

**PROTECTION OF CABLE FORMS AND SKINNERS  
AND REPAIR OF INSULATION  
WIRING AND CABLING  
GENERAL EQUIPMENT REQUIREMENTS**

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TAPING . . . . .	3	1.01 This practice covers the general equipment requirements for protecting cable forms and skinners and for the repair of insulation.	
SLEEVING OR TUBING . . . . .	3	1.02 This practice is reissued to make changes that are listed under Reasons for Reissue at the end of this practice. Since this reissue covers a gen- eral revision, the arrows ordinarily used to indicate changes have been omitted.	
SHEET FIBER . . . . .	3	1.03 The requirements covered herein shall be fol- lowed, except as modified by applicable specifications or drawings.	
SPLIT RIGID POLYVINYL CHLORIDE (PVC) TUBES . . . . .	4	1.04 The AT&T Practices and drawings listed below contain protection requirements that supplement the requirements of this practice and, where applicable, are referred to in other parts of this practice.	
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- 800-612-154—Connecting and Soldering Individual Conductors
- 800-612-156—Placing, Securing, and Supporting Cable Forms
- 800-612-158—Splicing Switchboard Cables, and Individual Conductors
- 800-612-162—Selection of Standard Copper and Lightguide Central Office Cables
- 800-612-164—Forming, Grounding, Splicing, and Terminating Shielded Wire and Cable
- 802-001-180—Protective Grounding Systems for Power Plants
- 802-005-180—Assembly and Installation of Power Plant Bus Bar and Wiring
- ED-1A201-10—Mounting of Modular Fuse Blocks for Electronic Switching Systems
- ED-95131-10—Modular Fuse Blocks and Accessories for .090 Mounting Plates and 70-Type Fuses

1.05 Information on wire codes, sizes, and insulation type is covered in AT&T Practice 800-610-152.

## 2. PROTECTING WIRES AND CABLE FORMS

### GENERAL

2.01 Dress all wires and cables away from sharp corners or edges of equipment parts and heat-producing components that might cause damage to insulation. Wires or cables should never be dressed taut against apparatus, apparatus terminals, or equipment parts.

2.02 Protect all wires and cables that:

- (a) Might come in contact with sharp corners or edges of equipment parts.
- (b) Are dressed through holes in metal parts or holes with sharp edges in plastic parts.
- (c) Might come in contact with movable parts.
- (d) Are to be secured to metal parts not provided with an approved protective finish such as the 483 gray insulating baked enamel.
- (e) Are used in battery stand equipment applications.

### SPECIFIC

2.03 **Surface wiring** (wiring that is dressed near or against the surface of a mounting plate or panel; see AT&T Practice 800-612-153) does not require protection except as specified in 2.02.

2.04 **Flexible rubber or neoprene insulated power cordage** such as KS-15141-, KS-15143-, KS-20195-, and similar types shall be formed and protected in accordance with AT&T Practice 800-612-153. Such cordage requires protection when sewn or tied with twine or when secured to wiring supports (see 3.08). No protection is required when banding the cordage together with KS-20986 cable ties.

2.05 **PVC-insulated conductors of KS-13385 type wires** (textile jacket removed) need not be protected when sewn or tied together with twine or cable ties. However, **in power systems** applications where the wires are to be secured to wiring supports, they shall be protected from contact with the wiring support and twine as indicated in 3.08.

2.06 **Coaxial and twin-conductor shielded office cables** (except KS-21112-, KS-19689-, and similar types; see 2.07) shall be treated as specified in AT&T Practice 800-612-153. Except for miniature type coaxial cable (such as the KS-19224-type), protection is not required when the cables are sewn into cable forms or secured to wiring supports. Where miniature coaxial cables are to be secured to wiring supports, they shall be protected from contact with the wiring support and twine as specified in 3.08.

2.07 **KS-19689, KS-21112, and similar type coaxial cables** having semisolid or foam type (soft) dielectrics shall be formed and protected in accordance with AT&T Practice 800-612-153. Such cables are required to be taped instead of sewn. Where the cables are to be tied to wiring supports, they shall be protected from contact with the wiring support and twine as specified in 3.08.

2.08 **Exposed shields and ground wires** of shielded cables and shielded wires shall be protected in accordance with AT&T Practice 800-612-164.

