

**SPlicing SWITCHBOARD AND
LEAD-COVERED CABLES, LOCAL CABLES,
AND INDIVIDUAL CONDUCTORS
WIRING AND CABLING
GENERAL EQUIPMENT REQUIREMENTS**

CONTENTS	PAGE	
1. GENERAL	2	chloride [PVC], and lead-covered) using 16-gauge and smaller diameter wire. The splicing of 14-gauge and larger diameter wire (power wire) is covered in AT&T Practice 802-005-180. The splicing of coaxial and twin-conductor shielded office cable and shielded wire is covered in AT&T Practice 800-612-164.
2. INDIVIDUAL CONDUCTOR SPLICES	2	
A. Types	2	1.02 Detailed reasons for reissue will be found under Reasons for Reissue at the end of this practice.
B. Splicing Requirements	3	
General	3	1.03 The requirements for splicing lead-covered switchboard cable apply to taped joints. Where there is a possibility that the splices in lead-covered switchboard cable will be exposed to moisture, the splices should be made in accordance with the standard requirements for splicing outside plant lead-covered cable except that the conductor splices are to be soldered if the wire is enameled.
Switchboard Cable and Local Cable Forms	3	
Skinners	5	1.04 The requirements covered in this practice shall be followed except as modified by applicable specifications and drawings.
Multiple Bank Wire	6	1.05 The AT&T Practices and drawings listed below contain supplementary wiring and cabling requirements and, where applicable, are referred to in other parts of this practice.
3. SWITCHBOARD CABLE SPLICES	6	
A. Types	6	005-150-101—Wiring Symbols, Wiring Abbreviations and Definitions
B. Splicing Requirements	8	800-610-152—Gauge and Insulation of Wire
C. Length and Location of Cable Splice Requirements	9	800-612-150—Specific Requirements for Electronic-Type Equipment
D. Protecting the Cable Splice	9	800-612-151—Design of Cable Forms
4. PAIRED WIRE TWISTED MORE THAN TWO TWISTS	9	800-612-153—Stripping and Butting Cables
A. Requirements	9	800-612-154—Connecting and Soldering Individual Conductors
5. REASONS FOR REISSUE	10	800-612-156—Placing, Securing and Supporting Cable Forms
1. GENERAL		
1.01 This practice covers the general equipment requirements for splicing individual conductors and switchboard cable (fabric, polyvinyl		

AT&T TECHNOLOGIES—PROPRIETARY

This document contains proprietary information of AT&T Technologies, Inc. and is not to be disclosed, reproduced, or published without written consent.

This document must be rendered illegible when being discarded.

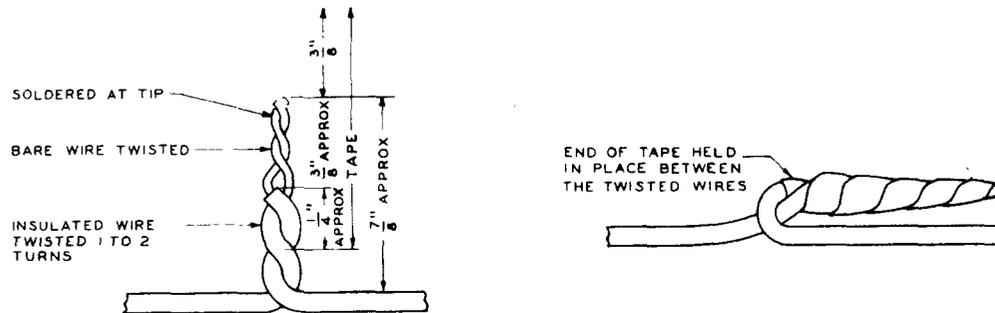
- 800-612-157—Protection of Cable Forms and Skinners
- 800-612-160—Dressing of Skinners
- 800-612-161—Color Combinations and Uses
- 800-612-162—Selection of Standard Copper and Lightguide Central Office Cables
- 800-612-163—Specific Requirements for Crossbar-Type Equipment
- 800-612-164—Forming, Grounding, Splicing and Terminating Shielded Wiring
- 800-612-165—Dressing of Skinners - Power Plant Apparatus
- 800-614-152—Switchboard, Power and Local Power Cables

