ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES®

IPC/WHMA-A-620

Requirements and Acceptance for Cable and Wire Harness Assemblies

Developed by the IPC Task Group (7-31f) of the Product Assurance Subcommittee (7-30) and the WHMA Industry Technical Guidelines Committee (ITGC)

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Users of this standard are encouraged to participate in the development of future revisions.

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Foreword

1.1 Scope

This standard is a collection of visual Quality Acceptability Requirements for Cable, Wire and Harness Assemblies. It was prepared by the ITGC Industry Technical Guidelines Committee of the Wire Harness Manufacturers Association and the Product Assurance Committee of IPC - Association Connecting Electronic Industries. IPC/WHMA-A-620 can be used as a stand-alone document for purchasing products, however it does not specify frequency of in-process inspection or frequency of end product inspection. No limit is placed on the number of process indicators or the number of allowable repair/rework of defects. Such information should be developed with a statistical process control plan (see IPC-9191).

1.2 Purpose

This publication describes acceptability criteria for producing crimped, mechanically secured, or soldered interconnections and the associated lacing/restraining criteria associated with cable and harness assemblies. It is not the intent of this document to exclude any acceptable procedure used to make the electrical connection; however, the methods used must produce completed assemblies that conform to the acceptability requirements described in this document.

1.3 Approach To This Document

The illustrations in this document portray specific points noted in the title of each section. A brief description follows each illustration. The development committee recognizes that different parts of the industry have different definitions for some terms used herein. For the purposes of this document, the terms cable and wire harness are used interchangeably.

1.4 Specialized Designs

IPC/WHMA-A-620, as an industry consensus document, cannot address all of the possible product design combinations. However, the standard does provide criteria for commonly used technologies. Where uncommon or specialized technologies are used, it may be necessary to develop unique acceptance criteria. The development of unique criteria should include customer involvement or consent and the criteria developed should include an agreed upon definition for acceptance of each characteristic.

Whenever possible, new criteria, or criteria on specialized products should be submitted, using the Standard Improvement Form included in this standard, to the IPC Technical Committee to be considered for inclusion in upcoming revisions of this standard.

1.5 Terms and Definitions

Terms are consistent with the definitions provided by IPC-T-50. For the understanding of this document, selected definitions are listed below and in Appendix A.

Shall or Must – Mean that the requirement or attribute discussed is mandatory for all Product Classes.

Should – Reflects recommendations and is used to reflect general industry practices and procedures for guidance only.

Wire Diameter – In this document, wire diameter (D) is the overall diameter of conductor plus insulation.

1.6 Classes of Products

The customer has the ultimate responsibility for identifying the class to which the assembly is evaluated. Thus, accept and/or reject decisions must be based on applicable documentation such as contracts, drawings, specifications, standards and reference documents. Criteria defined in this standard reflect three Product Classes, which are as follows:

Class 1 – General Electronic Products

Includes products suitable for applications where the major requirement is the function of the completed assembly.

Class 2 – Dedicated Service Electronic Products

Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

Class 3 – High Performance Electronic Products

Includes products where continued performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support systems and other critical systems.

5.1 Stamped and Formed Contacts

Criteria for insulated lugs is included.

There are different configurations for insulation support and crimp areas and for the conductor crimp. Additionally, there may be an outer insulator over part or all of the crimp area.

Figures 5-1 and 5-2 identify the component parts of typical stamped and formed contacts.

When attaching multiple wires to a single terminal, each wire is to meet the same acceptability criteria as a single wire termination. The attachment of a single wire or combination of multiple wires attached to a terminal/contact must meet the manufacturer's specifications for a single wire i.e., total wire area may not exceed the circular mil area for the terminal specified.

