

SHEATH DEFECTS AND MINOR CORE DAMAGE REPAIRING

LEAD AND PLASTIC SHEATHED CABLE

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1. GENERAL

1.01 This section covers the methods of repairing sheath defects in plastic or lead sheathed cables where conductor damage has not occurred and also covers methods for opening and closing plastic or lead sheathed cables where minor core damage has occurred.

1.02 This section is reissued to include two new methods of repairing plastic cable jackets

where swelling or splits in the sheath have occurred. This section also contains information formerly contained in Sections 627-395-312 and 632-800-300. Since this reissue is a general revision, no revision arrows have been used to denote significant changes.

1.03 Cables under air pressure must be vented and bled to zero pressure before and during repair.

1.04 In buried or underground plant where sufficient slack cannot be obtained, it is recommended that the sheath be removed, the core repaired, and the appropriate splice closure or case be used to close the opening.

2. PRECAUTIONS

2.01 Methods of sheath repair covered in this section, which require the use of an open flame, must **not** be used in manholes, cable vaults, or other locations where the use of an open flame is prohibited.

2.02 Due to the urgency associated with cable restoration, the craft person(s) must be familiar with and must follow all safety precautions pertaining to the type of cable plant on which work is to be performed.

2.03 When repairing cables which are joint with power, observe the following:

Danger: Certain electrical supply cables have characteristics that are identical to telephone cables which make visual identification impossible; therefore in all cases, employees shall make positive electrical identification as outlined in Section 629-020-102 before working on cable.

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

3. REPAIRING SHEATH DEFECTS

A. Soldering Method (Lead Sheathed Cable)

3.01 Repair small defects in the lead sheath as follows.

Danger: Do not use the carding brush on any area of the lead sheath that has not been completely covered with lead particle entrapment compound (LEPEC).

- (1) Clean the area on the sheath that includes the defect and a minimum of 3/4 inch around the defect using LEPEC and a carding brush. The use of LEPEC is described in Section 081-852-127.
- (2) When the lead surface of the sheath has been thoroughly cleaned, remove all excess LEPEC with a clean dry cloth. Use B cleaning fluid to remove residual LEPEC. **Adequate ventilation must be provided when using B cleaning fluid.**
- (3) Use a lead file to remove sheath at the point of the defect to a depth of one-half the sheath thickness. Slope the file cut gradually to the outer edge of the defect.
- (4) Apply a coating of stearine to the cleaned area.
- (5) Ignite the acetylene torch, adjust the flame, and apply heat with a brushing motion to the cleaned area. Avoid concentrating the heat in one spot and allowing the blue tip of the flame to contact the sheath. See paragraph 2.01.

Note: The description and operation of acetylene torches is covered in Section 081-330-105.

- (6) Hold solder in contact with the sheath and heat with a brushing motion of the flame until the solder flows and adheres to the sheath. Tin the sheath in the cleaned area by gently heating around the adhered solder.
- (7) After the cleaned area has been tinned, build up the repair with solder until the center of the repair is approximately 1/32- to 1/16-inch above the level of the good sheath and tapers to the level of the good sheath at the outer edges of the repair. Excess solder should be removed with a small wiping cloth, **not with a file.**
- (8) After excess solder has been removed, apply heat to the repair to allow the solder to flow slightly and fill any pores that may have developed.

B. E Pressure Flange Method (Plastic Sheathed Cable)

3.02 Minor repairs to plastic-sheathed cables of 1-inch or larger diameter may be made using the E pressure flange (Fig. 1). Plastic-sheathed cables of 1.6-inch or smaller diameter, with sheath damage, may be repaired with a 13A or 14A splice case as covered in Section 633-470-100. The E pressure flange is described in Section 637-235-201.