- 802-005-180—Assembly and Installation of Power Plant Bus Bar and Wiring
- ED-94964-10—Cable Splices Using 710 Series Connectors
- ED-2C531-10—Splicing - Use of 711 Connectors

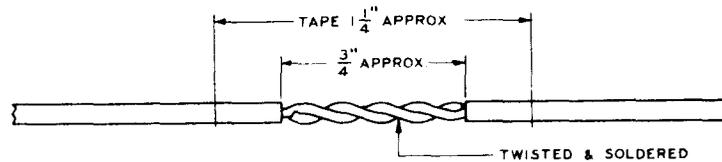
2. INDIVIDUAL CONDUCTOR SPLICES

A. Types

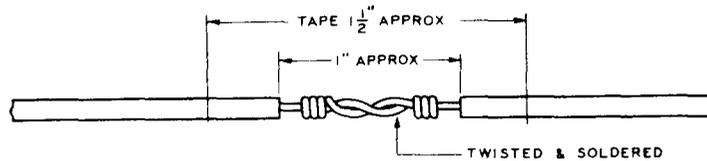
2.01 A *straight splice* is used to splice individual conductors approaching from opposite directions without a splice sleeve (Fig 1) or with a KS-21256 L1 or L2 splice sleeve (Fig 2). See Table A.



FOR INDIVIDUAL CONDUCTORS SMALLER THAN 16 GAUGE
(PIGTAIL SPLICE - CABLES ONLY)



FOR INDIVIDUAL CONDUCTORS SMALLER THAN 16 GAUGE
AND IN CABLES WHERE THE DIMENSIONS OF THE SPLICE
ARE SUCH AS TO PREVENT THE USE OF THE PIGTAIL SPLICE



FOR INDIVIDUAL CONDUCTORS 16 GAUGE
(WESTERN UNION SPLICE)

Fig 1—Straight Splice for Individual Conductors

See proprietary notice on cover page.

TABLE A

KS-21256 SPLICE SLEEVE

WIRE GAUGE	FIG	LIST	COMCODE
20-22	2	2(R)	401224548
24-26	2	1(BK)	401224530
20-26	4	3(No Color)	401224555
28-30	5	1(BK)	401224530
20-26	6	3(No Color) (2 Req)	401224555

2.02 An *end splice* is used to splice adjacent wires approaching from the same direction without a splice sleeve (Fig 3), or with a KS-21256 L3 (Fig 4) or L1 (Fig 5) splice sleeve. See Table A.

2.03 Individual conductors may also be spliced using the 3M Company UP2, UP3, and UPB in-line connectors and the 701-2AR (COMCODE 102751724) and 702-2AR (COMCODE 102751732) connectors.

B. Splicing Requirements

General

2.04 When making splices per Fig 1 or 3, the wires should be twisted together, soldered, and insulated with at least a half lap of approved tape per AT&T Practice 800-612-157. Sleeving or tubing per AT&T Practice 800-612-157 (varnish-impregnated or nonrigid PVC) may be used as an alternate means of insulating the pigtail and end splices shown in Fig 1 or 3.

(a) When making splices per Fig 1, heat-shrinkable tubing (COMCODE 900451022, KYNAR RT 850, Raychem Corp) may be used as an alternate insulation method. The wires should be twisted as shown in Fig 1 except the 1-inch approximate dimension of twisted portion shall be 3/8-inch approximate. A 1-inch long heat shrink sleeve shall be applied after soldering the twisted joint and then shrunk in place.

2.05 When making splices using the KS-21256 splice sleeve, the following shall apply:

(a) The sleeve shall be used in accordance with list number, gauge, and color code as shown in Table A.

(b) The R-4444 or approved equivalent heat gun shall be used to shrink the entire sleeving and complete the splice.

(c) The bare portions of the wires may be laid flat against each other (Fig 2 or 4).

(d) The solder ring shall not be broken prior to the application of heat.

(e) The solder flow shall be confined within the splice sleeve. The length of the solder fillet for list 1 and list 2 shall be 1/4-inch minimum.

