

BELL SYSTEM PRACTICES
Station Installation and Maintenance

SECTION C24.141
Issue 1, 9-1-31
Standard

SPLICING AND REPAIRING WIRE

1. GENERAL

1.01 This section outlines methods for the splicing and repairing of wire, and also specifies the conditions where splices are permitted.

1.02 **On reinstallations and moves** where it is necessary to extend station wires, they may be spliced when:

- (a) The removal of wire already in place would create an unsightly appearance.
- (b) The wire run already in place is 20 feet or more in length, is in good condition, and is properly fastened.
- (c) The wire run already in place is less than 20 feet in length and conditions are such that replacing would involve considerably more labor than making a splice.

1.03 **At new installations** where it is necessary to make a station wire run of less than fifty feet in length, the wire so used should contain no splices other than factory splices.

2. LOCATING

2.01 Locate each splice where it will always be available for inspection and where its appearance will not be unsightly. In this connection do not locate a splice in a wall, partition, or concealed wiring.

2.02 When reusing part of a run made with wire of the older colors (white and green), do not place a splice where the wires on the two sides of the splice are of different colors unless the splice is made in a location where appearance is not important. Where appearance is important, remove the old wire to a point where it (excluding the splice) is concealed; for example, as in passing through a hole in a floor or wall or running to a picture molding or similar location where it will not normally be visible from the floor.

3. IDENTIFICATION AND USE OF TRACER WIRES

3.01 Tracers have been woven into the insulation of conductors to facilitate their identification. In splicing wires, it is necessary that tracers be identified and spliced together so that they will be continuous.

3.02 The conductors of the various kinds of wire may be distinguished one from another as follows:

- (a) Single inside wire by the yellow tracer.
- (b) Pair inside wire by the red tracer and green tracer.
- (c) Triple inside wire by the red tracer, green tracer and yellow tracer.
- (d) Quad inside wire by the red tracer, green tracer, yellow tracer and black tracer.
- (e) Single bridle or duct wire by the double tracer (parallel raised threads).
- (f) Pair bridle or duct wire by the single raised thread on one wire and the plain surface on the other.
- (g) Triple bridle or duct wire by the double tracer, single tracer and plain wire.

4. SPLICING SINGLE INSIDE WIRE

4.01 Single inside wire should be spliced in the same manner as a single conductor of pair inside wire. Therefore, in splicing single inside wire be guided by the method outlined in paragraphs 5.03 to 5.09 inclusive.

5. SPLICING PAIR INSIDE WIRE

5.01 Make splices as shown in the following figures. For convenience the two pairs of wires to be joined are designated as pair No. 1 and pair No. 2.

5.02 Separate wires for about ten inches. Lay red tracer wire of pair No. 1 and green tracer wire of pair No. 2 together and cut off six inches from end.

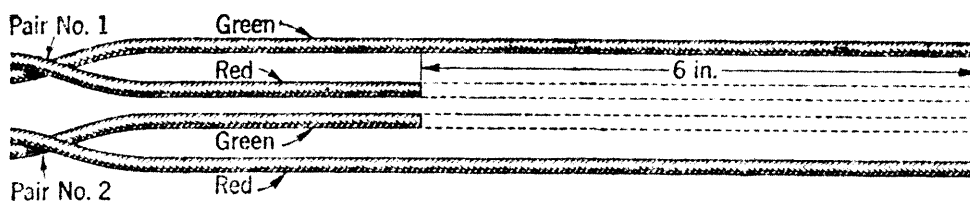


Fig. 1.

5.03 Remove insulation from wires for a distance of three inches as follows:

- (a) Loosen insulation at end of wire where splice is to be made by pulling wire between jaws of diagonal pliers.
- (b) Grasp wire between jaws of pliers, three inches from end. When notched pliers are used, slide the wire between the jaws of the pliers until the wire slips into the notch.
- (c) Exert pressure on pliers with care so as not to nick or cut the wire.

- (d) Remove insulation by drawing pliers toward end of wire.
- (e) Clean wire thoroughly by drawing bared wire through pliers.
- (f) Trim frayed ends of insulation.

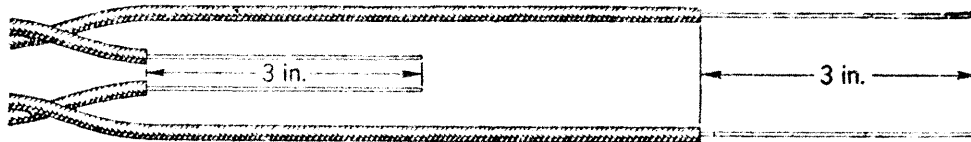


Fig. 2.

