

UNDERGROUND COAXIAL CABLE PLACING

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1. GENERAL

1.01 This section covers, in general, the methods, tools and equipment used to place underground coaxial cable.

1.02 As a general rule coaxial cable of up to 2.75 inches (od) may be placed in 3 1/2-inch (id) duct. Coaxial cable over 2.75 inches should be placed in 4-inch (id) duct.

1.03 Most standard coaxial cables are made up of 0.375-inch (id), disc-insulated coaxial tubes

and complements of single conductors, pairs, and/or quads or fillers. (See Section 626-759-350.) Because of this construction coaxial cable is more susceptible to crushing type damage during installation than paired cable. *Coaxial cable should not be pulled under tension over any sheaves or quadrant blocks* as is usual with paired cables. (See Part 9.)

1.04 When placing coaxial cable as a riser cable, the placing methods described in Section 627-610-225 may be used except that:

- Coaxial cable cannot be pulled under tension around a cable sheave or lowered over a sheave using the sheave to provide drag.
- Coaxial cable cannot be allowed to sag over the edge of ducts, rack, etc.
- Coaxial cable placed in a completely enclosed riser duct must be supported by a supporting strand.
- When coaxial cable is supported in a vertical run by being lashed to a supporting strand, the lashings should be spaced at 24-inch intervals on 18- and 22-tube cables and at 30-inch intervals on 8- and 12-tube cables. These spacings are necessary to avoid lashing the cable at the same intervals as the lay-lengths of the outer coaxial tubes.

1.05 *When setting up cable ends in the manhole for splicing, the inside bend radius should be 21 inches or more. Bending radii of less than 21 inches can cause damage to the coaxial tubes. Avoid denting, kinking, or bending coaxial cable over sharp corners. Always place cable bending shoes in ducts when bending cable in manholes.*

1.06 When setting up coaxial cable in pull-through or splicing manholes, special tools and procedures are required. (See Parts 13 and 15).

2. PRECAUTIONS

2.01 Before starting any underground coaxial cable placing operations, all personnel must be

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thoroughly familiar with the Bell System Practices that cover the following operations:

- (a) Guarding and protecting work areas,
 - (b) Testing and ventilating manholes,
 - (c) Precautions pertaining to smoking or use of open flames around manholes,
 - (d) Removing and replacing manholes covers,
 - (e) Signals used in outside plant construction work.
- 2.02** All personnel involved in placing underground coaxial cable must be familiar with the operation of construction equipment and apparatus that is to be used.
- 2.03** *Adequate communications must be established* between the cable feeding location and the pulling equipment prior to starting any pulling operations.
- 2.04** *Practice good housekeeping.* Arrange material in the vicinity of the manhole so it will not fall into the manhole or unnecessarily interfere with pedestrian or vehicular traffic.
- 2.05** Inspect manhole ladders each time before using and replace promptly when found in a deteriorated condition. When the bottom of the ladder is in water or otherwise invisible, remove it for inspection.
- 2.06** Each time before using pulling irons inspect for significant corrosion and to make sure they are securely anchored in the wall.
- 2.07** If work is done with a truck not equipped with an overhead exhaust and the truck is stationed near a manhole, locate the truck so the exhaust gas will not blow into the manhole or be picked up by the manhole blower.
- 2.08** Locate gasoline and propane-driven generators, blowers, pumps, etc, so the exhaust fumes will not blow into the manhole.
- 2.09** Exercise caution when entering and leaving manholes, particularly those located on traveled thoroughfares. Always use a ladder when entering or leaving manholes. When ascending

from the manhole, always face oncoming traffic. Keep hands free of materials or tools when ascending or descending ladders. *Never use a cable, coil case, or apparatus case as a step.*

2.10 When working in manholes, exercise care to prevent damage to cables while setting up the pulling apparatus or while using tools of any kind.

2.11 *Do not place hands on a moving winch line.* Be sure that B sheave guards are properly installed as outlined in Section 649-305-101.

2.12 *Employees should not remain in manholes during cable placing or removal operations when the pulling line is under tension.* Should it be necessary to check for proper alignment of equipment prior to starting the pulling operation, the employee can enter the manhole if

- (a) he remains clear of the equipment and outside the angle formed by the pulling line, and
- (b) the winch line has only enough tension to provide normal alignment of the equipment.

2.13 Reels that are delivered to the job, but are not to be set up immediately for placing operations, should be securely blocked or secured to a pole or other substantial support to prevent rolling or movement by unauthorized persons. Do not leave them on a grade or in a traffic lane if this can be avoided. When it is necessary to leave a reel on a grade, cant it against the curb and block it so that it cannot roll.

2.14 Mark cable reels left on streets or highways overnight in accordance with local regulations. Otherwise, barricade and light with flasher lights or red lanterns not later than 1/2 hour before sunset.

3. PRESURVEY

3.01 The route of the proposed underground cable should be presurveyed, giving special attention to the following:

- (a) Location of manholes in regard to traffic conditions
- (b) Safeguarding work area including any special precautions required because of pedestrians

- (c) Special permits that may be required
- (d) "No stopping" or "no parking" areas (note the hours that pulling equipment can be located on the street.)
- (e) Pumping requirements:

Water: Additional pumps may be required because of the heavy flow of water into the manhole. Additional drain hoses may be needed in areas where proper drain facilities are not available. Spread salt to prevent icing on sidewalks, streets, or highways during cold weather.

Gasoline or oil: Do not pump until all safety precautions have been taken to protect employees and the public (Section 620-145-010). When required, notify fire and police department for means of removing oil from sidewalks, streets, or highways.

3.02 The presurvey should verify manhole facilities and arrangements including duct selection, pull-through information, and locations for setup of the pulling truck and cable reel trailer. The pulling truck should be positioned at locations where the least amount of pulling tension will be necessary. Pulling eyes on 18- and 22-tube coaxial cable fail at approximately 10,000 pounds tension.

4. TOOLS

4.01 Tools generally required when placing underground coaxial cable and the sections describing the tools are as follows:

SECTION	TITLE
081-020-100	Construction Chain
081-410-102	Cable Grips
081-410-105	B Connecting Link
081-410-115	Cable Bending Shoes
081-410-116	Cable Feeder and Cable Lubricator
081-500-101	B, C, or E Chain Hoist
081-500-102	
081-500-105	

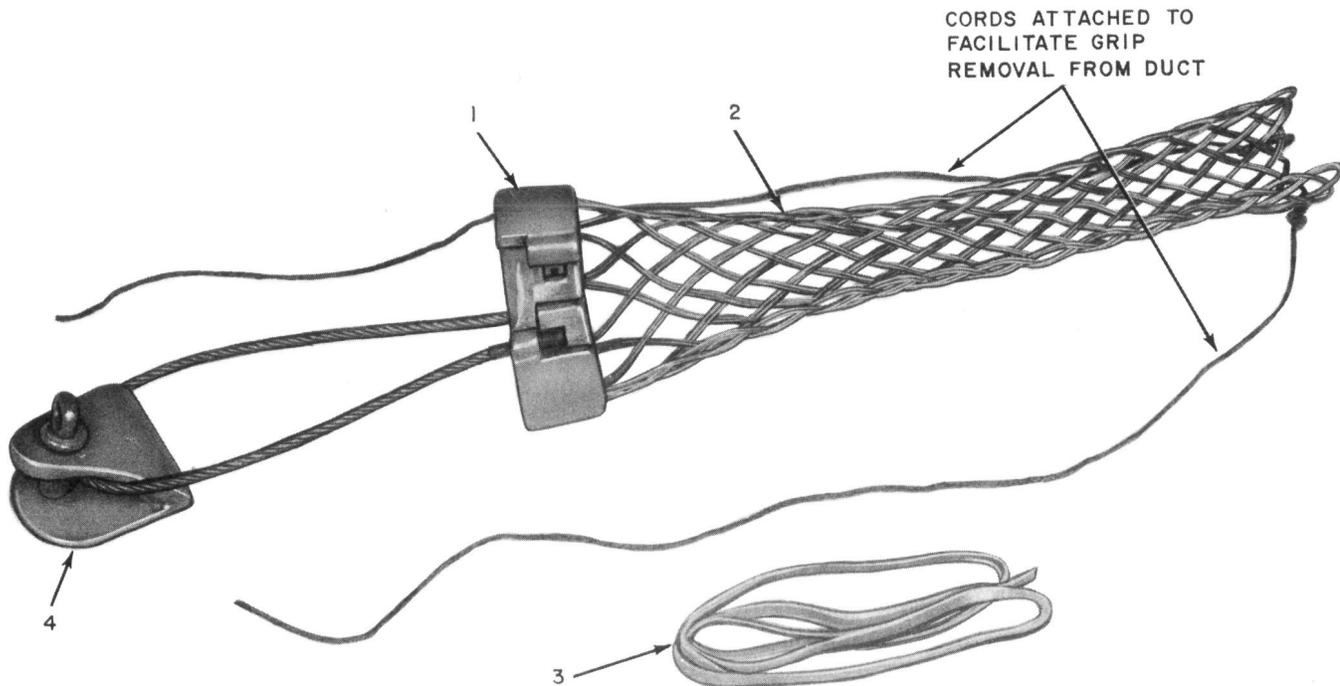
SECTION	TITLE
081-511-101	Plastic Rope
081-520-100	C Manhole Sheave
081-520-101	Cable Sheaves
081-520-102	Pulling Frame
081-520-105	B and C Quadrant Block
081-520-150	Wire Rope Snatch Block
649-040-200	Wheel Chocks
649-210-121	B Cable Reel Brake
649-210-122	AT-8413 Cable Reel Brake
649-210-111	Cable Reel Trailers
649-305-101	B Sheave Guard
649-310-011	Wire Rope
649-310-111	Cable Reel Sling
649-315-100	CR Collapsible Power Reel

4.02 Tools specifically required for placing underground coaxial cable are:

TOOL	DESCRIPTION
Cable Luffing Grip	KELLEMS™ split laced (or equivalent) See Fig. 1.
AT-8755, G Slack Puller	Includes: Adjustable strut, pivoting head, chain lock. (Chain not included). See Fig. 2.
AT-7286, B Cable Racking Jack	See Fig. 3.
AT-8744, F Cable Bender	See Fig. 4.

5. CHECKING DUCT AND PLACING PULLING LINE

5.01 Check to determine if the selected duct, as indicated on the running sheet or print, has been threaded. If more than one duct in the same section is found threaded, make sure the correct duct is used.



PART	PART NAME	MFG PART NO. (NOTE 1)	FOR CABLE DIA. (INCHES)
1	B SPLIT RING	201-05-003	1.75 - 3.00 (NOTE 2)
2	SPLIT-LACED GRIP	033-07-014 033-07-015 033-07-016	1.75 - 2.00 2.00 - 2.50 2.50 - 3.00 (NOTE 2)
3	RAWHIDE LACE	209-20-002	ALL SIZES
4	PULLING YOKE	201-05-001	ALL SIZES

NOTES:
 1. AVAILABLE FROM KELLEMS DIVISION, HARVEY HUBBELL, INC.
 STONINGTON, CONNECTICUT 06378
 2. ALSO FITS 22 TUBE LEPATH-PJ COAX CABLE
 WHICH HAS 3.05" DIA.

Fig. 1—Cable Luffing Grip

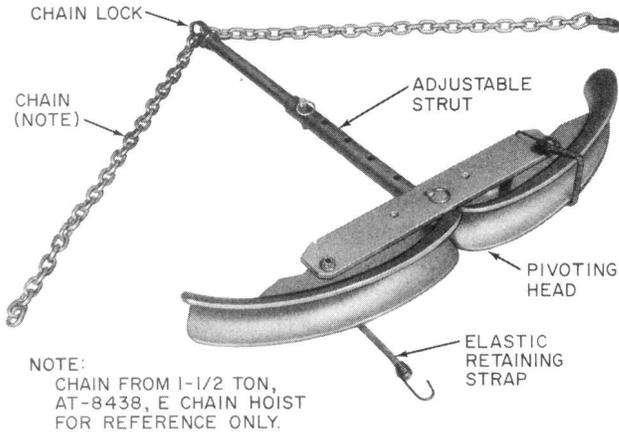


Fig. 2—G Slack Puller

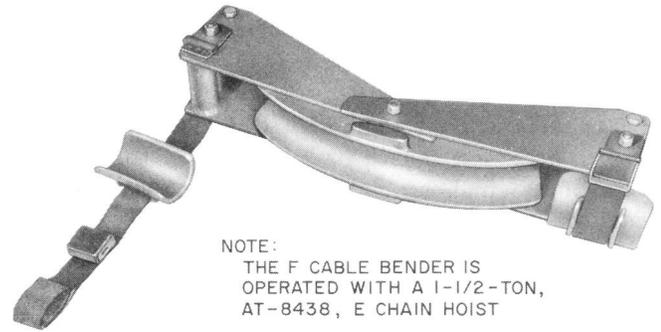


Fig. 4—F Cable Bender

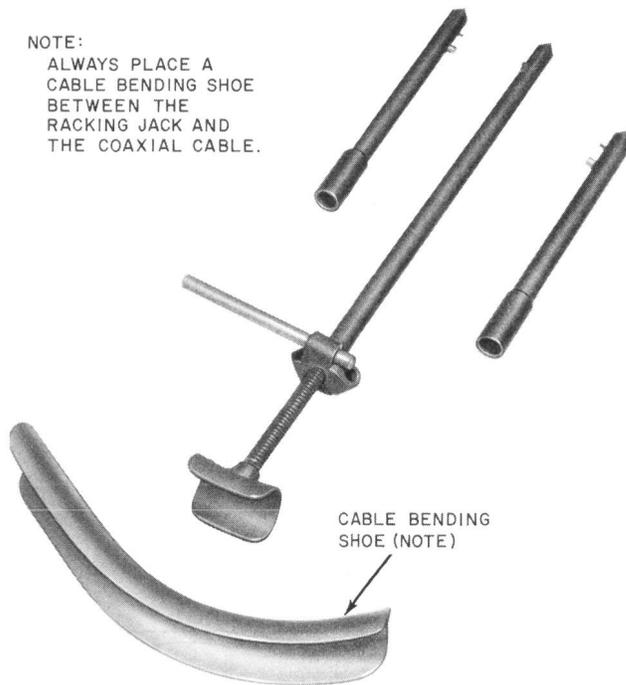


Fig. 3—B Cable Racking Jack

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5.02 If the duct has been threaded with B fishline (polypropylene rope), place the pulling line in accordance with Section 649-325-101.

