

LEAD-CALCIUM SLEEVES

DESCRIPTION AND INSTALLATION

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1.03 The B Lead-Calcium Sleeve replaces the lead, lead-antimony, and extra strength lead sleeves.

1.04 Due to the higher tensile strength and long term creep resistance, lead-calcium sleeves may be used on both pressurized and nonpressurized cables. The reinforcing of lead sleeves, as outlined in Section 637-020-200, is not required with either split or nonsplit B Lead-Calcium Sleeves.

1.05 The solder used for wiping is covered in Section 633-020-011.

1.06 Lead-calcium sleeves are to be used when the length or the diameter of the splice prohibits the use of a splice case.

2. PRECAUTIONS

2.01 The following precautions are to be observed when wiping or unwiping joints:

(1) General

- (a) Regular eye protection must be worn at all times.
- (b) Use a drip pan to catch drippings, to prevent injury to persons or damage to property.
- (c) When working near a wall, fence, or in a building, protect the property from drippings.
- (d) Do not allow pedestrians to pass beneath a splice when it is being wiped or unwiped.
- (e) To assure adequate ventilation and to prevent tent flaps from being blown into an open flame, the tent flaps must be open and tied securely (aerial and buried plant only).
- (f) All gas cylinders must be placed outside the tents and as far from the open flame as possible.
- (g) Turn torches or furnaces off at the gas cylinder. Before storing torch or furnace, open valve on torch or furnace and flush the hose.

(h) At poles with conduit or pipes attached, the tent must be placed in such a manner that the conduit or pipes are outside the tent.

(i) At filled splices it is necessary to boil the splice out and remove the existing muslin before unwiping the joints. Allow the splice to cool, then wrap with new muslin.

(j) Before wiping or unwiping joints or doing any other solder work on a cable under pressure, bore a hole in the sleeve with a cable drill or, if there is a valve or flange on the sleeve, remove the valve core or the plug from the flange so that any gas pressure may be released through the opening before the solder work begins. This prevents the gas from escaping through the molten solder which would interfere with the soldering operation and could blow molten solder onto the craftsman and cause injuries.

(2) Wiping

- (a) All tools used in the wiping operation must be kept dry and clean.
- (b) All tools must be placed on a dry surface.
- (c) Any solder added to, or tools placed in, a hot solder pot must be dried by preheating to avoid explosion of the liquid solder.
- (d) Wiping gloves must be worn during the casting and wiping operation.

(3) Torch Method (Aerial and Buried Plant only)

- (a) When using the torch, do not allow the flame to contact the strand. Heating the strand may weaken it or cause it to break.
- (b) Do not allow the torch flame to come in contact with wood backboards, inflammable materials, conductors, muslin, and wax or paraffin from the splice.
- (c) Ventilate tents while the torch is lighted.
- (d) Observe all other precautions or uses as covered in local instructions or procedures.

3. DESCRIPTION OF B LEAD-CALCIUM SLEEVE

3.01 B Lead-Calcium Sleeves (Fig. 1), 3-1/2 inch or larger (Fig. 1A), have two half-round beads and a V-shaped slot extending the length of the sleeve. Sleeves 3-1/4 inch or smaller (Fig. 1B)

have two pairs of parallel beads extending longitudinally the length of the sleeve on the outer surface. This design (no V-shaped slot) is required when the sleeve is used as an auxiliary. The diameter, length, weight, and wall thickness for the various sizes are listed in Table A.

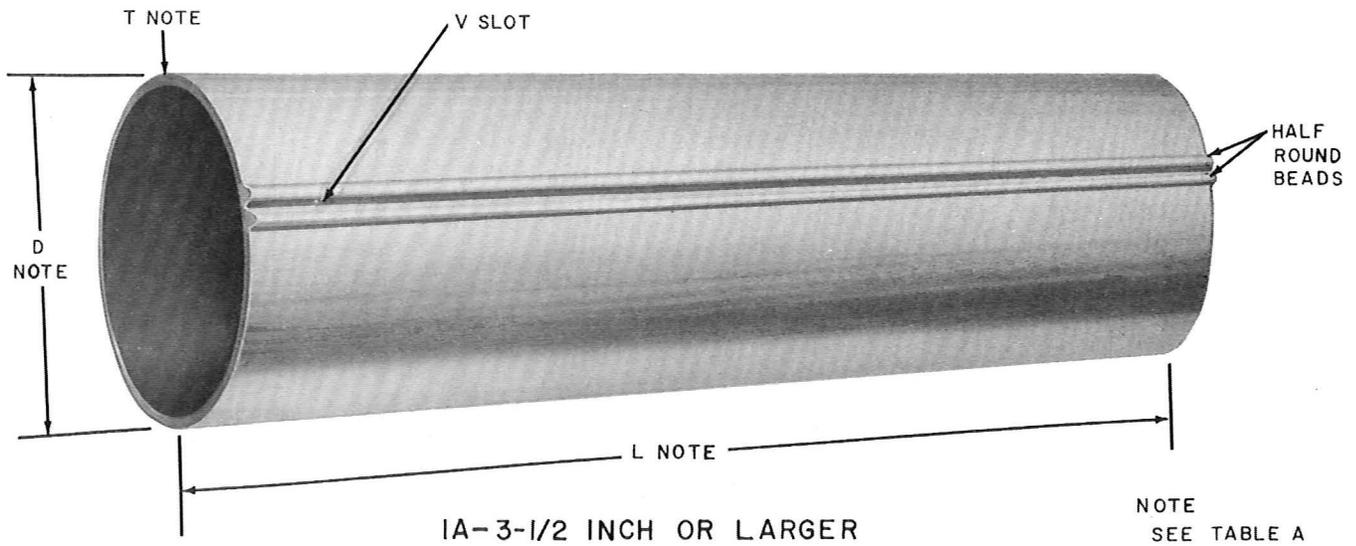
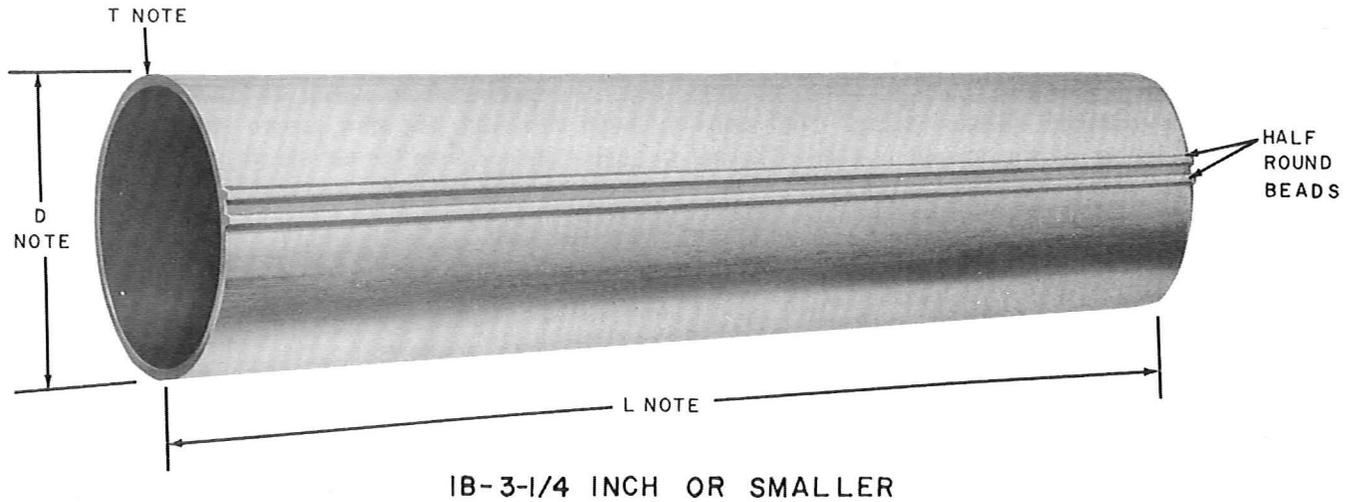


Fig. 1—B Lead-Calcium Sleeve

Note: The diameter of a lead sleeve is always given as the inside diameter.

3.02 The V-slot and half round beads on the 3-1/2 inch or larger sleeves are used as guides in splitting and seaming the Lead-Calcium Sleeve. When splitting a sleeve, the V-slot provides a groove for the cable saw or B Sleeve Splitter to follow. The half-round beads provide a guide for the correct bevel and proper amount of material to be removed. The two pair of beads on the 3-1/4 inch or smaller sleeves serves the same purpose. Soldering of the unsplit V-groove is not required.

4. GENERAL RULES

4.01 The location of splice openings should be carefully planned to avoid the use of split sleeves wherever possible.

4.02 If a new sleeve is to be used to close an opening from which an existing sleeve has been removed, the new sleeve should be about 3 inches longer than the old sleeve. This will provide fresh wiping surfaces.

TABLE A

B LEAD CALCIUM SLEEVES — SIZES AND WEIGHTS

| INSIDE DIAMETER (INCHES) | LENGTH (INCHES) | | WALL THICKNESS (INCH) | WEIGHT (APPROX.) | |
|--------------------------------|-----------------|------|-----------------------------|--------------------------|-------------------------|
| | SHORT | LONG | | SHORT LENGTH (POUNDS) | LONG LENGTH (POUNDS) |
| 3/4 | 15 | 72 | .070 | 1.1 | 5.1 |
| 1 | 15 | 72 | .070 | 1.6 | 7.8 |
| 1-1/4 | 15 | 72 | .070 | 1.8 | 8.5 |
| 1-1/2 | 17 | 72 | .070 | 2.4 | 10.3 |
| 1-3/4 | 17 | 72 | .077 | 2.7 | 11.5 |
| 2 | 17 | 72 | .086 | 3.6 | 15.3 |
| 2-1/4 | 17 | 72 | .094 | 4.3 | 17.9 |
| 2-1/2 | 20 | 72 | .101 | 6.2 | 21.9 |
| 2-3/4 | 20 | 72 | .110 | 7.3 | 25.9 |
| 3 | 20 | 72 | .115 | 8.6 | 30.8 |
| 3-1/4 | 20 | 72 | .123 | 9.7 | 35.3 |
| 3-1/2 | 20 | 72 | .097 | 8.5 | 30.6 |
| 4 | 24 | 72 | .108 | 13.1 | 39.3 |
| 4-1/2 | 24 | 72 | .119 | 16.4 | 49.0 |
| 5 | 24 | 72 | .129 | 20.0 | 60.0 |
| 5-1/2 | 27 | 72 | .140 | 26.9 | 71.8 |
| 6 | 27 | 72 | .151 | 31.5 | 74.0 |
| 6-1/2 | 27 | 60 | .162 | 36.8 | 81.7 |
| 7 | 27 | 60 | .173 | 42.4 | 93.2 |
| 7-1/2 | 27 | 60 | .184 | 48.4 | 107.5 |
| 8 | 27 | 60 | .195 | 54.9 | 122.2 |
| 9 | 27 | 60 | .216 | 68.9 | 153.2 |
| 10 | 27 | 60 | .238 | 84.2 | 187.2 |

4.03 At test openings, trouble openings, capped ends, duct splices, and butt splices, the sleeve diameter should be just large enough to fit over the wrapped conductors.

4.04 At underground locations C Pressure Flanges should be installed on lead sleeves before they are wiped. The F Pressure Testing Valve is installed after the wiping operation and is used to flash test the sleeve. It is also used to obtain pressure readings in a pressurized cable system. When required, the F Pressure Testing Valve is removed and a C Pressure Flange Plug is installed in the C Pressure Flange to seal the opening.

4.05 In aerial plant the C Pressure Flange and F Pressure Testing Valve are installed where called for on the detail plan.

4.06 All surface areas where the soldering operation will take place must be cleaned and when required coated with stearine.

Note: When considerable beat-in on 3-1/2 inch or larger sleeves is required, splitting at the base of the V-slot can be avoided by removing some of the web at the end of the sleeve. (File approximately 1-1/2 inches of the V-slot prior to beat-in.)

4.07 End plates should be used in aerial, buried, or underground plant when the lead sleeve diameter is larger than 2-3/4 inches.

4.08 To bond lead sleeves wiped on polyethylene sheath cables in aerial plant, solder a No. 6 Ground Wire to the sleeve and terminate the opposite end on the strand using a strand ground clamp or cable lashing clamp. In underground plant, bond all sleeves together using bonding ribbon or No. 6 Ground Wire.

4.09 In aerial plant, lead sleeves are lashed to the strand with lashed cable supports. The description and use of these supports is covered in Section 627-340-101. The use of lashed cable supports at Y-splices is covered in Section 633-020-201.

5. WIPING SOLDER

5.01 Wiping solder is an alloy of tin and lead with small quantities of other metals. The tin content of the standard wiping solder is about 35 percent. Although the solder handles well for

wiping, the joints are porous and must be treated with C Sealing Solder while still hot (Part 7). Excess lead will produce a coarse and more porous solder. Excess tin will not allow sufficient time for a satisfactory joint to form before the solder solidifies.

5.02 The following rules may be used as a general guide to determine whether solder has the proper percentage of tin and lead:

(a) Solder with excess lead will be coarse and have a dull white chalky appearance when cold.

(b) Good solder, when poured on a dry concrete, stone, or metal surface, will show bright spots on the top surface after cooling.

5.03 The wiping and unwiping of sleeves tends to increase the lead content of the solder. Discard solder that contains excess lead.

5.04 Care should be taken not to introduce any zinc (from galvanized hardware) into the solder. A very small quantity will adversely affect the solder.

5.05 Wiping solder should be heated to about 800°F. The surface of molten solder gives an approximate indication of its temperature. As the temperature rises, the surface of the molten solder changes from yellow to blue to gray. When the surface has a uniform gray color, the solder is at approximately the right temperature.

5.06 When solder is heated, a small quantity of dross collects on the surface. Before starting wiping operations, skim off the dross using a ladle or old rasp. Stir the solder thoroughly.

Caution: Preheat the ladle or old rasp. Do not insert a cold ladle or rasp into the molten solder.

