

UNSIGNED HARDCOPY
NOT CONTROLLED



Instruction
Hardware Engineering

No. LMS 11-8

SUBJECT: Wire Identification and Sleeving

APPROVED BY Manager, Hardware Engineering

STATUS Maintenance Revision

PURPOSE Defines requirements for the identification of cable assemblies, wires, and electrical connectors. Also covers application of sleeving as used for abrasion protection. L-3 Communications Corporation, Link Simulation and Training Division (hereafter referred to as Link) personnel shall follow this instruction to the extent specified herein when identifying wires, cable assemblies, and electrical connectors and when using sleeving for abrasion protection.

AFFECTED FUNCTIONS Hardware Engineering
Manufacturing

REFERENCES Link Manufacturing Standard **LMS 1-1, “Identification Marking, Hardware”**

DEFINITIONS

Cable assembly. A cable assembly is an assembly of more than one wire, branched if necessary, and terminated with connectors or lugs to serve as an electrical interconnection between units (cabinets, cockpit, consoles, etc.).

Cable harness. A bundle of wire, bound as a group by lacing, ties, or similar means to serve as an electrical interconnection between the components, assemblies, etc. within a unit.

Interconnecting wiring. Interconnecting wiring consists of wire cables, groups, or harnesses used to connect complete units of electrical or electronic systems.

Prejacketed cable. A prejacketed cable is a bundle of insulated wires encased in a common sheath packaged by a vendor, such as a multi-conductor shielded cable or a rubber-jacketed 56-conductor cable.

1. Requirements

1.1 General.

- a. Color coding. Except as noted below, color coding shall be as specified on the drawing.
- b. Large gauge wires or braid are often available only in one color (generally black). When used in cables (if the wire is not the proper color), the color of the function of the wire circuit, as specified on the drawing, shall be indicated on the wire identification sleeve in addition to the dual identification. See Figure 1 part "A". The color may be spelled out or abbreviated using the following abbreviations:

*COLOR	ABBREVIATION	*COLOR	ABBREVIATION
Black	BLK	Green	GRN
Brown	BRN	Blue	BLU
Red	RED	Violet	VIO
Orange	ORN	Gray	GY
Yellow	YEL	White	WHT

*Not necessary to mark on sleeve if wire is proper color.

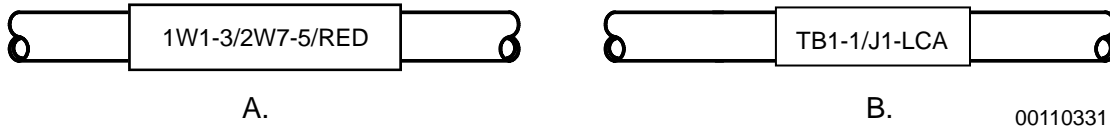


Figure 1 Identification Sleeve

- c. Materials. White vinyl sleeving (Link PN 1006809 or equivalent) may be used as a base surface as described below.
 - (1) On small diameter cables, harness assemblies, or branch leads, white vinyl sleeving shall be used to develop a base when pressure-sensitive tape is used.
 - (2) If the surface is not smooth, white vinyl sleeving shall be used to develop a smooth base for pressure-sensitive tape.
 - (3) On small diameter cables or cables not having a smooth surface, plastic identification plates similar to Link PN B656364-01 may be used to develop a base for a pressure sensitive tape. The

identification plate shall be secured to the cable in a manner appropriate for the tag.

- d. Sleeving size. Because of dimensional build-up of wire in cable assemblies, and identifier character size limitations, sleeving sizes may vary up or down two sizes from those specified on the Engineering drawing. The same basic item as specified on the Engineering drawing shall be used, the substitution being limited to such variations as length, size, and diameter.
- e. Location of identification sleeving. Except as noted below, identification sleeving shall be located near the terminal or connector. Care shall be taken to assure that the identification characters are visible after assembly.
 - (1) When the drawing specifies the use of pressure-sensitive adhesive identification tape, it shall be applied circumferentially around the cable, approximately every 3 feet (91.44 cm) along the main trunk.
 - (2) Connector identification sleeves may be either slipped over the cable assembly trunk and folded or be slit and wrapped around the trunk. The sleeve shall be tied on both ends or pressure-sensitive tape may be anchored around the wires and tightly secured, thus eliminating tie wraps on both ends. Where required, use of backing material is allowed to prevent identification sleeving from sticking to individual wires or cable. Apply such that backing material will allow identification sleeve to spin but not slip.