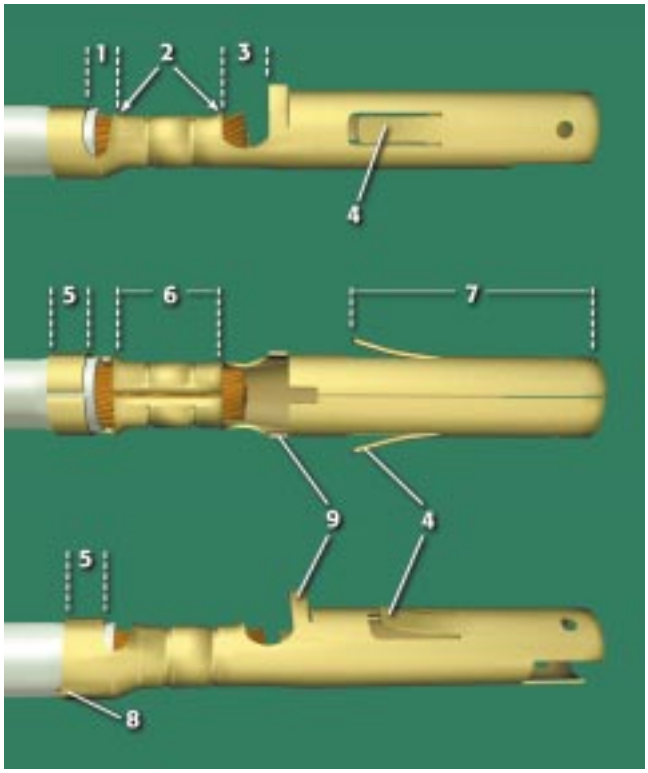

Figure 5-1

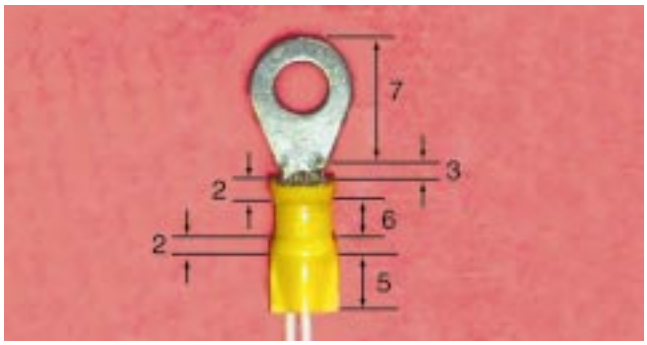

Figure 5-2

1. Insulation inspection window
2. Bellmouth
3. Brush inspection window
4. Locking tab/tang
5. Insulation crimp area
6. Conductor crimp area
7. Terminal mating area
8. Cut off tab (may be at either end of terminal)
9. Terminal stop ear