(f) The security of the connection will be considered adequate when it will withstand a pull test of 2 pounds minimum for 28- and 30-gauge wire, and 4 pounds minimum for larger diameter wires.

(g) The sleeving shall not be punctured or show signs of being punctured. The solder sleeve shall not be excessively scorched (colored black) or burnt; however, a slight tinge of brown does not indicate the insulation is defective.

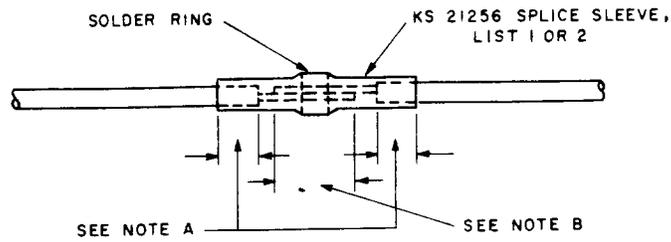
Switchboard Cable and Local Cable Forms

2.06 Conductors in switchboard cables and local cables (including type AM or BH wire run as cable) should not be spliced except where specified.

(a) Individual conductors of BH-2 P wire run as cable may be spliced using 701-2AR (COMCODE 102751724) and 702-2AR (COMCODE 102751732) connectors. When using the connectors, the finished splice shall be protected with at least a half-lap of approved tape in accordance with AT&T Practice 800-612-157.

2.07 Accidentally broken conductors may be spliced in the switchboard cable forms (including type AM or BH wire run as cable) and sewed local cables (not in local loose wire forms made up of bulk wire), but the number of splices should be kept to a reasonable minimum consistent with careful workmanship.

2.08 In formed ends of switchboard cables (loose or sewed) or in sewed local cable forms, splices should be located in a readily accessible place at the outside of the form.



NOTES:

- A. THE INSULATION OF EACH WIRE SHALL EXTEND INTO THE SLEEVE 1/8 INCH MINIMUM.
- B. THE BARE WIRES WITHIN THE SLEEVE MAY BE LAID FLAT AGAINST EACH OTHER WITH A MINIMUM 3/8 INCH OVERLAP. THE BARE PORTION OF THE WIRE SHALL NOT OVERLAP THE INSULATED PORTION OF THE WIRE. THE SOLDER RING SHOULD BE APPROXIMATELY AT THE CENTER.

Fig 2—KS-21256 Splice Sleeve for Individual Conductors (Sleeve Shown Not Shrunk)

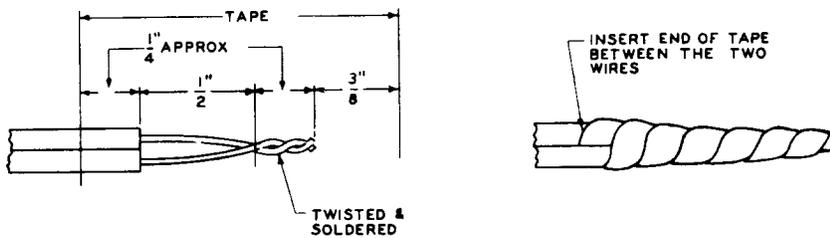
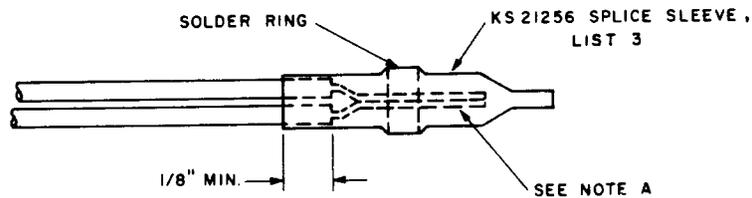


Fig 3—End Splice for Individual Conductors



NOTE:

- A. BRING WIRES APPROXIMATELY TO THE BEND OF THE SPLICE SLEEVE.

Fig 4—KS-21256 Splice Sleeve Used as an End Splice for Individual Conductors (Sleeve Shown Not Shrunk)

See proprietary notice on cover page.

2.09 In fanned forms, the splice should be located as near the cable butt as practicable.

Skidders

2.10 Where it is necessary to splice short or broken skidders in sewed or loose wire switchboard cable forms and in sewed local cable forms, use a straight splice (Fig 1, 2, 5, or 6).

