Title: Cable Harness Assembly **Number: WS-003**
Revision: B **Revision Date: 6/22/2011** **Requirements: NA**
Contact Name: Manager of Ops Inspection

Contents

3 Cable Harness Assembly

3.1 Requirements and Acceptance for Cable and Wire Harness Assemblies

3.1.1 Scope/Purpose The purpose of WS-003 is to supplement IPC/WHMA-A-620, by providing additional Class 3 requirements and acceptance criteria applicable to the assembly of cables and wire harnesses. The criteria may be new where none exists, add clarification to existing criteria or add criteria that are unique to L-3 Communications (CSW's) products or processes.

Where WS-003 does not provide supplemental criteria to IPC/WHMA-A-620, the Class 3 requirements of IPC/WHMA-A-620 apply (see IS-003). These requirements apply to stand alone cable assemblies as well as LRUs, System integration or any where similar characteristics exist.

WS-003 is organized in the same manner as the IPC/WHMA-A-620. This is deliberate to simplify its use and to group criteria into areas common to IPC/WHMA-A-620. Where no unique or additional criteria exist, the header is marked "**see IPC/WHMA-A-620 for criteria**."

The product classes to which the criteria apply has been omitted; only Class 3 requirements are addressed in WS-003A.

Note:
Torque requirements for threaded hardware **shall** be in accordance with 60083155, Specification of Torque and Retention Requirements for Threaded Hardware.

3.1.2 Terms and Definitions

Cable - An assembly of one or more wires carrying electrical current, with connectors on either end, formed together to create a single assembly. The terms cable and harness are used interchangeably, but harnesses normally have more than two connectors. RF cables are a special type of cable that transmit RF signals and use coaxial type of wire and use coaxial type of connectors.

3.2 Applicable Documents

Document Information Table 3-1

Responsible Organization:	**Operations**
Sub-Level function:	Workmanship Standards
Governing Document:	Y-001, Business Management System IPC/WHMA-A-620, Requirements and Acceptance for Cable and Harness Assemblies
Subordinate Documents:	NA
Related documents:	IS-001, Use of NON-Specified Hardware/Material
	IS-002, Alternate Piece Marking Method
	IS-003, Workmanship Acceptability of Electronic Assemblies
	IS-008, Part Number/Suffix Configuration
	IS-010, Unique Identification Number (UID)
	P-023, Calibration Standards/Electrical and Mechanical
	P-047, Inspection
	P-127, Assembly Tools and Control and Replacement
	W-103, Heat Shrink Terminations for Shielded Wire
	W-215, Specialized Connector Torque Application
	W-404, Inspection of Connector Contact/Pin Seating
	W-432, Practices for EMC-Electromagnetic Compatibility
	W-442, Unique Identification (UID) Piece Marking Label Printing and Verification
	60083155, Specification of Torque and Retention Requirements for Threaded Hardware
	60100697, Specification for Dielectric Withstanding Voltage (DWV) for Cable Assemblies

3.3 Preparation

Preparation

3.3.1 Wire Insulation Damage

Figure 3-1.

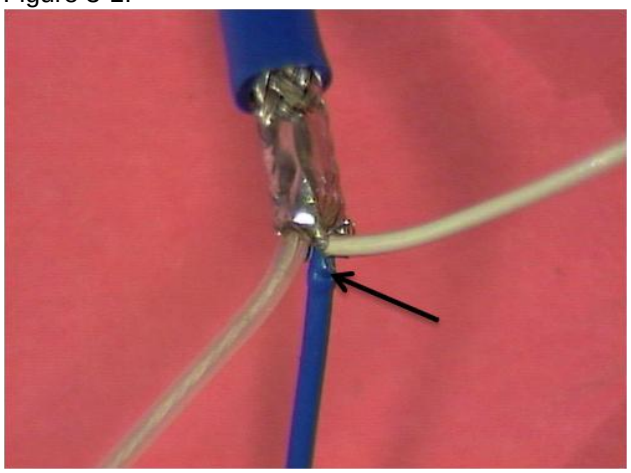
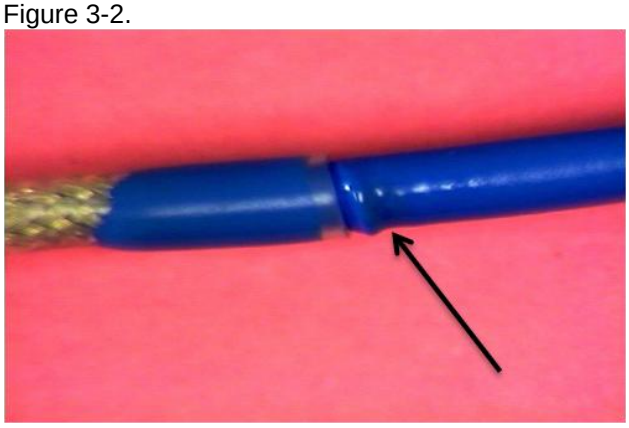


Figure 3-2.



Defect

- Insulation is melted exposing conductors.
- Insulation melted reducing insulation thickness more than 20%.

3.4 Soldered Terminations

(See IPC/ WHMA-A-620 for criteria)

3.5 Crimp Terminations (Contacts and Lugs)

This section provides additional crimp termination (contact and Lug) requirements and acceptance criteria that are currently not in IPC/WHAMA-A-620, and are unique to CS-W products or processes.

Crimp Terminations (Contacts and Lugs)

3.5.1 Crimping Solid Leads and Wires

The following criteria are applicable when the design requires a solid lead/wire to be crimped in a termination. Open or closed barrel contacts, the solid lead/wire **shall** be soldered to the termination in the brush inspection window (see Figure 3-3). When solid leads/wires are crimped in machined contacts without insulation support, the lead/wire **shall** be soldered to the contact in the insulation gap (insulation clearance area) (see Figure 3-4). When solid leads/wires are crimped in machined contacts with insulation support (see IPC/WHMA-A-620, Figure 5-4**7**) the lead/wire **shall** be soldered to the contact at the wire inspection window (see Figure 3-4).

Note: Soldering is performed after the crimping operation.

.

Figure 3-3.

Acceptable

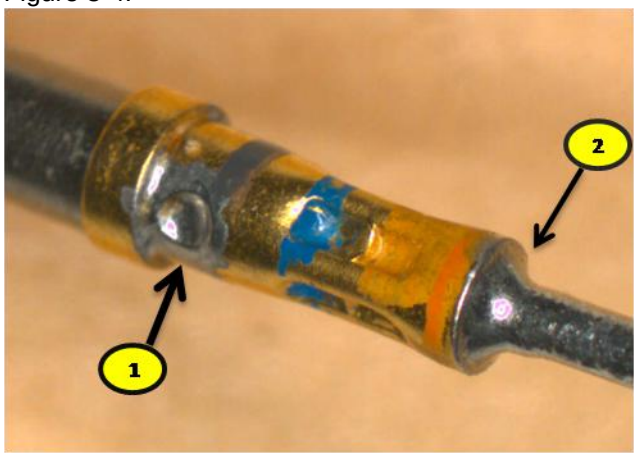
- Solid lead/wire soldered to Terminal.
- Meets solder requirements.
- Machined contacts may have a thin film of solder on the outside of the contact but may not extend onto the locking mechanism or the electrical mating surface.

Note: Also applies to open barrel contacts.

Crimp Terminations (Contacts and Lugs)

3.5.1 Crimping Solid Leads and Wires (cont.)

Figure 3-4.



1. Inspection Window
2. Insulation Gap (clearance area)

Acceptable (cont.)

Figure 3-5.

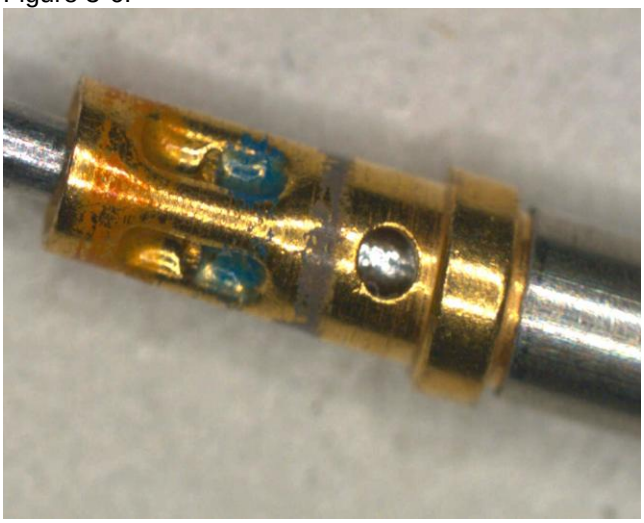
Defect

- Solid lead/wire not soldered.
- Solder does not meet requirements.
- Any evidence of nonwetting to wire or terminal.
- Dewetting of either wire or terminal.
- Solder buildup that affects form, fit or function.
- Machined contacts where the solder extends onto the locking mechanism or the electrical mating surface.

Crimp Terminations (Contacts and Lugs)

3.5.1 Crimping Solid Leads and Wires (cont.)

Figure 3-6.



Defect (cont.)

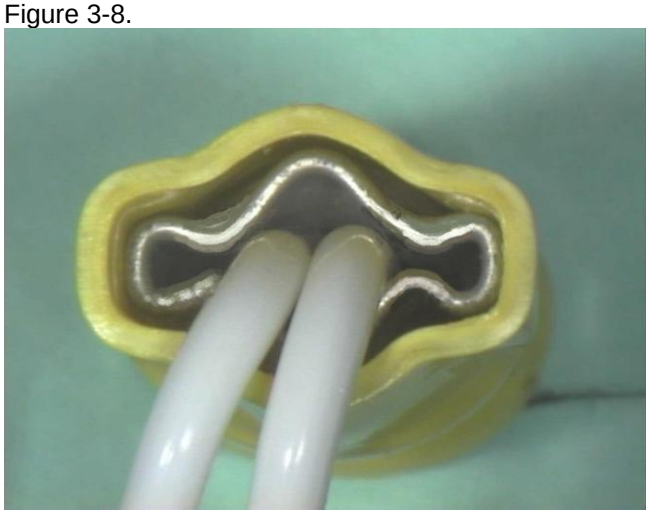
Crimp Terminations (Contacts and Lugs)

3.5.2 Stamped and Formed – Insulation Crimp

This section describes criteria that are applicable only when the wire diameter is outside the insulation support range specified by the contact manufacturer and the insulation support crimp cannot meet the requirements of IPC/WHMA-A-620, sections 5.1, Open Barrel or 5.2, Closed barrel terminations due to design requirements.

Figure 3-7.

Figure 3-8.



Acceptable

Single Wire

- Insulation crimp (inside diameter) does not exceed 1.5 times the wire diameter including insulation

Multiple Wire

- Insulation crimp (inside diameter) does not exceed 1.5 times the wire group diameter including insulation

Crimp Terminations (Contacts and Lugs)

3.5.2 Stamped and Formed – Insulation Crimp (cont.)

Figure 3-9.

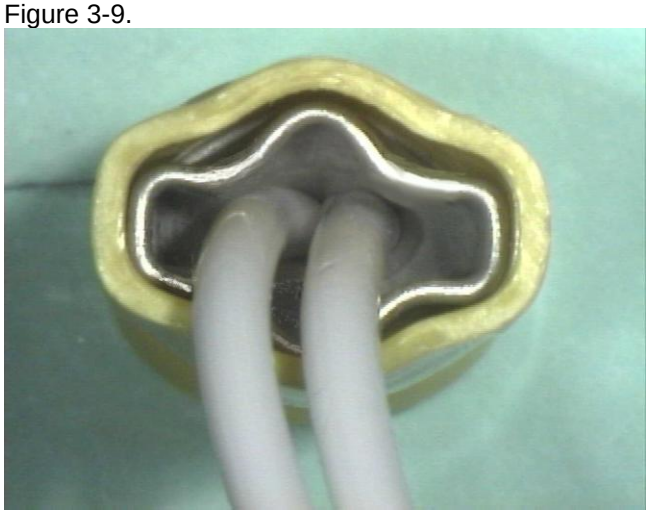
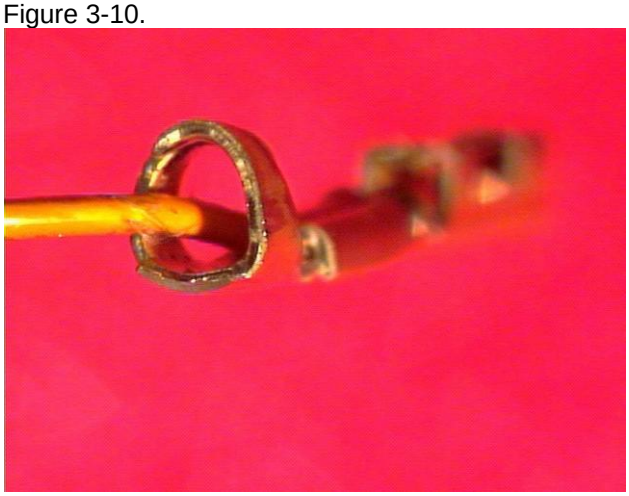


Figure 3-10.



Defect

Multiple Wire

- Wire insulation crimp (inside diameter is greater than 1.5 times the wire group diameter).

Single Wire

- Wire insulation crimp (inside diameter exceeds 1.5 times the wire diameter

Crimp Terminations (Contacts and Lugs)

3.5.3 Terminal Lugs – Without Metal Insulation Support

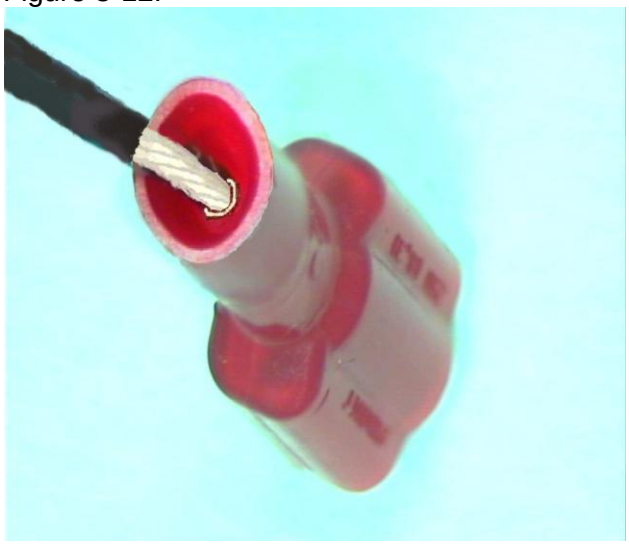
Terminals without a metal insulation support are exempt from the insulation crimp requirements due to the spring-back action (memory) of the plastic after crimping, all other criteria apply.

Figure 3-11.

Acceptable

- Wire insulation is within the insulation support barrel.
- Wire insulation does not enter the conductor crimp area.
- Wire crimp area is well formed and properly positioned.

Figure 3-12.



Defect

- Wire insulation is not within the insulation support barrel.
- Wire insulation enters the conductor crimp area.
- Insulation gap is greater than one wire diameter.

Crimp Terminations (Contacts and Lugs)

3.5.4 Terminal Lugs – For Aluminum/Copper Code Conductors

This section addresses the visual criteria for closed barrel crimped lugs that typically accommodate wire sizes that range from #10 AWG through 4/0. Some lugs in this range are high conductivity wrought aluminum approved for aluminum and copper conductors, performing equally well on both metals. These lugs are filled with a high temperature oxide inhibitor compound. Lugs are electro tin plated to prevent electrolytic corrosion when in contact with copper.

Caution:
The oxide inhibitor must never be removed prior to use.

