CABLE SPLICING—GENERAL DRYING WET CABLE SECTIONS AND SPLICES

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1. GENERAL		1	2.01 Due to the urge restoration, the
2. PRECAUTIONS		1	must be familiar with and pertaining to the type
3. OPENING CABLE		2	is performed (Section 6
4. DRYING WET CON	DUCTORS .	3	2.02 Individual paper- in a wet section or
A. Heated Air Me	ethod	3	until the insulation has handling the conductor
B. Desiccant Meth	od	8 .	insulation.
5. REPAIRING INSUL			2.03 Except in the c
CONDUCTOR GROU	JPS	11	method of determ circuits will be in accord
6. WRAP DOWN AND	CLOSING .	12	Restore special circuits
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- This section outlines the methods used to dry wet sections and splices of pulp- or paper-insulated conductors. The section also includes information for drying splices where the 710 connector system has been used for joining conductors.
- When this section is reissued, the reason for the reissue will be listed in this paragraph.
- The procedures for drying wet conductors described in this section are limited to pulpor paper-insulated conductors. Restoring wet PIC cable is described in Section 644-200-030.

ncy associated with cable employee making repairs d must follow all precautions

of cable plant where work 44-200-040).

- or pulp-insulated conductors splice must not be handled dried sufficiently to permit rs without damaging the
- ase of total failure, the ining restoration of special dance with local procedure. first whenever possible.
- desk when the cable is to tablish a talk circuit with soon as practicable (Section 634-020-501). Shorts, crosses, and grounds, even though temporary, will interfere with the operation of central office equipment and could put the equipment out of service.
- 2.05 Take special care to avoid damage to connections of balancing units, capacitors, resistors, or loading coils. Do not boil these units with paraffin since the heat may change their characteristics. If it is necessary to open a conductor pair to make repairs, place a bridge to maintain continuity of service; then, open the conductors and mark both ends to ensure proper restoration.

2.06 On any cables which are pressurized, place a regulated air supply at equal distance on each side of the wet section and regulate the feed pressure in accordance with Table A (Section 644-200-040).

TABLE A
PRESSURE APPLICATIONS

MAXIMUM ALLOWANCE CABLE PRESSURE	TYPE OF SYSTEM			
20 PSI	Submarine cables not involving 471-Type Apparatus Cases			
15 PSI	Land cable not involving 471-Type Apparatus Cases			
10 PSI	Any cable where maximum pressure would extend into a 471-Type Apparatus Case			

3. OPENING CABLE



Before any lead sheath cable is opened, a temporary cable bond must be placed across the proposed opening. On polyjacketed cables, the bond must be placed immediately after the outside polysheath has been removed (Section 638-300-200).

- 3.01 The removal of the splice cases and lead sleeves is described in the 633 Division of the Bell System Practices.
- 3.02 If the splice is wet at or near a splice joint, remove the joints and adjacent sheath to expose the entire wet section. **Do not** apply heat to remove the joints or cable sheath because heat will force the moisture further under the sheath.
- 3.03 Each end of the opening must be prepared with the proper serving to protect the conductors from damage. On sheath openings, remove the paper wrapping, and cut the outer layer of binders to allow ballooning the wet area (Fig. 1).

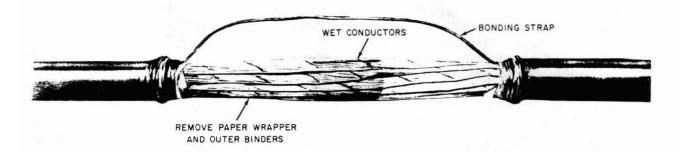


Fig. 1—Sheath Opening

- 3.04 If the conductor insulation is too wet to handle without causing damage, dry the outside area first to allow handling the conductor groups for ballooning the wet area and increasing air circulation.
- 3.05 At wet splice locations, remove the splice wrapping material and cut the splice bundle tie. Cut and remove the unit ties and replace them with a temporary tie located at each end of the opening.

Caution: When handling splice bundles and splice units of wet pulp- or paper-insulated conductors, extra care must be used to avoid stripping or breaking the insulation. Shorted pairs could cause arcing and burn the insulation from the surrounding pairs.

4. DRYING WET CONDUCTORS

A. Heated Air Method

- 4.01 The heated air method of drying wet cable conductors utilizes a prefabricated cable drying hood connected to a blower hose which is attached to a ventilator/heater.
- 4.02 A commercially available drying hood (such as the T. A. Pelsue, No. 7000) consists of a piece of impregnated nylon equipped with zippers and straps for enclosing the cable. The drying hood is approximately 6 feet long and 2-1/2 feet wide with an opening in the center designed to accept an adapter for attaching the 8-inch blower hose (Fig. 2). Holes are provided at the bottom of the hood to allow the air to escape.

