

INSULATING JOINTS AND CAPACITOR INSTALLATION ON LEAD AND POLYETHYLENE SHEATH CABLES

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1. GENERAL

1.01 This section describes the method of:

- Making airtight insulating joints in lead or polyethylene sheath cables
- Installing bypass capacitors across insulating joints

- Preparing a combination pressure plug and insulating joint.

1.02 When this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 This section includes information formerly contained in Sections 633-320-200, -201, -202, and -207.

2. LOCATION OF INSULATING JOINT

2.01 The insulating joint should be located in a straight portion of the cable where it will not be subject to bending stress. In vaults having horizontal cable entry (Fig. 1), make the joints as close as practical to the second upright from the duct entrance to allow as much straight cable as possible between the bend at the first vertical and insulating joint.

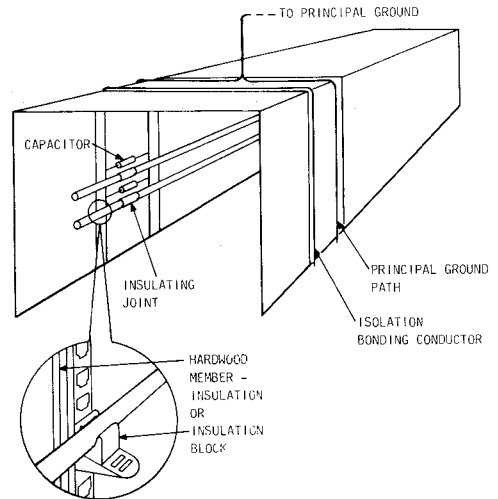


Fig. 1—Horizontal Entry (Location of Insulating Joint)

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2.02 In vaults having vertical cable entry (Fig. 2) with limited cable length in the vault, the combination pressure plug/insulating joint with capacitor may be used if it can be located at least 5 inches from the tip splice and air inlet flange.

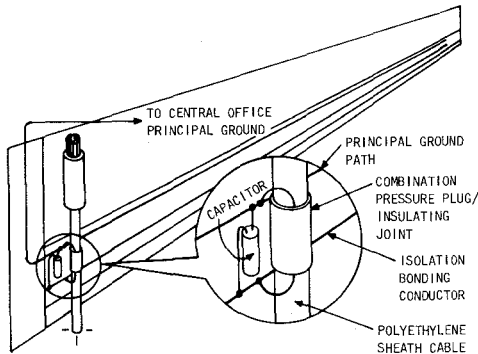


Fig. 2—Vertical Entry (Location of Combination Pressure Plug/Insulating Joint)

2.03 An insulating joint in an aerial cable supported by rings, as well as one in a lashed cable, is illustrated in Fig. 3. The joint should be located under the strain insulator.

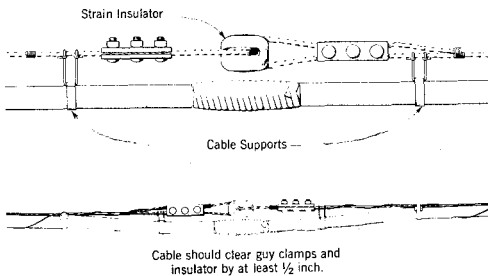


Fig. 3—Location of Joint in Aerial Cable

3. CONSTRUCTING INSULATING JOINT WITHOUT CAPACITOR (LEAD AND POLYETHYLENE SHEATHS)

3.01 The following procedures are used for straight insulating joints in lead, alpeth, stalpeth, PAP, or PASP sheath cable. Any variation in procedures between lead and polyethylene will be so indicated.

- (a) Remove any longitudinal scratches on the sheath at the proposed opening. Use shave hook or splicers file to remove scratches on lead, while the carding brush may be used on polyethylene sheath.
- (b) Mark and remove a 3/4-inch wide section of outer sheath. **Do not remove the core wrap.**

Note: On polyethylene sheath, score and remove the polyethylene jack; then, remove the aluminum or steel and aluminum to produce a smooth flared end. Remove any sharp points of metal which project toward the cable core.

- (c) Clean 4 inches on both sides of the opening, using a carding brush for polyethylene sheath and Le. P.E.C. (Lead Particle Entrapment Compound) along with carding brush for lead sheath cables.
- (d) Fill the opening with several layers of unstretched 3/4-inch DR tape until the tape level is flush with the outer sheath.
- (e) Apply C cement over the DR tape and the scuffed or cleaned area. Let the cement dry until tacky.
- (f) Starting at the center, cover the joint and scuffed area with several half-lapped layers of unstretched 3/4-inch DR tape until an even wrap is produced.
- (g) Cover the 3/4-inch DR tape with two half-lapped layers of fully stretched 2-inch wide DR tape. **For lead sheath cable, skip step (h).**

(h) **On polyethylene sheath cable only:**

Cover the 2-inch DR tape with two half-lapped layers of 4-inch wide B aluminum tape. Dress the aluminum tape with a hammer handle or cable dresser.

(i) **On lead sheath cable only:** Apply a collar of three turns of B aluminum tape centered on the DR tape. Dress the aluminum tape with a hammer handle or cable dresser.

(j) Complete the wrapping with two half-lapped layers of 1-inch wide F or G vinyl tape.

(k) If the cable is to be placed under continuous air pressure, place sealing clamps over the outer wrapping.

4. CONSTRUCTING INSULATING JOINT WITH CAPACITOR (LEAD AND POLYETHYLENE SHEATHS)

DESCRIPTION OF CAPACITORS

4.01 KS-14595 capacitors are used at insulating joints *to provide a path to ground for power fault current and to reduce noise on voice and carrier frequency circuits* in the cable. The capacitors provide a low-impedance path across the joint for alternating current while blocking the passage of direct current.

4.02 The use of capacitors shall be designated by the engineering departments that are responsible for electrical protection and noise reduction.

4.03 The **KS-14595 L1 capacitor** is a 1000 microfarad 25-volt dc nonpolarized dry-type electrolytic capacitor. It is intended for operation in circuits where the dc potential will not exceed 25 volts and where the ac potential will not exceed approximately 2.5 volts rms at 60 Hz. It is enclosed in a sealed (waterproof) cylindrical lead case which is 2 inches in diameter and 6-1/2 inches long. Two No. 14 stranded copper wires project from one end of the case. The wires are 18-1/2 inches in length and are rubber insulated and covered with neoprene.

4.04 The **KS-14595 L2 capacitor** is a 10,000 microfarad 25-volt dc nonpolarized dry-type electrolytic capacitor. It is intended for operation in circuits where the dc potential will not exceed 25 volts and where the ac potential will not exceed

approximately 2.5 volts rms at 60 Hz. It is enclosed in a sealed (waterproof) cylindrical lead case which is 3 inches in diameter and 6-1/2 inches long. Two No. 14 stranded copper wires project from one end of the case. The wires are 18-1/2 inches in length and are rubber insulated and covered with neoprene.

4.05 The KS-14595 L2 capacitor is intended for use where two or more KS-14595 L1 capacitors would be required for satisfactory noise suppression.

4.06 To test the KS-14595-type capacitor, disconnect the leads at the B connectors. Discharge the capacitor by holding the bare ends together briefly. Connect the capacitor leads to the terminals of an ohmmeter. A capacitor in good condition will show a temporary deflection of the needle while the capacitor is charging and then return to infinity. An open capacitor will show a very high or infinite resistance with no initial deflection of the needle. If the capacitor shows a low resistance, it is partially or completely shorted. Open or shorted capacitors should be replaced.