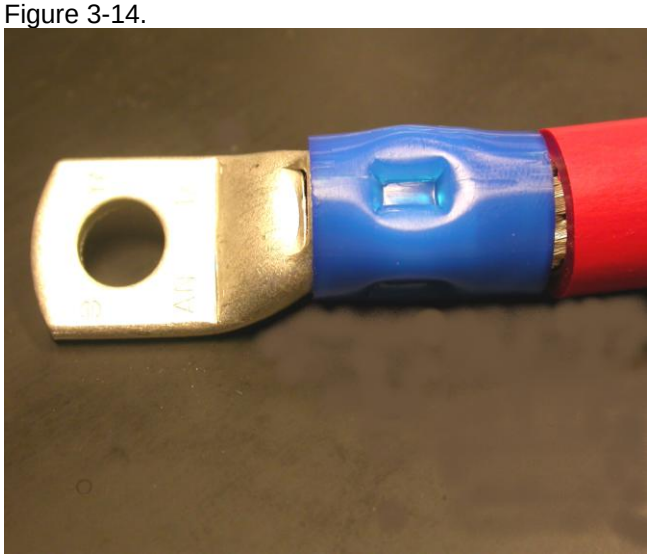
Note: Insulated terminals may or may not have an insulation crimp depending upon the terminal and the crimping tool used

Crimp Terminations (Contacts and Lugs)

3.5.4 Terminal Lugs – For Aluminum/Copper Code Conductors (cont.)

Figure 3-13.

Figure 3-14.



Target

- There is visible clearance between the terminal lug and the conductor insulation.
- Crimp indents are centered on the crimp barrel.
- Lug is not cracked or fractured.

Crimp Terminations (Contacts and Lugs)

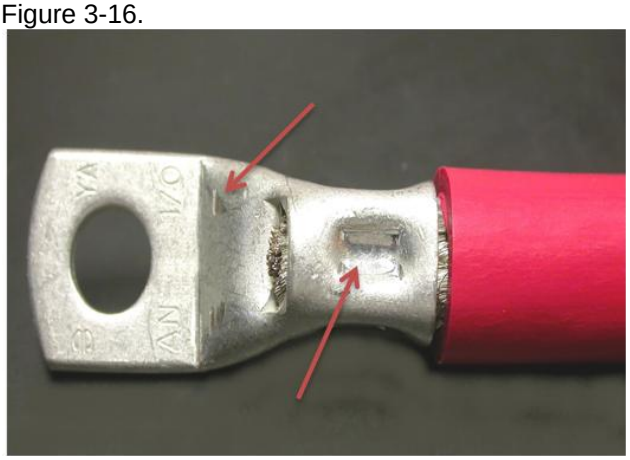
3.5.4 Terminal Lugs – For Aluminum/Copper Code Conductors (cont.)

Figure 3-15.

Acceptable

- Insulation gap is a maximum of 0.25 inch.
- Crimp indents are not centered and the terminal is not bent.
- Wire entry end of the barrel is not deformed by the crimp.
- Burnishing, tooling marks and deformation required to crimp the terminal.

Figure 3-16.



Crimp Terminations (Contacts and Lugs)

3.5.4 Terminal Lugs – For Aluminum/Copper Code Conductors (cont.)

Figure 3-17.

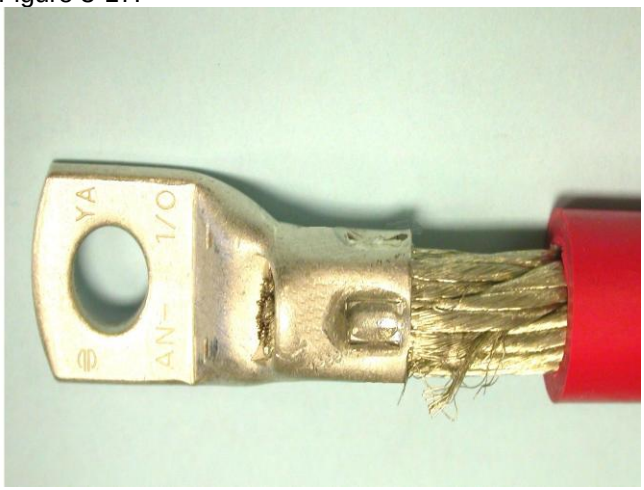
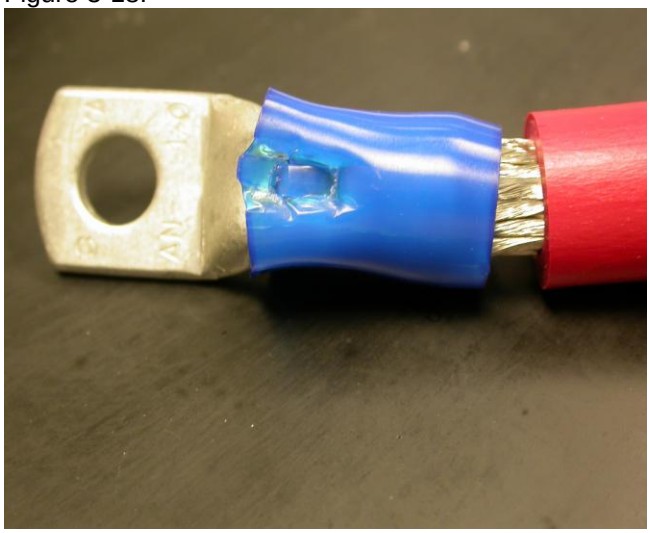


Figure 3-18.



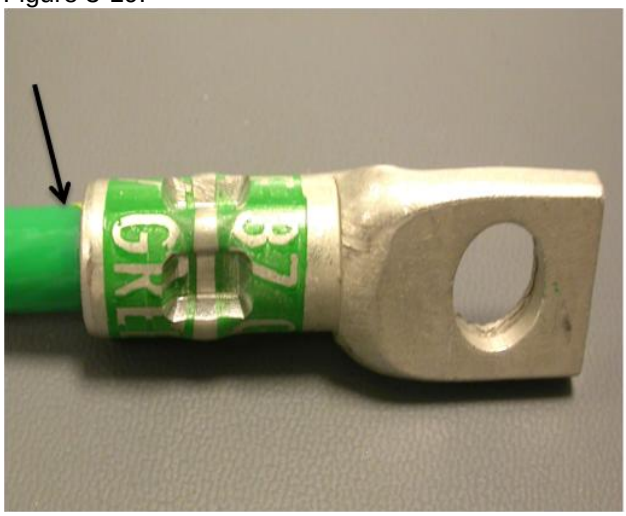
Defect

- Insulation gap greater than 0.25 inch.
- Wire strands not contained in the crimp.
- Contact is fractured or cracked (not shown).
- Wire entry end of the terminal is deformed.
- Terminal insulation damaged exposing metal.
- Wire insulation enters barrel of terminal (Fig. 3-19).
- Terminal is bent (not shown).

Crimp Terminations (contacts and Lugs)

3.5.4 Terminal Lugs – For Aluminum/Copper Code Conductors (cont.)

Figure 3-19.



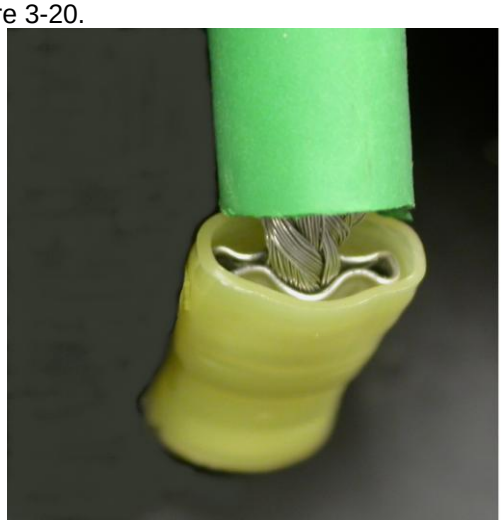
Defect (cont.)

Crimp Terminations (Contacts and Lugs)

3.5.5 Stamped and Formed – Wire Braid Terminations

This section addresses the insulation support crimp of Stamped and Formed – Closed Barrel Terminations. When wire braid is required to be terminated to a crimped lug the braid should be formed round and concentric to the wire barrel and inserted through the barrel. The crimped terminal must meet all other criteria for crimped lugs (see IPC/WHMA-A-620). The braid may continue its round form and extend through the insulation crimp or it may be left flat in the insulation support area.

Figure 3-20.

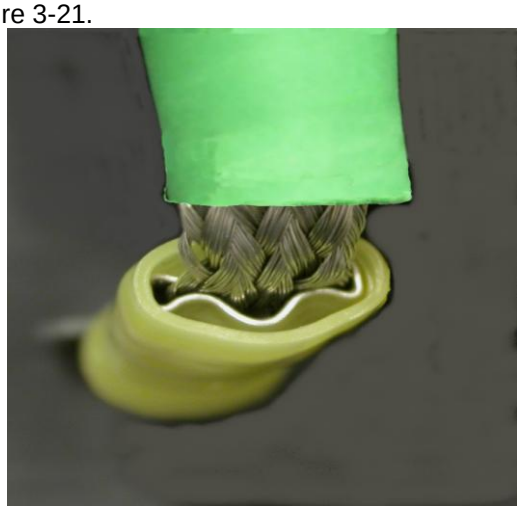


Acceptable

- Round form or the metal braid extends through the insulation crimp.
- Wire braid is flat in the insulation crimp.

Note: Heat shrink Sleeving has been pulled back for clarity.

Figure 3-21.



See IPC/WHMA-A-620, Section 5 for additional criteria.

Crimp Terminations (Contacts and Lugs)

3.5.6 Stamped and Formed – Open Barrel – Soldered Metal Braid

This section address open barrel terminals that are hand formed (no crimping tool available) and terminated to metal braid, then soldered to ensure connection integrity.

Figure 3-22.

Figure 3-23.

Target

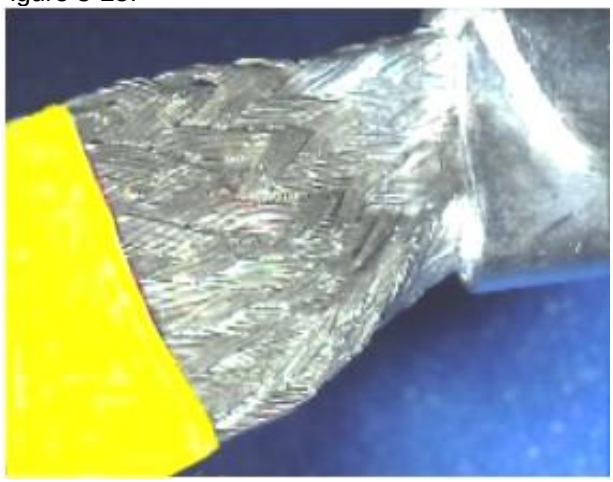
- Solder fillet is wetted to 100% of the contact area between the braid and the wire crimp barrel interface
- Wire braid extends slightly past the crimp barrel.
- Braid is contained within the wire crimp barrel
- Braid is contained in the insulation crimp.
- No damaged strands in the wire braid.

Crimp Terminations (Contacts and Lugs)

3.5.6 Stamped and Formed – Open Barrel – Soldered Metal Braid (cont.)

Figure 3-24.

Figure 3-25.



Acceptable

- Solder is Wetted to a minimum of 75% of the contact area of the braid and the wire barrel interface.
- Wire braid is flush to the end of the wire crimp barrel.
- The braid end does not extend into the mating area of the terminal.
- Less than 6% of the braid strands are cut or broken or damaged (see IPC/WHMA-A-620, Table 13-1).
- The wire crimp and the insulation crimp are gripping the wire braid.
- Solder has wicked past the insulation crimp in a smooth even flow.

Note: Broken strands should be soldered in place.

Crimp Terminations (Contacts and Lugs)

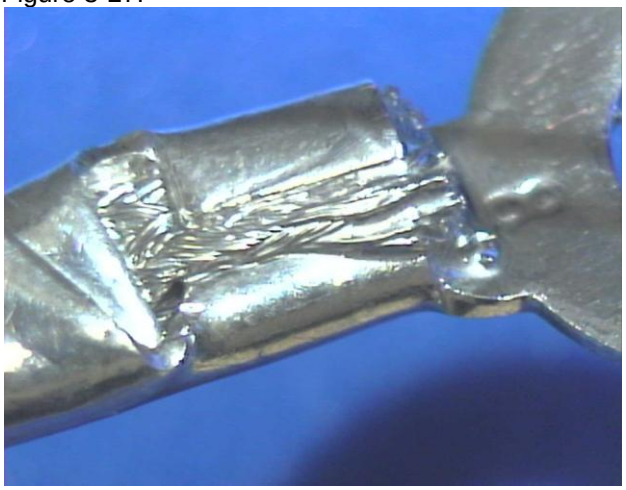
3.5.6 Stamped and Formed – Open Barrel – Soldered Metal Braid (cont.)

Figure 3-26.

Defect

- Solder fillet is wetted to less than 75% of the contact area between the braid and the wire crimp barrel interface (Fig. 3-26).
- Wire braid not completely contained within the wire barrel and or the insulation crimp (Fig. 3-27)
- Wire braid extends into the mating area of the contact (not shown).
- More than 6% of the braid strands are cut or broken or damaged (Fig. 3-28) (see IPC/WHMA-A-620, Table 13-1).
- Solder ridges, sharp solder flow lines, solder protrusions or icicles that could cause damage to product or are a potential safety hazard (Fig. 3-29 & 3-30).

Figure 3-27.



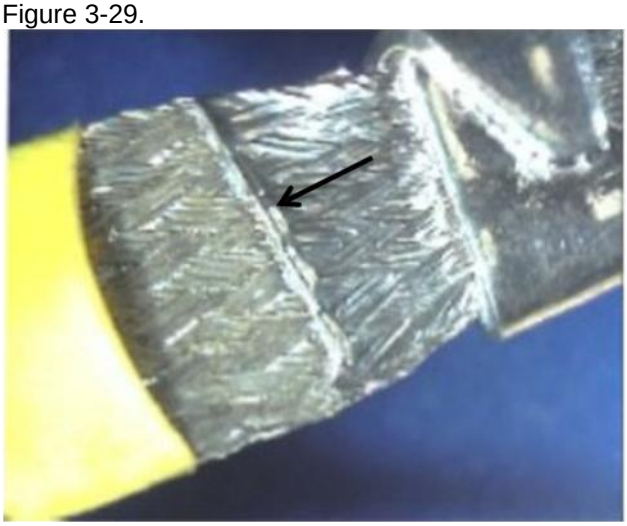
Crimp Terminations (Contacts and Lugs)

3.5.6 Stamped and Formed – Open Barrel – Soldered Metal Braid (cont.)

Figure 3-28.

Defect (cont.)

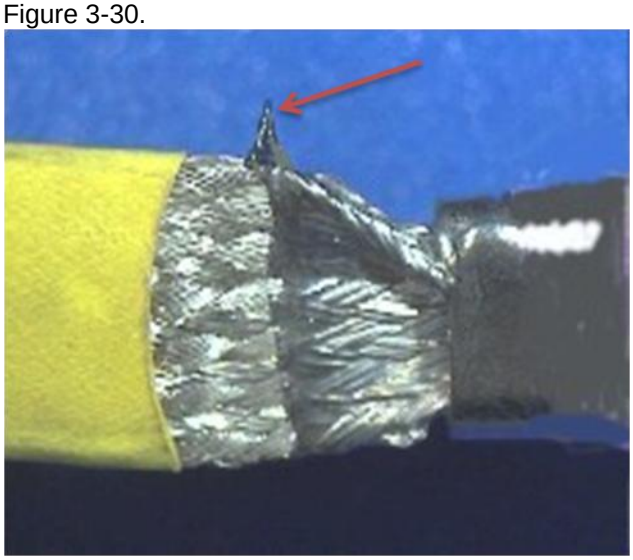
Figure 3-29.



Crimp Terminations (Contacts and Lugs)

3.5.6 Stamped and Formed – Open Barrel – Soldered Metal Braid (cont.)

Figure 3-30.



Defect (cont.)