(a) In sewed forms, locate the splice in the form rather than in the skidders, where practicable.

(b) In loose wire switchboard cable forms when the wires are run loosely through cable brackets, fanning rings, and adjustable wiring supports, etc, locate the splice as near the cable butt as practicable. When the loose wire form is secured to cable brackets or is banded with sewing twine or ties, the splice may be located in the loose wiring path between any two bands or ties or as near the cable butt as practicable.

2.11 Where common leads have been cut and skinned for connection to apparatus and the apparatus has been removed, the ends of the conductors should be connected together (Fig 3, 4, or 5).

2.12 Where skidders or D leads are to be connected to pigtail apparatus, make the connection by means of the straight or end splice shown in Fig 1 through 4. When using the method shown in Fig 1 or 3, protect the splice and bare pigtail lead with tape, sleeving, or tubing per AT&T Practice 800-612-157 (varnish-impregnated or nonrigid PVC). Short or broken pigtail leads should be spliced by means of a straight or end splice to increase the length of the pigtail lead. In general, the wire (insulated or bare) should be the same gauge as the pigtail lead. Where the wire is of a different gauge, it is permissible to twist two full turns of the smaller gauge conductor around the larger gauge conductor and solder. In any case, the splice should not be made closer to the pigtail apparatus body than 3/8 inch, unless otherwise specified.

(a) Insulated pigtail leads from stud and screw mounted apparatus, such as coils and transformers, may be extended by splicing on a length of the same gauge and type of wire as the pigtail lead, if available, or a wire of the type used throughout the unit. Use the straight or end splice per Fig 1 through 5.

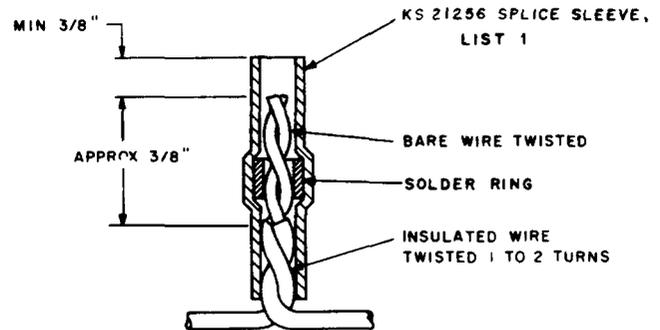
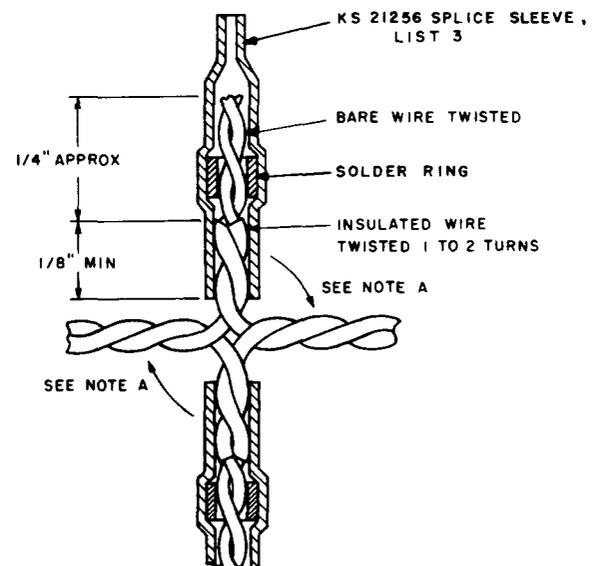


Fig 5—KS-21256 Splice Sleeve Used for Splicing 28- and 30-Gauge Conductors (Sleeve Shown Cross Sectioned and Not Shrunk)



NOTE:

A. AFTER THE SPLICES ARE MADE, THE SPLICES SHALL BE FOLDED IN OPPOSITE DIRECTIONS PARALLEL TO THE TWISTED PAIR.

Fig 6—KS-21256 Splice Sleeve Used for Splicing Paired Wires Twisted More Than Two Twists per Inch (Sleeve Shown Cross Sectioned and Not Shrunk)

Multiple Bank Wire

2.13 Splices in type AR (rated Mfr Disc) or DR stranded, multiple-bank wire are made in the wire shop by tying a square knot in the wire ends. Such splices (which fall between bank terminals or between terminal strips, and the end bank of step-by-step equipment during fabrication) should be soldered and insulated with overlapping turns of KS-14090 tape or polyethylene pressure-sensitive tape per RM-593896 (red) or RM-596897 (blue) to match the color of the wire.