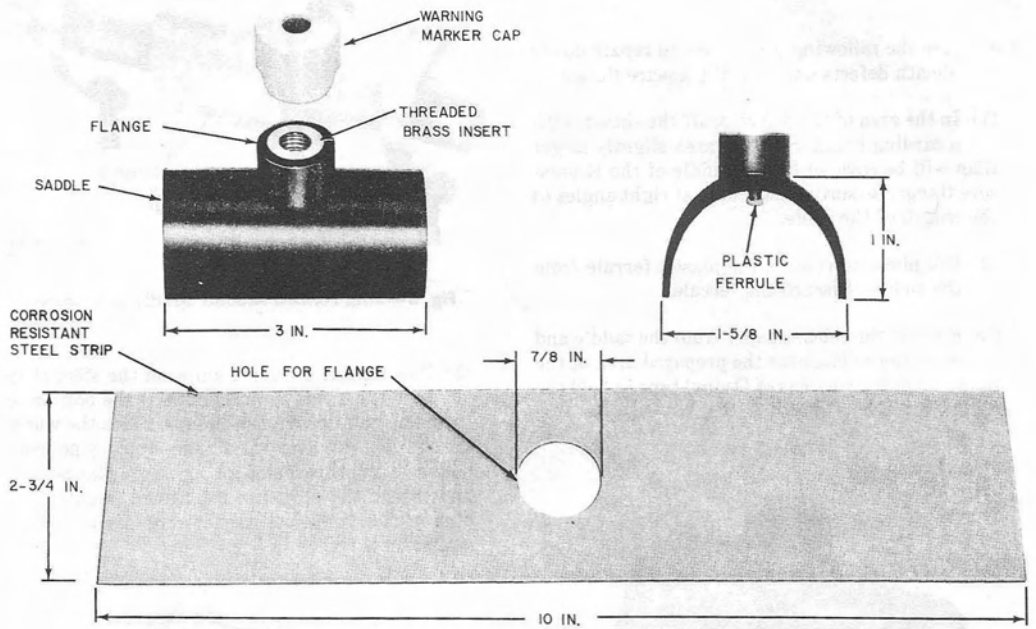


Fig. 1—E Pressure Flange

3.03 The E pressure flange method of sheath repair is limited to minor damage, such as cuts, cracks, holes made in connection with pressure tests, etc.

3.04 Use the following procedures to repair minor sheath defects using an E pressure flange:

- (1) In the area of the defect, scuff the sheath with a carding brush. Scuff an area slightly larger than will be covered by the saddle of the E pressure flange. Be sure to scuff only at right angles to the length of the cable.
- (2) Use pliers to remove the plastic ferrule from the saddle. Discard the ferrule.
- (3) Remove the release paper from the saddle and place the saddle over the prepared area of the sheath. Apply two turns of D vinyl tape to hold the flange in place as shown in Fig. 2.

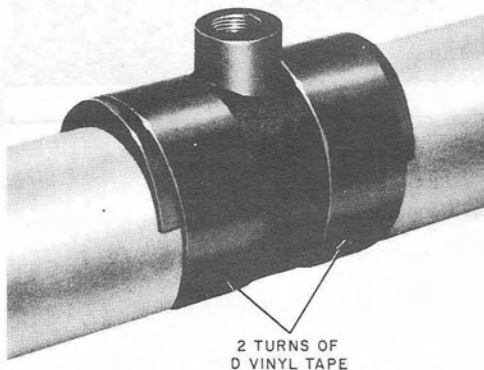
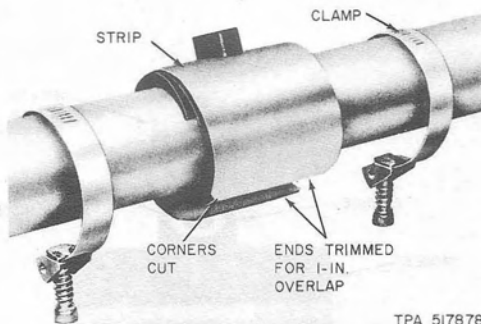


Fig. 2—Saddle Taped to Cable

- (4) Place two sealing clamps loosely around the cable on each side of the saddle. Place the steel strip over the flange, and form the strip snugly around the cable and saddle. Use shears to cut off one end of the strip so the end is directly under the cable and parallel to it. Cut off the other end of the strip so the ends overlap about 1 inch. Cut the corners off of the strip and smooth all cut edges with a file. Figure 3 illustrates the partially completed installation.