2.09 **Lightguide cables** (single, duplex, or quad fiber) shall be treated in accordance with AT&T Practice 800-612-153. These cables are to be taped together or to other cables, when required, to hold them in place. Where the cables are to be tied to wiring supports with twine, they shall be protected from contact with the wiring support and twine as specified in 3.08.

See proprietary notice on cover page.

**3. METHOD OF PROVIDING PROTECTION****GENERAL**

**3.01** Plastic tapes or flexible plastic (PVC) tubings shall not be used for wire protection where they might come in contact with a hot soldering iron or other heat-producing devices, or where they might be subjected to pressure, such as on wiring that is to be tied to framework.

**PROTECTION MATERIALS**

**3.02** The materials generally used for protecting wires and cables are:

Material	Codes or Part No.	
Gray friction tape	995911278	
Gray plastic tape	AT-7610, R-3359, R-3428, KS-14090	
Flexible PVC-coated fiberglass sleeving	KS-7851	
Flexible polyolefin tubing	KS-21855	
Flexible PVC tubing	ASTM D-922	
1/64-inch gray sheet fiber	985831011	
Split rigid PVC tubes	Inside Dia inches	Length inches
	3/4	16
	1	29
	1 1/4	30
	1 1/2	30
	1 3/4	23
Plastic grommets	Par. 3.10 and Table A	
Grommet strips	WP-91138	

**TAPING**

**3.03** Tape shall be kept as clean as practicable during application to assure good adhesion and to prevent unraveling. Due to the tendency of plastic tape to recede, the last two turns shall be put on without tension.

**3.04** To protect wiring, either the wiring or the metalwork may be taped (whichever is most practicable) as indicated in 3.05 or 3.06. Plastic tape shall not be applied to metalwork having a nitrocellulose lacquer finish, such as the 472-type, since the finish would be softened by contact with the tape.

**3.05** Apply friction or plastic tape to wiring or metalwork by winding it tightly and evenly around the wiring or metalwork with an overlap of at least half the tape width (3/16 inch for plastic tape) using a minimum of three turns of tape. The last two turns shall be put on so that the end of the tape completely overlaps the preceding turns of tape.

**3.06** Plastic tape may be applied to the surface of metalwork instead of winding. If more than one strip of tape is required, the strips may be butted together instead of overlapped. If an edge is to be taped lengthwise, use a wide tape since narrow tapes may not adhere satisfactorily.

**SLEEVING OR TUBING**

**3.07** Sleeving or tubing (see 3.02) may be used for protecting small cable forms (under 1 inch in diameter) or loose wires or skimmers where taping is impracticable. KS-7851, KS-21855, or similar type sleeving (not PVC tubing) shall be used where the wiring might be subjected to heat or pressure such as that described in 3.01.

**SHEET FIBER**

**3.08** Gray, 1/64-inch thick sheet fiber may be used instead of tape or tubing to protect wires or cables from contact with metalwork. The fiber, where practicable, shall be tied to the metalwork rather than to the cables or wires. Sheet fiber shall be used instead of tape or flexible PVC tubing for wires or cables (such as those described in 2.04 through 2.07 and 2.09) that must be protected from contact with both the metalwork and sewing twine. In this case, the fiber shall be wrapped and tied around the wiring.

**SPLIT RIGID POLYVINYL CLORIDE (PVC) TUBES**

3.09 Split rigid PVC tubes (see 3.02) may be wrapped and tied around wiring instead of the sheet fiber for protecting wiring from contact with the metalwork and/or twine.

**GROMMETS**

3.10 The piece-part grommets listed in Table A may be used for protecting wires or cables dressed through holes in mounting plates, panels, or in other metal parts, or in plastic parts if the holes have sharp edges. Grommet strips per WP-91138 may be used, where practicable, instead of the piece-part grommets for holes of 1/2-inch diameter and larger. The grommet strips are continuous lengths of polyethylene grommeting material that is designed to be cut to size and formed around the hole.

TABLE A

Part No.	COMCODE	Panel Thickness	Hole Diameter
		inch	
P-267786	802677864	1/16	1/8
P-267787	802677872		1/4
P-267788	802677880		1/2
P-267789	802677898		13/16
P-267790	802677906	3/32	1/8
P-267791	802677914		1/4
P-267792	802677922		1/2
P-267793	802677930		13/16
P-267794	802677948	7/32	1/8
P-267795	802677955		1/4
P-267796	802677963		1/2
P-267797	802677971		13/16

**4. SPECIFIC APPLICATIONS**

**BATTERY FEEDER CONNECTORS**

4.01 Battery feeder connectors resting against the frame top angle shall be protected by 813218245 insulator attached to the top angle with

3M Company EC847 adhesive. As an alternate, twine may be used to secure the fiber when the adhesive is not available. Where battery feeder connectors rest against other metal parts, the parts shall be covered with two layers of gray sheet fiber.

