REPAIR OF AERIAL CABLE

Contents

1. GENERAL

1.01 This section has been reissued to include the information in the addendum to this practice concerning the use of desiccant in expelling moisture from cables where the opening is covered by a lead sleeve. Addendum G74.410, Issue 1 is canceled.

2. PRECAUTIONS

2.01 **Testing Strand:** Where there is any doubt as to the condition of the strand or poles because of fire damage, falling objects or other causes, the strand and poles should be tested before being depended upon to support a ladder or platform. Where strand, poles or cable must be replaced, it may be possible to expedite the restoration of service by lowering the cable at the damaged section sufficiently to permit splicing-in a piece of cable or bridging the fault with duct or bridle wires from the ground.

2.02 **Removal of Grade Clamps:** If a grade clamp is located so close to the joint at which repairs are required as to interfere with the splicing work, an auxiliary grade clamp (or the new one, if the old is to be replaced) should be installed to hold the cable, before removing the existing grade clamp.

2.03 **Work on Cables Under Tension:** The conductors of cables that are tension spliced in cold weather or spliced without tension in warm weather may be taut when the sheath is opened in cold weather. If slack is required to facilitate repair operations, it can be obtained as outlined in the tension splicing Section 632-300-204.

Exchange Cables

2.04 Exchange cables may contain program, toll or other special circuits and conductors in them should not be handled, except in the case of total failure, without first obtaining permission in accordance with local routine.

2.05 Conductors which have been repaired should be check tested before the fault is considered cleared.

2.06 **Dial System Lines:** Care should be exercised in handling dial system lines in order that interference with the operation of mechanical equipment in the central office may be avoided.

(a) Short circuits, crosses and grounds, even though only momentary, will interfere with the operation of the central office equipment, and, in the case of trunk lines, are very apt to put the equipment out of order.

(b) A reversal puts certain of the central office apparatus out of order and considerable delay may be caused in restoring service as such trouble cannot readily be detected by the central office forces.

Toll Cables

2.07 The local routine with regard to opening and closing toll cables shall be followed.

2.08 When working in toll cable splices in which balancing units, condensers, building-out stubs or loading coil terminals are connected, care should be exercised to avoid damaging the connections. If in making repairs it is necessary to remove a unit temporarily, tag the individual conductors so as to permit reestablishing the original connections.

2.09 In wiping or unwiping joints or doing other solder work on cables maintained under pressure, a hole should be drilled in the sheath with the cable boring tool or, if there is a valve in the sleeve, the valve core should be removed so that gas may escape through the opening while solder work is in progress.

3. REPAIR OF SHEATH DEFECTS

3.01 Ring cuts and small defects that do not extend through the sheath may be repaired by the carbon electrode soldering method outlined in Part 4 or by a wiped joint. Cuts in cables supported on 10M and 16M strand deeper than 1/3 the thickness of the sheath should be repaired. Cuts in cables supported on 6M strand should be repaired if they exceed 1/2 the thickness of the sheath.

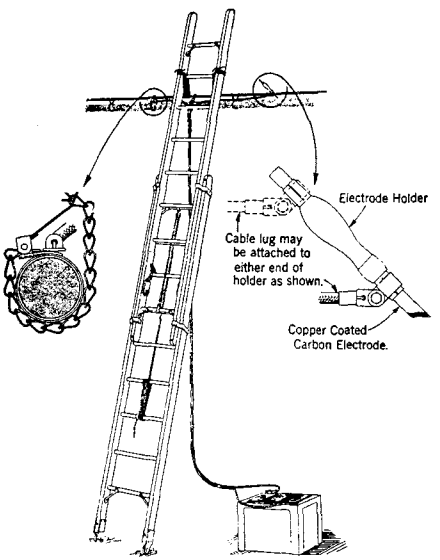
3.02 If the sheath of the cable is cracked or the defect extends to the core, a sheath opening will usually be required in order to permit boiling out the core. The opening should be closed with a lead sleeve. Where such an opening would result in a lead sleeve closer than approximately 12 inches from the through bolt in small cables and 18 inches in cables over 1-1/2 inches in diameter, the repair can be made by one of the other methods outlined in this section.

3.03 Sheath cracks that occur during repair operations may be repaired by means of the carbon electrode or by means of a wiped joint.

3.04 The use of nitrogen gas as a supplementary means of locating sheath openings and of clearing moisture troubles is outlined in Section 637-450-011.

4. CARBON ELECTRODE SOLDERING METHOD

4.01 The apparatus required for making repairs by the carbon electrode soldering method is illustrated below. The lead can be attached to either end of the carbon holder. The battery should remain on the ground or truck.

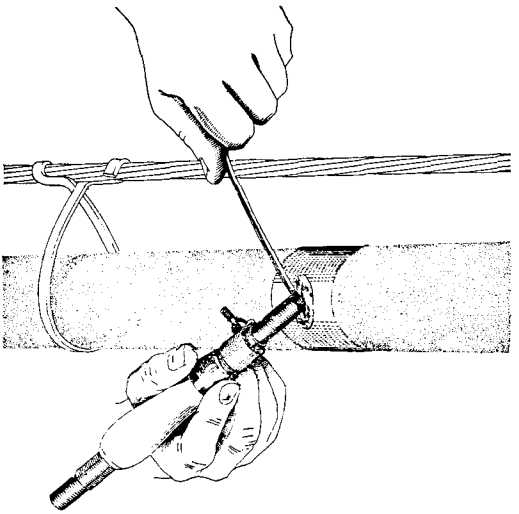


4.02 **Precautions:** Standard impact goggles should be worn while using the outfit as small particles of solder may occasionally be thrown from the sheath. The carbon electrode method must not be employed in manholes. Care should be taken in handling the equipment to avoid short circuiting the leads.