3.6 Insulation Displacement Connections (ICD)

(See IPC/WHMA-A-620 for criteria)

3.7 Ultrasonic Welding

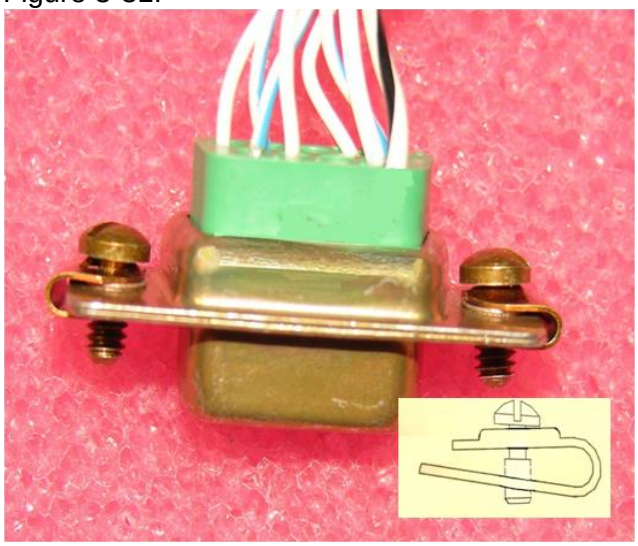
(Not Applicable to L-3, CS-W Processes)

3.8 Splices

(See IPC/WHMA-A-620 for criteria)

3.9 Connectorization

Figure 3-31.



Connectorization

3.9.1 Hardware Mounting – Connector Screw Retaining Clips

Acceptable

- The formed thread (raised portion) of the clip is oriented opposite to the mating surface of the connector.
- Screw is completely engaged through the thread (formed portion).

Figure 3-32.

Connectorization

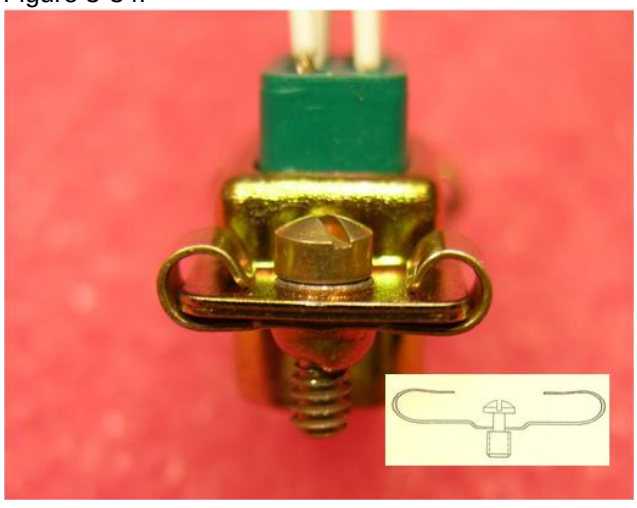
3.9.1 Hardware Mounting – Connector Screw Retaining Clips (cont.)

Figure 3-33.

Defect

- The formed thread (raised portion) of the clip is oriented on the mating surface of the connector (Fig. 3-33 & Fig. 3-34).
- Screw is not completely engaged through the thread (formed portion) (Fig.3-35).

Figure 3-34.



Connectorization

3.9.1 Hardware Mounting – Connector Screw Retaining Clips (cont.)

Figure 3-35.

Defect (cont.)

Connectorization

3.9.2 Strain Relief – Clamp Fit

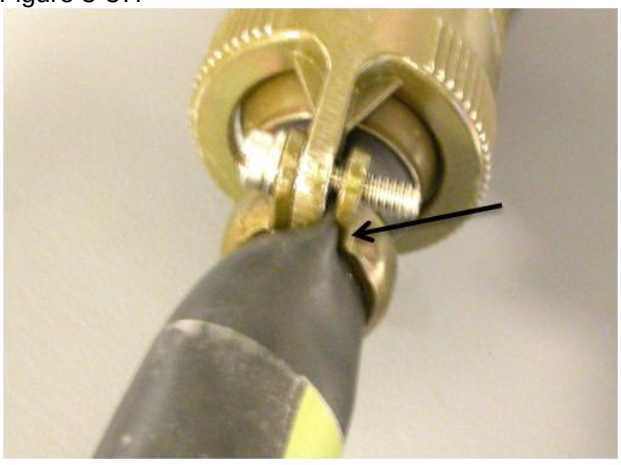
Note:
Insulating tape or sleeving may be used to prevent wire movement within the strain relief. Protective sleeving size can be changed to fit (see IS-001).

Figure 3-36.

Acceptable

- Approved material used to "build-up" bundle diameter to provide contact support between the cable and strain relief clamp (insulating tape or sleeving may be used).
- Split lock washer when used is fully compressed.

Figure 3-37.



Defect

- Pinched sleeving or wire.
- Split lock washer if used is not fully compressed.
- Splice or ferrule located under the strain relief clamp (not shown).

Connectorization

3.9.3 Connector Damage – Cadmium Plated Surfaces

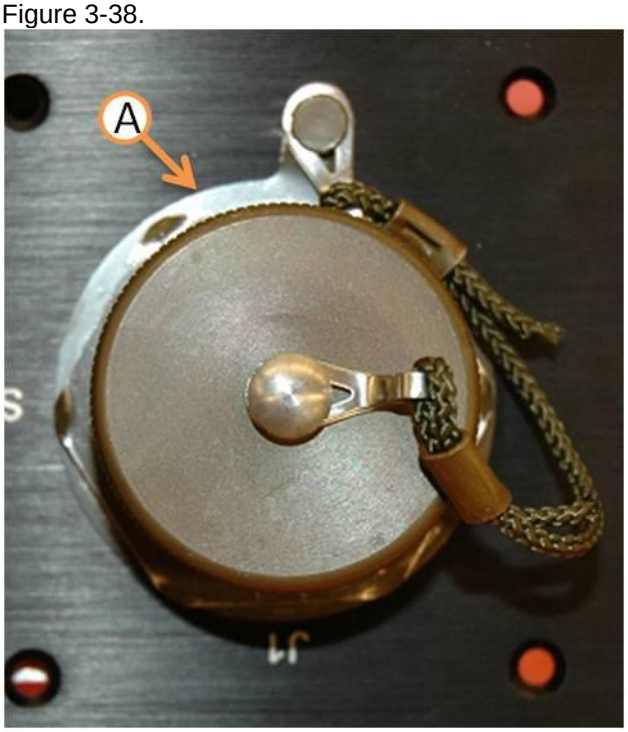
This section addresses visual acceptance criteria of cadmium plated surfaces e.g., connectors, adaptors, dust caps, etc. Only dust caps are shown due to the ease of displaying visual surface appearance. This criterion takes exception to IPC/WHMA-A-620A, 9.4.1, Defect – Class 2, 3, that does not allow exposure of base metal.

For additional connector plating information see IS-001 Use of Non-Specified hardware/Material, clause 1.13 Connector Plating.

Note: Surface finish inspection shall be performed without magnification.

Note: Connectors that incorporate a jam nut retaining ring (Figure 3-38, A) as part of the cap restraining mechanism (chain/lanyard), the positioning of the jam nut retaining ring is not defined, unless dimensioned on the engineering drawing; however the retaining ring tab may not obscure any panel marking.

Figure 3-38.



Target

- Free of scratches, mars, burrs, gouges, groves, scores or other damage.
- Gasket material (located inside the cap) is in place (not shown).

3.9.3 Connector Damage – Cadmium Plated Surfaces (cont.)

Figure 3-39.

Acceptable

- scratched, marred or burnished Figure 3-39.

Figure 3-40.

Defect

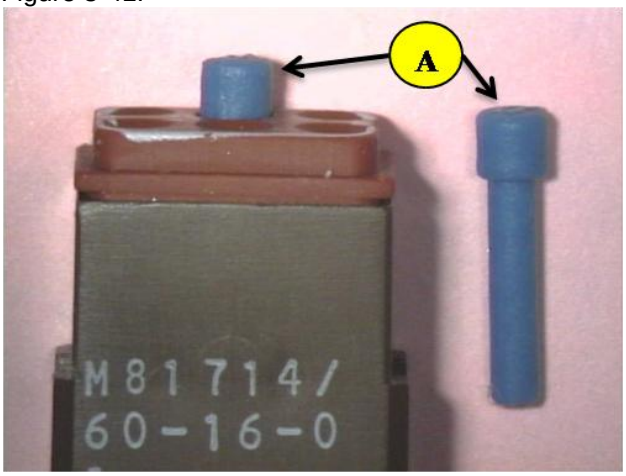
- Scored, notched or gouged Figure 3-40.Burrs (not shown)
- Jam nut retaining ring (when used) (see Figure 3-38, A) obscures panel marking (not shown).
- Missing gasket, lanyard or other integral part (not shown).

Connectorization

3.9.4 Installation of Sealing Plugs into Shorting Blocks

This section addresses sealing plugs that are installed into Terminal Junction/Shorting blocks. Figure 3.41 illustrates a typical sealing plug (A). It should be noted that sealing plugs that feature a head are installed into the Terminal Junction/Shorting Block with the shaft first and the head against the insert grommet and the head completely visible.

Figure 3-41.

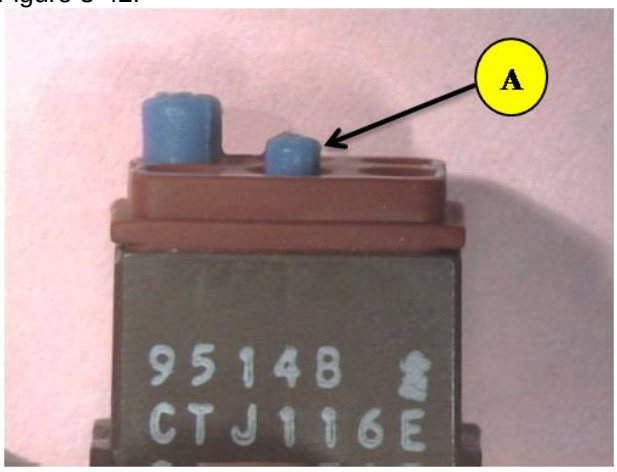


Acceptable
(Shorting Blocks Only)

- Sealing plug (A) is installed with the shaft first.
- Sealing plug shaft is captured by the insert grommet (head is visible).

Note: Where a sealing plug is installed, a contact will not be installed.

Figure 3-42.



Defect
(Shorting Blocks Only)

- Sealing Plug (A) installed head end first (head not visible).
- Sealing plug(s) missing where required.

Connectorization

3.9.5 Raychem MTC 50 Connector Termination

Figure 3-43.

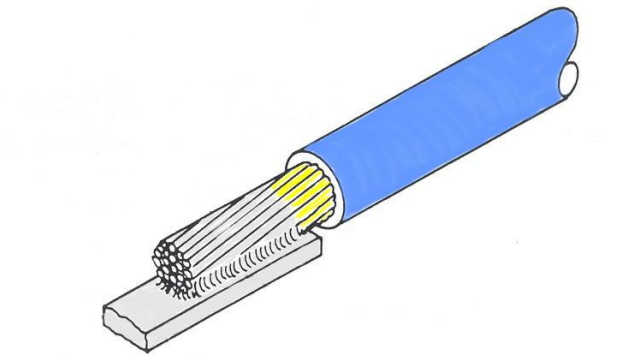
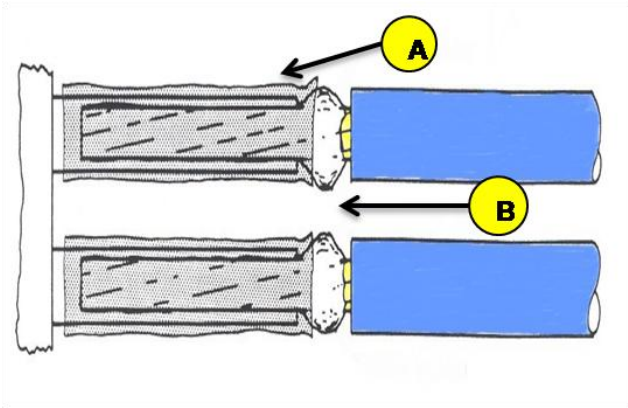


Figure 3-44.



Target

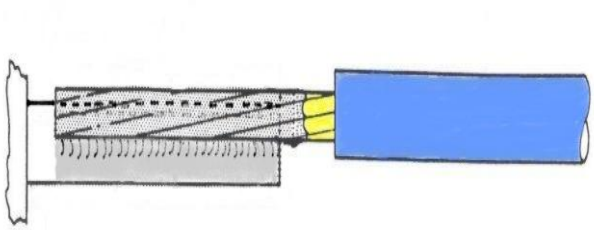
- The stripped conductor overlaps the connector terminal more than two stripped wire diameters.
- The solder pre-form is completely melted and there is no remnant of the solder pre-form shape.
- There is an acceptable solder fillet between the wire and the terminal.
- The heat shrinkable sleeving (A) is fully shrunk onto the wire and the terminal.
- The heat shrinkable sleeving is not burnt or charred, and does not have any splits or tears.
- The minimum electrical clearance between electrically conductive surfaces. (B) is greater than .015 inch

Note: Heat shrinkable sleeving has been partially removed for clarity.

Connectorization

3.9.5 Raychem MTC 50 Connector Termination (cont.)

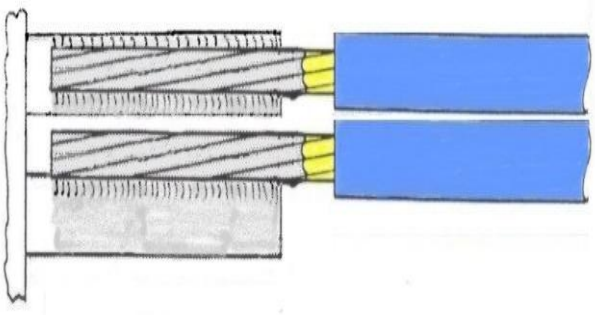
Figure 3-45.



Acceptable

- The wire overlaps the terminal a minimum of two stripped wire diameters.
- Side overhang of the wire does not exceed 25% of the stripped wire diameter.
- The minimum electrical clearance between electrically conductive surfaces (B) is a minimum of .015 inch.
- There is a visible fillet between the wire and the terminal.

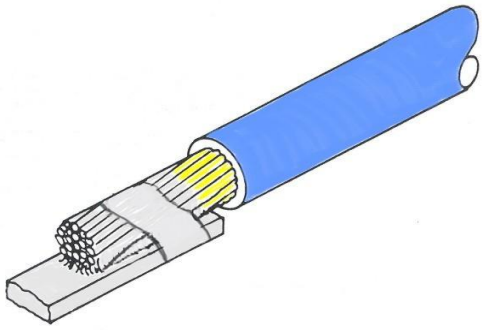
Figure 3-46.



Defect

- Side overhang of the wire exceeds 25% of the stripped diameter.
- The minimum electrical clearance between electrically conductive surfaces is less than .015 inch.
- Wire overlap is less than two stripped wire diameters.
- Heat shrinkable sleeving not completely shrunk.
- The heat shrinkable sleeving is charred, split or torn.
- The solder pre-form not completely flowed.
- Wire insulation overlaps the solder termination area.

Figure 3-47.



Connectorization

3.9.6 Raychem MTC 100 Connector Termination

Solder ferrule (heat shrinkable device) consist of an outer shrinkable sleeve (1), two meltable sealing rings (2) and a solder ring (3) see Figure 3-48.

Figure 3-48.

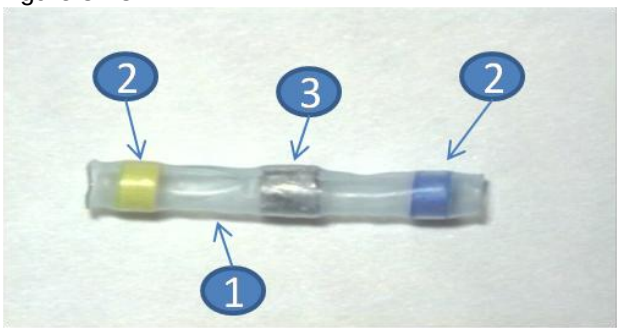
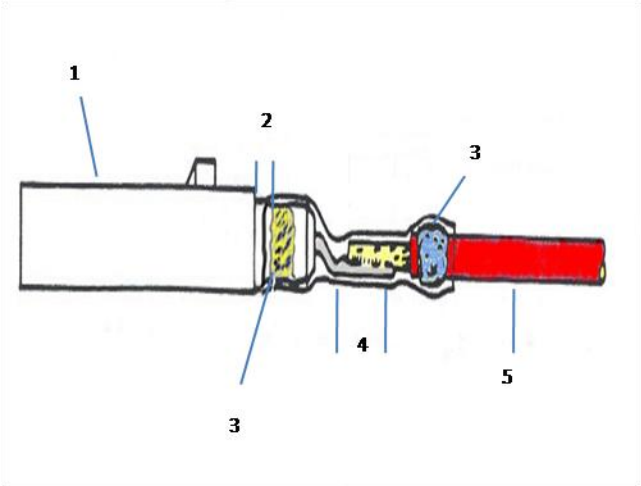


Figure 3-49.