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Fig. 3—Strip Formed Around Saddle and Cable

- (5) Position the sealing clamps on the steel strip with the heads of the clamps at the bottom of the cable and tighten the clamps. Place the warning marker cap over the flange, apply pipe compound to the threads of a C pressure flange plug and thread the plug into the flange. Tighten the plug with a 7/16-inch wrench. The completed installation is shown in Fig. 4.

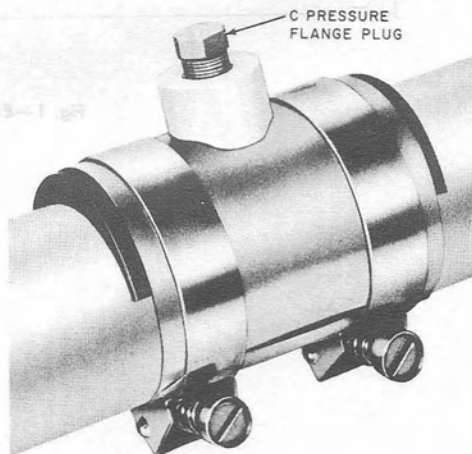


Fig. 4—E Pressure Flange Installed

- (6) If the cable is pressurized, test for leaks with E pressure testing solution.

C. E Sheath Repair Sleeving Method (Lead or Plastic Sheathed Cable)

3.05 The repair of lead or plastic sheathed cable may be accomplished using the E sheath repair sleeving method as outlined in Section 644-200-005.

D. General Reinforcement Method (Plastic Sheathed Cable)

3.06 This method consists of a tape wrap which is used to reinforce sections of cable sheath that have become loose due to expansion by internal pressure when exposed to high temperature.

3.07 This method is also used as a protective overwrap for the patch weld method described in Part 3E and is recommended for cables 2 inches or larger in diameter.

3.08 The material required for reinforcement of sections of cable sheath (which have no holes or slits) is Fiberglass/Silicone Rubber Tape No. G557 supplied in 3/4-, 1-, or 1 1/2-inch widths. This material may be ordered from Connecticut Hard Rubber Company (CHR), 407 East Street, New Haven, Connecticut 06509. This does not imply that equivalent material from other manufacturers is not equally suitable.

3.09 The procedures for sheath repair using fiberglass/silicone rubber tape are as follows:

- (1) Expose the cable to be repaired for a distance beyond the high temperature zone.
- (2) Remove surface contaminants from the sheath using a damp cloth.
- (3) Depending on the cable diameter and curvature, select the most convenient fiberglass tape width. The maximum convenient tape width is generally 1-1/2 inches.

Note: If cable is not less than 2 inches in diameter and has significant curvature in the area to be wrapped, the narrower tapes will provide a smooth tight wrap.

- (4) Starting 12 inches beyond one end of the affected area (outside the high temperature zone), wrap the cable sheath tightly with a single half-lapped layer of fiberglass tape for a distance

of 12 inches beyond the other end of the affected area. This completes the general reinforcement method.

E. Patch Weld Method (Plastic Sheathed Cable)

3.10 This method provides a means of repairing cable sheaths having a damaged area not more than 4-inches long and not encompassing more than one-half the cable circumference.

3.11 The materials required for this method are:

- B cleaning fluid (AT-9236)
- B glass tape (Comcode 900414566)
- Torch (propane or acetylene)
- Low density polyethylene patches (sections of cleaned cable sheath)
- Fiberglass/Silicone rubber tape.

3.12 The procedures for sheath repair using the patch weld method are as follows:

Cable Sheath Cleaning

- (1) Remove all dirt, flooding compound, and filling compound from the sheath.
- (2) Using a file, remove any high spots of polyethylene from around the damaged area.
- (3) Remove all remaining contamination with B cleaning fluid.

Note: Special care *must* be taken to ensure that all traces of contamination be removed from the sheath surface around the repair area.

Patch Preparation and Placement

- (4) Cut a patch of polyethylene cable sheath 1/2-inch larger on all sides than the damaged area.
- (5) Thoroughly clean the patch (inside and outside surface) with B cleaning fluid.

