BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

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PRESSURE TESTING
MAINTAINING DEFECTIVE SECTION UNDER PRESSURE

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1. GENERAL

1.01 This section replaces Section G73.236, Issue 1, which is cancelled, and describes the methods of maintaining a section of cable containing a sheath defect under pressure while the conductors are being cut over to a new section. The methods may be used to minimize conductor troubles in underground and submarine cables where the section of the cable containing the sheath defect is under water. They are applicable to cables maintained under pressure as well as to those not maintained under pressure.

1.02 Temporary plugs are constructed near each end of the defective section. Cylinders of gas are then connected to the defective section to maintain pressure and prevent the entrance of moisture until the cutover has been completed.

2. PRECAUTIONS

2.01 When a section of cable containing a leak is maintained under pressure, a large quantity of nitrogen gas may escape into the manhole with the result that the atmosphere in the manhole may become deficient in oxygen. To ensure a safe atmosphere, the manhole should be ventilated with a sail or power ventilator depending on weather conditions, depth of manhole, etc.

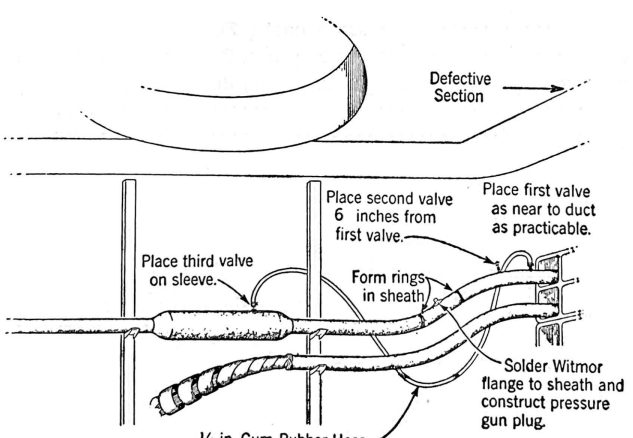
3. CABLES CONTAINING ONLY PAPER INSULATED CONDUCTORS

3.01 Temporary plugs in cables containing only paper insulated conductors should be constructed by the pressure gun method regardless of the size of the cable. The procedure for constructing the plugs and preparing the defective section for the cutover is outlined in the subsequent paragraphs.

3.02 Connect cylinders of gas to the cable at accessible valve points approximately 1000 feet from each end of the defective section with regulators adjusted to about 10 pounds pressure.

3.03 Install F flanges equipped with F valves in the manholes at each end of the defective section, as follows. Install one valve on the defective cable as near the duct as practicable. Install a second valve six inches from the first. Install a third valve on the splice sleeve.

3.04 Remove the core from the valve on the sleeve and from the valve nearest the duct. Connect these valves with a length of 1/4-inch gum rubber hose. Secure the hose to the valve with servings of lashing wire. The desired arrangement in the manholes at each end of the defective section is shown in the following illustration.



3.05 Construct a pressure gun type plug in the defective section midway between the splice and duct. The procedure in constructing the plug is the same as given in the section covering the pressure gun type plug except for minor changes as discussed below.

3.06 Form the constrictions eight inches apart using a cable sheath constrictor. As an alternative in large diameter cable, the rings can be formed by striking with a hammer a smooth 1/2-inch diameter steel rod which is held against the sheath. The depth of rings depends on the size of cable and type of conductors and will range from about 1/8 inch for a one-inch cable to 3/8 inch for a full-size cable. The depth must be sufficient to tightly constrict the core. Place three or four turns of steel lashing wire tightly around the cable in each constriction ring.

3.07 Solder a Witmor flange on the cable midway between constrictions as described in the section covering the pressure gun plug and impregnate the core. More than one filling of the pressure gun will be required for the larger cables. Heat the cable between constrictions with hot paraffin before impregnating and during the time the pressure gun is being refilled in order to insure complete impregnation of the core.

3.08 Repeat these operations at the other end of the defective section. Maintain pressure in the defective section during the construction of the plugs with gas supplied through the rubber hose by-passes from the cable on each side.

3.09 Prior to starting the cutover, connect a cylinder of gas to the free valve on the defective section in each manhole. A pressure of about 5 pounds should be maintained in the defective section except where the cable is under a head of water requiring a greater pressure. In the latter case, the regulator pressure should be increased so that the pressure at each end of the defective cable is maintained about 5 pounds higher than that resulting from the water pressure, which is about 1/2-pound per foot of water over the cable.