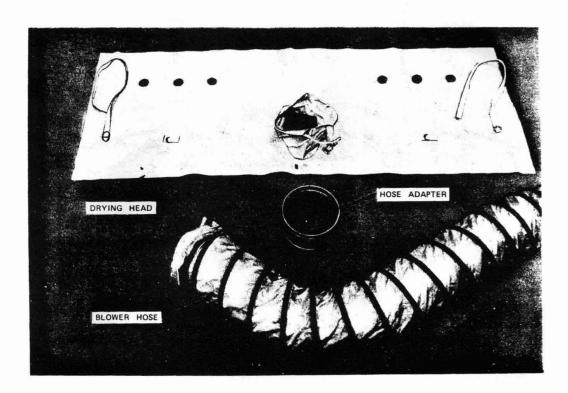


Fig. 2—Cable Drying Hood and Attachments

SECTION 644-200-101

- 4.03 Observe the following precautions when using the heated air method of drying wet cable conductors.
 - Do not use desiccant in the drying hood because of the danger of flying particles.
 - Observe all precautions relating to the use of ventilator/heaters and blower hoses as covered in the 649 Division of the Bell System Practices.
 - Do not handle individual wet conductors until the paper or pulp insulation has dried sufficiently.

- If the cable being dried is in a manhole, a second ventilator/heater is required to ventilate the manhole.
- 4.04 To dry conductors with the heated air method, proceed as follows:
 - (a) Prepare the cable for drying as described in Part 3.
 - (b) Place the cable drying hood over the wet area of the cable, centering the hood over the wet conductors (Fig. 3).

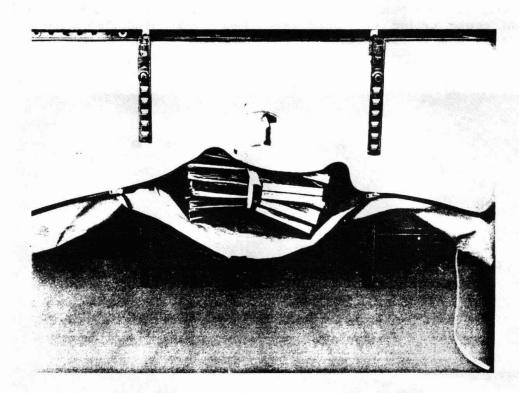


Fig. 3—Placing Drying Hood Over Wet Area

- (c) Secure the ends of the hood to the cable with the straps provided (Fig. 4).
- (d) Close the zipper opening and connect the blower hose to the hood, using the blower hose adapter (Fig. 5).
- (e) Operate the ventilator/heater at maximum heat and air volume.
- (f) Periodically check the drying process through the zipper opening.
- (g) Remove the inner conductor binders or ties as soon as conditions permit (paragraphs 3.04 and 3.05). Balloon the wet area to permit greater air circulation (Fig. 6).

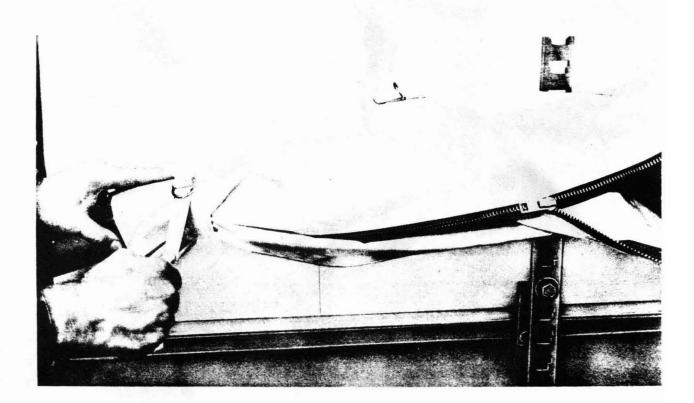


Fig. 4—Securing Ends of Drying Hood

Fig. 5—Drying Hood in Place

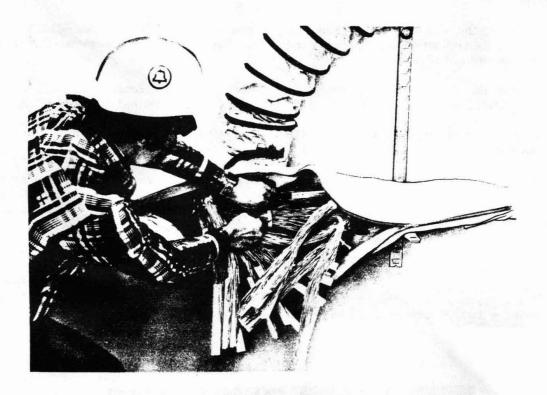


Fig. 6-Wet Splice-Removing Ties

SECTION 644-200-101

- (h) Continue the drying process, checking periodically, until all conductors are dry and circuits are returned to normal limits.
- Remove the drying hood and check for insulation damage.
- B. Desiccant Method (Do Not Use With 710 Connectors)
- 4.05 Desiccant is a harmless substance. However,
 B desiccant must be handled carefully to
 avoid inhalation of dust particles from it. Regular
 eye protection (safety glasses) must be worn when
 handling desiccant. Under windy conditions, special
 eye protection (goggles) must be worn to prevent
 dust particles from entering the eyes.
- 4.06 Before applying the desiccant method of drying wet cable conductors, all employees

must be familiar with Section 632-050-205 of the Bell System Practices (Desiccants—Description and Use).

- 4.07 To dry wet conductor insulation using the desiccant method, proceed as follows:
 - (a) Prepare the cable for drying as discussed in Part 3.
 - (b) Place a loose muslin envelope around the exposed conductors and secure the ends of the envelope to the cable sheath, as shown in Fig. 7.