- (a) When splices are made by the installer, the straight splice shown in Fig 1 or 2 should be used.

3. SWITCHBOARD CABLE SPLICES

A. Types

3.01 *The straight splice* (Fig 7) should be used where a cable is to be spliced to a second cable, the latter cable serving as an extension of the first cable.

Note: The straight splice is also used for turnover splices in quadded cables, the individual wires being spliced as covered in paragraph 3.14.

3.02 *The T splice* (Fig 8) should be used where a cable (B) is spliced to continuous cable (A) and the cables are at right angles to each other.

3.03 *The Y splice* (Fig 9) should be used where a cable (B) is spliced to continuous cable (A) and the cables are parallel or at a slight angle to each other.

3.04 *The X splice* (Fig 10) should be used where two continuous and parallel or slightly divergent cables are spliced together.

3.05 *The YY splice* (Fig 11) should be used where cables B and C running parallel or at a slight angle to a continuous cable are to be spliced to the continuous cable and enter the splice at the same end.

NOTE: INDIVIDUAL CONDUCTORS SPLICED AS SHOWN ON FIGURE 1 OR 2

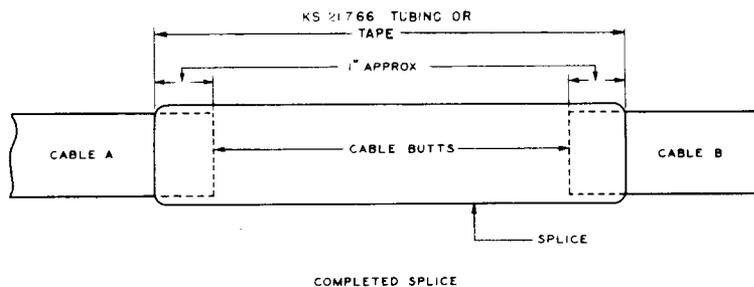


Fig 7—Straight Splice for Switchboard and Lead-Covered Cables

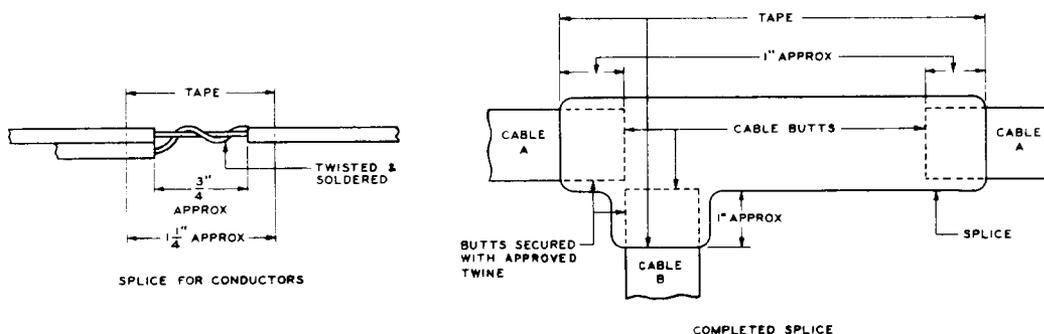


Fig 8—T Splice for Switchboard and Lead-Covered Cables

See proprietary notice on cover page.