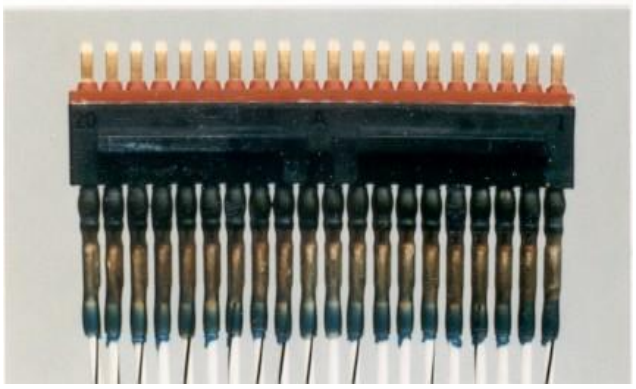
Target

- The stripped conductor extends the full length of the cupped area (4) of the solder terminal.
- The stripped conductor overlaps the solder terminal (4) more than two stripped wire diameters.
- The stripped conductor is parallel to the solder terminal.
- The wire insulation (5) has not entered the solder terminal area.
- The meltable sealing ring (3) is overlapping the wire insulation.
- The end of solder ferrule sleeve (2) is within .040 inch of the connector body (1).
- Solder preform (ring) is completely melted and a properly wetted and a fillet is visible between the lead and the terminal.
- The meltable sealing rings (3) have melted and flowed.
- The shrinkable sleeve or the wire insulation show no sign of discoloration.

Connectorization

3.9.6 Raychem MTC 100 Connector Termination (cont.)

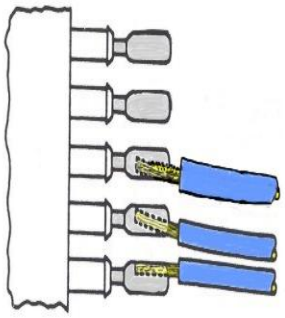
Figure 3-50.



Acceptable

- The wire overlaps the terminal a minimum of two stripped wire diameters.
- Side overhang of the wire does not exceed 25% of the stripped wire diameter.
- Conductors have not ruptured or damaged the ferrule (shrinkable) sleeve.
- Shrinkable sleeve is discolored but is not burnt or charred.
- Solder fillet is visible between the lead and the terminal.
- Solder pre-form has flowed properly leaving no evidence of solder ring.
- No pits or cracks are visible in the connector body.

Figure 3-51.



Connectorization

3.9.6 Raychem MTC 100 Connector Termination (cont.)

Figure 3-52.

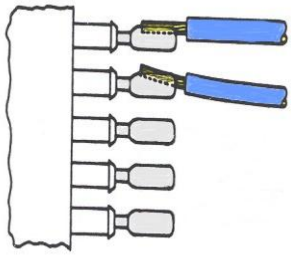
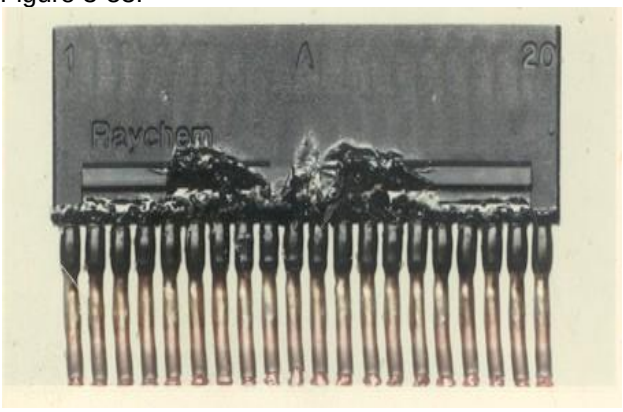


Figure 3-53.



Defect

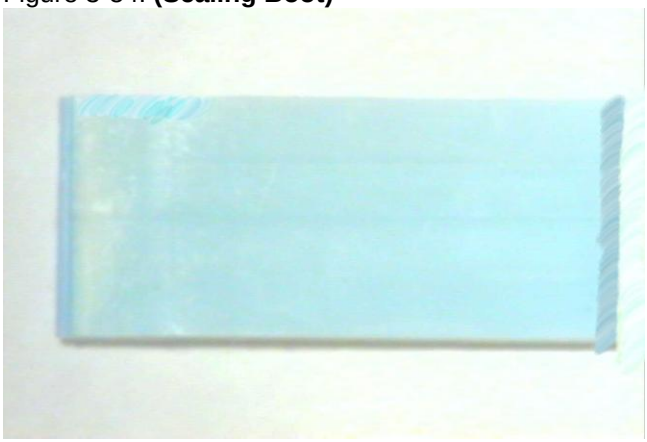
- Side overhang of the wire exceeds 25%
- Conductor strands are protruding through the solder ferrule sleeve
- Wire overlap is less than 2 wire diameters.
- Incomplete reflow of the solder pre-form.
- The shrinkable sleeving is charred, split or torn.
- Wire insulation overlaps the solder termination area.
- Solder fillet not visible between the lead and the terminal.
- Pits or cracks are visible in the connector body (applies to both MTC 50 and MTC 100 connectors).

Connectorization

3.9.6.1 Raychem MTC 100 Connector Termination – Sealing Boot

Note: ***Criteria apply to both MTC50 and MTC 100 connectors.***

Figure 3-54. **(Sealing Boot)**



MTC 100 and MTC 50 sealing boots consist of heat shrinkable sleeve and meltable adhesive inside the boot (see Figure 3-54).

Figure 3-55.

Acceptable

- Sealing boot is shrunk (boot is tight).
- Meltable adhesive has properly flowed.
- Insulating boot is discolored but is not split, torn burnt or charred.
- Boot is properly positioned (overlaps onto the connector and the wire insulation).

Defect (no illustrations)

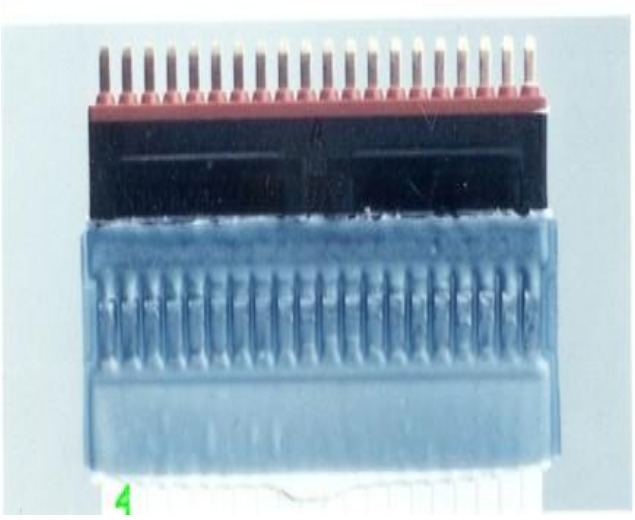
- Boot is loose
- Meltable adhesive has not completely flowed.
- Boot is split, torn or charred.
- Pits or cracks are visible in the connector body

Connectorization

3.9.6.2 Raychem MTC 100 Connector Termination – Flat Cable

Note: ***Criteria apply to both MTC50 and MTC 100 connectors.***

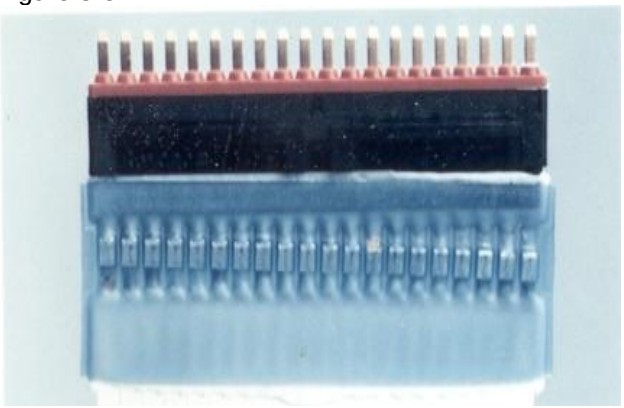
Figure 3-56.



Acceptable

- Flat cable is oriented correctly (color strip or numbers or letters identify pin one).
- Cable is not misaligned (skewed).
- Boot is not damaged.
- Acceptable solder fillets are evident.
- Conductor side overhang is less than 25% of the conductor width.
- Shrinkable sleeving or boot discolored but not burnt or charred.

Figure 3-57.

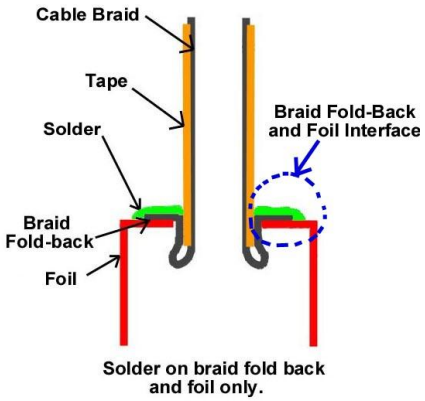


Defect

- Flat cable misaligned, side overhang is greater than 25% of the conductor width or violates electrical clearance.
- Flat cable is oriented incorrectly (color strip or numbers or letters) not matching connector pin one.
- Overheated or disturbed solder.
- Shrinkable sleeving or boot is split, torn or charred.
- Solder rings not completely flowed.
- Meltable adhesive not flowed.
- Boot is loose or not completely shrunk.
- Connector body damage pits or cracks.

3.10 Molding/Potting

Figure 3-58.



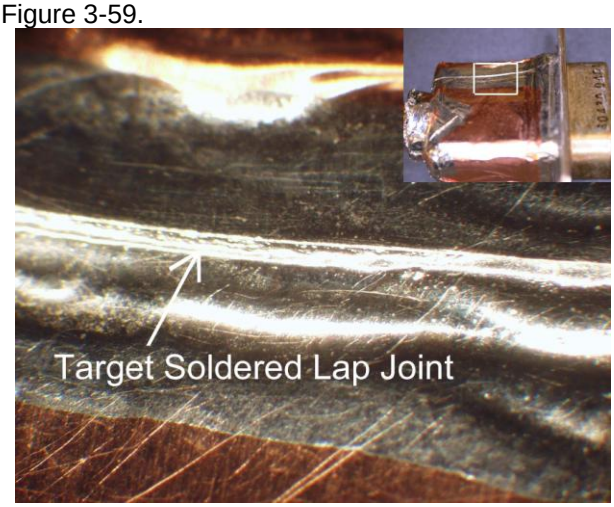
Molding/Potting

3.10.1 EMI/RFI Shielding – Foil (prior to molding)

Target

- Solder fillet is visible for the full length of any location where foil is overlapped.
- Foil is soldered for 360º of the folded back portion of the cable braid and foil interface (no voids), Fig. 3-58.
- The cable braid fold back is not bridged to the cable braid junction, Fig. 3-58.
- No openings or holes in the foil.
- No flux, flux residue, sharp points or icicles.

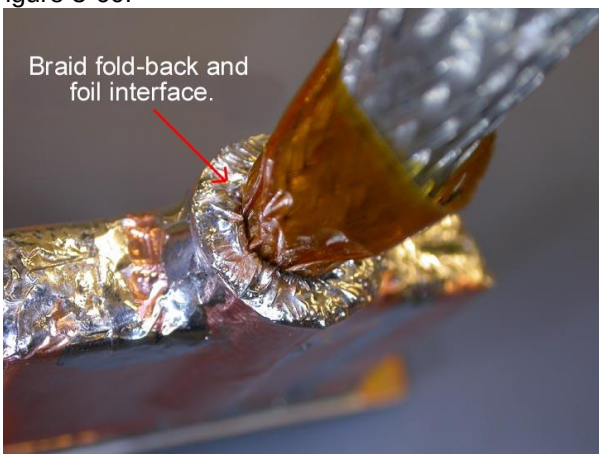
Figure 3-59.



Molding/Potting

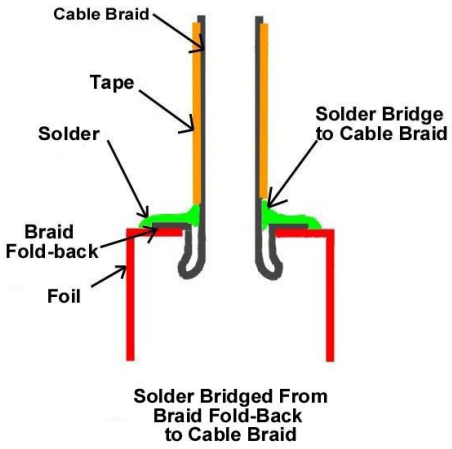
3.10.1 EMI/RFI Shielding – Foil (prior to molding) (cont.)

Figure 3-60.



Target (cont.)

Figure 3-61.



Acceptable

- Solder (thin film) visible on the connector, Fig. 3-63.
- Solder bridged between foil and braid fold back, Fig. 3-61.
- Braid soldered directly to foil, no fold back (not preferred), Fig. 3-62.
- Foil opening/damage covered with a foil patch and soldered in place, Fig. 3-64.
- 75% minimum solder coverage along any length of a lap soldered joint.
- 90% minimum solder coverage of the circumference of the braid to the foil interface. (Fig. 3-60)

Molding/Potting

3.10.1 EMI/RFI Shielding – Foil (prior to molding) (cont.)

Figure 3-62.

Acceptable (cont.)

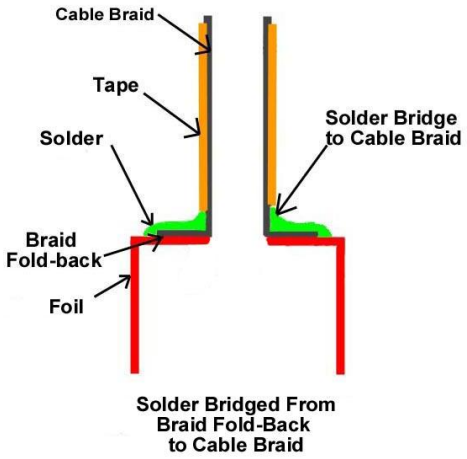
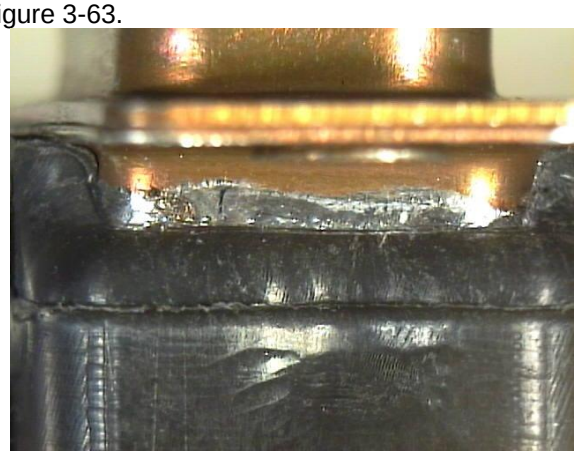


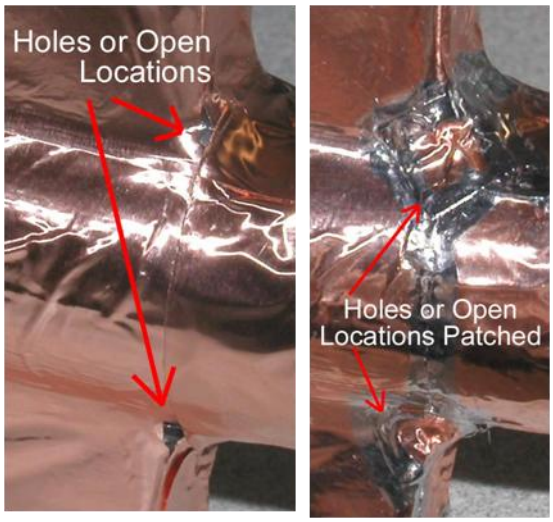
Figure 3-63.