Note: The envelope opening must be at the top and the envelope must be sufficiently large to permit reaching by hand from the opening to the bottom of the splice.

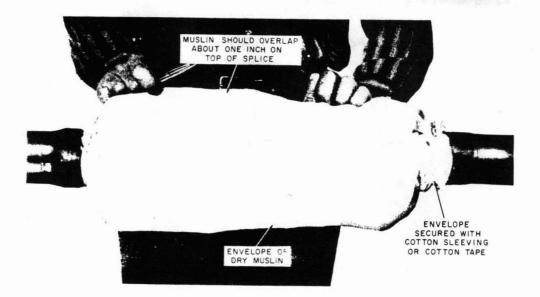


Fig. 7-Muslin Envelope in Place

(c) Pour granular (B) desiccant over the conductors, covering as many conductors as possible,

and allow the desiccant to sift through to the bottom of the envelope (Fig. 8).

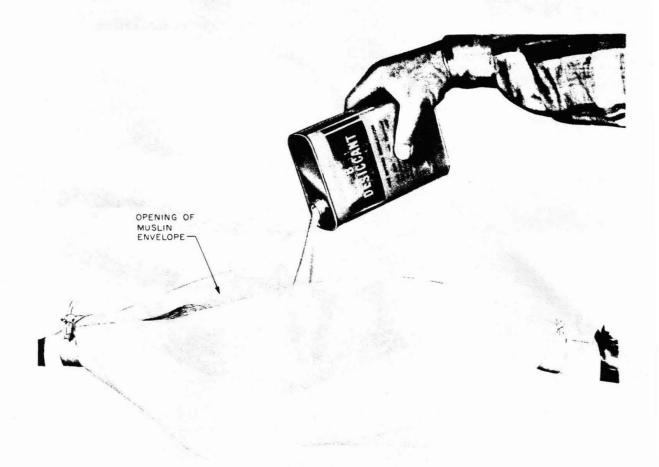


Fig. 8—Pouring Desiccant Over Splice

- (d) Continue the drying process by scooping the desiccant from the bottom of the envelope with the hand and repouring the desiccant over the wet area. Replace the spent desiccant as required (Fig. 9).
- (e) Remove the inner conductor binders or ties as soon as conditions permit (paragraphs 3.04 and 3.05). Balloon the wet area to permit greater air circulation and desiccant contact.
- (f) Continue drying the conductors with desiccant unti! inspection reveals that the insulation has dried sufficiently to permit handling the conductors without causing damage.
- (g) Remove the muslin envelope and excess desiccant. Verify circuit condition with the control test desk.

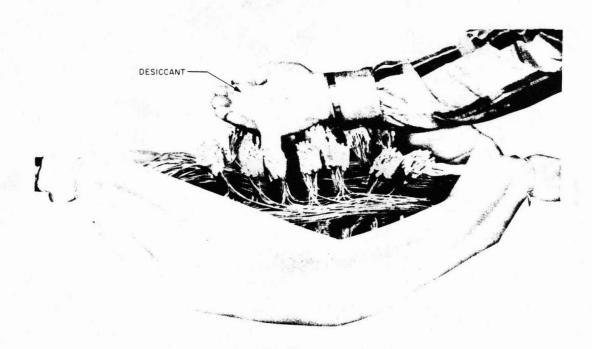


Fig. 9—Repouring Desiccant Over Splice

- REPAIRING INSULATION AND RETYING CONDUCTOR GROUPS
- 5.01 Each group of conductors must be inspected for insulation damage. Repair any damaged insulation by aligning a piece of B paper tape along the damaged area of the conductor insulation and closing the tape securely around the area, as shown in Fig. 10.
- 5.02 After all conductors have been inspected and the necessary repairs have been made, notify the office controlling the circuits and obtain assurance that all circuits conform to transmission requirements.



Fig. 10—Repairing Insulation

5.03 Remove the temporary ties at splice locations and retie the splice groups in accordance with the procedures described in the 632 Division of the Bell System Practices (Fig. 11).

6. WRAP DOWN AND CLOSING

6.01 The 632 Division of the Bell System Practices describes the methods used for prepairing the sheath ends of the cable opening.

- 6.02 Section 632-490-200 describes the methods used to wrap completed splices and sheath openings prior to applying the appropriate closure.
- 6.03 The appropriate closure must be selected and applied in accordance with the methods described for the closure selected.
- 6.04 Cable pressure must be allowed to stabilize before the temporary air supply is removed.