**CONNECTORIZED CABLES**

4.02 Where the butt of a cable is to be clamped to a multicontact connector, one wrapping of 900351156, 1/8-inch thick, adhesive-coated neoprene, or 997425988 or 997291596 slit tube spacers may be applied around the butt, instead of tape, to protect the cable from contact with the connector cable clamp. This also provides the buildup that may be required for securely clamping the wiring to the connector.

**DISTRIBUTING FRAMES**

4.03 At the horizontal side of distributing frames where cables are run parallel to the transverse arms and where a fanning ring is not used at the cable butt, place a 804497592 insulator 1/64-inch sheet fiber between the cable butt and the transverse arm, when the butt is secured, to prevent the wires at the butt from coming into contact with the transverse arm. Such protection is not required in the case of 750-type cables having shielded pairs if the shields are grounded at the distributing frame end.

**DUCT-TYPE BAYS**

4.04 Instead of taping local cable arms, loose wiring, or switchboard cables dressed around the flange edge of duct-type bays, the wiring may be protected by placing an 841887185 or R-4458 protection strip over the edge of the flange.

**5. PROTECTION OF SKINNERS**

5.01 Where skimmers require protection, either the metalwork or the skimmers may be taped, sleeved, or otherwise protected, whichever is most practicable.

5.02 The skimmer ends of all unconnected leads (whether skinned or unskinned) shall be protected individually with sleeving, tubing, or tape applied separately to each lead. Sleeving is available in precut lengths as follows.

See proprietary notice on cover page.

Wire Gauge	Sleeve or Tube Code	Type	Length inches
<b>For Leads To Be Soldered</b>			
22 or smaller	824410765	PVC	1 1/2
	401929914	KS-7851	1
<b>For Leads To Be Solderless Wrapped</b>			
22 or smaller		PVC	2 3/4
	401929922	KS-7851	2 3/4

5.03 The sleeving or tubing shall be placed over the end of the Skinner so that it extends at least 1/4 inch beyond the end of the bare wire and overlaps the insulation by at least 1/4 inch for leads to be soldered and at least 1/2 inch for leads to be solderless wrapped.

5.04 Each sleeved Skinner shall be doubled back at approximately the center of the sleeved insulated wire portion of the Skinner, as shown in Fig 1. In no case shall the sleeving be doubled back along the sleeved bare wire length of the Skinner since it may produce a severely kinked shiner, thereby preventing the shiner from freely entering the wrapping tool bit.

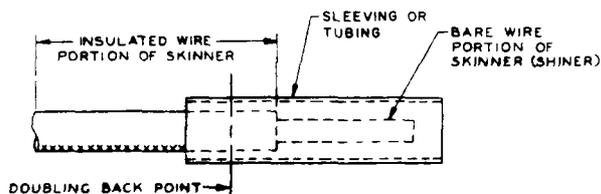


Fig 1—Sleeving Skinners Ends of Unconnected Leads

5.05 Where the unconnected leads are to be sewn back on the form, at least one stitch of the sewing shall be placed over the sleeves to hold them in place. Where practicable, KS-20986 cable ties (instead of twine) may be used in accordance with

AT&T Practice 800-612-153 to tie back the sleeved leads on the form. Sewing may be omitted where the sleeved leads are to be enclosed in tubes.