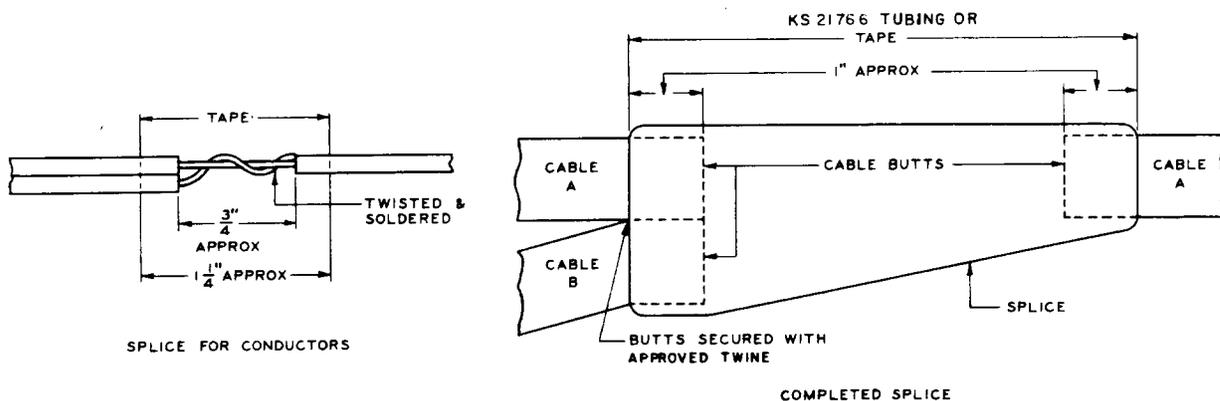


Fig 9—Y Splice for Switchboard and Lead-Covered Cables

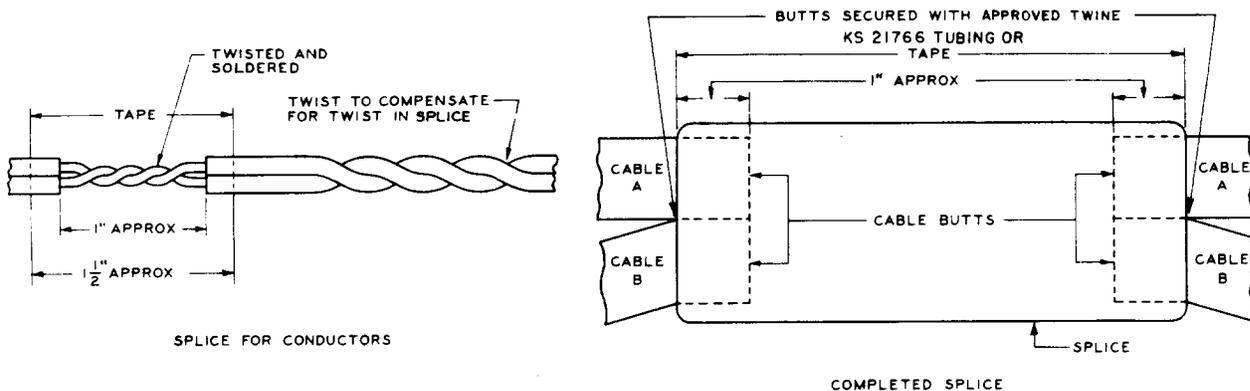


Fig 10—X Splice for Switchboard and Lead-Covered Cables

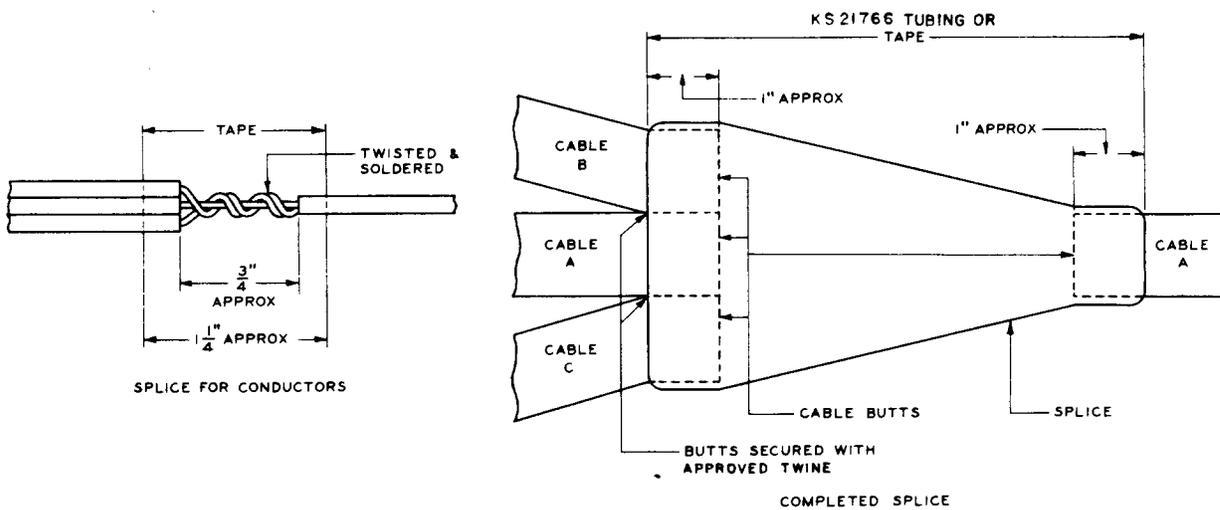


Fig 11—YY Splice for Switchboard and Lead-Covered Cables

B. Splicing Requirements

3.06 Switchboard cables should not be spliced except where specified.

3.07 Individual conductors in cable splices may be made by any of the three methods specified in paragraphs 3.11 through 3.13.

3.08 Like-colored leads should be spliced together as far as color code permits. Where one type of cable has been replaced by another having a different conductor color code and it is necessary to splice two such cables together, the conductors should be spliced in the order of the color sequence in each cable.

3.09 All spare wires in the cable are spliced as far as practicable.

3.10 Individual conductor splices should be distributed uniformly throughout the cable splice, keeping them a sufficient distance from the cable butt to avoid bunching of wires.

3.11 Individual twisted conductor splices shall be made as follows.

- (a) Make individual twisted conductor splices in straight-cable splices as shown in Fig 1 and 3 and insulate with tape. Varnish-impregnated sleeving per KS-7851 or nonrigid PVC sleeving per ASTM-D922 may be used in cases where the number of individual splices is so large as to make the use of sleeving more practicable than the use of tape. Sleeving should be long enough to completely cover the bare portion of the splice and to extend far enough over the insulation to hold the sleeving in place.

Note: No. 14 sleeving (COMCODE 100721513) is satisfactory for insulating splices in No. 22- and 24-gauge wires. For other gauges, the sleeving should fit with a tightness equivalent to No. 14 sleeving on No. 22-gauge wire.