Note: Any contaminants left on the inside surface will prevent proper bonding.

- (6) Place the patch over the damaged area, ensuring that the 1/2-inch overlap is maintained.
- (7) Apply a single half-lapped layer of B glass tape over the patch, starting 3 inches from the patch and ending 3 inches beyond the patch. **Maintain as much pressure as possible.** See Fig. 5.

Polyethylene Patch Welding (See paragraph 2.01)

- (8) Heat the patch area through the glass tape with a circular motion of the torch. Heat the entire patch and approximately 1/4 inch of cable around the patch. **Do not heat the cable sheath beyond the repair area which is not covered with glass tape.**

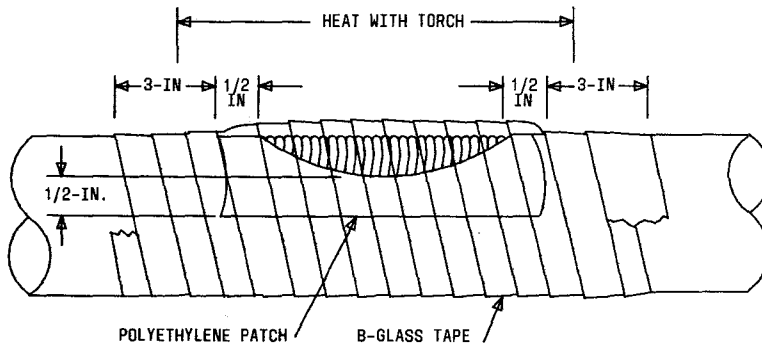


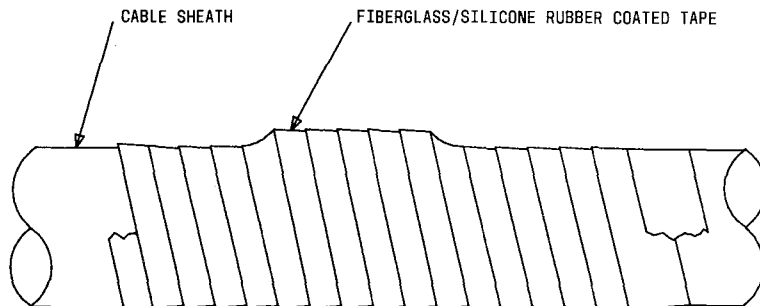
Fig. 5—Application of Polyethylene Patch Over Damaged Area

Note: Because of the adhesive on the B glass tape, a flame will be seen during the heating procedure.

- (9) Observe the patch edges during heating. The edges should change from the noticeable step to a smooth transition from patch to cable sheath. If not, apply more heat to the edges of the patch.
- (10) When polyethylene can be seen coming through the glass tape, apply heat for approximately 1 minute longer. This completes the patch weld portion. Removal of the B glass tape is not necessary.

Protective Overwrap

- (11) If the patch area will be exposed to high temperatures, the entire patch region extending a minimum of 12 inches beyond each side of the B glass tape should be overlapped with fiberglass/silicone rubber tape as described in Part 3D. See Fig. 6.
- (12) After repair area has returned to normal temperature, air pressure must be reapplied.



NOTE: FIBERGLASS/SILICONE RUBBER TAPE IS APPLIED TO THE LENGTH OF CABLE EXPOSED TO STEAM CONDITIONS.

Fig. 6—Completed Sheath Repair

4. REPAIRING MINOR CORE DAMAGE

4.01 The aerial application of the slit sheath method is covered in this part; however, if sufficient slack can be obtained in other types of cable installations, this method may be used. See paragraph 1.04.

A. Slit Sheath Method (Lead Sheathed Cable)

4.02 The slit sheath method of repairing lead sheathed cable basically consists of slitting the sheath, removing the core, repairing the conductors, replacing the core, and restoring the sheath by soldering the slit with an acetylene torch (paragraph 2.01).

4.03 This method is generally applicable only where the cable diameter is 1-1/2 inches or less.

4.04 If the repairs to the conductors should increase the overall size of core enough to prevent the sheath from being properly restored, a length of the sheath must be removed and the cable closed with a sleeve rather than by the slit sheath method.