6. JOINT TINNING

JOINT

6.01 To properly wipe a joint it is necessary to form an alloy bond between the surfaces to be joined. The formation of this alloy is referred to as tinning the surface.

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6.02 To tin a lead surface it must be bright and clean. Clean the lead surface with a carding brush. Shave hooks or rasps should not be used on lead sheaths as they tend to remove an excessive amount of lead. They also leave transverse score marks which weaken the sheath causing fatigue cracks, especially in aerial cables.

6.03 A clean lead surface becomes dull quickly when exposed to the air. Coat the cleaned surface with stearine immediately after cleaning. The stearine also serves as a flux and makes tinning of the lead surface easier.

SOLDER COPPER

6.04 To properly tin a soldering copper proceed as follows:

- (1) Using a rasp, file the tip of the cold soldering copper until all foreign material and pits are removed. Finish the tip with a fine tooth file.
- (2) Heat the soldering copper, being careful not to overheat, and apply seam solder to the tip until a bright finish is observed.

7. C SEALING SOLDER

7.01 C Sealing Solder must be used to seal the pores that develop in wiped joints.

7.02 C Sealing Solder contains bismuth, lead, and tin. It is available in 1/4-pound sticks that are 1/4 inch square by 13-1/2 inches long. C Sealing Solder melts at 200°F.

Caution: *Before applying the sealing solder, allow the joint to partially cool. When applied to a joint that is too hot the sealing solder will not flow smoothly.*

7.03 The surface of a wiped joint is coated with sealing solder by rubbing the end of the stick over the joint. Then a soft cloth is used to spread the molten sealing solder over the entire wiped area including the surface of end plates

when they are used. The surface area coated with the sealing solder will have a bright appearance. In this way it can be determined when all areas of the joint have been treated.

7.04 Do not build up a heavy coating of sealing solder on the joint. The sealer is not intended to seal defects in the joint due to improper tinning, overwipes, cold solder, etc. Such defects must be corrected by rewiping the joint.

7.05 Only a small quantity of sealing solder is required for treating a joint, about one ounce for a 6-inch lead sleeve; therefore the quality of solder in the solder pot will not be impaired when treated joints are unwiped.

8. CASTING AND PREPARATION OF END PLATES

8.01 The B, C, and D End Plate Molds are used to cast end plates that are used in conjunction with lead sleeves to enclose a splice.

8.02 To prevent excessive beat-in and working of the splice bundle, end plates should be used when the sleeve diameter is 3 inches or greater. End plates should also be used in conjunction with sleeves with thin lead sheath cables and lead sheath cables having inner polyethylene jackets.

8.03 The B End Plate Mold (Fig. 2) consists of the following:

- (a) Rings in sizes 3 inch and larger corresponding to most standard sizes of B Lead-Calcium Sleeves
- (b) Mold core plugs ranging in size from 1/2 inch up
- (c) One spirit level
- (d) One 7-inch square baseplate on which rings are placed for casting end plates
- (e) A wood carrying case.

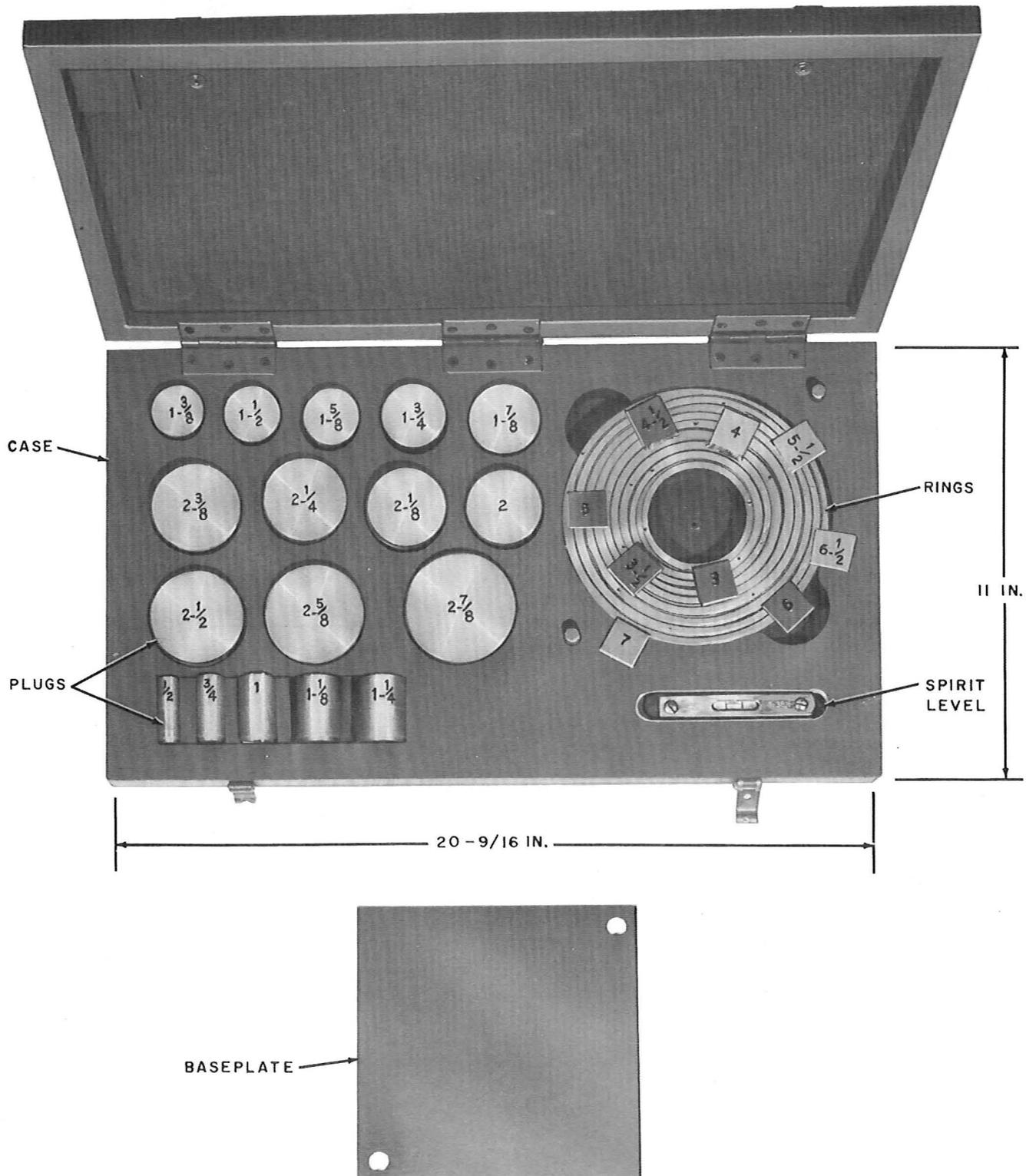


Fig. 2—B End Plate Mold

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8.04 The C End Plate Mold, illustrated in Fig. 3, and the D End Plate Mold consist of the following:

- (a) **C End Plate Mold:** Three rings with diameters of 7-1/2, 8, and 9 inches
- (b) **D End Plate Mold:** One 10-inch diameter ring and one each 3-, 3-1/4, and 3-1/2 inch core plugs
- (c) One baseplate on which rings are placed for casting end plates
- (d) A wood carrying case.

Note: The mold core plugs from the B and D End Plate Molds are used with the C and D End Plate Mold Rings.

8.05 Asbestos or heavy leather-faced gloves should be worn in pouring the end plates and in removing them from the mold.

8.06 The baseplate of the mold should be level for casting. Where the ground cannot be leveled, place the baseplate on a box, board, or other substantial object which can be leveled. Then level the object.

8.07 Do not use the spirit level (Fig. 2) on a hot baseplate or mold ring.

CASTING AND PREPARATION

8.08 Place the baseplate on a firm surface and level the plate with the spirit level. In casting end plates larger than 7 inches in diameter the baseplate provided with the C or D End Plate Mold must be used. Select an outside mold ring of the proper size and place it on the baseplate as illustrated in Fig. 4.

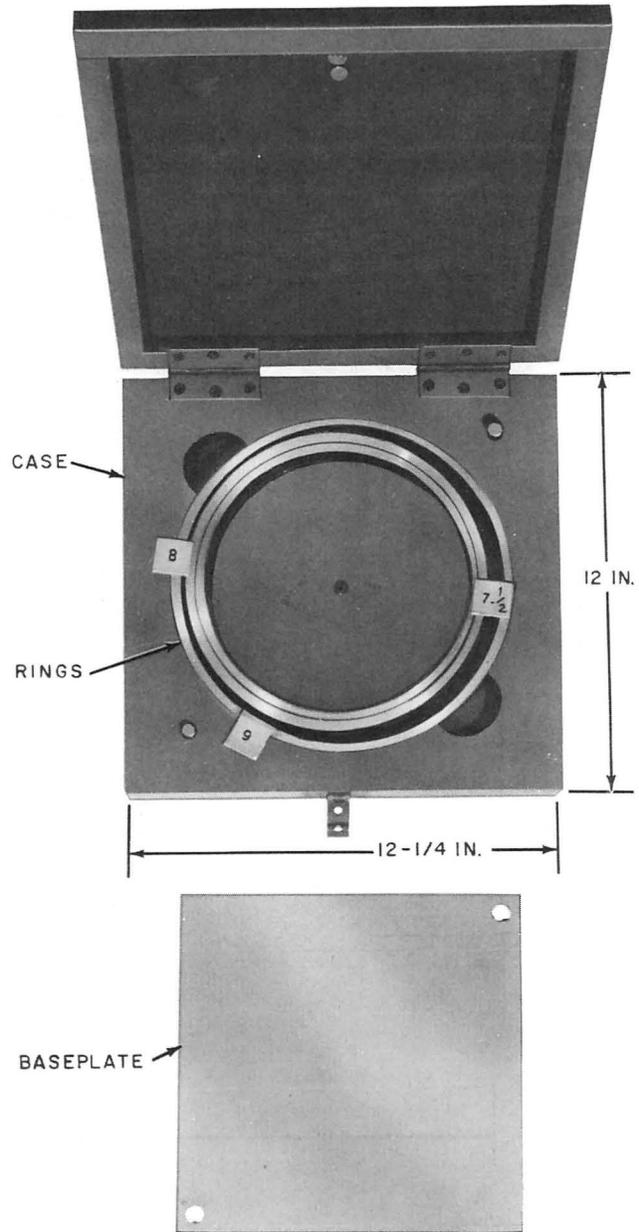


Fig. 3—C End Plate Mold

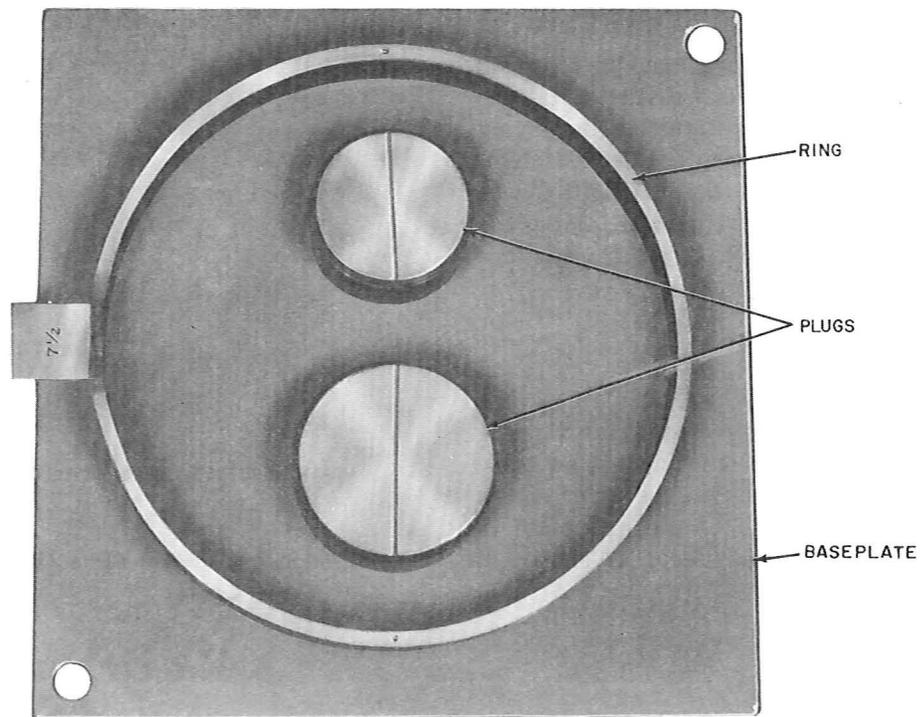
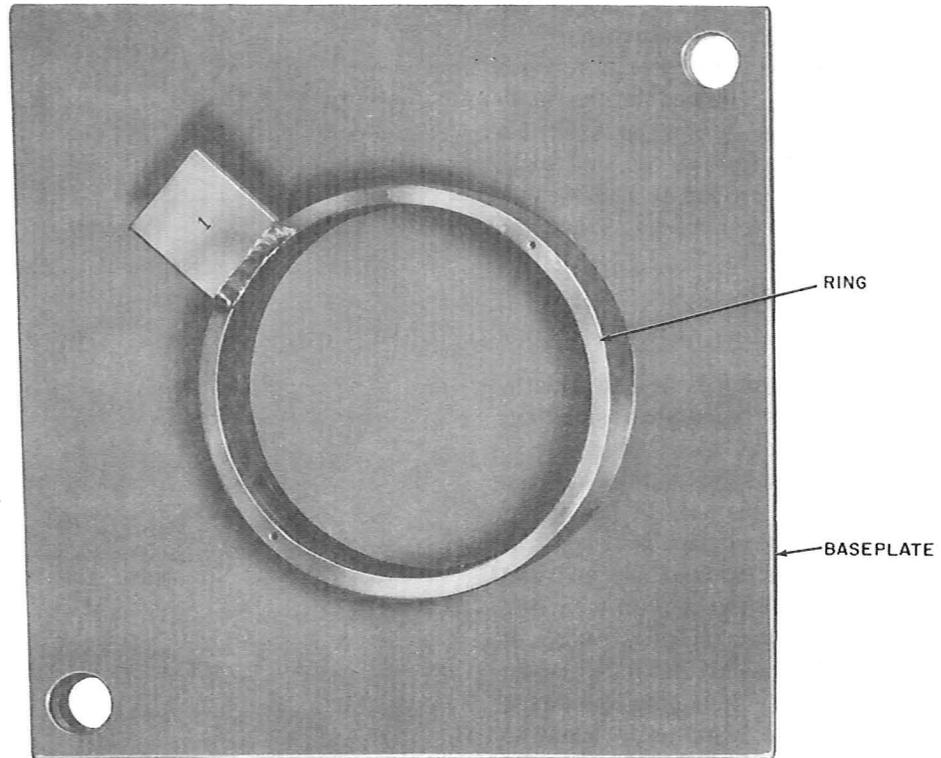