NOTE: Electrical tape and pressure-sensitive adhesive identification tape shall not be used for strain relief under any condition.

- f. Marking legibility.
- (1) All marking shall be permanent for the life of the equipment, of suitable contrast, and of sufficient size to be legible under normal viewing conditions. Each character shall appear in its entirety.
 - (2) The preferred method is that the identification read from the connector toward the cable.

Alternate method: in order for Identifications to all be “correct” and reading from the same direction (without a portion of the marking sleeves inverted so the lettering is upside down), Identifications may read from the connector toward the cable providing the markings are read left to right so that the first information is the designation for the connector to which that connector connects.
 - (3) When lettering equipment used to print identifying sleeves, tubing, etc., will not print lower-case letters, upper-case letters may be used preceded by the explanatory letters “LC”. A typical example is delineated in Figure 1 part “B”.

1.2 Identification

- a. Connector identification sleeves. Unless otherwise specified on the drawing, each electrical connector on cable assemblies shall be identified with a sleeve containing the following information. (See Figure 2.)
- (1) Line 1. The marking on line 1 constitutes the identification of the connector itself. This connector identification will take one of two forms, as determined by the following:
 - (a) If the cable has a “W” number, such as W15, the connector identification shall consist of the “W” number, followed by the connector “P” number. For example: W15P1, W15P2, etc.
 - (b) If the connector is part of a rack dangle, for example, and does not have a “W” number, the connector identification shall consist of the designation of the rack, chassis, etc., from which the dangle originates (such as 12A4), followed by the connector “P” number. For example: 12A4P1.

- (c) It is permissible for Hardware Engineering to decide when not to include the cabinet or unit number for cables which begin and terminate within that cabinet or unit and which have no external connections (e.g. 99W15P1 would be W15P1). This will facilitate the reuse of cable assemblies functionally the same but with different unit numbers.

NOTE: Connector identification. “P1”, when referenced in this instruction shall be interpreted to mean the lowest connector number of a given cable.

- (2) Line 2. The information on line 2 represents the receptacle to which the connector is connected at final installation. This information shall be either “single” or “dual” identification as determined by the following:
 - (a) Single identification is used when the connector is part of a rack dangle or part of a cable assembly which contains branches (more than two ends). As stated above, this identifies the receptacle to which the connector is connected. For example, in Figure 2, line 2 on the 12A4P1 connector sleeve defines that connector 12A4P1 is connected to W15P1 connector at final installation.
Note: Dual identification may be used for branched cable assemblies if it is determined that upon installation it will be difficult to trace the cable’s origin (e.g. tightly bundled cables, visibility difficult due to location, etc.).
 - (b) Dual identification shall be used only on cable assemblies that are continuous trunks (with no branches of any nature), having only one connector at each end. The dual identification constitutes to/from information (separated by a slash) which identifies the receptacles to which both connectors of the cable assembly are connected. For example, in Figure 2, line 2 on the W15P1 connector sleeve defines that connector W15P1 is connected to 12A4P1 connector, and that the other end of the cable assembly is