4.03 **Preparation of Electrode:** One end of the electrode should be beveled with a file so that the beveled surface makes an angle of about 45 degrees with the longitudinal axis of the electrode. The copper plating at the tip of the carbon should be removed with a file for a distance of approximately 1/4 inch, to ensure adequate heating. The electrode should be placed in the holder with the tip approximately 2 inches from the handle.

4.04 **Method of Soldering:** The sheath at the defect should be cleaned with a shave hook, round file or file card. The cleaned area should be coated lightly with stearine and the size of the repair limited by placing cable pasters around the defect.

4.05 Low content rosin core solder or stearine core solder should be fused to the sheath by holding the end of the solder in contact with the sheath and touching the solder with the beveled end of the electrode, as illustrated below.



The solder deposited on the sheath should be heated and manipulated with the beveled surface of the electrode to tin a small area of the patch. This operation should be repeated until the entire patch is tinned. Light contact and a circular motion of the electrode on the solder will aid in raising the temperature of the solder so that the tinning can be accomplished to best advantage. The tinning is known to be satisfactory when the solder flows uniformly from under the tip as the electrode is drawn over the patch. Additional solder should be fused to the repair after the surface is tinned, and manipulated to expel air bubbles and solid flux. When soldering around the edges of the patch, overlap the cable pasters with the carbon tip and rock the electrode alternately on the paper and on the solder to control the temperature. Then draw the electrode over the solder to give the patch a reasonably smooth appearance. The cable pasters should be removed on completion of the operation.

4.06 **Maintenance:** The surface of the beveled end of the electrode should be kept free of pits by smoothing it with a fine cut file. The copper plating at the tip should be removed occasionally so that approximately 1/4 inch of exposed carbon is maintained between the tip and the plating. The battery should be recharged or replaced when the generation of soldering heat diminishes noticeably.

5. OPENING CABLES

Sleeve Openings

5.01 In opening a sleeve that is not to be reused, the center portion of the sleeve should be removed before unwiping the joints. This will facilitate unwiping as well as removing the end sections of the sleeve.

5.02 If the trouble is due to moisture penetration through a crack at the end of a wiped joint it may be advisable to remove the joint by cutting it apart with the chipping knife and hammer, as under certain conditions the moisture might be driven farther under the sheath by the heat of the solder used to unwipe the joint.

5.03 When the sleeve is to be reused on completion of repairs the splice can be opened as outlined below.

(1) Scrape the joints to remove all dirt.

(2) Place cable pasters on the sleeve and cable sheath to prevent tinning of these parts.

(3) Heat the joint by pouring molten solder over it and after the joint has become soft, wipe off the solder.

(4) Before the joint becomes chilled, insert a screw-driver or other suitable tool between the sleeve and the sheath and pry open the end of the sleeve. The pliers may also be found useful in opening the end of the sleeve.

(5) At branch splices the straight joint should be unwiped before the "Y" joint. After both joints have been unwiped, the sleeve should be pulled toward the straight end.

Sheath Openings

5.04 A deep scoring should be made around the sheath at the extremities of the opening, after which the sheath surface on both sides of the proposed opening should be scraped clean. A close inspection of the cleaned surfaces must be made to see that all dull spots and streaks have been removed. The scraped surfaces should then be covered with stearine. The cleaning may be postponed if the opening is not to be covered with a sleeve immediately after the repairs have been completed.

5.05 The sheath should be cut with a chipping knife as described in the splicing Practices. Care should be exercised to avoid damaging the insulating paper. The sheath can be removed by turning back the raised portion along the slit with a hammer or pliers until the opening is wide enough to permit removal by hand. Before removing the core wrapping paper, the ends of the sheath should be wrapped with freshly boiled cotton tape, or sleeving in the case of very small cables.

6. CLEARING DEFECTIVE CONDUCTORS—NO MOISTURE

6.01 After removing the core wrapping paper (or the muslin at a splice) the pairs should be boiled out with paraffin. During cold weather splicing oil can be added to the paraffin to avoid excessive hardening. No work should be done in a splice until the splice is thoroughly heated. Tone should be connected to the defective conductors at a distribution terminal in which they appear, at a cross-connecting terminal, or at the main distributing frame, depending on which is most convenient. After the defective pairs have been identified they should be examined carefully and repaired, piecing out conductors if necessary.

6.02 Crossed, short or grounded conductors in a section should be cleared by opening the cable at the location of the trouble unless previous openings have been made which will permit substitution of a good tracer quad or pair in the defective section.

6.03 Upon approval, a pair in trouble at a terminal may be cut dead in the splice to clear the pair for service elsewhere.

6.04 If the conductors at the opening are so taut that repairs cannot be made, sufficient slack may be obtained by pulling the cable from both directions as outlined in the tension splicing Practices, Section 632-300-204.