Molding/Potting

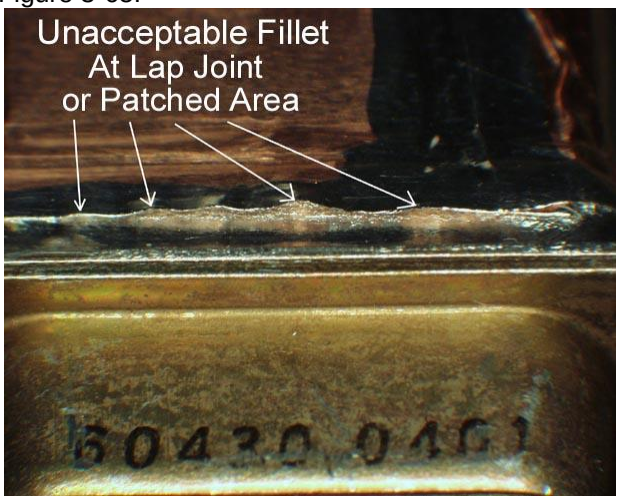
3.10.1 EMI/RFI Shielding – Foil (prior to molding) (cont.)

Figure 3-64.



Acceptable (cont.)

Figure 3-65.



Defect

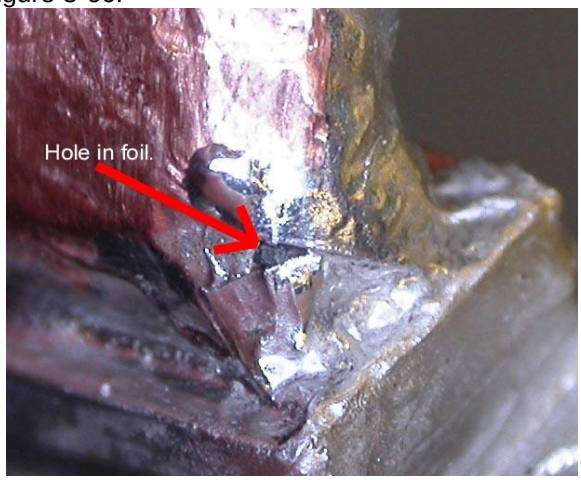
- Solder buildup that affects subsequent process steps.
- Any foil opening or hole.
- Less than 75% solder coverage along any length of a lap soldered joint.
- Less than 90% solder coverage of the fold back (Fig. 3-60) or the direct soldered braid (Fig. 3-62) and foil interface.
- Dewetting or disturbed solder.
- Solder cracks or fractures.
- Dirt, flux, flux residue, points, or icicles.

Molding/Potting

3.10.1 EMI/RFI Shielding – Foil (prior to molding) (cont.)

Defect (cont.)

Figure 3-66.



Molding/Potting

3.10.2 Hardware installation – Jackscrews

The criteria in this section addresses the installation of connector mounting hardware (i.e., jackscrews or jackposts) in injection molded or cold pour potted connectors.

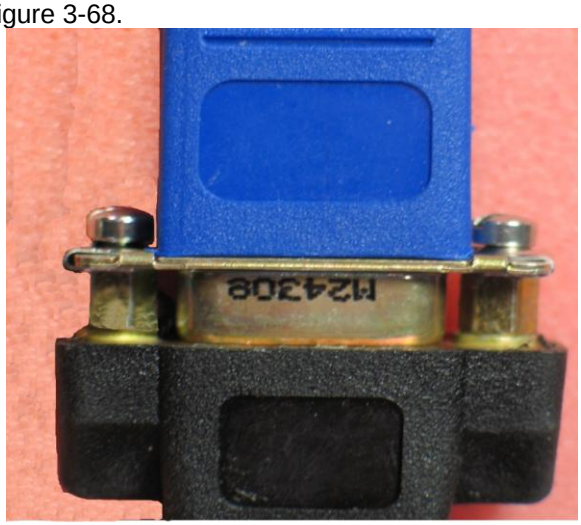
Note: A trial mating of connector to connector or connector to assembly may be required for final acceptance.

Target

- Mold design provides clearance for hardware installation.
- Mates properly with mating connector hardware.

Figure 3-67.

Figure 3-68.



Molding/Potting

3.10.2 Hardware installation – Jackscrews (cont.)

Figure 3-69.

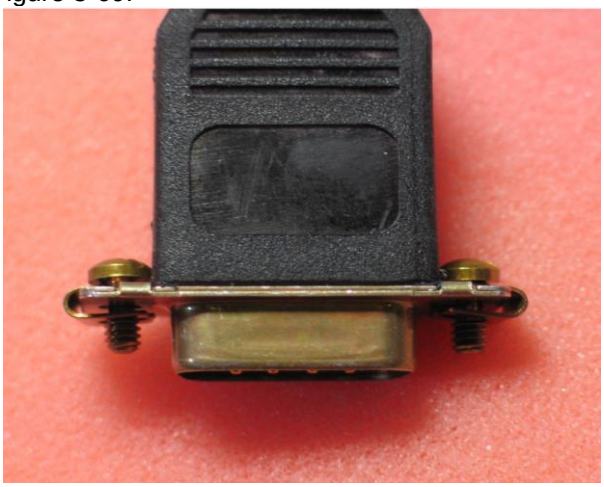


Figure 3-70.

Acceptable

- Molding material does not obstruct or interfere with the mounting hardware.
- Mold obstruction adjacent the mounting hardware is trimmed flush to the surface to provide hardware clearance.

Molding/Potting

3.10.2 Hardware installation – Jackscrews (cont.)

Figure 3-71.

Figure 3-72.

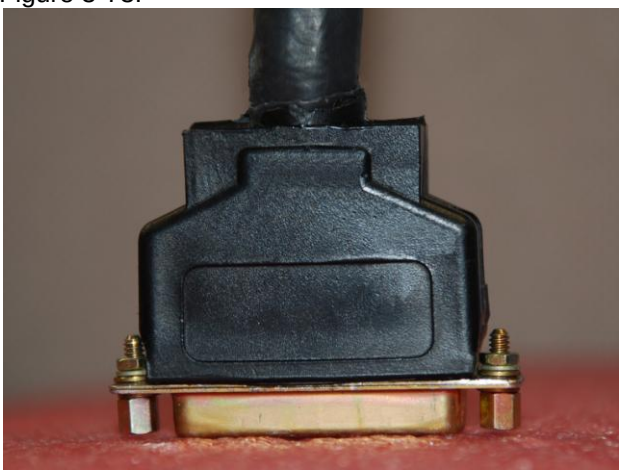
Defect

- Connector hardware is misaligned due to molding obstruction.
- Will not mate with mating connector hardware.
- Un-authorized trimming or modification that reduces the molded surface below flush (see Figure 3-73).
- Trimming or damage to the molding material that exposes the foil or connector housing.
- Un-authorized repair. (Not shown)

Molding/Potting

3.10.2 Hardware installation – Jackscrews (cont.)

Figure 3-73.



Defect (cont.)

- Trimming or modification that reduces the molded surface below flush.

Molding/Potting

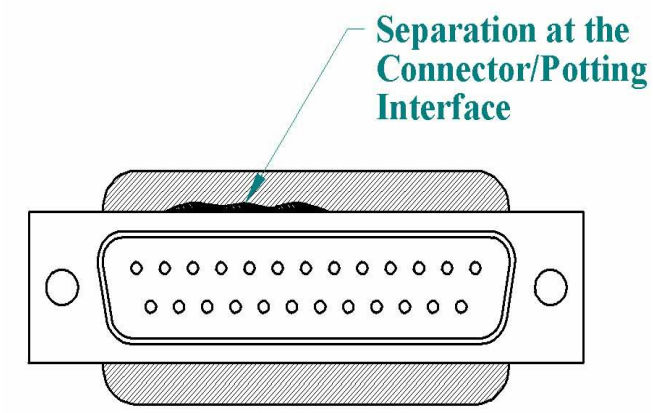
3.10.3 Potting – Cold Pour, Room Temperature Vulcanization (RTV)

When cold pour, RTV, is used to assemble/manufacture cable harness assemblies the materials and processes shall be selected such that their use, in combination, are compatible and produce products that meet the following requirements.

Target (Not Illustrated)

- Potting material is in contact with the connector and has no gaps, or cracks and the connector is secure in the potting material.
- Potting material does not affect form, fit or function of the connector.
- No potting material on the mating surfaces of the connector/contacts.
- No evidence of flash, voids, bubbles, foreign material or entrapped air.

Figure 3-74.



Acceptable

- Potting material secures the connector
- Voids or separations that do not expose wire[s] or conductor[s].
- Potting material or flash that does not interfere with form fit or function

Molding/Potting

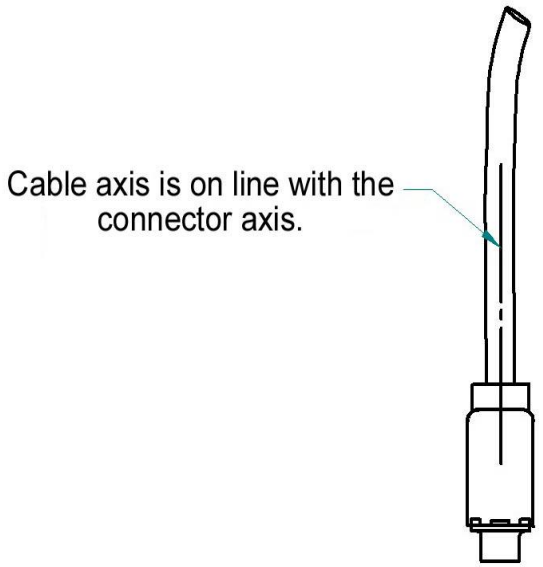
3.10.3 Potting – Cold Pour, Room Temperature Vulcanization (RTV) (cont.)

Figure 3-75.

Defect

- Exposed wire[s] or conductor[s].
- Cracks or splits in the potting material.
- Potting material present on mating surfaces of connector or contacts
- Potting material that affects form, fit or function of the connector or contacts.
- Connector is not secured in the potting material.
- Voids or separations that expose wire[s] or conductor[s].

Figure 3-76.



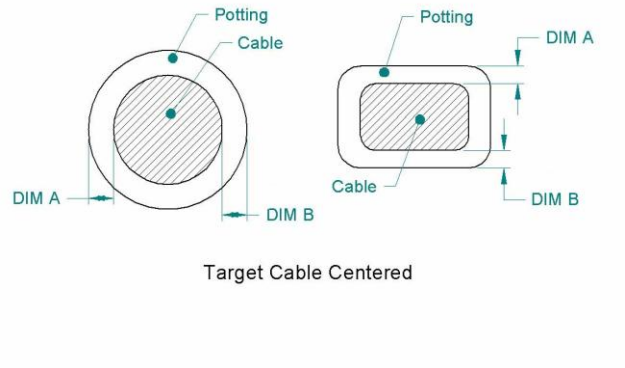
Molding/Potting

3.10.3.1 Potting – Cold Pour, Room Temperature Vulcanization (RTV) – Fit to Wire or Cable

Target

- Potting material is in contact with the entire circumference of wire[s], sleeve or cable jacket interface.
- Cable axis is on line with the connector axis per design.
- Cable is centered within the potting and cable interface.

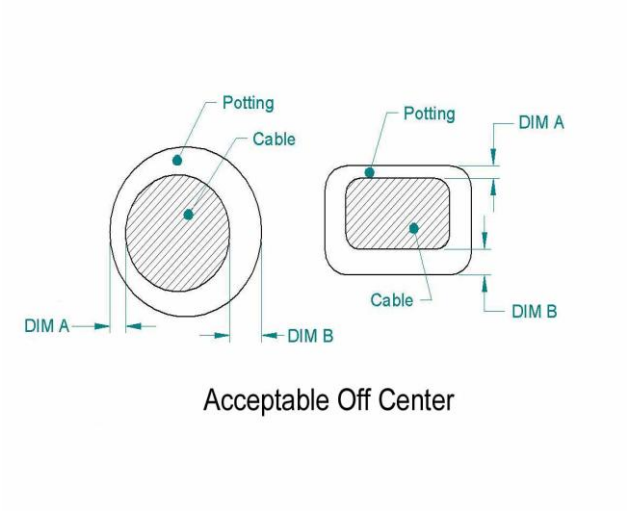
Figure 3-77.



Molding/Potting

3.10.3.1 Potting – Cold Pour, Room Temperature Vulcanization (RTV) – Fit to Wire or Cable (cont.)

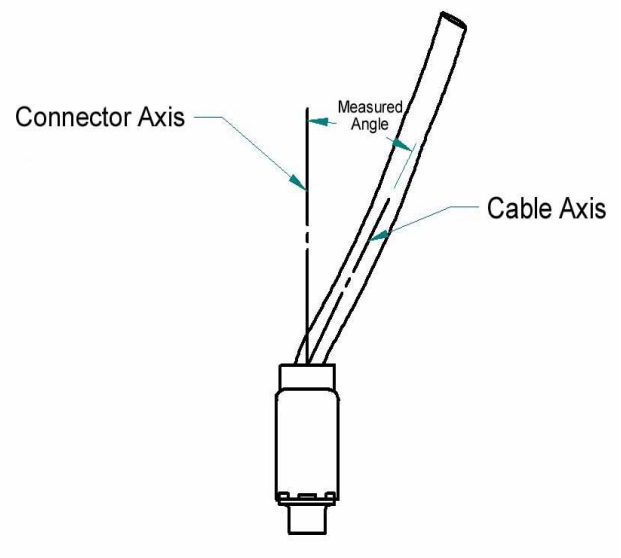
Figure 3-78.



Acceptable

- Potting material is in contact with wire[s], sleeve or cable jacket but may have separation or gaps providing internal components (e.g., wire[s] shielding, etc.) are not visible.
- Cable axis has a measured angle less than or equal to 15º from the connector axis design.
- Cable may be off centered in the potting material providing dimension (DIM) B does not exceed 2X (times) dimension (DIM) A.

Figure 3-79.



Defect

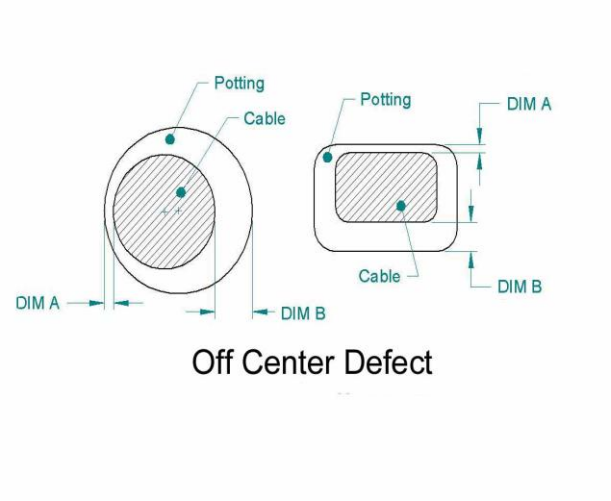
- Internal components visible between wire[s], sleeve or cable jacket and potting material.
- Cable axis has a measured angle greater than 15º from the connector axis design.
- Cable is off centered in the potting material where dimension (DIM) B exceeds 2X (times) dimension (DIM) A.

Molding/Potting

3.10.3.1 Potting – Cold Pour, Room Temperature Vulcanization (RTV) – Fit to Wire or Cable (cont.)

Figure 3-80.

Defect (cont.)



Molding/Potting

3.10.3.2 Potting – Cold Pour, Room Temperature Vulcanization (RTV) – Curing

(There are no Illustrations for this section).

Target

- Potting material is cured and is not tacky.
- Potting material meets hardness range (when specified).

Acceptable

- Potting material has hardened and is tack free to the touch

Defect

- Potting material is tacky.
- Does not meet hardness range (when specified).

Molding/Potting

3.10.3.3 Potting – Cold Pour, Room Temperature Vulcanization (RTV) – Rework/Touchup

Note: Rework/touchup of the potted assembly must be completed using the same material.

Acceptable

- Rework/touchup that does not affect form, fit or function.

Defect

- Rework/touchup that affects form, fit or function.
- Rework/touchup material is different than the original potting material used.