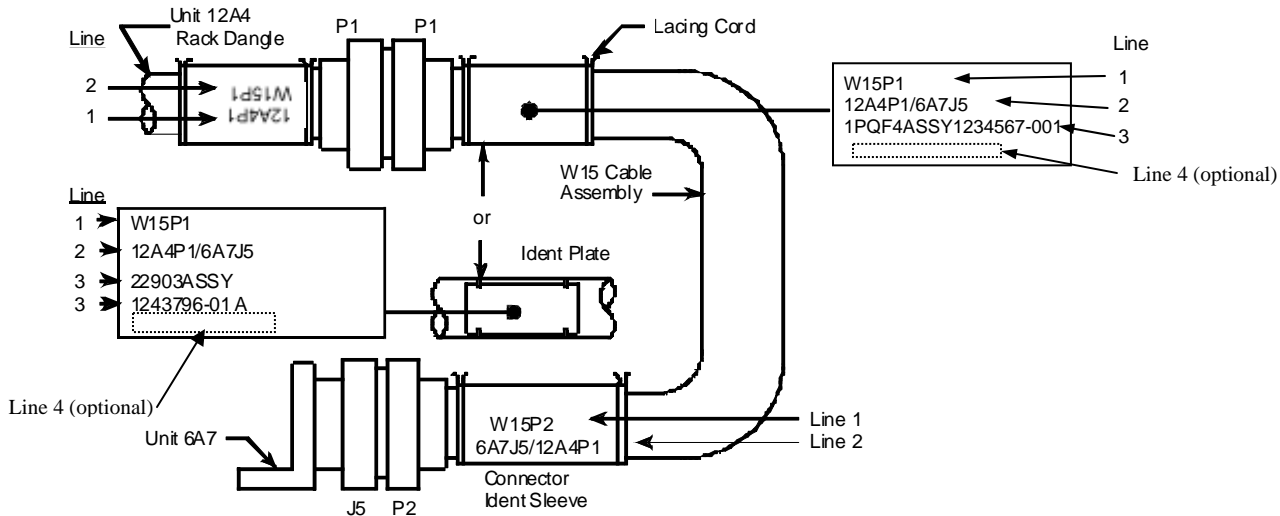
connected to receptacle 6A7J5 at final installation. Note that the Line 2 information is reversed on the opposite end of the cable assembly to signify that connector W15P2 is connected to receptacle 6A7J5, and the other end is connected to 12A4P1 at final assembly. .

- (c) It is permissible for Hardware Engineering to decide when not to include the cabinet or unit number for cables which begin and terminate within that cabinet or unit and which have no external connections (e.g. 99A4P1/99A6P2 would be A4P1/A6P2). This will facilitate the reuse of cable assemblies functionally the same but with different unit numbers.
- (3) The “P1” connector identification sleeve on cable assemblies will be the only connector identification sleeve having more than two lines of information. Lines 3 and 4 will be marked only on a cable assembly “P1” connector identification sleeve, as shown in Figure 2.

It is permissible to use as much area of the sleeve as needed to add the information.

- (4) Line 3.
- Link designed cable assemblies: The information marked on line 3 shall be the identification of the cable assembly. This identification shall be marked only on the cable assembly “P1” connector identification sleeve. The complete identification includes the CAGE Code of the design activity, followed by the abbreviation “ASSY”, followed by the assembly part number.
- Customer Off The Shelf (COTS) cables: For purchased cables the marking on line 3 shall be the manufacturer’s part number and Cage Code IAW **LMS 1-1**.
- (5) Line 4. (optional) When used the fourth line shall be the original manufacturing date code, revision level that the cable was built to (month-year-rev), and serial No. (See Figure 2.) This information shall be marked only on the “P1” connector identification sleeve of a cable assembly.

- (6) Serial Numbers (optional). Cable assemblies shall have serial numbers assigned as specified in **LMS 1-1**. When the items are changed by ECN, the new revision letter is required on line 4 (e.g. REV B P/L REV B SER NO. 1002).



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Figure 2 Cable Assembly Marking

b. Single conductor identification.

- (1) Single conductors terminating at points other than connectors. Except as noted below, single conductors terminated with lugs or similar mechanical connections shall be identified using the dual identification system defined in paragraph 1.2a(2). This requirement does not apply to the following cases:
- When the engineering drawing specifies a different system.
 - When the termination is a taper pin, wire wrap, terminpoint, or soldered termination.
 - When the length of the conductor is such that it cannot reach any other attaching point.
 - When two or more such conductors could be connected interchangeably without altering the electrical circuit (for example, all connect to ground).

- (e) Subassemblies for all Commercial Simulator Contracts.

