How to Splice Plastic Cable

CONSIDERABLE INTEREST has been shown by railroad men in the splicing of plastic communications cable as evidenced by discussion at the last two or three Communications Section annual meetings. This type of cable is being used extensively in yard communications systems and elsewhere. Therefore, Railway Signaling and Communications is presenting this Special Report on the splicing of plastic communications cable.

Information and illustrations have been secured from manufacturers of cable, casings, and splicing materials. Associate Editor Robert Barber has prepared this special report from the material. Recommendations are those of the manufacturers. Railway Signaling and Communications makes NO RECOMMENDATIONS concerning the splicing of plastic cable. This report is presented as a survey of the literature available on the subject. Further details concerning any of the methods of splicing and materials used may be obtained by writing directly to the manufacturers, who are listed at the end of the article (page 30).

The material as received from the manufacturers was reviewed and it was found that most agreed as to the procedure to be followed. Where a manufacturer differed or offered an alternate method, it is presented here identified with that supplier.

One cable manufacturer (Superior Cable Co.) pointed out that an important consideration here is that the conductors themselves are covered with a moisture resistant insulation. Moisture entering through a hole in the cable sheath will have no effect until it reaches a splice where the conductor insulation has been removed. They recommend, therefore, that the wire joint be made moisture proof through the use of filled plastic splicing sleeves.

There are three main steps to splicing plastic cable. The material is presented, therefore, as follows:

PREPARATION

Here is discussed the location of the splice, the proper method of opening the sheath and performing other steps preliminary to the actual splicing of the conductors.

SPLICING

Several methods of providing electrical continuity between the conductors are presented.

ENCLOSING

Having joined the conductors, the splice must be protected by some form of enclosure. There are three methods of enclosing the splice: (1) By wrapping the splice with layers of various tapes; (2) By enclosing the splice within a manufactured case; (3) By casting an enclosure of an epoxy resin. Each type of manufactured case requires certain preliminary and certain final steps which are unique to that case. These are discussed in separate parts of the Preparation and Enclosing steps. The initial steps for a splice that is to be enclosed by a casting of epoxy resins are the same as those for a taped splice.

PREPARATION

Have all tools and materials required for the splice at hand. Once the splicing has begun, it should be continuous and as rapid as good workmanship will allow, in order to minimize the exposure of the insulation to dirt, moisture, and atmosphere. A splice should not be started unless there is reasonable opportunity to complete it. Suitable temporary supports and covers to protect the cable ends, splicing materials, and tools from foreign matter and mechanical damage, should be provided.

Splicing materials and tools should be kept at a temperature above ambient in order to prevent moisture condensation on their surfaces.

Messenger-supported cable on either side of the splice should lie along the strand without bowing and without tension, when the strand is placed at the required stringing tension.

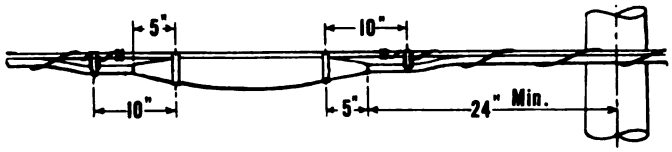
When removing the sheath and shield from the cable end in preparation for making a splice, care should be exercised to prevent conductors in the individual pairs from unwinding. Where pair ends are short it may be necessary to twist the paired conductors tightly together at their ends.

Tapes, referred to as "A", "B", etc., are identified on page 30.

Taped Splice

The same preliminary steps shown here for a splice that is to be enclosed by tape apply to the cast epoxy resin type enclosure.

1 The nearest end of the splice should be at least 24 in. from a pole support, and this should be increased to 30 in. if the cable makes a turn at that pole. If the center of the splice is less than 48 in. from the center line of the pole, cable spacers and supports should be used instead of lashing.



R. E. A.

Location of a Taped Splice for aerial cable.

2 Remove the cable sheath carefully so that there will be no damage to the metal shield, core wrapper, or insulation around the conductors.

First cut a ring part way through the jacket wall at the proper distance from the end of the cable. Then cut a slit part way through the jacket wall, from the ring to the end of the cable (see table). The jacket can then be torn off by hand without damaging the shield.

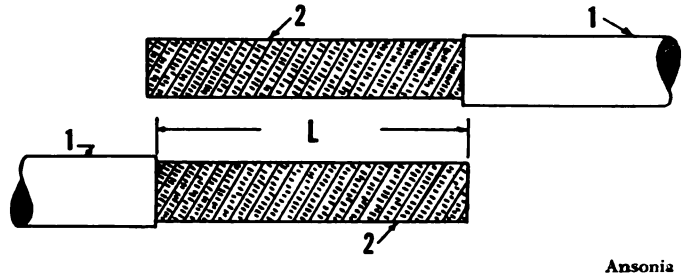
LENGTH "L"

Length of Overlap and Length of Sheath to be Removed			
No. of Pairs in Cable	As Recommended By Anaconda, REA Whitney Blake	Ansonia Rex	Okonite
11	11 in.	12 1/2 in.	15 1/4 in.
16	11	14 1/2	19
26	13	16 1/2	19
51	13	18 1/2	22 3/4
76	15	20 1/2	22 3/4
101	15	22 1/2	22 3/4

LENGTH "L"

If Using "Scotchcast" Mold		
Cable O.D.	"L"	3M Splice Kit No.
1/4 in.-5/8 in.	1 1/4 in.	82A1
5/8 in.-1 in.	5 3/4 in.	82A2
1 in.-1 7/16 in.	9 3/4 in.	82A3

Or mold may be built up from tape to suit any cable size or sheath opening



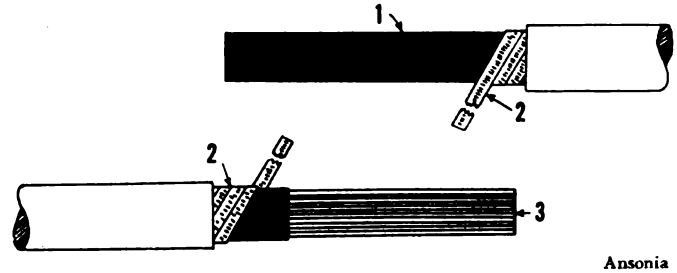
Ansonia

Cable sheath (1) is removed for a distance "L" exposing the metallic shield (2). Distance "L" is obtained from tables above.

3 Scuff outer jacket for a distance of 6 in. back from edge to insure proper adhesion of tapes. Use 2½ grade sandpaper. **Do Not Use Emery Cloth or Emery Paper.**

Some manufacturers recommend this step be made just before applying tapes. See Step 11-A.

4 Unwrap metal shielding tape, positioning it so as not to interfere with subsequent taping operations. Care should be used to keep metal tape in good condition so that it may be wrapped across the finished splice.



Ansonia

Core wrapping (1) is exposed as metallic shield (2) is unwound. Some core wrapping is left to protect conductor insulation (3).

Okonite recommends: Remove shield from each cable so that one inch extends from beneath the sheath. Tack solder or bind the turns of the shield together. (If this is done, follow Second Method under **Enclosing** the Splice.)

5 Remove the binder wrapping to expose the insulated conductors. Leave one to two inches of the wrapping over the conductors and bind the cut edge of the serving to the cable with two turns of "B" tape.

6 Splice the conductors following one of the methods shown, starting on page 24. The use of a moisture proof wire joint using one of the filled plastic sleeves is recommended by some manufacturers.

Splice Cases

These manufactured cases appear as four types:

A) A lead sleeve.
B) A neoprene or rubber enclosure.
C) A plastic pipe.
D) A cast aluminum housing.

The preparation procedure for each follows.

Case "A"

The Case: A lead sleeve.

1 Slip a lead sleeve of the proper diameter and length, "L" + 11 in., over the end of one cable and push back out of the way. See table in step 1 of Taped Splice.

2 Remove the cable sheath carefully so that there will be no damage to the metal shield, core wrapper, or insulation around the conductors.

First cut a ring part way through the jacket wall at the proper distance from the end of the cable. Then cut a slit part way through the jacket wall, from the ring to the end of the cable. The jacket can then be torn off by hand without damaging the shield.