- (b) Make individual twisted conductor splices in T, Y, X, and YY cable splices as shown in Fig 8 through 11, respectively. Insulate the splices with tape.

- (c) Gray plastic tape per KS-14090 may be used for insulating individual conductor splices.

3.12 The KS-21256 splice sleeve may be used to splice individual conductors in cable splices as shown in Fig 2 and 4. The requirements in paragraph 2.05 shall apply. See Table A.

3.13 701-2AR and 702-2AR Connectors: Connectors 701-2AR (COMCODE 102751724) for straight splices and 702-2AR (COMCODE 102751732) for half-tape splices are approved for splicing individual leads in cable splices. When used, the following shall apply:

- (a) No more than 15 connectors shall be used in a completed splice.

- (b) The above connectors are approved for the following cables:

- (1) CL cable, 22 gauge, containing C2 wire (all textile insulation)
- (2) M cable, 22- or 24-gauge, containing C3 wire (PVC-CL insulation)
- (3) A cable, 22-, 24-, or 26-gauge, containing PVC insulation
- (4) R cable, 20-, 22-, or 24-gauge, containing PVC insulation

- (c) The E connector presser, G long nose pliers, or approved equivalent tool, shall be used to complete the splice.

- (d) The connectors shall not be reused.

3.14 Turnover—Splices: The turnover splice (a method of reducing capacity unbalances in quadded toll office cables) consists of cutting the cable at midpoint, and reconnecting each quad, with the top and ring of each pair reversed. The pigtail splice, as illustrated in Fig 1, or the KS-21256 splice, per Fig 2 or 4, should be used for individual conductors. See Table A.

3.15 The butts of the cables to be spliced together should be tied securely together with twine to avoid strain on the spliced conductors. When the position of the cables makes tying together impracticable, the butts should be tied to supports or to adjacent cables.

See proprietary notice on cover page.