NOTE: The rules for single-conductor termination identification defined in paragraph 1.2b(1), above, are applicable to all new designs released after May 1, 1980. “New design”, as used herein, is defined as a new dash numbered item of equipment that has not previously been released for fabrication or assembly. This may be a new engineering drawing or a new dash-numbered item being added to an existing drawing. The release date of a new dash number of an existing drawing appears in the “Revisions” block of the drawing. The release date of an Engineering Notice appears in the “Issue Date” block.

- (2) Single conductors terminating at a bus bar. Individual lugged wires on cable assemblies, harness assemblies, wire lists, etc., that terminate at bus bars shall be identified by the bus bar reference designation only, such as 12A4W5. Specific terminals of the bus bar shall not be indicated. The full dual identification will be, for example, 12A4TB2-2/12A4W5.
- (3) Single conductors terminating in a connector. See Program Process Notes for unique requirements.
- (4) The first part of the dual identification marking shall identify the associated terminal lug. (See Figure 3.)

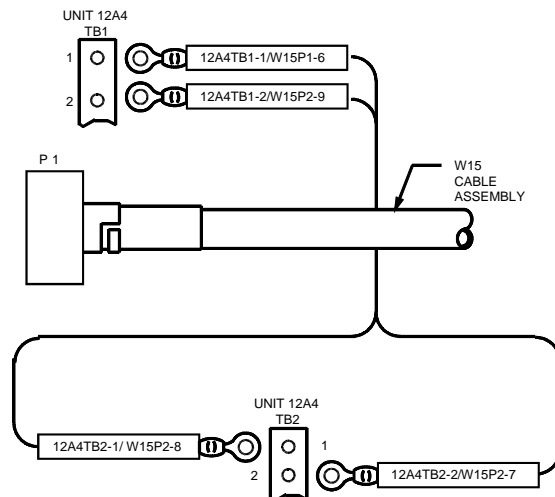


Figure 3 Lugged Lead Identification

- (5) A lugged lead wire terminating in an electrical connector at the opposite end of a cable assembly, harness, solder connection, etc., shall have a wire identification sleeve on the terminal lug end only. (See Figure 3.) If the wire is not part of a cable assembly or harness, and has a terminal lug on each end of the wire, wire identification sleeves shall be used on each end. (See Figure 4.) However, short (approximately 18 inches [45.72 cm] or less), individual lugged lead wires that are easily traceable, without any possible confusion, may be identified by one identification sleeve on either end.

Single or multiple wire lugged lead cables or harnesses which have been assigned a “W” number, and which will not contain any connectors, shall be identified with a cable identification sleeve. This sleeve shall be in addition to the individual wire identification sleeves and shall contain the assembly number, the “W” number, and the manufacturing number. The information may appear as two lines, as shown in Figure 5.