3 Unwrap metal shielding tape, positioning it so as not to interfere with subsequent taping operations. Care should be used to keep metal tape in good condition, so that it may be wrapped across the finished splice.

4 Remove the binder wrapping to expose the insulated conductors. Leave one to two inches of the wrapping over the conductors and bind the cut edge of the serving to the cable with two turns of "B" tape.

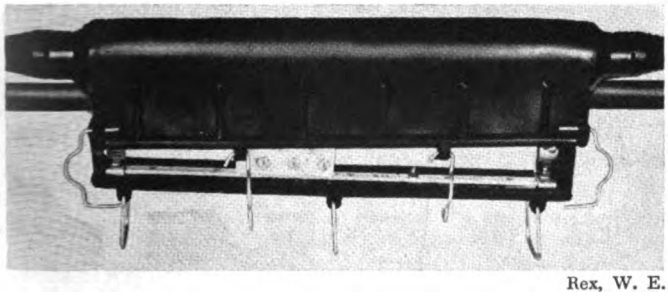
5 Splice the conductors, following one of the methods shown, starting on page 24.

Case "B"

The Case: A cover or hood, of flexible rubber or neoprene, which fits over a base assembly of the same material. The base is fitted with metal hangars for clamping to the cable and to the messenger strand.

This case is designed for aerial use only with PIC type cable (plastic jacket over plastic insulated conductors). It is waterproof but not moisture proof.

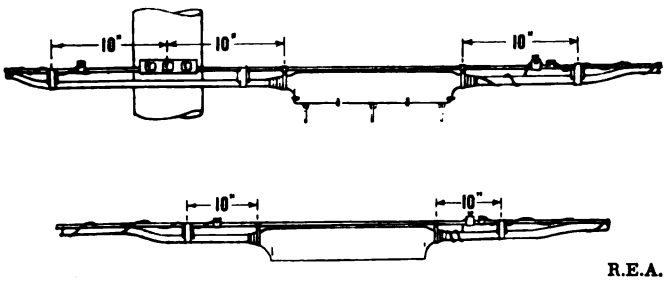
The enclosure will also accommodate terminal blocks or loading coils. Provision is made for running drop wires from the case. The case is easily reopened for access to the splice, terminals or coils.



Rex, W. E.

1 The splice case may be located at any point in a span, but not closer than 10 in. from a pole. The preferred location is on the right hand side of the pole, as seen from the cable side. Terminate the lashing wire with cable lashing clamps 10 in. from each end of the splice case.

CAUTION: This splice case should never be used closer than 120 ft from a junction between paper insulated and polyethylene insulated cables, unless a gas plug is present at the junction.

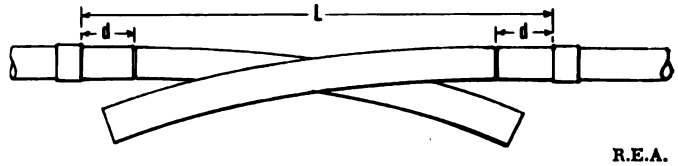


R.E.A.

2 Position the cable and place tape collars on the sheath to mark the length of sheath opening required for mounting the splice case.

3 Remove the cable sheath carefully so that there will be no damage to the metal shield, core wrapper, or insulation around the conductors.

Cut a ring part part way through the jacket wall at the proper distance from the end of the cable. Then cut a slit part way through the jacket wall, from the ring to the end of the cable. The jacket can then be torn off by hand without damaging the shield.



R.E.A.

Length "L" between marker tapes depends upon case used. Cut and remove sheath 1¾ in. (distance "d") from these tapes.

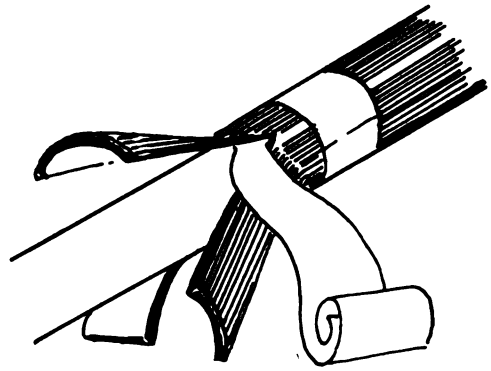
4 At each sheath opening, form tabs by cutting through sheath lengthwise to the marker tape. Make three tabs for cables under 0.6-in. diameter and four tabs for larger cables.

For cases made by Reliable, enlarge the side opening facing the workman to ⅛ in. by making an additional cut.

Fold back tabs away from shielding. Take care when making tabs not to cut into the shield.

Reliable

5A Rex recommends: Cut metal shield 4 in. from each marker tape applied in step 2. Carefully unwind metal shield and place between tabs. Proceed with step 5, except that tape collars will be over core binder instead of shield.



Rex

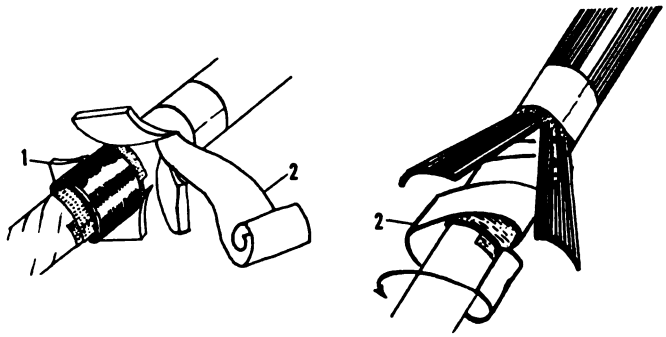
5 Form a tape collar by placing two layers, half lapped, of tape with adhesive side up, then one layer with the adhesive side down. On cables less than 0.6-in. diameter, add five additional layers of tape, adhesive side down.

Slip this collar under the tabs. Remove marker tapes placed in step 2.

R.E.A.

PREPARATION (Continued)

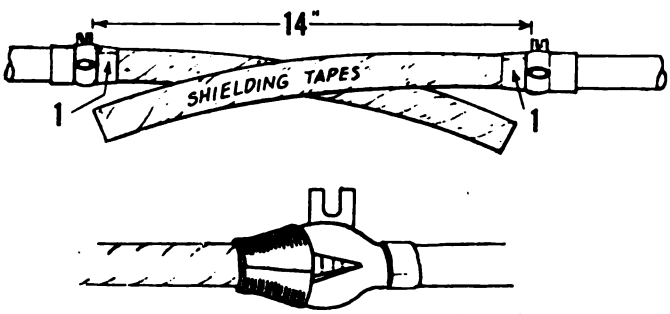
6A Rex recommends: Rewrap metal tape over collars and cable core. Fasten ends with one turn of tape. Proceed with step 6, except that clamps will make contact with metal shield.



Tape collar (1) is slid under tabs and shield (2) rewrapped over it.

6 Place a core clamp over the tape collar and work the clamps back under the tabs until there is 14 in. between the inside edges of the clamps. For the Reliable case, the ears of the clamp will project toward the workman; for the Western Electric case, the ears will project upward.

Place two turns of tape over the cut ends of the tabs to hold the clamp securely in place.



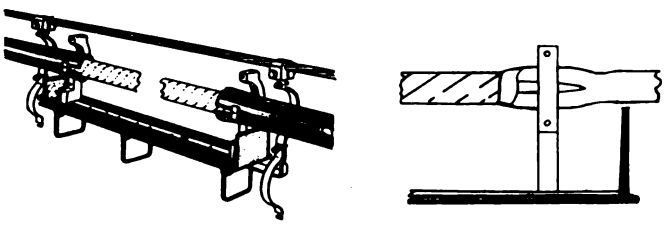
R.E.A. (top); Rex (bottom)

Tape (1) is wrapped over tab ends to hold clamp in place.

7 Center the base assembly on the sheath opening, with the embossed numbers on the base progressing from left to right, odd numbers on the side of the cable away from the pole.

Adjust and secure clamps. On the Western Electric case, engage the projecting ears of the core clamp on the top machine screw. On the Reliable case, the clamp attaches to the messenger strand.

For the Reliable case, install the sheath clamp and tie rod.