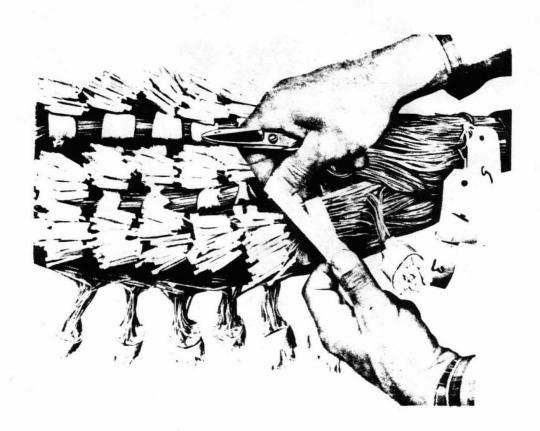


Fig. 11—Retying Groups After Repair

MAINTENANCE SYSTEM FOR AIR CORE POLYETHLENE-INSULATED CONDUCTOR (PIC) CABLE IN UNDERGROUND PLANT

			CO	NTEN	NTS						P	AGE
1.	GE	NERAL						•				1
2.	PR	ESSURIZA	TION D	URIN	IG	cc	NS	TR	UC	TIO	N	
												2
3.	PRI	ESSURE S	YSTEM	DESI	GN					٠		3
	A.	Exchang	ge Cable	•					٠			3
	B.	Toll and	d Trunk	Cab	le			•	•			3
4.	PRI	ESSURE A	ONITO	RING								3
5.	MA	INTENAN	ICE									4
	A.	Sheath	Breaks									4
	B.	Cable F	Repair	٠	•							4
	C.	Water I	Entry									7
	D.	Water I	Removal									8
	E.	PIC-PUL	PInterfo	ices								13
6.	REL	ATED BE	LL SYSTI	EM F	PRA	CT	ICE	s		•		13

1. GENERAL

- 1.01 This section provides an overview of the information covered in various Bell System Practices that relate to the methods and means for the design and implementation of a maintenance system for air core PIC cable in the underground environment.
- 1.02 When this section is reissued, the reason for reissue will be listed in this paragraph.

- plant of new designs of air core PIC cables, such as STEAMPETH, MAT, and DUCTPIC, it is imperative that an appropriate maintenance strategy accompany these new cable designs. In this regard, it is recommended that Section 930-200-001 covering Engineering and Implementation Methods System (EIMS) be reviewed. In addition, reference should be made to the current AT&T Company policy guidelines relating to cable pressure systems (Section 637-020-011).
- sheath maintenance system is to provide a scheme to prevent or minimize the entrance of water into the core of the cable. Toward this end, it is essential that air core underground PIC cable be maintained under continuous air pressure in the same manner as other air core cable systems in the underground plant. Although plastic insulation is more tolerant of water and moisture than pulp, water in PIC cable cannot be ignored. While most pairs will continue to "work" in a wet PIC cable, conductor corrosion will occur whenever water reaches defects in the plastic insulation, with a resultant degradation of service and, ultimately, loss of pairs.
- 1.05 A properly designed and continuously monitored and maintained pressure system will prevent the entrance of water through all but catastrophic leaks that may occur in the cable sheath. However, procedures must be established and strictly adhered to which will ensure prompt response to pressure alarms and restoration of the cable to dry conditions in the event of water entry.
- 1.06 With regard to water entry, the 1A sensor device (Section 644-201-105) is available as an option to aid in locating water in splices in the event of a sheath break. This simple device is bridged across a common pair at splice points during construction and, in the presence of water,

NOTICE

Not for use or disclosure outside the Bell System except under written agreement will test as a low-resistance fault. Location of the wet sensor is determined by standard bridge measuring techniques.

- 1.07 Since PIC insulation is not adversely affected by the use of filled connectors as is pulp, it is strongly recommended that the filled series of the 710 Connector System or equivalent be used in all splicing operations to provide additional protection against possible moisture entry.
- 1.08 In the event that water enters the cable core and contaminates a cable section, the Forced Air Restoration Method (FARM) is available for the restoration of the wet section. This method involves the injection of air at high pressures into the cable and thereby forces large quantities of dry air through the wet section to remove the water and restore the cable to a dry condition.
- 1.09 Of major importance in maintaining cable in the underground loop plant is the necessity for pressure plugs at all PIC-pulp interfaces. This arrangement is required to prevent a concentration of moisture in the pulp at the junction splice due to permeated moisture which will be transported by the normal air flow through the nonhygroscopic core of the PIC cable section. This isolation of PIC-pulp sections will, of course, require that each section be maintained as a separate pressure section, both from pressure feed and monitoring standpoints.
- 1.10 The following sections highlight the more important elements of the overall maintenance strategy. Complete details are covered in the appropriate Bell System Practices.

2. PRESSURIZATION DURING CONSTRUCTION

Related Bell System Practices — Sections 637-305-303 and 637-450-011

2.01 Pressurized cables are shipped from the factory under 10 psi pressure. As covered in Section 637-450-011, pressure readings should be made and recorded on the proper form for each cable length immediately after delivery, and at periodic intervals if extended storage is required, to detect any leaks that may occur. Similar readings should be taken and recorded before removing the reel from the storage yard and again immediately after a reel length has been placed to ascertain that no leaks have developed during the placing operation. If a leak is detected after the cable is

pulled into the duct and tests show that the leak is not at the exposed ends, the cable should be removed from the duct and the leak repaired or the cable section replaced.

Note: During any occasion when a leak has occurred and the cable has been exposed to water, the tests and procedures described in Section 644-104-090 (Fig. 5 and 6) should be followed to detect and remove any water that may have entered the cable.