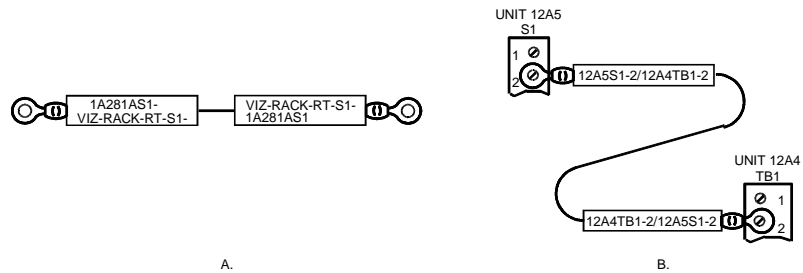


Figure 4 Single Wire Identification

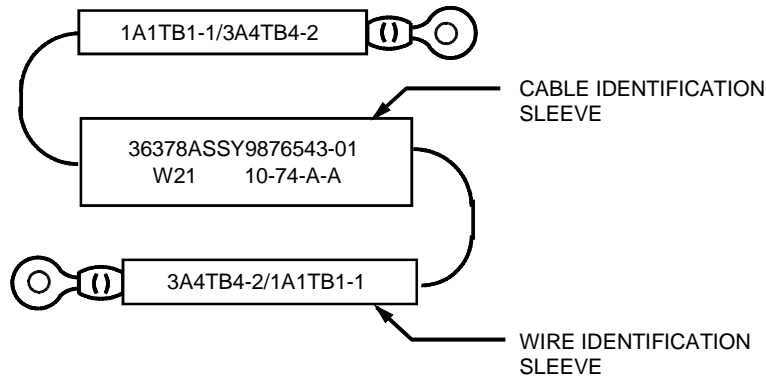


Figure 5 Cable Identification

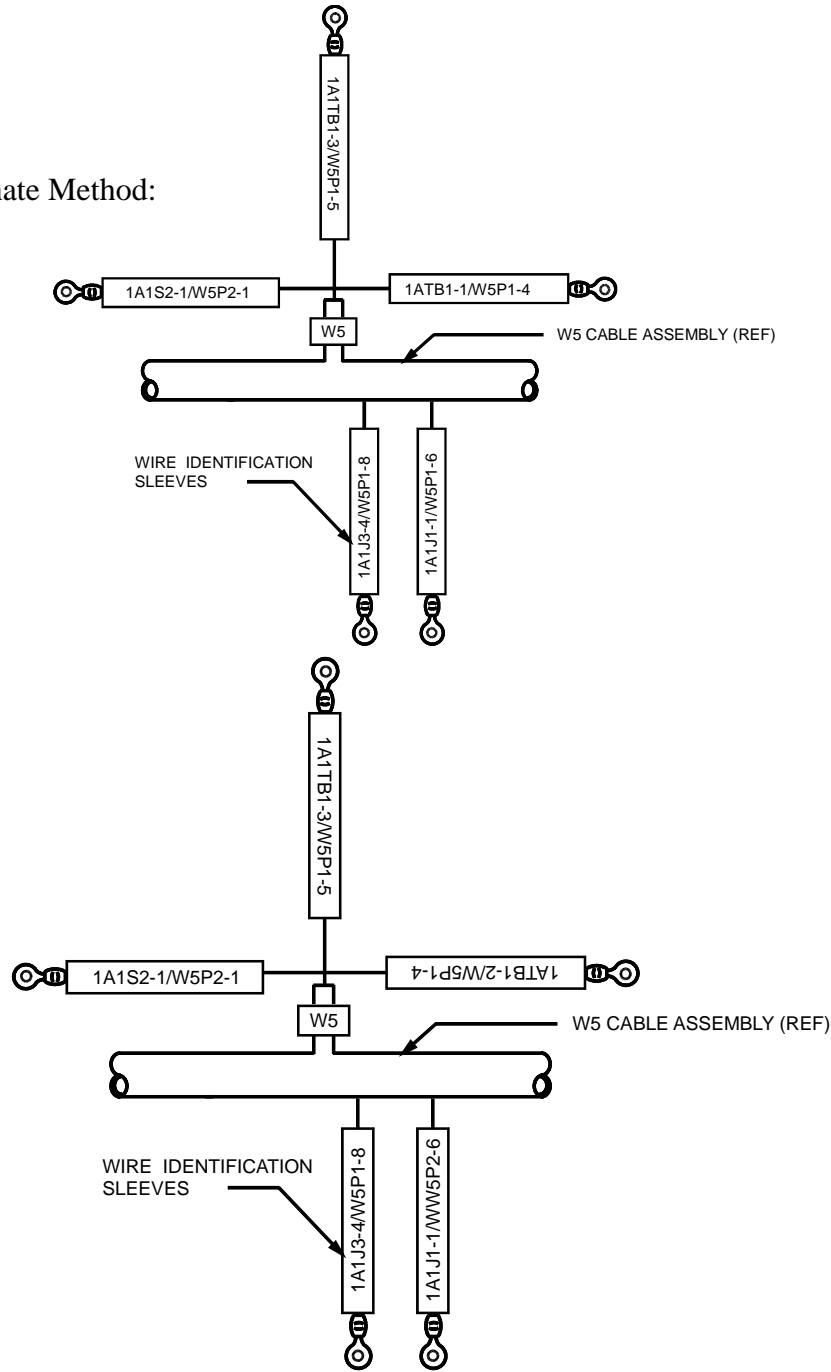
- (6) Single conductors not terminating in a terminal lug or connector. Plain individual wires having no terminal lug or connector may have identification sleeves to facilitate ease of installation. The identification sleeve shall be removed at the time of final inspection.
- (7) Fan lead and dangle lead identification. On cable assemblies, it is preferred that fan lead and dangle lead wire identification sleeves be affixed in such a manner that the identification reads away from the terminal end toward the cable body. (See Figure 6.) Identifications not reading away from the terminal end toward the cable body are acceptable, providing the marking designating the connection for that particular terminal is placed nearest to the terminal.

