BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G57.410.1
Issue 1, May, 1954
AT&T Co Standard

SUBMARINE CABLE
REPAIRING

Contents **Page**

1. GENERAL

1.01 This section replaces Section G74.710. It covers the features of repairing submarine cable that differ from those followed in repairing lead covered cable. The repair of conductors and the lead sheath should be done in accordance with the methods used in the repair of lead covered cable.

2. TRACING ROUTE OF CABLE

2.01 The general location of a submarine cable can usually be determined from record prints and by tracing the shore ends of the cable.

2.02 Where the exact location of the cable is required, it can be traced by means of an exploring coil, as outlined in the section "Locating Underground Pipes and Cables—Low Frequency Method."

3. LOCATION OF FAULT BY MEASUREMENTS

3.01 When a circuit trouble exists in the submarine cable, the approximate location of the fault can be determined by Wheatstone bridge measurements.

4. APPLICATION OF GAS TO LOCATE DEFECT

4.01 In some cases where the water is shallow and the surface of the water is smooth, it may be practicable to locate a defect in the sheath by gas escaping through the defect. The gas pressure should be applied to the cable at the shore ends and the surface of the water over the route of the cable observed for bubbles.

4.02 Where the submarine cable is connected to land cable maintained under pressure, the location of a leak can usually be determined by the pressure-gradient method as covered in the Pressure Testing Practices.

5. APPLICATION OF GAS TO PREVENT FAILURE

5.01 If the depth of the cable is less than about 20 feet, it will sometimes be practicable to retard the flow of water into the cable by applying gas to the cable at the shore ends. The procedure to be followed is covered in the Practice "Maintaining Defective Section Under Pressure."

6. UNDERRUNNING CABLE

6.01 The starting point for underrunning cable may be at either shore end or at some point in the crossing where the cable has been raised. In either case the underrunning should progress from the starting point in the probable direction toward the fault.

6.02 To raise the cable at a point in the crossing, a heavy grappling hook should be lowered to the bottom from the repair boat or barge located to one side of the cable crossing. The boat should then proceed to cross over the cable with the hook dragging on the bottom. When the cable is caught by the grapple, it should be raised to the deck of the boat.

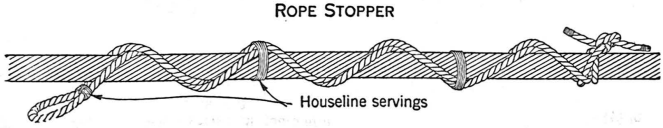
6.03 After the cable has been raised to the deck either near the shore end or at a point farther out in the crossing, it should be underrun by means of two sheaves suspended from the side of the boat or from a sheave on a

boom. In the former case, one of the sheaves should be placed near the bow and the other sheave at some point far back on the deck so that the cable can be inspected for some distance.

6.04 The boat or barge should proceed slowly along the crossing and it should be held to a course that permits the cable to run in line over the sheaves. The cable should be inspected carefully as it passes and when the fault is located the boat or barge should be stopped and anchored.

7. PREPARATION FOR REPAIR

7.01 The cable should be held to the barge or boat by means of split wire grips or rope attached to the cable, as shown below. It should be supported on the deck at sufficient height to permit making repairs. The cable then should be lashed securely to the boat on each side of the fault.



7.02 All the materials and tools required for the repair should be placed on the deck where they will be readily available for use.

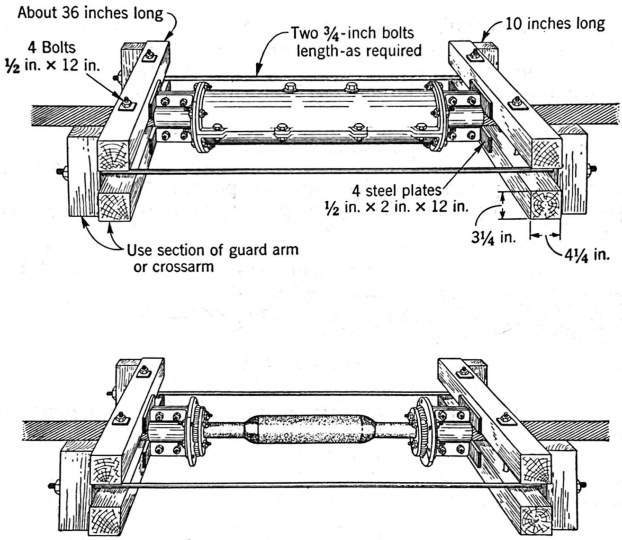
8. REPAIRS TO SHEATH

8.01 Cut the armor wires at the damage and terminate the wires in the end clamps of a splice case, and if water has not entered the core, wipe a small joint over the damage and complete repairs by bolting the side members of the case to the end clamps.

8.02 If water has entered the cable, cut the armor wires at the point of damage and unwind the wires from the cable a few at a time a distance sufficient to permit removal of sheath and examination of the conductors. The armor wires should be unwound and sheath removed until dry core is encountered. After the moisture has been removed, if sufficient slack can be obtained by pulling the cable, the armor wires should be terminated in the end clamps of a splice case in the usual manner, slack cut out of the conductors, the splice wrapped, the lead sleeve wiped in the usual manner and the side members bolted to the end clamps of the case. If slack cannot be obtained by pulling the cable, it will be necessary to splice in a length.