5.03 If the duct has been threaded with wire, attached the threading wire to the pulling line of a winch truck located at one end of the section. At the other end of the section, attach the threading wire to a CR reel mounted on a second truck. Pull the first few feet slowly to determine if any obstructions are in the conduit. After this, make a normal steady pull until the winch line has completely replaced the threading wire in the duct. Disconnect the winch line from the threading wire. A typical setup is illustrated in Fig. 5.

5.04 Special care is required to be sure ducts are properly aligned and free of obstructions. Coaxial cable will probably be damaged if it has to be pulled back out of an obstructed duct.

5.05 To check the ability of conduit to allow the passage of cables having a pulling eye, it is the normal procedure to pull a conduit mandrel of appropriate size through the conduit to check for obstructions. However, since coaxial cable is more susceptible to damage from duct misalignment than paired cable, a cable slug at least 10 feet long with factory installed pulling eyes at both ends should

be ordered with the cable and pulled through the duct before attempting to place the cable. Any gouging or flattening of the slug or other indication of a duct obstruction will necessitate duct repairs or cleaning as outlined in Section 628-200-200.

5.06 If the conduit mandrel is used, remember that it is made of unyielding materials and should be drawn through clay tile ducts with care. If forced through clay tile ducts, the duct walls or webs may be broken. If the cable slug with a pulling eye at each end is used, make certain that the cap on each end is dressed into the cable sheath so it will not catch in a duct joint.

6. CHECKING REEL AND CABLE MARKINGS

6.01 Before setting up a reel, check the reel number and the size, gauge, and length of cable on it with the information given on the running sheet or print.

6.02 Coaxial cable for placing in underground conduit should be ordered equipped with pulling eyes and under gas pressure. Read the gas pressure prior to and after placing to determine whether sheath defects have occurred during placing. Record these readings on a linen tag attached to the end of the cable for further checking by the employee who later joins the conductors.

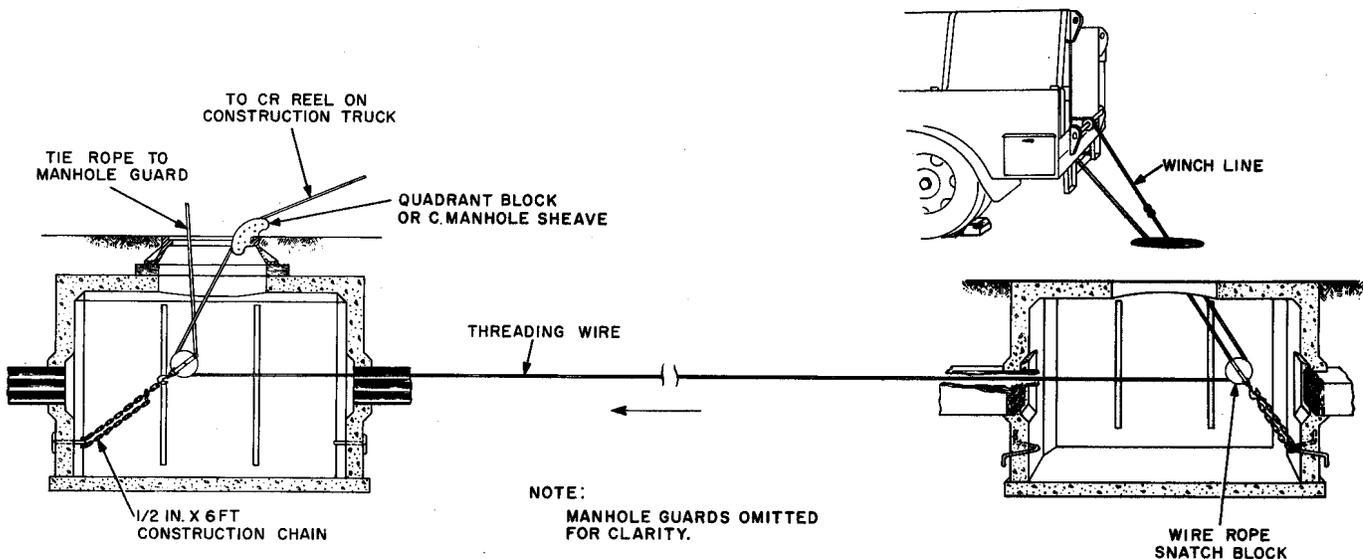


Fig. 5—Placing Winchline in Duct

6.03 Cable containing defective pairs is painted red on the end.

7. SETTING UP CABLE REEL

7.01 Inspect cable reels for flange protrusions which could damage the cable sheath. Also inspect for any obstructions that could interfere with proper unwinding of the cable.

7.02 Set up the reel on a cable reel trailer (Fig. 6) equipped with a brake so that reel rotation can be controlled. Do not use a plank or any other improvised arrangement to brake the reel. Refer to Section 649-210-211 for loading and to Section 649-210-121 for cable reel brakes.

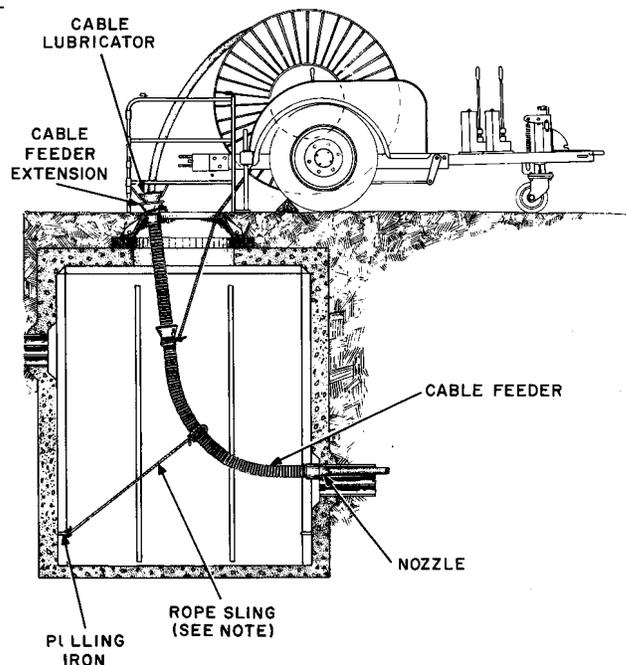


Fig. 6—Supporting Cable Reel With Cable Reel Trailer

7.03 When the cable reel is to be hauled on a construction truck, a CT cable reel sling may be used for loading or unloading the reel.

7.04 If it is necessary to roll the reel to the desired location, roll it in the direction of the arrow on the reel. When handling a heavy cable reel, careful control of its movement must be maintained. Never permit the reel to tilt. Where uneven ground is encountered, provide a substantial runway of heavy planks leveled by blocking so that the reel does not tilt.

7.05 If the duct line in which the cable is to be pulled contains a curve, set up the reel at the manhole closest to the curve if conditions permit.

7.06 Set up the reel on the same side of the manhole as the conduit section in which the cable is to be placed. The reel should be in alignment with the duct and in such a position that the cable can be passed from the top of the reel in a long, smooth bend into the duct without twisting. **Never pull the cable from the bottom of the reel. Never leave a moving reel unattended.**

7.07 If the reel is lagged, secure the banding to the lags at several points to prevent the banding from flying off when it is cut.

7.08 It is essential that the reel be in proper alignment and level during the placing operation. Incorrect positioning of the reel will cause unnecessary binding which will result in uneven cable feed.

8. ATTACHING PULLING LINE

8.01 Use only pulling lines in good condition in connection with cable placing and removing operations.

8.02 Place a marker consisting of several turns of friction tape on the pulling line, 20 feet from the cable end of the line. This marker is used to indicate when the cable is about to enter the manhole.

8.03 Figure 7 illustrates a pulling line attached to a lead covered cable equipped with a pulling eye.

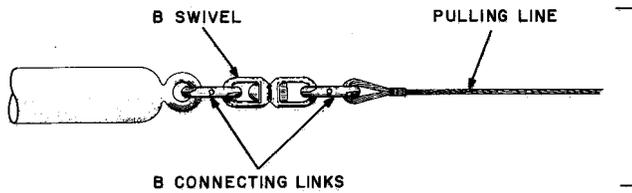
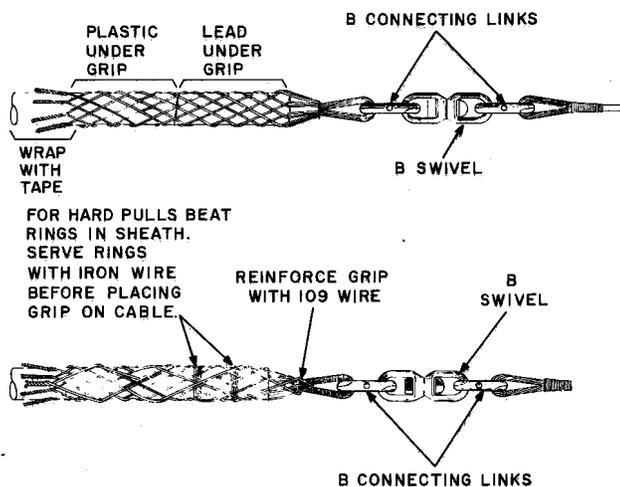


Fig. 7—Pulling Eye Attached to Pulling Line

8.04 When pulling lead covered cable *not* equipped with pulling eyes, a cable grip may be used (Fig. 8). Before installing the grip:

- (1) remove all lubricant from the cable in the gripping region;
- (2) remove the outer plastic sheath layer from the cable for half the gripping length so that the grip will be half on lead and half on plastic; and
- (3) seal the cable end with a cable cap as described in Division 633 of the Bell System Practices. Install the grip and wrap vinyl tape tightly around the end of the grip continuing onto the plastic sheath.



CAUTION: THE STRANDS OF WOVEN CABLE GRIPS BECOME WORN WITH USE. IN PLACING OR REMOVING THE GRIP BE ALERT FOR BROKEN STRANDS OR OTHER WORN PARTS WHICH MAY INJURE THE HANDS.

Fig. 8—Cable Grips on Cable

9. PULLING APPARATUS

9.01 Since coaxial cable is more susceptible to crushing damage than paired cable, it cannot be pulled under tension around sheaves or quadrant blocks as is usual with paired cable. Cable slack in splicing manholes will have to be developed using cable luffing grips on the cable (see 11.12). Cable slack should include 3 feet for waste at the pulling eye in addition to the slack required for splicing.

9.02 If the manhole is equipped with pulling-in irons, use a B wire rope snatch block and construction chain at the pulling end as shown in Fig. 9. A B quadrant block or B cable sheave with B cable sheave shackle may be used in place of the wire rope snatch block. When it is not possible to position the winch truck adjacent to the manhole, a B quadrant block or C manhole sheave should be used at the top of the manhole as shown in Fig. 10 and 11, respectively.

9.03 If the manhole is not equipped with pulling-in irons, use the C or D pulling frame for placing cable. Place the pulling frame in a vertical position with the S or T cable sheave placed in the frame as illustrated in Fig. 12. A quadrant block may be used in place of the cable sheave. To prevent the frame from moving, 4- by 4-inch hardwood timber should be used at the floor of the manhole. Figure 13 illustrates an S or T cable sheave placed in the top of the pulling frame and the additional blocking required in the manhole opening to support the frame. If it is necessary to make the pull at an angle to the conduit run, further bracing should be placed to prevent any side movement of the frame.

10. LUBRICATING CABLES

10.01 Approved cable lubricants and the conditions covering their use are shown in Table A. Only the approved B, C, and D cable lubricants should be used.

10.02 The quantities of lubricant required for various sizes of cable are given in Table B. Note that extra lubricant is used for heavy pulls and pull-throughs.

10.03 For convenience in handling the cable during splicing or luffing, the first 20 feet of cable need not be lubricated unless a heavy pull is anticipated.

