

C RECLAMATION COMPOUND
RECLAIMING WET BURIED PIC CABLE

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4. TOOLS AND MATERIALS	11	1.01 This section covers the methods to be used for reclaiming wet buried PIC cables by in-place purging and filling with C reclamation compound (AT-8645).	
Tools	11	1.02 This section is reissued to update information and to include the REN G-810 restoration pump. Since this is a general revision, no revision arrows have been used to denote significant changes.	
Materials	11	1.03 See Section 644-104-101 for information on prerehabilitation testing.	
G 810 REN Cable Reclamation Pump— Description	12	1.04 The reclamation method for PIC cable con- sists of injecting C reclamation compound into the cable core to purge the water from the core. The C reclamation compound is left in place to gel, thus resulting in a filled cable to prevent the subsequent reentry of water. C reclamation compound is injected by means of a C tank (AT-8647), or a REN G-810 res- toration pump.	
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NOTICE

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Generally, water in the cable core will cause the insulation resistance to be less than 1 megohm if there are insulation defects in the conductor. Water may be detected using a 176A test set or a time domain reflectometer (TDR) cable fault locator.

1.07 Wet buried PIC cables that are giving unsatisfactory service may be reclaimed by the in-place filling method rather than replaced. Measurements of insulation resistance (IR) and foreign voltages on conductors are necessary to determine if cable reclamation is needed.

Caution: *C reclamation compound softens polyethylene insulation. In splicing of a reclaimed cable, avoid stretching the insulation.*

1.08 Reclamation of wet cables using the in-place filling method creates a permanent change in the transmission properties of the cable. A cable full of water will have an excess capacitance of 140 percent over the design value. Filling of the core with the reclamation compound will increase capacitance to only about 30 to 50 percent over the manufactured value depending on the effectiveness of the fill. This will result in a 15 to 20 percent increase in attenuation and a change in the characteristic impedance compared to that of dry cable. This has little effect on voiceband transmission. If a relatively small percentage of the cable loop is filled, it will have little effect on most carrier systems. The effect on other more sophisticated systems has not been evaluated.

1.09 The reclamation method for buried PIC insulation cable consists of three steps:

- (1) Selection of a cable for reclamation
- (2) Cable preparation
- (3) Filling operation.

2. SELECTION OF CABLE FOR RECLAMATION

2.01 There are two requirements that must be met before using the reclamation method for buried PIC cables.

- (1) Water in the core of the cable must be the cause of the problem as determined by electrical measurements (paragraph 3.03).
- (2) Filling must be economically justified because it will:

- Eliminate the need for cable replacement, or
- Eliminate excessive upkeep costs, and/or it is necessary to avert customer reaction to replacement.

2.02 Generally, it is more economical to reclaim wet cables rather than replace them provided that:

- (1) The cable route does not need immediate reinforcement.
- (2) There are not an excessive number of buried splices with B wire connectors that are not encapsulated and must be respliced.
- (3) Replacement would be uneconomical because of obstacles to plowing or trenching.

Note: All buried splices in the section to be reclaimed should be dug up, whether encapsulated or not. If the splice is encapsulated, it **must** be located since the encapsulation will prevent the flow of reclamation compound. If the splice is not encapsulated or only the connectors are encapsulated, it **should** be located since there is a risk of faults in these splices which may not be cured by reclamation. Some unknown splices may exist that will not be located by the test procedures of paragraph 2.03. This is an acceptable risk in view of the overall advantages of buried cable reclamation.

2.03 Verify that water in the cable core is the cause of defective pairs by making electrical measurements per Section 644-104-101 after:

- (1) Isolating cable between terminals or pedestals.
- (2) Clearing any known buried splices by reslicing the conductors if necessary because wet B wire connectors cannot be reclaimed.

Note: Splices with encapsulated B wire connectors **must** be located before electrical testing because they restrict the flow of compound in the cable; however, they need not be cleared.

3. CABLE PREPARATION

3.01 Proper preparation of the cable is essential for successful filling. ***The integrity of the***

sheath must be checked with a 173A test set or air pressure measurements (paragraph 3.10). All large sheath breaks must be located and repaired. Cables having small sheath breaks, such as lightning pinholes, can be filled although the filling time will be lengthened somewhat.

3.02 Refer to Table A for alpeth (single) sheath cable and for PAP or PASP (double) sheath cable to determine the approximate pumping times for the size and gauge of the cable to be filled. Divide the cable into fill sections, choosing spacing that will not in general exceed 2.0 hours fill time. Because of variations in cable construction, actual fill times may vary considerably from those shown in Table A.

3.03 The most efficient filling method is to inject the compound at the center of a cable section and simultaneously fill two sections from one injection point as shown in Fig. 1 and 2. If this is not practicable, a single fill section may be filled as shown in Fig. 3.

3.04 Establish the injection points for the compounds by referring to Table A.

3.05 An example of selecting the injection points for a 700-foot length of 200-pair, 19-gauge, alpeth sheath cable is shown in Fig. 4. The cable is divided into two equal sections of 350 feet. Injection points are placed in the center of each section to feed 175 feet in each direction. Note that 175 feet does not exceed the maximum fill length shown in Table A for this size and gauge of cable with the ground temperature at cable depth of 55°F. Assuming no leaks in the sheath, the time to fill each 350-foot section will be approximately 1-1/2 hours (Table A).

Note: Filling time is dependent upon ground temperature which may be obtained with any outdoor type thermometer inserted into the earth at cable depth.

3.06 An example of selecting an injection point for a 125-foot length of 25-pair, 22-gauge alpeth sheath cable is shown in Fig. 5. In this case, compound is fed in one direction only with a fill time of approximately 1-1/2 hours, assuming no leaks and a ground temperature at cable depth of 45°F.

3.07 Pressure plugs and/or drain vents should be installed:

- At buried splices which require pressure isolation plugs to avoid damage to the splice.

- In cable sections which are too long to be pumped in one operation. Divide these sections into reasonable reclamation lengths by pressure plugs.
- In areas where all reclamation compound must be collected and none can be allowed to run from the cable end or open vent.
- In cable sections which must be pumped from some point other than the approximate center. If the cable section must be pumped from one end, then at least one pressure plug must be used.
- At the ends of the cable sections which are on sloped terrain so that the cable can be sealed after pumping. This keeps the compound from draining away at the high end of the cable before it has time to gel.

3.08 Pressure plugs can be made with the direct sheath injection method using J plug compound. **Plugs adjacent to C reclamation compound injection points must be of the sheath injection type because of the high pressure (40 to 90 psi) used in the filling operation.** Follow the manufacturer's instructions for the direct sheath injection plugs. **In addition, place a sealing clamp around the cable and plug on the side toward the reclamation compound injection point.**

3.09 Install an F pressure flange (see Section 637-235-201) at each end of the section to be filled. Also place an F pressure flange at the injection point if feed is to be in two directions as in paragraph 3.05. Connect a piece of 3/8-inch C plastic tubing to each bleed-point flange with a 3/8-inch B plastic tubing fitting. The tubing should be of sufficient length to extend from the cable to approximately 2 feet above ground level. At the injection point flange, install 1/2-inch od translucent polyethylene tubing rated at 90 psi (250 psi bursting strength). Translucent plastic tubing enables observation of the compounds entering the injection point. Flash test all fittings and flanges at a pressure of 15 psi.

Note 1: The F pressure flange cannot be used on cables with an outside diameter of 3/4 inch or less. For cables 3/4 inch or less, use a model 4475 flange manufactured by Minnesota Mining and Manufacturing Company, or equivalent.