7. RAISING INSULATION RESISTANCE—EXPELLING MOISTURE FROM CABLE

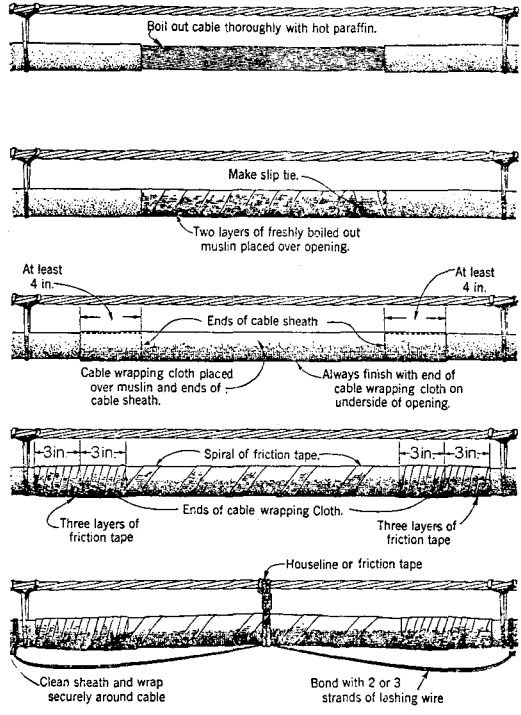
7.01 Examine the insulation at the ends of the opening and if moisture extends under the sheath, enlarge the opening until all of the core affected by moisture is exposed. When sufficient sheath has been removed, balloon the conductors and boil out the pairs by pouring paraffin on the sheath approximately six inches beyond the ends of the sheath, gradually working toward the center of the opening. The boiling should be done in this manner in order to avoid driving moisture farther into the cable. If there is appreciable moisture in the cable, the paraffin should be heated to about 350° F. Continue to boil the conductors until the bubbling or frying sound ceases. The insulation of the conductors should be examined thoroughly after boiling and all broken insulation repaired. If charred insulation was found these wires should also be pieced out. In extreme cases it may be necessary to replace a short piece of cable to complete repairs.

8. PROTECTING TEMPORARY OPENINGS

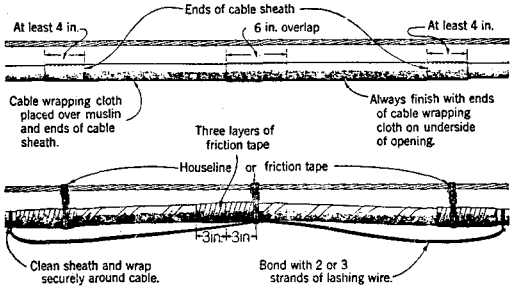
8.01 It is generally preferable to close trouble openings in toll cables with a lead sleeve immediately on completion of repairs. This is equally true of subscribers' cables, but where it is impracticable to make permanent repairs or unnecessary because of other reasons, the opening may be protected by one of the following methods.

Wrapping Cloth Method

8.02 Wrap the conductors with two layers of freshly boiled muslin. Examine the cable wrapping cloth to make sure that it is in good condition. The cloth should be wrapped over the muslin so that the exposed edge of the cloth is on the under side of the opening. The ends of the wrapping cloth should extend over the sheath for at least 4 inches. One end of the cloth should be taped for a distance of 3 inches each way from the end of the cloth with three layers of friction tape. To prevent the cloth from sagging or flapping, one spiral of friction tape should be run the length of the cloth. In running the spiral of friction tape, begin at the taped end and run the spiral to the free end without cutting the tape. The second end of the cloth should then be taped down. The cable should be supported from the suspension strand at each end of the cable wrapping cloth with cable rings placed about 2 inches from the edge of the cloth. Place a bond of 2 or 3 strands of lashing wire across the opening. The sheath should be cleaned and the wire wrapped securely to ensure good contact. Raise the middle of the wrapped opening and support it and the bond with two or three turns of houseline, or fasten it to the strand with friction tape. The procedure is illustrated below.



8.03 Where the length of the opening is such that two or more cloths are required, the cloths should be wrapped one at a time around the opening with overlaps of not less than 6 inches. The ends of the cloths over the cable sheath as well as the overlaps should be taped, as shown below. The wrapped cable should be raised slightly at the overlap and supported from the strand together with the bond, using two turns of houseline or friction tape.



8.04 Cable wrapping cloths should be rolled and not folded when they are being carried in a splicers' trailer or truck.

Friction Tape Wrapping

8.05 Wrap the conductors with two layers of freshly boiled muslin. Then cover the muslin with a layer of rubber tape overlapped approximately one-half its width, and two layers of friction tape. If the cable is in a vertical position, start the friction tape at the bottom of the opening, wrap to the top and then finish at the starting point. Both tapes should overlap the sheath approximately 3 inches. Horizontal taped openings should be raised and supported at the mid-point in the same manner as the cloth wrapped openings. Tape wrappings in aerial cables should be painted with P. and B. compound.

Rubber Bandage Method

8.06 After the conductors have been wrapped with freshly boiled muslin, cover the splice with two layers of rubber bandage overlapped approximately one-half its width. The bandage should overlap the sheath approximately 6 inches. The bandage method should be used only when permanent repairs are to be deferred not more than one or two days.