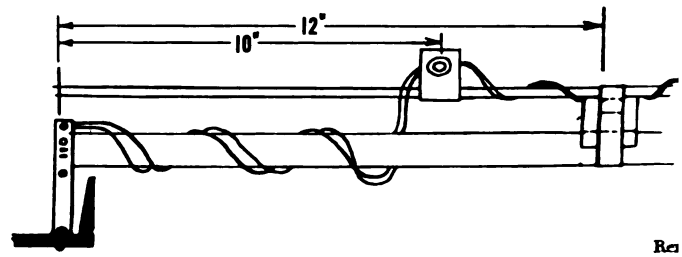
Reliable (left); Rex, W. E. (right)

8 Attach a piece of No. 14 wire to one of the cable lashing clamps for a ground wire. Spiral this wire around cable and through the shield clamp. Wire should be long enough to reach to far end of case, serving as a bond wire for the shield.

If steps 5A and 6A were followed, install ground wire as recommended by Rex:

Form a loop from 3 ft of No. 14 tinned copper wire and place the loop under the nut of the top sheath clamp and tighten the top screw securely.

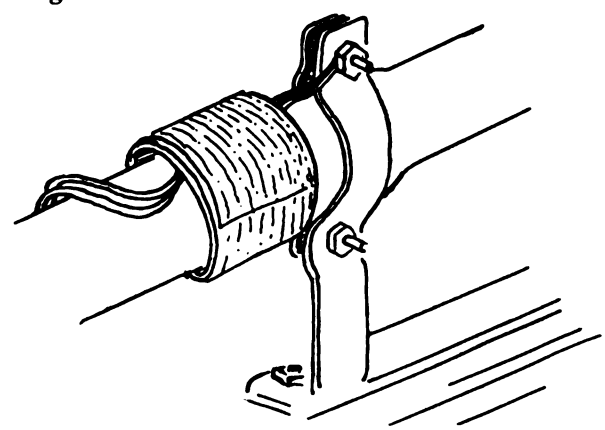
Spiral the loop of wire around the cable and fasten the ends around the bolt of the cable lashing clamp.



Rex

9 Form drip collars by applying sealing tape (supplied with case) not farther than ⅜ in. outside sheath clamps. Starting from the top, build up layers of tape until length is used up. First layer should be worked carefully and tightly over the ground wire.

Apply two turns of "B" tape to prevent cover from sticking.

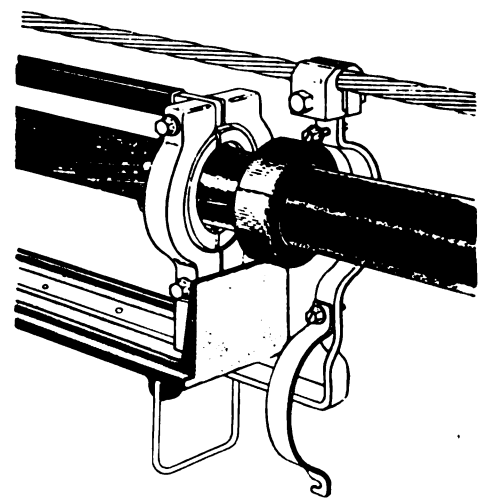


Rex

10 (If steps 5A and 6A were followed omit steps 10 and 11.). Remove part of shield, leaving approximately 1¼-in. tab at each end. Secure end with "B" tape.

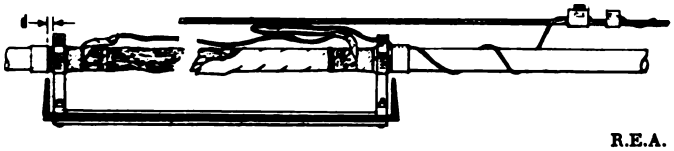
11 Remove core wrapper to edge of tape holding metal shield.

12 Solder a piece of No. 14 wire to the tabs at each end, thereby bonding and grounding shield. If a long enough piece of ground wire was installed in step 8, it may serve as the bond wire as well.



Reliable

13 Splice the conductors, following one of the methods shown, starting on page 24. It is necessary to provide a moisture proof wire joint (by using filled plastic sleeves) with these cases, as the cases are not moisture proof.



R.E.A.

Tho W.E. assembly ready for conductor splicing. Drip washer should not be more than ⅛ in. (distance "d") from clamp.

Case "C"

The Case: A plastic housing consisting of a length of plastic pipe, threaded on both ends, neoprene or silicone rubber seals, plastic washers, and threaded plastic end caps. These cases are suitable for direct burial.

1 Train the cables as nearly as possible into their final position, allowing the ends to overlap for at least the distance ½ L. Avoid sharp bends.

DIMENSIONS FOR G & W CASE

No. of Pairs in Cable	"A"	"B"	"I"	"L"
6	4 3/4 in.	3 1/4 in.	2 in.	12 in.
51	8 1/2	7	2	20
101	9 1/2	8	2	22

The dimensions apply to the G & W case only. "Peaco" case dimensions were not available at time of publication.

2 Determine the location of the centerline of the joint and make a reference mark on each cable at this point. Make a second reference mark on each cable at the distance "A" from the centerline mark.

3 Prepare the plastic housing as follows:

1) Remove the caps, seals and washers from each end of the plastic pipe.

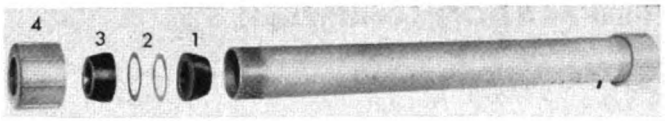
2) Wipe out the interior of the pipe to remove dust or dirt.

3) Clean the surface of the cable jacket where the pipe will rest during the splicing operation.

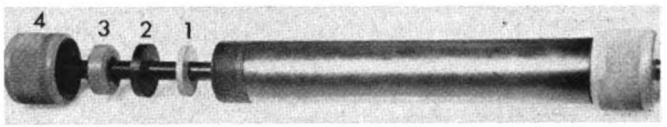
4) Wipe out the interiors of the caps and seals.

5) For the G&W Case: Slip a cap, 1 seal with taper away from splice, 2 washers, and 1 seal with taper toward splice, in that order, over the end of each cable.

For the Peaco Case: Slip a cap, pressure washer (chamfered edge), seal, and back-up washer (square edge), in that order, over the end of each cable.



G & W Case: (1) Neoprene seal; (2) Plastic washers; (3) Neoprene seal; (4) Compression cap.



"Peaco" Case: (1) Back-up washer; (2) Silicone rubber seal; (3) Pressure washer; (4) Compression cap.

6) Slip the plastic pipe back out of the way over the cable that was cleaned earlier.

4 Remove the cable sheath carefully so that there will be no damage to the metal shield, core wrapper, or insulation around the conductors.

Cut a ring part way through the jacket wall at the proper distance from the end of the cable. Then cut a slit part way through the jacket wall, from the ring to the end of the cable. The jacket can then be torn off by hand without damaging the shield.

5 Unwrap metal shielding tape, positioning it so as not to interfere with subsequent taping operations. Care should be used to keep metal tape in good condition so that it may be wrapped across the finished splice.

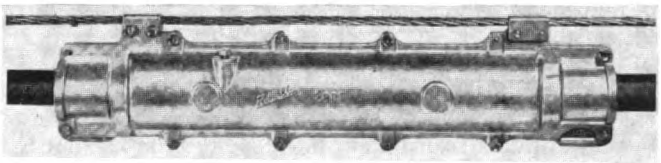
6 Remove the binder wrapping to expose the insulated conductors. Leave one to two inches of the wrapping over the conductors and bind the cut edge of the serving to the cable with two turns of "B" tape.