TABLE A
APPROXIMATE PUMPING TIMES FOR 19 AWG PIC CABLE

PAIR SIZE	PUMPING DISTANCE, FEET										
	50	75	100	125	150	175	200	225	250	275	300
GROUND TEMPERATURE, 75 DEGREES FAHRENHEIT											
25	0:05	0:05	0:20	0:25	0:35	0:50	1:0	1:20	1:35	1:55	2:10
50	0:05	0:10	0:20	0:30	0:40	1:0	1:20	1:40	2:05	2:30	3:0
75,100	0:05	0:10	0:25	0:35	0:50	1:10	1:35	2:0	2:30	3:0	3:35
150,200	0:05	0:20	0:25	0:40	1:0	1:25	1:50	2:20	2:50	3:25	4:0
300	0:05	0:20	0:30	0:50	1:05	1:35	2:0	2:35	3:10	3:50	4:35
GROUND TEMPERATURE, 65 DEGREES FAHRENHEIT											
25	0:05	0:10	0:20	0:25	0:35	0:09	1:05	1:25	1:50	2:05	2:35
50	0:05	0:10	0:25	0:35	0:50	1:05	1:30	1:55	2:20	2:50	3:25
75,100	0:05	0:20	0:30	0:40	1:0	1:25	1:50	2:20	2:50	3:25	4:05
150,200	0:05	0:20	0:30	0:50	1:05	1:30	2:0	2:25	3:10	3:50	4:30
300	0:05	0:20	0:35	0:55	1:20	1:40	2:20	2:55	3:30	4:20	5:05
GROUND TEMPERATURE, 55 DEGREES FAHRENHEIT											
25	0:05	0:10	0:25	0:40	0:50	1:0	1:25	1:40	2:05	2:35	3:05
50	0:05	0:10	0:25	0:40	1:0	1:25	1:50	2:10	2:50	3:20	4:0
75,100	0:05	0:20	0:30	0:55	1:10	1:40	2:10	2:50	3:25	4:05	4:55
150,200	0:10	0:20	0:35	0:55	1:25	1:50	2:25	3:0	3:50	4:30	5:25
300	0:10	0:25	0:40	1:05	1:30	2:05	2:40	3:30	4:20	5:10	6:05
GROUND TEMPERATURE, 45 DEGREES FAHRENHEIT											
25	0:05	0:20	0:30	0:40	1:0	1:25	1:50	2:25	2:55	3:30	4:10
50	0:05	0:20	0:35	0:55	1:20	1:50	2:20	3:0	3:40	4:25	5:20
75,100	0:10	0:25	0:40	1:05	1:35	2:10	2:50	3:35	4:25	5:20	6:20
150,200	0:10	0:25	0:50	1:10	1:50	2:25	3:05	4:0	4:55	5:55	7:05
300	0:10	0:30	0:55	1:25	2:0	2:40	3:30	4:30	5:30	6:40	8:0

TABLE A (Contd)

APPROXIMATE PUMPING TIMES FOR 22 AWG PIC CABLE

PAIR SIZE	PUMPING DISTANCE, FEET										
	50	75	100	125	150	175	200	225	250	275	300
GROUND TEMPERATURE, 75 DEGREES FAHRENHEIT											
25	0:05	0:10	0:25	0:30	0:50	1:05	1:25	1:50	2:10	2:35	3:05
50	0:05	0:10	0:25	0:35	0:55	1:10	1:35	2:0	2:30	3:0	3:35
75,100	0:05	0:20	0:30	0:50	1:10	1:35	2:05	2:40	3:20	4:0	4:40
150,200	0:10	0:25	0:35	1:0	1:25	1:55	2:30	3:10	3:55	4:50	5:40
300,400	0:10	0:25	0:40	1:05	1:35	2:05	2:50	3:35	4:25	5:20	6:20
600	0:10	0:30	0:50	1:20	1:50	2:30	3:10	4:05	5:0	6:05	7:10
GROUND TEMPERATURE, 65 DEGREES FAHRENHEIT											
25	0:05	0:10	0:25	0:35	0:55	1:10	1:35	2:05	2:30	3:05	3:40
50	0:05	0:20	0:25	0:40	1:0	1:25	1:50	2:20	2:50	3:25	4:0
75,100	0:05	0:20	0:35	0:55	1:20	1:50	2:25	3:0	3:40	4:50	5:20
150,200	0:10	0:20	0:40	1:05	1:35	2:10	2:55	3:35	4:30	5:25	6:30
300,400	0:10	0:25	0:50	1:10	1:50	2:25	3:10	4:0	5:0	6:0	7:05
600	0:10	0:30	0:55	1:25	2:0	2:40	3:35	4:30	5:35	6:50	8:05
GROUND TEMPERATURE, 55 DEGREES FAHRENHEIT											
25,50	0:05	0:20	0:30	0:50	1:10	1:35	2:05	2:40	3:20	4:0	4:40
75,100	0:10	0:25	0:40	1:05	1:35	2:10	2:55	3:35	4:30	5:25	6:30
150,200	0:10	0:30	0:55	1:20	1:55	2:35	3:25	4:25	5:25	6:30	7:50
300,400	0:10	0:30	0:55	1:30	2:05	2:55	3:50	4:50	5:55	7:10	8:30
600	0:20	0:35	1:05	1:40	2:25	3:20	4:20	5:30	6:40	8:05	9:40
GROUND TEMPERATURE, 45 DEGREES FAHRENHEIT											
25,50	0:10	0:25	0:40	1:05	1:35	2:10	2:55	3:40	4:35	5:30	6:30
75,100	0:10	0:30	0:55	1:25	2:05	2:50	3:40	4:40	5:50	7:0	8:20
150,200	0:20	0:35	1:05	1:40	2:30	3:25	4:25	5:35	6:55	8:25	
300,400	0:20	0:40	1:10	1:55	2:50	3:50	5:0	6:20	7:40	9:25	
600	0:20	0:50	1:25	2:10	3:05	4:20	5:35	7:05	8:40		

TABLE A (Contd)

APPROXIMATE PUMPING TIMES FOR 24 AWG PIC CABLE

	PUMPING DISTANCE, FEET										
	50	75	100	125	150	175	200	225	250	275	300
PAIR SIZE	GROUND TEMPERATURE, 75 DEGREES FAHRENHEIT										
	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN
25,50	0:05	0:20	0:30	0:40	1:0	1:30	1:55	2:25	3:0	3:35	4:20
75,100	0:05	0:20	0:30	0:50	1:10	1:35	2:10	2:40	3:25	4:05	4:55
150,200	0:10	0:24	0:40	1:05	1:35	2:10	2:55	3:35	4:30	5:25	6:25
300	0:10	0:30	0:55	1:20	1:55	2:35	3:25	4:20	5:25	6:30	7:40
400,600	0:10	0:30	1:0	1:30	2:10	2:55	3:50	4:55	6:0	7:20	8:35
900	0:20	0:35	1:05	1:40	2:30	3:25	4:25	5:30	6:50	8:20	9:50
	GROUND TEMPERATURE, 65 DEGREES FAHRENHEIT										
25,50	0:05	0:20	0:35	0:55	1:50	1:40	2:10	2:50	3:30	4:10	5:0
75,100	0:10	0:20	0:35	1:0	1:25	1:55	2:25	3:05	3:50	4:35	5:30
150,200	0:10	0:30	0:50	1:20	1:50	2:30	3:10	4:05	5:0	6:05	7:20
300	0:20	0:35	1:0	1:30	2:10	3:0	3:55	5:0	6:05	7:25	8:50
400,600	0:20	0:35	1:05	1:40	2:25	3:20	4:25	5:30	6:50	8:10	9:50
900	0:20	0:50	1:25	2:10	3:05	4:20	5:35	7:0	8:40		
	GROUND TEMPERATURE, 55 DEGREES FAHRENHEIT										
25,50,75,100	0:10	0:25	0:40	1:05	1:40	2:10	2:55	3:40	4:35	5:30	6:35
150,200	0:10	0:35	1:0	1:30	2:10	3:0	3:55	5:0	6:05	7:25	8:40
300	0:20	0:40	1:10	1:50	2:35	3:35	4:40	5:55	7:20	8:55	
400,600	0:20	0:40	1:20	2:0	2:55	4:0	5:10	6:30	8:5	9:50	
900	0:25	0:50	1:30	2:20	3:20	4:30	5:55	7:25	9:10		
	GROUND TEMPERATURE, 45 DEGREES FAHRENHEIT										
25,50,75,100	0:10	0:35	1:0	1:35	2:20	3:0	4:0	5:0	6:10	7:30	8:55
150,200	0:20	0:40	1:20	2:0	2:50	3:55	5:0	6:25	7:55	9:30	
300	0:25	0:55	1:30	2:25	3:25	4:35	6:05	7:40	9:30		
400,600	0:25	0:55	1:40	2:35	3:50	5:10	6:50	8:30			
900	0:30	1:05	1:55	3:0	4:20	5:50	7:40	9:35			

TABLE A (Contd)

APPROXIMATE PUMPING TIMES FOR 26 AWG PIC CABLE

	PUMPING DISTANCE, FEET										
	50	75	100	125	150	175	200	225	250	275	300
PAIR SIZE	GROUND TEMPERATURE, 75 DEGREES FAHRENHEIT										
	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN	HRS:MIN
25,50,75,100	0:20	0:40	1:10	1:55	2:40	3:40	4:55	6:10	7:35		
150,200,300	0:30	1:0	1:50	2:55	4:05	5:35	7:20	9:20			
400	0:30	1:10	2:10	3:25	4:55	6:40	8:50				
600,900	0:35	1:25	2:30	3:50	5:30	7:30	9:55				
GROUND TEMPERATURE, 65 DEGREES FAHRENHEIT											
25,50,75,100	0:25	0:50	1:25	2:10	3:10	4:25	5:40	7:10	8:55		
150,200,300	0:30	1:10	2:0	3:10	4:40	6:20	8:20				
400	0:35	1:25	2:30	3:55	5:35	7:40					
600,900	0:40	1:35	2:50	4:25	6:20	8:30					
GROUND TEMPERATURE, 55 DEGREES FAHRENHEIT											
25,50,75,100	0:30	1:0	1:50	2:55	4:50	5:35	7:25	9:20			
150,200,300	0:35	1:25	2:30	3:55	5:35	7:40					
400	0:50	1:40	3:0	4:40	6:50	9:10					
600,900	0:50	1:55	3:20	5:10	7:30						
GROUND TEMPERATURE, 45 DEGREES FAHRENHEIT											
25,50,75,100	0:35	1:25	2:30	4:0	5:40	7:50					
150,200,300	0:50	1:50	3:20	5:0	7:20	9:55					
400	1:0	2:10	3:55	6:05	8:40						
600,900	1:05	2:25	4:20	6:50	9:40						