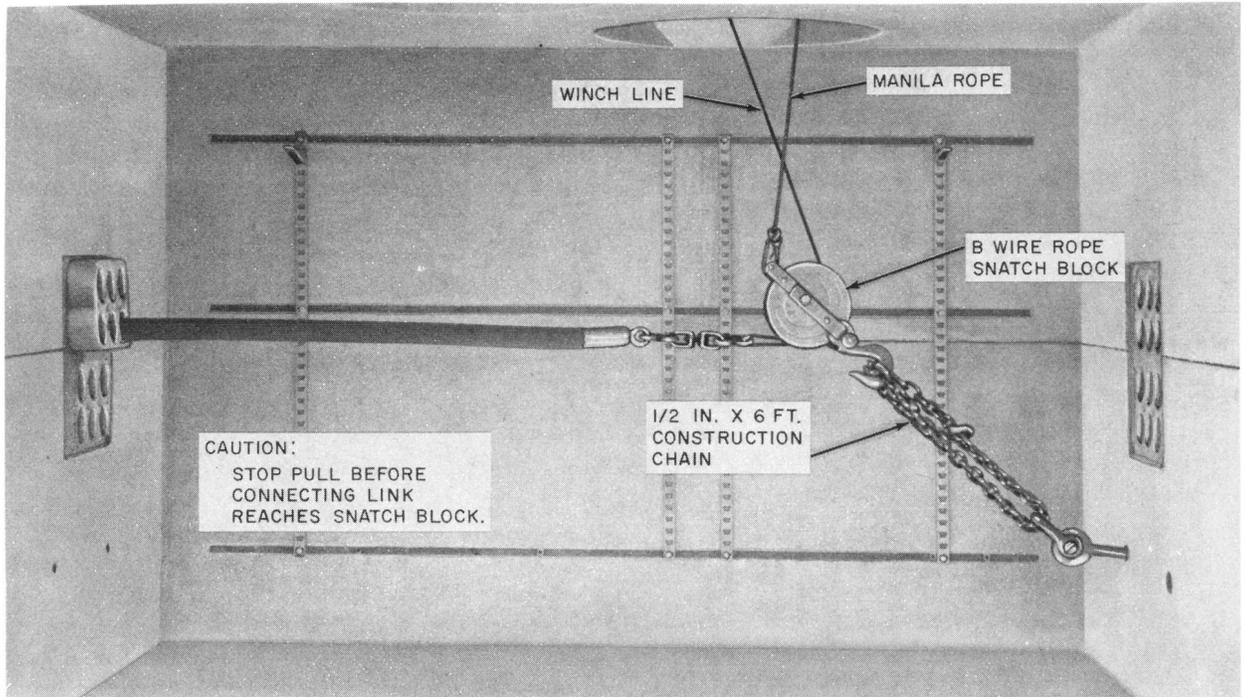


Fig. 9—Pulling Arrangement Using B Wire Rope Snatch Block and Construction Chain

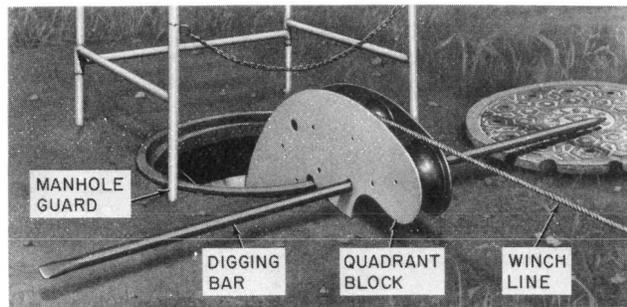


Fig. 10—Pulling Arrangement Using Quadrant Block on Manhole Frame

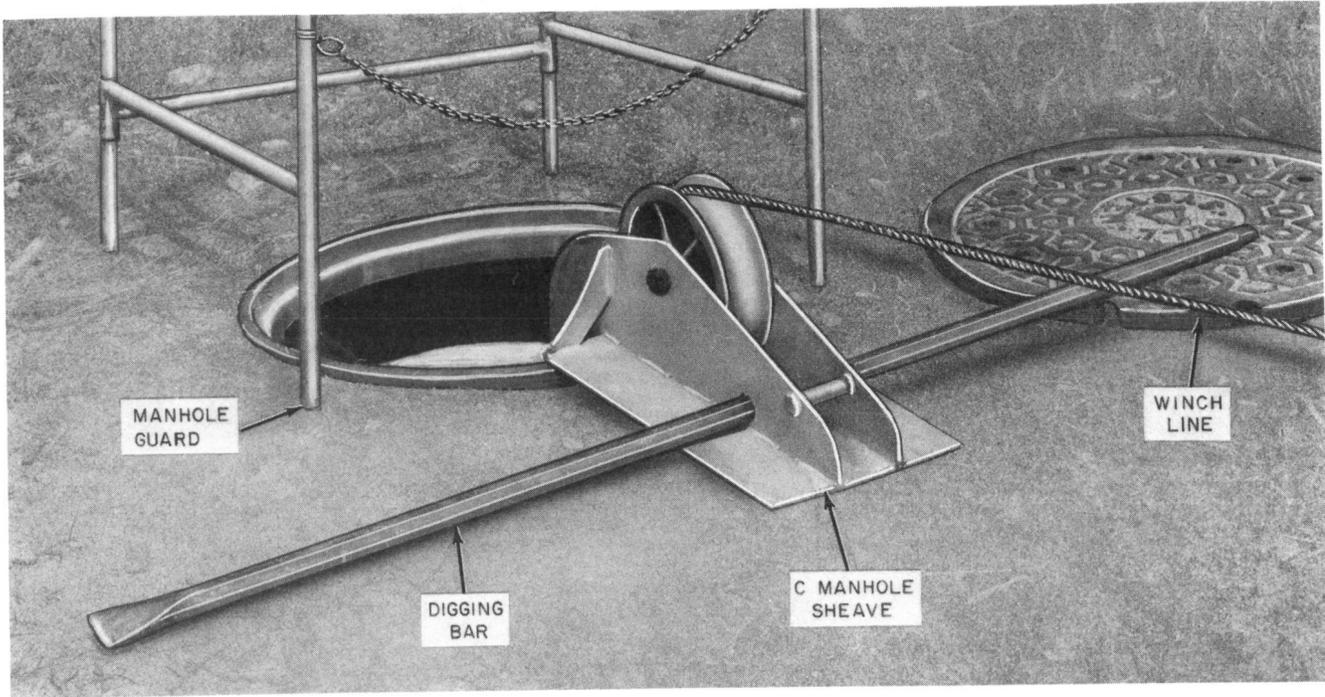


Fig. 11—Pulling Arrangement Using C Manhole Sheave on Manhole Frame

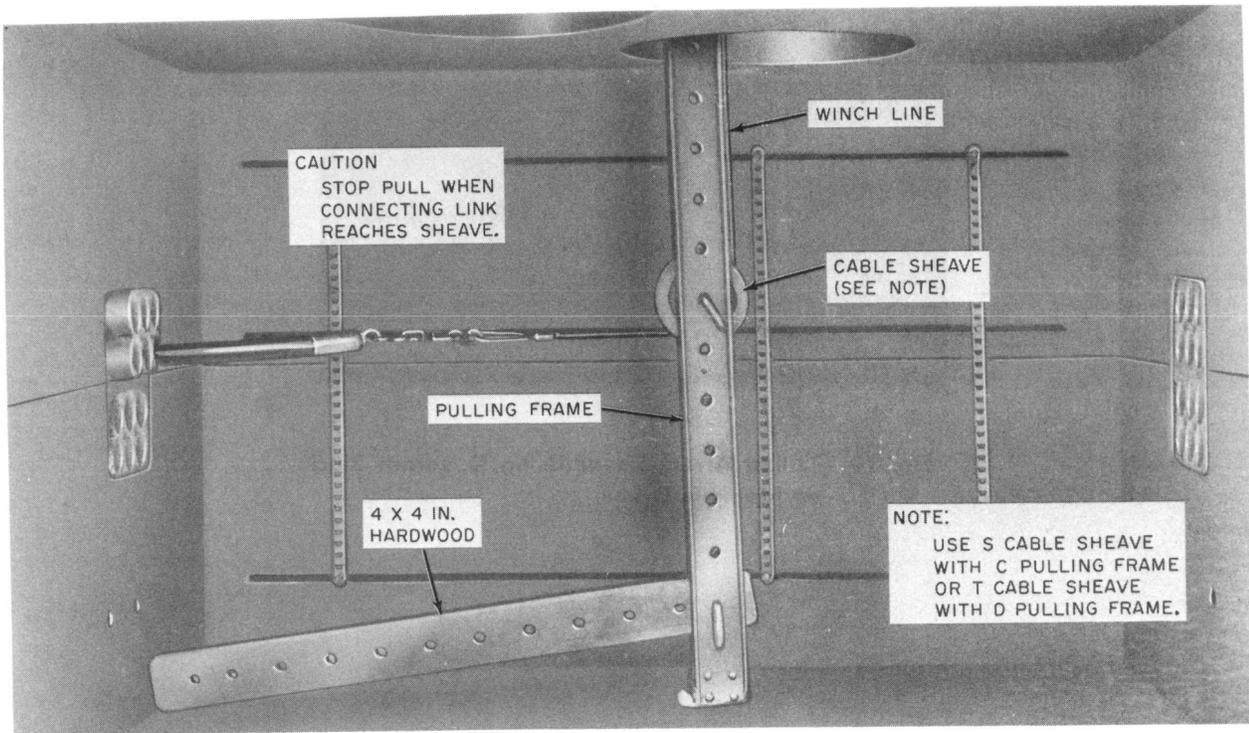


Fig. 12—Pulling Arrangement Using Pulling Frame and Cable Sheave

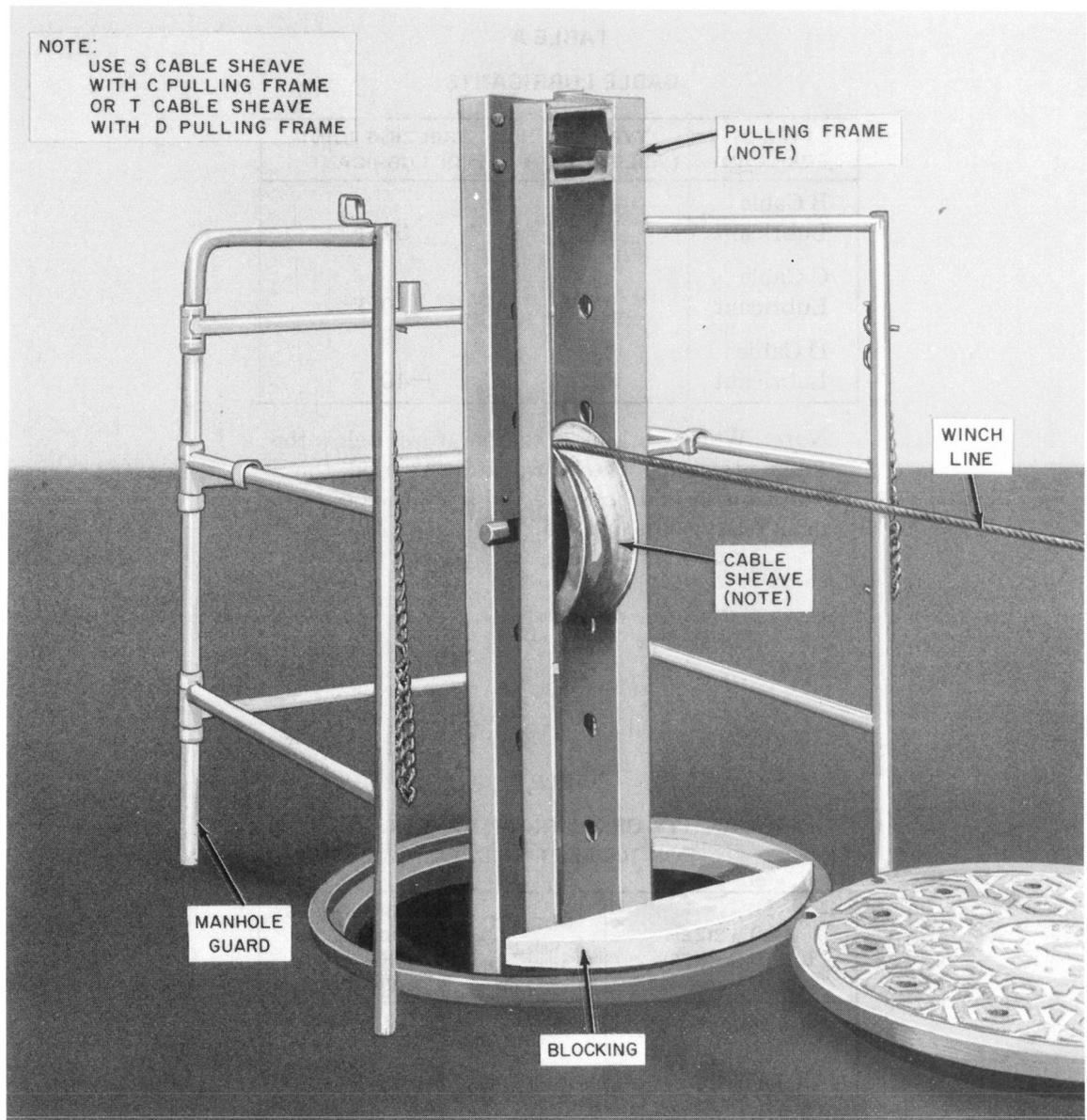


Fig. 13—View Above Manhole of Pulling Frame and Cable Sheave Arrangement

TABLE A
CABLE LUBRICANTS

TYPE OF LUBRICANT	TYPE OF CABLE SHEATH	FREEZING POINT OF LUBRICANT
B Cable Lubricant	All	32° F
C Cable Lubricant	All	10° F ¹
D Cable Lubricant	All	-40° F

Note: When working at temperatures below the freezing point of the lubricant being used, the lubricant should be protected from the cold until ready to be applied.

TABLE B
QUANTITY OF LUBRICANT REQUIRED
FOR 100 FEET OF CABLE

CABLE SIZE (OD IN INCHES)	NORMAL PULLS (POUNDS)	LONG PULLS AND PULL-THROUGHS (POUNDS)
Less than 1-3/8	5	10
1-3/8 to 2	7.5	12.5
Larger than 2	10	15

11. FEEDING AND PULLING CABLE

11.01 The cable feeder is used to protect and guide the cable into the duct. Where an extension section of the cable feeder is required, its nozzle end should be fitted into the bell end of the main section.

11.02 Thread the pulling line from the duct through the cable feeder, and through the cable lubricator before the connection is made between the line and the cable.

11.03 Throughout the placing operation, keep the cable lubricator (in the mouth of the

feeder or extension) filled with lubricant until only 5 or 6 turns of the cable remain on the reel.

11.04 Before starting the pull, check the equipment carefully to make sure that it is properly set up to minimize the chance of interruption once pulling has started. Tension should be kept on both the cable reel and the pulling line at the start of the pull. Excessive slack and the twist of the pulling line may cause the connecting links to turn and catch in the duct. As far as possible, the cable should be pulled in without stopping until the required amount of cable is in each manhole. A pulling speed of 80 to 100 feet per minute is desirable. Figure 14 illustrates cable being placed in underground conduit.