7 Splice the conductors, following one of the methods shown, starting on page 24.

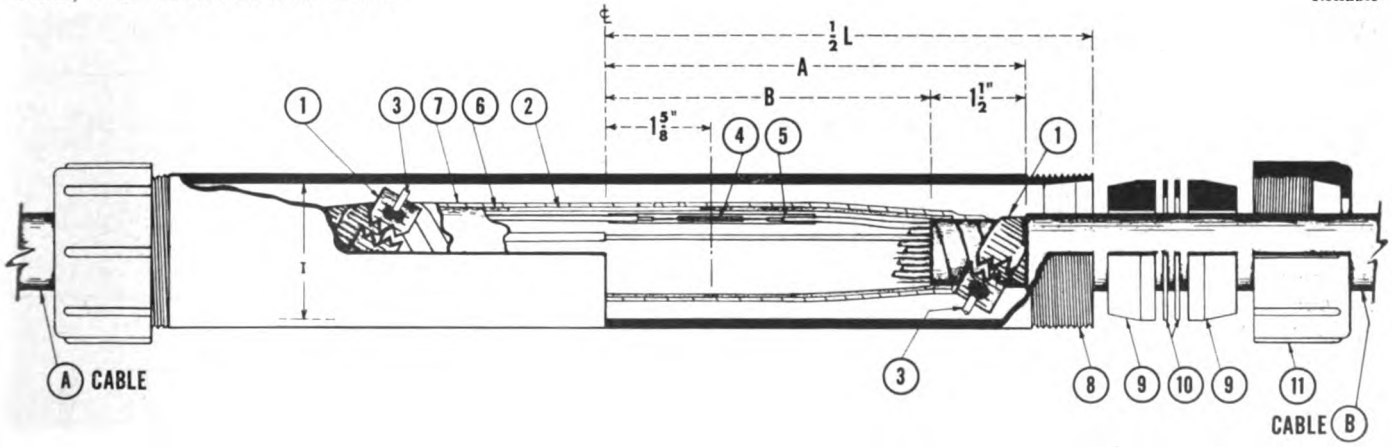
Case "D"

The Case: A split die cast aluminum cylinder. It is not recommended for underground or buried installation without special precaution. The cases are air tight and moisture proof and may be used on either lead covered or plastic jacketed cable. It is also available with terminal blocks for use with drop wire.

1 Tie the cable securely in position. Select the proper sealing washers and slip two on each cable out of the way.



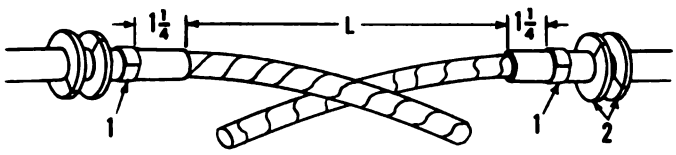
Reliable



G & W Case: (1) Metal shield; (2) Slot in polyethylene sheeting for desiccant; (3) Bond wire; (4) Wire connector; (5) Insulating sleeve; (6) Polyethylene sheeting; (7) Tape; (8) Plastic housing; (9) Neoprene seal; (10) Plastic washers; (11) Compression cap.

PREPARATION (Continued)

2 Place marker tapes.



Reliable

Marker tapes (1) are placed at distance "L" + 1¼ in. from cable ends. Obtain "L" from the table below. Sealing washers (2) were placed on cable in Step 1.

O.D. of Cable	Reliable Splice Case	"L" Sheath Opening (Step 3)	No. of Tabs (Step 4
less than 1 in.	20A1	13 1/2 in.	4
1 in. to 1.6 in.	20B1	16 1/2 in.	6

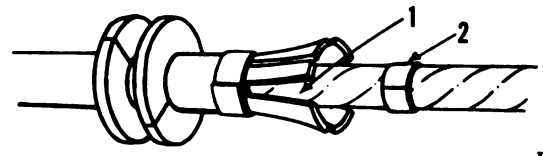
3 Remove the cable sheath and shield carefully so that there will be no damage to the core wrapper or insulation around the conductors.

Cut a ring part way through the jacket wall at the proper distance from the end of the cable. Then cut a slit part way through the jacket wall, from the ring to the end of the cable. The jacket can then be torn off by hand.

4 With tabbing shears or equivalent, cut the tabs. Cut through the sheath and shield. Avoid damage to the core wrapper.

Bend the tabs back. Cut out half of one tab to give space for the ears of the inner sheath clamp.

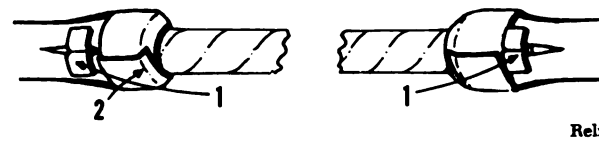
5 Make a collar by wrapping two turns of "B" tape, with the adhesive side out, around the core wrapper. Slip the collar under the tabs.



Reliable

(1) Enlarged tab opening for clamp ears; (2) Tape collars.

6 Slip the inner sheath clamp in place. Wrap four layers of "B" tape under the ends of the tabs to protect the core from the sharp metal shield ends. Bind the ends of the tabs down with tape.



Reliable

(1) Ears of inner sheath clamp; (2) Wrap of tape over tab ends.

7 Splice the conductors, using one of the methods shown, starting on page 24.

SPLICING

Splicing of the conductors may be done by any one of several methods:

1) Pigtail, using filled plastic sleeves.
   a) simple twist
   b) twist and solder
   c) using a connector, squeezed or soldered
2) Straight-through splice, using an unfilled sleeve and a connector, squeezed or soldered into place.

The following statement is quoted from Manual PC-2, of the Rural Electrification Administration, U.S. Department of Agriculture.

"In identifying pairs in splices where ends of the individual conductors are not available to the splicer, it is essential to maintain the insulated waterproof condition of the conductors. To maintain this condition throughout the plastic insulated cable plant, filled plastic sleeves were designed to seal all joints from moisture and are now in common use. Testing shall be accomplished by an inductive pick-up and amplifier.

"After all cable work is completed, the splicer shall make tests to ascertain that all pairs, except those specifically noted as defective . . ., are free from grounds, shorts, crosses, and opens. . . .

"Insulation leakage resistance tests shall be made and the resistance should not be less than 500 megohm miles between any one conductor and all other conductors and the shield. The tests should be made with a suitable . . . insulation tester with a maximum rated output of 400 or 500 volts dc.

"The insulation resistance varies inversely with the length of the cable, i.e., the longer the cable the lower the resistance. The number of insulation resistance tests will depend upon the length, size and type of cable. An insulation resistance test should be made at least once in every 20 sections of aerial cable or 10 sections of underground cable. A section of cable is defined in this instance as any given length of cable between splices."

INSULATION RESISTANCE FOR EACH CONDUCTOR BASED UPON REQUIREMENT OF 500 MEGOHM MILES

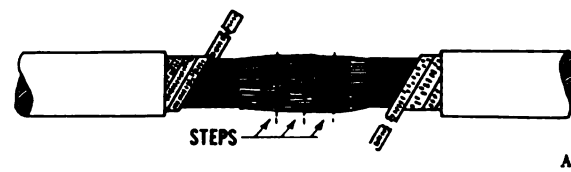
Length in Feet	Insulation Resistance in Megohms	Length in Feet	Insulation Resistance in Megohms
500	5,280	5,000	528
1,000	2,640	6,000	440
1,500	1,760	7,000	377
2,000	1,320	8,000	330
3,000	880	9,000	293
4,000	660	10,000	264

Table of insulation resistance as recommended by R.E.A.

The joints should be staggered or arranged in rows for uniform lay-up.

NUMBER OF STEPS AND LENGTH "S" OF CONDUCTOR SPLICE

No. of Pairs in Cable	Steps	Length "S"
11	2	7 inches
16	3	9
26	3	11
51	4	13
76	5	15
101	6	17



Ansonia

Start splicing with center conductors and work to the outer conductors.

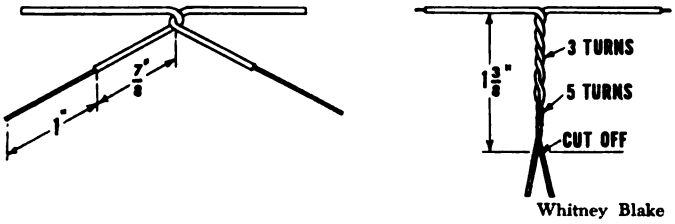
Separate conductors into bunches by color groups or complements and secure them in a convenient position for splicing.

Pigtail Splice

Two approaches to the pigtail splice are presented here—one twists only the individual conductors, the other retains the association of the pair.