Fig. 4—Mold Rings Placed on Baseplate

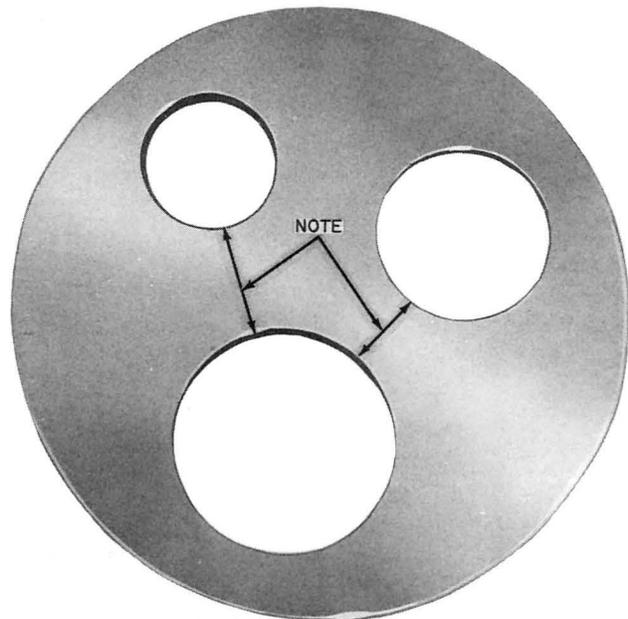
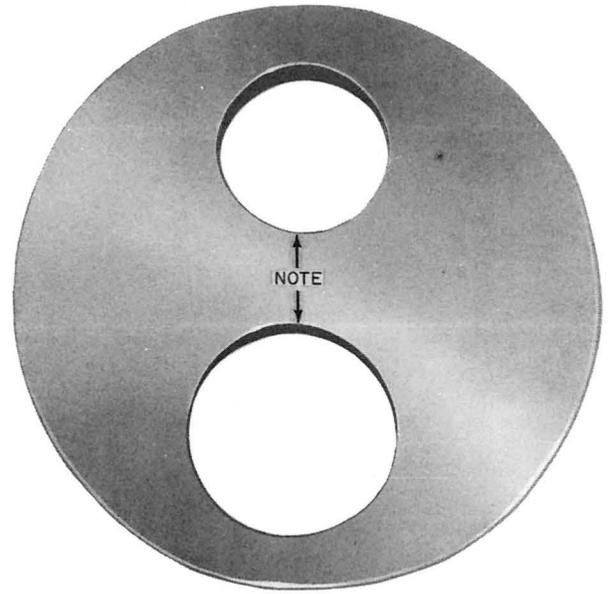
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8.09 Select core plugs with approximately the same or slightly larger diameter than the cables or auxiliary sleeves involved. For a straight splice the core plug may be centered in the plate or offset. On an aerial cable it may be desirable to offset the hole toward the top of the end plate so the cable can be positioned close to the strand. Where two or more cables are involved, space the plugs as illustrated in Fig. 5.

8.10 Prepare a pot of lead, using junk lead sheath, lead-antimony sleeving, pure lead sleeving, or lead-calcium sleeving. Heat the solder pot to about 900 or 1000°F, which is somewhat above the temperature of wiping solder. Preheat the baseplate, rings, and plugs to allow the molten lead to flow freely in the mold. To avoid laminating, use two ladles simultaneously and pour the molten lead into the mold in smooth fast streams. The streams of metal should be directed between the plugs when casting a multiple joint plate. Splashing should be avoided. The ring should be completely filled to the top to obtain the proper thickness of the end plate.

8.11 The steel rings and plugs may be removed from the end plate as soon as the metal has hardened. The ring is readily removed by prying upward on it while pressing down on the end plate. The plugs may be removed by tapping lightly with a hammer. It is important to prevent the plugs from falling and being damaged when they are removed from the mold.

8.12 Rasp the openings in the end plate to the minimum diameter required to permit slipping the end plate freely over the stearine coated cable sheath or auxiliary sleeve. Bevel the edge of the hole(s) on the outside surface of the end plate to an angle of 45° by 3/16 inch deep, as shown in Fig. 6.



NOTE:
MAXIMUM SPACE WITHIN DIAMETER OF LEAD SLEEVE

Fig. 5—Spacing of End Plate Openings for Two and Three Cables

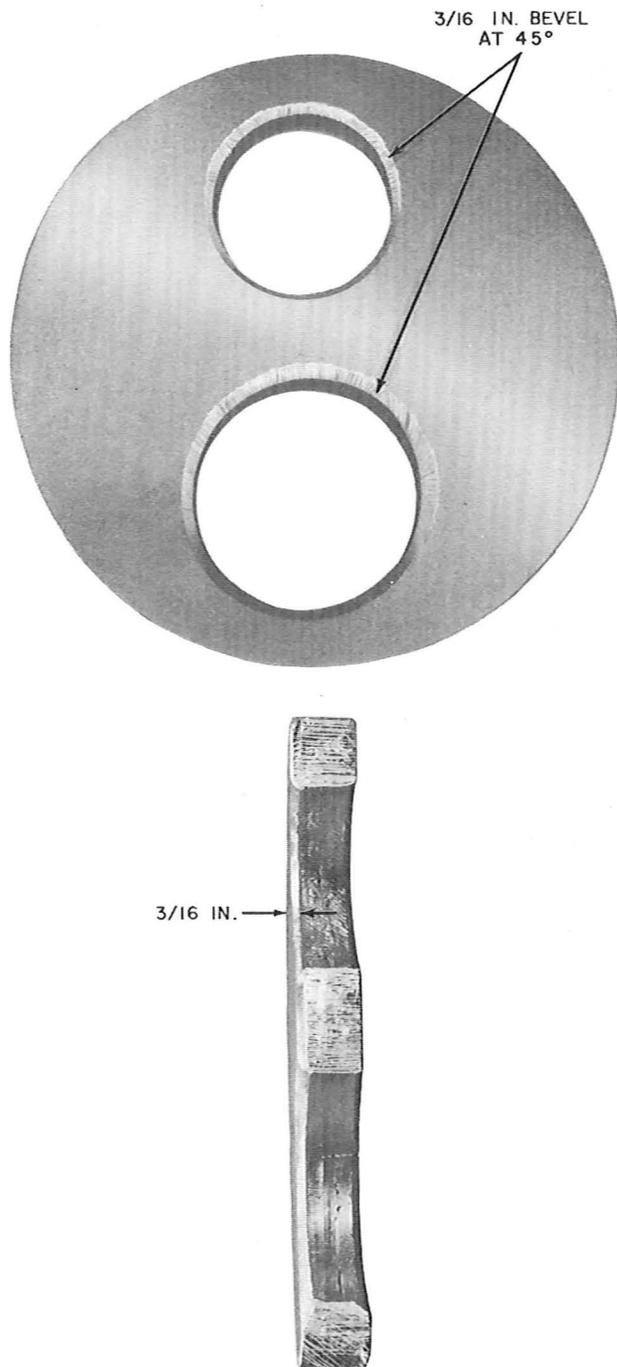


Fig. 6—End Plate Openings Beveled

8.13 Split end plates are required where the cable ends are not free. If a vise and a cable saw are available the plates can be made as outlined in 8.10, 8.11, and 8.12 and then cut apart. Any other method of splitting such as cutting with a chipping knife, etc, distorts the end plates and should not be used.

8.14 Casting of split end plates that do not require cutting can be carried out as follows:

- (a) Place plugs in the mold ring and put B Aluminum Tape around the plugs and in the area to be split as illustrated in Fig. 7.
- (b) Extend the tape on one side of the plugs to the mold ring, and to within 1/2 inch of the ring on the other side, which will permit spreading the end plate. In the split area the tape should be double thickness with the adhesive side in.
- (c) Pour the end plates as outlined in 8.10 and 8.11.

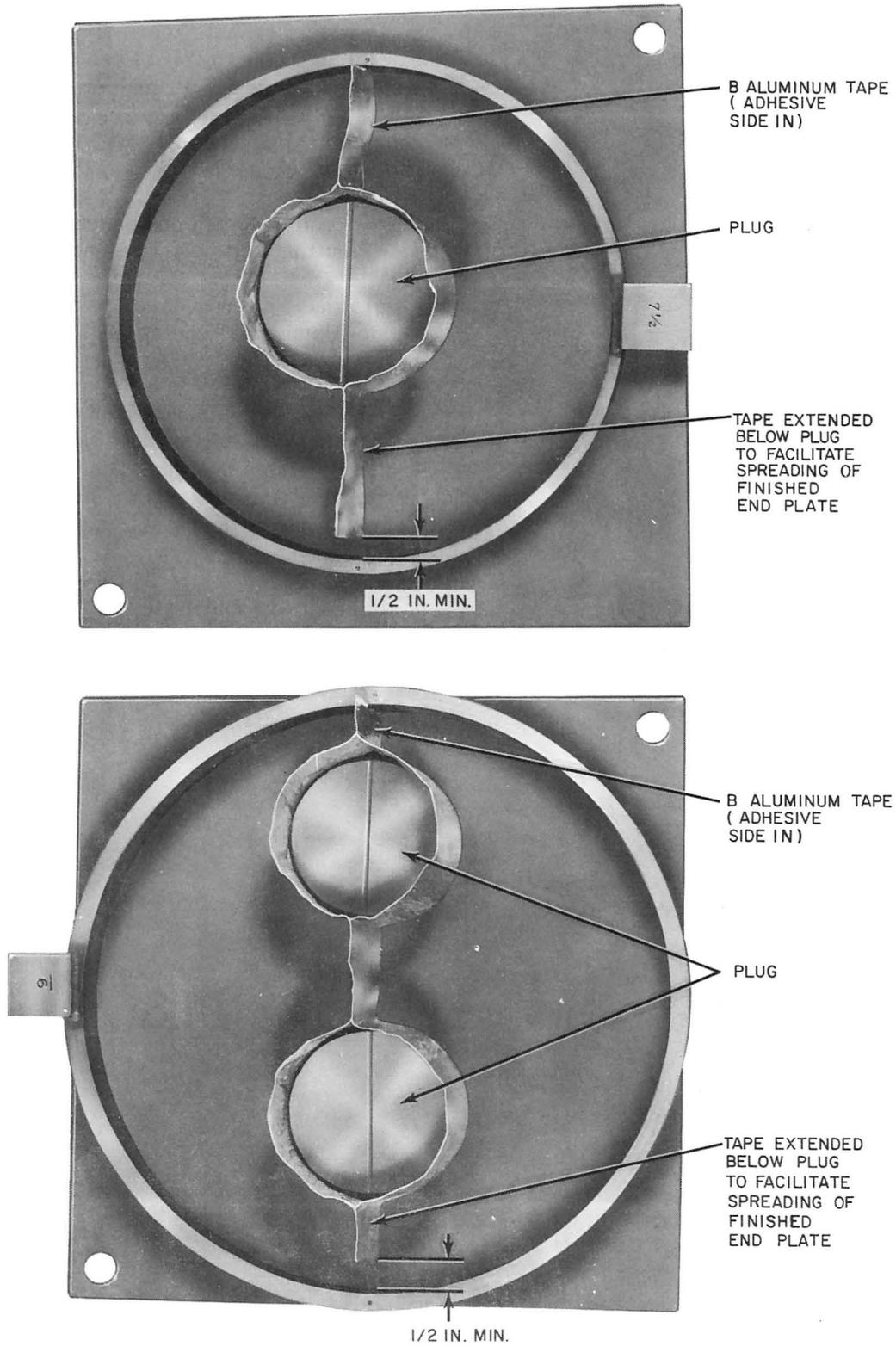


Fig. 7—Core Plug and Mold Ring Assemblies and Multiple Opening End Plates

- 8.15 Bevel the outside surface of the splits in the end plates as outlined in 8.12.
- 8.16 Fig. 8 illustrates end plate with single opening.
- 8.17 Fig. 9 illustrates end plate with multiple openings
- 8.18 Using a carding brush, clean all surfaces of the end plate that will subsequently be wiped or soldered and coat with stearine.