## 6. PROTECTION AT APPARATUS TERMINALS

### GENERAL

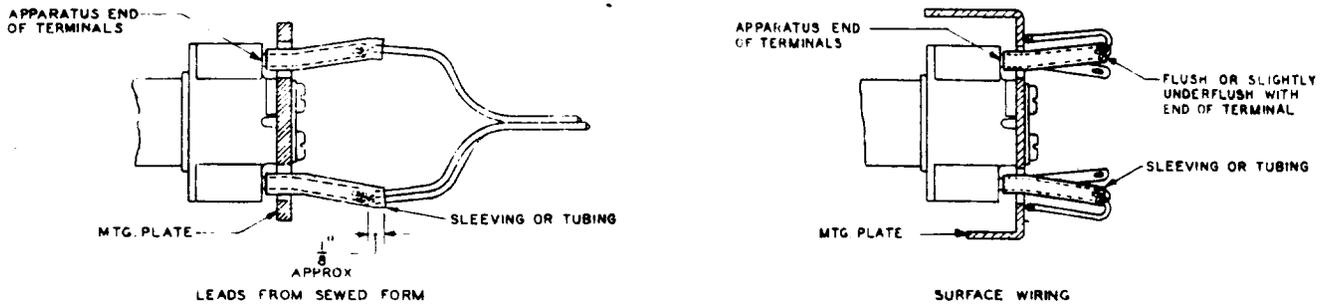
6.01 Where it is required to protect terminals and/or connections to terminals from short circuits with adjacent terminals or other parts of equipment, the terminal and connection shall be sleeved with sleeving or tubing (see 3.01 and 3.07). The sleeving or tubing should be applied as shown in Fig 2 or 3, whichever is applicable. The sleeving or tubing must be placed on the wire or wires before the connection is made.

6.02 Where pigtail component leads are to be connected to apparatus terminals (Fig 3), the sleeving or tubing may be partially slit and slid back on the component lead to allow sufficient clearance for making the connection. After making the connection, slide the sleeving or tubing over the terminal and connection.

### SPECIFIC

6.03 In electronic switching systems (ESS) type equipment, the terminals and connections on 22-, 23-, 24-, 26-, and 27-type modular fuse blocks shall be insulated as required per ED-1A201-10.

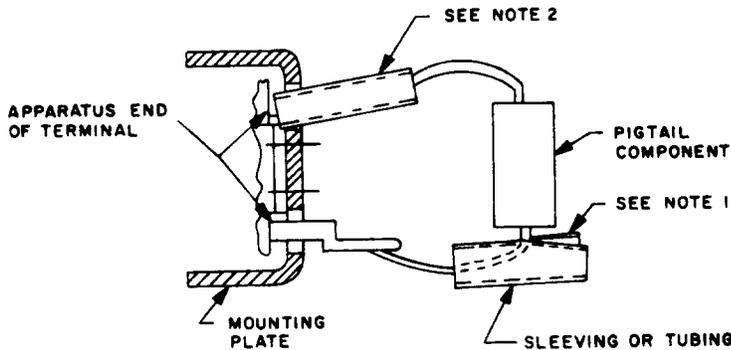
6.04 In equipment other than ESS-type, terminals of the battery bus bars, auxiliary battery bus bar, pilot fuse alarm and alarm lamp of 22-, 23-, and 24-type modular fuse blocks, and all terminals of the alarm bus bars of 22-, 23-, 24-, 25-, 26-, and 27-type modular fuse blocks shall be insulated from the mounting plate with sleeving or tubing per 3.07. The sleeving shall be applied to the terminals before any connections are made and shall be placed so as to butt against the fuse block and extend beyond the mounting plate a minimum of 1/16 inch. There shall be adequate clearance between the terminal and mounting plate to allow the sleeving to be placed freely on the terminal. All connections to these terminals shall be insulated with tip insulators as shown on ED-95131-10.



**Fig 2—Sleeving Connections at Apparatus Terminals**

**NOTES:**

1. SLEEVING OR TUBING MAY BE PARTIALLY SLIT AND SLID BACK ON LEAD TO ALLOW SUFFICIENT CLEARANCE FOR MAKING CONNECTION.
2. END OF SLEEVING OR TUBING SHOULD PROJECT APPROXIMATELY 1/8 INCH BEYOND END OF TERMINAL WITH SLIT ORIENTED TOWARDS SIDE OR BOTTOM OF APPARATUS.



**Fig 3—Sleeving of Pigtail Lead Connections to Apparatus Terminals**

See proprietary notice on cover page.

## 7. REPAIR OF INSULATION

### GENERAL

7.01 Where practicable, damaged wires should be replaced (instead of repaired) with similar-type wire, if available. If the same type of wire is no longer available, use a comparable substitute (see AT&T Practice 800-610-152 covering gauge and insulation of wire). Where splicing is required to replace a damaged or broken skinner with a new wire, refer to AT&T Practice 800-612-158 on splicing of individual conductors.