First Method

1 Take the corresponding wire from each cable and give them a sharp twist where the pigtail will be made.
2 Cut off the excess wire approximately 1⅜ in. below this twist.
3 Strip 1 in. of insulation from the end of each conductor.
4 Twist the conductors together, catching the insulation in the first three loose half turns of the pigtail.
5 Complete the pigtail with five firm half turns of the bare conductor. The completed pigtail should be approximately 1 ⅝ in. long.

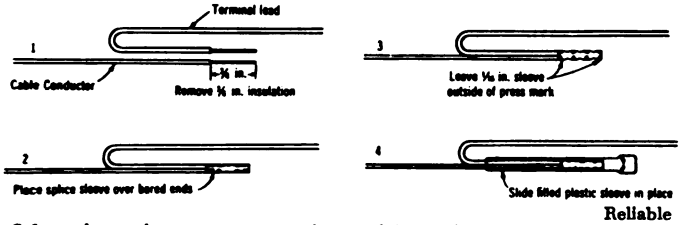


Whitney Blake

Procedure in making a pigtail splice with individual conductors.

The twisted pigtail may then be soldered, as recommended by some.

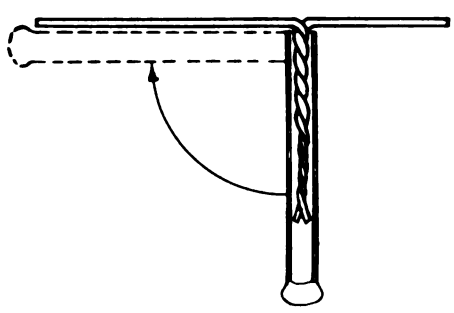
Instead of twisting the conductors, a metal connector may be placed over the bare conductors and crimped or soldered in place.



Reliable

Crimped metal connectors may be used instead of twisting the wires.

6 Slide a silicone grease filled plastic sleeve over the pigtail.
7 Bend pigtail into place parallel to cable.



Whitney Blake

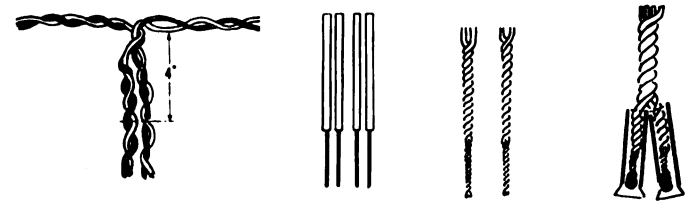
The completed pigtail splice is bent into place parallel to the cable.

Second Method

1 Take the corresponding pair from each cable and give them a sharp twist where the pigtail will be made.
2 Cut off the excess wire approximately 4 in. below this twist.
3 Strip 1 in. of insulation from the end of each conductor.
4 Twist the individual conductors together, catching the insulation in the first three loose half turns of the pigtail.
5 Complete the pigtail with five firm half turns of the bare conductor.

The twisted pigtail may then be soldered, as recommended by some.

Instead of twisting the conductors, a metal connector may be placed over the conductors and crimped or soldered in place.



Whitney Blake

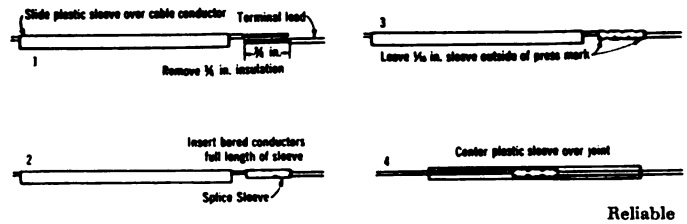
6 Slide a silicone grease filled plastic sleeve over each pigtail.
7 The joined tip conductors and the joined ring conductors should then be twisted together.
8 Bend pigtail into place parallel to cable.

Straight-Through Splice

1 Train an individual conductor of one cable so that it overlaps the companion conductor of the other cable. Determine the location of the centerline of the connector when it will be in the final position in the splice, and mark both conductors at this point.
2 Depending on the type of connector used:

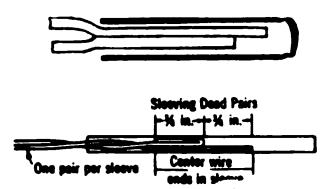
a) Cut both conductors so that their ends butt squarely together, if butt-type connector is used; or

b) Cut both conductors so that their ends overlap approximately ¾ in., if the overlapping type is used.



Reliable

3 Slip a sleeve over one of the conductors.
4 Remove insulation for ¾-in. on each conductor.
5 Fit the connector onto the conductors and crimp or solder in place.
6 Bring the sleeve into position over the connector, centering it over the joint.



Whitney Blake (top); Reliable (bottom)

Two methods of ending conductors in a splice.

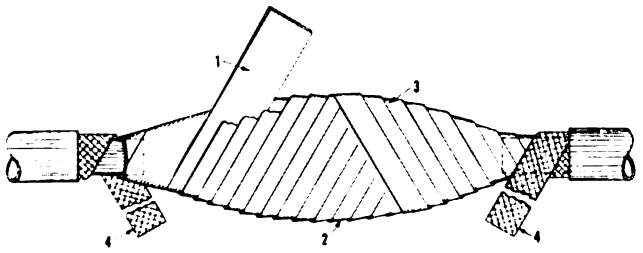
ENCLOSING

With the conductors now joined, the next step is to protect the splice with an outer wrapping. All but the manufactured case "B" are moisture proof when the steps are followed.

Tape Enclosure: First Method

7 When necessary, apply "E" tape to fill out major irregularities and voids in the splice in order to obtain a uniform base for the steps which follow. Penciling the sheath is also recommended.

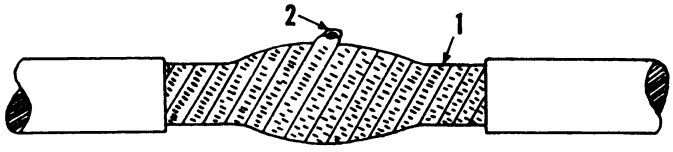
8 Wrap the splice with two layers of "B" tape, half lapped to cover the entire splice, but not to overlap the cable sheath or shield. The first layer of tape should be applied **adhesive side OUT.** The second should be applied **adhesive side IN.**



Whitney Blake

(1) Filler tape; (2) Tape with adhesive side out; (3) Tape with adhesive side in; (4) Metal shield.

9 Rewrap the shields around the splice and solder. If the shields do not meet, solder in an additional piece of shield. PERFORM ALL SOLDERING OPERATIONS AWAY FROM THE CABLE CORE.



Ansonia

Metal shield (1) is rewrapped over splice and soldered (2).

10 In applying tapes as included in the following operations, start at the center, working from center to the right in one operation, and from center to the left in the next. This method, designated as wrapping downhill, enables the craftsman to turn out a smooth tapered splice.

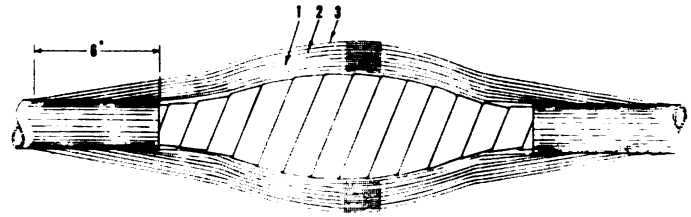
All tapes, other than BiSeal, should be applied with only enough tension to remove them from the roll, which is the equivalent of about 10 per cent stretch. BiSeal tapes should not be stretched more than 100 per cent, which will reduce the width to about 75 per cent.

11A (Omit if step 3 was performed.) At this point Ansonia recommends the scuffing of the cable sheath for a distance of 2 in. back from the edge to insure proper adhesion of tapes. Use No. 2 ½ grade sandpaper. **Do No Use Emery Cloth or Emery Paper.**

---

12 Apply four layers of "A" tape (or "B" tape if "A" not available) half lapped over the splice, with the ends feathered out over the cable sheath at ½-in. intervals, thus covering 2 in. of the cable sheath.