INSTALLATION ON LEAD SHEATH CABLES

4.07 The method of installing capacitors across insulating joints in lead sheath cables is as follows.

(a) Construct insulating joint as outlined in paragraph 3.01 (a) through (k).

(b) Fasten the capacitor in place with lashed cable supports and D cable spacers as shown in Fig. 4. The capacitor should be positioned close to the joint so the shorter lead does not exceed 6 inches in length.

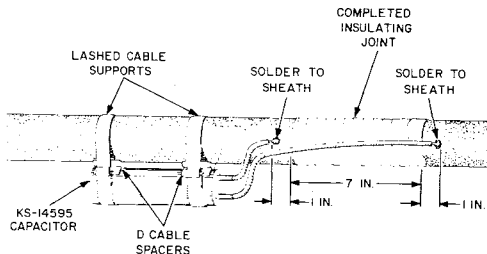


Fig. 4—Securing Capacitor

- (c) Cut the leads to the desired length, leaving small drip loops in each and remove 5/8-inch insulation from the end of each lead.
- (d) Solder the leads to the sheath, one on each side of the insulating joint. Dress the leads as close to the cable as possible (Fig. 4).
- (e) Place sealing clamps over the outer vinyl tape wrapping as shown in Fig. 5.

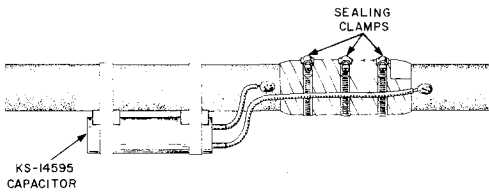


Fig. 5—Sealing Clamps Placed

- (f) Apply one half-lapped layer of vinyl tape over the insulating joint covering the soldered connections, the capacitor leads, and the sealing clamps as shown in Fig. 6.

Note: The last turn should be laid on with no tension so the end of the tape will not creep.

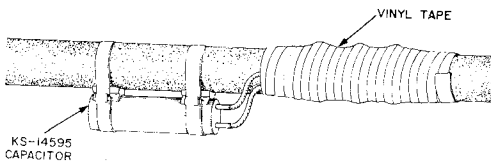


Fig. 6—Vinyl Tape Placed

- 4.08 *In a cable vault*, the KS-14595-type capacitor can be mounted at the side or on the top of the cable sheath between the insulated

upright and the insulating joint since the capacitor unit is well insulated from its case. Fasten the capacitor and connect the leads as shown in Fig. 5. If the arrangement of the cables or the position of the joint does not leave space for mounting the capacitor in this way, it may be mounted in a convenient position on the framework, consistent with maintaining short lead length.

Note: In order for the capacitor to be effective at carrier frequencies, the capacitor leads should be kept as short as possible. (Fig. 4 is a good example.) Every possible effort should be made to conform to this type of construction.

- 4.09 *The procedures to be followed in the installation of a pole-mounted capacitor and bracket* are identical with those covered in paragraph 4.07 (a) through (f), except the bracket is used in place of the lashed cable supports.

- 4.10 Secure the KS-14595-type capacitor to the pole with a B capacitor bracket. This capacitor and bracket are intended to be mounted vertically on a pole with the capacitor leads at the bottom of the bracket as shown in Fig. 7. This arrangement permits the leads to be kept short. Holes are provided in the bracket for two 1-1/2 inch No. 14 RH galvanized wood screws.

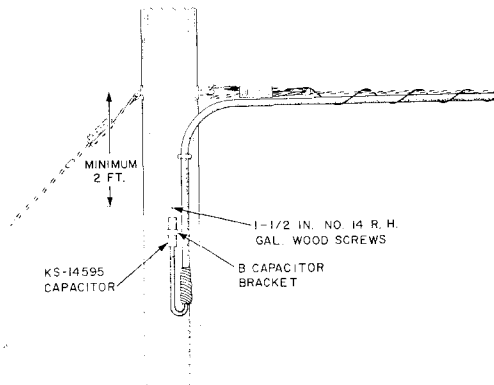


Fig. 7—Pole-Mounted Capacitor

INSTALLATION ON POLYETHYLENE SHEATH CABLES

A. Insulating Joint Preparation

4.11 The following are procedures for the preparation of an insulating joint when a capacitor is to be installed across the joint.

(a) Mark and remove a 3/4-inch wide section of outer sheath and metallic shield. **Do not remove core wrap.**

(b) Using a carding brush, scuff the outer sheath 4 inches on both sides of the opening.

(c) Attach two B bond clamps and bonding ribbon as shown in Fig. 8. Cut off excess bond clamp stud length.

Note: Where it is desirable for both bonding ribbons to protrude from the same end of the joint, arrange the bonding hardware as shown in Fig. 9.

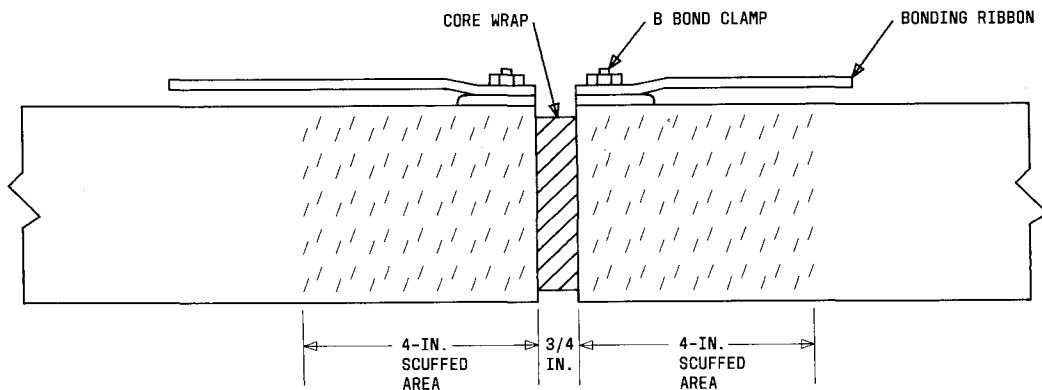


Fig. 8—Placing Bonding Clamps and Ribbon

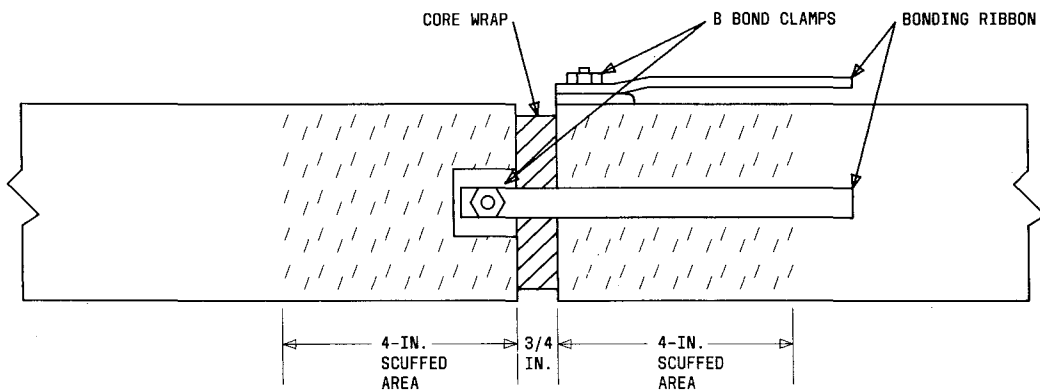


Fig. 9—Alternate Method of Placing Bond Clamps and Ribbon

- (d) Fill the opening with several layers of unstretched 3/4-inch DR tape until the tape is flush with the outer sheath.
- (e) Apply C cement over the DR tape and the scuffed area. Let the cement dry until tacky.
- (f) Build a collar, using three layers of unstretched 2-inch wide DR tape, on each side of the opening as shown in Fig. 10.

