REPAIR OF UNDERGROUND CABLE

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1. GENERAL

1.01 This section outlines methods of repairing conductors and sheath defects in underground cable.

1.02 This section is reissued to add the hot-air method of drying wet conductors in underground cables.

1.03 The repair of a wet splice, where the B Wire Holder or the fold-back method was used in joining the conductors, is covered in Section 632-800-302.

2. PRECAUTIONS

2.01 Due to the urgency associated with cable restoration, the workman should be familiar with and should follow all safety precautions pertaining to the type of cable plant on which work is to be performed.

NO JOB IS SO IMPORTANT AND NO SERVICE SO URGENT THAT WE CANNOT TAKE TIME TO PERFORM OUR WORK SAFELY.

2.02 Strip paper or pulp-insulated conductors in a wet splice must not be handled until the insulation has been dried sufficiently to permit work on the conductors without damaging the insulation.

2.03 Exercise care in handling the conductors to avoid causing additional circuit troubles, especially those transmitting toll, program, data, or other special services. Except in the case of total failure, the method of determining and handling special circuits shall be in accordance with local procedure. Restore special circuits first whenever possible.

2.04 Short circuits, crosses, grounds, and sometimes reversals, even though momentary, will interfere with the operation of central office equipment and may put the equipment out of order.

2.05 Follow local routines when opening or working in a cable. Advise test desk that the cable is to be opened. Then, if the cable is under pressure, vent it before performing solder work.

2.06 Take special care to avoid breaking connections to balancing units, capacitors, resistors, or loading coils. Do ***not*** boil these devices with paraffin since the heat may change their characteristics. If it is necessary to open a pair temporarily to make repairs, place a bridge to maintain continuity of service, then open the conductors and mark both ends to ensure proper resplicing.

3. OPENING CABLE

3.01 Place a temporary cable bond between the cable sheaths of lead-covered cables to maintain the electrical continuity of the sheath before removing the lead sleeve or sheath. Place a bond at polyethylene-sheathed cables as soon as practicable after the splice closure or sheath has been removed.

3.02 The removal of splice cases and lead sleeves is described in the 633 Division of Plant Series Practices.

3.03 If the splice is wet because of a defect at or near a wiped joint, remove the joints and adjacent sheath from the cable after cutting them into sections with a chipping knife. Do not unwipe the joints since heat will drive moisture further under the sheath.

4. CLEARING PHYSICAL TROUBLES

4.01 After exposing the conductors:

(a) If paraffin was used, remove sufficient paraffin by boiling to facilitate working on the conductors.

(b) If desiccant was used on the splice, shake the splice to remove excess desiccant so as to avoid abrasion of conductor insulation when probing for defective pairs.

4.02 Identify the defective pairs, using an amplifier, and probe and tone supplied at a convenient termination. Carefully examine and repair damaged conductors. Piece-out the conductors if necessary.

4.03 After repairs are completed, close the splice with a splice case or lead sleeve in the usual manner.

5. DRYING WET CONDUCTORS

Desiccant Method

5.01 Remove the splice closure and enough sheath to expose all the core affected by moisture. Carefully balloon the splice, place a loose muslin envelope around the exposed conductors, and secure the ends of the envelope to the cable sheath with the opening of the envelope at the top of the splice as shown in Fig. 1.

5.02 Pour desiccant into the envelope, covering as many conductors as practical and allowing the desiccant to sift through to the conductors underneath (Fig. 2).

5.03 Continue drying the conductors with desiccant until inspection reveals that the insulation on the conductors is sufficiently dry so as to permit handling without causing damage. Desiccant can be picked up from the bottom of the envelope and poured over the conductors.