5.1.1 Stamped and Formed Contacts – Insulation Support Crimp

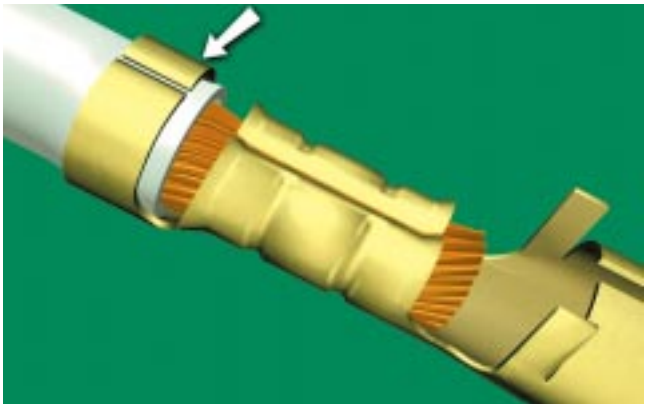

Figure 5-3

Figure 5-4

Figure 5-5

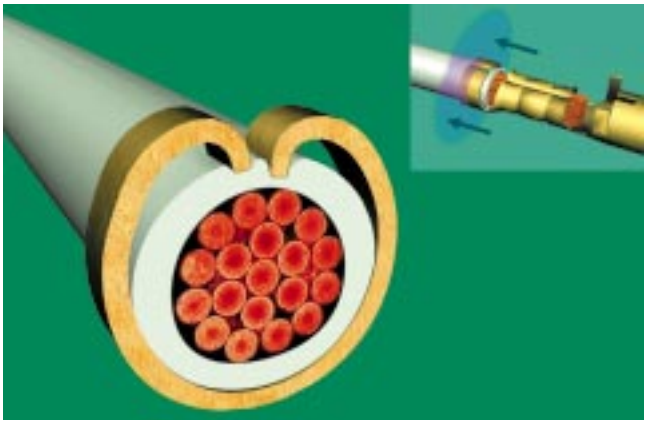

Figure 5-6

Target - Class 1,2,3

- Insulation fully enters and extends past the insulation crimp tabs.
- If multiple wires are used insulation from all wires extend past the insulation crimp tabs.
- Insulation crimp does not cut or break insulation.
- Insulation crimp tabs fully wrap and support insulation.
- For insulated lugs, the insulation crimp is evenly formed and contacts the wire insulation providing support without damaging the insulation (Figure 5-5).

Acceptable - Class 1
Process Indicator - Class 2
Defect - Class 3

- Puncturing of the insulation surface by the insulation crimp tabs, provided that the tabs do not penetrate down to the conductor.

5.1.1 Stamped and Formed Contacts – Insulation Support Crimp (cont.)

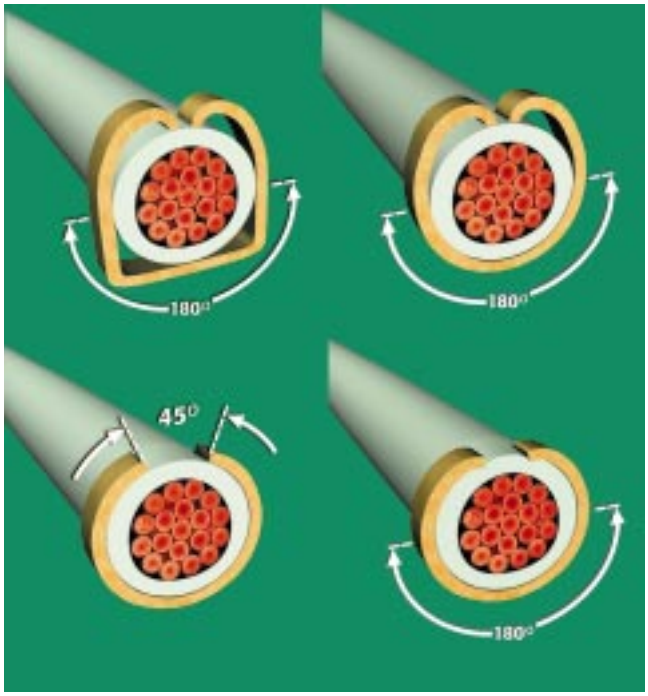

Figure 5-7

Acceptable - Class 2,3

- Minor deformation of the insulation surface as long as the insulation crimp tabs do not cut, break, penetrate or puncture the surface of the wire insulation.
- Insulation crimp tabs provide a minimum side support of 180° to the wire insulation and both tabs contact the top of the wire insulation.
- Insulation rimp tabs do not meet at the top, but encircle the wire leaving an opening of 45° or less at the top.
- The outer insulation sleeve on insulated terminals **shall** remain secured to the terminal after crimping.

Figure 5-8

Acceptable - Class 1
Process Indicator - Class 2,3

- For insulated terminals, irregular shaped insulation crimp contacts the wire insulation providing support without damaging the insulation (Figures 5-8 and 5-9).

Figure 5-9

5.2.4 Machined Crimp Contacts - Crimping (cont.)

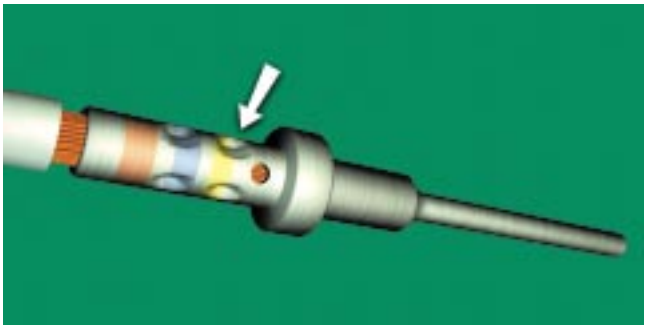

Figure 5-64

Acceptable - Class 2,3

- The crimp is not centered and the inspection window is not deformed.
- The wire entry end of the barrel is not deformed by the crimp.