5.04 Place a sleeve on each wire of pair No. 1 and push back to within about one-half inch from the end of the insulation. Keep fingers clear of ends to avoid injury when wires come through sleeves. Bend up ends of wires slightly.

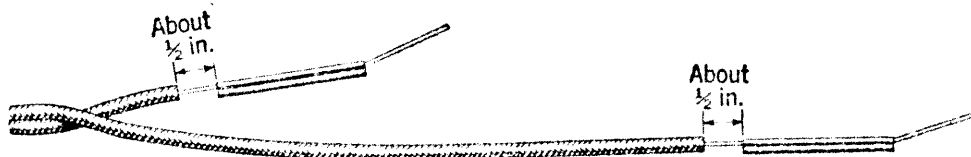


Fig. 3.

5.05 Insert one wire of pair No. 2 in the sleeve on the corresponding wire (red or green tracers) of pair No. 1. Push the wire through the sleeve until it is beyond end of sleeve.

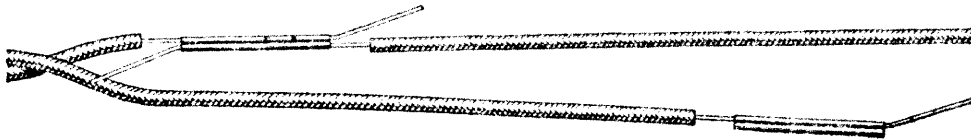


Fig. 4.

5.06 Pull ends of wires through sleeve until insulation is tight against ends of sleeve.

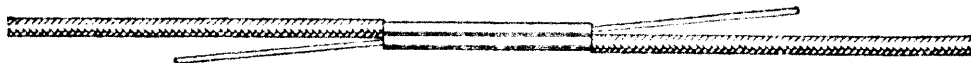


Fig. 5.

5.07 Grip sleeve at each end with pliers and diagonals as shown. The jaws of pliers shall not extend over ends of sleeve.

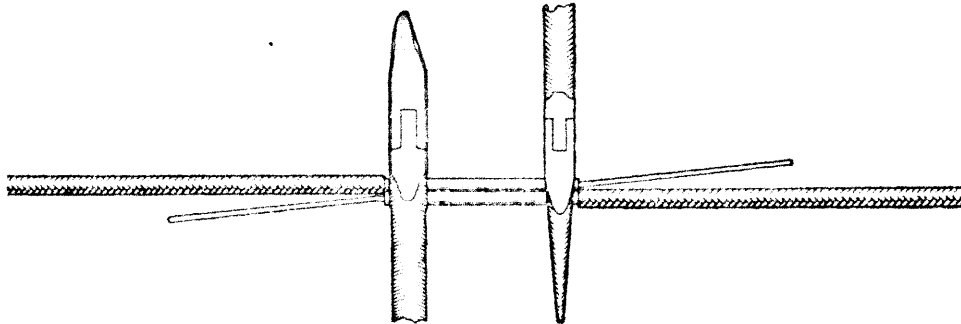


Fig. 6.

5.08 Give sleeve four half-turns. Sleeve shall be twisted from both ends. Wrap remaining wire around insulation three times, beginning within one-quarter of an inch of sleeve. Cut off excess wires and press ends in firmly against insulation with long-nose pliers.

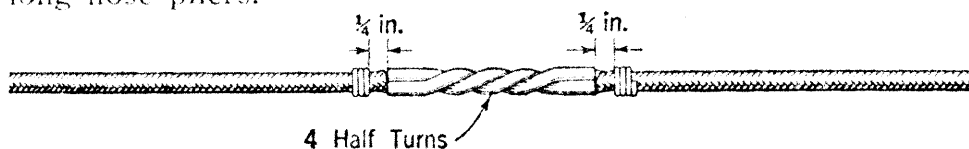


Fig. 7.

5.09 Cover the joint with two wrappings of friction tape, half-lapped and reversed. Start wrap at center. Wrap to one inch beyond last turn of wire around insulation. Reverse wrap to one inch beyond last turn of wire at opposite end of sleeve, and then reverse wrap and end at center of sleeve. Keep the tape under tension while it is being wrapped. Tear tape off square and press end firmly against splice.

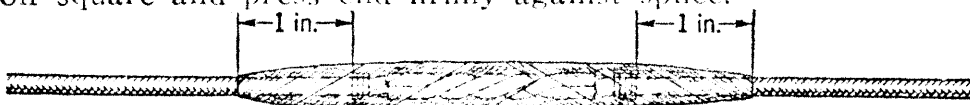


Fig. 8.

5.10 Twist the free wires about the spliced wire with as nearly as possible the original lay, allowing just enough to remain untwisted for convenient splicing.