9. CLOSING TROUBLE OPENINGS

9.01 The maximum length of sleeve to be used in closing a trouble opening will depend on the character of the fault, the general condition of the cable and the location of the fault with respect to the pole. If it is known that the cable will be replaced within a relatively short time, it would be advisable to cover the opening with a long sleeve rather than make the repair in some more permanent manner. However, if the cable is relatively new and the fault is in a position that would result in having a wiped joint closer than 12 inches from the through bolt in the case of small cables, or 18 inches in cables over 1-1/2 inches in diameter, it would be advisable—

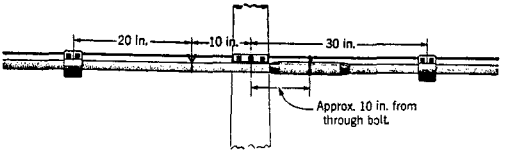
a. to complete the repair by sliding sheath, or

b. to repair the sheath as required and sectionalize the repaired portion with grade clamps, as outlined below.

9.02 The sleeve at a sheath opening should be large enough to fit over the repaired cable and 3 inches longer than the distance between the ends of the cable sheath.

9.03 When a split sleeve is used at a splice it should be made long enough to cover the original wiped portion on the cable sheath. If the original sleeve is used, the cable pasters on the sheath should be placed so that the new joints will extend an eighth of an inch or so beyond the extremities of the original joints.

9.04 **Sectionalizing Repair With Grade Clamps.** If on examination of the job it is found impracticable to avoid placing a sleeve near the pole, the cable should be repaired in the usual manner after which the repaired portion should be sectionalized with grade clamps as illustrated below, so as to prevent movement at the pole which might damage the cable at the joints. The method of installing grade clamps is outlined in Section 627-300-211.

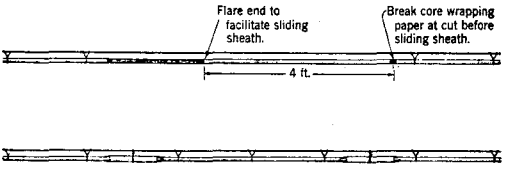


10. SLIDING SHEATH TO AVOID SPLICING-IN A LENGTH OF CABLE

10.01 This method of making repairs has the advantage that it allows changing the location of the trouble sleeve to a more favorable location with respect to the pole. It also makes possible the repair of large trouble openings with short sleeves. It is not applicable to those cases where a considerable amount of insulation is damaged or where the sheath is badly dented.

In Spans

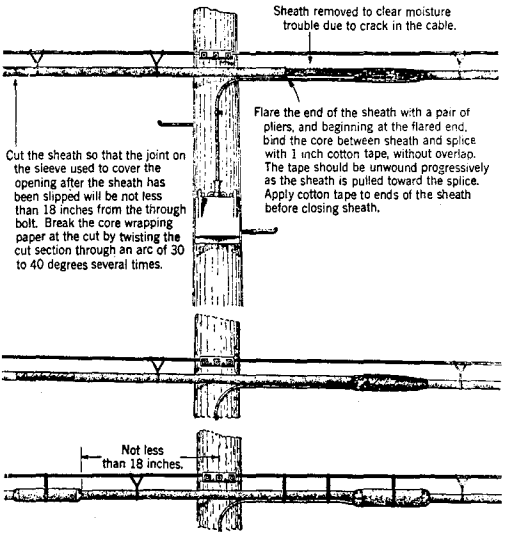
10.02 Where the trouble opening is such as to require placing a lead sleeve substantially in excess of the standard length, the installation of a new piece of cable or the use of a long sleeve can be avoided by sliding sheath. The end of the sheath should be flared and a ring cut in the cable sheath approximately four feet from the trouble opening. The core wrapping paper should be broken at the cut by twisting the section of cable back and forth through an arc of 30 to 40 degrees several times, to permit the sliding of the core wrapper with the sheath.



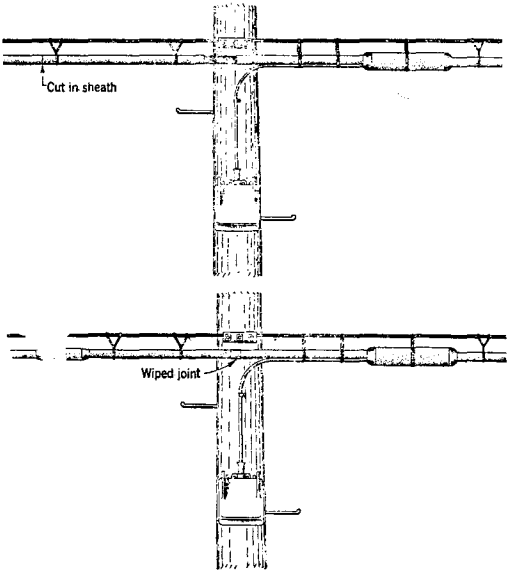
After the wrapper is broken the core, beginning at the flared end of the sheath, should be tightly wrapped with one-inch cotton tape, without overlap. The tape should then be unwound progressively as the sheath is pulled along the core toward the splice or repair opening. Twisting the sheath in the same direction as the spiral of the core wrapping paper while the sheath is being slipped will facilitate the work. In extreme cases several four-foot sections of sheath may be slipped so that sleeves of approximately standard length can be used to make the repair.