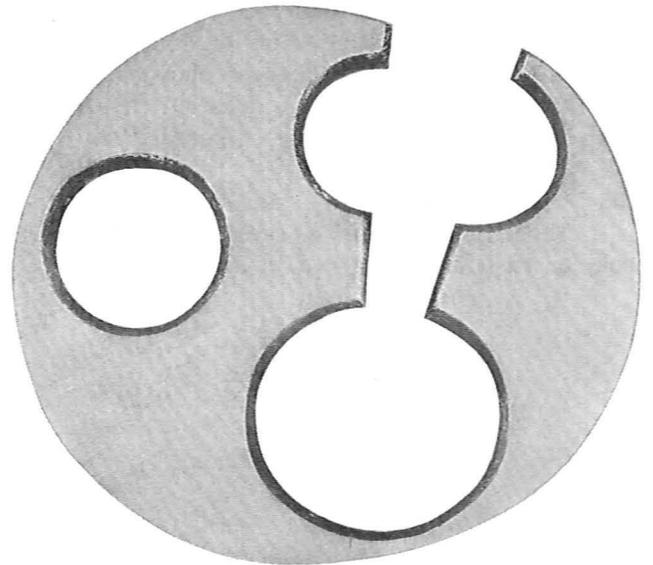
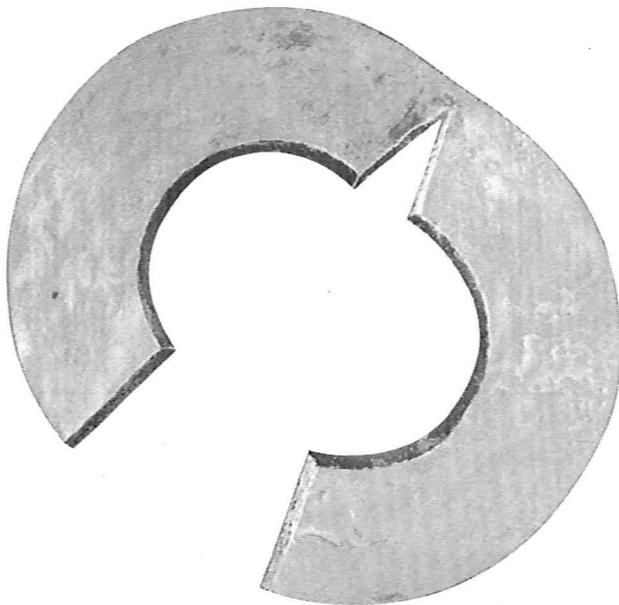
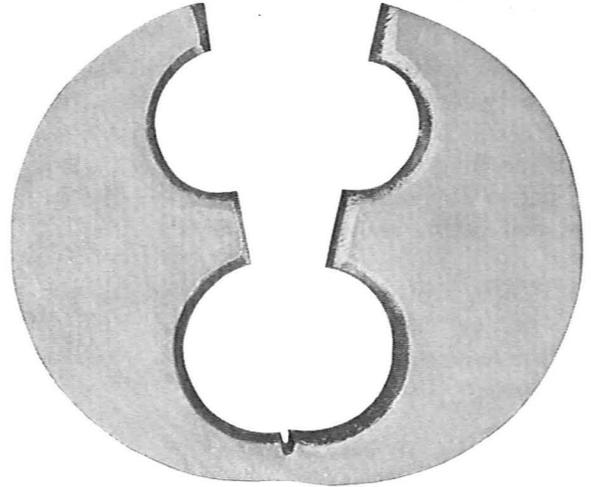


Fig.8—Split End Plate (Single Opening)

Fig. 9—Split End Plate (Multiple Opening)

9. LEAD WEDGES

9.01 Lead wedges are used to provide separation between cables at bridge splices. Although 17 different sizes of wedges are available, they should no longer be used on new work when the lead sleeve diameter exceeds 2-3/4 inches. In such cases end plates should be used (Part 8).

9.02 Each lead wedge is identified by the size number cast in the surface. Fig. 10 illustrates a typical lead wedge. Table B lists the sizes and dimensions of the lead wedges.

9.03 The No. 10 lead wedge (Fig. 11) is used in three-way joints.

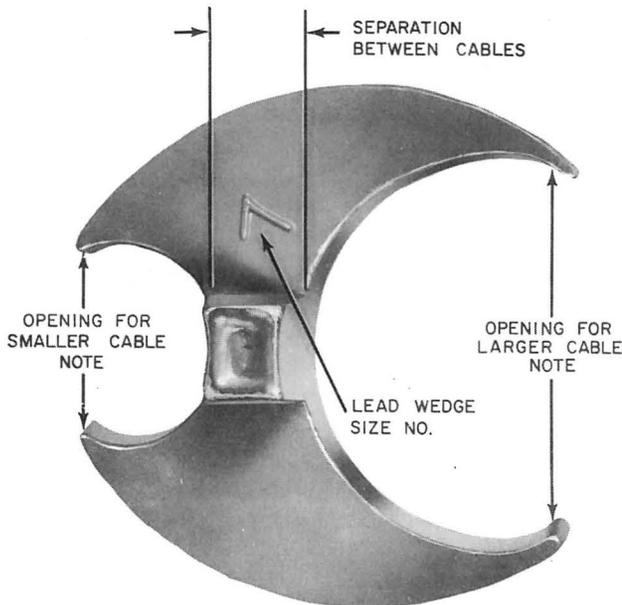
9.04 The proper size lead wedge to be used at Y-joints can be selected by measuring the diameters of the cables with the B Measuring Tape. When the selected lead wedge does not fit properly it can be adjusted by rasping or bending the ears.

9.05 Before placing a lead wedge, clean it thoroughly using a carding brush, shave hook, or rasp and then coat it with stearine.

TABLE B

LEAD WEDGES — SIZES AND DIMENSIONS

| WEDGE SIZE NUMBER | SMALLER CABLE OPENING (INCHES) | LARGER CABLE OPENING (INCHES) | SEPARATION BETWEEN CABLES (INCHES) |
|-------------------|--------------------------------|-------------------------------|------------------------------------|
| 0 | 1/2 | 5/8 | 3/8 |
| 1 | 1/2 | 7/8 | 3/8 |
| 2 | 7/8 | 1-1/2 | 3/8 |
| 3 | 1-5/16 | 2 | 1/2 |
| 4 | 2 | 2 | 1/2 |
| 5 | 1/2 | 2-5/8 | 3/8 |
| 6 | 7/8 | 2-5/8 | 1/2 |
| 7 | 1-5/16 | 2-5/8 | 5/8 |
| 8 | 2 | 2-5/8 | 5/8 |
| 9 | 2-5/8 | 2-5/8 | 5/8 |
| 11 | 1/2 | 3-1/4 | 3/8 |
| 12 | 7/8 | 3-1/4 | 1/2 |
| 13 | 1-5/16 | 3-1/4 | 5/8 |
| 14 | 2 | 3-1/4 | 5/8 |
| 15 | 2-5/8 | 3-1/4 | 5/8 |
| 16 | 3-1/4 | 3-1/4 | 5/8 |



NOTE:
SEE TABLE B FOR DIMENSIONS

Fig. 10—Typical Lead Wedge

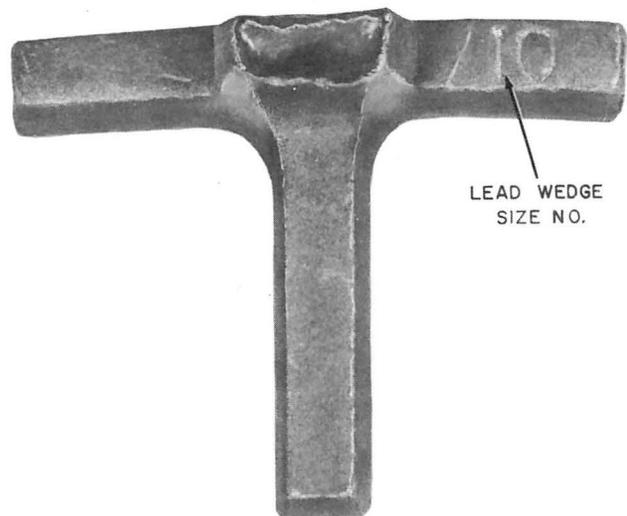


Fig. 11—No. 10 Lead Wedge

9.06 The lead wedge is placed between the cables and held in place by tying the cable butts firmly together with muslin (Fig. 12).

9.07 Fig. 13 illustrates the No. 10 lead wedge placed for a three-way joint.

10. PREPARATION OF LEAD SLEEVE

10.01 The lead sleeve should be cylindrical and free from defects. If the sleeve is not cylindrical or contains dents, use a drift plug of the same diameter as the sleeve to drift the sleeve as outlined in Section 081-420-101.

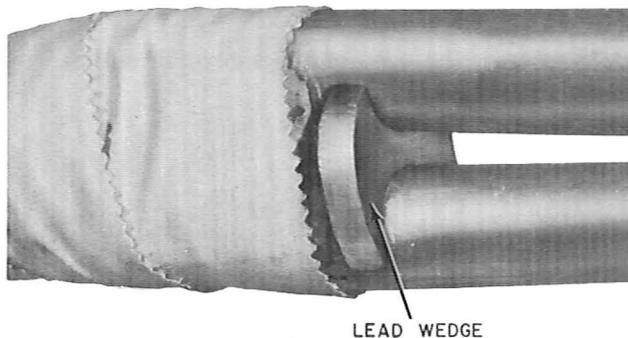


Fig. 12—Lead Wedge Placed for Y-Joint

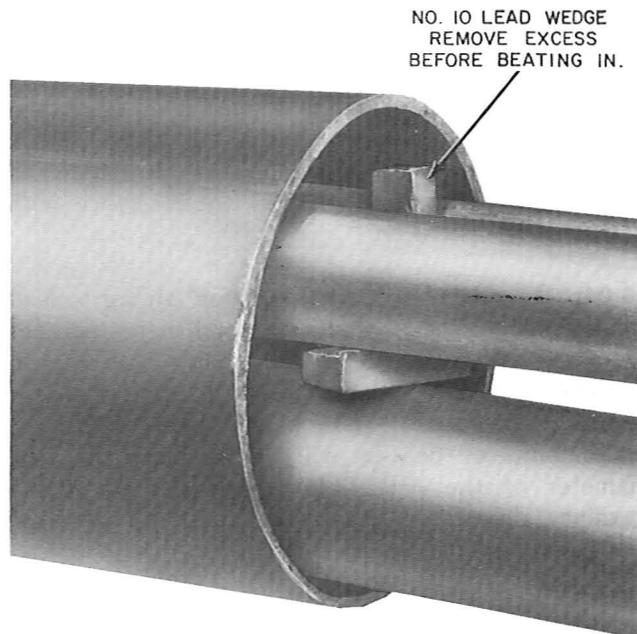


Fig. 13—No. 10 Lead Wedge Placed

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10.02 Using a carding brush, clean each end of the sleeve back about two inches from each end. Bevel each end of the sleeve, remove any burrs from the inside, and coat the cleaned area with stearine (Fig. 14).

10.03 Before the sleeve is slipped over the cable, be sure the inside is dry and clean. Place the cleaned sleeve over the end of the cable and slip it to a point where it will not interfere with the splicing operation.

10.04 At cut cable locations, when wiping to lead sheath cables and when end plates are not used, one end of the lead sleeve should be beat-in to a diameter slightly larger than the cable diameter before it is slipped. At auxiliary sleeve locations, the amount of beat-in will be restricted by the diameter of the end plate or taped part of the auxiliary sleeve.

10.05 When a considerable amount of time will elapse before the sleeve is to be wiped, it is necessary to protect the cleaned end by wrapping with muslin.

Note: If the stearine has dried out or is flaky, reclean the ends of the sleeve using a carding brush and recoat with stearine.

SPLIT SLEEVES

10.06 When the cable is not cut or when a slipped sleeve will interfere with the splicing operation, a split sleeve must be used.

10.07 Clean the ends of the sleeve as outlined in 10.02.

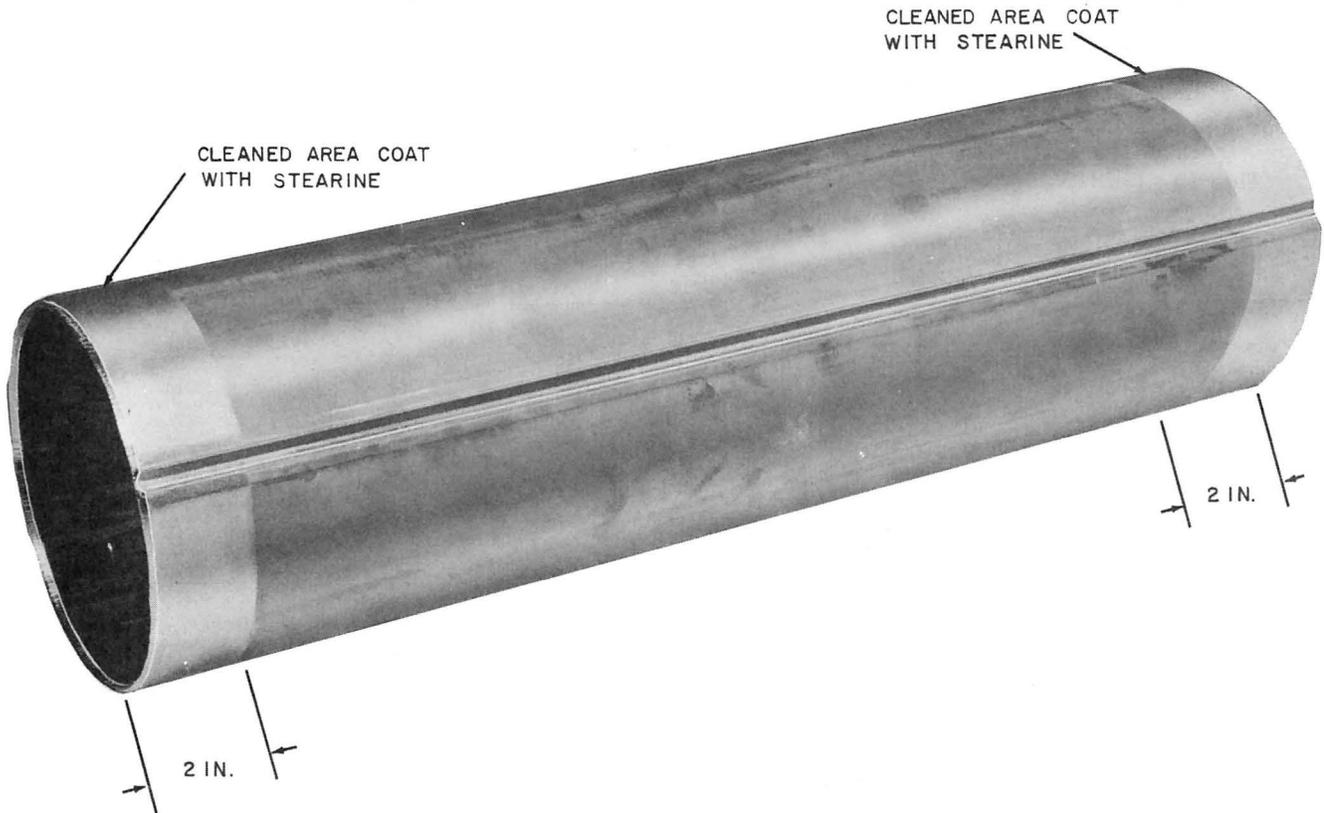


Fig. 14—Cleaned Sleeve

10.08 Using a cable saw or B Lead Sleeve Splitter (Section 081-780-105), split the sleeve between the two center beads (sleeves 3-1/4 inch or smaller) or the V-shaped slot, taking care that the cut is straight and extends squarely through the sleeve walls. Remove any burrs from the inside of the sleeve walls. Do not dress the split to avoid misalignment of the mating edges of the sleeve.