5.04 Remove the spent desiccant from the envelope and continue drying the conductors using fresh desiccant.

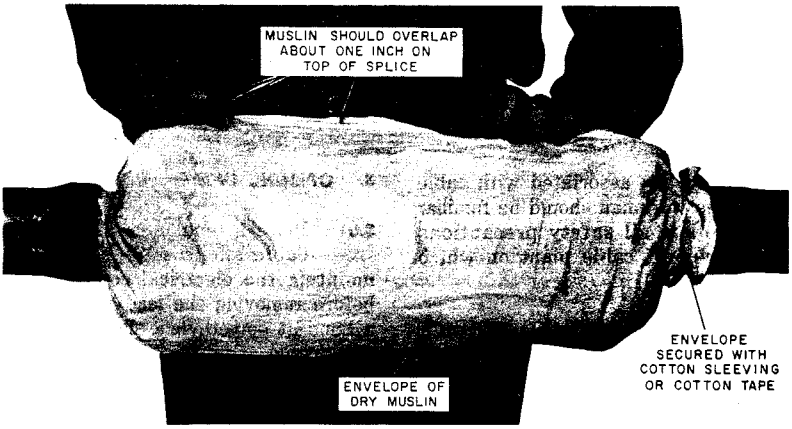

Fig. 1—Muslin Envelope Placed

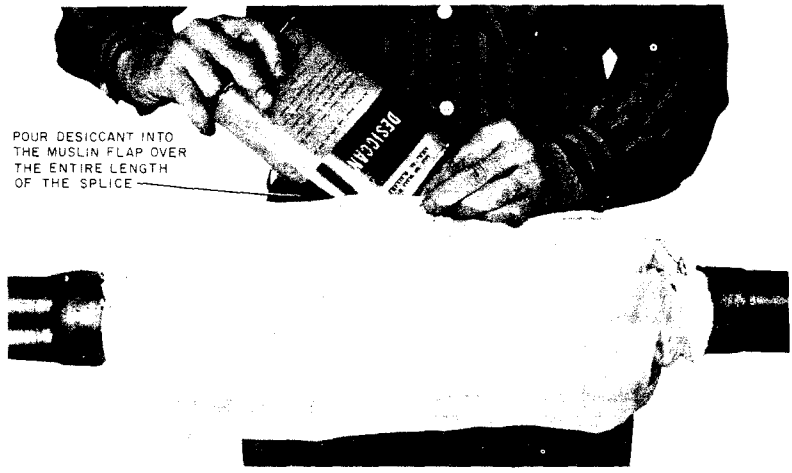

Fig. 2—Applying Desiccant to Wet Conductors

5.05 After the splice has dried sufficiently to permit work on the conductors, remove the muslin envelope and gently shake the splice to remove desiccant. Repair conductors having badly charred or broken insulation.

5.06 After the trouble is cleared, place fresh desiccant among the conductors using the table in Section 632-050-205 as a guide. Wrap the splice and close with a splice case or lead sleeve.

Heated Air Method

5.07 The heated air method of drying wet cable conductors, utilizes a prefabricated cable drying hood connected through a blower hose to a ventilator/heater.

5.08 Commercially available drying hoods consist of an approximately 6 ft by 30 in piece impregnated nylon equipped with zippers and straps for enclosing the cable. An opening is provided in the center to accept an adapter for the 8-inch blower hose. Holes are provided on the bottom of the hood to allow the air to escape.

Note: The cable drying hood may be obtained commercially, or made locally with a six-foot square of medium weight canvas fitted with a sleeve in the center for attaching to a blower hose.

5.09 Observe the following precautions when using the heated air method:

- Observe all precautions relating to the use of ventilator/heaters and blower hoses as covered in the 649 Division.
- Do not use desiccant because of the danger of flying particles.
- Do not handle wet conductors until the insulation has dried sufficiently.
- If the cable being dried is in a manhole, another ventilator/heater is required to ventilate the manhole.

10 To dry conductors with the heated air method, proceed as follows:

(1) Remove the cable sheath to expose at least 4 inches of dry cable on either side of the moisture (Fig. 3).

(2) Remove the paper wrapper and the outside binders if this can be done without damaging the wet insulation (Fig. 4). If insulation is too wet, place the cable drying hood over the cable and operate the blower at least 10 minutes before removing the outside binders.

(3) Place the cable drying hood over the cable, centering the opening over the wet conductors.

(4) Secure the ends of the hood to the cable with the straps provided, or in the case of locally made hoods, rubber bandage may be used.

(5) Close the zipper opening and connect the blower hose to the hood using the blower hose adapter (Fig. 5).

(6) Operate the ventilator/heater at maximum heat and air volume.