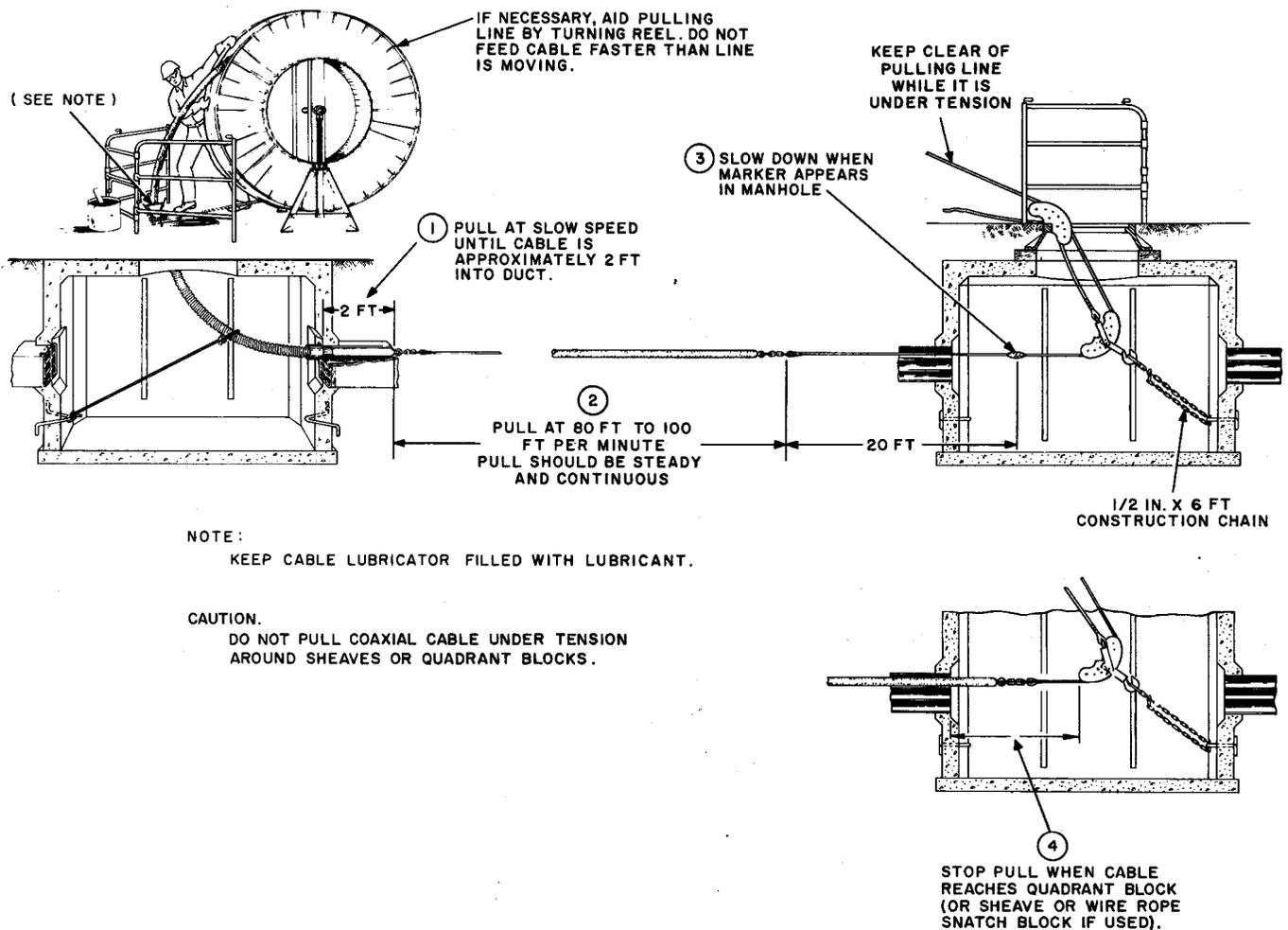


Fig. 14—Typical Setup for Placing Coaxial Cable in Underground Conduit

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11.05 Before placing the cable, verify that the cable is under pressure and note the reading on the pressure gauge. After cable has been placed, check the pressure. If there is no drop in pressure, indicate the pressure reading on the linen tag attached to the cable end. If there has been a drop in pressure (or if there is no pressure, charge the cable with air) flash test each end of the cable for leaks. If the end of the cable is damaged, repair the damage and charge the cable with 7 to 9 psi of air and flash test. If the ends are not damaged, notify your supervisor.

11.06 Watch the cable carefully as it unreels and inspect for sheath defects. If a defect is noticed, stop the pull. Any cracks or breaks in the sheath should be repaired and pressure tested before placing the cable. Notify your supervisor if there are any serious kinks or dents in the coaxial cable.

11.07 Pay careful attention to signals as the cable is being pulled so that pulling may be

stopped instantly whenever necessary. Use a talking line, or radio when available, between the reel and the pulling truck.

11.08 When it is necessary to stop the pulling operation, the winch operator should stop the winch but not release tension unless signaled to do so. In starting up again, the inertia of the cable should be overcome by gradually increasing the tension in steps a few seconds apart until the cable starts to move.

11.09 Figure 15 illustrates the LG-345 Leadergard™, a flanged nylon split-tube which can be inserted into a duct to prevent cable damage from sharp duct edges. It is particularly advantageous at pull-through manholes to guide the cable into the duct of the front section and to prevent cable sheath abrasion at the duct entrance. To place the leadergard, form it into a cylinder slightly smaller than the duct, and insert it into the duct.

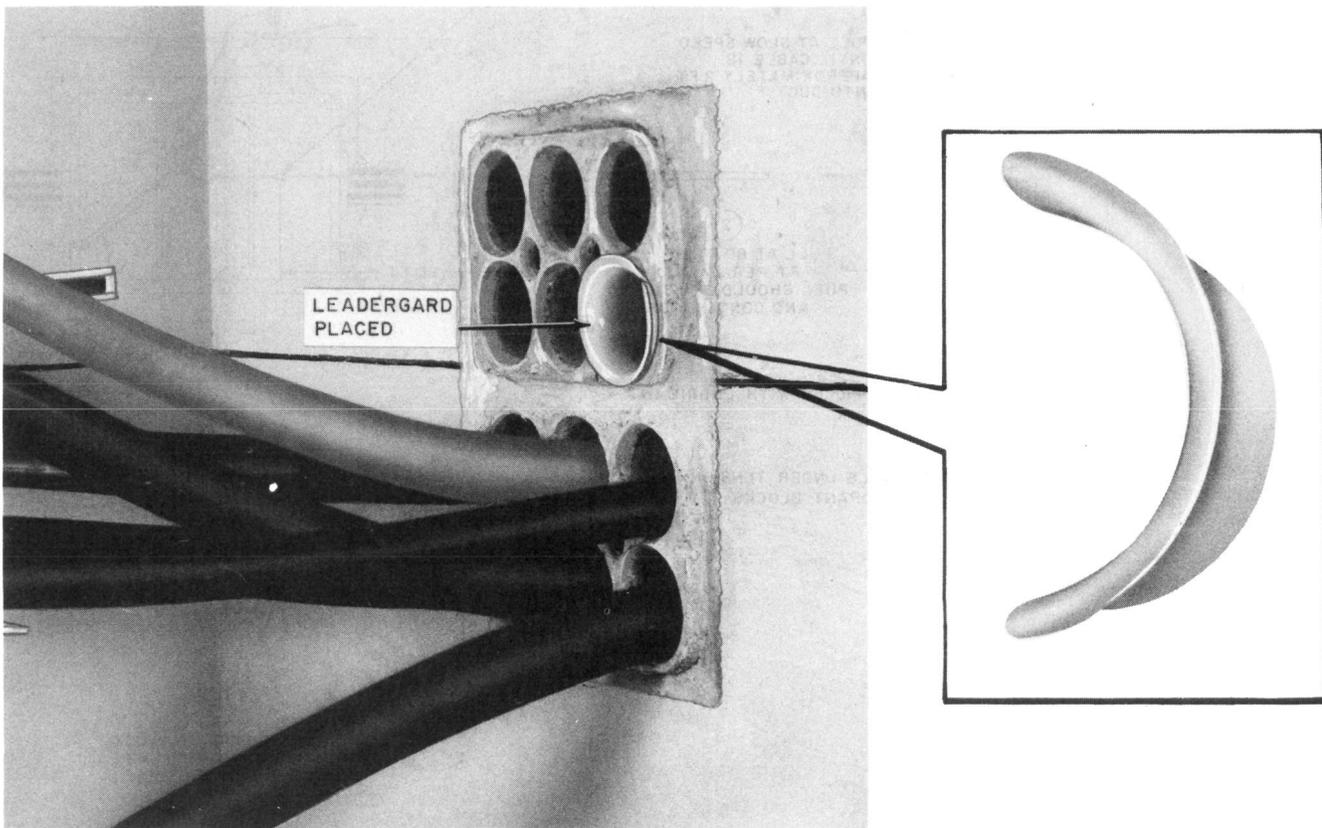


Fig. 15—LG-345 Leadergard

11.10 When an LG-345 Leadergard is not available for use at pull-through manholes, guide the end of the cable into the duct of the front section; then place a cable feeder nozzle around the cable, and slide it into the duct to protect the cable. This will prevent sheath abrasion if the ducts are offset slightly.

CAUTION: *The ducts must be in line in pull-through manholes. Duct offset can damage the coaxial tubes in the cable.*

11.11 Plan sufficient slack to rack the cable at pull-through manholes, plus the amount needed to rack and splice at end manholes. The amount of slack necessary for racking pull-through manholes can be determined from Part 13 of this section.

11.12 *Stop the pull when the cable reaches the sheave or quadrant block in the terminal manhole. Additional cable slack can be developed in the manhole by "fleeting" the cable forward using cable luffing grips.* Remove lubricant from the cable and install the luffing grip on the plastic sheath layer as shown in Fig. 16. Gripping force can be increased if necessary by wrapping one layer of friction tape (one inch of sheath showing between wraps) on the sheath under

the grip, and by tightening a C sealing clamp (hose clamp) around the end of the luffing grip. Slide the grip back toward the duct, insert B cable bending shoes, and attach the winch line to the grip (Fig. 17 and 18). Bend the cable up by pulling on the rope attached to the pulling eye, and secure the rope (Fig. 19). Pull the cable forward slowly (Fig. 20) making sure the equipment is properly aligned and the luffing grip does not slip, and stop when the B connecting link reaches the wire rope snatch block. To repeat the cycle (Fig. 21) slacken the winch line, slide the luffing grip back, readjust cable bending shoes, pull up on the pulling-eye rope and secure it. Then pull the cable forward again, repeating the luffing operation until the required slack is developed. Lower the slack slowly back down into the manhole making sure the cable is supported at the manhole wall by a cable bending shoe and is not bent sharper than a 21-inch inside radius. Employees should not remain in manholes during the luffing operation when the pulling line is under tension (see 2.12). If the manhole is not equipped with pulling-in irons alternate pulling arrangements must be used. The pulling line can be fed back through the next duct run and attached to the luffing grip, or a chain hoist attached to a pulling frame can luff the cable forward. Due to congestion, using winch line over a pulling frame is not recommended for luffing when the winch line, frame, and cable all leave from the same