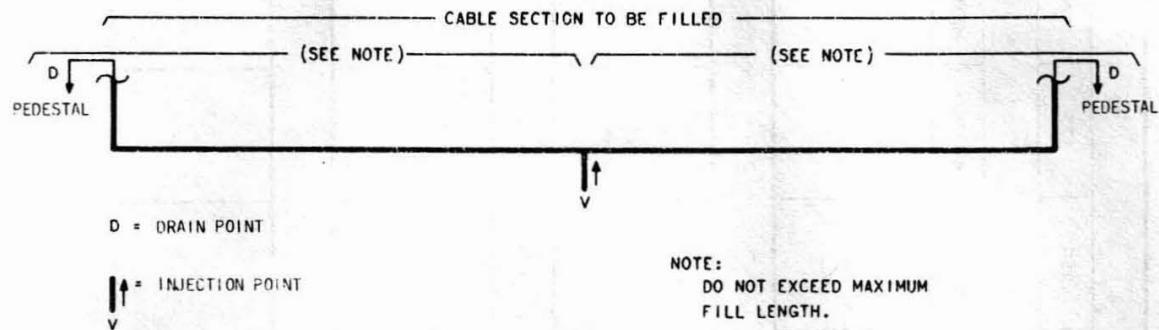


Fig. 1—Method of Dividing Cable Into Fill Sections

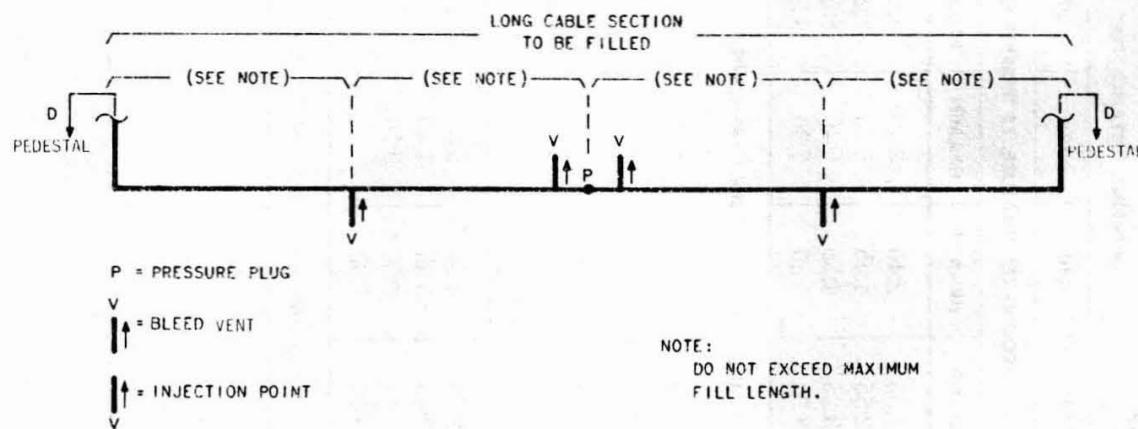


Fig. 2—Method of Dividing Long Cable Into Fill Sections

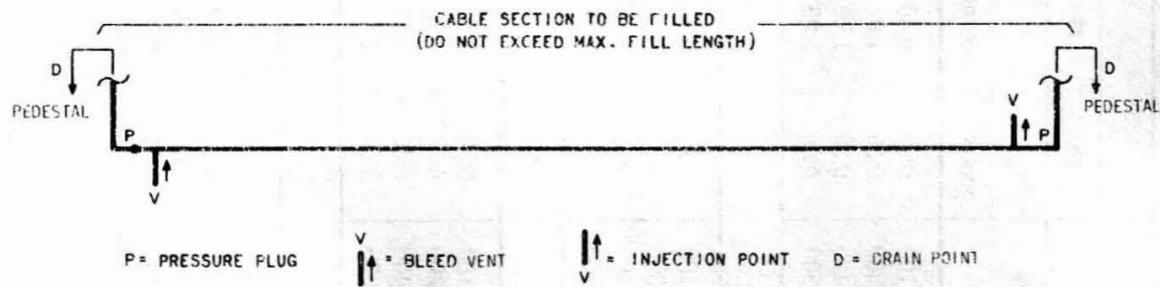


Fig. 3—Example of Single Fill Section

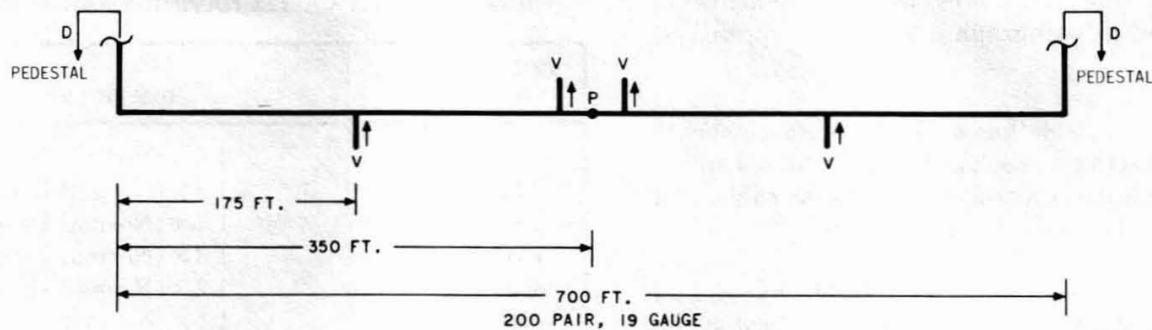


Fig. 4—Example of Injection Point Selection—Two-Direction Fill Method

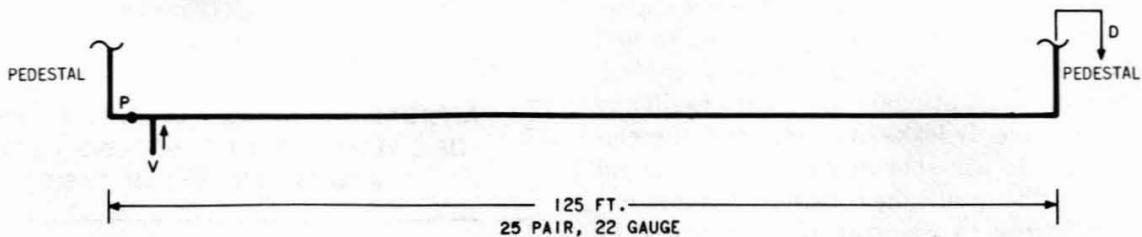


Fig. 5—Example of Injection Point Selection—One-Direction Fill Method

Note 2: The excavations made for installing the pressure plugs and flanges may now be backfilled if it would be undesirable to leave the excavations open because of hazardous locations. Install F pressure testing valves on the tubing for use during subsequent pressure measurements and filling operations.

Pressure Measurements for Checking Sheath Integrity

3.10 Check each section to be filled for sheath integrity as follows:

- (1) Feed nitrogen at 10 psi into one of the flanges (or tubing) at the end of the section after reading and recording the volume of nitrogen in the cylinder.

- (2) Check the flange (or tubing) at the opposite end for flow of water and air mixture. No flow indicates a blockage or zero leak.
- (3) When most of the water has been blown from the cable, install F pressure testing valves, wait 5 minutes, and record the cable pressure measured with a C pressure gauge.
- (4) If the pressure is 4 psi or more, repeat Steps (1) through (3) with the nitrogen cylinder located at the opposite end of the section.
- (5) Determine the lower of the two outlet pressures measured in Steps (3) and (4). Use this pressure for interpreting the results (paragraph 3.11).

Interpreting Results of Pressure Measurements

3.11 The results of the pressure measurements obtained in paragraph 3.10 are interpreted as follows:

No Pressure: Cable has at least one large sheath break or a restriction such as an encapsulated splice. Check the volume of nitrogen fed into the cable. If it is near zero, the cable has a restriction.

Low Pressure (0 to 3.9 psi): Cable has one or more large sheath breaks which must be located and repaired before filling.

Pressures 4 to 9 psi: Cable has small leak or leaks. Employee has the option of locating leaks and repairing them or filling cable without having sheath repaired. It will take longer to fill the individual sections of cable if the leak is not repaired. Table B gives the maximum additional time needed to fill any section of the cable. If leaks are indicated, the employee can elect to use shorter spacing for the fill lengths to keep the total time constant. **Do not extend the fill time to greater than 4 hours as determined by Table A.**

3.12 **For example:** Lowest pressure measurement obtained in paragraph 3.10 is 5.5 psi. Referring to Table C, the filling time will be a maximum of 1.6 times the normal filling time (Table A) if the leaks are not repaired.