Note: When beveling the seam, remove the half-round beads on the 3-1/4 inch or smaller sleeve that provide the reference mark for splitting, also remove the beads from the 3-1/2 inch or larger sleeves that are used as

a guide for the width of the seam (Fig. 1A, 1B, and 15)

10.09 Open the split in the sleeve until it is wide enough to allow the sleeve to be slipped onto the cable. Using a rasp or shave hook, bevel the split as illustrated in Fig. 15. Clean a strip about 1/2-inch wide along each edge with a carding brush. Place cable pasters about 1/8 inch from the edge of the beveled areas. Coat the area between the pasters with stearine (Fig. 15).

Note: When running a seam do not allow the sleeve to rest on plastic sheath cables because the heat from the molten solder will damage the sheath.

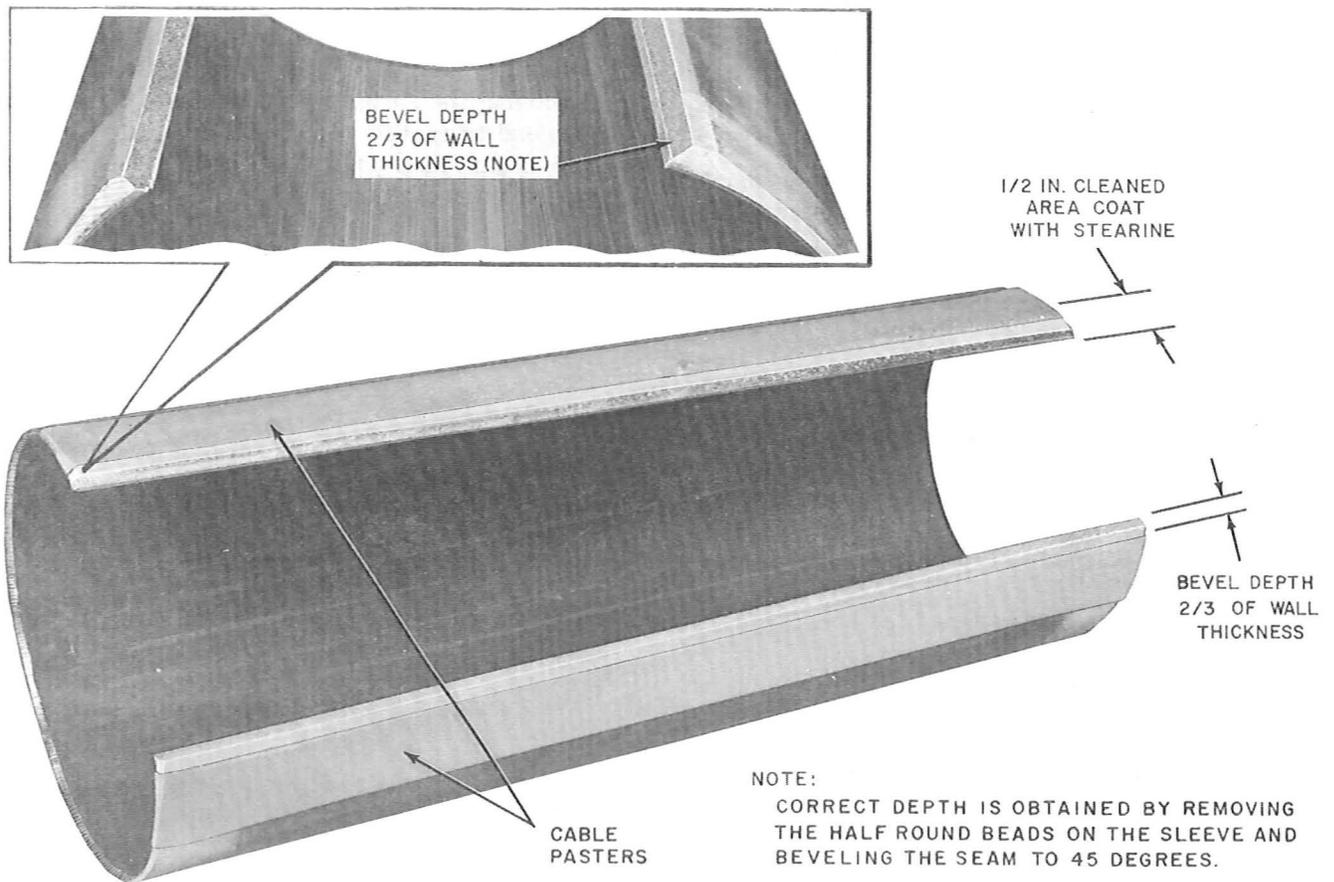


Fig. 15—Beveled V-Slot for Seam

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10.10 Slip the split sleeve over the cable and proceed as follows:

- (1) Partially close the sleeve by hand.
- (2) Place sealing or split sleeve clamps (Section 081-330-130) around the sleeve approximately 2 inches from each end (Fig. 16).

Note: Large diameter sleeves or sleeves of exceptional length may require a third clamp placed at the center of the sleeve.

- (3) Alternately tighten the clamps until the edges of the sleeve are drawn together (Fig. 16).
- (4) Draw the tip of a screwdriver through the V-slot to help seal the butted edges of the split at the base of the sleeve V-slot.
- (5) Tack the sleeve with solder near each end and, if necessary, at two or three intermediate points.
- (6) Remove the clamps.

10.11 After the sleeve has been prepared as outlined in 10.10 to run the seam with a soldering copper, proceed as follows:

Note: To ensure a good seam, the soldering copper must be hot and tinned.

- (1) Using seam solder, tin the seam over the entire length of the sleeve being careful not to break the tack points located at each end. Any spots that do not tin must be recleaned, coated with stearine, and tinned.
- (2) Coat the tinned area with stearine.
- (3) Starting about 1 inch from the end of the sleeve, with the soldering copper resting lightly on the pasters, the butt end tilted slightly and supported with a screwdriver, and the leading edge raised slightly above the sleeve, move the soldering copper with a steady movement over the length of the sleeve stopping and removing the soldering copper about 1 inch from the end (Fig. 17). To obtain adequate strength the seam must extend about 1/16 inch above the surface of the sleeve.
- (4) Examine the interior of the sleeve after the seam has been run for loose or excessive solder drippings and remove as required.

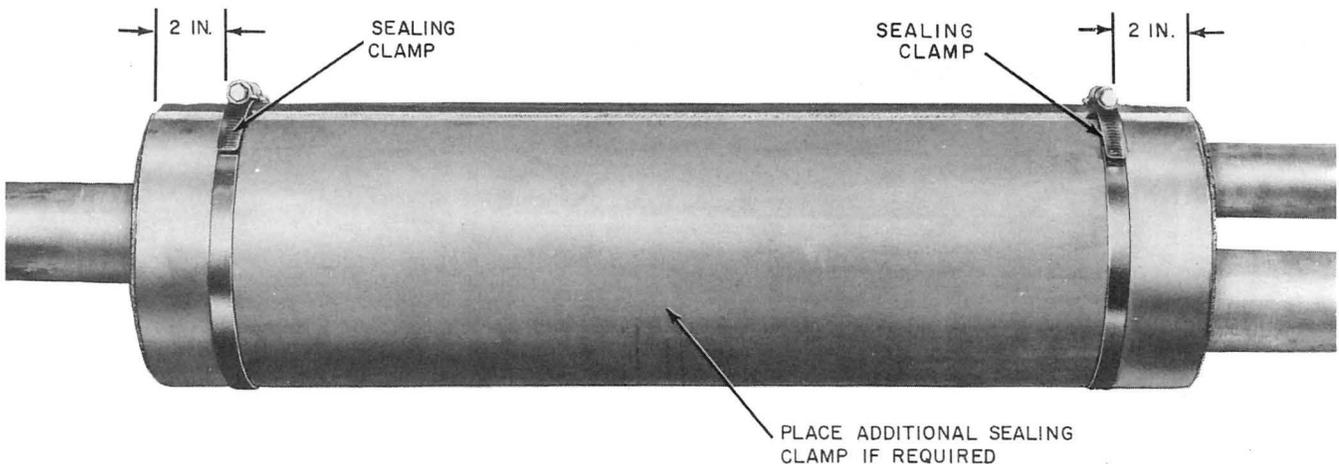


Fig. 16—Sealing Clamps Placed

10.12 After the sleeve has been prepared as outlined in 10.10, in aerial and buried plant only, the seam can be run with a torch as follows:

Note: Cable pasters are not required.

- (1) Starting at one end, being careful not to break the tack points, heat the stearine core solder and let it form in the V-slot the length of the sleeve.
- (2) Starting at one end, heat the solder with a brushing motion of the torch flame until the solder flows and adheres to the cleaned portion of the sleeve. The seam is tinned by heating around the adhered solder.

Note: When completed, the seam should extend about 1/16 inch above the sleeve surface.

11. PLACING LEAD SLEEVE FOR WIPING

11.01 In the area where the joint is to be wiped, clean about 2 inches of the sheath with a carding brush and coat with stearine (Fig. 18).

Note: Before placing the end plates, clean and coat the surface area that will be wiped with stearine.

11.02 If the cable is cut, slip the end plates before starting the splicing operation. If split end plates are to be used, they can be placed either before or after the splicing operation is completed.

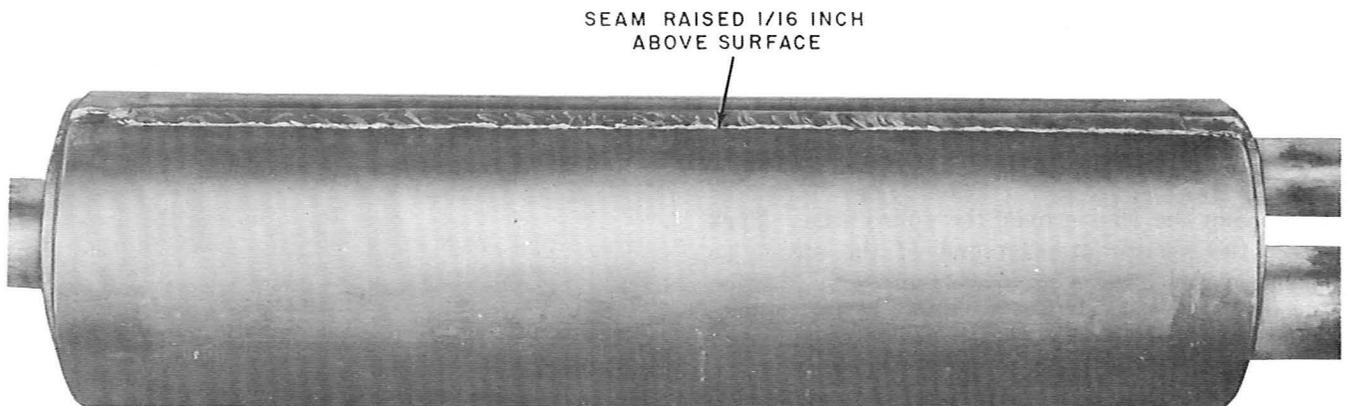


Fig. 17—Completed Seam



Fig. 18—Cleaned Sheath

11.03 When split end plates are used, compress the end plates using a sealing clamp until the edges butt. Tack the end plates at the split so it will not separate (Fig. 19).

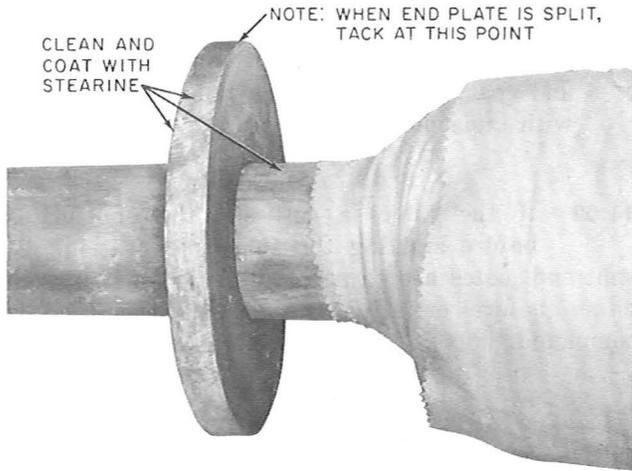


Fig. 19—End Plate Placed

11.04 Slip the sleeve over the splice area. Mark the sheath at each end of the sleeve so the end plates can be accurately placed. Position the end plates so the distance between the outside surfaces of the end plates is 1/4 inch greater than the sleeve length. Tack the inside surface of the end plates to the cable or auxiliary sleeves.

11.05 Slip the sleeve into position over the end plates. Rotate the sleeve slowly and at the same time beat in each end of the sleeve with a cable dresser or hammer until it fits tightly against the end plates. The final position of the sleeve should leave about 1/8 inch of the end plate exposed (Fig. 20).

11.06 When a split sleeve is used, position the seam vertically whenever possible. Close the seam as outlined in Part 10.

11.07 Place cable pasters on the cable about 1/4 inch from the end plates and on the sleeve about 1-1/2 inches from the outside face of the end plates (Fig. 21).