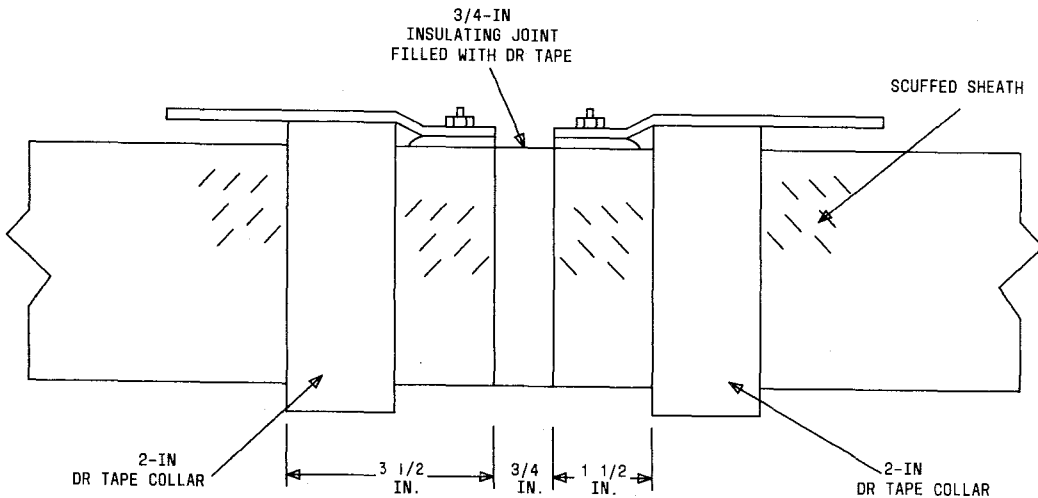


Fig. 10—Placing DR Tape Collars

- (g) Apply C cement to the DR tape and to the bonding ribbon. Let dry until tacky.
- (h) Press the bonding ribbons onto the DR tape collars.
- (i) Starting at the center, cover the joint, bond clamps, ribbon, collars, and scuffed area with several half-lapped layers of unstretched 3/4-inch DR tape until an even wrap is produced.
- (j) Cover the taped area with two half-lapped layers of fully stretched 2-inch wide DR tape.
- (k) Cover the DR tape with two half-lapped layers of 4-inch wide B aluminum tape. Dress the aluminum tape with a hammer handle or cable dresser.
- (l) Cover the aluminum with two half-lapped layers of 1-inch wide F or G vinyl tape.
- (m) Apply two sealing clamps, one on each side of the opening, directly on the DR tape collars. Tighten clamps until snug.

B. Installing Capacitors

4.12 Capacitors are mounted across the insulating joint as follows:

- (a) Mount the capacitor on the insulating joint with B lashed cable supports and D cable spacers as shown in Fig. 11.

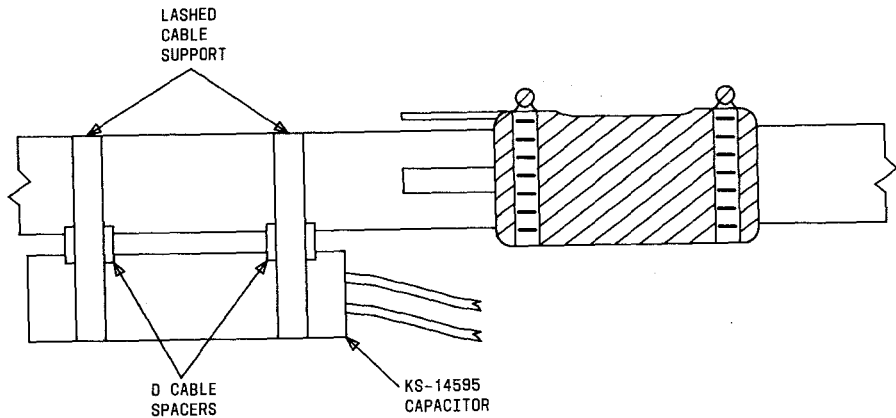


Fig. 11—Capacitor Mounted

- (b) Connect the bonding ribbon to the capacitor leads with B connectors (AT-7827) as shown in Fig. 12. The length of the leads should be as short as possible without placing them under tension.

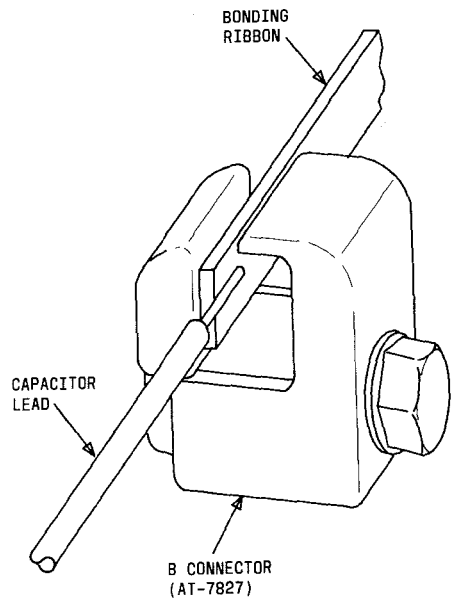


Fig. 12—Connecting Bonding Ribbon and Capacitor Leads with B Connectors

(c) Cover the B connectors and the leads on each side of them with B sealing tape and vinyl tape as shown in Fig. 13.

