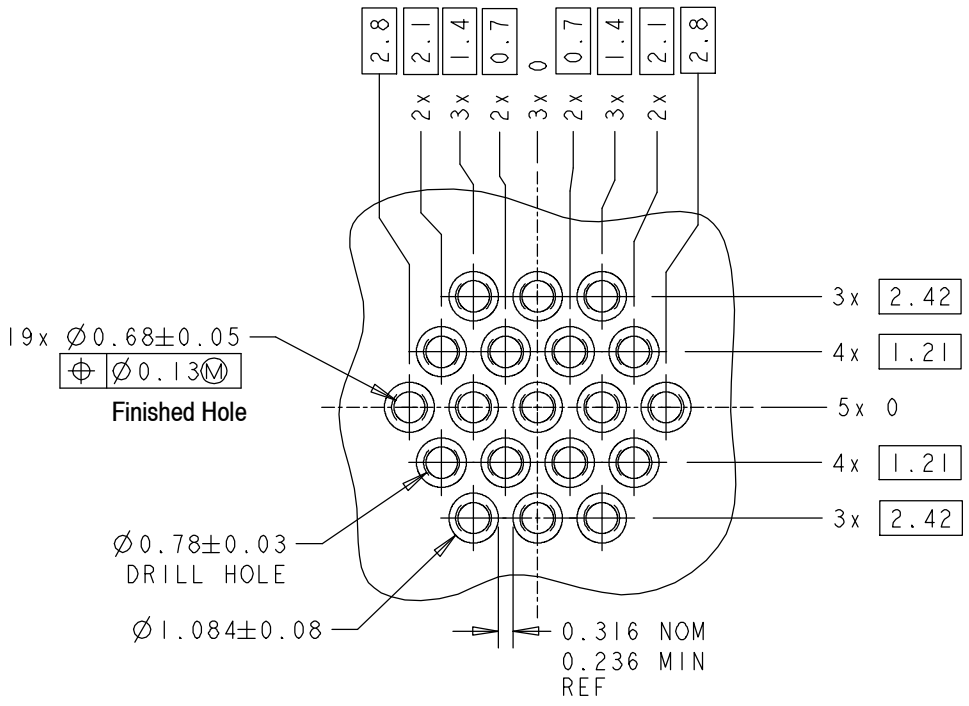
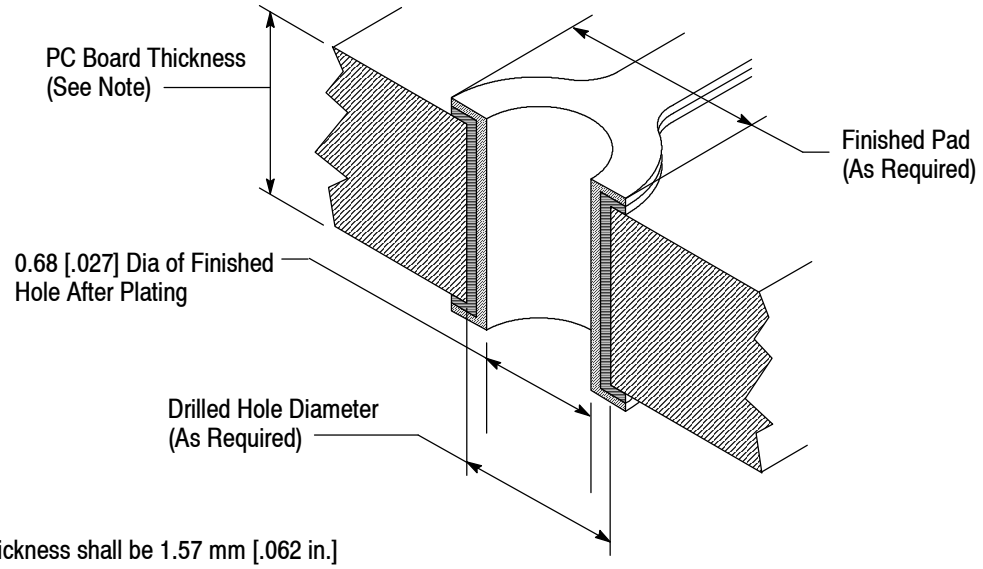


Figure 19

3.11. PC Board Contact Tine Holes

These connectors are used with plated-through holes. The drilled hole size, plating types, and plating thickness are dependent on customer application requirements. The finished hole size must be as stated in Figure 20 to provide unrestricted insertion and ensure adequate application of the solder to the connector solder tines.



NOTE: PC board thickness shall be 1.57 mm [.062 in.]

Figure 20

3.12. Connector Placement

CAUTION

The connector should be handled only by the metal shell to avoid deformation, contamination, or other damage to the solder-tails.