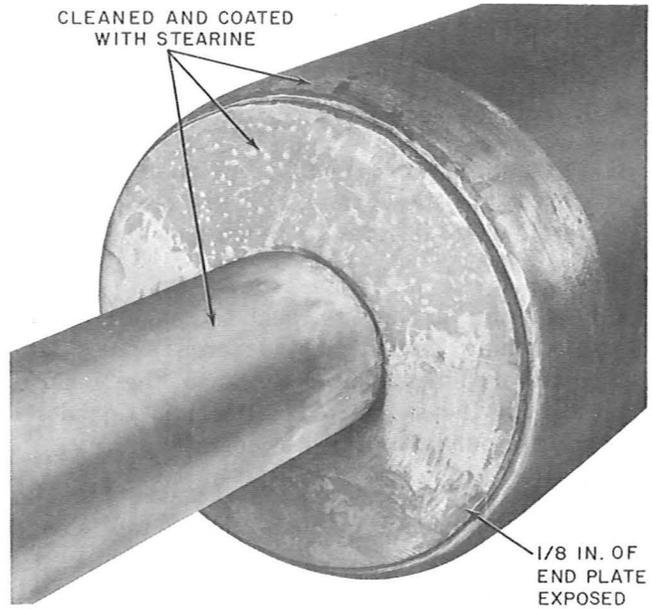


Fig. 20—Sleeve Placed (3 in. or larger)

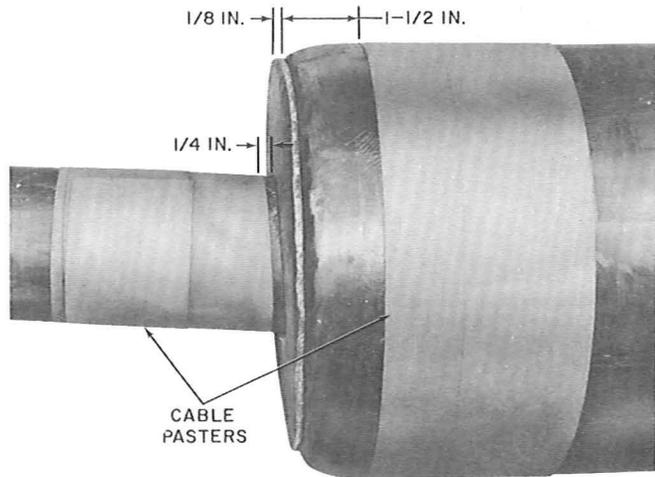


Fig. 21—Cable Pastes Placed

11.08 Sleeves of 2-3/4 inch or less in diameter may be placed without end plates. To place the sleeve proceed as follows:

(a) **All Splices:**

- (1) Center the sleeve over the splice or sheath opening.

(2) Make light marks at each end of the sleeve on the cable sheath. These marks are used as a guide to properly position the sleeve after it is beat-in and during the wiping operation.

(b) ***Straight Splice:*** Rotate the sleeve slowly and at the same time beat in the ends of the sleeve with a lead dresser or hammer until they fit tightly against the sheath. The beat-in should be uniform, free from furrows or dents, and should follow a smooth curve (Fig. 22).

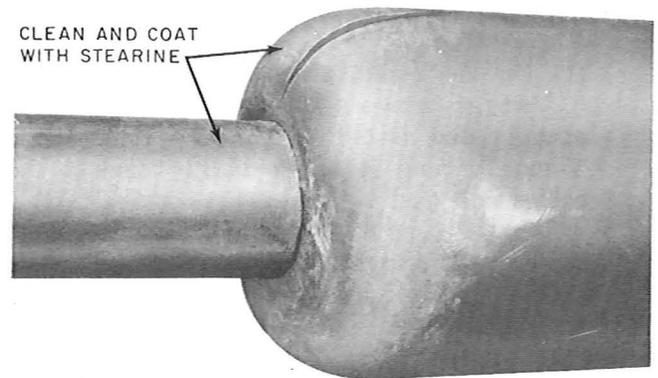


Fig. 22—Sleeve Placed (Less than 3 in.)

(c) *Bridge Splice:*

(1) On the Y-end, place the proper size lead wedge between the cables. Beat in the straight end as outlined in (b). Beat in the Y-end forming it to fit tightly against the cables and lead wedge.

Note: At bridge splices the smaller cable should be set up on top of the larger cable to facilitate the wiping process.

(2) Place cable pasters on the cables and lead sleeve as illustrated in Fig. 23.

12. SOLDER METHOD OF WIPING LEAD SLEEVE

12.01 Before starting to wipe a joint, check to see that the following conditions have been met:

(a) The sheath and sleeve surfaces are clean and coated with stearine.

(b) The sleeve is in the proper position over the sheath opening.

(c) The ends of the sleeve are beat in tightly around the sheath, end plates, or lead wedge.

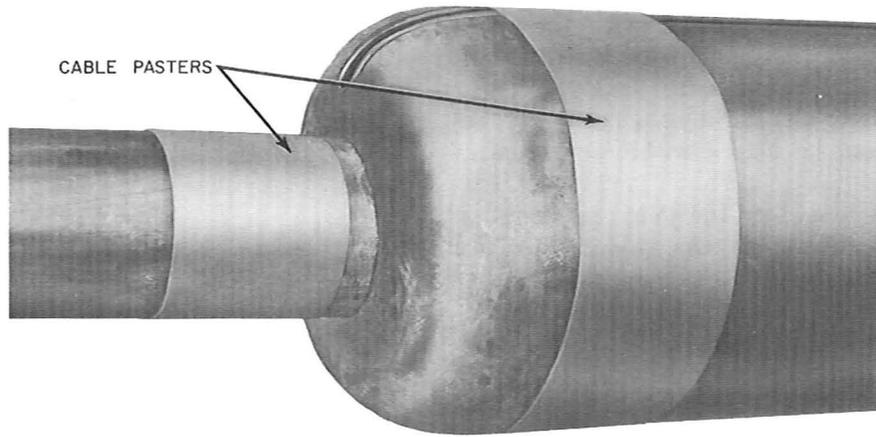
(d) Cable pasters are in place around the sleeve and cables. The cable pasters limit the width of the joint and prevent solder from adhering to the sleeve and cables.

(e) A drip pan is in place and secured below the joint.

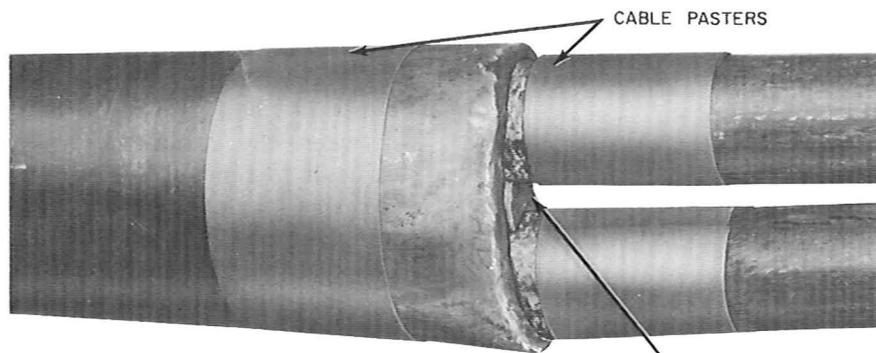
(f) The ladle is preheated. Do not insert a cold ladle into a pot of hot solder.

(g) The catch cloth and finishing cloth are warmed. This can be done with the preheated ladle.

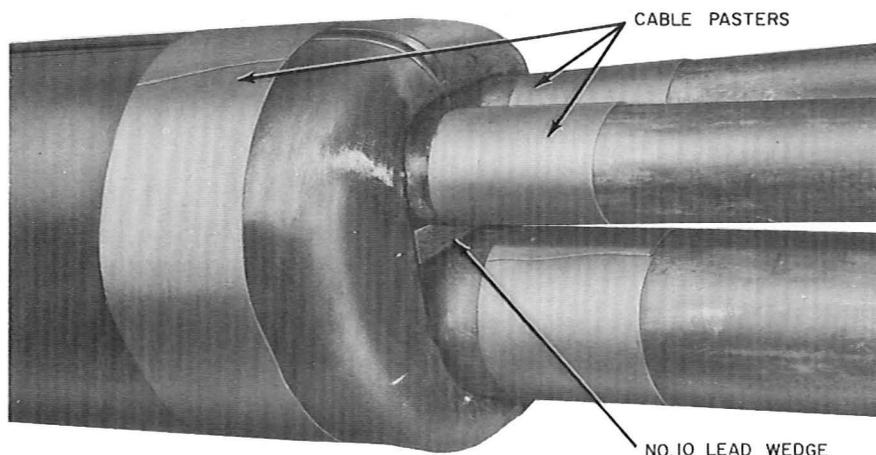
12.02 Pour a small amount of solder on the sleeve, end plate, and sheath of the joint at the opposite end of the sleeve. This will prevent the sleeve from twisting during the wiping operation.



STRAIGHT JOINT



Y-JOINT



THREE WAY JOINT

NOTE:
CLEAN AND COAT AREA BETWEEN CABLE PASTERS WITH STEARINE

Fig. 23—Cable Pasters Placed

12.03 In wiping a straight joint, position the catch cloth beneath the joint with the butt of the hand holding the catch cloth lightly against the sleeve, end plate, and forming a pocket. The finishing cloth should be placed within easy reach.

12.04 Pour the solder over the joint, moving the ladle continuously so the solder will not fall in one spot and melt a hole in the sleeve. After one or two ladles of solder have been poured over the joint, slide the catch cloth toward the top of the sleeve, move the ladle beneath the joint to catch the excess solder, as it falls, deposit the solder from the catch cloth on top of the joint. Continue pouring solder depositing the solder from the catch cloth on the top and sides of the joint, until all areas of the joint are thoroughly heated and tinned. Place the ladle and catch cloth in the drip pan. Using the finishing cloth, remove the excess solder from the joint leaving a rounded external fillet of solder between the end plate and sleeve and between the end plates and pasters on the cable sheath (Fig. 24). When end plates are not used, the external fillet of solder is left between the pasters on the cable and the end of the sleeve (Fig. 25).

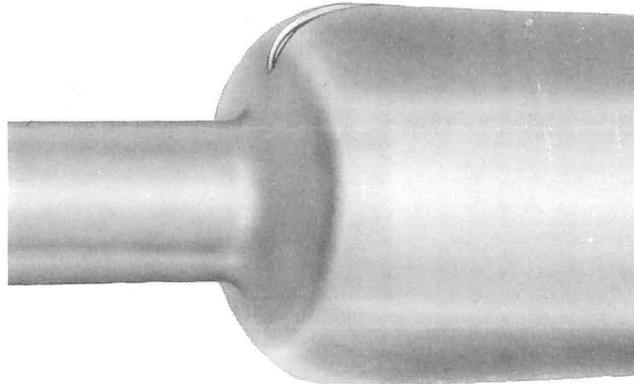


Fig. 25—Finished Joint—No End Plates

12.05 A Y-joint is heated as outlined in 12.04. Do not force the solder between the cables until the joint is hot. As the solder is worked between the cables, a buildup occurs which is difficult to remove. An old screwdriver or similar tool that has been heated in the solder pot can be used to remove the buildup and help tin the crotch. Continue pouring solder until all areas of the joint are thoroughly heated and tinned. Finish wiping the joint as outlined in 12.04. A textile insulated wire is used to cut the crotch. Fig. 26 illustrates a completed Y-joint.

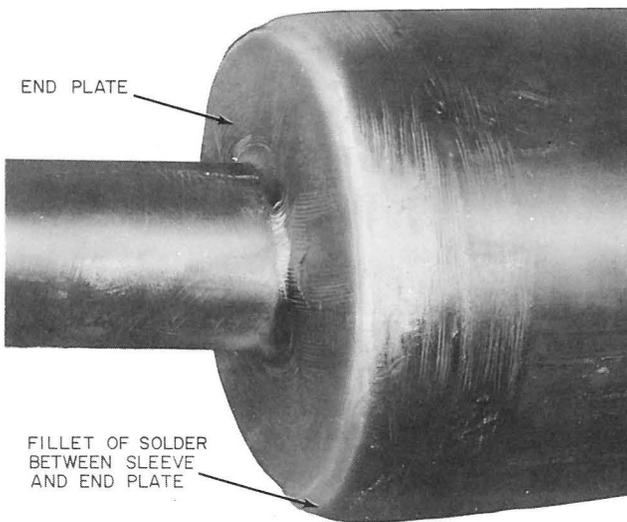
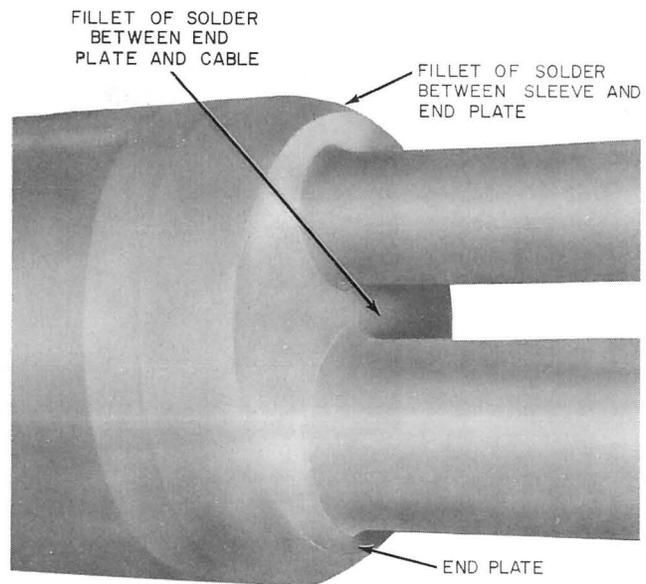


Fig. 24—Finished Joint—End Plates



NOTE:
SMALL CABLE ON TOP WHENEVER POSSIBLE.

Fig. 26—Wiped Y-Joint

12.06 Finished joints should be smooth, with clean edges, and of uniform shape. Inspect the joints carefully for any visible defects. The splicer's mirror can be used to inspect the back and bottom.

12.07 It is not advisable to wipe two large joints in succession without reheating the solder pot. The solder in the pot may cool to such an extent while wiping the first joint that the temperature at the start of the second joint will be too low to permit wiping a satisfactory joint.

12.08 Do not move or jar the cable while the solder is hardening. This may crack the joint.

Note: Finished joints should be allowed to cool naturally. Do not apply soap solution, water, stearine, etc, to accelerate the cooling process.