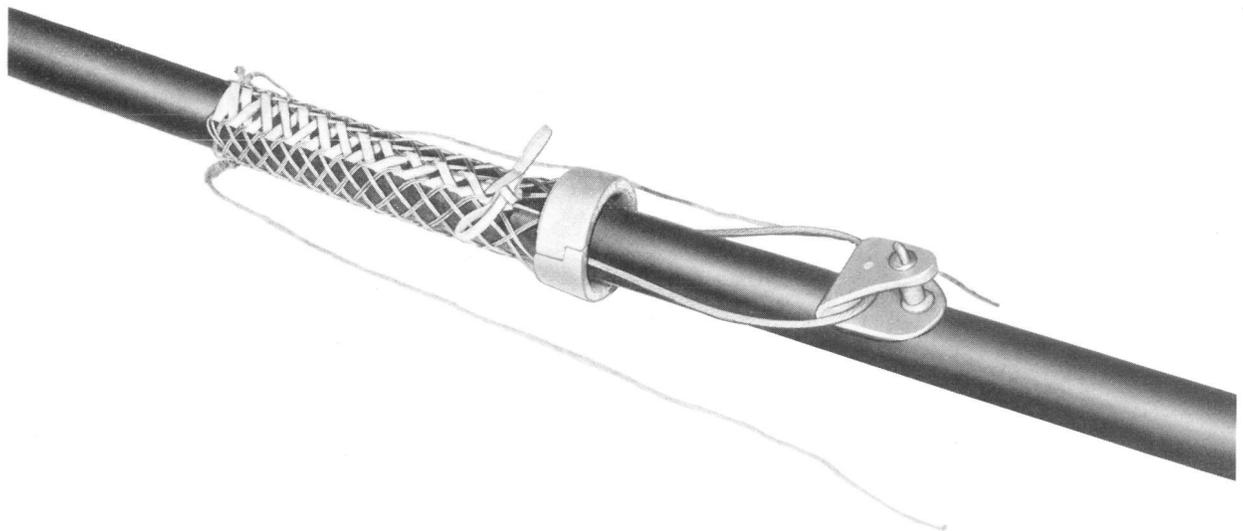


Fig. 16—Luffing Grip Laced on Cable

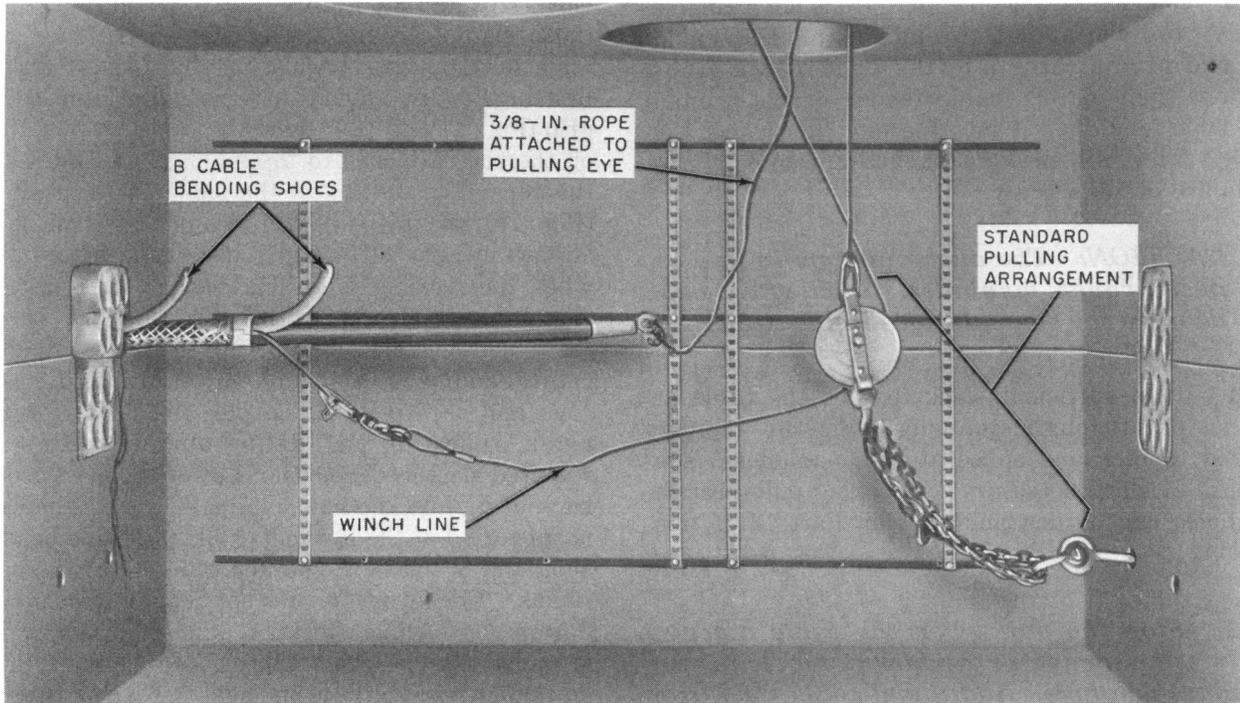


Fig. 17—Cable Luffing Setup

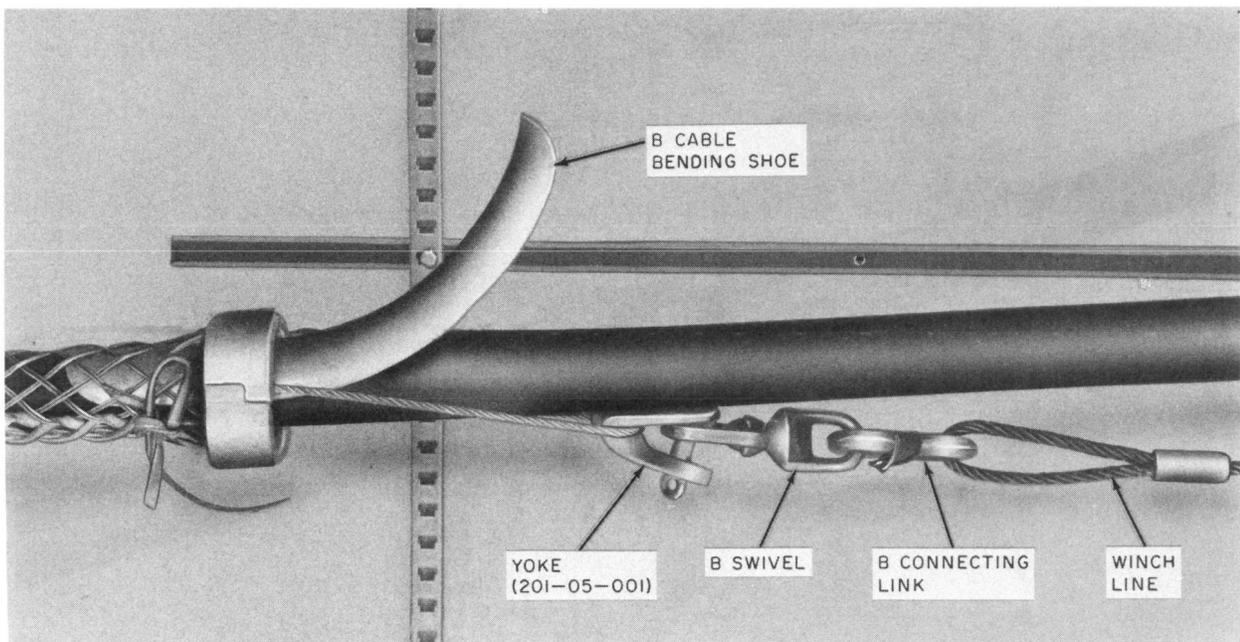


Fig. 18—Pulling Line Attached to Luffing Grip

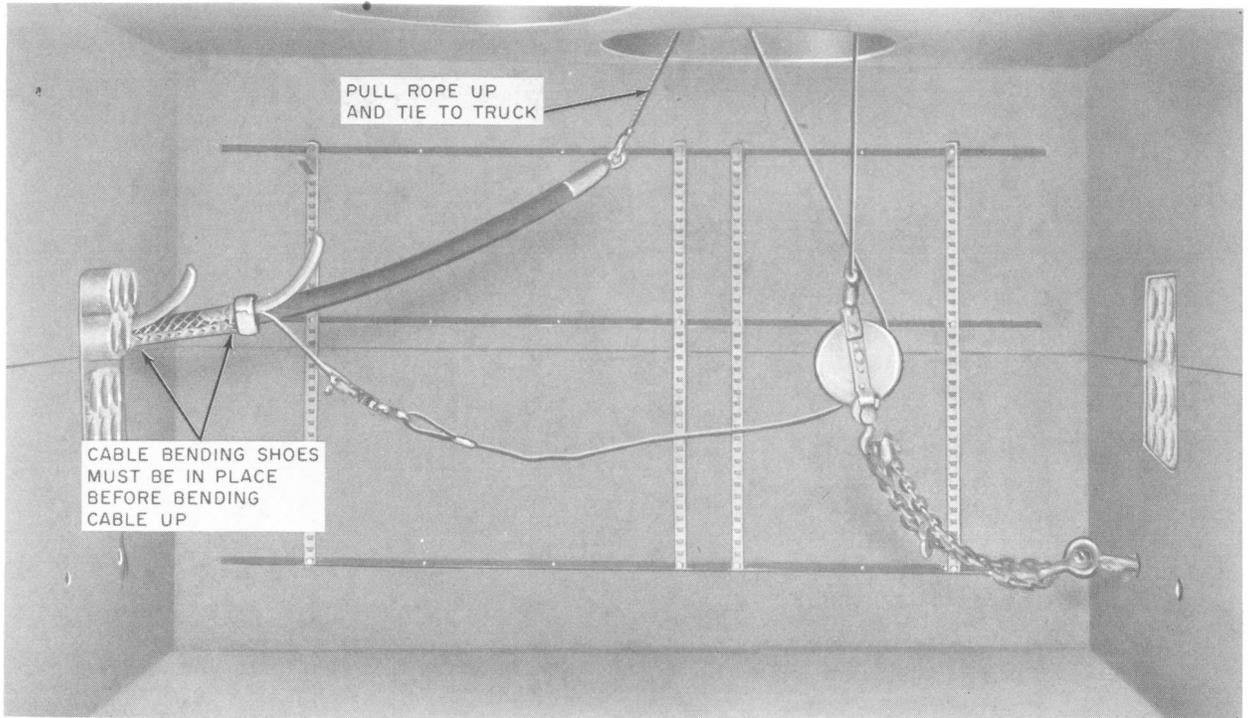


Fig. 19—Pulling Cable Up

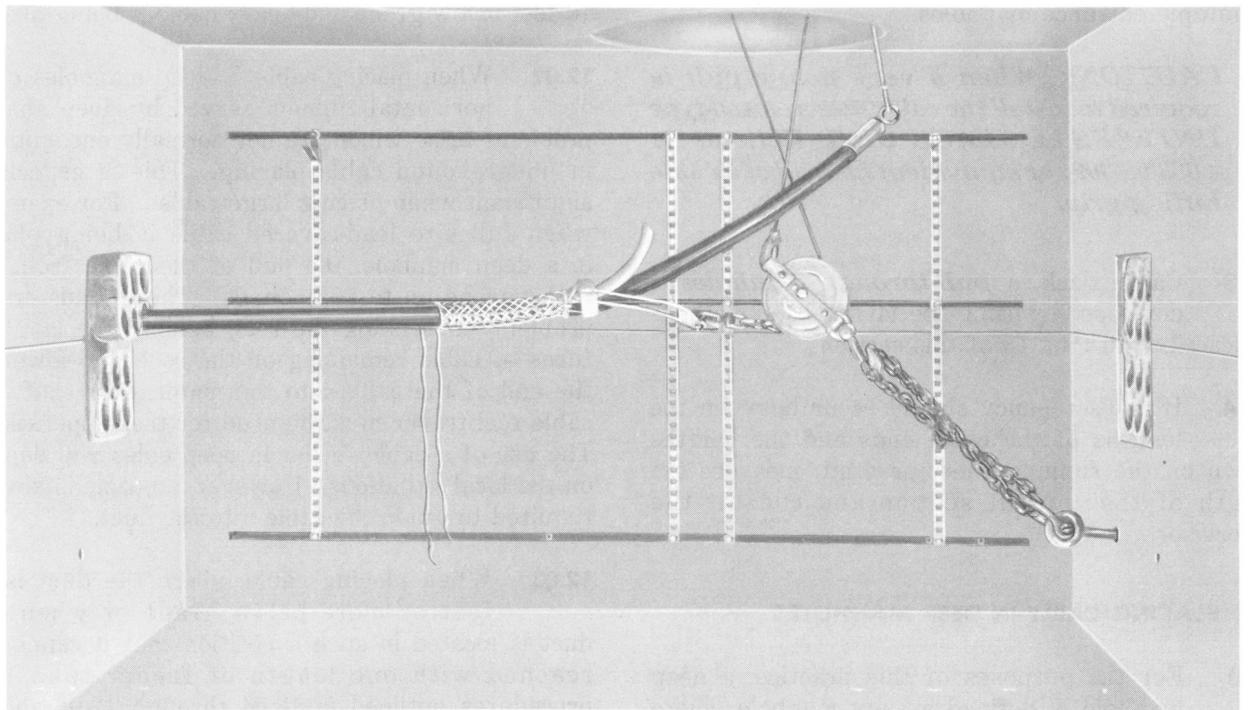


Fig. 20—Pulling Cable Forward

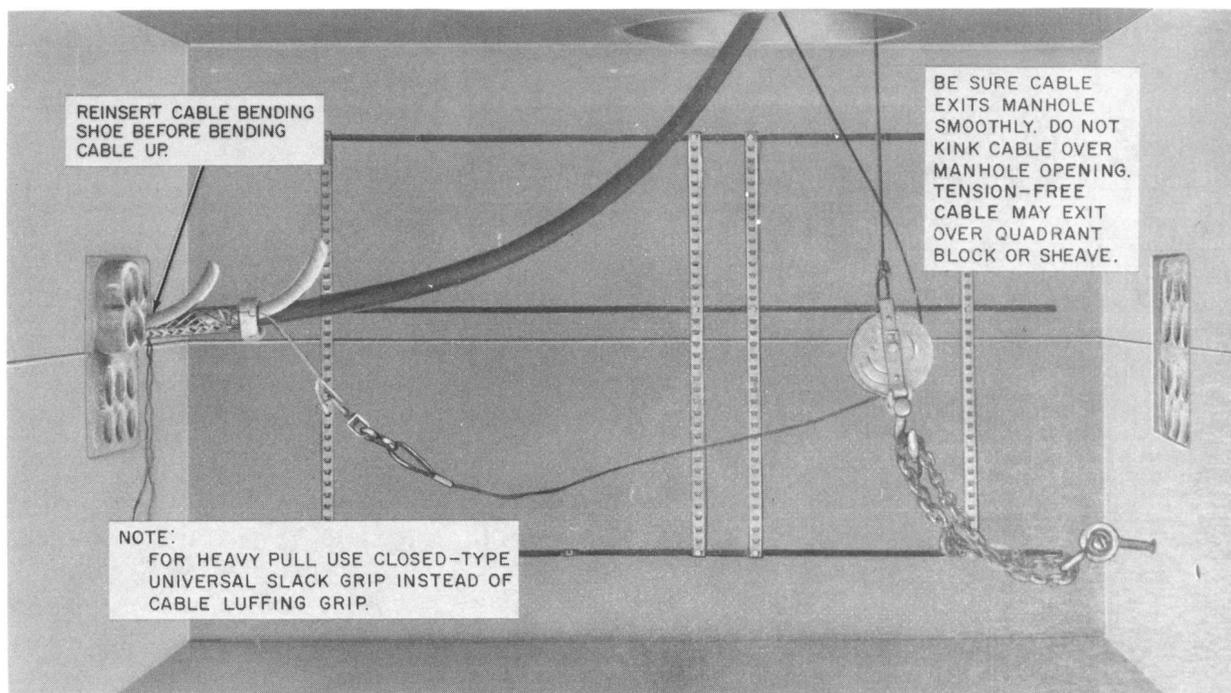


Fig. 21—Repeating Luffing Cycle

manhole entrance. A pulling frame can be used in multiple entrance manholes.

CAUTION: *When a very heavy pull is required to install the cable, use a closed-type UNIVERSAL SLACK GRIP KellemSM #033-08-009 or equivalent instead of a cable luffing grip.*

11.13 Cable slack in *pull-through manholes* is developed by using special tools and methods as described in Part 13 of this section.

11.14 If a discrepancy should occur between the lengths of the cable ends and the lengths shown on the running sheet or print, measure the length of the conduit section and consult the supervisor.

12. PLACING CABLE IN DEEP MANHOLES

12.01 For the purposes of this practice, a deep manhole is defined as any manhole where the ducts are 10 feet or more below grade or located where they cannot be reached with one length of cable feeder tube. It is desirable to use

deep manhole methods where the ducts are 5 to 10 feet below grade and heavy cable is being placed.

12.02 When placing cable in deep manholes or in horizontal tunnels served by deep shafts, problems arise which are not normally encountered in underground cable placing. This is especially significant when placing large cables. For example, when full size lead-covered cable is being placed in a deep manhole, the pull of the cable from the reel may be up to 800 pounds. These loads create problems in braking the reel, holding the last few turns of cable remaining on the reel, and lowering the end of the cable into the manhole or shaft. A cable reel trailer must be used for these operations. The use of a cable feeder in deep holes will depend on the local situations. However, a nozzle is always required to guide the cable into the duct.

12.03 When placing cable where the duct is 10 feet or more below grade or when the duct is located in such a position that it cannot be reached with one length of feeder tube, the procedures outlined in 12.04 through 12.08 should be used. It is also desirable to use this method when placing *heavy cable* where the ducts are 5 to 10 feet below grade.

- 12.04** Slow the reel when the last layer of cable appears on the reel (Fig. 22).



Fig. 22—Reel Slowed When Last Layer of Cable Appears

- 12.05** Stop the reel when no less than four turns of cable remain on the reel and attach a split cable grip to the cable just above the cable lubricator (Fig. 23). Tie a 5/8-inch manila rope to the grip using a bowline knot and secure the other end of the rope to the cable reel trailer frame keeping the rope tight and parallel to the cable lead.

- 12.06** Loosen the cable reel brake so that the reel may be turned freely by hand. Rotate the reel to loosen the cable turns to permit the end of the cable to be pulled out of the cable port of the reel. The loose turns can readily be pushed toward the center of the drum so that the end of the cable is accessible. Place a cable grip over the end of the cable and using a bowline knot attach a length of 5/8-inch manila rope to the eye

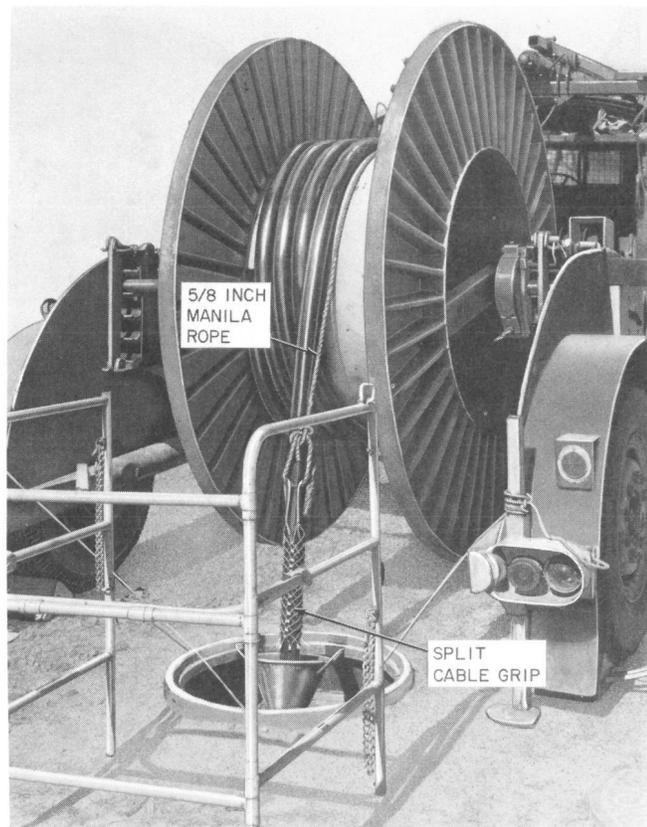


Fig. 23—Split Cable Grip in Place

of the grip as shown in Fig. 24. The rope should be passed four times around the drum in the same direction as the cable. The rope should be long enough to reach to the bottom of the manhole or shaft after being passed four times around the reel. Coil the free end of the rope on the ground near the manhole.