Leak Locating

3.13 Sheath leaks are best located with 173A sheath fault locator. Large leaks can best be found using the helium leak locating method described in Section 637-416-501.

3.14 Because the highest internal cable pressures will be nearest the compound injection points, it is recommended that leak locating begin at the injection points and proceed toward the bleed points.

3.15 Sheath repairs can be made using wrapped-joint lead sleeves (Section 633-300-201) or tape wrapping (Section 628-800-300), depending on type of sheath damage. Small sheath punctures may be repaired with an F pressure flange equipped with a sheath repair cap (Section 637-235-201).

TABLE B

FILLING TIME FOR CABLES HAVING SMALL LEAKS

PRESSURE (psi)	TIME REQUIRED
4 to 5	1.8 × (Normal Time)
5 to 6	1.6 × (Normal Time)
6 to 7	1.4 × (Normal Time)
7 to 8	1.3 × (Normal Time)
8 to 9	1.2 × (Normal Time)
9+	1.1 × (Normal Time)

TABLE C

APPROXIMATE NUMBER OF GALLONS (NOTE)
OF C RECLAMATION COMPOUND TO FLUSH
AND FILL 100 FEET OF CABLE

NUMBER PAIRS	GAUGE			
	19	22	24	26
25	2	1	1	1
50	4	2	2	1
75	5	3	2	2
100	7	4	3	2
150	10	5	4	2
200	13	7	5	2
300	20	10	7	4
400	—	13	8	4
600	—	16	12	8
900	—	—	15	12

Note: Assuming no leaks in cable sheath.

4. TOOLS AND MATERIALS

Tools

4.01 The following tools are necessary for the reclamation procedures:

TOOL	USE
Thermometer	For measuring ground temperature at cable depth to determine fill length, injection pressure, and fill time
Goggles	For eye protection when handling C reclamation compound
Gloves (rubber or plastic disposable)	For hand protection when handling C reclamation compound
C Gas Regulator (AT-7553)	For regulating injection pressures for C tanks
C Pressure Gauge (AT-7717)	For making pressure measurements to check sheath integrity
C Tank (AT-8647) or REN-G-810 Restoration Pump	For injecting C reclamation compound into cable
B Spout (AT-8673)	For pouring C reclamation compound into C tank or pump drum
B or C Pressure Testing Regulator (AT-8221)	For controlling gas pressure when leak locating and flash testing
Screwdriver	For installing air/fluid fittings
Wrenches	For making hose connections
D Cable Drill	For cutting 3/8 inch hole in cable to install air/fluid fittings

TOOL

USE

Pipe Pliers

For holding pipe nipple when making connections

Materials

4.02 The following materials are necessary for the reclamation procedures:

MATERIAL

USE

REN Air/Fluid Fittings

For mounting on cable to provide injection and bleed points, and making pressure measurements

F Pressure Flange (AT-8669)

For mounting on cable to provide injection and bleed points, and making pressure measurements

F Pressure Testing Value (AT-6914)

For making pressure measurements

Nitrogen

For making pressure measurements and for pressuring C tank

Translucent Polyethylene Tubing 1/2 inch od, 90 psi (250 psi bursting strength) (Obtain locally)

For C reclamation compound injection from C tank, and optionally for bleed point installation

C Plastic Tubing (AT-8063)

For bleed point installation

Bell, battery operated (obtain locally)

For audible low-level alarm on C tank

C Reclamation Compound (two parts, Part I and Part II)(AT-8645)

For injection into cables to remove water. Gels in cable to prevent water reentry.

Air Rate Indicator (Optional)

May be installed on C tank to indicate flow or compound into cable

MATERIAL	USE
1/8 inch Pipe Fittings	For connecting injection hoses to pressure flanges and to install air rate indicator on C tank
Pipe Nipples	
Elbows	
Unions	
Reducing Couplings (Obtain locally)	
Pipe Thread Compound	For sealing pipe threads to prevent leakage
Glass jars, with lids 1/2-pint capacity (obtain locally)	For collecting compound samples at bleed points
J Plug Compound (AT-8649)	For constructing pressure plugs by direct sheath injection method
Waterless Hand-cleaner	For cleaning hands after handling C reclamation compound
Kerosene, or other approved solvent (see note)	For cleaning C tank, hoses, and fittings after use

Note: Any approved solvent must have a flash point of over 140°F and be classified OSHA, Class 3.

G 810 REN Cable Reclamation Pump—Description

4.03 The G 810 REN pump kit (Fig. 6) consists of a reciprocating pump, drum, lid, nylon fluid output hose (with adaptors), and a nylon recirculation hose.

4.04 The pump is powered using dry air or nitrogen with a normal operating range of 30 to 90 psi.

The pressure is carried only in the pump and not in the drum.

4.05 Three valves are provided on the pump, one to control the input pressure, one to control the recirculation of the reclamation compound, and the third controls the material flow into the cable (see Fig. 6).

4.06 An optional 15 gallon drum conversion kit is available to dispense larger quantities of reclamation compound.

G 810 REN Cable Reclamation Pump—Maintenance

4.07 When using dry nitrogen, periodically place 15 drops of light oil into the air input port where the quick-connect fitting is attached. This provides lubrication for the driving piston, seals, and "O" rings.

4.08 When pumping cable reclamation compound, no lubrication is required in the ball (grease) fitting.

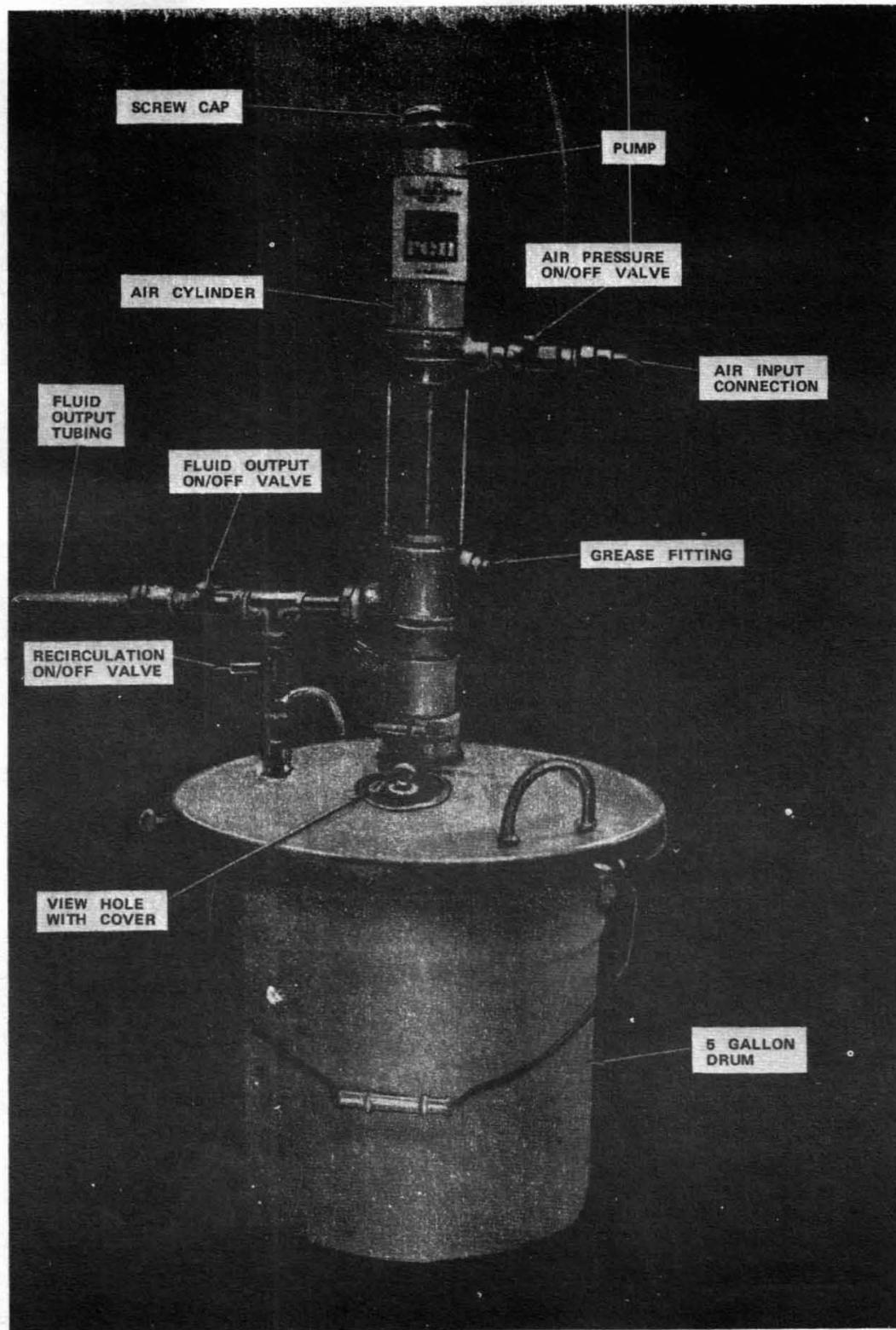


Fig. 6—G 810 REN Cable Reclamation Pump

4.09 Should the leather packings on the pump become worn, order the G 810-8 pump replacement packing kit, and install the packings in the following manner: (See Fig. 7.)