Slitting the Sheath

4.05 Provide sufficient working space by removing cable rings, supports, etc, and by clamping the lashing wire on each side of the proposed work area and turning back the lashing wire between the clamps. Slit the sheath using the following procedures:

Danger: Do not use the carding brush on any area of the lead sheath that has not been completely covered with LEPEC.

(1) Clean an 18-inch by 1/4-inch strip of sheath on the top of the cable using LEPEC and a carding brush. The use of LEPEC is described in Section 081-852-127.

(2) When the selected area of the sheath has been thoroughly cleaned, remove all excess LEPEC with a clean dry cloth. Use B cleaning fluid to remove residual LEPEC. **Adequate ventilation must be provided when using B cleaning fluid.**

(3) Score the sheath lightly with a cable sheath slitter along the center of the cleaned area as shown in Fig. 7. Then cut the sheath by drawing the slitter back and forth along the score mark until the core wrapping paper is exposed at several points.

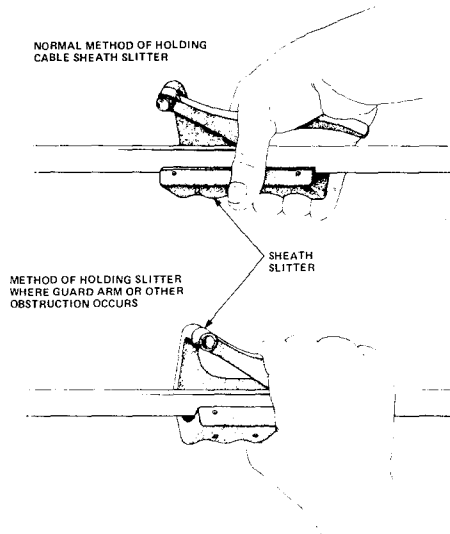


Fig. 7—Slitting the Sheath of Lead Sheathed Cable

Note: If the core is wet, the opening should be extended to at least 2 inches beyond the wet area.

- (4) Starting at the center of the cut, pry the edges of the sheath apart with a pair of cable openers, as illustrated in Fig. 8, until the core can be removed. Care should be exercised to avoid denting or kinking the edges of the sheath.

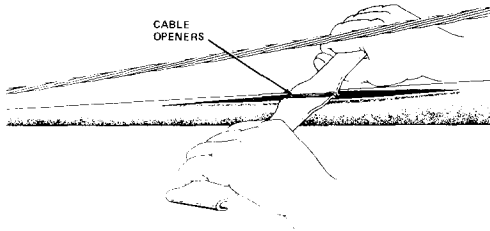


Fig. 8—Opening the Sheath With Cable Openers

- (5) Remove the burrs from the inner edges of the slit and coat the edges with stearine.

Removing the Core

- (6) Install a slack puller on the strand at a point where it will not interfere with the repair operations. Pull slack in the cable until the core can be lifted from the sheath.
- (7) Place two turns of B paper tape around the core 3 inches from each end of the slit. Remove the core wrapping paper between the tape collars. See Fig. 9.

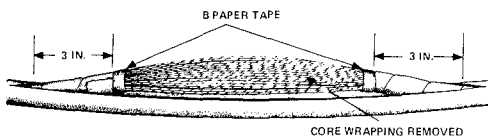


Fig. 9—Core Removed From Sheath

Repairing the Conductors

- (8) If the conductors are wet, dry them using the desiccant or heated air method as outlined in Section 644-200-101.

- (9) Repair the damaged conductor insulation using B paper tape as shown in Fig. 10. Burned or otherwise defective conductors should be pieced out and the joints insulated in the same manner.

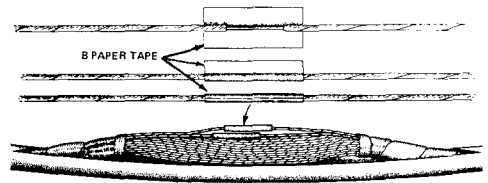


Fig. 10—Repairing Damaged Insulation

- (10) After the conductor repairs have been made, wrap the core with 1-inch black bias-cut varnished cambric tape, overlapping the cambric tape one-third its width and overlapping onto the undisturbed core at each end. Wrap the core as tightly as practicable to obtain a small core diameter.