12.09 After the joint has partially cooled, apply C Sealing Solder as outlined in Part 7.

12.10 Remove the cable pasters from the cable being careful not to score the sheath or sleeve.

12.11 Flash test the sleeve as outlined in Part 16.

13. TORCH METHOD OF WIPING LEAD SLEEVE—AERIAL OR BURIED PLANT ONLY

13.01 Prepare the sleeve as outlined in Part 10. When a split sleeve is used, run the seam as outlined in Part 11.

13.02 Using a carding brush, clean the sheath in the area where the joint is to be wiped and coat with stearine. Beat the sleeve in as outlined in Part 11.

Note: Cable pasters are not required when joints are wiped with a torch.

13.03 Starting at the top of the joint, holding stearine core solder on the joint, apply the flame to the solder and joint with a brushing motion until the solder flows and adheres to the joint. Using a small finishing cloth, work some of the solder between the edge of the sleeve and end plates or cable sheath. The joint is tinned by heating the adhered solder. As each area of the

joint is tinned, build up the solder on the joint. Complete the wiping by heating the solder until a glazed finish is observed (Fig. 27). Flash test the sleeve as outlined in Part 16.

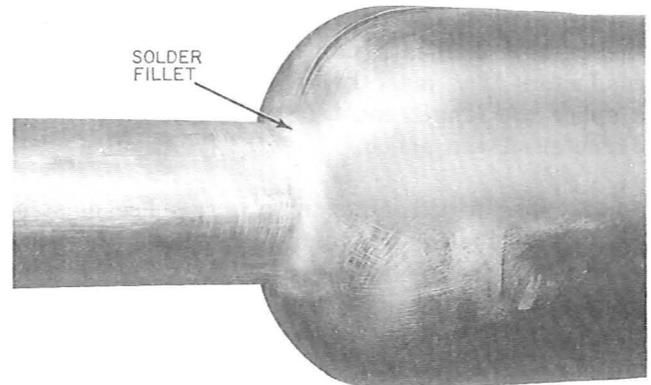


Fig. 27—Wiped Straight Joint (Torch Method)

13.04 To wipe a Y-joint, thoroughly clean the sheath with carding brush and coat the area where the joint is to be wiped with stearine. Place the cleaned end plates or lead wedge. Beat in the sleeve as outlined in Part 11. Wipe the joint as outlined in 13.03. Fig. 28 illustrates a completed joint. Flash test the sleeve.

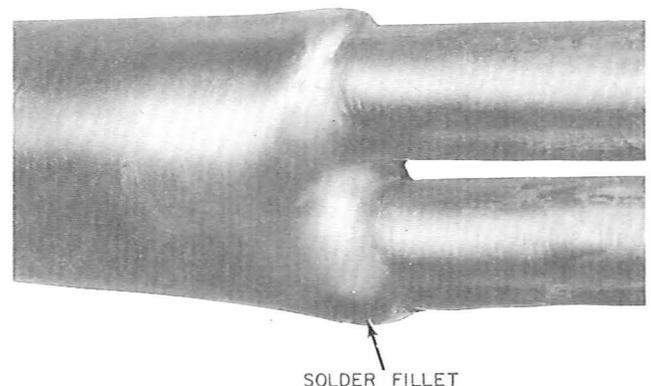


Fig. 28—Wiped Y-Joint (Torch Method)

14. DUCT SPLICE

14.01 The maximum diameter of a B Lead-Calcium Sleeve that can be used to construct a duct splice or to repair a cable will depend on the

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inside diameter of the duct. Table A lists the B Lead-Calcium Sleeve diameters and wall thicknesses.

14.02 The length of the lead sleeve will depend on whether it is used to repair a damaged cable or to enclose a splice. When repairing a damaged cable, the sleeve length is determined by the extent of sheath damage and the number of conductors that must be repaired. When making a splice the length must be varied to restrict the diameter of the splice.

14.03 The wiped joints for a duct splice must be strong enough to permit pulling the cable in or out of the duct. The space between the cable pasters placed on the cable sheath to the end of the sleeve should be spaced slightly longer than normal. The joints should be wiped as flat as possible (Fig. 29).

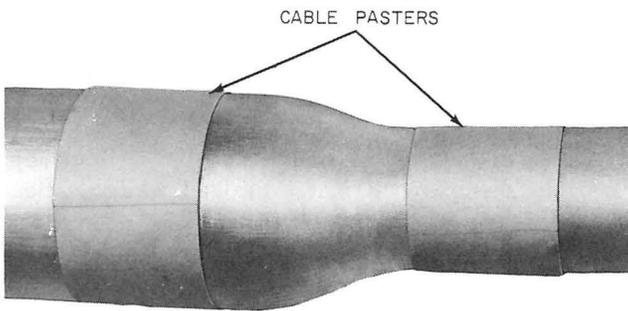


Fig. 29—Wiped Duct Splice

15. CAP JOINTS

15.01 Lead sleeves with cap joints are used to seal the end of cables or are placed over butt splices.

15.02 The cap joint should be wiped before the sleeve is placed over the cable. If it is necessary to place the sleeve before wiping the cap joint, wipe the straight or Y-joint first.

15.03 When the lead sleeve is 2-3/4 inches or less in diameter, the end to be capped is beat-in. A blank end plate is used to close the cap end of 3 inch or larger sleeves.

15.04 The cap end can be wiped with a torch (aerial or buried splices only) or it can be closed with solder and a soldering copper. Wipe

the joint as outlined for straight joints. Fig. 30 illustrates a cap joint with end plates. Fig. 31 illustrates a capped joint without end plates.

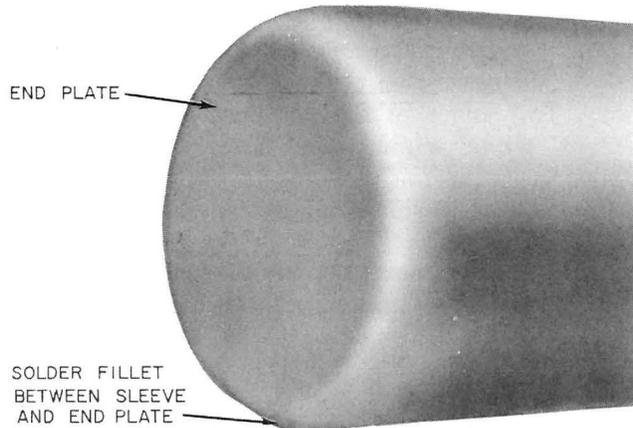


Fig. 30—Cap Joint With End Plates

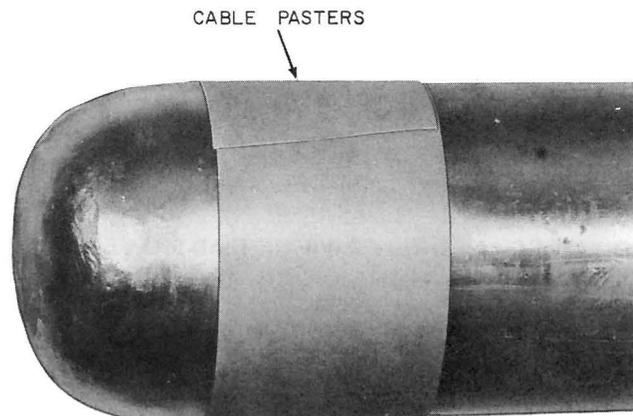


Fig. 31—Cap Joint With No End Plates

16. FLASH TESTING

16.01 All lead sleeves used to close splices *must* be flash tested.

16.02 The following tools are required for flash testing:

- (a) A nitrogen gas cylinder containing dry nitrogen gas (Section 637-300-100)

- (b) A C Pressure Testing Regulator (Section 081-601-100)
- (c) A B Pressure Hose with snap-on air chuck (Section 081-330-104)
- (d) E Pressure Testing Solution (Section 637-020-100).

16.03 To supply gas for flash testing, a gas admission point must be connected to the lead sleeve. A pressure testing clamp can be used as a temporary means or a pressure testing valve can be placed as a more permanent means.

16.04 To flash test a lead sleeve, proceed as follows:

- (a) Open the nitrogen cylinder outlet valve slightly to blow out any moisture or foreign matter that may have collected in the gas outlet. Then close the valve.
- (b) Turn the C Pressure Testing Regulator adjusting screw counterclockwise until it turns freely in its socket.
- (c) Attach the B Pressure Hose to the regulator outlet.
- (d) Attach the pressure testing regulator to the outlet valve on the nitrogen cylinder.
- (e) Open the nitrogen cylinder valve slowly and completely.
- (f) Turn the adjusting screw on the pressure testing regulator until the low pressure gauge indicates 15 pounds.
- (g) Depress the valve in the air chuck to remove any moisture or foreign material from the air hose. Release the valve.
- (h) Attach the air chuck to the pressure testing valve or pressure testing clamp. Allow pressure to build up in the sleeve. Remove the air chuck from the valve. Using a B Pressure Gauge, read the back pressure. The back pressure should be between 7 and 10 psi. If the back pressure exceeds 10 psi, reduce the amount of gas flow by turning the adjusting screw on the pressure testing regulator counterclockwise until the low pressure gauge

reads 10 psi. Place the air chuck on the valve.

Note: If a B Pressure Gauge is not available, the back pressure can be checked by turning off the nitrogen cylinder, releasing the gas from the pressure hose, placing the air chuck on the pressure valve, and reading the back pressure on the low pressure gauge.

- (i) Using the sprayer or B Soap Bucket and Brush, apply E Pressure Testing Solution to the wiped joints and seam if a split sleeve was placed. Observe the area that has been soaped. If growing soap bubbles are observed, it indicates a leak. Remove the gas pressure from the sleeve, repair the leak, and flash test the sleeve. When it has been determined there are no air leaks in the sleeve, seal the gas admission point. Flash test the gas admission point.

17. REMOVING LEAD SLEEVE WITH SOLDER

17.01 Before removing a sleeve that is part of a pressurized gas system notify the proper office according to local procedures. Then release the pressure before starting any unwiping operations.

17.02 Do not attempt to reuse a sleeve if it is filled with paraffin or if it is being removed to correct moisture penetration at or near the wiped joint.

17.03 When unwiping joints that contain end plates, unwipe only that part of the joint where the sleeve end contacts the end plate, if the end plates can be reused.

17.04 To unwipe a lead sleeve that is not to be reused, proceed as follows:

- (1) Remove all moisture and dirt from the sleeve and joint area.
- (2) Using a chipping knife and hammer, cut a ring partially through and completely around the sleeve, about 1/2 inch in from the edge of each wiped joint.
- (3) Using a chipping knife and hammer, make a slit between the two cuts along the top of the sleeve.
- (4) Pry open the slit and remove the section between the two cuts.

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17.05 To unwipe joints with solder, proceed as follows:

- (1) Using a carding brush, thoroughly clean the joint area.
- (2) Place cable pasters on the cable sheath and sleeve at the edge of the joints.
- (3) Secure a drip pan beneath the joint to be unwiped.
- (4) Pour solder over the joint area, holding a catch cloth beneath the joint. Work the solder from the catch cloth around the joint. Continue pouring solder over the joint until the sleeve no longer adheres to the cable sheath. Using pliers, twist the end section of the sleeve gently until the solder solidifies. Cut the end section off the cable with a chipping knife.

REMOVING LEAD SLEEVE WITH A TORCH—AERIAL BURIED SPLICES ONLY

17.06 To unwipe a joint with a torch, proceed as follows:

- (1) Clean the surface of the joint with a carding brush.
- (2) Secure a drip pan beneath the joint to be unwiped.
- (3) With a brushing motion, apply the flame to a small area of the joint. As the solder melts, remove the melted solder with a shave hook or small finishing cloth.
- (4) When the sleeve no longer adheres to the sheath, using pliers, twist the end section of the sleeve gently until the solder solidifies. Cut the end section off with a chipping knife.

17.07 When a lead sleeve is to be reused, unwipe the sleeve with solder as outlined in 17.05. Remove as much solder from the joint area as possible. When the sleeve no longer adheres to the cable sheath, using a screwdriver or similar tool, pry open the beat-in. The end section should be opened just enough to allow the sleeve to be slipped over the splice.

Note: If the sleeve has a Y-joint, unwipe the straight end first, then pull the sleeve

toward the straight end after the Y-joint has been unwiped.

17.08 When unwiping a joint with a torch, exercise care to prevent setting the splice on fire. The torch should not be held parallel to the cable but should be held at an angle to prevent the flame from entering the splice through the opening between the end section and sheath.

17.09 When a lead sleeve is to be reused, unwipe the sleeve with a torch as outlined in 17.06. Remove as much solder as possible from the joint area. When the sleeve no longer adheres to the cable sheath, use a screwdriver or similar tool to pry open the beat-in. The end section should be opened just enough to allow the sleeve to be slipped over the splice.

17.10 After the sleeve has been removed from the opening, the torch can be used to remove end plates, lead wedges, and to remove excess solder from the cable sheath.

Note: On splices that have been filled with paraffin, remove the muslin and rewrap the splice with half-lapped layers of new dry muslin. Before removing end plates, lead wedges, or cleaning the cable sheath, wipe away any paraffin from inside the joints. Protect the cable at the sheath ends by wrapping with aluminum tape.

18. BONDING

MANHOLES

18.01 The sheath or sleeve of all cables in every manhole are bonded together except polyethylene-sheathed cables in pull-through manholes, where no opening is made in the sheath.

Note: The bonding and grounding requirements of cables are covered in the 638-300 Subdivision of the Bell System Practices.

18.02 To permanently bond the sleeves or sheath of cables in manholes, bonding ribbon is installed in the manhole. Attach the bonding ribbon to the manhole wall with bonding ribbon clamps and 3/16-inch by 7/8-inch hammer drive anchors spaced about 18 inches apart. To facilitate the soldering of a piece of bonding ribbon from the permanent bond to a sleeve or cable sheath, 1/2

inch projections are placed in the permanent bond every 4 to 6 inches. A typical installation of bonding ribbon installed in a manhole is illustrated in Fig. 32.