Determine which hole in the pc board is to receive the number one contact solder-tail, then orient the connector so the number one solder-tail is aligned with the hole.

3.13. Soldering

A. Flux Selection

Contact solder-tails must be fluxed prior to soldering with a mildly active flux. Selection of the flux will depend on the type of pc board and other components mounted on the board. Additionally, the flux must be compatible with the wave solder line, manufacturing, health, and safety requirements.

B. Soldering Guidelines

These connectors can be soldered using wave or equivalent soldering techniques. The temperatures and exposure time shall be within the ranges specified in
Figure 21.

NOTE

Manual 402-40 provides some guidelines for establishing soldering practices. Refer to Paragraph 2.4, Manuals.

SOLDERING PROCESS	TEMPERATURE		TIME (At Max Temp)
	CELSIUS	FAHRENHEIT	
WAVE SOLDERING	240° ±5° ❖	464° ±9° ❖	10 ±.5 Seconds

❖ Wave Temperature

Figure 21

C. 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 22.

Cleaners must be free of dissolved flux and other contaminants. We recommend cleaning with the pc board on its edge. If using an aqueous cleaner, we recommend standard equipment such as a soak-tank or an automatic in-line machine.

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 TE 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)	TEMPERATURE (Maximum)
NAME	TYPE		
ALPHA 2110	Aqueous	1	132°C [270°F]
BIOACT EC-7	Solvent	5	100°C [212°F]
Butyl CARBITOL	Solvent	1	Ambient Room
Isopropyl Alcohol	Solvent	5	100°C [212°F]
KESTER 5778	Aqueous	5	100°C [212°F]
KESTER 5779	Aqueous	5	100°C [212°F]
LONCOTERGE 520	Aqueous	5	100°C [212°F]
LONCOTERGE 530	Aqueous	5	100°C [212°F]
Terpene Solvent	Solvent	5	100°C [212°F]

Figure 22

D. 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]. Excessive temperatures may cause connector degradation.

3.14. Checking Installed Connector

Metal Shell Micro Circular Connectors may be seated on top of a suitable standoff that is on the pc board similar to what is shown in Figure 23.

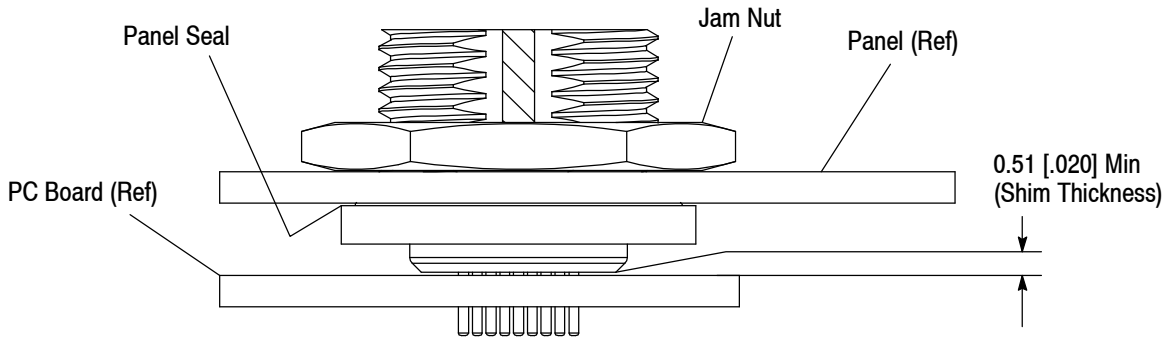


Figure 23

3.15. Alignment Configurations

Assurance of proper mating is provided by colored key configuration. The colored slot of the cable plug assembly must align with the colored area and internal key of the receptacle assembly. See Figure 24 for typical alignment configurations.

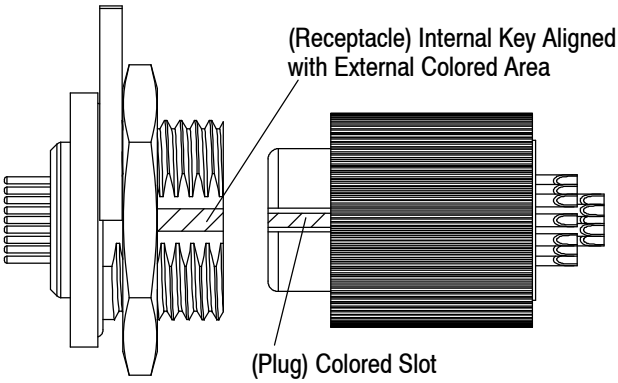


Figure 24

3.16. Ancillary Items

A. Dust Caps

If used, the dust cap should be attached to the receptacle assembly by using the attached bead chain and coupling loop. The loop of the chain is slid over the front face of the receptacle assembly, before the jam nut is threaded onto the receptacle assembly. See Figure 25.