At Poles

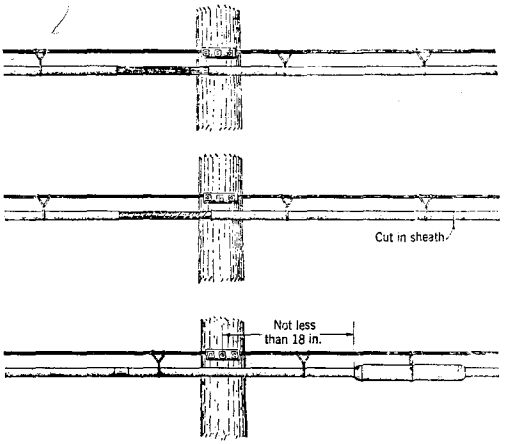
10.03 Where the damage is at a splice adjacent to a pole, the cut in the sheath should be made so that the wiped joint on the sleeve will not be less than 18 inches from the through bolt at the pole. The figure below illustrates the method.



10.04 Where a fault occurs at a pole and there is a splice near the pole, the defect may be repaired by sliding sheath. Cut the sheath, as shown, slide it over the cable and wipe a joint at the junction of the cable sheaths. Close the opening with a split sleeve.



10.05 If there is no splice at the pole, the trouble may be repaired as illustrated below.



11. SECTION CABLE THROWS

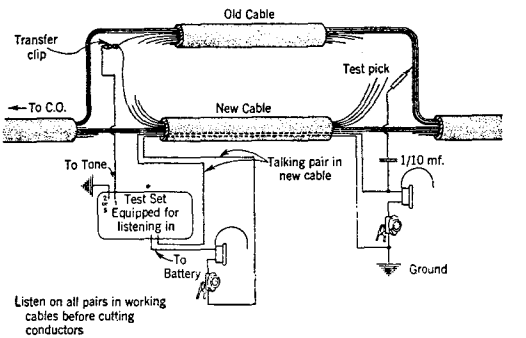
Exchange Cables

11.01 In some instances moisture may penetrate the core a considerable distance or the cable may be otherwise damaged to such an extent as to make the above methods of repair impracticable. Under these conditions it will be necessary to replace the damaged portion of the cable.

11.02 **Wet Section:** Where practicable, remove the moisture in the cable by boiling before the work of replacing the damaged portion is begun. This should be done in order to temporarily restore as much service as possible.

11.03 Where the length of cable to be replaced can be adequately protected, the sheath of the old cable should be removed between the two splice points. The new piece of cable should be placed in the cable rings and the transfer made by splicing pairs which have been identified in the new cable to pairs traced in the old cable.

11.04 Where the length to be replaced makes tracing impracticable or if the exposed core cannot be adequately protected, the sheath of the old cable should not be removed, except as required to boil out moisture. Under these conditions, replacement of the damaged portion of the cable should be made by the sectional cable throw method, as described in Section 632-800-301. The testing circuit to be employed in exchange cables is illustrated schematically below.



11.05 **Cut or Burned Cable:** In the event that the cable is burned so that the pairs cannot be traced or the cable is cut in two, it will be necessary to effect repairs in the following manner: A random splice should be made at one junction between the new and the old cables. The other splice should be made by test, identifying the pairs in both directions (from the central office or cross-connecting terminal and from the distribution terminals). Where a number of working or special lines are out of service or where a number of terminals must be visited to identify the pairs, the work of restoring service can be facilitated by having two splicing crews make the repairs. One crew should make the random splice at the office end of the junction of the new and old cables while the other crew is identifying the conductors in the old cable away from the office. The supervisor will generally determine the manner in which repairs are to be made.

Toll Cables

11.06 In replacing a portion of an aerial toll cable which is not out of service, the circuits should be rerouted, if practicable, by the central office forces to minimize service interruptions.

11.07 If a cable has been severely burned or otherwise damaged and the defective portion cannot be replaced immediately with cable of the same type, service can be temporarily restored by splicing in a piece of emergency cable or by bridging the faulty section with duct or bridle wire. The method of installing quadded emergency cable is essentially the same as that followed in making a section cable throw. The procedure to be followed in restoring service by means of duct or bridle wire is outlined below.

Partial Failure

(a) When only a portion of the cable has been damaged, lengths of duct or bridle wire should be cut long enough to span the defect. The ends should be prepared for splicing and tagged consecutively. The conductors in the cable should be traced one at a time or identified from the central offices or repeater stations, after which the prepared lengths of bridle wire can be spliced in. The cable conductors and wires should be joined by means of twisted joints and insulated with 1/4-inch prepared cotton sleeves. The joints should not be soldered.

Complete Failure—No Intervening Splice

(b) **Universal Type Cable.** Sufficient sheath should be removed so that the layers can be identified. If there was no splice in the damaged portion of the cable, splice the duct wires (which have been prepared as above) to the cable conductors, starting at the orange-red marker quad in the outer layer and continue around the layer in the direction of the quad with the blue binder. Cut only one quad at a time and splice to consecutively numbered pairs of duct wire. The odd-numbered pair should be spliced to the red or blue pair of the quad and the even-numbered duct wire pair should be spliced to the orange, white or green pair of the quad. It will not be necessary to splice tip to tip and ring to ring on the individual pairs until permanent repairs are made.