(7) Drying progress can be checked through the zipper opening.

(8) Remove the inner binders as soon as conditions permit.

(9) After all binders are removed, place spacers (no sharp edges) between the units.

(10) When the insulation has completely dried, close the opening with a splice case or lead sleeve.

6. CLEARING SECTION TROUBLES

6.01 When a sheath fault develops in a section between manholes and the cable becomes wet, service can usually be restored more quickly by excavating at the area of the fault to make repairs.

6.02 Determine the exact location of the fault by Wheatstone Bridge measurements made from the splices in adjacent manholes. Place temporary closures on both splices as soon as possible and

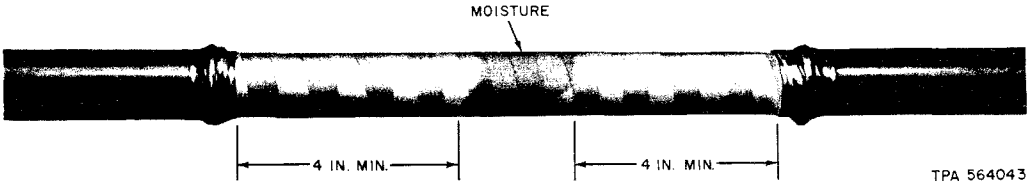

Fig. 3—Cable Sheath Removed

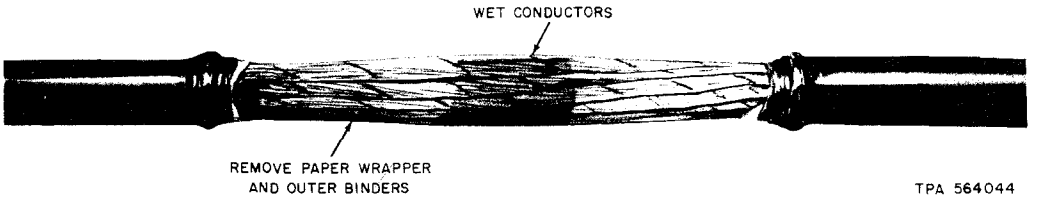

Fig. 4—Paper Wrapping Removed

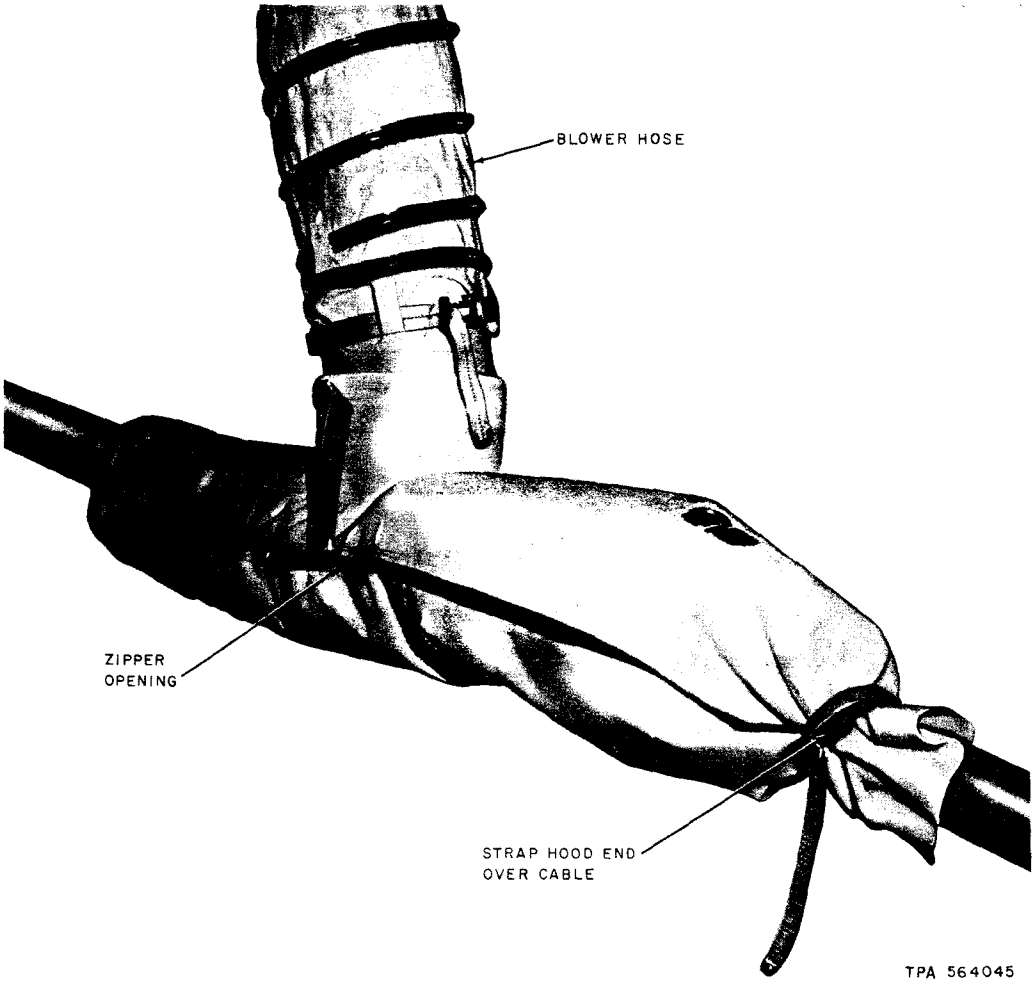

Fig. 5—Cable Drying Hood in Place

introduce air or nitrogen into the section at each splice to prevent further moisture from entering the sheath fault.

6.03 The area to be excavated should be marked off. This may be determined by using conduit layout maps or by tracing the path of the cable using an exploring coil. Obtain a permit to make an opening in the street where necessary.