If not engaging connectors immediately, the dust cap should be installed onto the receptacle assembly by threading its cap onto the mating threads of the receptacle assembly. The dust cap chain can be attached to the panel by any suitable means. A self tapping screw is one example. See Figure 25.

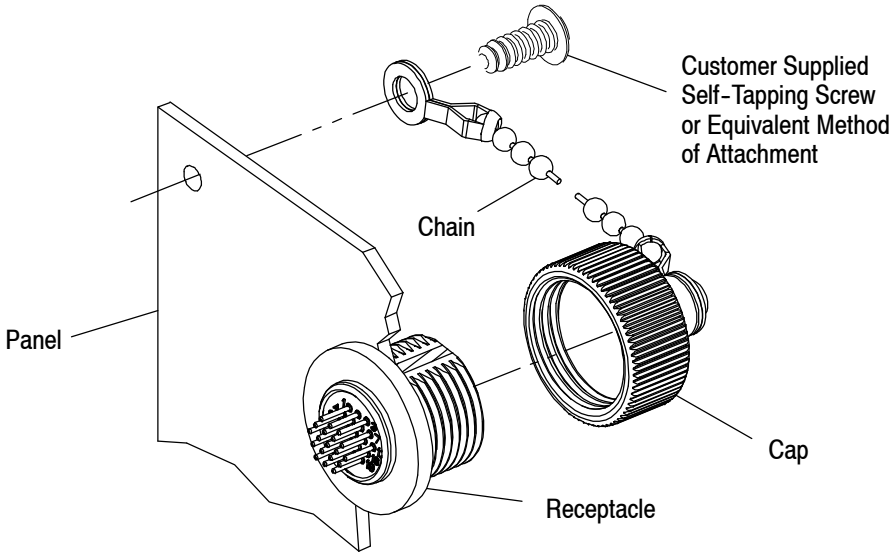


Figure 25

B. Jam Nuts

Jam nuts are used when a panel-mount configuration is used. Refer to Paragraph 3.9.B for information on the use of jam nuts. Contact the Product Information number at the bottom of page 1 for specific part numbers and sizes of jam nuts.

C. Overmold Adapter

The overmold adapter is used to protect the soldered wires and contacts and provides an area to attach on for the overmold or heat shrink tubing to seal the completed assembly. An extended overmold adapter is also available to allow for a terminating cable shield. Refer to Paragraph 3.7 for information on the use of the overmold adapter. Contact the Product Information number at the bottom of page 1 for specific part numbers and sizes of overmold adapters.

D. Panel Seals

Two types of panel seals are available for your production requirements. The closed cell neoprene sponge (black) seal is available for rear panel-mounting as well as the flourosilicone o-ring (blue) panel seal. Contact the Product Information number at the bottom of page 1 for specific part numbers and sizes of the panel seals.

3.17. Mating

CAUTION

Connectors should be handled only by the metal shell to avoid deformation, contamination, or damage to the contact solder joints.

1. The mating faces of the receptacle assembly and plug assembly must face each other with the alignment features located in the proper position. Refer to Figure 24.
2. The mating face of the plug assembly must be inserted into the mating face of the receptacle assembly, then the coupling locking ring must be threaded on the receptacle threads until the plug connector bottoms inside the receptacle assembly.

3.18. Mating Dimension

The dimension needed to ensure full mating of connectors must be considered when determining location. The mated dimension of the connectors is provided in Figure 26.

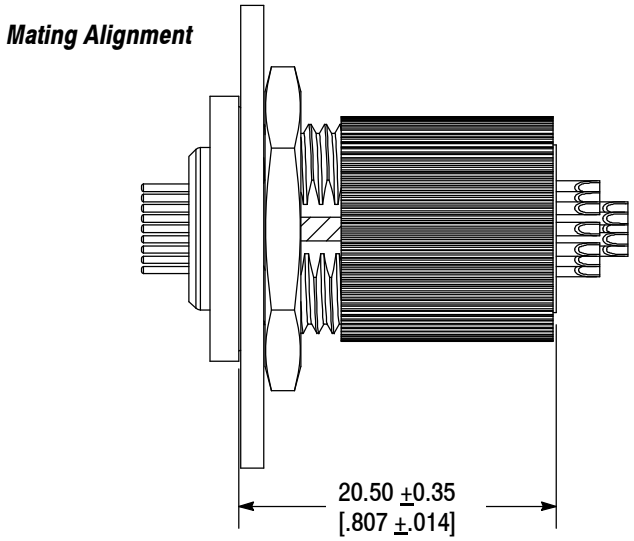


Figure 26

3.19. Disassembly

The connectors must be unmated by unthreading the coupling locking ring until the connectors disconnect. Pull the connectors straight apart. To avoid damage to the soldered connections, DO NOT pull on the wires.