(c) **Non-Universal Type Cable With Marker Quads:** Sufficient sheath should be removed so that the individual layers and quad formation within layers can be readily identified. The splicer at one end should splice the prepared lengths of duct wire to the cable conductors, beginning with the marker quad and proceeding in a clockwise direction. The splicer at the other end should splice the duct wires to the cable conductors, beginning with the marker quad and proceeding in a counter-clockwise direction.

Intervening Splice or Non-Universal Type Cable Without Marker Quads

(d) The conductors should be identified from the central offices or repeater stations. The quads should be pieced out with duct wire as soon as they are identified. To facilitate restoring service, do not identify the tip and ring conductors or pairs. Where prompt restoration of service is essential, it may be advisable to join the quads at random. In this case the conductors will be identified at the central office or repeater station.

(e) The tags on the bridle or duct wires should not be removed until permanent repairs are made as they can be used to facilitate identification of conductors.

11.08 **Preparation of New Lengths of Cable:** In making permanent repairs by replacing a short section of cable, the quads and pairs should be boarded or bunched at both ends of the new piece in the same manner as that followed when the cable was originally installed. This arrangement will provide for the proper segregation of conductor groups in the new section.

11.09 **Splicing to Existing Cable:** Where the new length is to be placed between existing splices and colored cotton sleeves were used at the time the cable was installed, the identity of the conductor groups can usually be established from these sleeves.

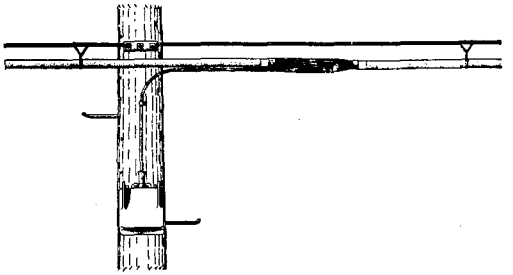
11.10 Where the new length is to be placed between existing splices at which colored cotton sleeves were not employed at the time of installation, or where existing splices are not involved, it will be necessary to determine the layup of the quads in order to ensure proper segregation of conductor groups. This should be done at each end of the portion of cable to be replaced by cutting back on the sheath away from the defect. The selection of conductor groups in the replacing cable should correspond with the grouping arrangement in the existing cable.

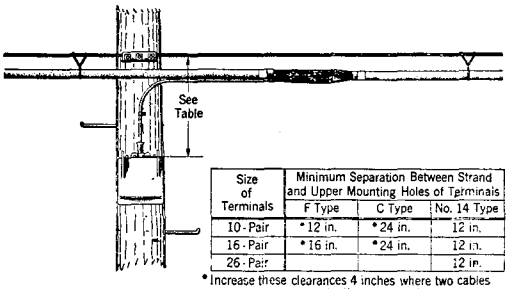
12. REPAIRING TERMINAL STUB CABLES

12.01 Damaged stub cables of distribution terminals can be repaired by one of the methods described below, which will avoid the necessity for replacing the terminal in many cases.

12.02 Where the trouble is due to a crack at the end of the wiped joint, the repair can be completed by wiping a slightly longer joint on the sleeve or, if necessary, by replacing the sleeve with a slightly longer one.

12.03 Faults which can be cleared by making a small opening in the stub cable near the splice can usually be repaired by raising the terminal on the pole (or lowering it in case the terminal is above the strand) a distance equal to the length of sheath removed from the stub, provided that the separation between terminal and strand will not be less than that given in the table below. The slack in the conductors should be removed and the repairs completed by placing and wiping a split sleeve over the splice. Where repairs cannot be made by this method because of cover clearance limitations, the damage may be repaired as outlined in Paragraph 12.04.

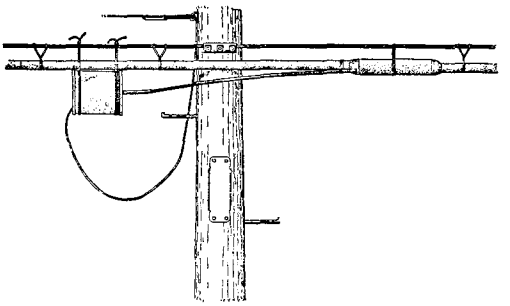




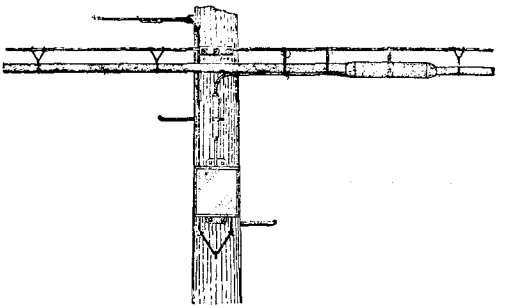
Size of Terminals	Minimum Separation Between Strand and Upper Mounting Holes of Terminals		
	F Type	C Type	No. 14 Type
10-Pair	*12 in.	*24 in.	12 in.
16-Pair	*16 in.	*24 in.	12 in.
26-Pair			12 in.

*Increase these clearances 4 inches where two cables are supported by the one strand.