3.10 After the cylinders have been connected at each end of the defective section, remove the rubber hose by-passes and replace the valve cores in the two valves. The defective section is now ready for the cutover.

3.11 During the cutover a full cylinder of gas should be connected to the cable before the cylinder in use is fully discharged. Where an extra regulator and hose are available, connect the full cylinder to the valve not in use and admit gas to the cable. Then disconnect the discharged cylinder.

4. CABLES CONTAINING COAXIALS

4.01 The pressure gun type plug can not be employed on cables containing coaxials. When such conductors are involved the plugs should be constructed and the defective section prepared for the cutover as outlined in the subsequent paragraphs.

4.02 Connect cylinders of gas to the cable at accessible valve points approximately 1000 feet each side of the defective section with regulators adjusted to about 10 pounds pressure.

4.03 Install two valves in the manholes at each end of the defective section. Locate one valve on the defective cable as near the duct as practicable. Place the second valve 6 inches from the first valve.

4.04 Connect a cylinder of gas to the valve nearer the splice. Adjust the regulator to maintain a pressure of about 5 pounds in the defective section, as measured at the second valve, except where the cable is under a head of water requiring a greater pressure. In the latter case, the regulator pressure should be increased so that the pressure at each end of the defective cable is maintained about 5 pounds higher than that resulting from the water pressure, which is about 1/2 pound per foot of water over the cable.

4.05 Construct a temporary plug in the defective cable as follows. First remove the sleeve from the splice at one end of the defective section and remove the splice wrappings. Then remove one foot of sheath from the defective cable at the end of the splice. Remove the outer core wrapping from the one-foot length, leaving about 1/2 inch of core wrap adjacent to the sheath butt. Do not place a cotton tape at the sheath ends.

4.06 Provide slack in the coaxials and paper insulated conductors in this one-foot length by reducing the radius of bends in the setup of the cable in the manhole, and by moving back the slack already available in the splice. Be careful not to kink the coaxials.

4.07 If there are paper insulated conductors over the coaxials, place three turns of waxed cord over the core wrapper adjacent to the sheath. Pull the cord up tightly and tie it. Each interstice wire or group of wires, including the core unit, should be similarly tied over its paper wrapper within two to three inches of the sheath butt. Be careful not to break the paper wrapper when tightening the cord.

4.08 Work a handful of plastic duct seal into a string about 3/4 inch in diameter, by rolling it between the palms of the hands. Place a turn of this material around the cable on the sheath immediately adjacent to the sheath end, and then interlace the remainder alternately under and over the coaxials. Repeat with additional duct seal, reversing the interlacing so that the new material lies over a coaxial on which the original duct seal was placed under the coaxial. Separate the paper insulated conductors in the outer layers as much as possible and work the material between them. Also, place complete turns of the duct seal around the core unit and interstice conductors.

4.09 Continue interlacing the material around the coaxials and working it between other conductors until it has been placed over a length of about six inches. Work each new layer of material into that previously placed and knead it into a solid mass. One to two pounds of duct seal should be adequate for a plug.

4.10 Starting about 2 inches on the lead sheath, wrap the full length of duct seal with a half-lapped layer of 2-inch rubber tape, stretching the tape as it is applied to constrict the duct seal. Without cutting the tape, wrap back with a second half-lapped layer. Secure the tape at each end of the wrap with rubber cord. This completes the plug.

4.11 The plug at the other end of the section should now be constructed by repeating operations given in Paragraphs 4.04 to 4.10, inclusive. **Do not build both plugs at the same time.** Otherwise the defective section may not be adequately protected during the plug construction.

4.12 The defective section is now ready to be cut over. As the coaxials are transferred to the replacing section, cut them off about one inch from the plug and seal the opening with scotch tape to restrict the flow of gas.

4.13 If the plugs are made in cold weather, the plastic seal should be heated to about 70° F. to improve its workability.

5. CABLES CONTAINING VIDEO PAIRS

5.01 If the defective section of cable contains video pairs, the temporary pressure plugs should be constructed in the same manner as given for coaxial cable. (See Part 4.)