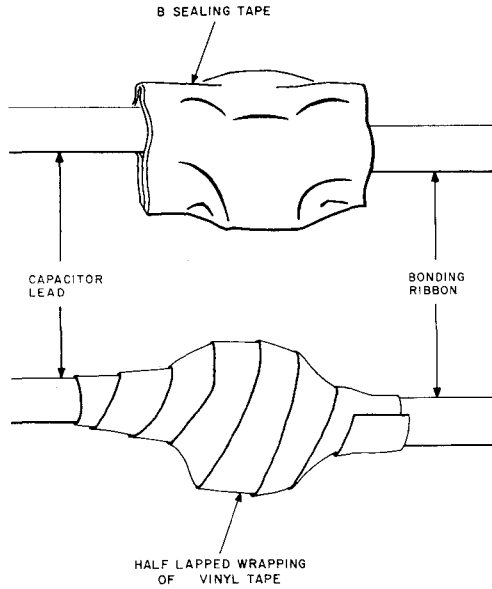


Fig. 13—Covering B Connectors

4.13 A typical completed installation of a KS-14595-type capacitor can be mounted on the si⁺ cable is shown in Fig. 14.

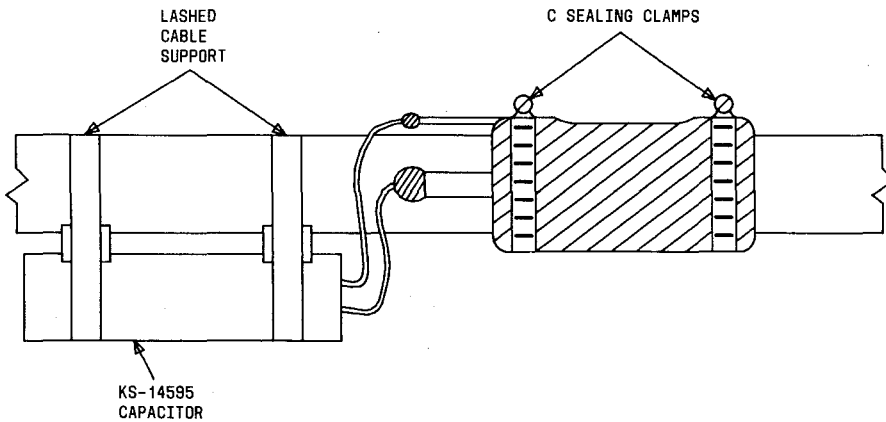


Fig. 14—Completed Installation

5. CONSTRUCTING COMBINATION PRESSURE PLUG AND INSULATING JOINT (POLYETHYLENE SHEATH)

GENERAL

5.01 The combining of a pressure plug and insulating joint is considered most desirable when cable pressurization and inner shield isolation are factors in a confined vault area. This compact combination may be installed in polyethylene sheath cables having either pulp-, paper-, or polyethylene-insulated conductors and may be constructed in either a vertical or horizontal plane.

5.02 The closure injecting method, using J plug compound, is used for constructing the pressure plug portion of this combination and will provide adequate electrical, corrosion, and moisture protection to the cable core.

5.03 The description and use of J plug compound and the precautions in handling plugging compound are covered in Section 637-241-011.

INSTALLATION

5.04 The procedures for installing a pressure plug/insulating joint combination are as follows.

- (a) Measure and mark an 8-inch long section of the outer jacket.
- (b) Thoroughly scuff the outer sheath a distance of 4 inches on both sides of the proposed sheath opening using a carding brush, rasp, or equivalent.
- (c) With a cable knife or similar cutting tool, cut and remove the outer polyethylene jacket (Fig. 15).

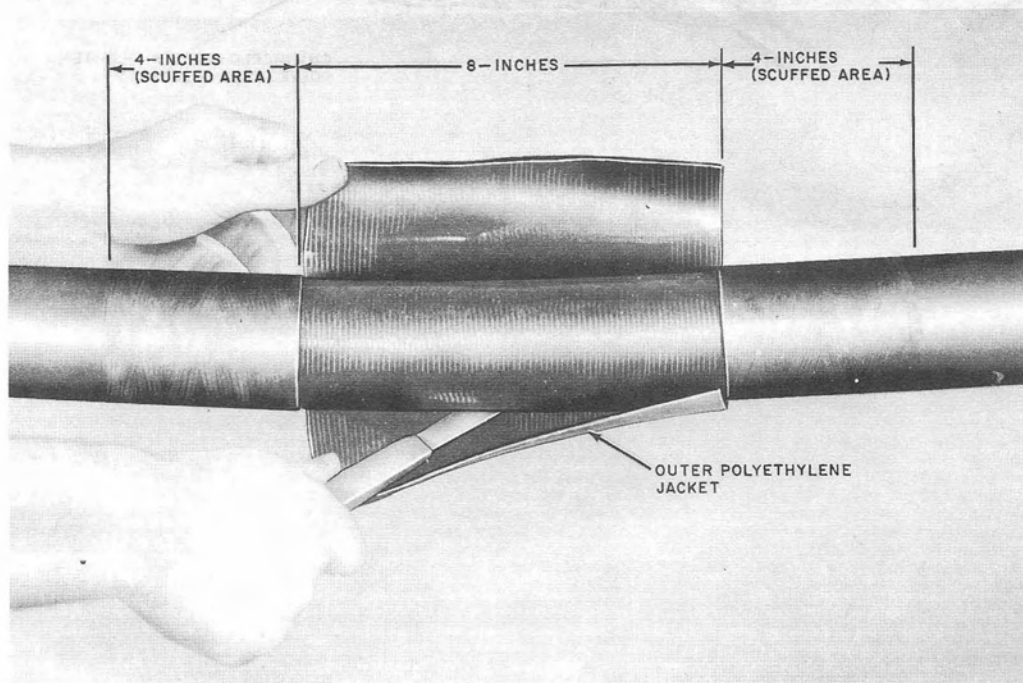


Fig. 15—Removing Outer Polyethylene Jacket

(d) Remove the aluminum/steel or aluminum polyethylene shield, cutting it flush with the outer polyethylene jacket (Fig. 16). **Check edges of exposed shield to be sure that no sharp edges are turned down toward the cable core.**

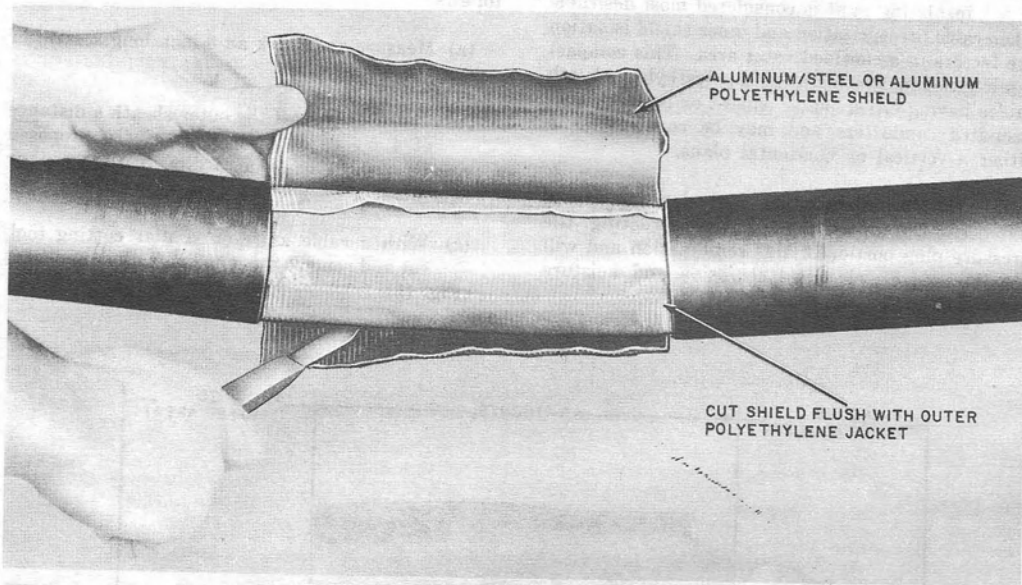


Fig. 16—Removing Inner Shields

- (e) Wrap several layers of 1/2-inch D paper tape over each end of the core wrap as shown in Fig. 17. Then, remove the core wrap between the D paper tape (Fig. 18).