- 2.02 Pressure measurements should be made and recorded just prior to opening the cable for splicing. If a leak is indicated, a pressure source should be connected to the section and the leak located and repaired or the cable replaced. During splicing operations, or whenever the cable sheath is opened, the procedures outlined in Section 637-305-303 covering pressure buffering should be followed to ensure that the cable sections are adequately protected against water entry.
- 2.03 As splicing progresses, the completed sections between the work location and the office pressure plug or section end should be connected to an air source near the plug or end point. As the distance to the splicing work from this air source increases, additional sources should be introduced at such intermediate points as required to maintain a minimum pressure of 5 psi in the completed sections.
- 2.04 When all splicing work has been completed, the cable should be connected to permanent air sources and pressurized to the normal monitored pressure of at least 6 psi. The pressure alarm devices should then be placed into operation and the cable monitored by automatic means such as the Cable Pressure Monitoring System (CPMS) as part of the overall pressure network. If the cable maintains the monitored pressure objective of 6 psi for seven consecutive days after all splicing work has been completed and the automatic monitoring procedures have been implemented, the responsibility for the cable may then be transferred to the maintenance organization.

3. PRESSURE SYSTEM DESIGN

A. Exchange Cable

Related Bell System Practices — Sections 901-473-050, 930-200-001, 930-200-010, and 637-020-020

- 3.01 Exchange cable pressurization is an engineering design function and should be planned and designed by the engineer of outside plant with the aid of the Air Pressure Analysis Program (AIRPAP) covered in Section 901-473-050. AIRPAP is a time-shared computer program administered by the Western Electric Company as part of the Engineering, Planning, and Analysis Systems (EPLANS).
- 3.02 This program eliminates the necessity of doing the time-consuming and tedious manual calculations required to analyze an exchange pressurization system, a task that is impractical to attempt manually. While AIRPAP is primarily intended to assist engineers in the design of a complete pressurization network, it can also be used to redesign any segment of an existing pressurization network.
- 3.03 Design information is provided in the program to ensure that a minimum design pressure of 5 psi is achieved throughout the pressurized underground cable network. In addition, the program recommends specific monitoring device locations so that adequate surveillance of the entire pressure system is ensured.
- 3.04 Based on data input to the program, AIRPAP design output information includes the following:
 - (a) Recommended auxiliary air source locations
 - (b) Recommended locations for monitoring devices
 - (c) Estimated air usage for the cable network
 - (d) The location of potentially low pressure points
 - (e) Route mileage of the pressurized cable network
 - (f) Installed cost of the pressurization hardware.

B. Toll and Trunk Cable

Related Bell System Practices — Sections 930-200-001, 930-210-100, 930-210-200, and 637-020-020

- 3.05 Toll and trunk cable pressurization is also an engineering design function and should be planned and designed by the engineer of outside plant. The pressurization system should be designed in accordance with the guidelines contained in Sections 930-210-100 and 930-210-200, Design of Air Sources for Toll and Trunk Cable and Guidelines for Locating Monitoring Devices on Toll and Trunk Cable, respectively.
- The practices provide in tabular and graphical 3.06 form the design information necessary for the engineer to position air source and monitoring locations in trunk and toll cable with a minimum of calculations and analysis. In general, source spacings of up to 8 miles with monitoring devices placed at the one-quarter, one-half, and three-quarter points are typical pressurization designs for this type of plant. However, every advantage should be taken of situations where toll or trunk cables parallel a subscriber cable in an underground network. In such cases, monitoring coverage can be easily and inexpensively obtained by utilizing the subscriber monitoring arrangement for pressure transducer surveillance of the toll or trunk cable.

4. PRESSURE MONITORING

Related Bell System Practices — Sections 930-210-020, 930-210-200, 637-222-101, 637-225-215, and 637-600 Series

4.01 Underground PIC cable must be maintained under the constant surveillance of an automatic cable pressure monitoring system in the same manner as other cables in the underground environment. Continuous monitoring of pressure and flow related devices will warn of slow pressure leaks that may develop as well as major sheath breaks. It is essential that pressure alarms be responded to immediately and a thorough investigation be made to find and correct the cause of the alarm.

The system standard, Cable Pressure Monitoring System (CPMS), is a centralized scanning and reporting system for the automatic surveillance of pressure monitoring devices associated with pressurized cable over a large geographical area. With CPMS, a computerized central terminal controls the assembly of alarm and status information from a large number of devices located throughout the pressurized cable network. Information gathered at the central terminal is analyzed and automatically disseminated to the responsible maintenance center for action. CPMS provides a very effective means of monitoring all standard pressure-related sensors and is, therefore, recommended as the most desirable vehicle for the complete surveillance of all pressure systems.

4.03 Where CPMS is not available, an automatic pressure monitoring system having features which include the following should be used:

- (a) 24 hour surveillance
- (b) Selected priority scanning and reporting of device status
- (c) Reporting of alarms on an exception basis
- (d) Reporting alarm information to remote locatings
- (e) Compatibility with standard pressure-related sensing devices.

5. MAINTENANCE

A. Sheath Breaks

Related Bell System Practices — Sections 637-410-011, 637-410-504, 644-104-090, and 637-412-500

5.01 The use of pressure measuring transducers located at strategic points in underground cable plant by AIRPAP and under the surveillance of an automatic cable pressure monitoring system such as CPMS is the most effective means for detecting sheath breaks as they occur. Prompt response to alarms will permit the clearing of essentially all but catastrophic breaks on a routine basis before they become service affecting.