3.20. Repair/Replacement

CAUTION

Damaged product should not be used. If damaged wires are evident, they must be removed (by standard desoldering methods) from the connector and replaced. If a damaged contact or connector is evident, the connector must be replaced.

4. QUALIFICATION

Metal-Shell Micro Circular Connectors are not required to be agency approved.

5. TOOLING

No tooling is required for assembly of the Metal-Shell Micro Circular Connectors with the exception of shield termination tooling, crimp ferrule, Band-It, or equivalent. Tool information and instructions are provided with the shield termination product.

6. VISUAL AID

Figure 27 shows a typical application of the Metal–Shell Micro Circular 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.

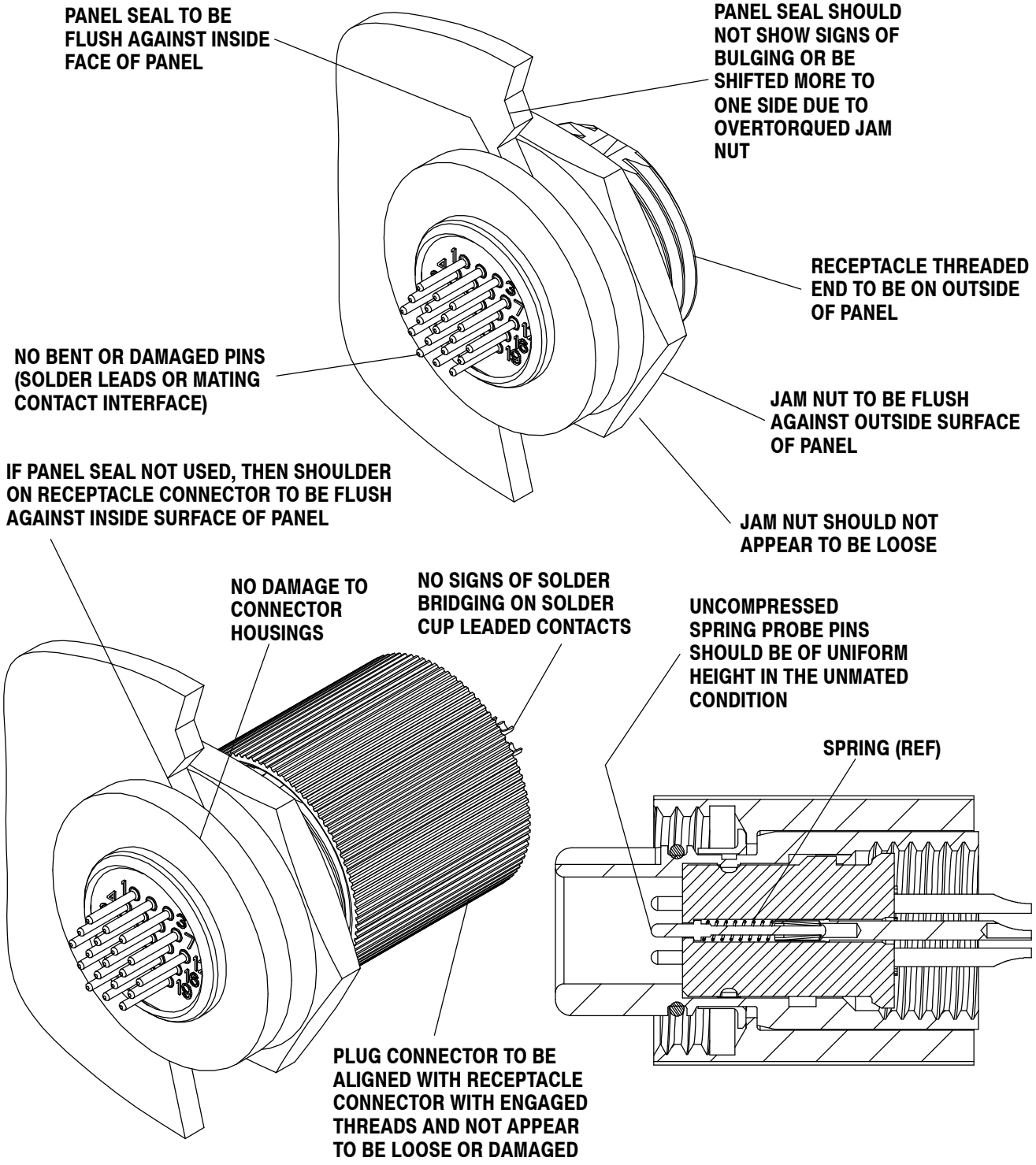


FIGURE 27. VISUAL AID