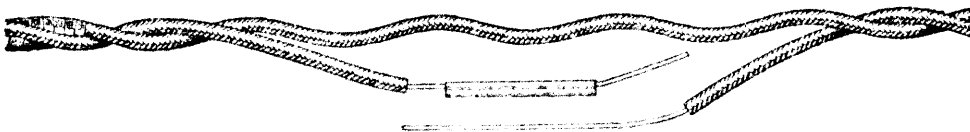


Fig. 9.

5.11 Make splice as before. Take care not to bend or twist the wire already spliced. Adjust lay of wires so that strain will be equally divided between the two.



Fig. 10.

6. SPLICING TRIPLE INSIDE WIRE

6.01 Separate triple wires for a distance of about sixteen inches and lay them together. Cut the red tracer wire of each triple six inches from the end. Then cut the green tracer wire of triple No. 1 and the yellow tracer wire of triple No. 2 twelve inches from the end.

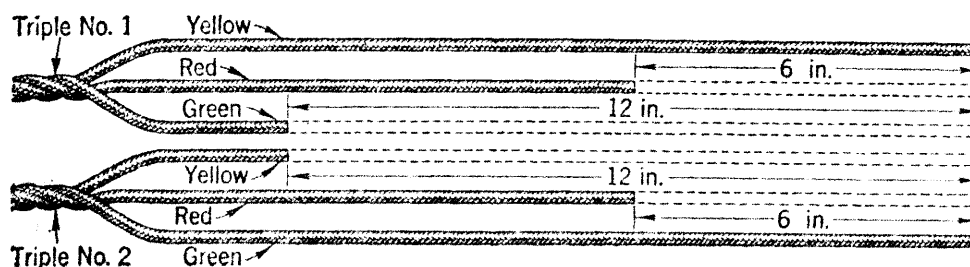


Fig. 11.

6.02 Continue operations as specified for splicing pair inside wire (Part 5).

7. SPLICING QUAD INSIDE WIRE

7.01 In general, quad inside wire should not be spliced because of the relatively short runs which are made with such wire. However, if splicing is necessary, separate the conductors of each quad wire for a distance of about twenty-two inches. Then lay them together so as to facilitate the cutting of wires at distances shown in the following table:

QUAD NO. 1		QUAD NO. 2	
COLOR OF TRACER	LENGTH TO CUT OFF	COLOR OF TRACER	LENGTH TO CUT OFF
Yellow	Do not cut	Yellow	18 inches
Red	6 inches	Red	12 inches
Green	12 inches	Green	6 inches
Black	18 inches	Black	Do not cut

7.02 Continue operations as specified for splicing pair inside wire (Part 5).

8. SPLICING SINGLE, PAIR AND TRIPLE BRIDLE OR DUCT WIRE

8.01 Splice single, pair and triple bridle or duct wire in accordance with the method outlined for splicing single, pair and triple inside wire (Parts 4, 5 and 6), an exception being where splice is made in wire which is run on the outside of a building or in damp places. In this case the splices must be covered with two layers of rubber tape followed by two layers of friction tape.

8.02 In applying rubber tape, start wrapping at center with an overlap of one-half the width of the tape. Wrap to one inch beyond last turn of wire around insulation. Reverse and wrap to one inch beyond last turn of wire at opposite end of sleeve. Reverse and end at center. Keep tape under tension while it is being wrapped. Press joint firmly between fingers or in the palm of the hand to cement the two layers of tape together. Generally, a six and one-half inch piece of tape will be sufficient.

8.03 In applying friction tape, start wrapping at center over rubber tape with an overlap of one-half the width of the tape. Wrap to one-half inch beyond end of rubber tape. Reverse and wrap to one-half inch beyond end of rubber tape at opposite end. Reverse and end at center. Keep tape under tension while wrapping. Tear off square and press end firmly against splice.

9. SPLICING BRIDLE OR DUCT WIRE TO INSIDE WIRE

9.01 In connecting 20-gauge bridle or duct wire to 22-gauge inside wire where it is found desirable to run bridle or duct wire for part of the run and inside wire for the remainder of the run, make a splice or, if it is necessary to establish a testing point at the point of connection, use a two or three-post connecting block (depending on whether pair or triple wire is used).

9.02 In splicing pair bridle or duct wire to pair inside wire, follow the method outlined for splicing pair inside wire (Part 5) with the exception of the connection of tracer wires which should be as follows:

(a) Single tracer bridle or duct wire to red tracer inside wire.

(b) Plain bridle or duct wire to green tracer inside wire.

9.03 In splicing triple bridle or duct wire to triple inside wire, follow the method outlined for splicing triple inside wire (Part 6) with the exception of the connection of tracer wires which should be as follows:

- (a) Single tracer bridle or duct wire to red tracer inside wire.
- (b) Plain bridle or duct wire to green tracer inside wire.
- (c) Double tracer bridle or duct wire to yellow tracer inside wire.