5.02 When a sheath break has been detected by a loss of pressure, the break must, of course, be located and repaired. Standard methods covered in the Bell System Practices include the use of pressure gradients and flow analysis means to locate the source of the leak. In this regard, experience has shown that in underground plant approximately 80% of the sheath breaks occur in manholes. In the event that the break is indicated to be in the section, and the cause is not obvious (ie, dig-up or the like), consideration should be given to the relative economics of replacing the cable section versus locating, exposing the conduit, and repairing the leak.

Note: During any occasion when a leak has occurred and the cable has been exposed to water, the tests and procedures described in Section 644-104-090 should be followed to detect and remove any water that may have entered the cable.

B. Cable Repair

Related Bell System Practices—Sections 634 Series and 644-104-090

5.03 The detection of conductor faults in cable plant is usually associated with customer trouble reports, Automatic Line Insulation Test (ALIT), noisy carrier circuits, and the like. These faults are usually caused by water entering the cable, lightning surges, physical damage to the sheath, or other similar mishaps.

The various techniques for locating conductor faults are covered in the 634 series of the Bell System Practices. In addition, a fault locating strategy is covered in a handbook entitled Fault Locating Strategy for Wire and Cable Maintenance (and Section 644-104-090). This information has been prepared to assist in locating conductor and cable troubles in the various outside plant environments. It consists of a series of flowcharts that are designed to provide an easy-to-follow. systematic approach to fault location. Figures 1 and 2 are modified versions of the flowcharts relating to PIC cable repair in the underground plant. These charts lead the field craft through a systematic, iterative procedure, using the proper test sets, to locate both resistive type and open conductor faults. In addition, Fig. 4 and 5, which are extensions of these charts, cover the procedure to be followed when the cable trouble is known or suspected to be water related.

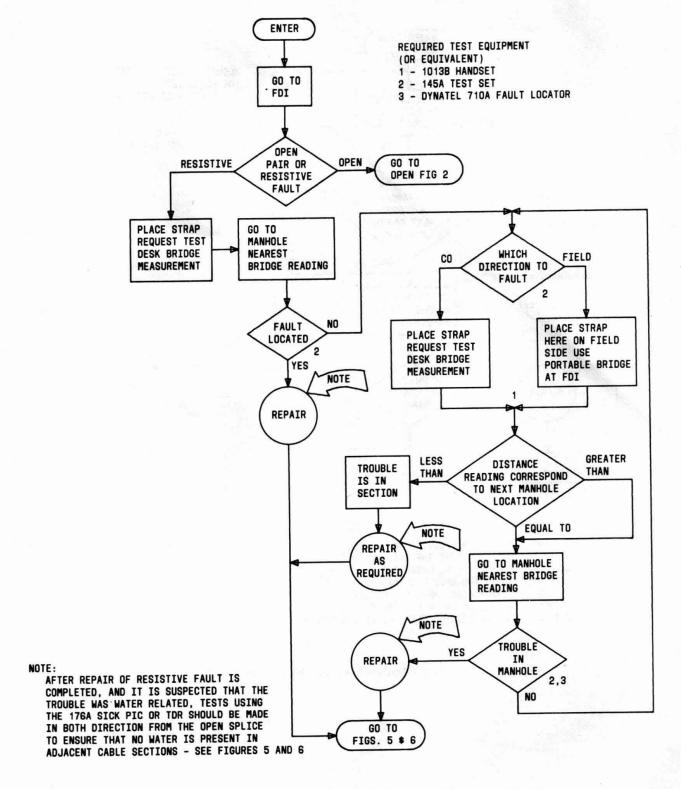
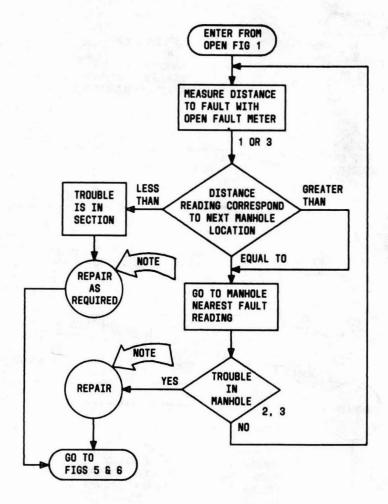


Fig. 1—Cable Repair—Underground PIC Plant (Resistance Fault)



REQUIRED TEST EQUIPMENT (OR EQUIVALENT) 1 - OPEN FAULT LOCATOR (145A TEST SET IF AVAILABLE) 2 - 1013A HANDSET

3 - 145A TEST SET

NOTE:

AFTER REPAIR OF OPEN FAULT IS COMPLETED,
AND IT IS SUSPECTED THAT THE TROUBLE
WAS MATER RELATED, TESTS USING THE
176A SICK PIC OR TDR SHOULD BE MADE
IN BOTH DIRECTION FROM THE OPEN SPLICE
TO ENSURE THAT NO WATER IS PRESENT IN
ADJACENT CABLE SECTIONS - SEE FIGURES 5 AND 6

Fig. 2—Cable Repair—Underground PIC Plant (Open Fault)

5.05 In general, the outside plant instruments used in the routine maintenance of PIC cable include resistive bridge-type test sets, open fault locators, and time domain reflectometers.