- (1) Remove cotter pin and unscrew connecting rod from connecting tube.
- (2) Remove air cylinder from base, loosen packing nut, and carefully pull connecting tube from top of base.
- (3) Remove packing nut and push bearing gland and packings from bottom of base. Clean and inspect all parts for damage or wear. Replace as necessary.
- (4) Soak new leather packings in light oil until flexible. Push gland and packings one by one into base and hand tighten packing retainer.
- (5) Install packing nut loosely, lubricate connecting tube, and carefully slide it through packings and base.
- (6) Draw up packing nut snugly; do not overtighten.
- (7) Reassemble remaining parts in reverse order from disassembly.

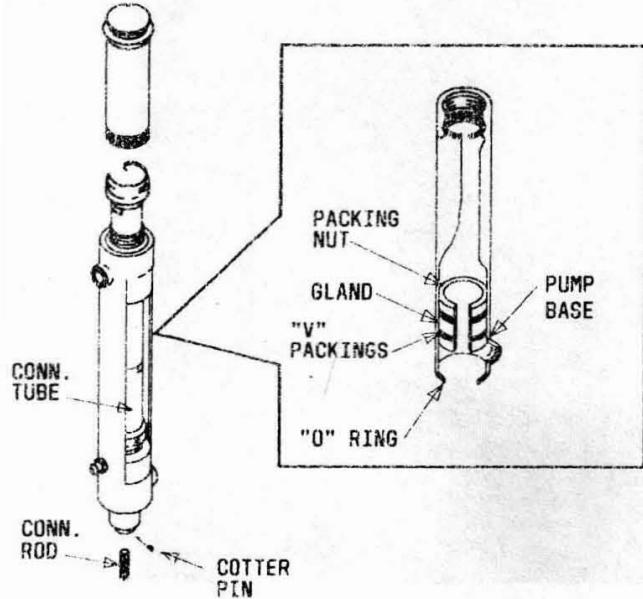


Fig. 7—REN Pump—Cutaway View

4.10 After considerable usage of the pump, seepage of fluid may drip from hole or tube in bottom of pump base, or such seepage may occur at the throat packing nut. This is normal for this type of pump and does not impair the efficiency of the operation of the unit.

4.11 Should the pump stop during a pump cycle, it is possible that the reversing valve in the driving piston chamber is not making contact with the piston. This can be corrected by tightening the screw cap on top of the pump, or by turning the air cylinder further down into the housing. In either case, all that is usually required is approximately a 1/8 to 1/2 turn.

C Tank Description

4.12 The C tank is a galvanized steel pressure vessel, approximately 36 inches tall and 14 inches in diameter. It weighs approximately 125 pounds when empty. The tank consists of two main parts: the body and the cover. A crank handle for the agitator is also furnished. The C tank is illustrated in Fig. 8, 9, 10, 11, and 12. The cover assembly has the following features:

- Pressure Inlet Valve
- Outlet Valve and Hose
- Manual Pressure Relief Valve
- Safety Pressure Relief Valve
- Low-Level Alarm Switch
- Automatic Shutoff Valve
- Pressure Gauge
- Filling Hole and Cap
- Agitator.

4.13 The cover is attached to the tank body by means of cover clamps permanently attached to the body. When the clamps are tightened, a pressure seal is made by a gasket contained in the cover.