3.11 Cable Assemblies and Wires

(See IPC/WHMA-A-620 for criteria)

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3.12 Marking and Labeling

Marking and Labeling

3.12.1 Part or Identifying Number (PIN)/Marker Sleeving.

See WS-012, for definition of broken lines, hidden lines; near side, far side and 7 digit part numbers and suffix, 8 digit part numbers and suffix also see IS-008.

Note: Acceptance criteria for marking and labeling of cables and wire harnesses are located in IPC/WHMA-A-620.

Caution:
When installing marking labels on Fiber-Optic cables, markers **shall** be spaced a minimum of 1.5 inches apart.

Marking and Labeling

3.12.2 UID Labels

The UID Matrix label typically includes the cage code, part number, and serial number. The Part Identifying Number (PIN) may also include other information such as job number, revision, and identifiers such as (17V) for cage code,(IP) for original part number, and (S) for serial number, characteristics of the UID.

- The UID Matrix label must meet the required quality level.
- The UID Matrix label must meet machine readability requirements.
- The UID Matrix label must be free of any obstructions.

Figure 3-81.

Acceptable

- UID matrix is completely visible.
- UID matrix is flat.

Figure 3-82.

Defect

- Label/marker not located per documentation.
- UID matrix symbol not completely visible, is partially obstructed, marked over or damaged. .
- UID matrix symbol does not meet the quality level required.
- UID matrix symbol not machine readable.
- Other markings don't meet marking requirements of IPC/WHMA-A-620.
- UID matrix is not flat.
- Alpha/numeric printing not legible.

Marking and Labeling

3.12.3 Flag Markers - Adhesive

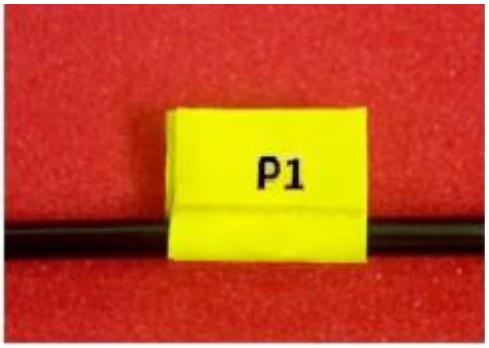
This section provides illustrations of adhesive flag markers; see IPC/WHMA-A-620, Section 12.

Figure 3-83.

Target

- See IPC/WHMA-A-620.

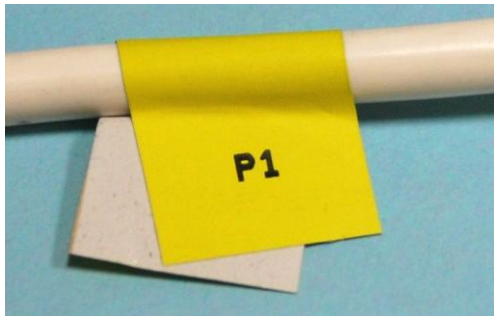
Figure 3-84.



Acceptable

- Edges of flag marker misaligned less than 25% of the width of the marker.

Figure 3-85.



Defect

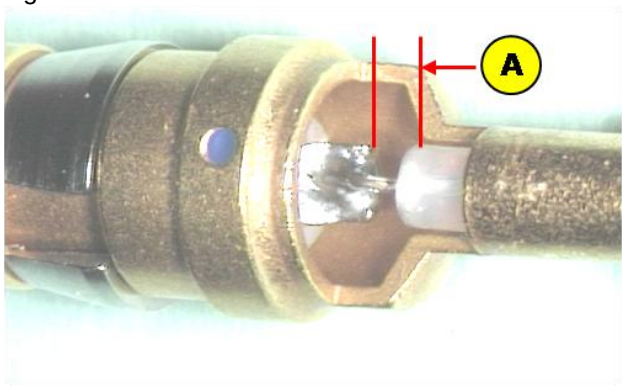
- See IPC/WHMA-A-620.
- Marker not secure on cable/harness.

3.13 Coaxial and Twinaxial Cable Assemblies

Coaxial & Twinaxial Cable Assemblies

3.13.1 Center Conductor Termination – Coax Pin Insulation Gap

Figure 3-86.



Target

- Insulation end (dielectric) is positioned within solder cup and support barrel area (A).

Note: Center conductor must be inserted for the full depth of the cup.

Figure 3-87.

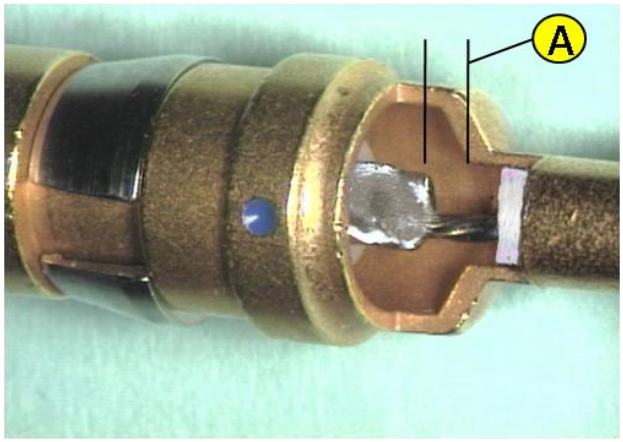
Acceptable

Insulation end contacts the solder cup but does not prevent the formation of an acceptable solder connection.

Coaxial & Twinaxial Cable Assemblies

3.13.1 Center Conductor Termination – Coax Pin Insulation Gap (cont.)

Figure 3-88.



Defect

- Insulation (dielectric) end is not positioned within solder cup and support barrel area (A).
- Insulation end prevents the formation of an acceptable solder connection (not shown).

3.14 Securing

This Section illustrates Low Profile tie wraps. Low pofile tie wraps should be used instead of the standard tie wraps or lacing /string tie as called out on the part list/drawing. The tie wrap size shall be in accordance with the chart located in IS-001. Acceptance criteria is the same as the standard tie wrap (see IPC-A-620, Section 14).

Figure 3-89.

Securing

3.14.1 Tie Wrap Application – Low Profile

Acceptable

- Wire bundle is secured.
- Insulation is not compressed or damaged by the restraining device.
- The end of the tie wrap is cut-off not greater than 1 tie wrap thickness and is reasonably square to the face of the wrap.
- No sharp points or edges.

Note:

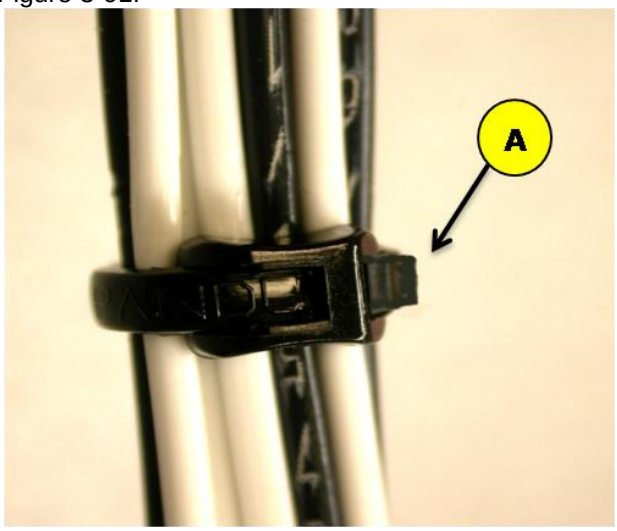
For fiber optic cable routing and Securing, See WS-005.

Figure 3-90.

Securing

3.14.1 Tie Wrap Application – Low Profile (cont.)

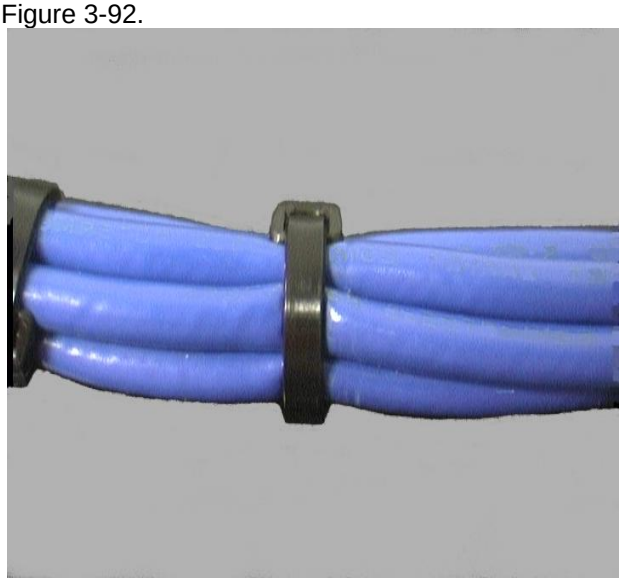
Figure 3-91.



Defect

- Cut end protrusion extends more than 1 tie wrap thickness.
- Bundle or insulation is compressed, distorted or damaged by the tie wrap.
- Not cut square (A) is sharp or hazardous.

Figure 3-92.

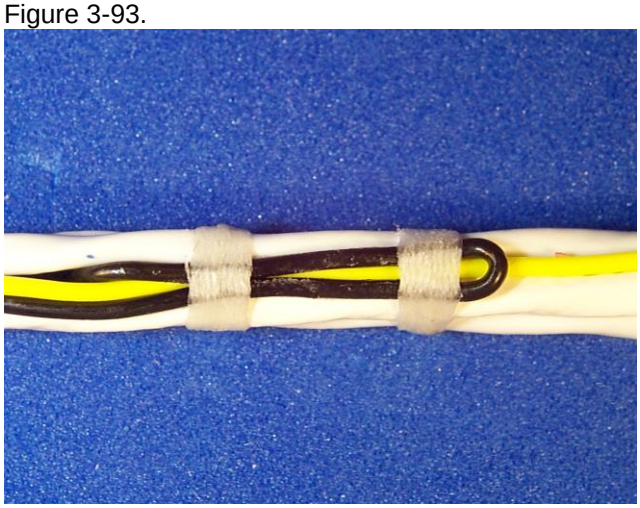


Securing

3.14.2 Excess Wire Length – Loop in Bundle

Note: This section only applies to wires terminated from point to point. Does not apply to pick-off or drain wires.

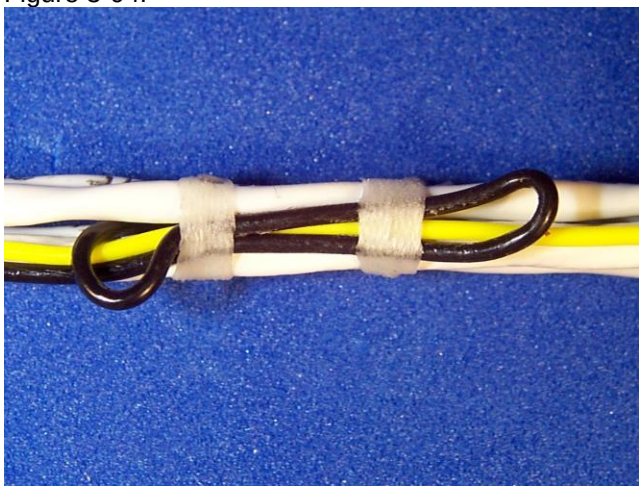
Figure 3-93.



Defect

- Excess wire length is looped or folded back.

Figure 3-94.



Securing

3.14.2 Excess Wire Length – Loop in Bundle (cont.)

Defect (cont.)

Figure 3-95.

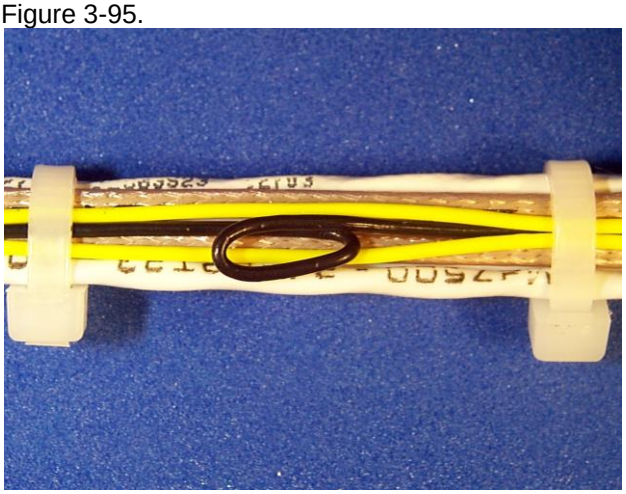


Figure 3-96.

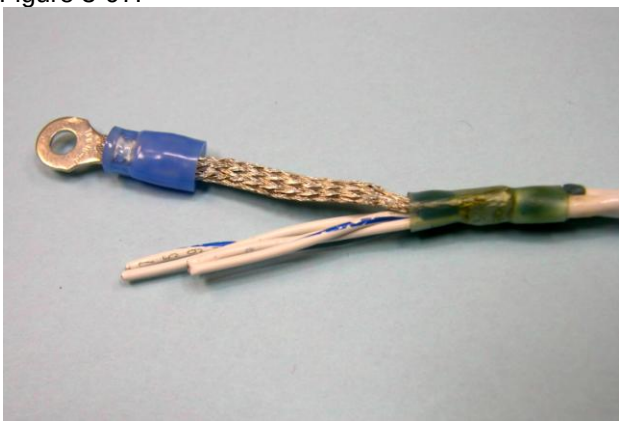
3.15 Harness/Cable Electrical Shielding

Harness/Cable Electrical Shielding

3.15.1 Shield Termination – Braided pick off

This criterion applies to soldered/heat shrinkable solder devices that incorporate a braided pick off lead instead of a stranded wire pick off. Braided pick off is not sleeved, unless specified by the engineering drawing.

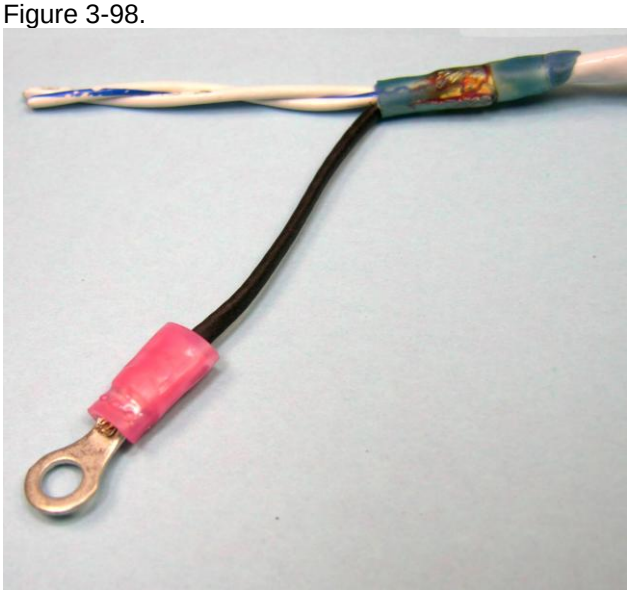
Figure 3-97.



Acceptable (unsleeved)

- Solder ring is completely melted wetting the braid and the cable shield and meets the requirements of IPC/WHMA-A-620, Section 15.
- Crimp termination meets the requirements of IPC/WHMA-A-620, Section 5.
- Braid is undamaged.

Figure 3-98.



Acceptable (sleeved)

When the braided pick off is required to be sleeved the following are met:

- Solder ring is completely melted wetting the braid and the cable shield and meets the requirements of IPC/WHMA-A-620, Section 15.
- Sleeving is tight on the braid.
- No cracks, tears or burns.
- The braid sleeving is flush to the heat shrink device.
- The braid sleeving extends into the insulation crimp area of the crimped termination.