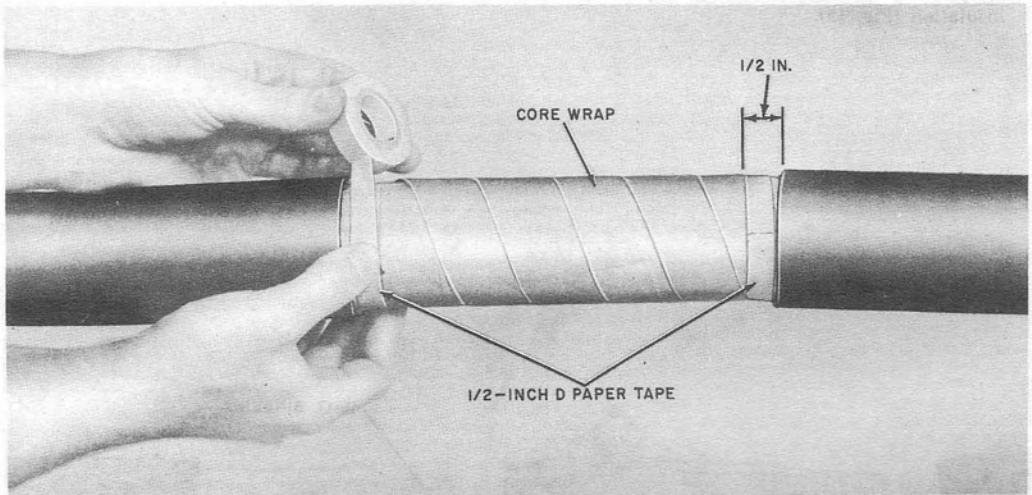


Fig. 17—Apply D Paper Tape

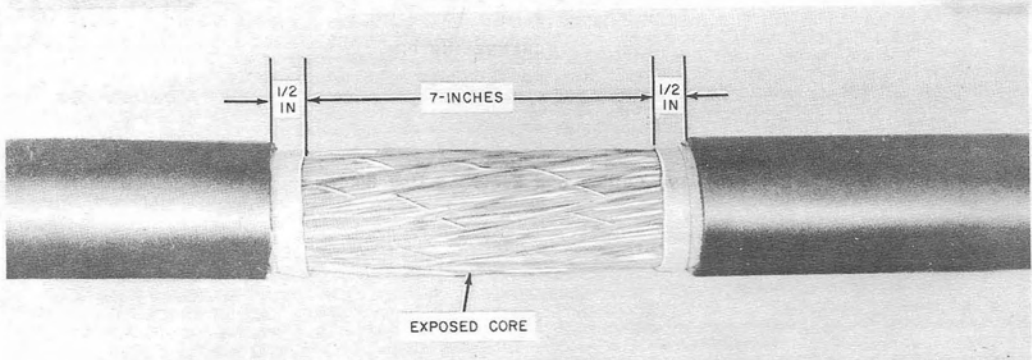


Fig. 18—Removed Cord Wrap

- (f) If possible, flex the cable both horizontally and vertically to loosen the exposed core.
- (g) With the aid of an orange stick or channeling pin, cut and remove as many unit binders as possible without damaging the conductor insulation (Fig. 19).

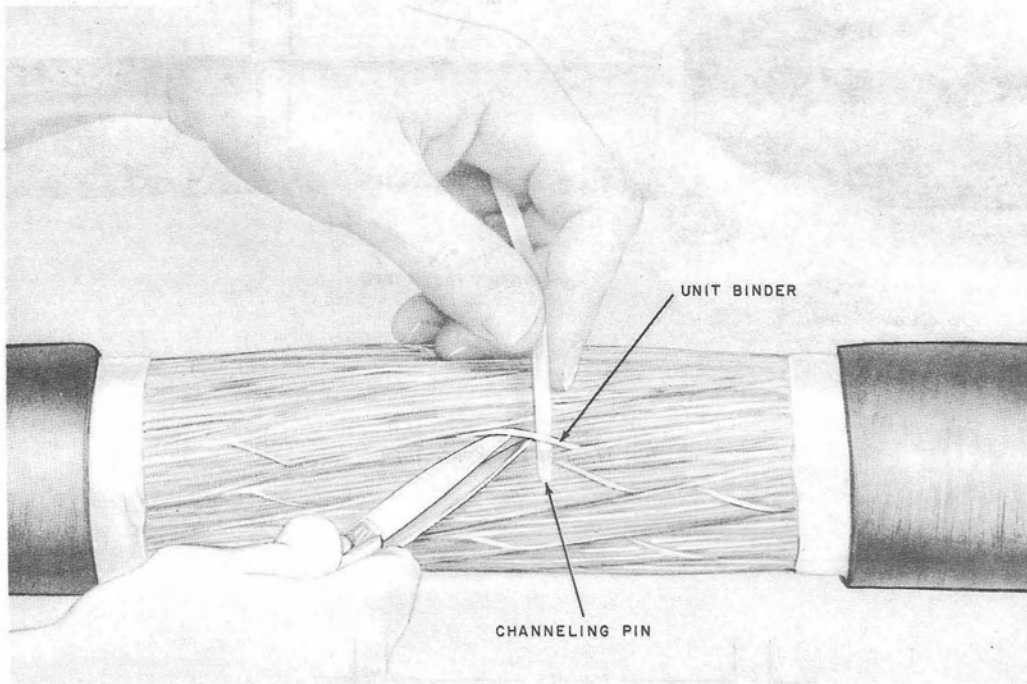


Fig. 19—Cutting and Removing Unit Binders

(h) Insert five channeling pins in the core following the pattern shown in Fig. 20. Trim excess channeling pin lengths.

Note: Channeling pins are important. They provide a path for the compound to flow into the core.

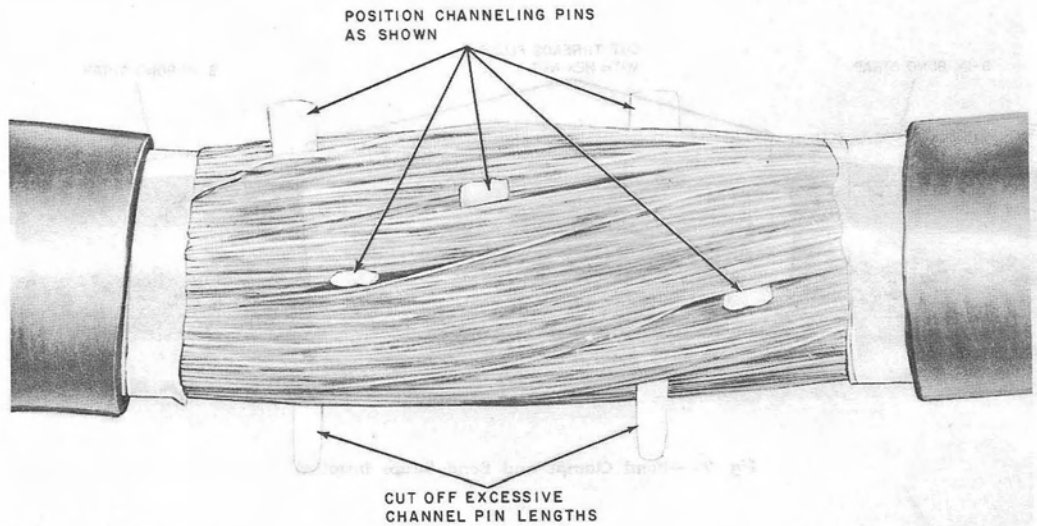


Fig. 20—Positioning Channeling Pins

- (i) Install two 8-inch bond straps, using two D bond clamps (Fig. 21). Install the D bond clamps as outlined in Section 081-852-119, **except do not split the polyethylene sheath.**
- (j) With a pair of cutting pliers, cut the bolt threads on the bond clamps flush with the hex nut (Fig. 21).