Alternate method: in order for Identifications to all be right reading from the same direction (without a portion of the marking sleeves inverted so that the lettering is upside down) Identifications may read from left to right so that the first information is the designation for the terminal to which that lead connects.

Manufacturing shall identify individual fanned leads of a cable assembly with either full or abbreviated identification. Full identification includes the “W” cable number and the individual wire identification. Abbreviated identification omits the “W” cable number from each individual wire and uses one “W” cable number added to the cable as close as possible to the break out.

- (8) When heat-shrinkable identification sleeves are used on lugged leads, the sleeve shall not obscure or cover the crimped terminal insulation or area of crimp.

Alternate Method:



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Figure 6 Fan Lead Identification

- (9) Component lead identification. Components which are not soldered at assembly, but which are mechanically assembled by such means as crimped lugs on the leads, and which are subject to removal during maintenance or servicing, shall have an identification sleeve on each lead signifying the attaching points or terminals for the component. (See Figure 7.)

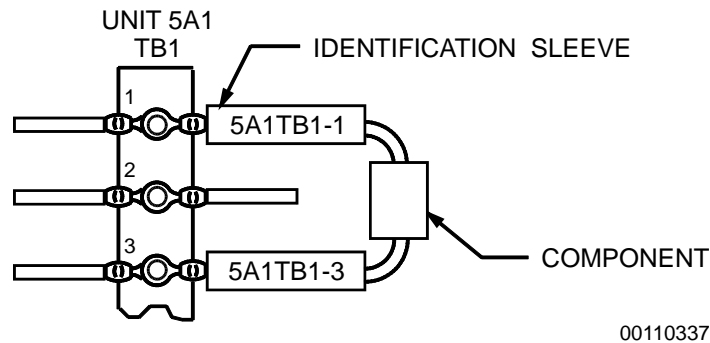


Figure 7 Component Lead Identification

- (10) Spare conductor identification.
- (a) Spare wiring terminated at one end. Spare wiring terminated at one end shall be identified as depicted in Figure 8.

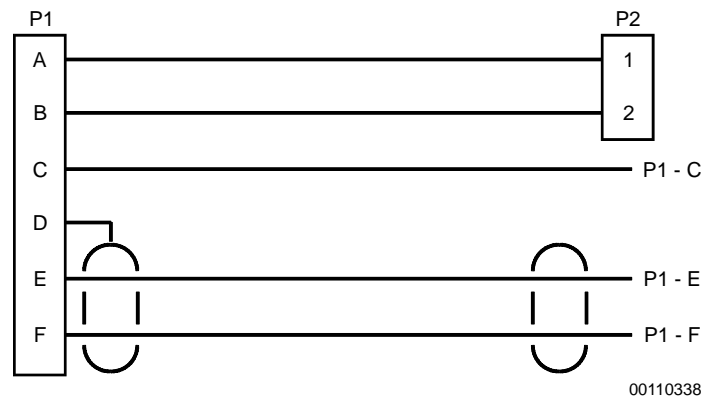
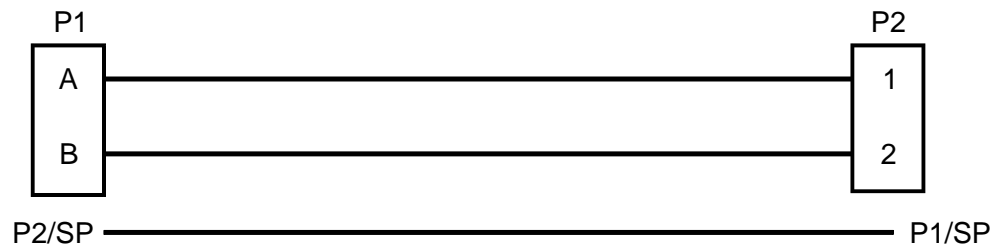