C. Water Entry.

Related Bell System Practices — Sections 637-305-303, 634-305-514, 644-104-090, 644-200-030, and 644-201-105

5.06 Although PIC insulation is more tolerant of water and moisture than pulp, water in PIC cable cannot be ignored. While water in PIC cable may not affect service initially, conductor corrosion will occur where insulation defects are exposed to water, resulting in a degradation of service. In this regard, it is recommended that the encapsulated series of the 710 Connector System or equivalent be used in all splicing operations in PIC cable in the underground plant.

5.07 A properly designed and adequately monitored pressure system will prevent or minimize the entrance of water through most sheath breaks. However, it is imperative that during any occasion when a leak has occurred and the cable has been exposed to water, the recommended procedures covered in Section 644-104-090 to detect and clear any water that may have entered the cable be strictly adhered to. In addition, proper pressure buffering procedures, as outlined in Section 637-305-303, must be followed whenever the cable sheath is opened to ensure that the cable sections are adequately protected against water entry during this period.

5.08 A device coded the 1A sensor is available as an option to aid in locating water in splices (Section 644-201-105). As shown in Fig. 3, the 1A sensor is a short length (approximately 12 inches) of paired conductors, one side of which is PIC with the insulation removed at one end, and the other side, pulp. A plastic cap at the exposed end ensures close contact of the pulp conductor with the bare copper. This arrangement results in a "junction" that is sensitive to water in that when dry, the resistance between sides of the pair is in the megohm range, but drops to less than 100 kilohms when wet.

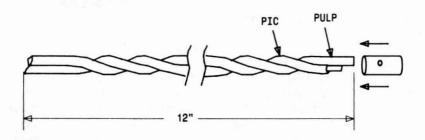


Fig. 3-1A Sensor

- 5.09 In practice, 1A sensors are bridged across a common dedicated pair at each splice point during construction. A second dedicated pair is required in the cable as a fault-locating pair to aid in identifying a "wet" sensor. As shown schematically in Fig. 4, these pairs are terminated on the MDF, but are not connected to automatic monitoring or alarming systems. In the event that water entry is suspected, the sensors may be accessed via a shoe at the MDF or a dedicated telephone number.
- 5.10 In addition to providing a means to aid in locating a "wet" splice should water enter a cable, the 1A sensor arrangement also provides a means for verifying splice dryness after initial installation, rearrangements, or at any time moisture entry is suspected.
- 5.11 Figures 5 and 6 are an extension of Fig. 1 and 2, and show in flowchart form the procedures to be followed by the field craft and test center, respectively, when water is suspected of having entered the cable. Essentially, these procedures require that whenever the field craft or the test center has reason to suspect water related troubles in a cable*, a test of the 1A sensor pair be made. If this test indicates a "wet" sensor, then the suspect sensor is identified by the test center using automatic bridge fault location techniques as covered in Section 634-305-514.

*Such as a large number of cable faults indicated by ALIT, customer trouble reports, etc.

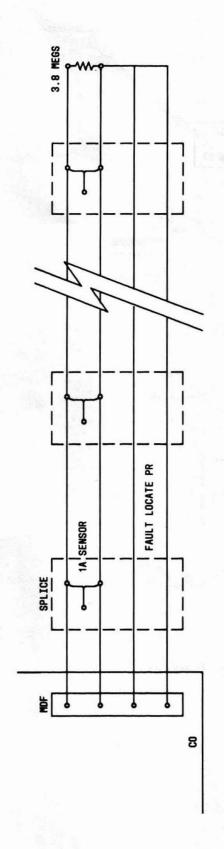
5.12 At this point, the field craft goes to the indicated manhole location and dries the splice in the normal manner. In addition, tests should be made at this time in both directions from the open splice to ensure that no water is in the adjacent cable sections. Instruments that may be used to conduct these tests include the 176A SICK PIC test set, time domain reflectometers, or humidity-sensing devices.

5.13 As shown in Fig. 5, if a cable trouble is suspected of being water related and the 1A sensor test indicates "dry" sensors, it is recommended that, while the cable is open at the trouble location, tests be made in both directions to ensure that no water is in the adjacent cable sections.

D. Water Removal

Related Bell System Practice — Section 644-200-030

- In the event that water enters a cable and it is determined that the area of contamination is confined to a splice, the wet splice should be dried in the usual manner such as using dry air or nitrogen and absorbent cloth. If the 1A Sensor System is used, the wet sensor in the splice should, of course, be replaced and the sensor pair again tested after the drying operation. In cases where it is determined that water is present in the section(s), the FARM process is available to dry the section(s) and restore the cable to a dry condition. The restoration of wet PIC cable by the FARM process is intended primarily for use in cases of "one-time" water entry such as that resulting from damage to the sheath or entry prior to installation. Before restoration procedures are initiated, any cable sheath damage that will affect the ability of the cable section to maintain pressure must be located and repaired.
- 5.15 The removal of water from wet PIC cable by FARM as covered in Section 644-200-030 is a two-step process. In the first step, the bulk of the water in the cable section(s) is removed by forcing high pressure air through the cable core. The air acts similarly to a "piston" in that it forces the water out of the cable at selected vent points. This "blast" approach results in removal of approximately 85% of the water in the cable section(s).