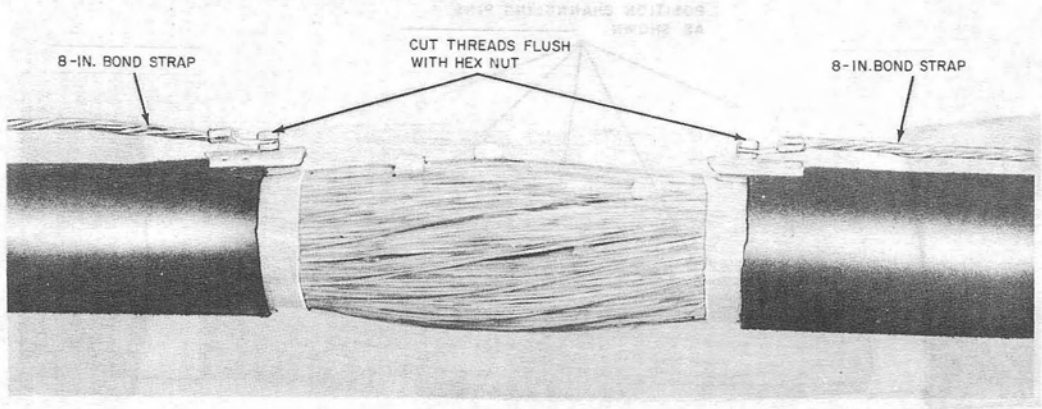


Fig. 21—Bond Clamps and Bond Straps Installed

(k) Using one layer of 3/4-inch wide B sealing tape, form a pressure collar 1-1/2 inches on each side of the sheath opening (Fig. 22). Wrap the collar with several turns of fully stretched DR tape (white side out) and finish with one turn unstretched. Ensure that the DR tape covers all exposed B sealing tape. See Fig. 23.

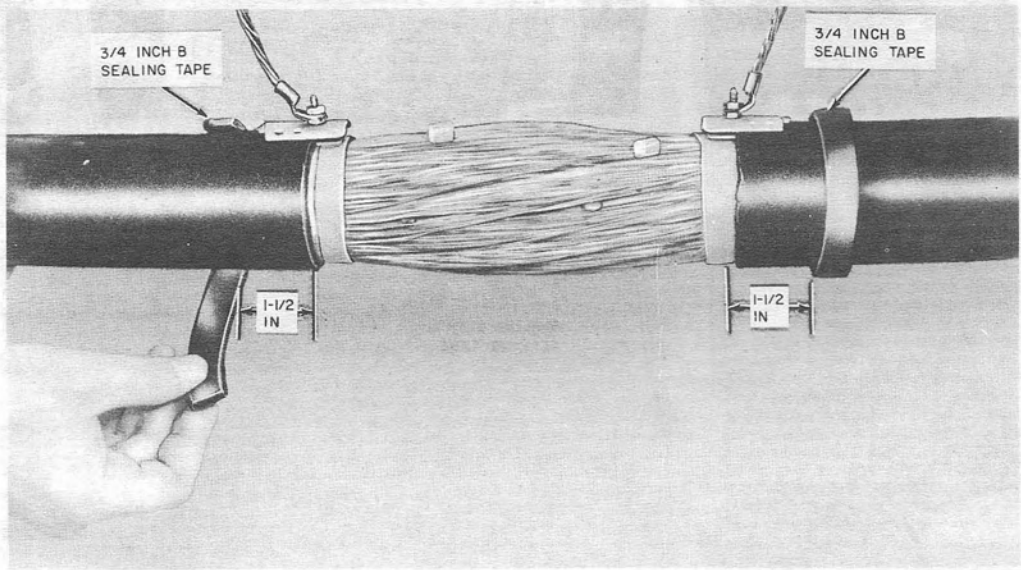


Fig. 22—Preparing Pressure Collar

(b) The length of the tape should be 1 1/2 inches longer than the length of the pressure collar. The tape should be applied over the pressure collar and the ends of the tape should be folded over each other to form a seal. The ends of the tape should be folded over each other to form a seal.

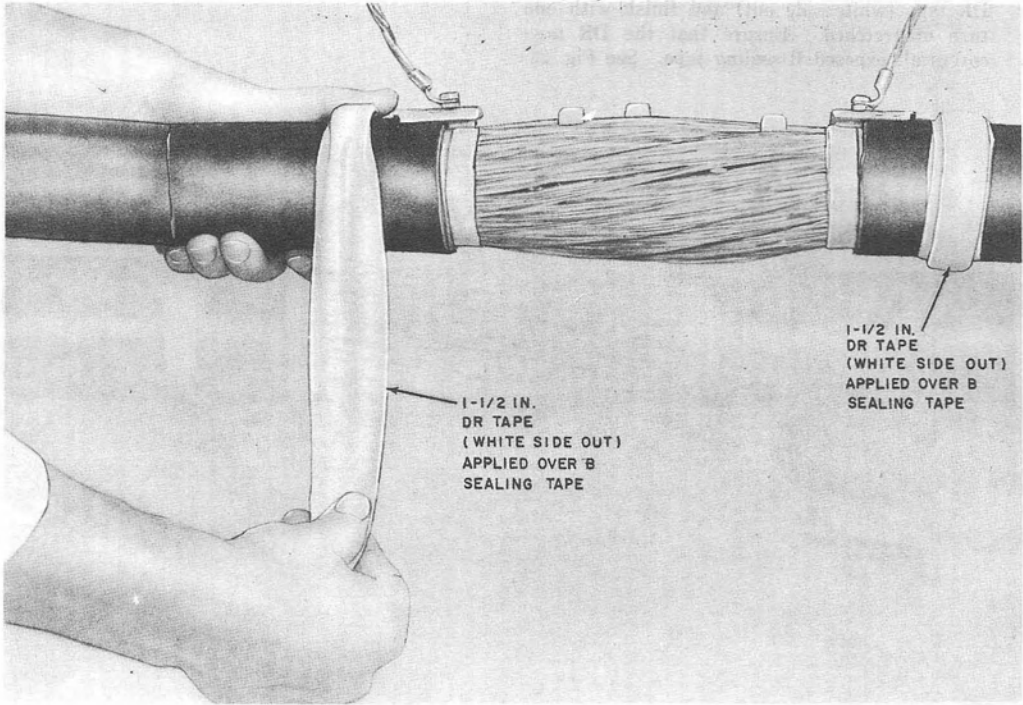


Fig. 23—Applying DR Tape Over Pressure Collar

(l) Apply four wraps of 1-1/2 inch wide B sealing tape approximately 2-3/4 inches from each end of the sheath opening. Press the bare ground wire leads onto the sealing tape and

continue to apply the sealing tape over the leads to a height sufficient to clear the top edge of the bond clamp hex nut by at least one thickness of tape (Fig. 24).