Ansonia recommends that the minimum wall thickness of this tape should be 1 ½ times the thickness of the original jacket which it replaced.



Whitney Blake

Taped splice is completed with the following wrappings: (1) Four layers of "A" tape; (2) Two layers of "D" tape; (3) Two layers of "C" tape.

13 Apply two layers of 2-in. adhesive backed aluminum tape (tape "D") over the splice, half lapped and feathered out on the cable sheath at 1-in. intervals beyond the ends of the plastic tapes applied in the previous step. Iron into a smooth, tight, moisture-proof fit by using the shank of a screw driver or handle or a carding tool.

14 Apply two layers of "C" tape over the splice, half lapped and feathered out beyond the aluminum tape 1 in. The splice may then be painted if desired.

Second Method

(Recommended by Okonite)

7 Bundle the completed conductor joints snugly together and apply two half lapped layers of friction tape ("Manson Tape") over the bundled conductor joints, extending up to the insulating belt (binder wrapping).

8 Wipe the insulating belt on each cable with a cloth moistened with a suitable solvent. Apply rubber cement and allow to dry until tacky.

9 Apply self-fusing rubber tape ("Okonite Tape") half lapped, tensioning it to approximately three-quarters of its original width. Build up to a thickness of ⅛ in., extending wrap onto the insulating belt and tapering down to the shield.

10 Form and shape the grounding strap tightly around the exposed shield and making close contact with it. Holes in the tabs must line up. Then solder the strap to the shield and solder the tabs together.

11 Apply one half lapped layer of shielding braid over the splice and solder the ends of the braid to the cable shield.

12 Apply a strip of 264/#34 flat braid along the length of the shielding braid and tack solder to the shielding braid and to the cable shield.

13 Apply two half lapped layers of friction tape ("Manson Tape") over the full length of the shielding braid and extending up to the sheath on each cable.

14 Buff the sheath on each cable for a length of 2 in. with Aloxite cloth. Wipe the buffed surfaces clean with a cloth moistened with a suitable solvent.

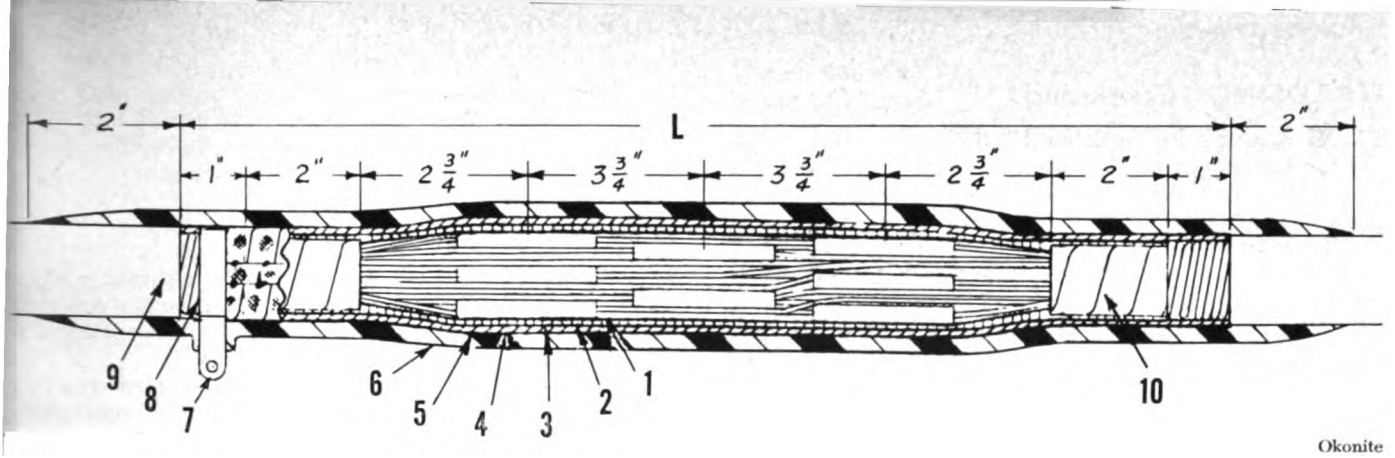
15 Though not necessary, better results are obtained by applying Okoweld Cement to the buffed surface of the sheath, and to 2 in. of the exposed ground strap. Allow to dry until tacky.

16 Apply three half lapped layers of self-fusing tape ("Okoweld Tape"), using minimum tension necessary so that the tape conforms evenly to the contours of the splice. Extend tape for 2 in. onto the sheath, wrapping around ground strap to provide a moisture seal.

Roll down each layer of tape with a heated splice roller.

Connect strap to ground.

(See diagram, top of next page)



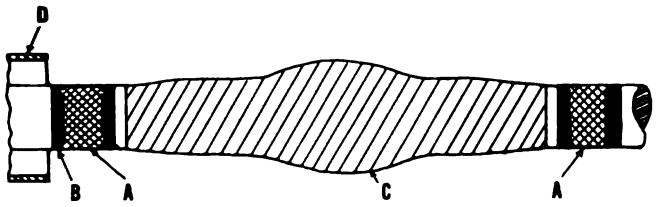
Okonite

Sectional view of a taped splice as recommended by Okonite. Length "L" is given in the table under Step 2 on page 20. (1) Two layers of "Manson" (friction) tape; (2) "Okonite" self-fusing rubber tape built up to a thickness of 1/8 in.; (3) Two layers of "Manson" tape; (4) One half lapped layer of copper mesh braid soldered to shield; (5) Two half lapped layers of "Manson" tape over copper mesh braid; (6) Three half lapped layers of self-fusing "Okoweld" tape; (7) Ground strap; (8) Shield; (9) Cable sheath; and (10) Insulating belt (binder wrapper).

Case "A

6 If a compound-filled splice is employed, or if additional protection in the form of a second moisture barrier is desired, follow steps 10, 11A, and 11 under the Tape Method.

7 Place soft copper wire mesh 3 in. wide over each cable jacket ½ in. from the end of the tape applied in step 6, or 2 ½ in. from the end of the jacket. Hold mesh tightly in place with two turns of "B" tape.

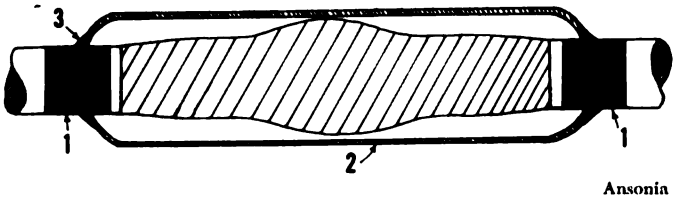


Ansonia

The copper screen (A) is held in place with a wrap of "B" tape (B); Splice (C) will be enclosed in lead shield (D).

8 Slip lead sleeve over splice and dress down to meet the copper mesh collars on the cable.

9 Solder each end of lead sleeve to copper mesh collar.



Ansonia

Lead shield (2) is dressed to copper screen (1) and soldered (3).

10 Clean lead sleeve 2 in. back from each end and scuff jackets 2 in. from end of copper mesh collars.

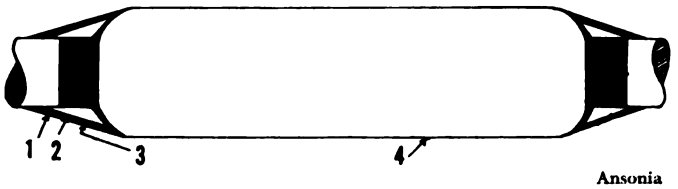
11 Sink copper mesh into jacket at a number of points with a very hot soldering iron. Patches will appear in the copper mesh when the plastic is soft enough.

12 Build up space between cable and lead sleeve with the required number of half lapped layers of "A" tape.

13 Apply two layers of "B" tape half lapped over the tape of the previous step.

14 If desired, apply two layers of friction tape half lapped over tape of previous step and paint.

If desired, the splice may be filled with sealing compound through a hole made in the lead sleeve. Solder over filling holes when filled. See step 6.