- (11) Secure the cambric tape at each end with one or two turns of B paper tape. See Fig. 11.

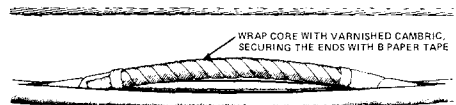


Fig. 11—Core Ready to be Replaced in Sheath

Replacing the Core

- (12) Inspect the inside of the sheath. Remove any dents or inside burrs.
- (13) If there is a hole in the sheath, place a piece of cleaned lead serving tape over the hole inside the sheath before the core is replaced. B paper tape may be used to hold the serving tape in place.

- (14) Remove the slack puller. Place the core in the sheath and partially close the sheath with the hands and the cable pliers, working from the ends toward the middle. See Fig. 12.



Fig. 12—Core Replaced in Sheath and Sheath Partly Closed

- (15) Cut a piece of lead serving tape approximately 1/4-inch longer than the sheath opening and between 1/4- and 1-inch wide, depending upon the diameter of the cable.
- (16) Taper the ends of the lead tape to facilitate inserting them under the sheath at the ends of the cut. Using the strand as an aid, form the lead tape to the approximate shape of the cable core. Clean the outer surface of the lead tape with LEPEC and a carding brush.
- (17) Place the lead tape in the opening, working the ends under the sheath. Close the sheath over the lead tape with the cable pliers, working the pliers around the cable to restore it, as much as practicable, to its original shape as shown in Fig. 13.

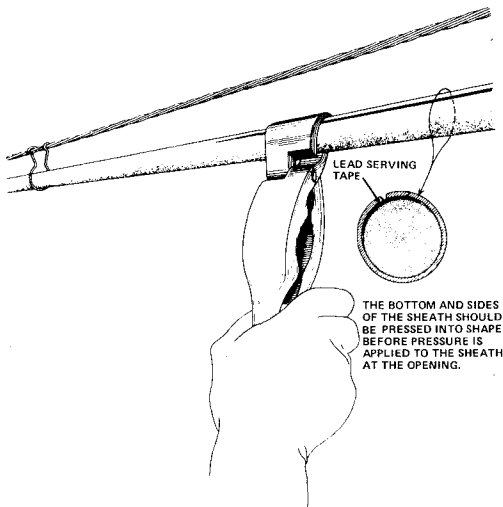


Fig. 13—Closing the Sheath With Cable Pliers

Soldering the Slit

- (18) Solder the opening with stearine core solder using an acetylene torch (paragraph 2.01). Defects in the sheath should be repaired after the slit has been soldered as outlined in Part 3A.
- (19) Restore the cable to its original position under the strand, and replace the cable rings or lashing wire.

B. Slit Sheath Method (Plastic Sheathed Cable)

- 4.06 The slit sheath method of repairing plastic sheathed cable consists of slitting the sheath, removing the core, repairing the conductors, replacing the core, and restoring the sheath by permanently taping the opening.
- 4.07 If the repairs to the conductors should increase the overall size of the core enough to prevent the sheath from being properly restored, a length of the sheath must be removed and the cable closed with a lead sleeve or splice case rather than by the slit sheath method.

Slitting the Sheath

- 4.08 Provide sufficient working space by removing cable rings, supports, etc, or by clamping the lashing wire on each side of the proposed work area and turning back the lashing wire between the clamps. Slit the sheath using the following procedures:
- (1) Position a chipping knife in line with the cable as shown in Fig. 14. Tap the knife lightly with the hammer and carefully cut, along the top of the cable, through the plastic sheath and metallic shield.
 - (2) Spread the edges of the slit apart, and remove any sharp or jagged edges of the metallic shield.

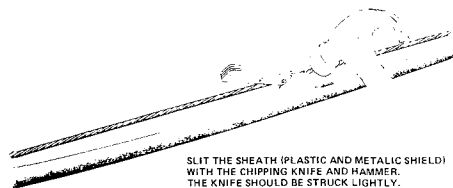


Fig. 14—Slitting the Sheath of Plastic Sheathed Cable

Removing the Core

- (3) Install the slack puller on the strand at a point where it will not interfere with repair operations, and obtain enough slack to permit core removal as shown in Fig. 15.