6.04 After the cable has been exposed, remove the sheath and dry the conductors as described in Part 5. Make necessary insulation repairs, apply fresh desiccant, and wrap the sheath opening.

6.05 To close the opening, use a lead sleeve 3 inches longer than the opening and only slightly larger in diameter than the diameter of the sheath. The sleeve diameter should never exceed 2-3/4 inches for a cable in standard clay conduit.

6.06 On lead-sheathed cable, beat shallow rings around the cable sheath where the lead sleeve is to be beaten in. Place the lead sleeve over the opening and beat the ends into the rings as shown in Fig. 6. Wipe thin joints to allow as much clearance in the duct as possible. Pressure test all solder work before replacing conduit.

6.07 Use a lead sleeve and wrapped joints on polyethylene-sheathed cable if the conduit will permit or can be enlarged to accommodate the sleeve. If not, local practice may require replacement of the section.

6.08 Replace conduit as outlined in Section 622-300-300.

6.09 Mark the cable in both adjacent manholes to show the location of the duct splice, in feet, from the manhole wall. Fig. 7 shows a duct splice tag. Follow local procedure for preparing a sketch for revising plant cable records.

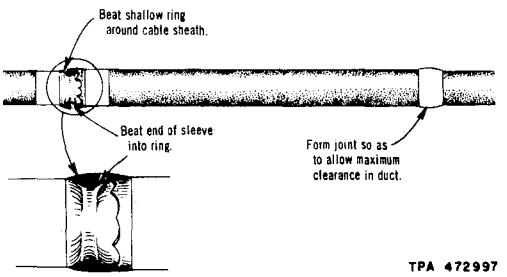

Fig. 6—Closing Duct Splice

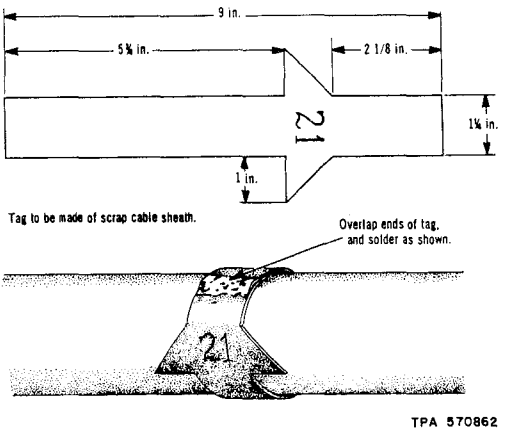

Fig. 7—Duct Splice Tag