Harness/Cable Electrical Shielding

3.15.1 Shield Termination – Braided pick off (cont.)

Defect (Not Illustrated)

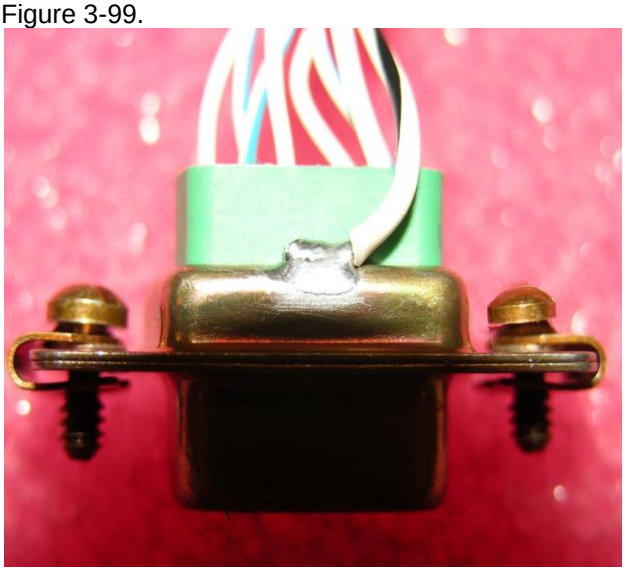
- When required to be sleeved, braid is not sleeved.
- When sleeved the insulation gap between the sleeving and the heat shrink device is greater than 2 sleeving diameters.
- Violation of soldering requirements, see IPC/WHMA-A-620, Section 15.
- Violation of crimping requirements, see IPC/WHMA-A-620, Section 5.
- Braid is damaged.

Harness/Cable Electrical Shielding

3.15.2 Shield Termination – Soldered to Connector Housing

This section is only applicable when specified by engineering documentation. This section addresses wires soldered to metal connector housings. Typically this type of termination requires the plating to be removed from a limited portion of the connector housing in order to create a solderable surface.

Figure 3-99.



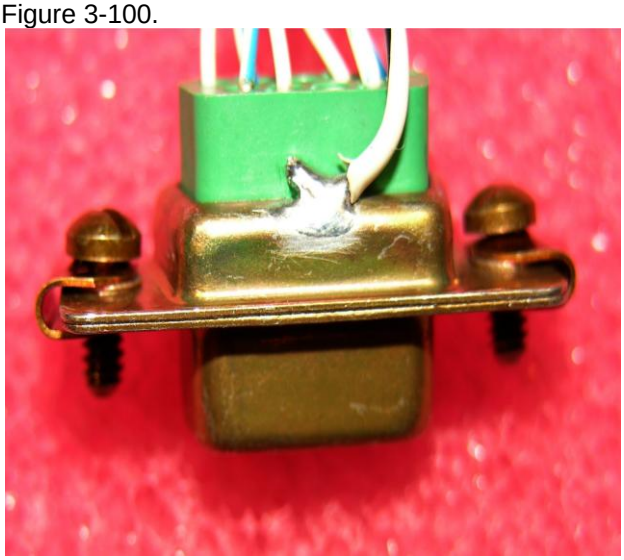
Acceptable

- Wire overlap to the metal surface is greater than 3, less than 5 wire diameters.
- The wire is in contact with and parallel to the metal surface of the connector.
- Solder is wetted and forms a fillet from the wire to the metal connector housing a minimum of 3 wire diameters.
- Wire contour is visible in the solder.
- Damage to the non-metal portion of the connector has not distorted the contact cavity.
- Insulation gap is within 2 wire diameters of solder fillet.
- Connector is clean and free of flux residue and foreign matter
- The buffed metal area of the connector is covered with wetted solder or other approved coating.

Harness/Cable Electrical Shielding

3.15.2 Shield Termination – Soldered to Connector Housing (cont.)

Figure 3-100.



Defect

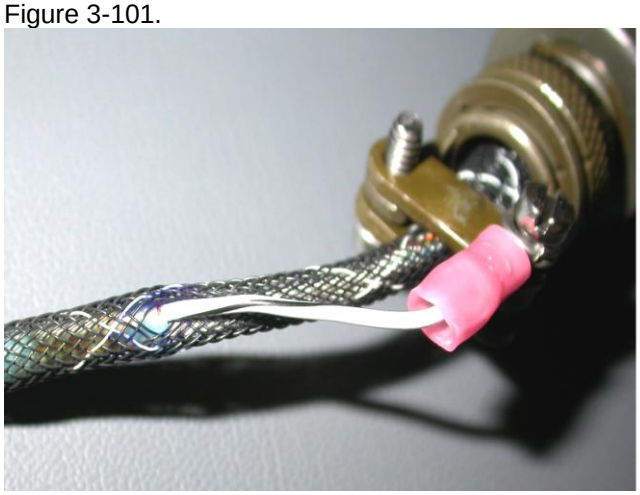
- Wire or insulation damage beyond limits (see IPC/WHMA-A-620).
- Soldered portion of the ground wire is not parallel to the connector surface.
- Wire is not in contact with the metal surface.
- Wire overlap is less than 3 or greater than 5 wire diameters.
- Solder wetting at the connector and wire interface is less than 3 wire diameters in length.
- Solder is dewetted or nowetted.
- Contact cavity (dielectric) of the connector is distorted.
- Insulation gap greater than 2 wire diameters from solder fillet.
- Flux residue or foreign matter evident on solder connection, connector or connector contacts.
- The buffed metal area of the connector is not covered with wetted solder or other approved coating.

3.16 Cable Harness Protective Coverings

Cable Harness Protective Coverings

3.16.1 Braid - Prewoven (plastic)

Figure 3-101.



Acceptable

- Braid strands are separated to allow wire passage.
- Braid strands not cut or damaged.
- Braid is not ballooned or bunched.

Defect (See IPC/WHMA-A-620, Section 16, for Additional Illustrations)

- Braid damage i.e., tears, cuts, broken, or melted.
- Braid is ballooned or bunched.

Cable Harness Protective Coverings

3.16.2 Heat Shrink Tubing – Indoor Applications

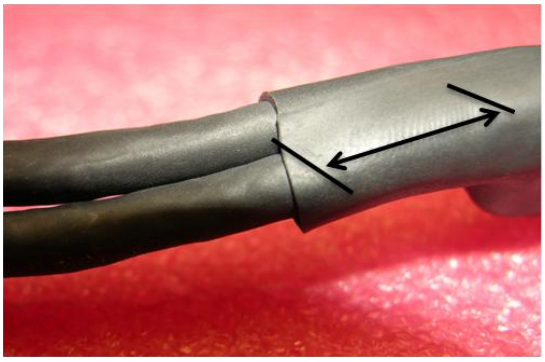
Note: Unless otherwise specified on the engineering drawing, all cable and wire harness assemblies are considered to be designed for an indoor environment.

Sleeving or boots overlapped on clampless adaptors are required to be adhesive bonded in place and **shall meet** the bonding requirements of this section. Adhesive lined sleeving e.g., boots satisfy the bonding requirements when specified on the engineering parts list. When adhesive lined sleeving (e.g., boots) is used, evidence of the adhesive may not be visible at the overlapped junction. Other sleeving overlapped junctions are not required to be adhesive bonded, unless specified per engineering documentation. However when adhesive bonding material is not listed on the engineering parts list, a harnessing adhesive (part number 7917693-00) may be applied to any interface between the connector backshell and/or the connector and the cable jacket as part of the standard process. A harnessing epoxy may also be applied to any sleeving overlap, junction, or splice as part of the standard process; see IS-001. When adhesive bonding is used it **shall** be bonded for a minimum of 270º (75%) of the circumference of the sleeving.

Cable Harness Protective Coverings

3.16.2.1 Heat Shrink Tubing – Indoor Applications Breakouts & Sleeving Splices

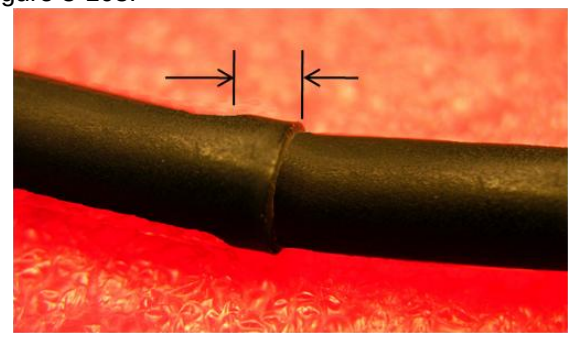
Figure 3-102.



Acceptable

- Sleeving is overlapped a minimum of 3 cable diameters, or 0.5 inch whichever is greater.
- Sleeving is shrunk and there is no lateral movement of the sleeving.

Figure 3-103.



Defect

- Sleeving overlap is less than 0.5 inch or less than 3 cable diameters if 3 cable diameters exceed 0.5 inch.
- Lateral movement of the sleeving (loose).

Cable Harness Protective Coverings

3.16.2.2 Heat Shrink Tubing – Indoor Applications – Cable Jacket/Sleeving Position

Figure 3-104.

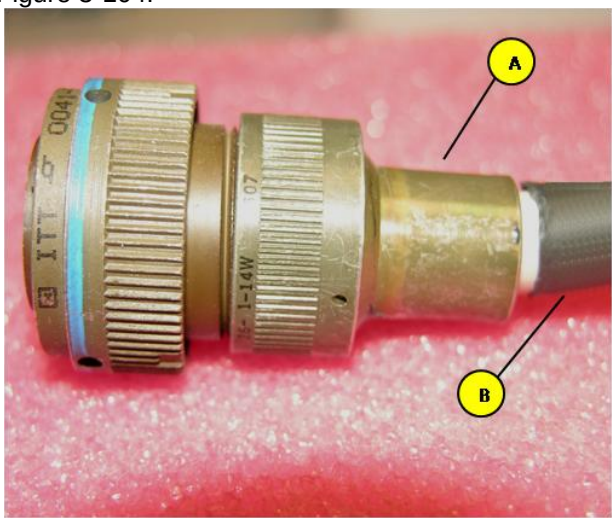
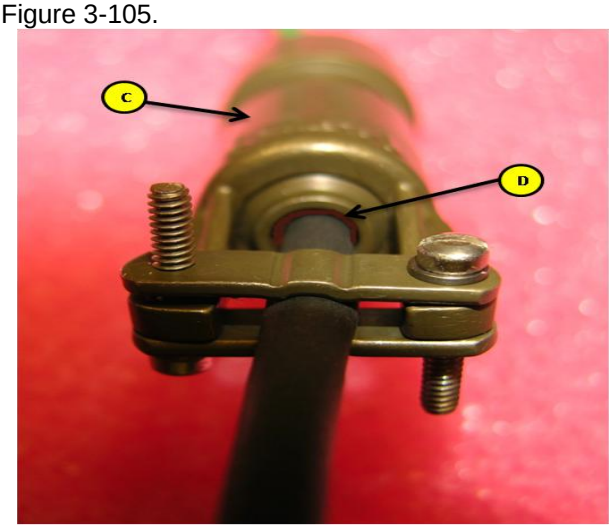


Figure 3-105.



Acceptable

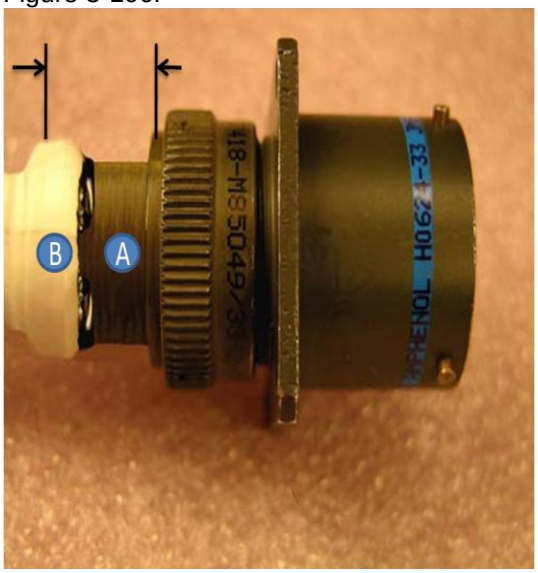
- Cable jacket/sleeving (B) extends to within one cable diameter of the clampless adapter (A).
- When heat shrink sleeving is used for the outer protective covering it is shrunk and there is no lateral movement.
- Environmental connector (C) the cable jacket/sleeving extends into the sealing grommet (D).
- Cable jacket/sleeving extends slightly past the adapter clamps.

Note: Figure 3-104 illustrates a connector with a clampless adapter this configuration requires a boot/sleeving, see 3.16.3.3.

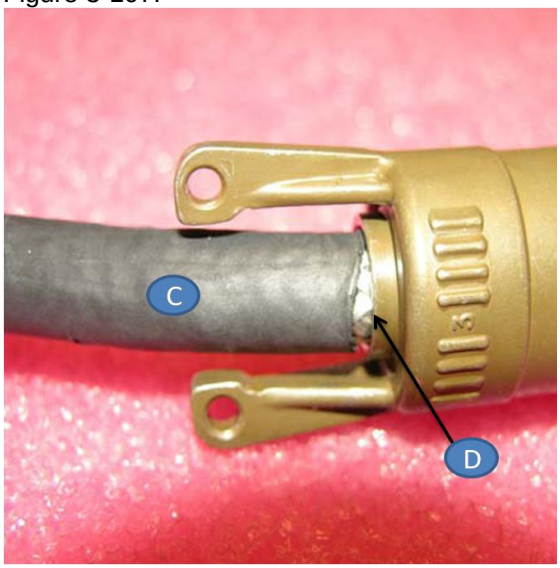
Cable Harness Protective Coverings

3.16.2.2 Heat Shrink Tubing – Indoor Applications – Cable Jacket/Sleeving Position (cont.)

- Figure 3-106.



- Figure 3-107.



Defect

- Cable jacket/sleeving (B) does not extend to within one cable diameter of the clampless adapter (A).
- Loose sleeving (if used).
- On an environmental connector (C) the cable jacket/sleeving does not extend into the sealing grommet (D).
- Connectors that have (strain relief clamps see IPC/WHMA- A-620, Section 9 for acceptance criteria.

Cable Harness Protective Coverings

3.16.2.3 Heat Shrink Tubing – Indoor Applications – Boots/Sleeving

Figure 3-108.

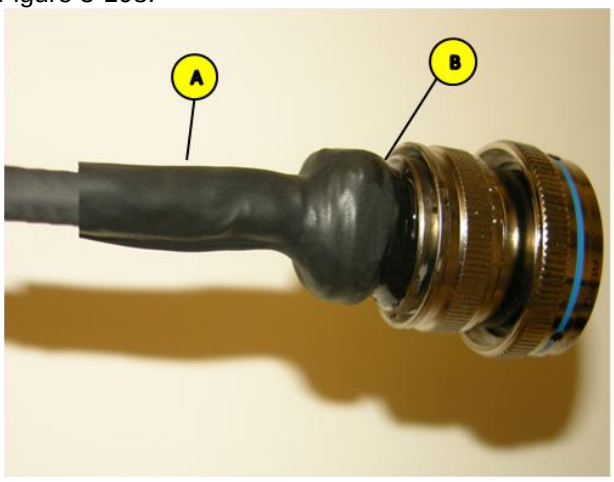
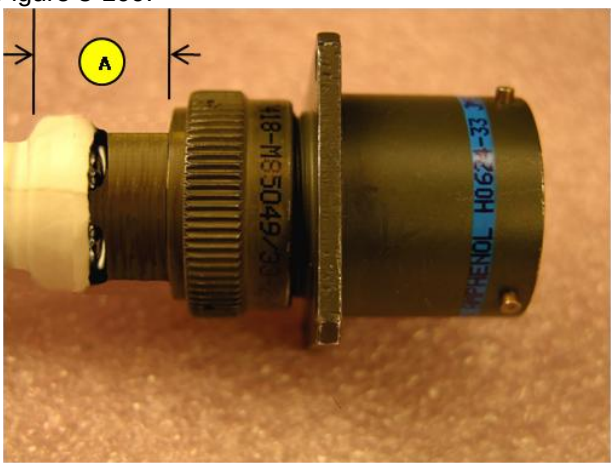


Figure 3-109.



Acceptable

- Boot/sleeving (A) extends onto the clampless adapter a minimum of 50% of adapter length.
- Boot/sleeving is shrunk and snug (no lateral movement).
- The boot/sleeving is bonded (B) to the clampless adapter for a minimum of 270º (75%) of its circumference.
- The boot/sleeving overlaps the cable jacket a minimum of 3 cable diameters, or 0.5 inch whichever is greater.

Note: The boot/sleeving is not required to be bonded to the cable Jacket/sleeving.