Fig. 8—C Tank

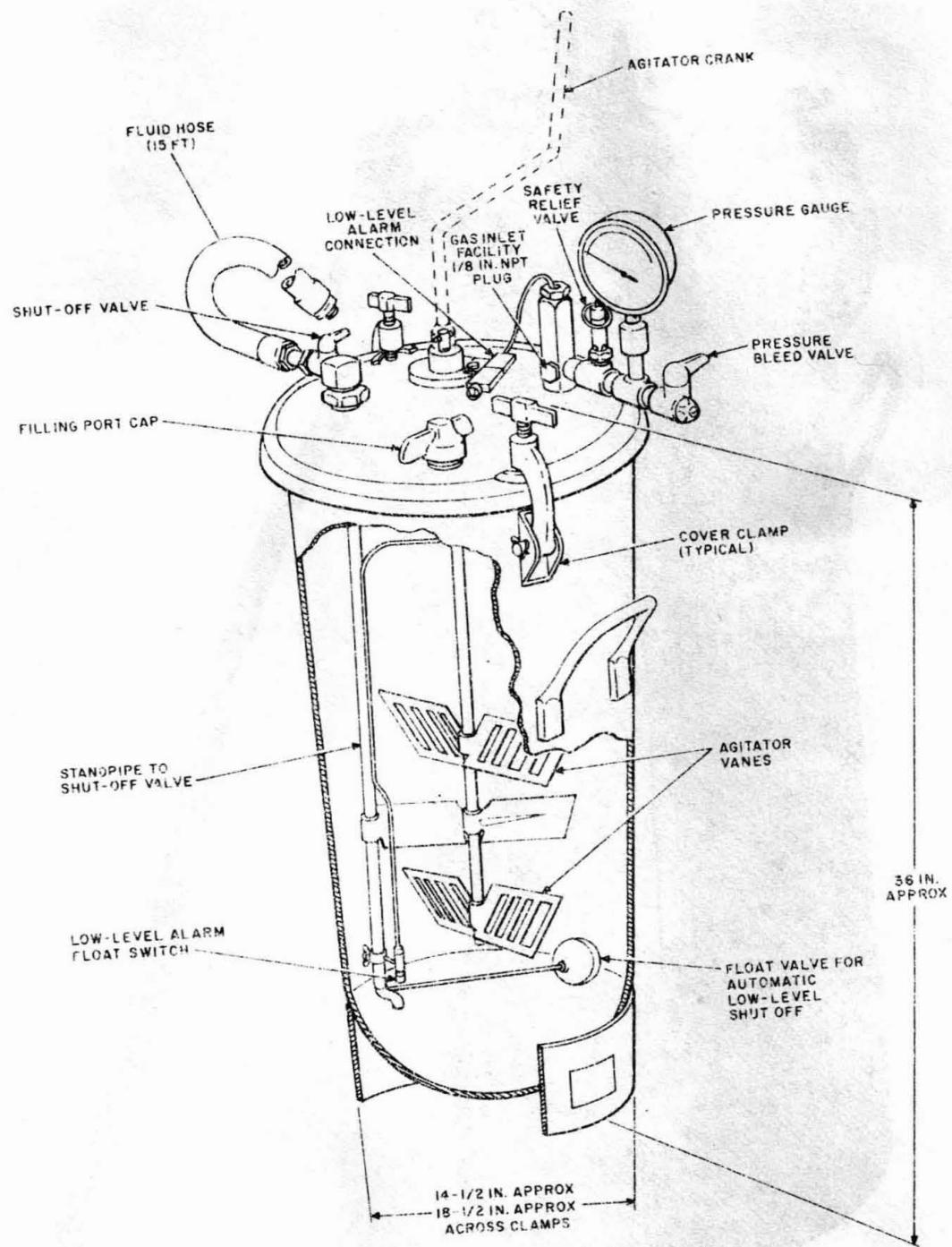


Fig. 9—C Tank—Cutaway View

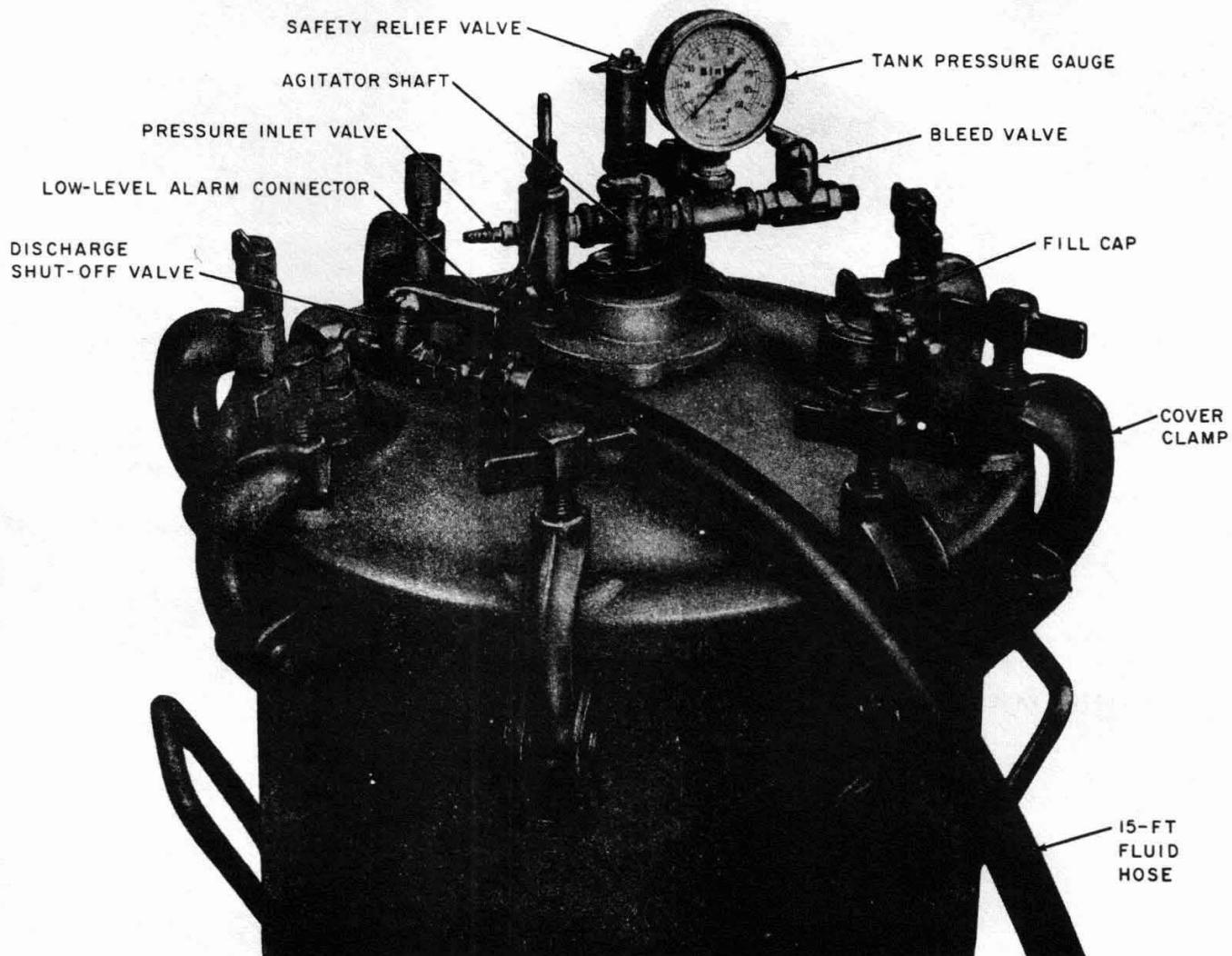


Fig. 10—C Tank—Upper View

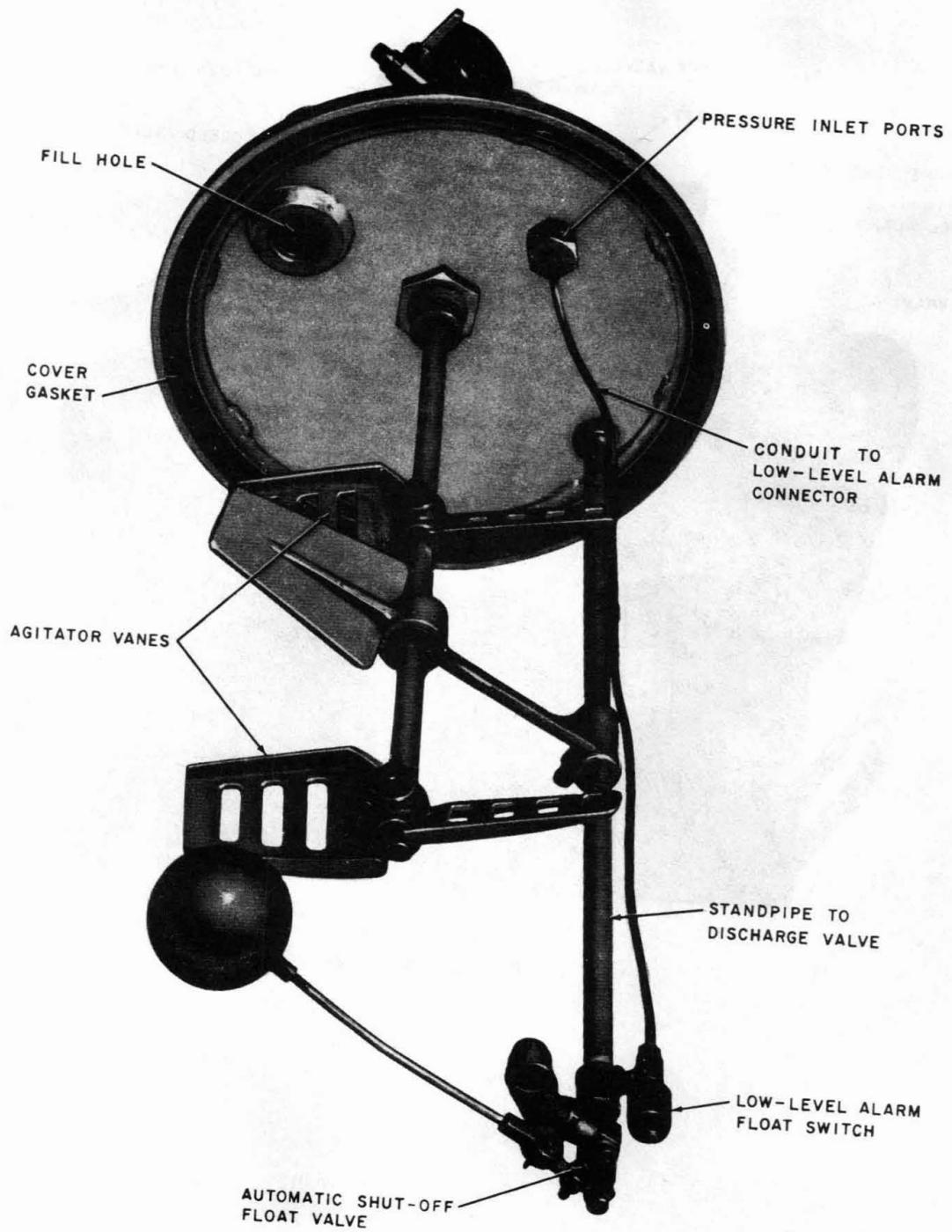


Fig. 11—C Tank Cover—Bottom View

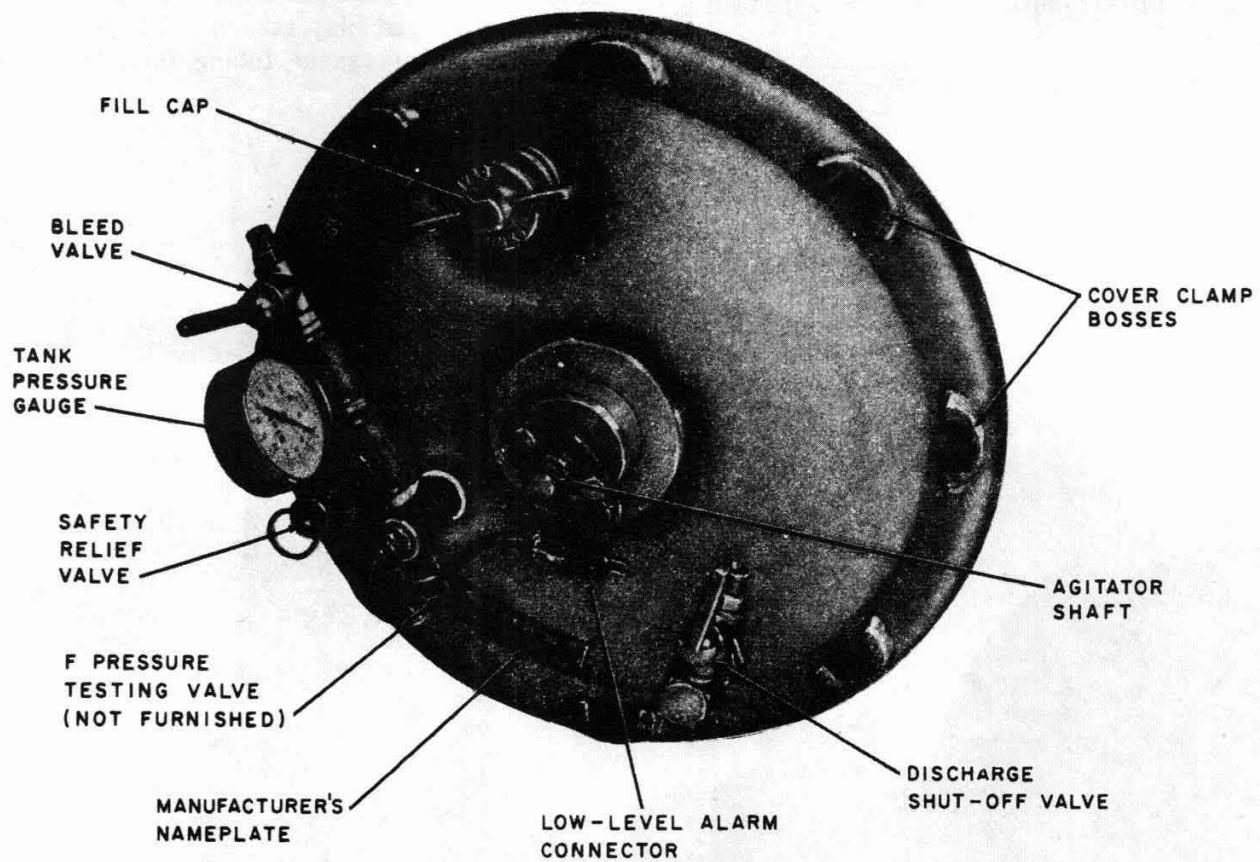


Fig. 12—C Tank Cover—Top View

4.14 An optional air rate indicator (AT-7684) may be installed in the pressure inlet of the tank to give a visual indication of nitrogen flow into the tank and thus compound flow into the cable. Conversely, no nitrogen flow would indicate no compound flow into the cable. Figure 13 illustrates the method of installing the air rate indicator and F pressure testing valve.

C Tank Care and Maintenance

4.15 The C tank is an ASME rated pressure vessel. No welding should be done on this tank as this will void the ASME rating. Care should be taken when handling the tank, not to drop it or otherwise damage the protective galvanize coating. When handling the cover assembly, take care not to damage the cover attachments (gauge, tubing, float-switch, etc).

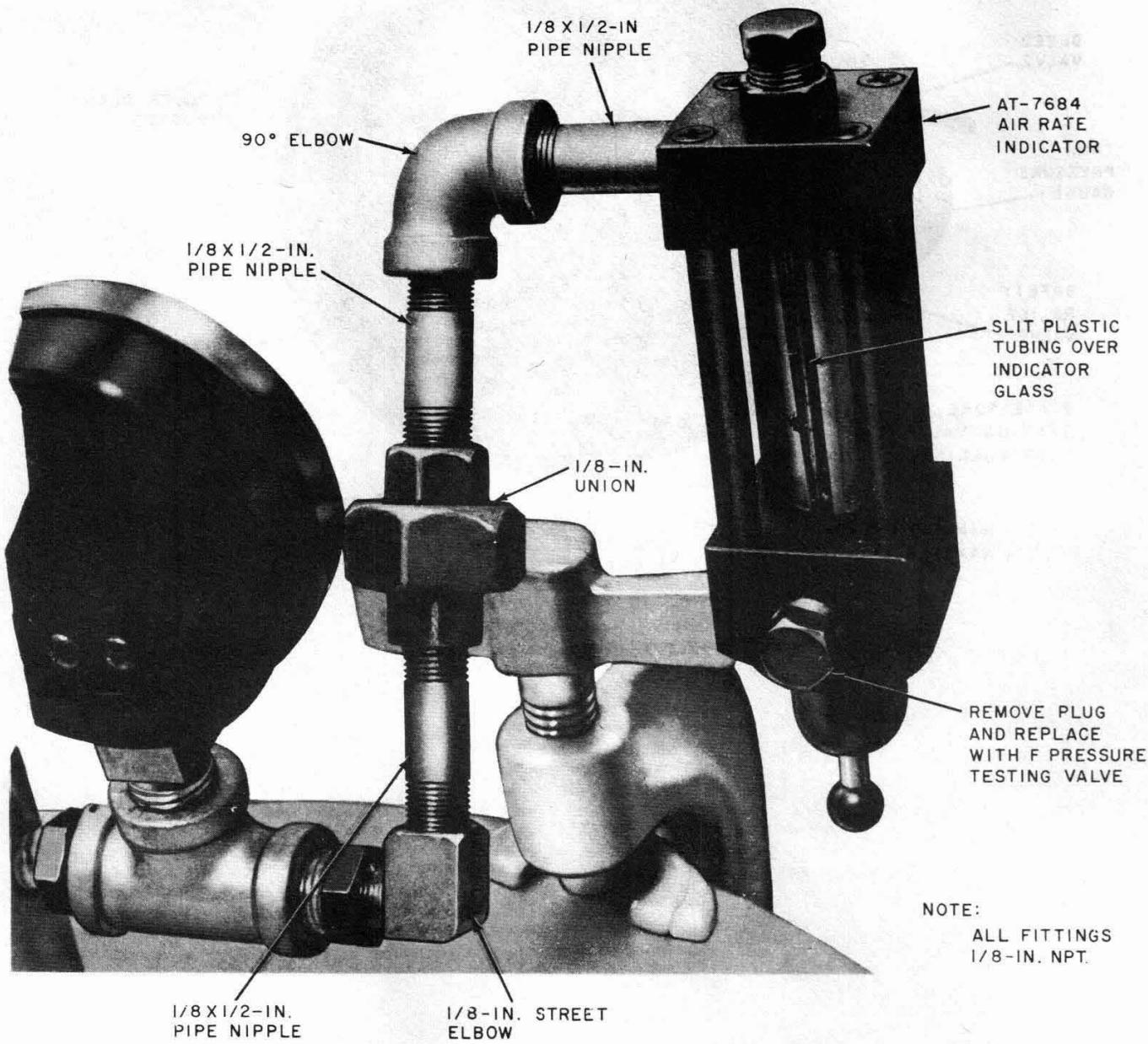


Fig. 13—Optional Air Rate Indicator Installation

4.16 The tank, fittings, and hose must be cleaned with a petroleum solvent, kerosene, or an approved solvent after each day of use, as covered in paragraph 6.06.

4.17 When not in use, the tank should be stored upright in a safe place, preferably in a wooden case.

5. FILLING OPERATIONS

Precautions

5.01 C reclamation compound can cause irritation if inadvertently splashed on the skin or in the eyes. When handling C reclamation compound observe the following precautions:

- (a) Wear goggles.
- (b) Wear gloves (preferably disposable plastic gloves).
- (c) Avoid getting compound on clothing.
- (d) Clean hands with waterless hand cleaner after each handling occasion.
- (e) If accidentally splashed in the eyes, **flush immediately with clear water for 15 minutes and consult a physician immediately.**

5.02 The following precautions must be observed when pressurizing the C tank:

- (a) Do not exceed 90 psi pressure.
- (b) Always bleed the pressure from the tank before removing its cover.

5.03 **Keep the C reclamation compound and drum or tank in a shaded place** (or cover with a tarpaulin) **out of direct sunlight** to keep the compound from prematurely gelling.