9. CONDUCTOR TROUBLE IN SPLICE

9.01 Conductor troubles in a splice can be cleared by removing the side members of the splice case and then removing the lead sleeve to gain access to the conductors. The present standard splice cases are equipped with tie rods. This permits removal of the side members and lead sleeve without affecting the spacing of the end clamps. Cases of superseded designs are not equipped with tie rods and in order not to change the distance between the end clamps after the side members and lead sleeve are removed, the end clamps should be tied together as shown in the following sketch.



10. CUTTING IN LENGTH OF CABLE

10.01 Where the damage is greater than appears practicable to repair by the preceding methods, it will probably be necessary to splice in a length of cable. The cable should be lashed securely on supports and the repaired length spliced in accordance with the practices for splicing submarine cable.

11. REPLACING SHORE END

11.01 When the shore end must be replaced due to damage to the cable, the cable should be picked up at the point where the splice is to be made, placed on a barge and then securely lashed to the barge. The replacing section should be placed from the landing to the splice. The cables should be supported at sufficient height off the deck to permit doing the work and lashed securely to prevent movement of the cable.

11.02 If the cable must be moved to a new location, the cable should be cut and capped at the shore end. Then the cable should be placed in its new location by underrunning it. If it is necessary to lengthen the cable, the new section should be spliced to the free end and laid in the usual manner.

12. TESTS AFTER COMPLETION OF REPAIRS

12.01 After a submarine cable has been repaired, the splice should be pressure tested and the conductors tested to ensure that the cable is in satisfactory condition. The pressure test should be made before the armor wires are repaired or the side members of the case are bolted in place.

13. LOWERING CABLE

13.01 After a cable has been repaired and the necessary tests made, it should be lowered back as nearly as possible to its original position, except where shore ends are moved to a new location.

13.02 The attachment to the cable and the line with which it is to be lowered should be such that the cable can be readily released after it has been lowered.

14. MOVING CABLE TO NEW LOCATION

14.01 In general, submarine cables can be moved for short distances by underrunning them several times in each direction, shifting the position of the cable as much as practicable with each underrun. Care should be taken to avoid damage to the cable by placing too large a strain in it.

14.02 Where sufficient slack is not available, it can be obtained by cutting in a length of cable for the purpose, preferably at the shore end. The slack should be pulled into the waterway and in the direction of the desired location of the cable. The cable should then be underrun until it is in the new location. If this is not practicable, it may be necessary to cut the cable and re-lay it in the new location.

15. LOWERING CABLE TO INCREASED DEPTH

15.01 There are two general methods of lowering submarine cable, one by excavating a trench alongside the cable and then moving the cable over into the new trench and the other by using a water jet to remove the supporting bottom material permitting the cable to settle.

15.02 The choice between the methods will depend on local conditions and the equipment available. If the cable is on a hard bottom, trenching by means of a dredge will usually be found more practicable. If the bottom is made up of reasonably fine material, such as silt or sand, the jet method probably will be found very effective.

15.03 Where dredging is employed, the trench should be dug a sufficient distance away from the cable to avoid damaging the cable. After the trench has been prepared, the cable should be underrun and moved over into the trench. It is usually desirable to have a diver inspect the cable to make sure that it is completely within the trench.

15.04 In using a jet to lower the cable, it is generally necessary to lower the cable a small amount at a time. The jet should be directed just under or alongside the cable and as the material is removed the cable will settle to the new level.

15.05 The services of a diver will generally be required. In some cases, however, the cable may be used to guide the jet by connecting it to the cable through a sliding linkage and pulling the unit across the waterway.

16. REPAIRS TO CABLE ANCHORAGE

16.01 In general chains and other materials used in the anchorage should be replaced if they are damaged or have corroded badly.

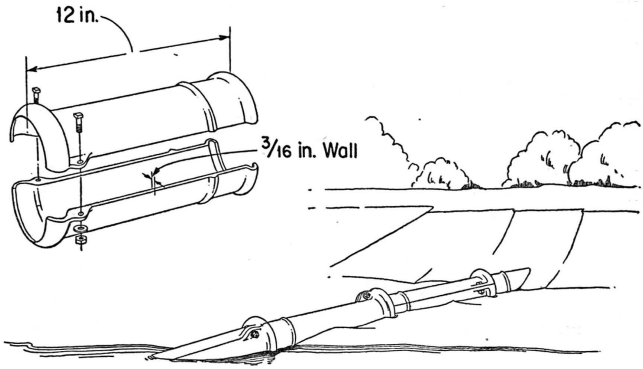
16.02 The new anchorage should be made in accordance with the practices covering the anchoring of submarine cable.

16.03 If it is apparent that the conditions at the anchorage are particularly corrosive, it may be advisable to wrap the entire attachment to the cable with a close serving of spun yarn and to cover the serving with a liberal coating of hot Terminal Compound.

16.04 The structure to which the cable anchorage is attached should be inspected and any repairs that are required should be made.

17. PROTECTION OF CABLE AT SHORE ENDS

17.01 The shore ends of submarine cables which lie exposed to abrasion or mechanical damage or cables on which the armor wires have become corroded, may be protected by Submarine Cable Armor Protectors, as illustrated in the sketch below.



17.02 The protectors are made of cast or malleable iron and consist of split sections which can readily be assembled by means of the two machine bolts furnished with each protector. The coupling of adjacent sections is designed to provide a substantial degree of flexibility so that the cable may be carried around obstructions and follow the contour of the bottom. The sections are 12 inches long and are available with inside diameters ranging from 2 inches to 5 inches in steps of 1/2 inch. Protectors approximately 1/2 inch larger in diameter than the outside diameter of the cable should be used.