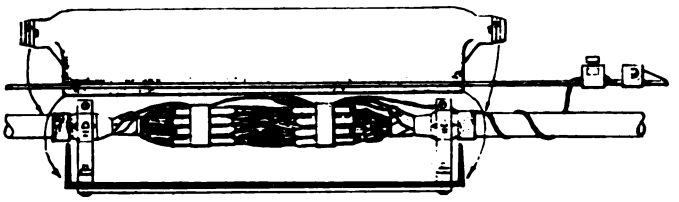


Ansonia

(1) "B" tape; (2) "A" tape; (3) Friction tape; (4) Lead sleeve.

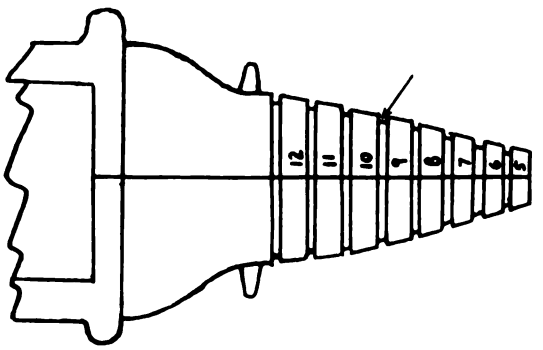
Case "B"

15 Wrap the splice bundle with two turns of "B" tape at two locations to hold the bundle in place. Include the bond wire within the wraps of tape.



R.E.A.

16 The ends of the cover of the terminal are tapered with grooves marked in tenths of inches indicating the outside diamter of the cable used. The tapered portion should be cut at the appropriate groove to provide a snug fit. The cut is made in the groove below the number.



Rex

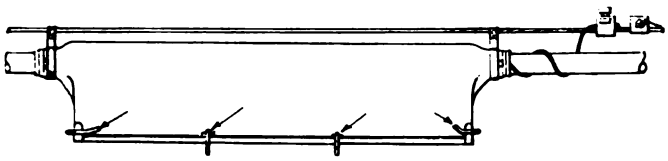
Arrow points to the 1-in. groove in tapered end of splice case.

ENCLOSING (Continued)

17 The cover sides are labeled "odd" and "even." Match the cover to the base. Slide the cover down over the cable and framework and fit along the edge of base. Fasten wire clips.

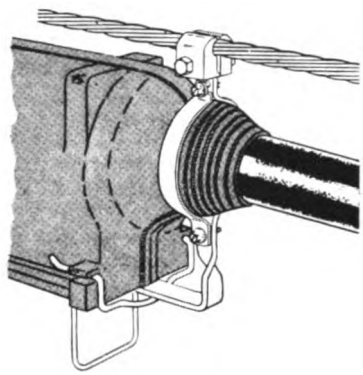
Make certain that the cover fits snugly around the cable. Work the ends with the fingers until the slit in the cover is tightly closed.

18 Install clamp around tapered ends of case.



R.E.A.

The completed W.E. case. Arrows indicate fastening clips (Step 17).



Reliable

The completed Reliable Series 100A/200 Case.

Case "C"

See drawing on page 23.

8 Bind the conductors together with a piece of tape.

9 Wrap the splice with a piece of polyethylene sheeting (suppled with case) so that edges overlap. The sheeting must also overlap the ends of the binder tape at each end of the joint. Secure the ends of the sheeting with twine or tape.

10 Carefully make a slit in the sheeting at the top of the joint for a sufficient distance to allow the desiccant to run into the joint. Avoid damage to the splices and conductor insulation during this operation.

Pour the desiccant through the slit in the sheeting to remove moisture by absorption.

11 Seal the opening in the polyethylene sheeting by applying a half lapped layer of tape entirely across the joint and extending beyond the ends of the sheeting.

12 As recommended by G&W: Solder a piece of bonding wire to the end of the shielding at each end of the joint. Rewind the shielding completely across the joint and secure each end with a piece of saturated flax twine. Twist the ends of the bonding wire together and solder. Bend the twisted ends down so that they rest along the joint and secure with a piece of saturated twine.

As recommended by Peaco: Rewrap the shields around the splice and solder. If the shields do not meet, solder in an additional piece of shield. Perform all soldering operations away from the cable core.

13 Bring the threaded plastic pipe into position, using care to center it with respect to the joint.

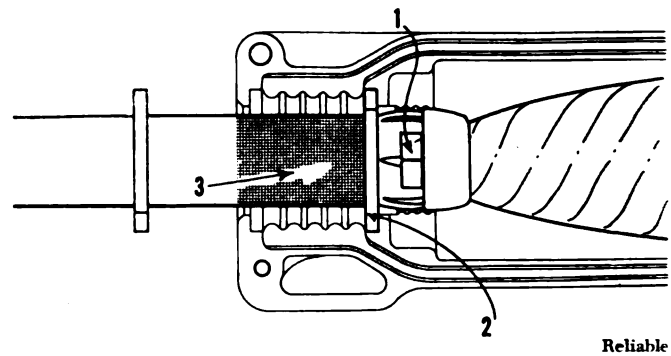
14 Bring the seals with washers into position in the ends of the pipe.

15 Screw the caps onto the ends of the pipe tightly to insure a good seal and prevent the entrance of moisture. (G&W recommends using a wrench on the end caps to tighten; Peaco recommends hand tightening only.)

Case "D"

8 Clean the sheath with a cloth. Scuff the sheath with a carding brush for a distance of 2 to 3 in. from the ends of the tab slits, using a circular motion. Be sure the sheath is scuffed completely around the cable.

9 Position the splice case and slide the inner sealing washer in place as shown. Mark the cable at the outer sides of these washers.



Reliable

(1) Inner sheath clamp; (2) sealing washer; (3) scuffed sheath.

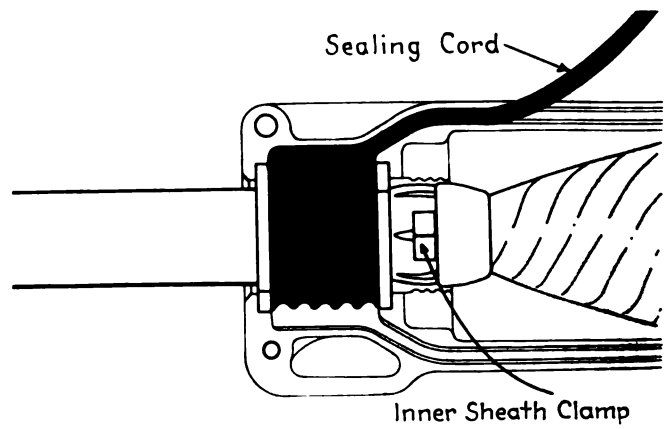
10 Remove the splice case. Wrap sealing tape (supplied with case) around each cable in single layers, with butted joints. Build up a collar until the diameter is slightly, but not more than 1/16 in., larger than that of the sealing washer. Start each succeeding layer of tape so as to lap the butted joint of the layer under it. The tape must be kept clean and must not be stretched.

11 Position the outer sealing washer so its slit is 90 deg from that of the inner washer.

12 Clean any oil, grease, moisture, etc., from the sealing surfaces of the splice case with a clean dry cloth.

13 Attach the splice case to the messenger strand with mounting lugs and bring it into position with the sealing washers against the shoulders provided.

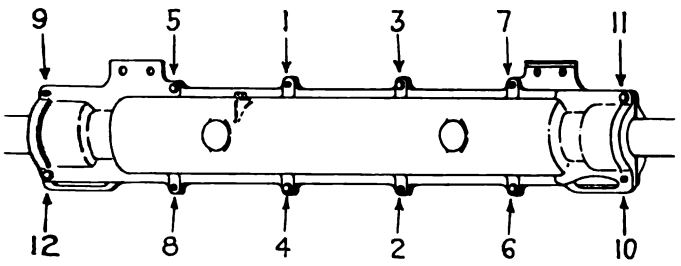
14 Place the sealing cord (supplied with case) in place along the length of the split of the two halves of the housing. Be careful to avoid severe dents in the cord. Do not stretch the cord. Be sure the cord is free from moisture and dirt.



Reliable

15 Place the other half of the splice case in position. Tighten down the bolts with a ratchet wrench about two turns at a time in the order shown, until a metal to metal contact is obtained. Examine the ends of the case. If some sealing tape has flowed past the sealing washer, or if the

washer is slightly deformed outwards, a good seal is indicated.