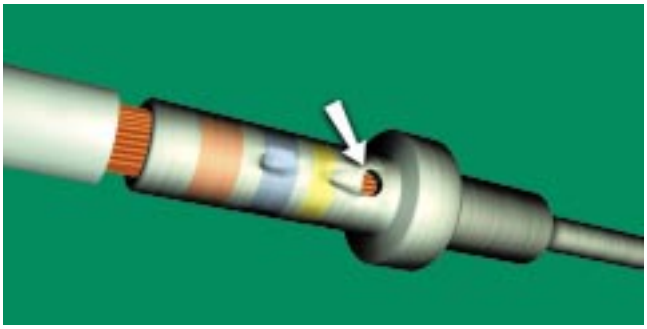

Figure 5-65

Defect - Class 2,3

- The crimp touches the top edge of the inspection window.
- Contact has exposed base metal.

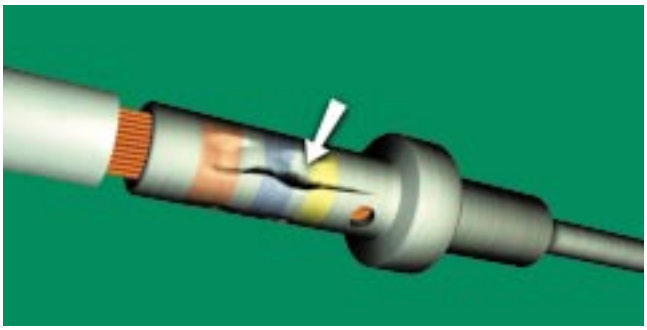

Figure 5-66

Defect - Class 1,2,3

- Wire is not secured by crimp.
- Contact has visible fracture or cracks.
- Double crimping of electrical terminations or connector contacts unless otherwise specified.
- Contact barrel is deformed or bent.

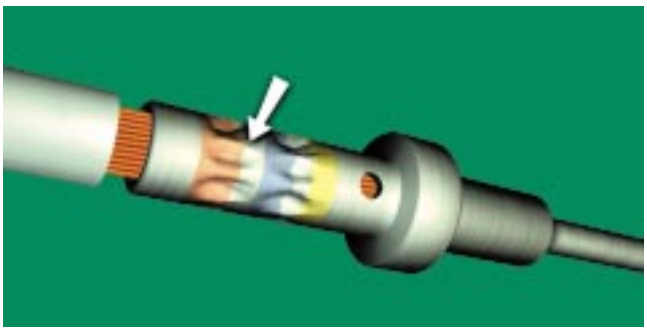

Figure 5-67

6.1.5 Mass Termination, Flat Cable – Connector Skew and Lateral Position

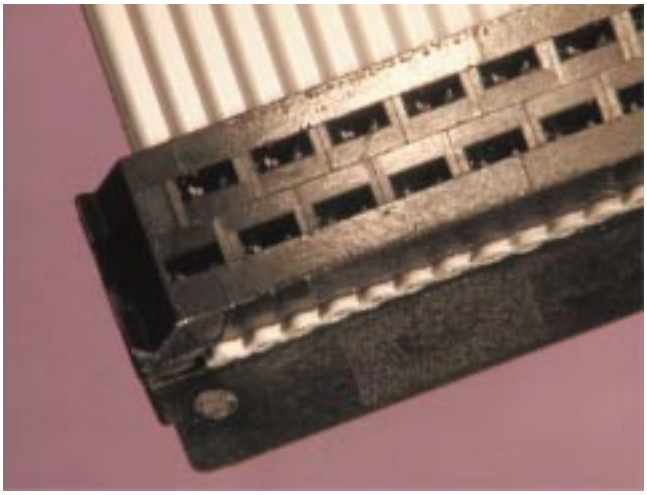

Figure 6-12

Target - Class 1,2,3

- Connector is aligned perpendicular to the edge of the flat cable.
- Cable end is flush along the entire length of the outside edge of the connector.
- All conductors are centered within the v-notch of the connector contacts.