Defect

- Boot/Sleeving is overlapped less than 50% of the clampless adapter length (A).
- Boot/ sleeving is not shrunk or has lateral movement.
- The boot/sleeving is bonded less than 270º (75%) of the circumference of the clampless adapter.
- Sleeving overlaps the cable jacket/sleeving less than 0.5 inch or less than 3 jacket/sleeving diameters if 3 jacket/sleeving diameters exceed 0.5 inch.
- Adhesive is on any electrical mating surface.
- Adhesive is on a surface that prevents proper mating or mechanical attachment of the connector.

Cable Harness Protective Coverings

3.16.3. Heat Shrink Tubing – Outdoor Applications

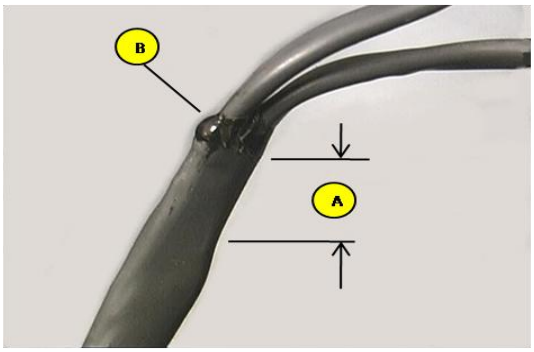
Cable or wire harness designated on the engineering drawing as Outdoor Application are designed to withstand exposure to external environments. These cables/wire harnesses **shall** be built in accordance with the drawing, and parts as designated on the parts list. This section addresses the adhesive bonding and sealing criteria of overlapped tubing splices, overlapped breakout junctions, and sealing of the cable jacket/sleeving to the connector.

Note: Adhesive lined sleeving satisfies bonding requirements when specified on the engineering parts listing. When adhesive lined sleeving (e.g., boots) is used, evidence of the adhesive may not be visible at the overlapped junction.

Cable Harness Protective Coverings

3.16.3.1 Heat Shrink Tubing – Outdoor Applications – Breakouts & Sleeving Splices

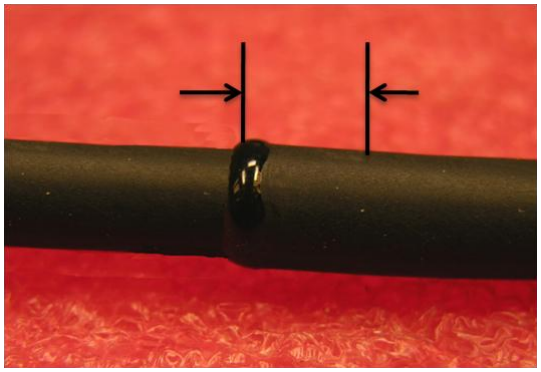
Figure 3-110.



Acceptable

- Sleeving is overlapped (A) a minimum of 3 cable diameters or 0.5 inch whichever is greater.
- The sleeving is shrunk and there is no lateral movement of the sleeving.
- Visual evidence of a 360º seal (B) of the overlapped junction or a 360º seal around each branch of an overlapped breakout junction.

Figure 3-111.



Cable Harness Protective Coverings

3.16.3.1 Heat Shrink Tubing – Outdoor Applications – Breakouts & Sleeving Splices (cont.)

Figure 3-112.

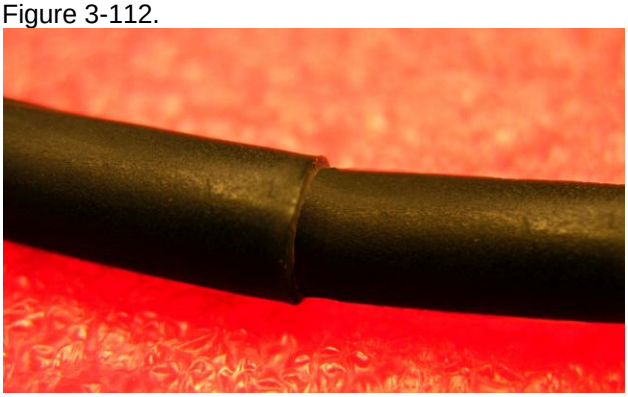
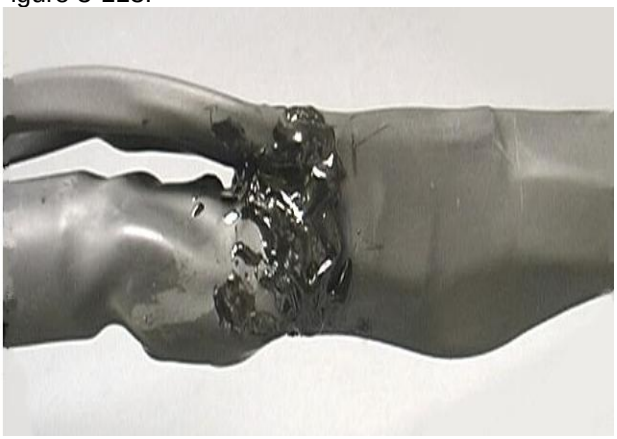


Figure 3-113.



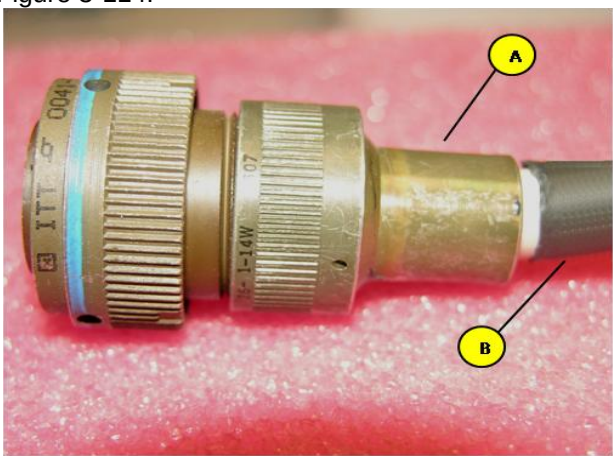
Defect

- Sleeving overlap is less than 0.5 inch or less than 3 cable diameters if 3 cable diameters exceed 0.5 inch.
- No evidence of a 360º seal (B) of the overlapped junction or a 360º seal around each branch of an overlapped breakout junction.
- Sleeving has lateral movement.
- Adhesive has not adhered to the sleeving.
- Voids or separation in the adhesive.
- Adhesive has flowed beyond the boundaries of the joint.

Cable Harness Protective Coverings

3.16.3.2 Heat Shrink Tubing – Outdoor Applications – Cable Jacket/Sleeving Position

Figure 3-114.

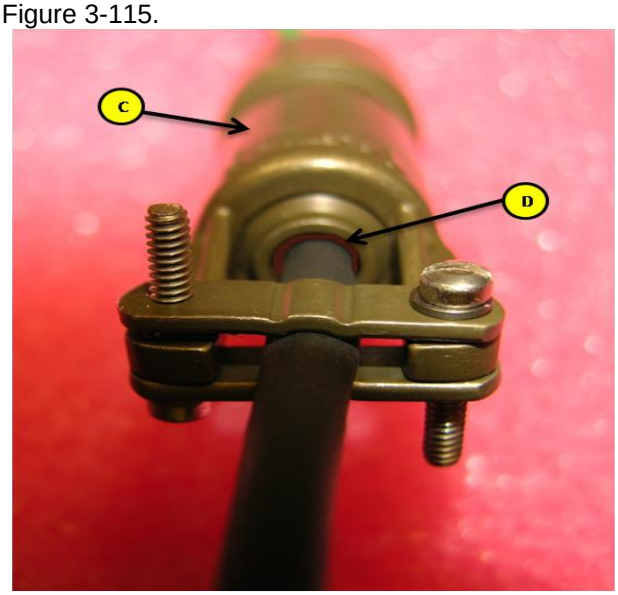


Acceptable

- Cable jacket/sleeving (B) extends to within one cable diameter of the clampless adapter (A)
- When heat shrink sleeving is used for the outer protective covering it is shrunk and there is no lateral movement.
- Environmental connector (Fig. 3-115) the cable jacket/sleeving extends into the sealing grommet (D).

Note: Figure 3-114 illustrates a connector with a clampless adapter this configuration requires a boot/sleeving, see 3.16.3.3.

Figure 3-115.

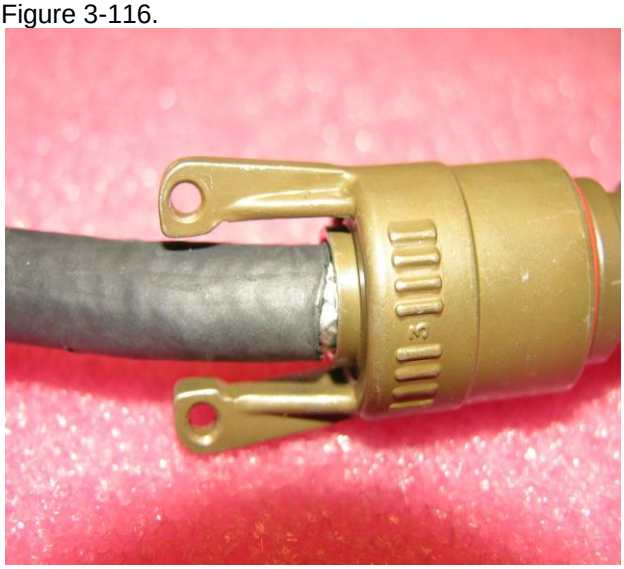


Note: Environmental connectors as shown in Fig. 3-115 do not require a bonded boot/sleeving (assembly is complete).

Cable Harness Protective Coverings

3.16.3.2 Heat Shrink Tubing – Outdoor Applications – Cable Jacket/Sleeving Position (cont.)

Figure 3-116.



Defect

- Cable jacket/sleeving does not extend to within one cable diameter of the clampless adapter (not shown).
- Loose sleeving (if used).
- On an environmental connector (Fig. 3-116) the cable jacket/sleeving does not extend into the sealing grommet.
- See IPC/WHMA- A-620, Section 9 for strain relief criteria.

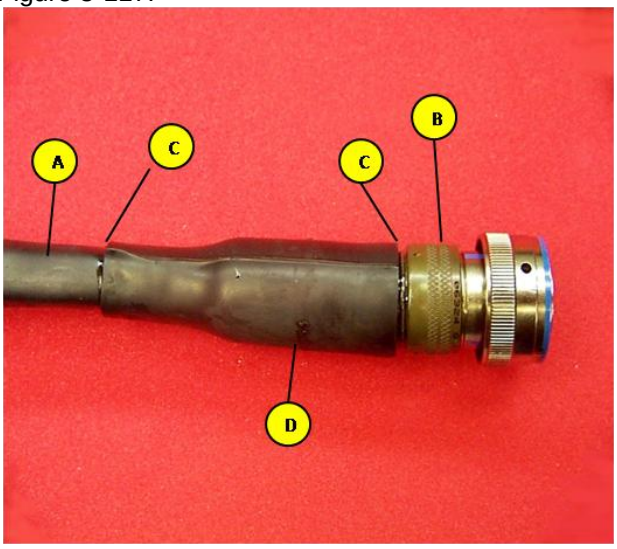
Note: Fig. 3-116 illustrates an environmental connector.

Cable Harness Protective Coverings

3.16.3.3 Heat Shrink Tubing – Outdoor Applications – Boots and Sleeving

(Applies only to clampless adaptors).

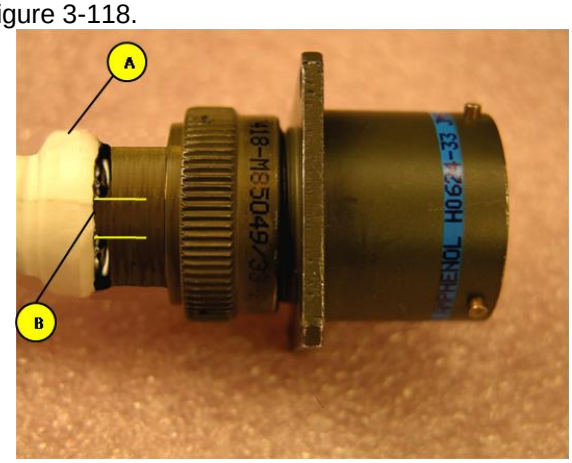
Figure 3-117.



Acceptable

- Boot/sleeving (D) extends over the clampless adapter for at least 50% of the of the adapter length.
- Boot/sleeving (D) is securely shrunk on the rear of the connector adapter (no lateral movement).
- Boot/sleeving does not extend onto the threaded adapter ring (B).
- Boot/sleeving overlaps the cable jacket/sleeving (A) a minimum of 3 cable diameters or 0.5 inch whichever is greater.
- Boot/sleeving is bonded with evidence of a 360º seal (C) at each end.
- Bonding adhesive does not extend onto the threaded adapter ring (B).
- Boot/sleeving or bonding adhesive does not interfere with the connector coupling ring.

Figure 3-118.



Cable Harness Protective Coverings

3.16.3.3 Heat Shrink Tubing – Outdoor Applications – Boots and Sleeving (cont.) *(Applies only to clampless adaptors).*

Defect

- Boot/sleeving (A) extends over the clampless adapter for less than 50% of the of the adapter length.
- Boot/sleeving (A) is loose on the rear of the connector adapter.
- Boot/sleeving extends onto the threaded adapter ring.
- Sleeving overlap on the cable jacket/sleeving is less than 0.5 inch or less than 3 cable diameters if 3 cable diameters exceed 0.5 inch.
- Not bonded and sealed (B) for 360º of circumference of the boot/sleeving (either end).
- Bonding adhesive extends onto the threaded adapter ring.
- Boot/sleeving or bonding adhesive interferes with the connector coupling ring.

3.17 Finished Assembly Installation

60083155, Specification of Standard Torque limits for Threaded Hardware, establish requirements for threaded hardware used at L-3 CSW.

(See IPC/WHMA-A-620 for criteria)

3.18 Solderless Wrap

(See IPC/WHMA-A-620 for criteria)

3.19 Testing

60100697, Specification for Dielectric Withstanding Voltage (DWV) for Cable Assemblies, provides guidance when it is appropriate to reduce dielectric withstanding voltage (DWV) for Class 3 cable assemblies tested per IPC/WHMA-A-620A.

(See IPC/WHMA-A-620 for criteria)

END OF DOCUMENT

DOCUMENT INFORMATION

Responsible Organization:	Operations
Sub-Level function:	Workmanship Standards
Governing Document:	IPC-WHMA-A-620A , Requirements and Acceptance for Cable and Wire Harness Assemblies
Subordinate Document(s):	NA
Related Documents(s)	IS-001, Use of Alternate Size Hardware IS-002, Alternate Piece Marking Method IS-003, Workmanship Acceptability of Electronic Assemblies IS-008, Part Number/Suffix Configuration IS-010, Unique Identification Number (UID) P-023, Calibration Standards/Electrical and Mechanical P-047, Inspection P-127, Assembly Tools and Control and Replacement W-103, Heat Shrink Terminations for Shielded Wire *W-404, Inspection of Connector Contact/Pin Seating W-442, Unique Identification (UID) Piece Marking Label Printing and Verification 60083155, Specification of Standard Torque Limits for Threaded Hardware 60100697, Specification for Dielectric Withstanding Voltage (DWV) for Cable Assemblies *
Approval Requirements:	Chairman of Workmanship Focus Team Manager, Inspection
Review Requirements:	The Workmanship Focus Team, including representation from: Quality, Engineering, Mechanical Design, Electromechanical Integration, Inspection/OES, Purchase Material Quality, and Electronics Circuits

Revision History Summary:

Rev.	Description of Change	Date:
A	WS-003 sections have been combined into one document.	04-22-2010
B	3.1.1, added a statement noting that requirements may be applied to where similar characteristics exist. Added 3.1.2, Terms and Definitions. Added note pointing to 60083155 for torque requirements. 3.9.2, added additional defect criteria. 3.9.3, complete rewrite of section and changed clause header to apply to Cadmium Plated Surfaces. 3.12.1, added caution note for Fiber-Optic cable markers.3.12.2 added defect: Alpha/numeric printing not legible. 3.17, added torque specification 60083155. 3.16.2, added statement clarifying adhesive lined sleeving. 3.16.3, added statement clarifying adhesive lined sleeving 3.19, Added specification for DWV testing. Deleted W-215 & ANSI/J STD 002 from related documents and added new specs. All changes are indicated with blue text.	6/22/2011