12.04 Where the terminal stub cable is damaged at a point away from the splice and a portion of the sheath has been removed to clear the trouble, the repair can usually be made by covering the opening with a small split sleeve of the required length; a short length of sheath from a slightly larger cable will suffice. The repairs can be facilitated by detaching the terminal from the pole and suspending it temporarily from the strand with houseline so that the stub cable is about in a horizontal position, when this is practicable. The wiped joints in the sleeve should be located so that they will not be at a bend when the terminal is replaced.



12.05 The completed repair is illustrated in the diagram below.



13. REPLACING TERMINALS

13.01 Before a terminal is replaced, the Plant Engineer should be consulted to determine whether (a) the terminal should be replaced, (b) a change should be made in the size of the replacing terminal, and (c) a change should be made in the pair count of the terminal.

13.02 The old terminal should be removed from the pole and suspended temporarily from the strand with houseline. The new terminal should be mounted as described in Section 631-200-200. The sleeve at the terminal splice should then be removed, after which the pairs to which the terminal is to be bridged should be identified from the cross-connecting terminal or main frame. The pairs at the end of the terminal stub cable should be boarded. Drop wires and cable pairs should be transferred simultaneously to minimize interruption to service.

14. REMOVING "B" TYPE TERMINALS

14.01 A regrouping or transfer of some of the pairs working through the terminal will usually be required and the job should, therefore, be checked before the splicing work is begun to determine whether all preliminary rearrangements have been cared for.

14.02 When protective cable is not required between the underground and aerial cables, the terminal can be removed in the following manner. Remove the bottom of the terminal box and the lead sleeves from the splices in the terminal. Then make a temporary splice between the underground and aerial cables. After the terminal has been lowered, remove the slack in the cable. The work of cutting out the slack and wiping the joints can be facilitated by removing several rings and lowering the cable so that the splice can be made in a horizontal position. The sleeve and cable should be attached permanently to the pole after the sleeve joints have been wiped.

14.03 If a length of protective cable is to be installed as the terminal is removed, the procedure outlined below can be followed.

(a) The splice on the strand should be made approximately 24 inches from the face of the pole or 30 inches from the through bolt at other than end poles.

(b) The splice to the underground cable can be made a short distance below the terminal, as illustrated. If not larger than a 3 inch diameter lead sleeve is required,

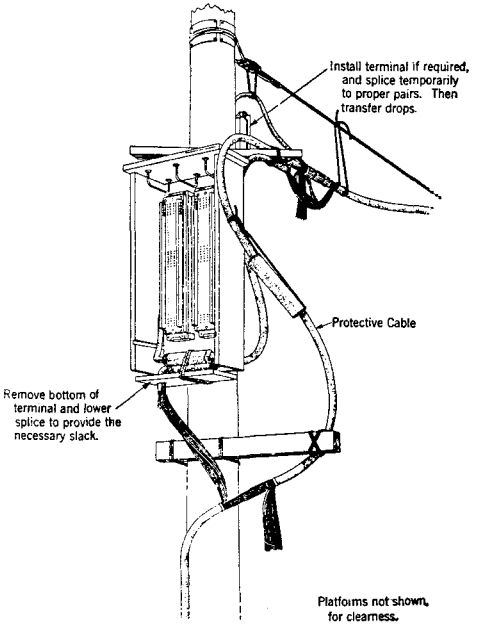
this splice may be located so that the lead sleeve will be covered by the U guard.

(c) Mark the position of the sheath opening on the aerial and underground cables and determine accurately the length of cable required to span the distance. (The length of the protective cable must be at least 6 feet.)

(d) After the ends of the protective cable have been prepared, the cable should be mounted for splicing, as illustrated.

(e) The aerial cable should be lowered from the rings a sufficient distance to permit making the splices in as near a horizontal position as practicable.

(f) If a distribution terminal is required to accommodate drops feeding from the pole, the terminal should be connected temporarily to the proper pairs in the old cable at the upper splice, as illustrated. The drops can be transferred immediately or during the course of the splicing operations



14.04 In case the cable is protected with a steel pipe guard which is to be removed, the pipe should be raised and the splice made near the base of the pole.

14.05 After the new cable has been cut in and the terminal has been removed, the cable should be raised to a vertical position and the sleeve and cable attached permanently to the pole.

15. REMOVAL OF BOWS

15.01 The removal of bows is described in Section 627-395-320. After the strand has been slacked off, the sheath should be carefully inspected. This inspection may be supplemented or superseded by pressure tests. Cable shields or cable clips should be installed where means of mitigating ring cutting are required.

16. MISCELLANEOUS REPAIRS

16.01 **Power or Lightning Burns:** The sheath should be inspected in the vicinity of power or lightning burns and any additional openings found should be repaired.

16.02 **Cable Guards:** Where tree limbs may not be removed to avoid rubbing the sheath, the cable should be protected by one of the standard methods. Report to the supervisor cases where trolley guards are needed or should be replaced.

16.03 **Rings and Wire Ties:** Missing or deteriorated rings or wire ties should be replaced. Variations in the spacing of rings which will not affect the proper support of the cable need not be corrected. Where extensive replacement or respacing of rings is required the work should be done at the direction of the supervisor.

16.04 **Grade Clamps:** Creeping cables should be anchored with grade clamps in accordance with the standard instructions.