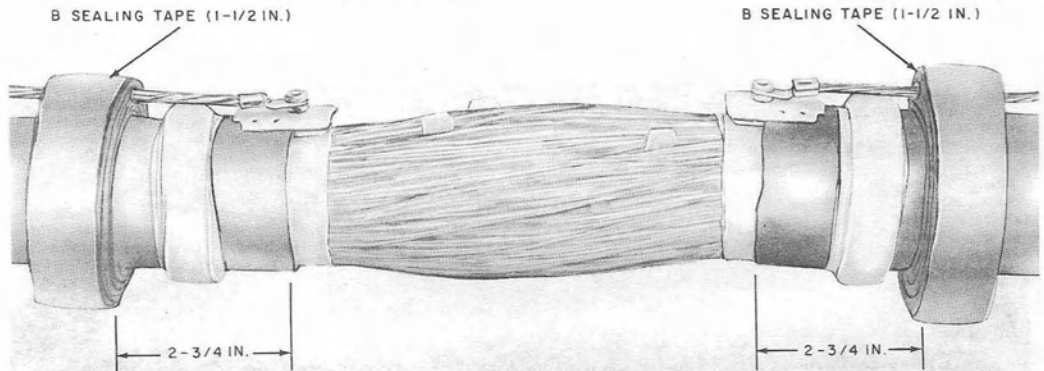


Fig. 24—Sealing Tape Collar Installed

(m) Place one layer of spacing material between the two sealing tape collars. Overlap the spacing material approximately 2 inches and secure with tie wraps on short lengths of vinyl tape (Fig. 25).

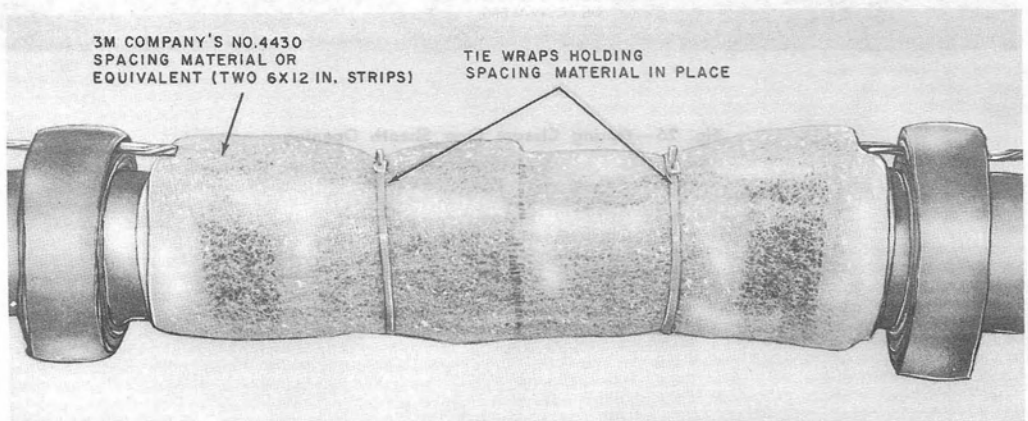


Fig. 25—Placement of Spacing Material

(n) Prepare the closure sleeve for assembly by bending along the perforations so that the edges overlap by 2 inches when it is positioned over the exposed core and is resting snugly on the B sealing tape collar. **Make certain this overlapping edge does not block the injection port.**

(o) Position the sleeve over the sealing tape collars (Fig. 26).

Note: The closure should be drawn tight enough so that annular contact is made between the inside of the closure and the sealing tape collars.

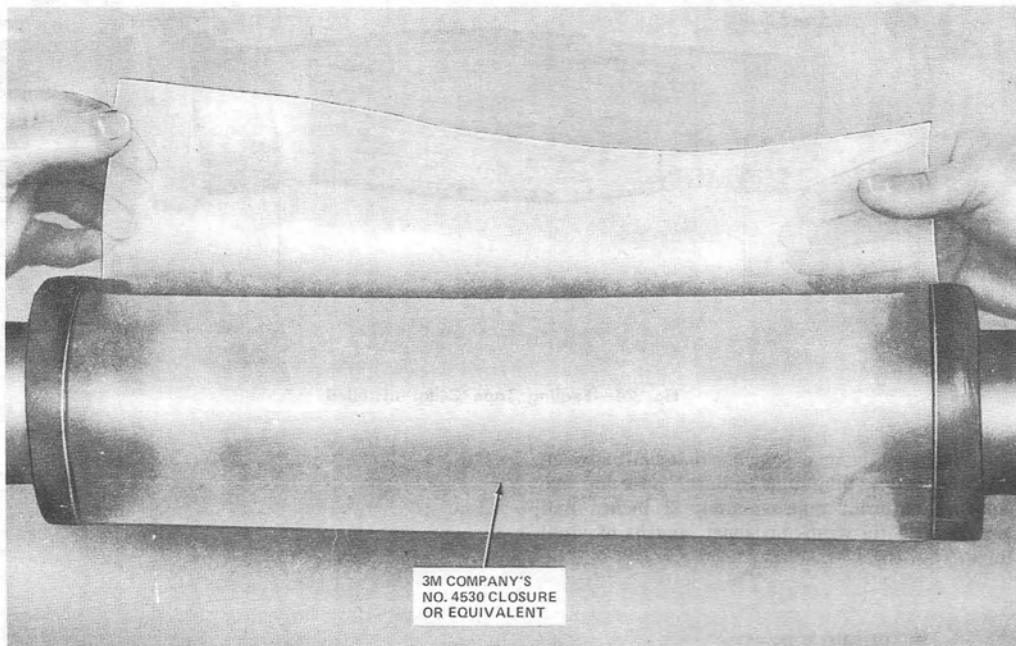


Fig. 26—Placing Closure Over Sheath Opening

(p) Apply two half-lapped layers of F or G vinyl tape over the entire sleeve. Apply two additional layers at each end directly over the sealing tape collars (Fig. 27).

Note: For *vertical installations*, do not cover the upper vent hole; for *horizontal installations*, leave both vent holes uncovered.

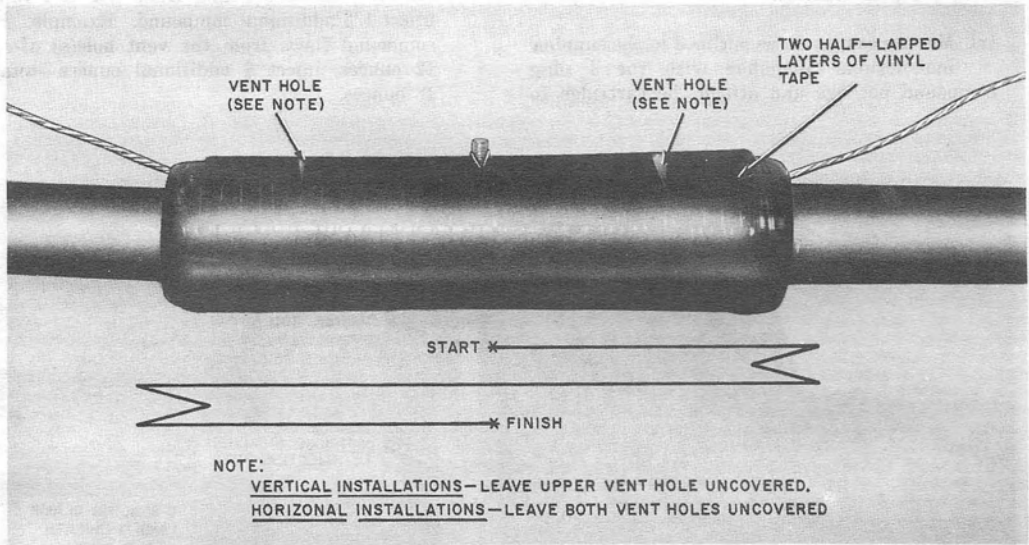


Fig. 27—Vinyl Tape Applied Over Entire Sleeve

(q) On multisheath cable, place a C sealing clamp on each side of the sleeve (approximately 2 inches from the sleeve) to restrict the flow of compound between the sheaths. These constricting clamps should remain on the cable at least 24 hours after the compound is injected in the sleeve (Fig. 28).