Acceptable - Class 1,2,3

- Connector is aligned so that all conductors are centered in their respective v-notches of the cable.

Figure 6-13

Defect - Class 1,2,3

- Connector misalignment precludes contact of all wires to the IDC contacts.
- Connector misalignment permits shorting of conductors in the IDC contact area.
- Connector misalignment precludes assembly of connector cover.
- Connector misalignment causes wire damage during crimping.
- Face of the cable is not parallel to the face of the connector (Figure 6-14).

Figure 6-14

6.2.3 Discrete Wire Termination – Overhang (Extension) (cont.)

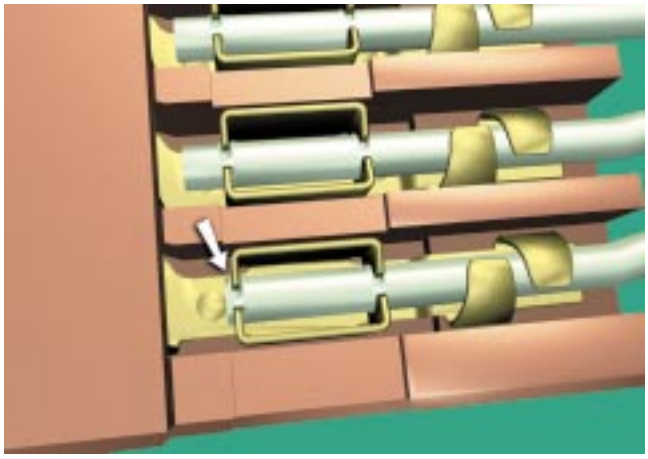

Figure 6-26

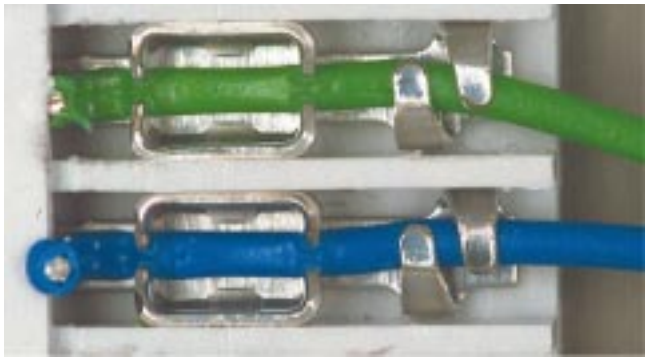

Figure 6-27

Defect - Class 2,3

- Overhang L of the wire is less than 50% overall wire diameter (Figure 6-26).
- Wire is deformed and extends out of the connector (Figure 6-27).

7.2.1 Weld Nugget – Geometry (cont.)

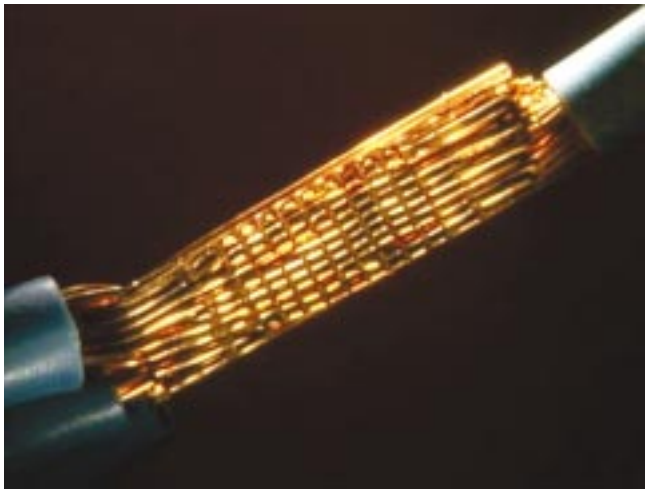

Figure 7-6

Acceptable - Class 1,
Process Indicator - Class 2,3

- Individual wire strands are distinguishable on compression surfaces, but there are no loose strands.