	TECHNIQUES	
LOCATE	• STD BRIDGE	
VERIFY	• LTD	o MLT
		NO CUSTOMER)
	E AT MDF) TEL #-(I
ACCESS	• SHC	• DEC

Fig. 4—1A Water Sensor System

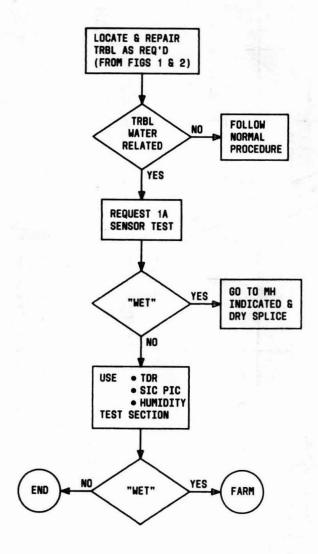


Fig. 5—Craft Procedures

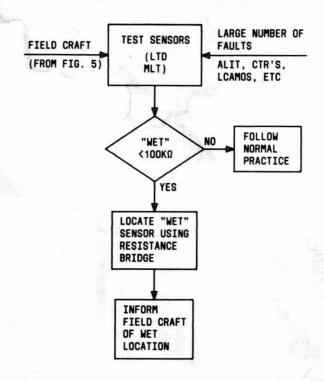
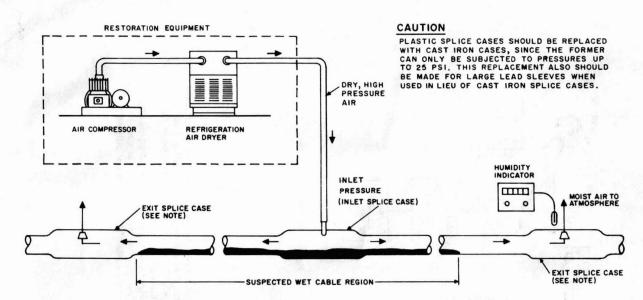


Fig. 6—Test Center Procedures

5.16 The second step in the restoration process removes by evaporation the residual water that remains, usually in the form of droplets and small puddles in the cable core. This is accomplished by forcing large quantities of high pressure dry air through the cable. The dry air vaporizes and purges the remaining water from the cable. This

procedure is continued until the humidity of the air exiting from the cable at the vent points is reduced below an acceptable level (35% rh).

5.17 A typical arrangement of the FARM techniques as used to purge a wet PIC cable is shown schematically in Fig. 7.



NOTE:
THE EXIT SPLICE CASES MUST BE REMOVED DURING INITAL PURGE.

Fig. 7—Water Removal Arrangement for Underground Cable

E. PIC-PULP I	nterfaces	930-200-010	Cable Upkeep System Selection
Related Bell System Practices — Sections 637-242-201 and 637-241-011		930-210-020	Cable Pressure Standards
5.18 While i	t is recommended that underground	930-210-100	Design of Air Sources — Trunk and Toll Cable
basis", the use exchange netwo with pulp core	e runs be constructed on an "end-to-end e of PIC cable in the underground ork will inevitably result in interfaces branch cables and the like. In this essential that pressure plugs be	930-210-200	Guidelines for Locating Pressure Monitoring Devices on Trunk or Toll Cables
constructed at from an air f	these interfaces to isolate the pulp low standpoint from the PIC. As ection 637-242-201, the plugging	634 Series	Electrical Cable Testing and Identification
arrangement is	s required to prevent a buildup of e pulp at the junction splice due to	637-020-020	Pneumatic Resistance of Cables
moisture perme the PIC secti	eation through the plastic jacket of on. The permeated moisture is by normal air flow through the	637-222-101	F Underground Pressure Transducer System
nonhygroscopic	core of the PIC and results in a of moisture "downstream" at the	637-225-215	B Airflow Transducer (AT-8720)
pulp interface.	In the absence of a pressure plug, ction of the pulp will result in low	637-241-011	Pressure Plugs
	tance at this point and a degradation	637-242-201	Plugging Plastic-Insulated Conductor (PIC) Cable
	nder no circumstances should the plug be circumvented by a by-pass	637-305-303	Cable Pressure Systems - Buffering
arrangement of the pul	ent, as this would violate the isolation lp from the PIC. This isolation of sections requires that each section	634-305-514	Locating Faults Using Dynatel 710A Test Set
be mainta	ined as a separate pressure section, m pressure feed and monitoring	637-410-011	Leak Locating Methods
standpoint	ts.	637-410-504	Gradient Method of Leak Locating
	commended that the 10-type series be used when joining PIC to pulp	637-412-500	Precision Leak Locating
sections. If lar required than the PIC can	rger PIC-to-pulp junction stubs are are available in the 10-type series, be plugged using the procedures ion 637-241-011 and J plug compound.	637-450-011	Cable Pressure System — Procedures During Placing and Splicing
Where J plug compound is used, it will be necessary to remove the core binder and "balloon" the core		637-600-	Cable Pressure Monitoring System
to allow penetr	ration of the compound.	644-104-090	Fault Locating Strategy for Wire and Cable
6. RELATED BI	ELL SYSTEM PRACTICES TITLE	644-200-030	Restoring Wet PIC Cable Using Air Drying
901-473-050	Air Pressure Analysis Program (AIRPAP)	644-201-101	Maintenance System for FIC Cable in Underground Plant
930-200-001	Engineering and Implementation Methods System (EIMS)	644-201-105	1A Water Sensor System