- 12.07** Rotate the reel to remove the slack in the cable and tighten the cable reel brake to the same setting used for pulling cable. Untie the rope securing the split grip and remove the grip.

- 12.08** Resume the cable pull and, as the reel turns, guide the rope onto the drum to replace the cable leaving the reel, as shown in Fig. 25. When the end of the cable leaves the reel, four turns of rope will remain and the rope will then be wound on the drum at the same rate of speed as the cable being lowered. Continue the pull until the desired amount of cable is in the manhole.

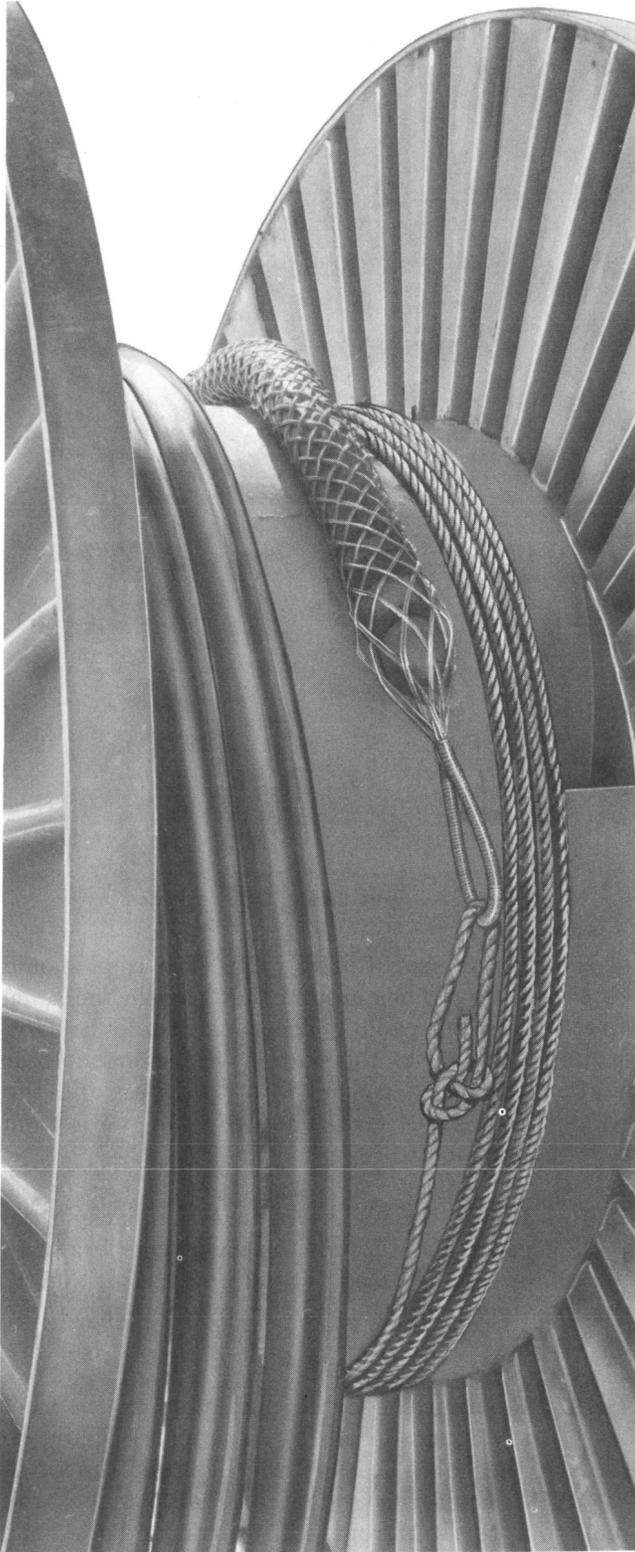


Fig. 24—Cable Grip on End of Cable

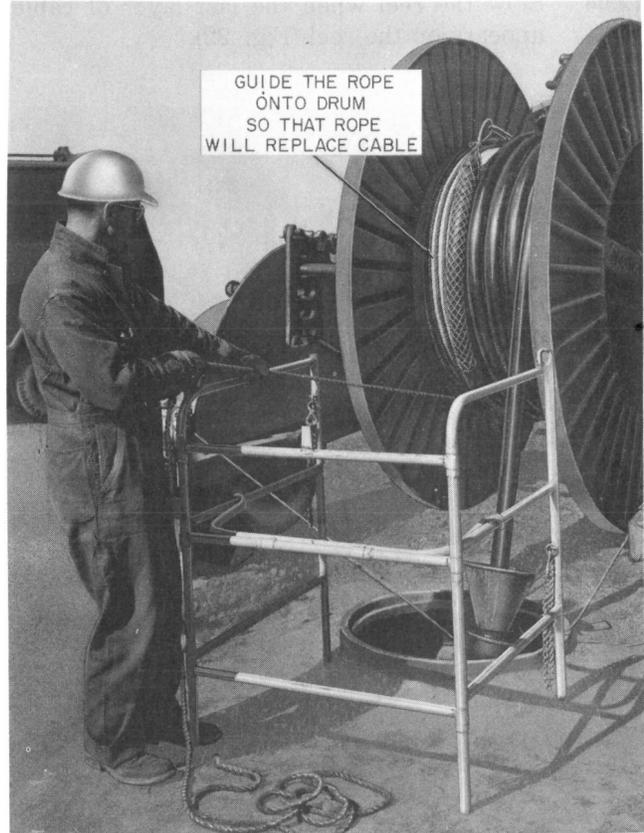


Fig. 25—Last of Cable Being Lowered

13. RACKING COAXIAL CABLE IN PULL-THROUGH MANHOLES

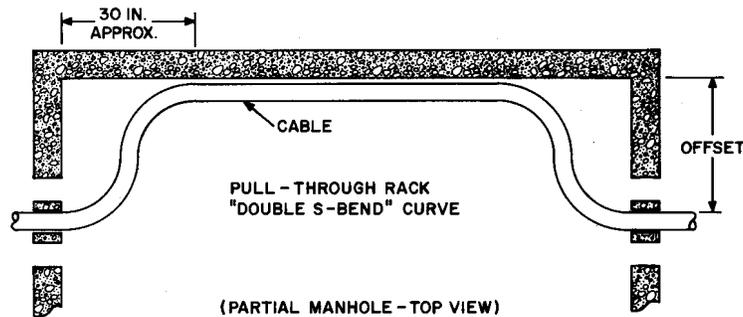
13.01 *Ordinary paired cable racking procedures can damage coaxial cable.* If slack is developed by lifting the cable with a sheave and winch, or by jacking the cable laterally, flattening damage can occur from high normal loads at both manhole walls and at the sheave or jack. **To rack coaxial cables in pull-through manholes, it is necessary, therefore, to obtain slack using tools specifically designed for that purpose.** The amount of slack required will vary according to the width of the manhole, position of ducts, etc. Figure 26 gives the amount of slack required to obtain offsets of specified distances.

13.02 To rack the cable, first measure the offset carefully to determine the amount of slack required and proceed as follows:

- (1) Clean lubricant from cable sheath for placement of split luffing grips at both ends of the manhole.
- (2) Depending on the type of lubricant used, it may be necessary to apply one layer of friction tape to cleaned area of cable, starting

at the ducts and leaving one inch of sheath showing between wraps, to keep luffing grips from slipping. A C sealing clamp (hose clamp) around the end of the grip also helps prevent slippage.

- (3) Place split luffing grip on cable at each end of manhole. Attach two lengths of heavy cord to the duct end of each luffing grip. The cords should be on opposite sides of the luffing grips. They can be used to aid removal of luffing grips which are partially in the duct.
- (4) Place cable bending shoes in the ducts and slide the luffing grips into the ducts as far as possible, especially in small manholes. Place cable bending shoe between split ring of the grip and the cable (Fig. 27).
- (5) Attach a 1-1/2 ton chain hoist to the pulling yokes of the luffing grips and position the G slack puller with the head of the tool on the cable at the center of the manhole. The adjustable strut points toward the wall opposite the wall on which the cable will be racked. Secure the slack puller to the cable with the two elastic cords and with vinyl tape (Fig. 27). There must be a minimum spacing of 12 inches between



OFFSET DISTANCE (INCHES)	TOTAL SLACK REQUIRED * (INCHES)	APPROXIMATE RULE
9	4	TOTAL SLACK EQUALS OFFSET LESS 5 INCHES
12	7	
15	10	
18	13	
21	17	
24	21	NONE
27	25	
30	31	

* APPLIES TO MANHOLE OF ANY LENGTH.

Fig. 26—Slack Required for Racking in Pull-Through Manholes

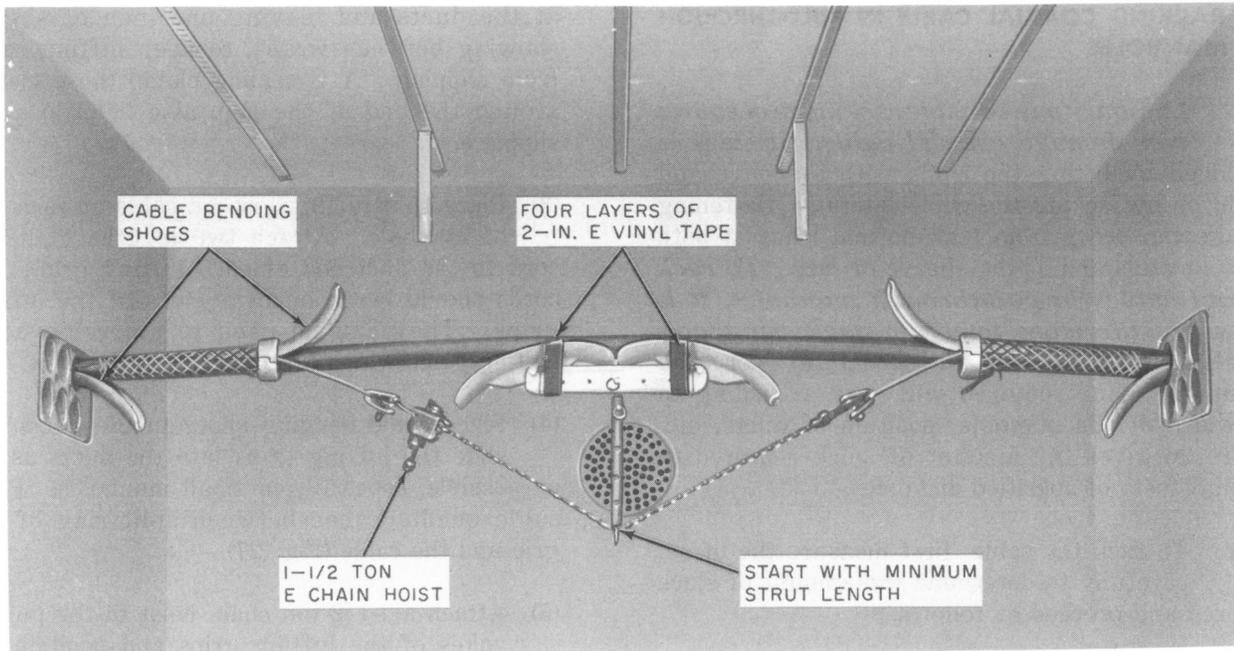


Fig. 27—Initial Position of G Slack Puller for Pull-Through Manhole Racking

the duct shoe and the end of the shoe on the head of the tool. Engage a link near the center of the chain in the chain lock on the end of the strut. Always start with the strut adjusted to minimum length.

(6) Take up on the chain hoist. The chain hoist pulls slack into the manhole while the strut pushes the cable toward the manhole wall. It will be necessary to reposition the end of the strut on the chain as the pull progresses to keep the strut at right angles to the head of the tool. The strut length can be increased as the pull progresses. Be sure the cable bending shoes remain in position in the ducts to prevent damage to the cable. As shown in Fig. 28, continue to take up on the chain hoist until the required amount of tension free slack (see 13.01) has been developed in the manhole.

(7) Remove the slack puller, chain hoist, and luffing grips. Leave the cable bending shoes in the ducts. The bend in the cable after the tool is removed is shown in Fig. 29.

(8) To start bending of the cable into the corners of the manhole, position one or two B cable racking jacks on the cable with a duct shoe between the cable and the jack (see Fig. 30).

A minimum spacing of 1 foot is required between the shoe in the duct and the shoe under the jack. Assemble appropriate extension lengths and carefully jack the cable toward the corners of the manhole, repositioning the jacks as required. Protect the cable from contact with racks, walls, etc, by placing small duct shoe segments behind the cable where necessary. Form the cable into a smooth curve, as shown in Fig. 31, and remove the racking jacks.

(9) Complete the cable bending using the F cable bender. Position the cable bender on the cable (Fig. 32), engage the chain hoist on the tool, and take up on the hoist. Complete bends at both ends of the manhole to obtain final rack shape shown in Fig. 33. Remove the bender and support the cable with cable hooks of the required size (Fig. 34). The duct shoes may be removed.

CAUTION: Remember the 21-inch minimum inside radius applies to these racking bends. Keep the curves as smooth as possible. Do not force the cable up against struts, manholes walls, etc, with the racking jacks or G slack puller. The F cable bender and racking jacks should be used on tension free cable only—do not use either to pull slack directly.