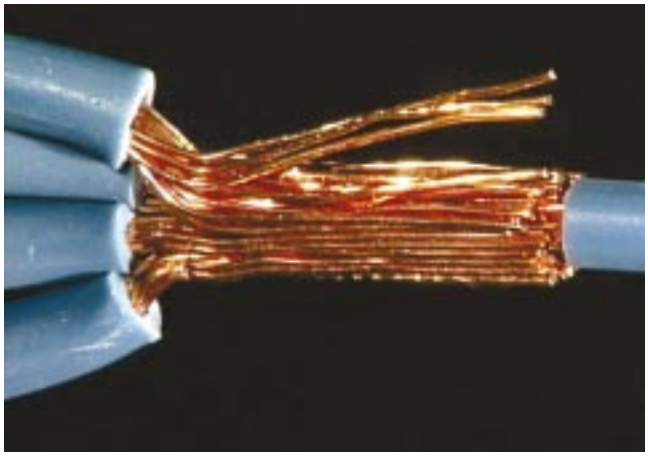

Figure 7-7

Defect - Class 2, 3.

- Any loose wire strands.

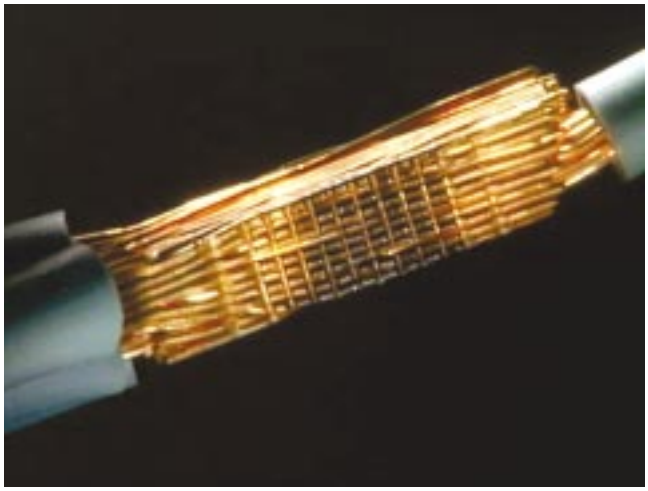

Figure 7-8

Defect - Class 1, 2, 3

- Any discoloration of the conductors.

13.2.1 Center Conductor Termination – Crimp (cont.)

Figure 13-5

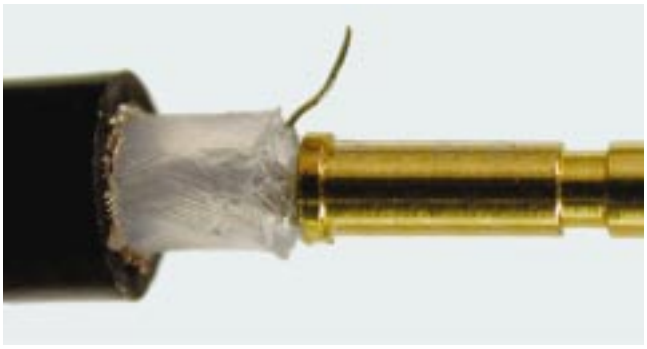

Figure 13-6

Figure 13-7

Figure 13-8

Defect - Class 1,2,3

- Crimp is not centered in crimp area of terminal and causes damage to terminal (Figure 13-5).
- Conductor strand(s) not captured in terminal (Figure 13-6).
- Terminal damaged by crimp (Figures 13-5, 7 and 8).
- Pin shows ''dog ear'' of excess material (Figure 13-7).
- Crimp loose - does not hold terminal (not shown).
- Braid strand(s) caught in terminal (not shown).