5.04 The cable sheath of the injection points should not be exposed to direct sunlight. Shade with an umbrella or tarpaulin, or cover with earth. Heat from direct sunlight can soften the polyethylene sheath and may result in ruptured sheaths from the injection pressures.

5.05 The pump or tank must be placed in a fairly level position as a precaution against tipping and to enable the float switch of the low-level alarm in the C tank to function properly.

5.06 Excess compound shall be collected in containers (empty C reclamation compound buckets) and along with wiping rags used, shall be collected after each day and disposed of in a safe place such as a sanitary landfill. **Never dump compound on the job site.**

Filling Pump or Tank With Reclamation Compound

5.07 From Table C, determine the amount of C reclamation compound required for the section to be filled. Allow for additional compound in case of leaks. Have it on hand so that the filling operation, once started, will not be interrupted.

5.08 Fill the REN pump as follows:

- (1) Remove the top portion of the pump assembly from the drum and lay it aside.
- (2) Carefully pour equal parts of C reclamation compound into the pump/drum.
- Note:** It is recommended that compound be mixed in 2-gallon batches for most operations. Additional compound may be added as required.
- (3) Replace top part pump assembly onto drum.
- (4) Close air pressure on/off valve.
- (5) Close fluid output on/off valve.
- (6) Open recirculation on/off valve.
- (7) Connect air supply hose to air input connection.
- (8) Set air input pressure to 30 psi and slowly open air pressure valve. Pump should begin to mix compound. After three to five minutes of mixing, close the recirculation valve. Compound is now ready for pumping into cable core.

5.09 Fill the C tank as follows:

- (1) Remove the filling hole cap from the tank lid.
- (2) Remove the cap and seal from the pouring hole of the Part I container and replace the cap with a flexible pouring spout. Also, vent the cover of the compound container opposite the pouring spout by punching holes in it.

(3) Carefully insert the flexible pouring spout into the tank filling hole and pour the Part I liquid into the tank (Fig. 14).

(4) Repeat Steps (2) and (3) for Part II.

(5) Replace the filling hole cap on the tank lid.

(6) Place the agitator crank handle on the agitator shaft projecting through the center of the tank lid.