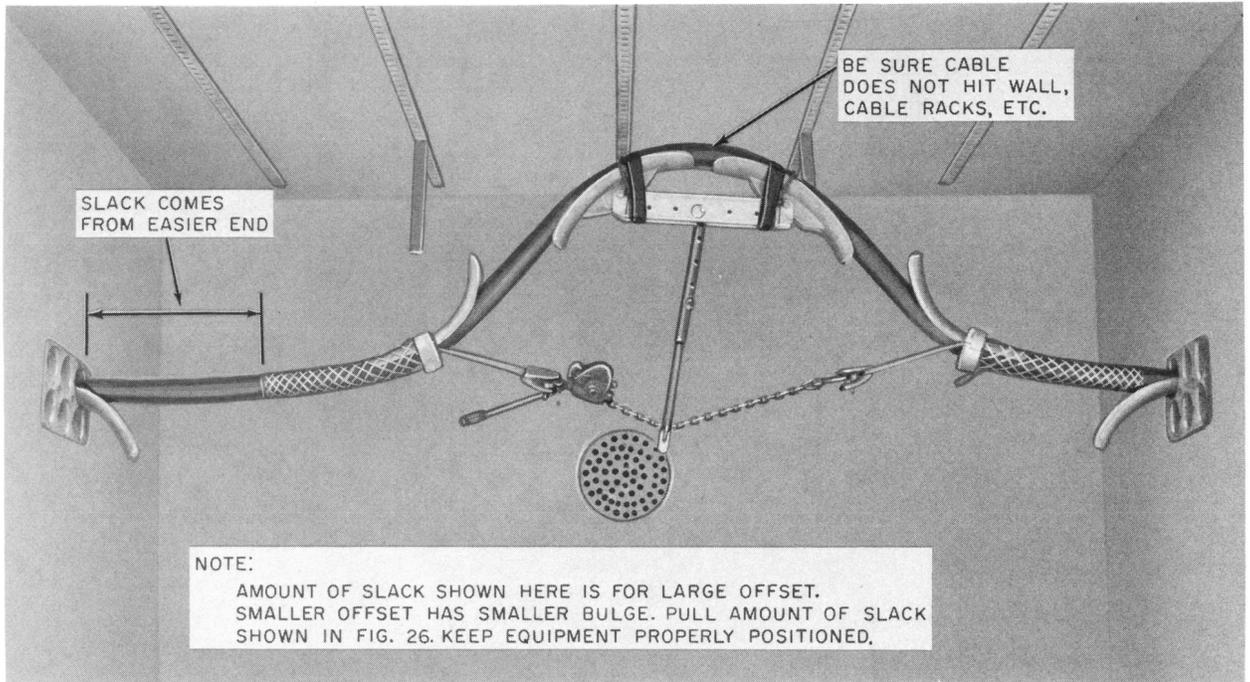


Fig. 28—Developing Slack

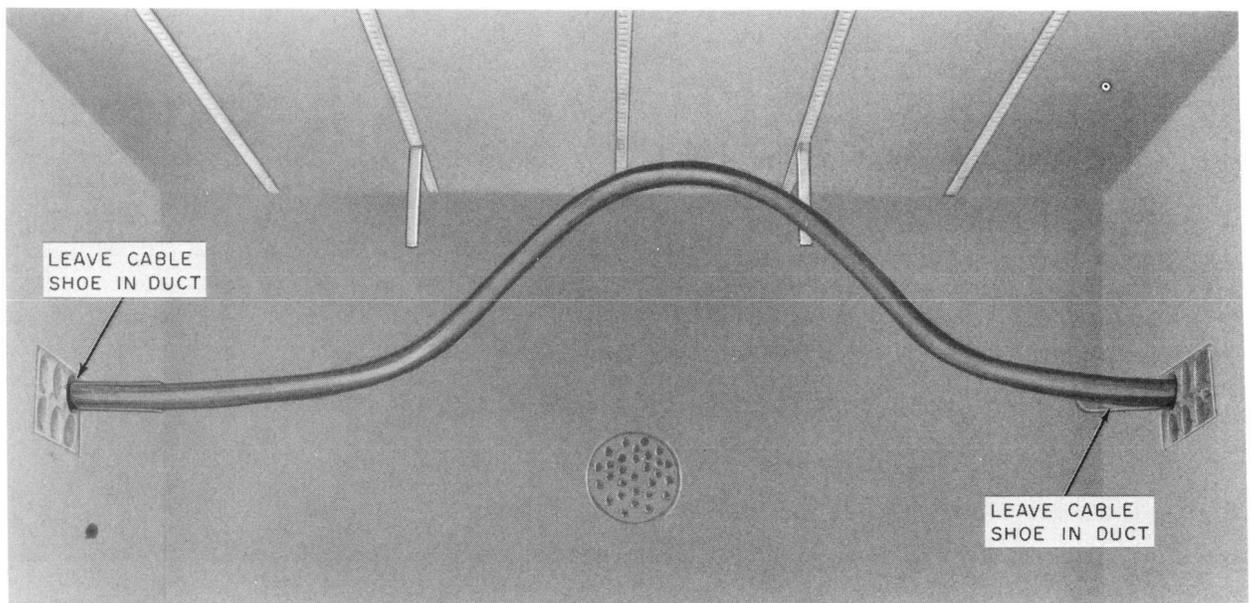


Fig. 29—Tension Free Slack in Manhole

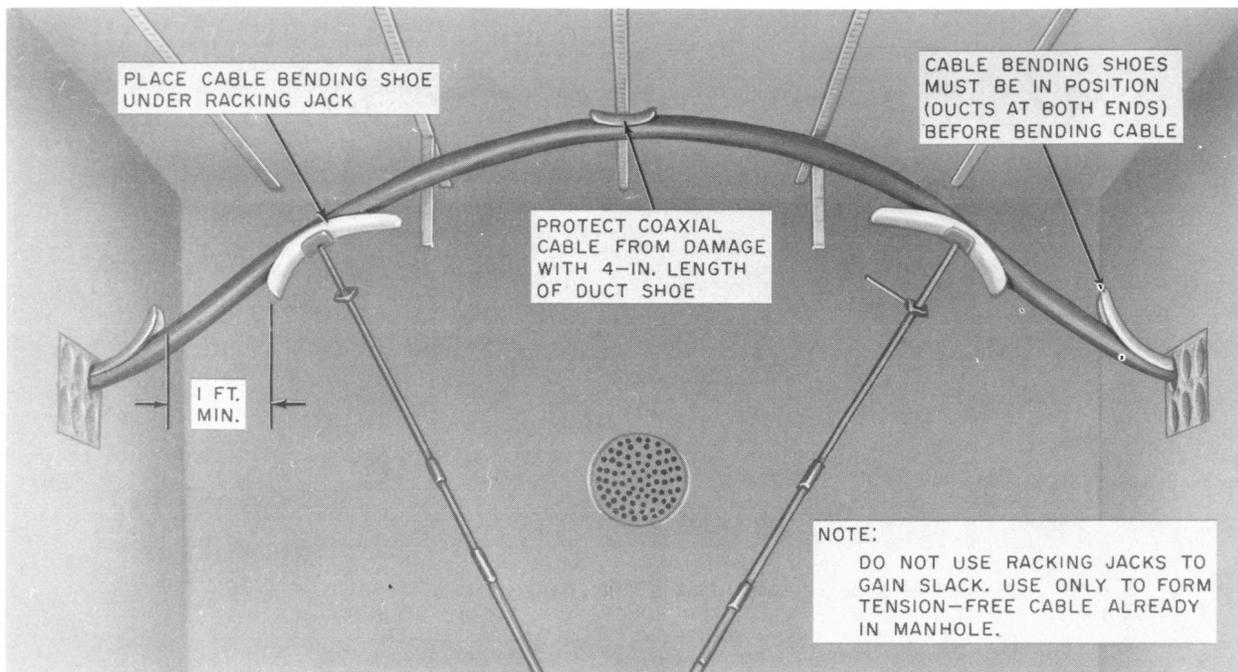


Fig. 30—Use of B Cable Racking Jacks on Coaxial Cable

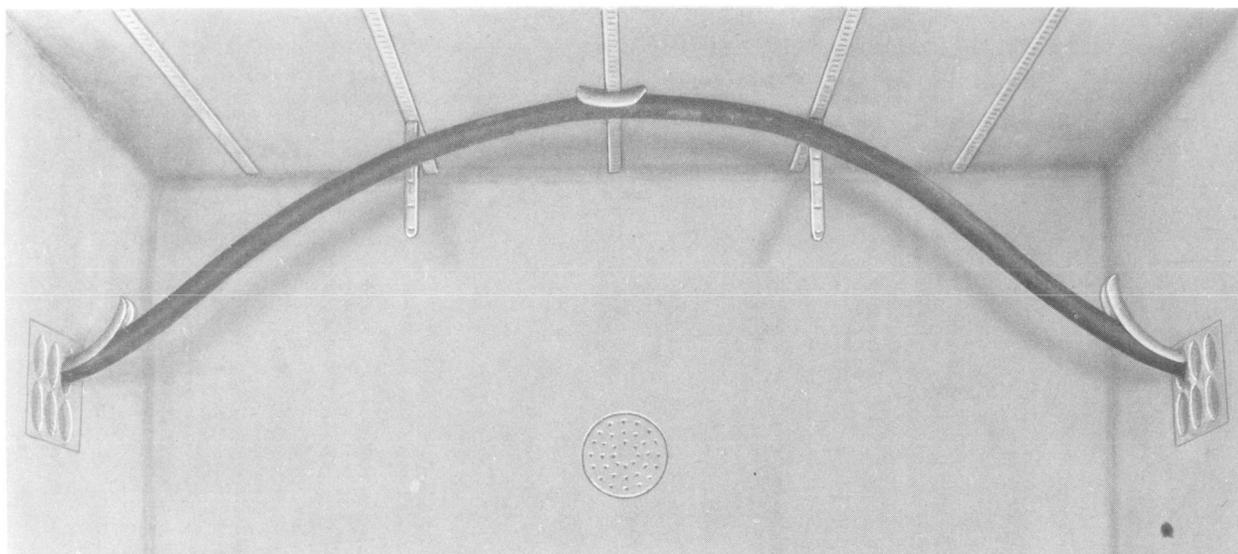


Fig. 31—Position of Cable After Use of B Cable Racking Jacks

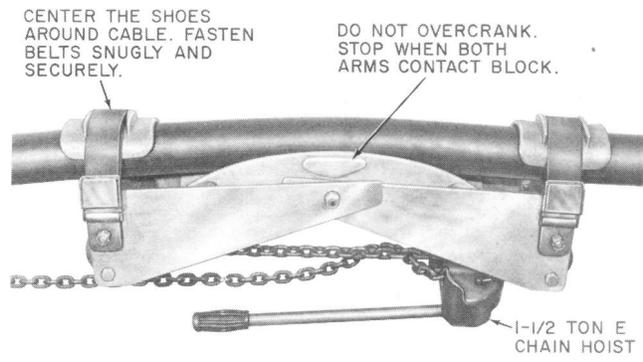


Fig. 32—F Cable Bender Positioned on Cable

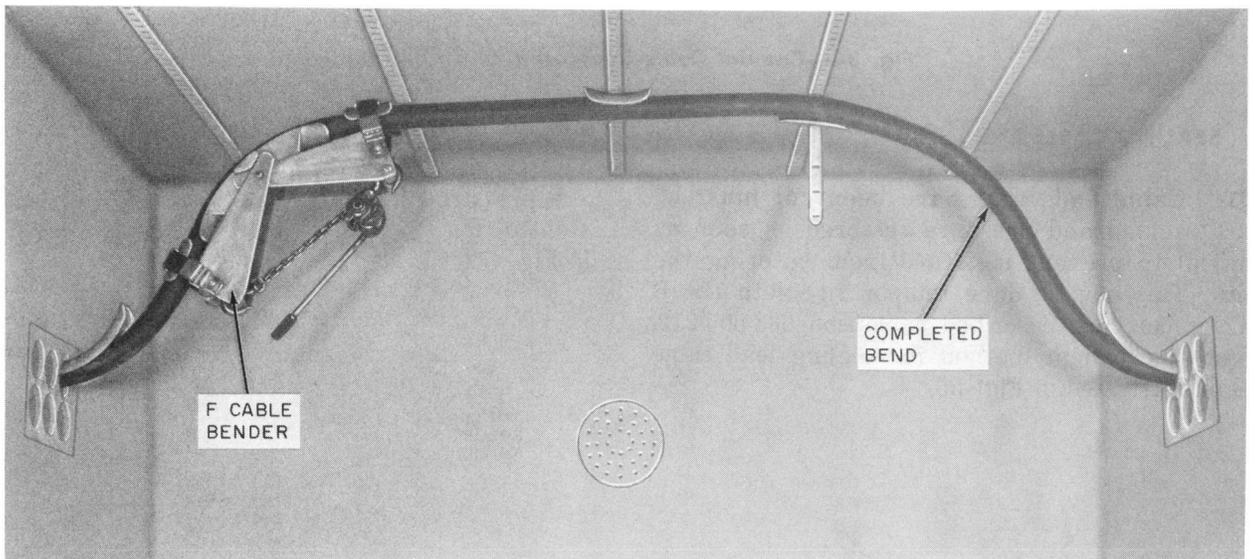


Fig. 33—Final Racking Shape Obtained With F Cable Bender

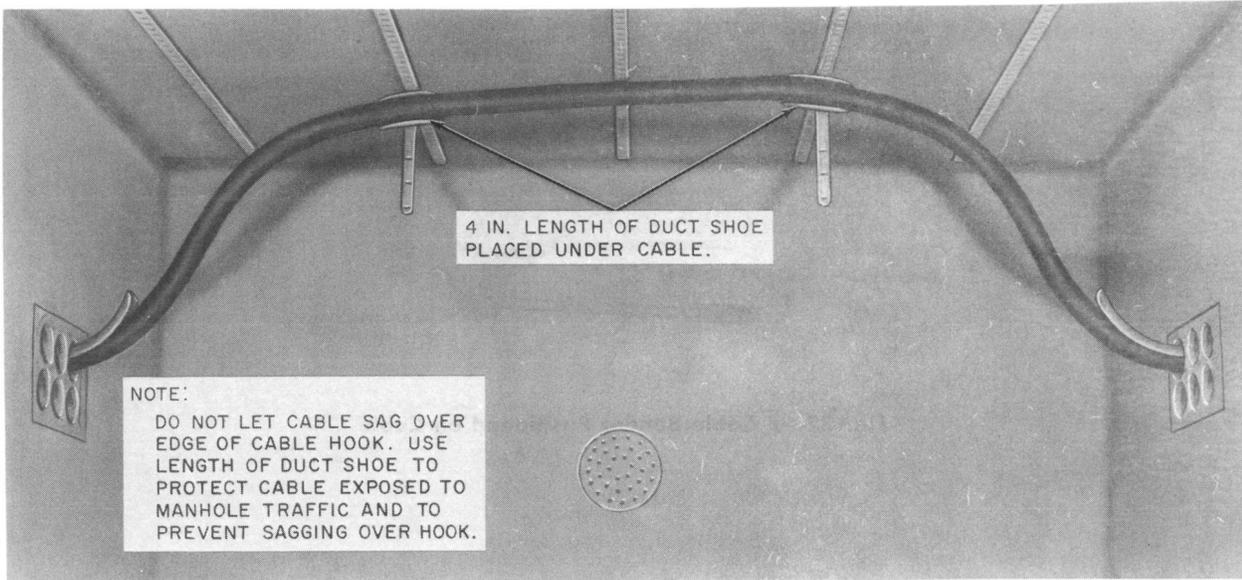
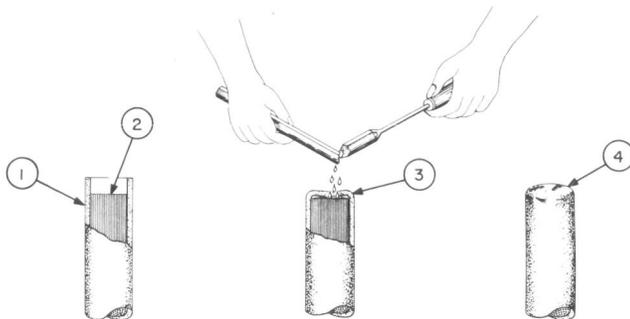


Fig. 34—Coaxial Cable Supported on Cable Hooks

14. SEALING CABLE ENDS

14.01 Cable ends that have been cut must be sealed and pressure restored as soon as practical to prevent moisture from entering the cable. This can be done temporarily with the B or C rubber caps described in Section 633-505-212. A more permanent method for sealing lead cable ends is illustrated in Fig. 35.