3.16 After the individual conductor splices have been completed and taped (where applicable), the entire cable splice should be sewed from butt to butt to prevent strain on the individual wire splices. Use approved sewing twine applied with winding or lock stitches spaced on approximately 1-inch centers. This sewing is applied before the final protective tape.

Note: Where necessary to limit the thickness, the splice may be broom-stitched.

C. Length and Location of Cable Splice Requirements

3.17 Length of Cable Splices: Keep the length of the splice (dimension between butts) as short as practicable without making the thickness of the completed splice greater than that of the cable. Except for larger than 100-conductor cables, the splices should be no longer than 20 inches.

- (a) **For 40-conductor cables,** a length of approximately 12 inches will be obtained by spacing the splices for each pair of wires or two single wires on 1/2-inch centers.
- (b) **For 40-to-100-conductor cables,** a length of approximately 20 inches will be obtained by spacing the splices for each pair of wires or two single wires on 3/8-inch centers.
- (c) **For larger than 100-conductor cables,** splice the wires for two pairs or four single wires at the same point on the maximum centers that will keep the length of the splice within 30 inches.

3.18 Location of Cable Splices: Locate to avoid piling in the cable run and in such a way as to avoid strain on the individual conductor splices.

- (a) Stagger splices in the cable run so that adjacent splices will not be opposite one another.
- (b) Locate splices where they will lie straight to avoid strain on the individual conductor splices.

D. Protecting the Cable Splice

3.19 Cables that are spliced using the twisted conductor method or the KS-21256 splice sleeve (see Table A) shall be protected and insulated by one of the following methods.

(a) Apply two layers of gray plastic tape per KS-14090 with an overlap of approximately 3/16 inch. Because of the tendency of plastic tape to recede, the last two turns shall be put on without tension.

(b) KS-21766 flame-retardant heat shrinkable sleeving may be used to protect the completed cable splice. The tubing should overlap the cable butt approximately 1 inch as shown in Fig 7. The adhesive supplied with the KS-21766 tubing shall be applied at the cable butt positions prior to shrinking. It is not necessary to shrink the center of the tubing; however, the butt ends shall be completely shrunk using the R-4444 or approved equivalent heat gun.

3.20 Cables that are spliced using the 701- or 702-type connectors shall be insulated by one of the following methods.

- (a) Use KS-21766 heat shrinkable tubing as specified in paragraph 3.19(b) to protect the completed splice.
- (b) If the KS-21766 tubing is not available, the overall completed splice shall be wrapped with one complete layer of cable jacket sheath overlapping the connector ends approximately 1 inch and taped as specified in paragraph 3.19(a).

4. PAIRED WIRE TWISTED MORE THAN TWO TWISTS

A. Requirements

4.01 Two KS-21256 L3 splice sleeves are used to splice paired wire twisted more than two twists per inch (Fig 6).

(a) An alternate method may be used for splicing paired wires twisted more than two twists per inch by using the straight splice per Fig 1 or the KS-21256 splice per Fig 2 for each individual conductor of a twisted pair. However, the splices shall be staggered approximately 1 inch or more apart, and the twist of the pair affected shall be maintained in its approximate original configuration to the extent possible at each conductor splice location and between the splice locations. See Table A.

4.02 Where the KS-21256 splice sleeve is used, the requirements covered in Sections 2 and 3 shall be followed. See Table A.

5. REASONS FOR REISSUE

1. To revise paragraph 1.04 to add reference to ED-2C531-10 for splicing switchboard cable using 711-type connectors.
2. To add paragraph 1.06 covering a list of supplementary wiring and cabling practices.
3. To add paragraph 2.03 to specify 3M Company UP2, UP3, and UPB inline connectors and 701-2AR and 702-2AR connectors for splicing individual conductors.
4. To add paragraph 2.04(a) to specify heat shrinkable tubing (COMCODE 900451022, KYNAR RT 850, Raychem Corp) as an alternate insulation method.
5. To add paragraph 2.06(a) to specify splicing BH-2 P wire using 701-2AR and 702-2AR connectors.
6. To add paragraph 4.01(a) to specify alternate method for splicing paired wires twisted more than two twists per inch.