### SPECIFIC

7.02 For repair of damaged power wire or switchboard cable, see AT&T Practice 800-614-152 covering switchboard, power, and local power cable installation.

7.03 Damage to served textile or cotton braided insulation may be repaired by wrapping the damaged portion of the wire with tape (see 3.01 through 3.06). Sleeving or tubing may be used in accordance with 3.07 for the wire repair where disconnection of the wire to apply the tubing can be tolerated.

7.04 Damage to PVC or IPVC insulation may be repaired by coating the damaged area, if it is smaller than 1/4 inch in length, with R-3155 wire insulation coating. If the damaged area is 1/4 inch or larger, wrap the damaged portion with tape (see 3.01 through 3.06). If the damaged area is 1/4 inch or larger and located on a skinner, the skinner should be replaced, if practicable, by splicing on a wire of the same gauge and color code. Where practicable, the use of sleeving or tubing per 3.07 or heat-shrinkable tubing per 7.06 for repairing the wire is also acceptable.

7.05 Damage to Tefzel-, Kynar-, or Milene-type insulations may be repaired by wrapping the damaged portion of the wire with plastic tape (see 3.01 through 3.06). Where practicable, the use of sleeving or tubing per 3.07 or heat-shrinkable tubing per 7.06 for repairing the wire is also acceptable.

7.06 Heat-shrinkable tubing per Material Specification 59074, List 4 may be used for repairing PVC-, IPVC-, Tefzel-Kynar-, or Milene-insulated wire or the PVC outer jacket of teflon-

insulated shielded wire or cable. The tubing shall extend 1/4 inch minimum beyond each side of the damaged area. **To avoid damaging the wire or cable, the tubing should be carefully applied with low-temperature hot-air type tools designed specifically for shrinkable tubing applications.** The tubing and PVC jacket shall not be discolored or distorted upon completion of the repair.

### REASONS FOR REISSUE

1. To include in 1.04 references to AT&T Practices 800-610-152, 800-612-156, 800-612-162, ED-1A201-01, and ED-95131-10.
2. To revise 2.01 and 2.02 (formerly 2.01 through 2.04) to remove references to specific wire codes and to generally clarify the protection requirements.
3. To revise 2.03 through 2.07 [formerly 2.05(a) through (e), 2.06, and 2.07] to remove information covered more appropriately in other AT&T Practices and to generally clarify the requirements.
4. To revise 2.08 (formerly 2.37) to omit protection information for wiring in contact with KS-15660 wiring support screw and to include information on treatment of exposed shields.
5. To add 2.09 to provide information on the treatment of lightguide cables.
6. To include in 3.02 (formerly 2.09) information on split rigid PVC tubes and WP-91138 grommet strips.
7. To clarify 3.01 through 3.06 (formerly 2.09 through 2.14) covering the use of plastic and friction tapes.
8. To omit 2.16(a) through (e) covering the use of varnished cotton cloth for protection against chafing, abrasion, and oil drippings.
9. To omit 2.18 covering the use of fiber escutcheons for protecting stationary cable forms passing through metalwork.
10. To include in 3.09 information for protecting wiring with split rigid PVC tubes.

See proprietary notice on cover page.

11. To omit 2.20 through 2.30, which provided information on protection of keyshelf local cables, cardshelf local cables, PBX switchboard local cables, cable forms in rear of switchboards, and multiple wiring at 42- and similar-type banks.
12. To omit Fig 1 covering fiber protection at operator telephone jacks.
13. To omit Fig 2 covering fiber protection at 42- and similar-type banks.
14. To revise 5.01 through 5.05 (formerly 3.01, 3.02, 3.05, and 3.06) for clarification.
15. To omit 3.03 on sleeving of multiplied leads.
16. To omit 3.04 concerning the sleeving of unequipped leads on manual and toll equipment manufactured before 1934.
17. To include in 3.10 information on WP-91138 grommet strip and to omit from Table A information on 103-type insulators.
18. To revise 6.01 and 6.02 (formerly 4.01 and 4.02) for clarification.
19. To renumber Fig 1, 2, and 3 (formerly 3, 4, and 5) and to add reference to tubing.
20. To revise 7.01 through 7.05 (formerly 5.01 through 5.04) for clarification.
21. To omit 5.05 on repair of damaged AR multiple-bank wiring.
22. To omit 5.06, 5.07, and Fig 6 covering repair of damaged wiring having loose-wrapped waxed insulation.