STEPS:

1. HOLD END OF CABLE UPRIGHT.
2. BEAT DOWN THE CORE 3/4 IN. WITH A HAMMER. REMOVE PAPER WRAPPING FROM INSIDE OF SHEATH.
3. BEAT OVER EDGE OF SHEATH AS SHOWN. CLEAN SHEATH WITH SHAVE HOOK, COAT WITH STEARINE, TIN AND THEN FLOAT WITH SOLDER UNTIL FLUSH WITH TOP.
4. SMOOTH OVER WITH SOLDERING COPPER.

Fig. 35—Sealing End of Lead Sheath Cable

14.02 When necessary to place a permanent valve in lead-sheathed cable, the core and sheath are prepared as shown in the first and second steps of Fig. 35 and the valve is soldered as shown in Fig. 36.

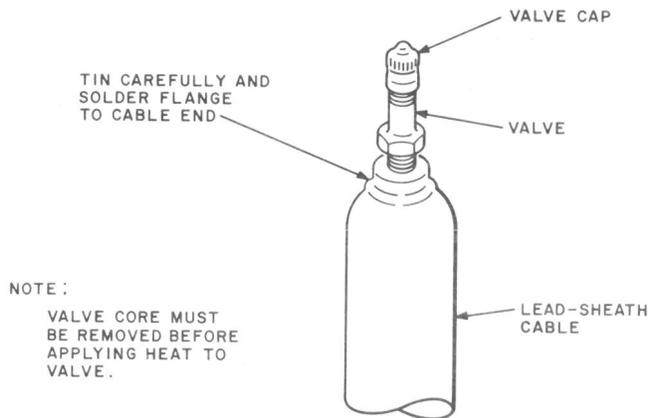


Fig. 36—Placement of Valve in Lead Sheath Cable

14.03 After pressure has been restored, pressure test all seals and pulled ends to determine if any sheath breaks are present. Repair any leaks. Record the pressure on a linen tag attached to the end of the cable for further checking by the splicer.

15. TYING AND RACKING CABLE ENDS

15.01 To prevent damage to the cable ends in the manhole and at the duct, tie them to the cable racks as shown in Fig. 37. Any cable bending required should be done carefully to avoid damage to the sheath or to the coaxial tubes. Inside bend radii must be at least 21 inches. The cable must not rest against sharp edges since the cable will eventually sag over the edges causing kinks that may damage the coaxial tubes. Leave cable bending shoes in the ducts until splicing has been completed.

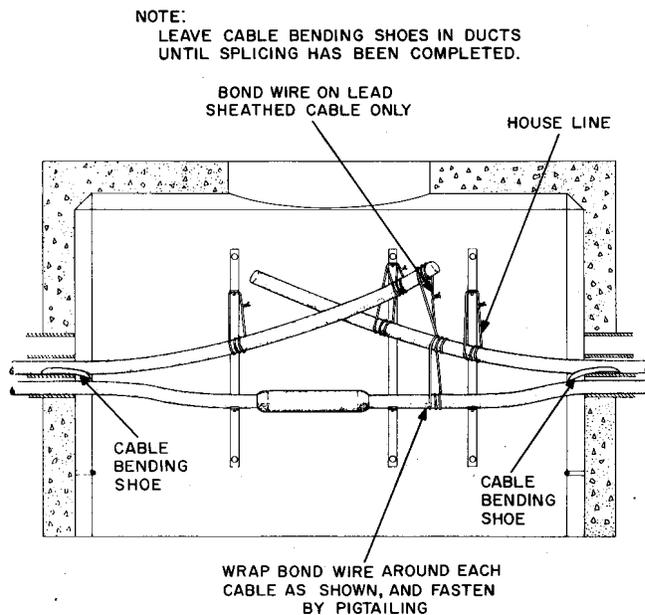


Fig. 37—Temporary Tying and Bonding of Lead Sheath Cable

15.02 Place extra protection around the cable in the end of the duct if there is a possibility of sheath damage from the ragged edges of broken ducts and where the cable is installed in steel pipe duct. An LG-345 Leadergard can be used advantageously in the mouth of such a duct.

15.03 An excessive length of cable left in a manhole should be looped around the hole in long sweeping bends and tied securely in a location where it will not obstruct the working space in the manhole.

15.04 Do not leave lead-sheathed cable in contact with any foreign pipes in the manhole.

15.05 *Coaxial cable can be racked in splicing manholes by using the F cable bender to make offset curves as shown in Fig. 38 through 40. Adhere to the 21-inch minimum inside radius rule and place a cable bending shoe at the edge of the duct when forming these bends.*

15.06 Markers similar to those illustrated in Fig. 41 should be used to distinguish coaxial cable in manholes.

16. TEMPORARY BONDING

16.01 Bond lead-sheathed cable, as soon as it is placed, to an existing cable other than one in which there is an insulating joint. Steel construction wire provides a good bond when used as illustrated in Fig. 37.

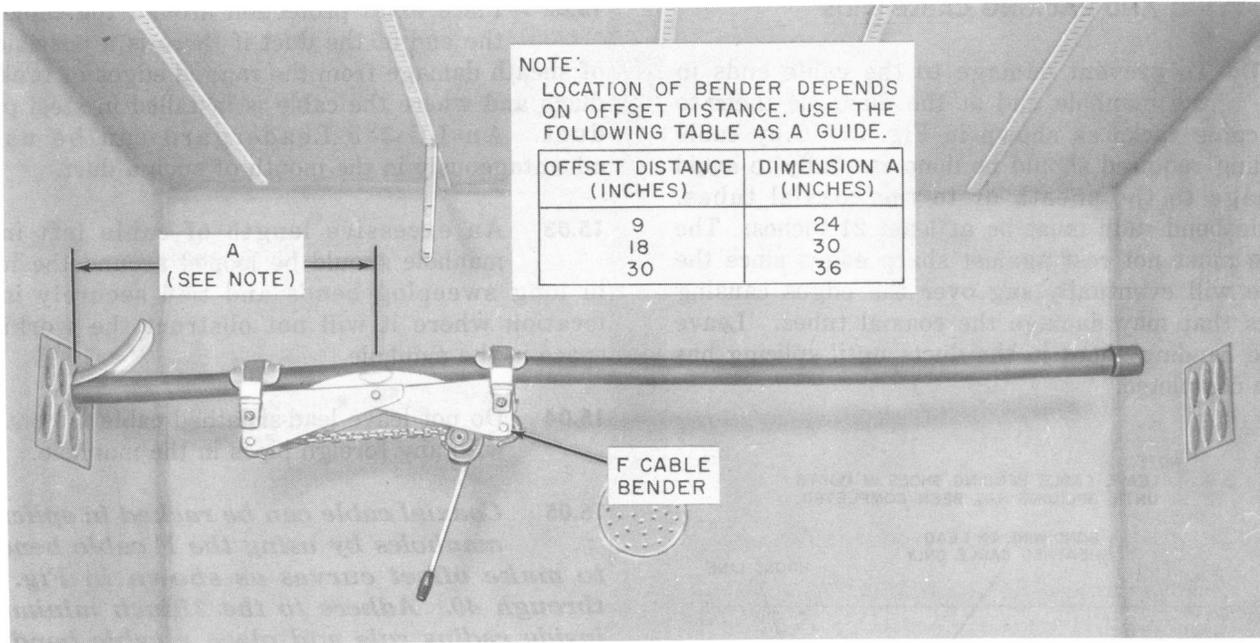


Fig. 38—Initial Position for Splicing Manhole Racking

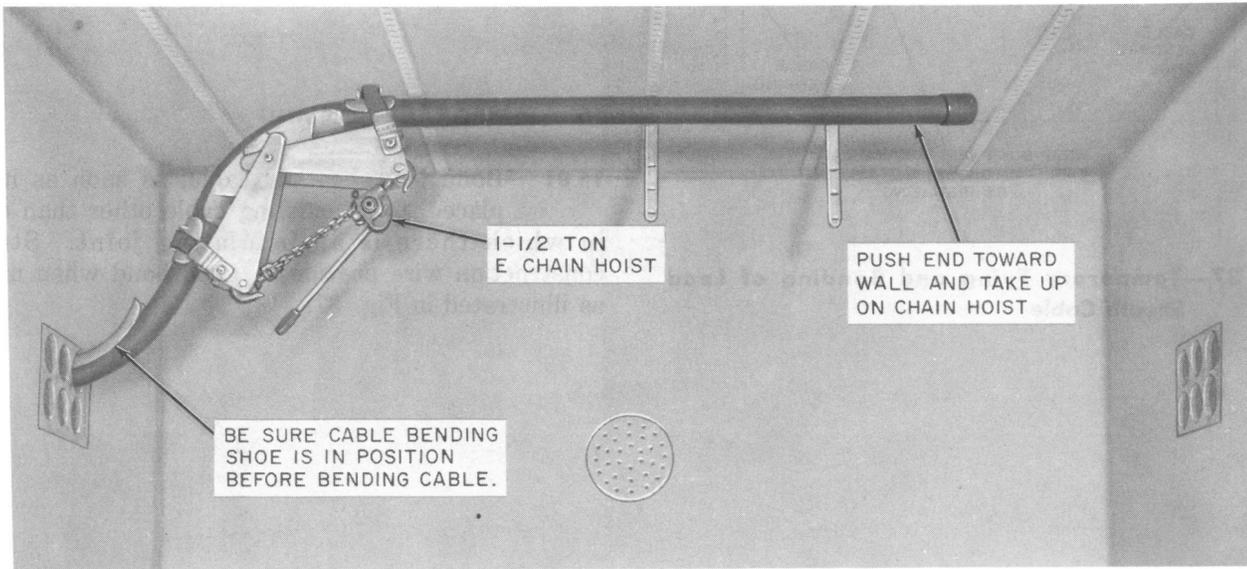


Fig. 39—Completing the Bond

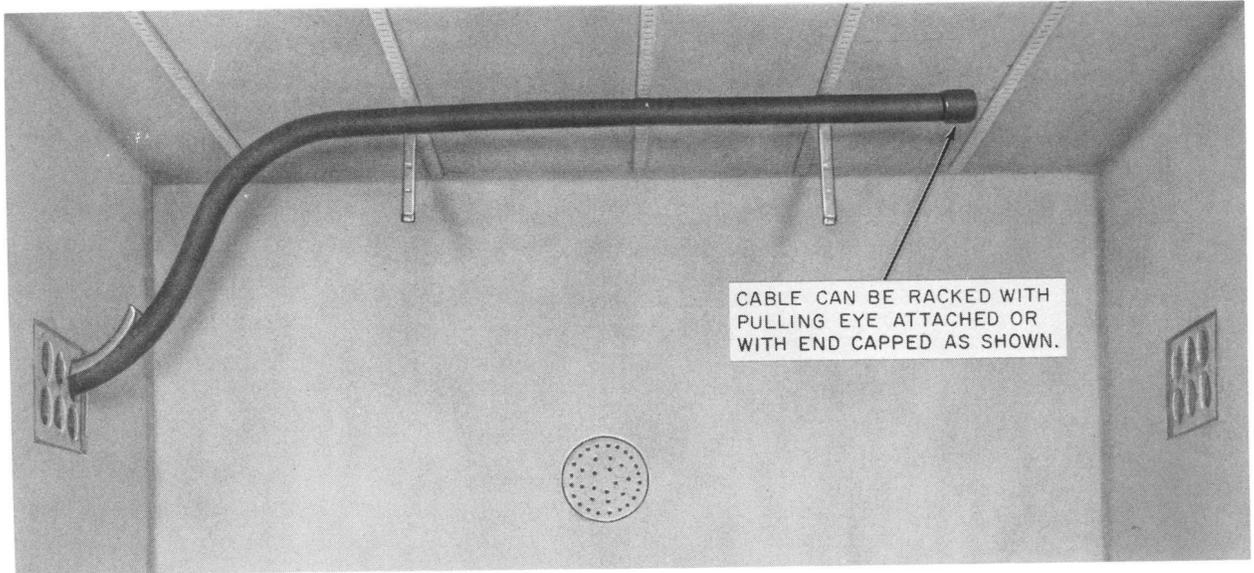


Fig. 40—Cable Supported on Cable Hooks



CABLE TAG (PLASTIC - RED WITH WHITE LETTERS)



IDENTIFICATION LABEL
(PRESSURE SENSITIVE ADHESIVE BACK - YELLOW
WITH BLACK LETTERS AND BORDER)

NOTE:
AVAILABLE FROM ISLAND VISUALS INC.,
MALVERNE, N.Y. 11565

Fig. 41—Coaxial Cable Identification Markers