16.05 If a grade clamp is to be replaced, the new clamp should be installed before the old is removed.

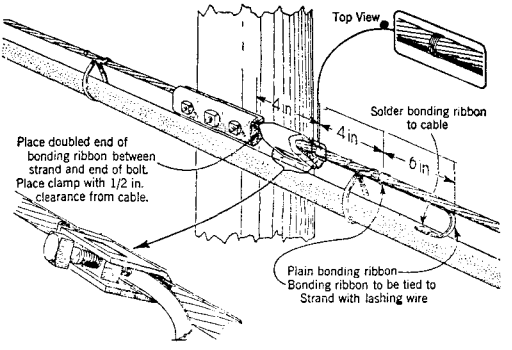
16.06 If the sheath is damaged under the clamp, place a new clamp nearby and repair the sheath in the usual manner.

16.07 Loose grade clamps should be tightened, or reset and tightened if necessary. If the existing clamp does not grip the cable properly because it is of the wrong size or type, the clamp should be replaced with one of the correct size and type. Where the cable has pulled through the clamp because of insufficient holding power, two clamps may be installed.

16.08 If any considerable slipping occurs, due to line damage or some unusual strain on the cable, such as sometimes happens at end poles, the cable should be pulled back to its original position, if practicable, after which the grade clamp should be tightened.

16.09 **Insulating Joints:** Insulating joints should be inspected and repainted with asphalt paint when the latter show signs of deterioration. The outer one or two layers of friction tape may be replaced if the insulating joint is badly weathered, after which it should be repainted.

16.10 **Rebonding Cables:** Where it is necessary to rebond an aerial cable at a pole, the splicer should not attempt to place the bonding ribbon in the suspension clamp. The strand ground clamp should be used to make the connection as illustrated below.



17. EXPELLING MOISTURE FROM CABLE — DESICCANT METHOD

17.01 Remove the sheath and expose all of the core affected by the moisture and some of the dry core on each side of the opening. Balloon the splice or core and repair any conductors having badly charred or otherwise damaged insulation in order to minimize the possibility of arcing.

17.02 Desiccant is a granular material and, unless reasonable care is exercised in applying it to the splice, it may have an abrasive action on insulation that is wet. As the insulation becomes dry, however, it becomes more resistant to mechanical damage.

17.03 Cut a piece of muslin about 6 inches longer than the sheath opening and several inches wider than the circumference of the cable or splice. Wrap the muslin around the cable or splice so that the opening in the muslin is at the top and the ends overlap the cable sheath. Then tie the ends of the muslin to the cable with cotton sleeving or tape, as shown below, to form an envelope.

17.04 The quantity of desiccant to be used in a standard length splice opening can be estimated from the table in Section 632-050-205. If the cable opening is longer than the usual splice opening or if the conductors are very wet, increase the quantity of desiccant accordingly. Do not use any more desiccant than can be distributed among the conductors as the material that falls to the bottom of the muslin or is piled on top of the splice does not aid in drying the insulation.

17.05 Sprinkle the desiccant among the conductors distributing it as thoroughly as possible. Distribution of the desiccant will be facilitated by separating the conductors with the fingers and gently working the granules into all spaces. The manipulation of the conductors will cause some of the desiccant to fall to the bottom of the envelope. As the desiccant collects at the bottom of the envelope, pick it up with the fingers and replace it among the conductors. When, in drying very wet cable, it is noted from the condition of the insulation that the drying action of the desiccant is slowing up, the spent material should be removed and replaced with fresh desiccant. It will ordinarily require about 5 minutes for thoroughly distributed desiccant to lose its effectiveness in very wet cable.

17.06 Continue these operations until all conductors are dry to the touch. Then hold the muslin against the bottom of the conductors with one hand and with the other place the desiccant that has fallen to the bottom back among the conductors, distributing it well. Then wrap the opening or splice with rubber bandages.

17.07 After about 15 minutes, call the testboard and request an insulation test to determine whether the conductors are serviceable. If they are, remove the rubber bandages and shake out all desiccant. Examine the conductors and repair all damaged insulation with Scotch electrical tape.

17.08 If the test shows that the conductors are not serviceable, remove the bandage, shake out the desiccant, and replace with fresh desiccant. After 10 or 15 minutes, call for another test.

17.09 After the conductors are found serviceable, slide the lashed ends of the envelope toward each other so that they extend about 1 inch over the sheath and place fresh desiccant among the conductors using the quantity of desiccant specified in Section 632-050-205 unless the opening is longer than the normal splice opening, in which case increase the quantity of desiccant accordingly. Then wrap the splice and cover it with a lead sleeve in the usual manner.

18. TWO-VISIT METHOD

18.01 When a large number of troubles occur at the same time as a result of storm conditions the following procedures may be employed to expedite clearing the troubles.

18.02 Remove the sheath and expose the wet insulation. Place muslin around the cable opening and distribute desiccant among the conductors as outlined in Paragraphs 17.03 and 17.04, and then wrap the opening by one of the methods outlined in Part 6. The opening may then be left while the clearing of other cases of trouble is undertaken.

18.03 Upon returning to wipe a sleeve over the opening, call the testboard and request that the conductors be tested for insulation resistance. If the insulation resistance is satisfactory remove the temporary covering, shake out the desiccant and complete the repair as described in Paragraph 17.09.