Note: Cable under pressure should be vented on each side of the sheath opening before injecting the compound to ensure zero pressure at the plug location.

(r) Mix the compound as outlined in the supplier instructions furnished with the J plug compound package and attach the cartridge to

the injection port (Fig. 28). **Compound supplied by different manufacturers should not be mixed in the same plug.**

(s) Using the dasher rod, inject the compound (several cartridges may be required) until it begins to flow out the vent hole(s). (See Fig. 28.) At this time, the vent hole(s) must be taped with several layers of tape.

Note: When compound flows from the vent hole(s), the closure and cable are 2/3 full; inject 1/3 additional compound. Example: If compound flows from the vent hole(s) after 12 ounces, inject 6 additional ounces—total 18 ounces.

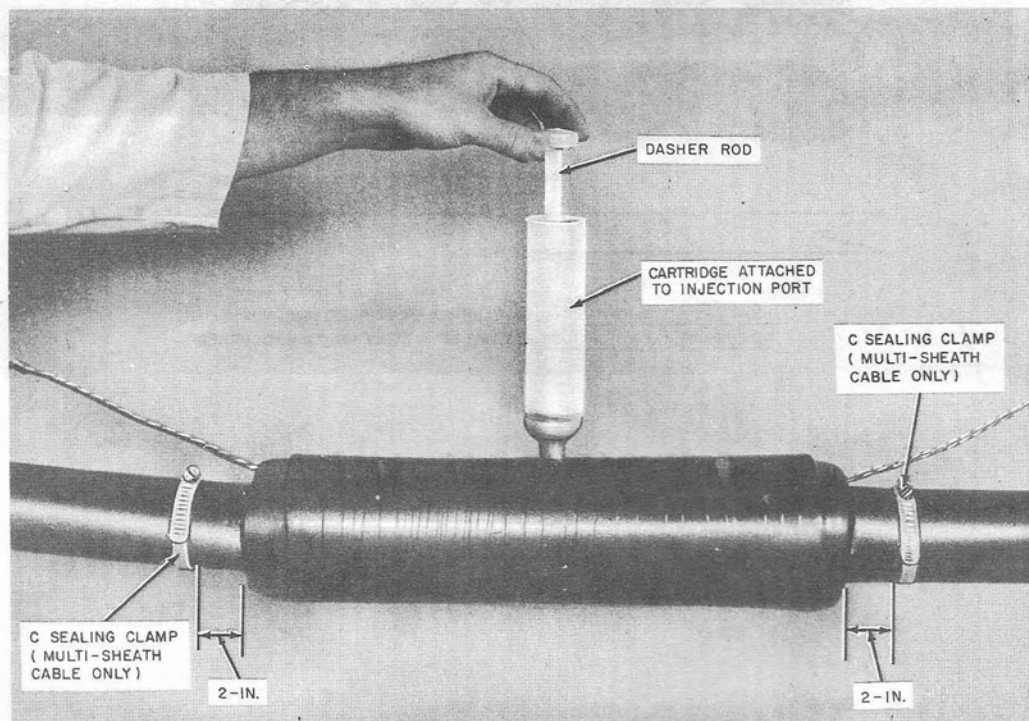


Fig. 28—Using Dasher Rod to Inject Compound

- (t) Install the injection gun on the cartridge and continue injecting compound until sustained back pressure is encountered (Fig. 29).

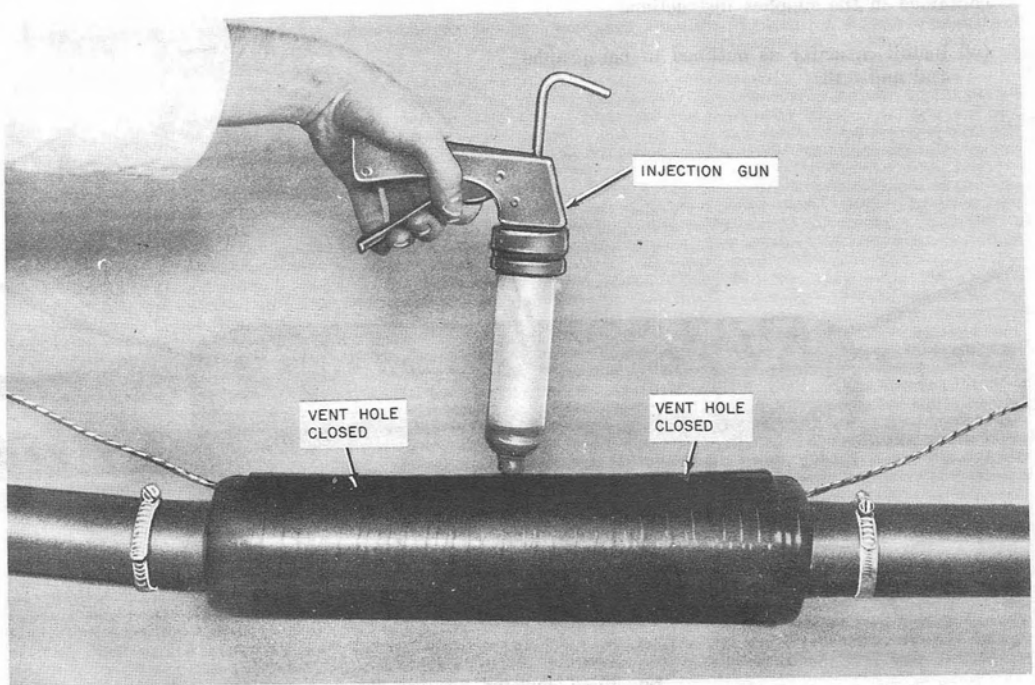


Fig. 29—Completing Injection of Compound with Vent Holes Closed

- (u) Seal the sleeve injection port, using the caps provided with the flange in the J plug compound package (Fig. 30).
- (v) Before applying pressure, observe the cure time versus temperature recommendations contained in the supplies instructions.
- (w) Install capacitor as outlined in paragraphs 4.12 and 4.13.

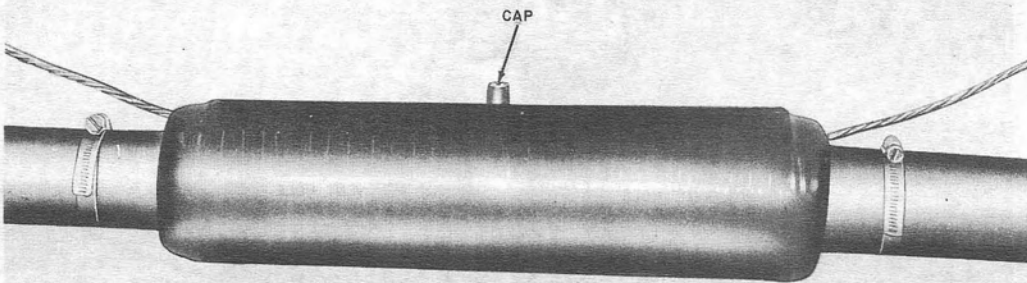


Fig. 30—Completed Pressure Plug