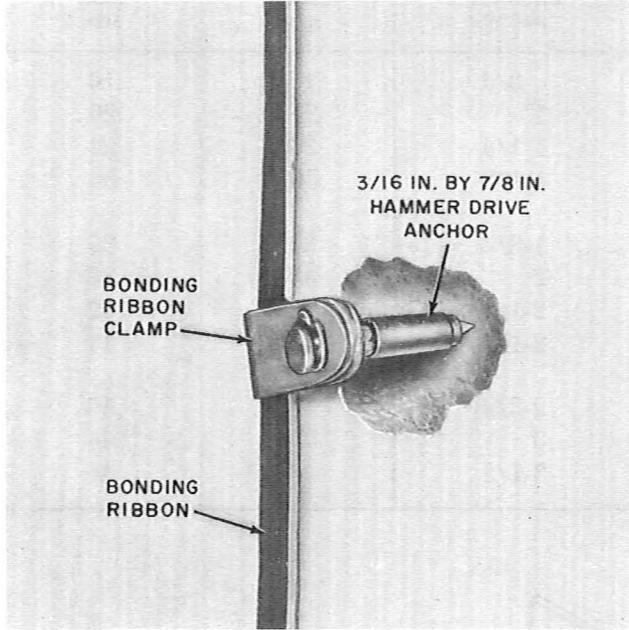


Fig. 32—Bonding Ribbon Installed

18.04 When the permanent bond has been installed without projections, solder a piece of bonding ribbon to the permanent bond as illustrated in Fig. 34.

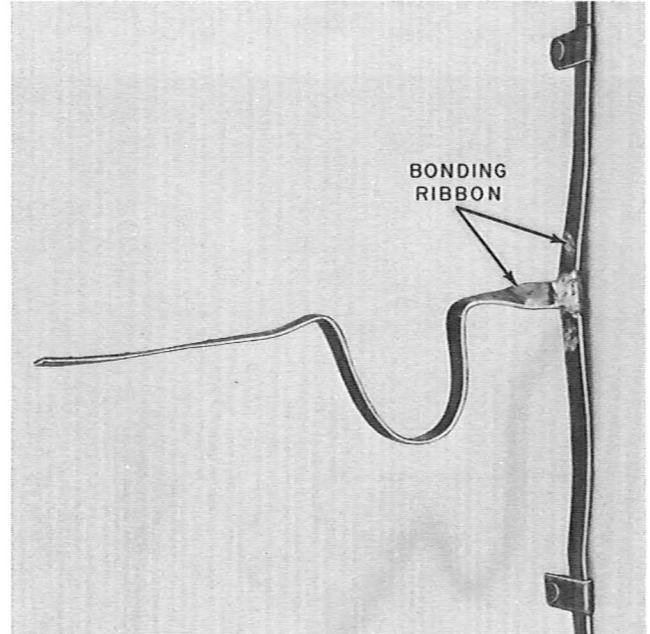


Fig. 34—Permanent Bond Without Projections

18.03 Fig. 33 illustrates the bonding of a sleeve to the permanent bond.

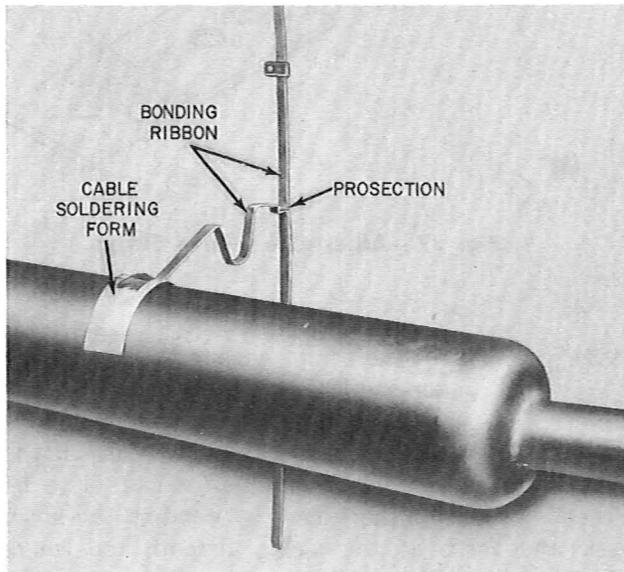


Fig. 33—Bonding Sleeve

CENTRAL OFFICE CABLE VAULTS

18.05 The sheath of all underground cables entering central office buildings must be bonded together and grounded to the central office ground. Section 638-300-200 covers the bonding and grounding in the central office vault.

B CONNECTOR

18.06 The B Connector (Fig. 35) is a bronze vise-type connector with the jaws tin-coated

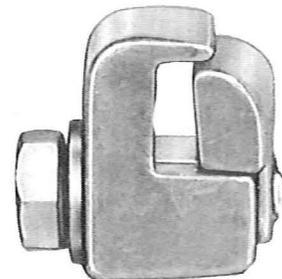


Fig. 35—B Connector

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to minimize corrosion. It is used to make solderless connections of bonding ribbon to bonding ribbon.

18.07 Fig. 36 illustrates the B Connector installed. A 7/16-inch B Ratchet Wrench is used to tighten the hex head bolt.

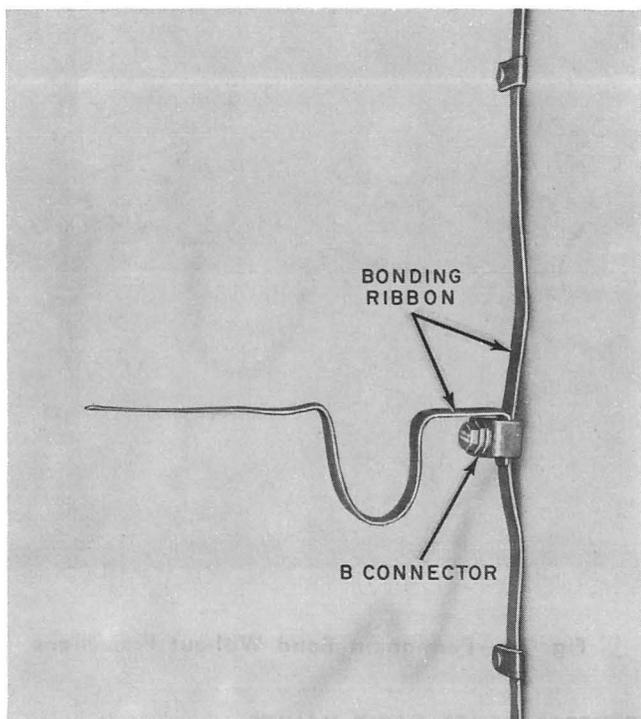


Fig. 36—B Connector Installed

19. CABLE CLAMPS, CABLE STRAPS, AND ADJUSTABLE SLEEVE STRAPS

19.01 Cable clamps, cable straps, or adjustable sleeve straps are available for attaching lead sleeves to walls constructed of wood, concrete, tile, etc. Table C lists the lead sleeve diameter and the size cable clamp or cable strap required.

19.02 An adjustable sleeve strap is required when a lead sleeve exceeds 3-1/2 inches in diameter.

19.03 The adjustable sleeve strap (Fig. 37) contains 25 holes spaced on 1/2-inch centers. These holes are to adjust the strap to fit various sizes of lead sleeves. The strap is also equipped with a slider for reinforcing the hole through which the top anchor will be placed.

TABLE C

CABLE CLAMPS AND CABLE STRAPS

| LEAD SLEEVE DIAMETER (INCHES) | CABLE CLAMP SIZE | CABLE STRAP SIZE |
|-------------------------------|------------------|------------------|
| 3/4 | 17 | 16 |
| 1 | 21 | 20 |
| 1-1/4 | 25 | 24 |
| 1-1/2 | 30 | 30 |
| 1-3/4 | 30 | 30 |
| 2 | 35 | 36 |
| 2-1/4 | 42 | 42 |
| 2-1/2 | 42 | 42 |
| 2-3/4 | — | 56 |
| 3 | — | 56 |
| 3-1/2 | — | 64 |

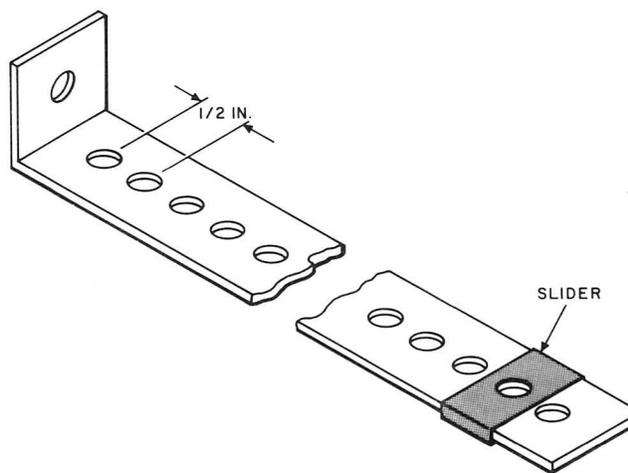


Fig. 37—Adjustable Sleeve Strap

19.04 To install the strap, anchor the preformed end under the lead sleeve. Form the strap around the sleeve. After the proper length is determined, nick the strap across its width at the next hole through which the top anchor is to be placed. Break off the excess by bending the strap back and forth at the nick. Smooth the rough edges with a file. Position the slider over the hole through which the anchor is to be placed and fasten the strap to its mounting surface.

19.05 To anchor cable clamps, cable straps, or adjustable sleeve straps to a solid wood wall, use 3/16-inch by 2-inch strap nails or No. 14 wood screws.

Note: At outside locations where corrosion is a problem, galvanized wood screws must be used. At inside locations or where corrosion is not a problem, blue wood screws or the equivalent may be used.

19.06 To install cable clamps, cable straps, or adjustable sleeve straps on concrete, tile, hollow walls, etc, the following anchoring devices are available:

- Masonry Fasteners
- Drive Anchors
- Plastic Anchors
- Machine Bolt Anchors

- Wall Screw Anchors
- Toggle Bolts

19.07 Fig. 38 illustrates a lead sleeve fastened to a wall surface.

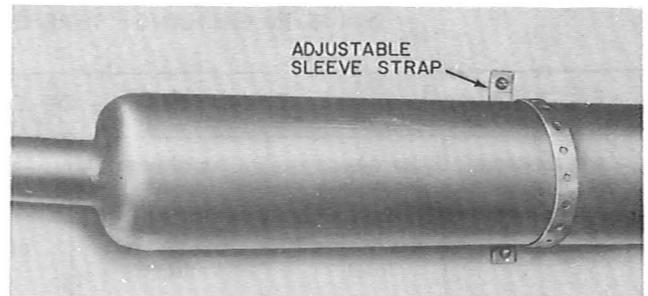


Fig. 38—Sleeve Strapped to Wall

20. TABLE OF RECOMMENDED SLEEVE SIZES FOR FOLDBACK SPLICES

20.01 Table D contains the recommended sleeve sizes for foldback splices.

TABLE D

**RECOMMENDED SIZES OF LEAD SLEEVES FOR STRAIGHT FOLDBACK SPLICES
MADE IN EXCHANGE TYPE CABLES WITH B WIRE CONNECTORS**

| GAUGE OF CABLE CONDUCTORS | | | | | | | | | | | | |
|---|------------------------------------|----|----------------------------------|----|------------------------------------|----|----------------------------------|----|----------------------------------|----|----------------------------------|----|
| SIZE OF CABLE IN NO. OF PAIRS ¹ | 17 GAUGE ALUMINUM CONDUCTORS | | 19 GAUGE COPPER CONDUCTORS | | 20 GAUGE ALUMINUM CONDUCTORS | | 22 GAUGE COPPER CONDUCTORS | | 24 GAUGE COPPER CONDUCTORS | | 26 GAUGE COPPER CONDUCTORS | |
| | DIA (IN.) | LG | DIA (IN.) | LG | DIA (IN.) | LG | DIA (IN.) | LG | DIA (IN.) | LG | DIA (IN.) | LG |
| 6 | | | 3/4 | 15 | | | | | | | | |
| 11 | | | 1 | 15 | | | 1 | 15 | 1 | 15 | 1 | 15 |
| 16 | | | 1 | 15 | | | 1 | 15 | 1 | 15 | 1 | 15 |
| 25 | 2-1/2 | 20 | 1-1/4 | 15 | 2 | 17 | 1-1/4 | 15 | 1-1/4 | 15 | 1 | 15 |
| 50 | 3 | 20 | 1-3/4 | 17 | 2-1/2 | 17 | 1-1/2 | 17 | 1-1/2 | 17 | 1-1/4 | 15 |
| 75 | 3-1/2 | 20 | 2 | 17 | 3 | 20 | 1-3/4 | 17 | 1-3/4 | 17 | 1-1/2 | 17 |
| 100 | 4 | 20 | 2-1/4 | 17 | 3-1/2 | 20 | 2 | 17 | 2 | 17 | 1-3/4 | 17 |
| 150 | 4-1/2 | 20 | 2-3/4 | 20 | 4 | 24 | 2-1/2 | 17 | 2-1/4 | 17 | 2 | 17 |
| 200 | 6 | 27 | 3 | 20 | 4-1/2 | 24 | 3 | 20 | 3 | 20 | 2-3/4 | 20 |
| 300 | | | 4 | 24 | 5-1/2 | 27 | 4 | 24 | 3-1/4 | 20 | 3 | 20 |
| 400 | | | 5 | 24 | 6 | 27 | 4-1/2 | 24 | 3-1/2 | 20 | 3-1/4 | 20 |
| 450 | | | 6 | 27 | | | | | | | | |
| 600 | | | | | | | 5-1/2 | 27 | 5 | 24 | 4-1/2 | 24 |
| 900 | | | | | | | 6 | 27 | 5 | 27 | 5 | 27 |
| 1100 | | | | | | | 8 | 27 | | | | |
| 1200 | | | | | | | | | 6 | 27 | 5-1/2 | 27 |
| 1500 | | | | | | | | | 6-1/2 | 27 | 6 | 27 |
| 1800 | | | | | | | | | 7-1/2 | 27 | 6-1/2 | 27 |
| 2100 | | | | | | | | | | | 7 | 27 |
| 2400 | | | | | | | | | | | 7-1/2 | 27 |
| 2700 | | | | | | | | | | | 8 | 27 |

Note 1: Does not include interstitial pairs.