10. REPAIRING STATION WIRES

General

- 10.01 The following general principles should be applied in making repairs to station wires:
- (a) Correct the condition which has caused the service to be impaired, doing the work in such a manner as to prevent the recurrence of the same trouble and to eliminate as far as practicable any unsatisfactory conditions that might result in the development of trouble in the near future.
 - (b) Avoid making temporary repairs whenever possible. If unable to repair defects permanently or to correct hazardous conditions because of the lack of proper equipment or material, or due to the nature of the work involved, be governed by instructions of the test deskman or dispatcher or by local practices.
 - (c) When clearing station wire trouble which locates at a wire tie, clamp, cleat or nail, make the repair in the standard manner, but do not place such a fastener over the splice or taped portion of the wire.
 - (d) When repairing opens in station wire, always take care to make the splice in such a manner that any strain will be equalized between the conductors of the wire.
- 10.02 In general, station wires that are damaged to such an extent as to require the splicing of open conductors or the replacement of a section of the wire may be economically repaired as outlined in the following table.

Method	Condition
(a) *Cut out the section in which defect exists and splice in a new section, by making a splice at one end of new section and terminating other end at a terminating point, such as protector, connecting block, set, etc.	<ol style="list-style-type: none"> 1. Wire is in such condition as to make it necessary to replace a section of the wire. 2. Open or other defect cannot be readily and definitely located after test and a careful visual inspection. 3. Distance to a terminating point or the type of fastener used is such as to make this method more economical and practicable than method (b).
(b) *Cut out the section in which defect exists and splice in a new section, by making a splice at both ends of the new section.	<ol style="list-style-type: none"> 1. Conditions 1 and 2 of method (a) obtain. 2. Distance to a terminating point or the type of fastener used is such as to make this method more economical and practicable than method (a).
(c) Cut wire at location of open and splice conductors by means of 025 or 032 copper sleeves (depending on gauge of wire).	<ol style="list-style-type: none"> 1. Open can be definitely located. 2. Wire is otherwise in good condition and properly fastened. 3. Sufficient slack can be obtained for such a splice.
(d) Splice open conductor by means of a No. 16 tinned, single tube, copper sleeve.	<ol style="list-style-type: none"> 1. Conditions 1 and 2 of method (c) obtain. 2. Sufficient slack cannot be obtained for splicing in accordance with method (c). 3. The wire already in place is of the older colors (white or green), appearance is important, and the splicing of a new section of wire in accordance with the method outlined in paragraph 2.02 is not practicable.
<p>* Where method (a) or (b) above is employed at locations where appearance is important and the color of the wire already in place is white or green, locate the splice as outlined in paragraph 2.02 if the wire used in the new section is ivory or brown.</p>	

Splicing

10.03 Where method (a), (b) or (c) in the table on page 8 is employed, make splices as outlined in Parts 4, 5, 6, 7, 8 or 9 of this section, depending on the type of wire to be spliced.

10.04 Where method (d) is employed, remove insulation for $\frac{3}{4}$ inch on both sides of the open, exercising care not to nick the wire, and then thoroughly clean conductors. A convenient method for removing insulation from wire is outlined in paragraph 5.03.

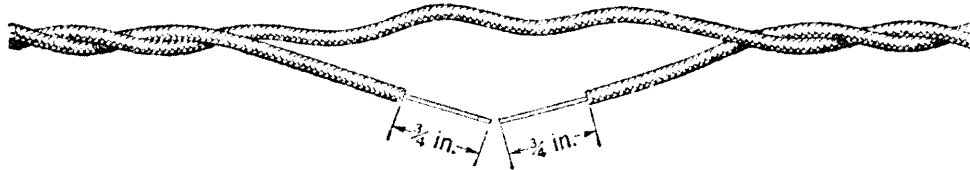


Fig. 12.

10.05 Insert bared ends of wire in a No. 16 tinned, single tube, copper sleeve, and then pinch ends of sleeve tight around wire with long nose pliers.

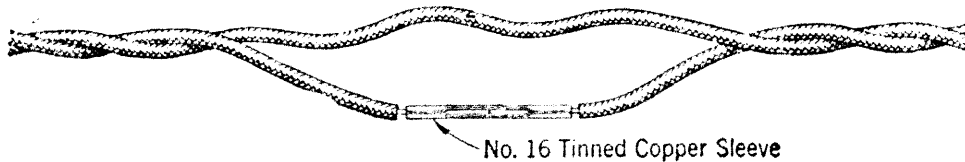


Fig. 13.

10.06 Solder entire length of sleeve with rosin core solder. Cover joint with two wrappings of friction tape as outlined in paragraph 5.09.



Tape shall extend 1 in. beyond each end of sleeve.

Fig. 14.