Figure 8 Spare Wiring Terminated At One End

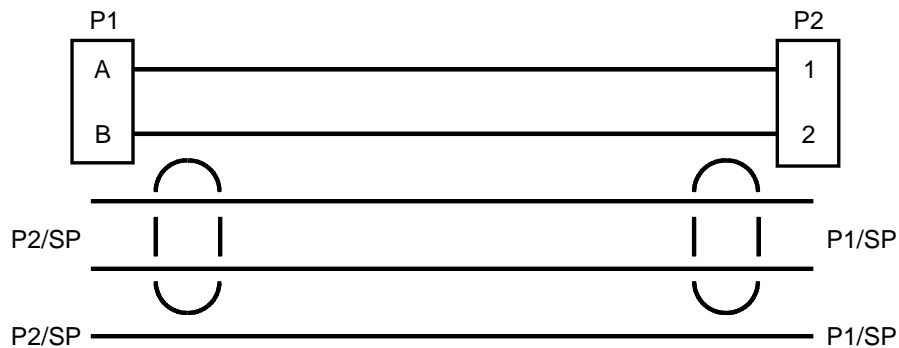
- (b) Spare wiring not terminated. Spare nonprejacketed wiring not terminated on either end shall be labeled as a spare, as depicted in Figure 9. Spare prejacketed wiring not terminated on either end does not need to be identified.



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Figure 9 Spare Wiring Not Terminated

- (c) Spare wiring not terminated, but contract requires to “identify all wire ends”. For programs with contract requirements to identify all wire ends, individual spare conductors, spare prejacketed cable runs, etc. shall be labeled as a spare, as depicted in Figure 10.

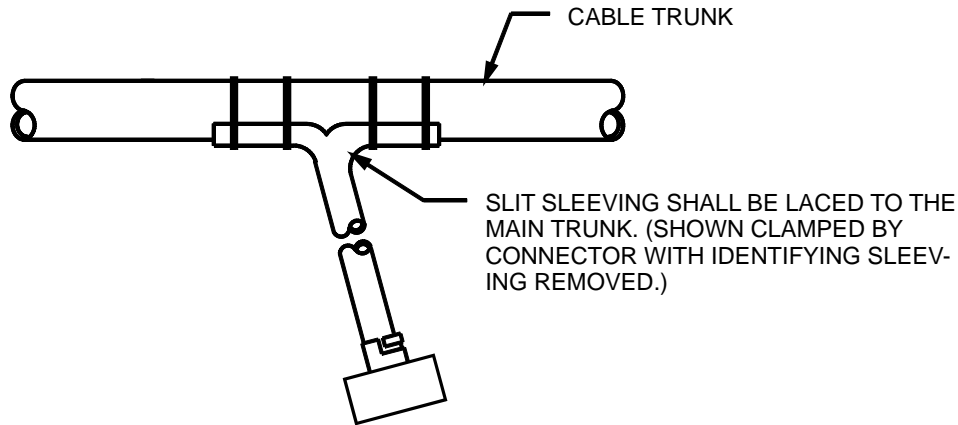


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Figure 10 Spare Wiring Not Terminated But Contract Requires to Identify All Wire Ends

NOTE: The abbreviation for spare (SP) may be used in either case of Figures 9 and 10.

- 1.3 Abrasion protection. When sleeving is used on a cable branch for protection, it shall be slit at the junction of the trunk and branch. The sleeving shall also be securely laced to the trunk and held by the connector clamp at the end of the branch. (See Figure 11.)



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Figure 11 Cable Protection Sleeving

2. Quality Assurance Provisions
- 2.1 Quality Assurance requirements for all wiring identification and sleeving shall conform to this instruction.
3. Preparation for Delivery (Not Applicable)