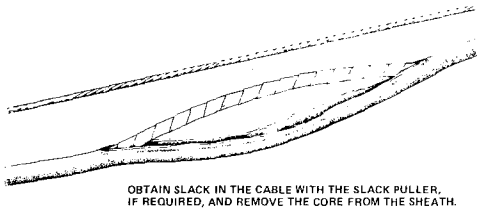


Fig. 15—Core of Cable Removed (Plastic Sheath)

- (4) Place one or two turns of B paper tape around the core 3 inches from each end of the slit, and remove the core wrap between the tape collars.

Repairing the Conductors

- (5) Dry the insulation as necessary, and repair damaged insulation with vinyl tape. Burned or otherwise defective conductors should be pieced out, and the joints insulated with vinyl tape.
- (6) After the conductor repairs are made, wrap the core with 1-inch black bias-cut varnished cambric tape, overlapping the cambric tape one-third its width and overlapping onto the undisturbed core at each end. Wrap the core as tightly as practicable to obtain a small core diameter.
- (7) Secure the cambric tape at each end with one or two turns of B paper tape.

Replacing the Core

- (8) Inspect the inside of the sheath and remove any burrs.
- (9) Push the core back into the sheath, remove the slack puller (if used), and close the sheath as much as possible, working from the ends of the opening toward the middle.

Permanently Taping the Opening

- (10) Scuff the entire sheath for the length of the opening plus approximately 2 inches beyond the ends of the opening. Scuff at right angles to the length of the cable as shown in Fig. 16. Do not scuff the sheath longitudinally as this will score the sheath and allow air to escape.

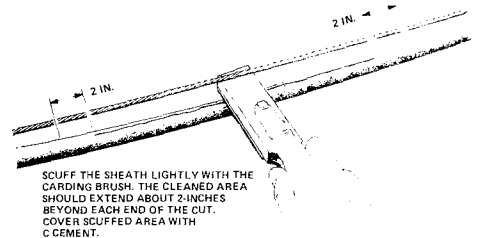


Fig. 16—Scuffing the Sheath

- (11) Apply C cement over the scuffed area. Allow the cement to set for about 5 minutes or until it becomes tacky.
- (12) Start at one end and cover the cemented area and approximately 1/2 inch beyond on each end with two half-lapped layers of 2-inch DR tape.
- (13) Place two half-lapped layers of 2-inch B aluminum tape over the DR tape and about 1/2 inch beyond each end of the DR tape. Smooth down the aluminum tape with a hammer handle.
- (14) Start at the center of the taped area, cover the aluminum tape and approximately 1/2 inch beyond each end of the aluminum tape with two half-lapped layers of 2-inch black friction tape.
- (15) Start at one end and apply (with light tension) two half-lapped layers of 1-inch vinyl tape over the friction tape. Allow the vinyl tape to extend approximately 1/2 inch beyond the friction tape at each end.

(16) Place a vinyl tape collar (1-1/2 inches from each end) over the final wrapping of vinyl tape. Each collar should consist of five layers of 1-inch vinyl tape. The first four layers of the tape should be applied with tension and the fifth layer without tension. See Fig. 17.

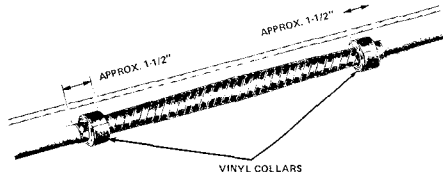


Fig. 17—Vinyl Collars in Place

Supporting the Taped Opening

(17) On lashed and ringed cable, place lashed or ringed support, respectively, on the cable 1 inch beyond each end of the tape wrapping.

(18) Support the wrapping at one or more places, depending on its length, with lashed support (lashed cable) or cable ring (ringed cable). Place two turns of lead serving tape under each cable support located on the wrapping.

Note: The distance between supports should be uniform and should not exceed 20 inches.