14.2.2 Breakouts – Spacing (cont.)

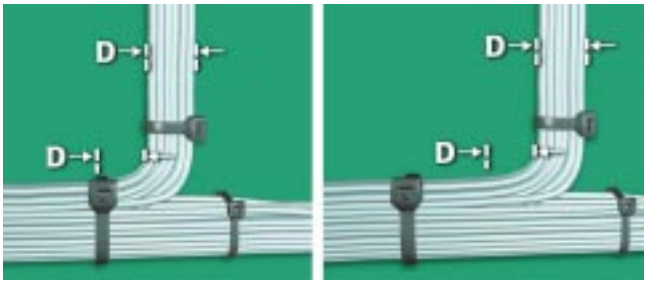

Figure 14-19

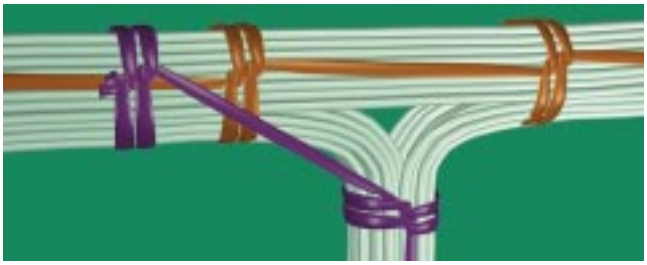

Figure 14-20

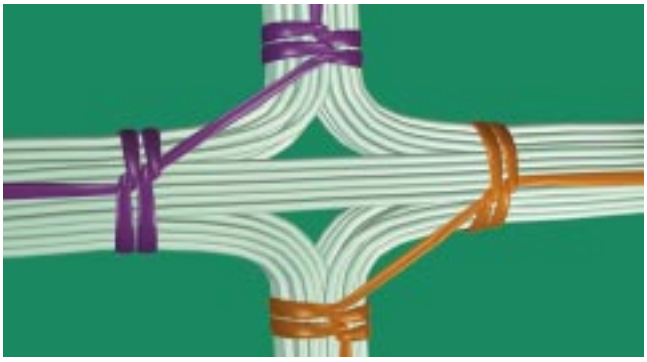

Figure 14-22

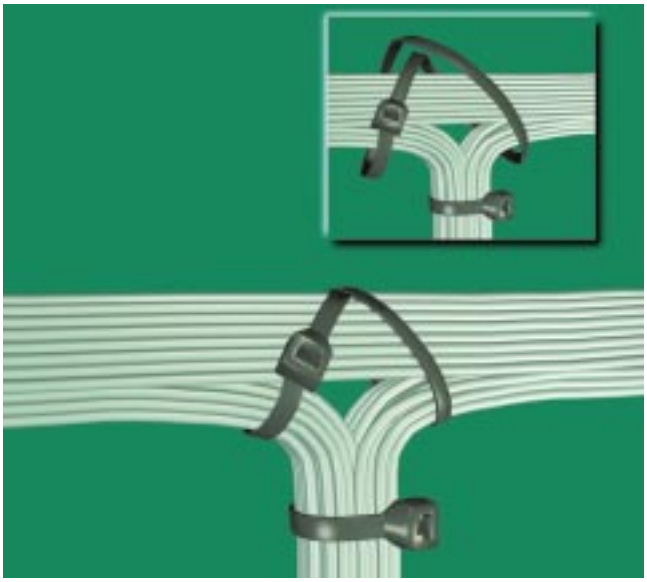

Figure 14-24

Acceptable - Class 1,2,3

- Restraining devices are placed before and after all breakouts.
- Spacing of first restraint from the breakout is three diameters of the wire bundle or 10 cm [4 in] whichever is less.

Note: Figures 14-19 through 14-25 provide examples of typically acceptable restraining configurations.

Figure 14-21

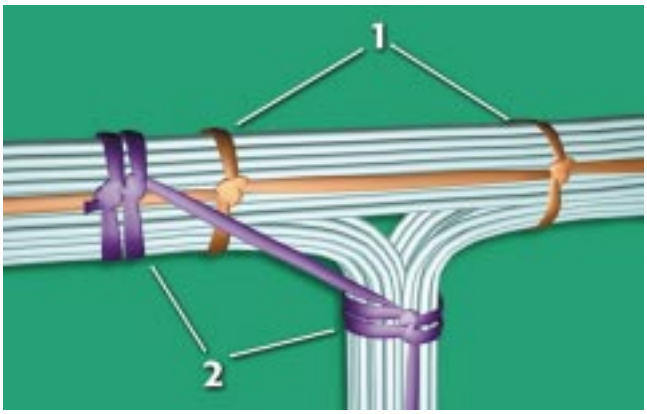

Figure 14-23
1. Single lock stitch
2. Double lock stitch

Figure 14-25