Reliable

16 Flash testing of each completed splice is recommended, using a pressure of 5 psi and testing solution.

Cast Epoxy Resin Enclosure

(Recommended by 3M Co.)

In this type of enclosure, the splice is encased in an epoxy resin ("Scotchcast"), which is poured or forced into a mold around the splice.

Two methods are available to form the mold: A two-piece, self-vented, split plastic mold for inline splices on cable 1 7/16 in. O.D. and smaller, and a mold that is built up of screen-like tape for larger cables and unusual configurations.

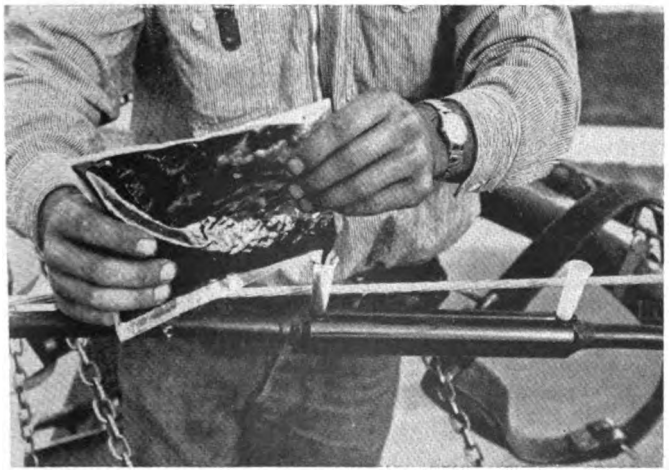
Split Plastic Mold

1 Scrape outer jacket of cable thoroughly with a knife held at right angles to the cable. Jacket must be completely cleaned of all wax and dirt. Be careful not to cut jacket.

2 Bond the shield across the splice as follows: Solder a piece of bonding wire to the shield of one cable. Run the bond along the cable away from the splice so that the wire will run outside the mold. Hold the wire in position with several turns of tape (3M #33). Loop the wire back to a point on the other cable that will be outside the mold. Tape bond wire to cable. Run the wire along the cable and solder to the cable sheath.

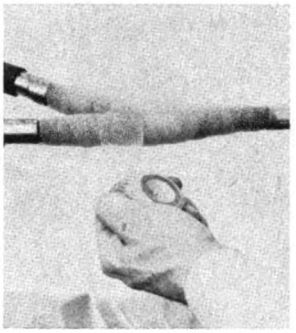
3 Snap mold in place around the splice and install plastic pouring spouts. Mold must overlap each cable sheath by at least 3 in. Wrap several turns of self-fusing rubber tape (3M-#23) around the juncture of the cable and the mold.

4 Mix resin and activator in the plastic bag ("Unipak") and pour into mold. Workman should stay with the splice, refilling both pouring spouts from time to time as the resin works its way into the splice.

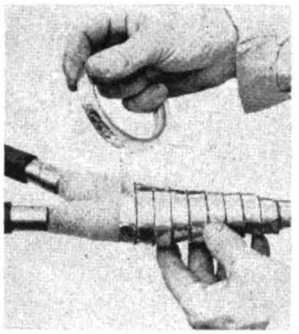


The pouring end of the mold is kept high to allow bubbles to escape. The resin cures through heat generated by chemical action.

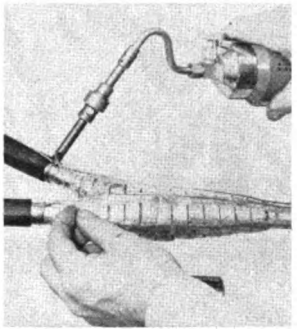
Built-Up Mold



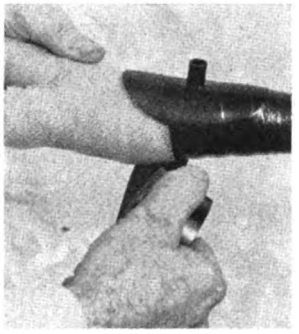
Wrapping with spacer tape.



Next: Aluminum shielding tape.

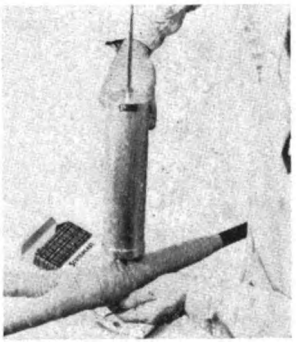


Bonding the cable shields.



Vinyl tape forms the seal.

Applying restricting tape.



Pumping resin into splice.

1 Scrape outer jacket of cable thoroughly with a knife held at right angles to the cable. Jacket must be completely cleaned of all wax and dirt. Be careful not to cut into jacket.

2 Build mold up part way with several layers of screen-like spacer tape (3M #P3).

3 Wrap aluminum shielding tape (3M #425) around the splice leaving about ¼ inch between turns. Solder a bond wire to the cable shields.

4 Apply additional spacing tape, overlapping sheath by 3 in. Cover with vinyl tape (3M #22), inserting injection fitting as shown. Fitting is placed nearer one end of splice. Vinyl tape forms the seal for the liquid resin.

5 Apply fabric restricting tape (3M #P4) which prevents vinyl tape from stretching under pressure.

6 Mix resin and activator in plastic bag and attach spout to the bag. Place bag in the gun. Make a small hole through the sealing tape at the far end of the splice to allow air to escape. Puncture bag through the spout and "shoot" resin into injection fitting. When resin seeps through hole made in far end of splice, seal hole with a wrap of tape (3M #33) and make a small hole at the rear end of splice. Continue pumping resin until it seeps through this hole. This shows complete saturation of splice.

LIST OF SUPPLIERS

FILLED PLASTIC SPLICING SLEEVES

Gauge of Conductors to be Joined	Inside Diameter and Color of Sleeves for Approximate Conductor Insulation Thickness	
	0.015 in.	0.012 in.
19 to 19	0.145 red	0.125 clear
19 to 22	0.125 clear	0.105 green
19 to 24	"	"
22 to 22	"	"
22 to 24	"	0.085 yellow
24 to 24	"	"

Irvington Varnish & Insulation Division, 3M Co.
Superior Cable Corp.
W. G. Pearson Co.

TAPE "A"
20-mil Self Bonding Polyethylene Tape

BiSeal #2	Bishop Mfg. Corp.

TAPE "B"
7-mil Pressure-Sensitive Vinyl Tape

#1	Bishop Mfg. Corp.
#166	Johns-Manville
Pol 852	Kendall Co.
#33	3M Co.
#29	Permacel Tape Corp.
#7	Plymouth Rubber Co.
#10	Rubber & Plastic Compound Co.

TAPE "C"
10-mil Pressure Sensitive Vinyl Tape

#2	Bishop Mfg. Corp.
#130	Johns-Manville
Pol 872	Kendall Co.
#22	3M Co.
#30	Permacel Tape Corp.
#10	Plymouth Rubber Co.
Tuck 330	Technical Tape Corp.

TAPE "D"

Adhesive Backed Aluminum Tape for Moisture Barrier

#49	3M Co.
#11	Permacel Tape Corp.

TAPE "E"
Filler Tape

#125	Bishop Mfg. Corp.
#2	3M Co.

CASE "B"
Strand mounted enclosure, with access to terminals, for plastic-jacketed, plastic-insulated cables

	For maximum 1.2 in. O.D.	For 1.0 in. to 2.2 in. O.D.
Cook Electric Co.	#81-161	#81-250
Reliable Electric Co.	#100A	#200
Western Electric Co.	#49A-0	#49B1-0

CASE "C"
Plastic pipe, suitable for direct burial

G & W Electric Specialty Co.

W. G. Pearson Co. ("Peaco")

CASE "D"
Cast aluminum, for aerial cable, lead or plastic

	For cables up to 1.0 in. O.D.	For cables 1.0 in. to 1.6 in. O.D.
Reliable Electric Co.	#20A1	#20B1

ALUMINUM FLUX

Alcoa #64	Aluminum Co. of America

Use only 50-50 wire solder with this flux

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