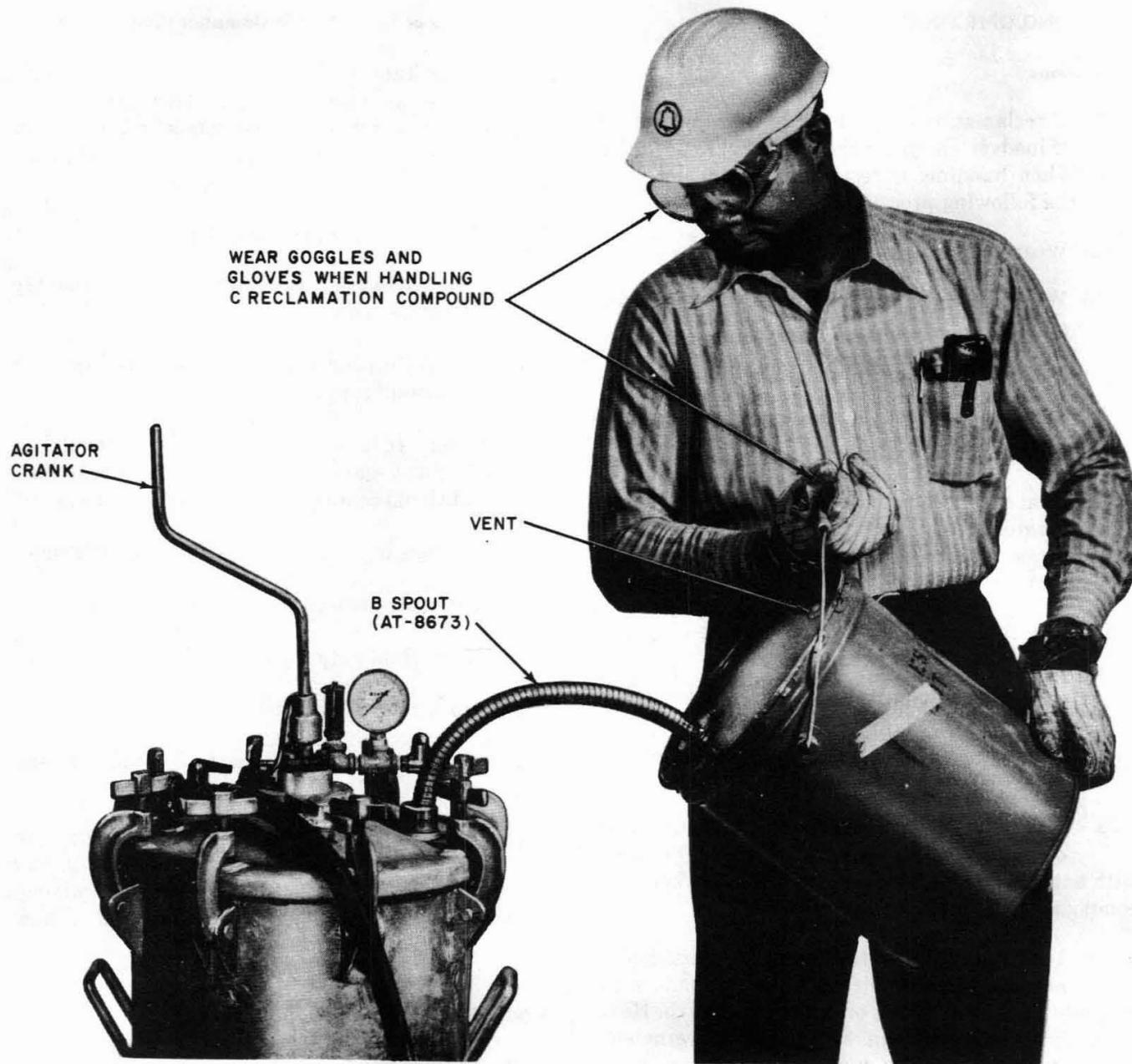


Fig. 14—Pouring C Reclamation Compound Into C Tank

- (7) Mix the tank contents thoroughly for two minutes, alternately reversing the crank direction approximately every ten revolutions (Fig. 15).
- (8) Make certain the filling hole cap and the bolts around the outer circumference of the lid are

tightened securely. Hand tightening is generally sufficient.

- (9) Connect the leads from a battery operated bell (obtain locally) to the low-level alarm connector on the tank cover (alarm on 76C test set will suffice).



Fig. 15—Mixing C Reclamation Compound—Part I and Part II in C Tank

Refilling C Tank

5.10 When the low-level alarm operates before the cable is filled, C reclamation compound is added to the C tank as follows:

Note: The low-level alarm operates when approximately 1 gallon remains in the tank. If the alarm should not be heard or fails to operate, the automatic shut-off valve will operate when approximately 1/2-gallon remains in the tank.

- (1) Close the tank outlet valve to stop the flow of compound and disconnect the alarm.
- (2) Remove the air chuck from the tank pressure inlet valve.

Danger: *Never attempt to open the tank while it is under pressure.*

- (3) **Bleed the tank pressure by opening the manual pressure relief valve.**
- (4) After the tank pressure is completely bled, remove the filling hole cap and add 10 gallons of C reclamation compound (one container of Part I, and one container of Part II) as covered in paragraph 5.09.
- (5) Replace the filling hole cap and mix thoroughly as covered in paragraph 5.09 (7).
- (6) Reconnect the low-level alarm and close the manual pressure relief valve.
- (7) Reconnect the air chuck and pressurize the tank to the required pressure.
- (8) When the tank pressure gauge indicates the filling pressure has been reached, **gradually** open the tank outlet valve to resume the flow of compound.

Filling the Cable

5.11 The C reclamation compound is pressure injected into the cable from the REN pump or the C tank. The pumping pressure is determined by referring to Table D. Pressure from the nitrogen cylinder is adjusted by the C gas regulator.

5.12 After the drum or tank has been filled, replace the pressure testing valve with a B plastic tubing fitting or 1/8-inch pipe nipple, connect the injection tubing or hose (Fig. 16 or 17), and proceed as follows:

REN Pump

- (1) Close the fluid output valve and open the recirculation valve.
- (2) Adjust the regulator of the master air supply to 30 psi. Slowly open the air input valve to start the pump and mixing procedure.
- (3) Recirculate compound for 5 to 10 minutes to ensure thorough mixing. Close air input valve.
- (4) Close the recirculation valve and open the fluid output valve. Again, slowly open air input valve to start pump. Starting the pump slowly ensures that all fittings are fluid tight. Operate the pump at 90 psi input pressure or as shown in Table D, whichever is lower.
- (5) When pump suddenly races, drum is empty. Close air input valve, refill drum, and repeat steps (1) through (4) until cable is filled.

C Tank

- (1) Make certain that the tank outlet and manual pressure relief valves are closed.
- (2) Check that the tank filling hole cover and the bolts around the tank lid are securely tightened.
- (3) Check the low-level alarm by shorting the alarm pair terminals.
- (4) Connect the hose from the gas regulator to the tank pressure inlet valve and pressurize the tank to the appropriate injection pressure as determined from Table D.
- (5) When the tank pressure gauge indicates injection pressure has been reached, **gradually** open the tank outlet valve to start the flow of compound into the cable.
- (6) If a flow rate indicator was installed on the tank, it should now indicate that compound is flowing into the cable.

TABLE D

**C RECLAMATION COMPOUND INJECTION PRESSURE (PSI) (NOTE)
FOR VARIOUS GROUND TEMPERATURES (DEGREES F)**

PAIR SIZE	GAUGE	GROUND TEMPERATURE AT CABLE DEPTH					
		50°F AND BELOW	51-60°F	61-70°F	71-80°F	81-90°F	91-100°F
25	19	90	88	82	73	64	56
	22	90	90	90	83	73	63
	24	90	90	90	83	73	63
	26	90	90	90	83	73	63
50	19	71	68	62	55	48	42
	22	90	90	82	73	64	56
	24	90	90	90	83	73	63
	26	90	90	90	83	73	63
75 and 100	19	59	55	51	46	40	35
	22	71	66	62	55	48	42
	24	90	88	82	73	64	56
	26	90	90	90	83	73	63
150 and 200	19	53	50	46	41	36	31
	22	59	55	51	46	40	35
	24	71	66	62	55	48	42
	26	71	66	62	55	48	42
300	19	47	44	41	36	32	28
	22	53	50	46	41	36	31
	24	59	55	51	46	40	35
	26	71	66	62	55	48	42
400	22	53	50	46	41	36	31
	24	53	50	46	41	36	31
	26	59	55	51	46	40	35
600	22	47	44	41	36	32	28
	24	53	50	46	41	36	31
	26	53	50	46	41	36	31
900	24	47	44	41	36	32	28
	26	53	50	46	41	36	31

Note: Do not exceed 90 psi



Fig. 16—Tubing Connection at F Pressure Flange

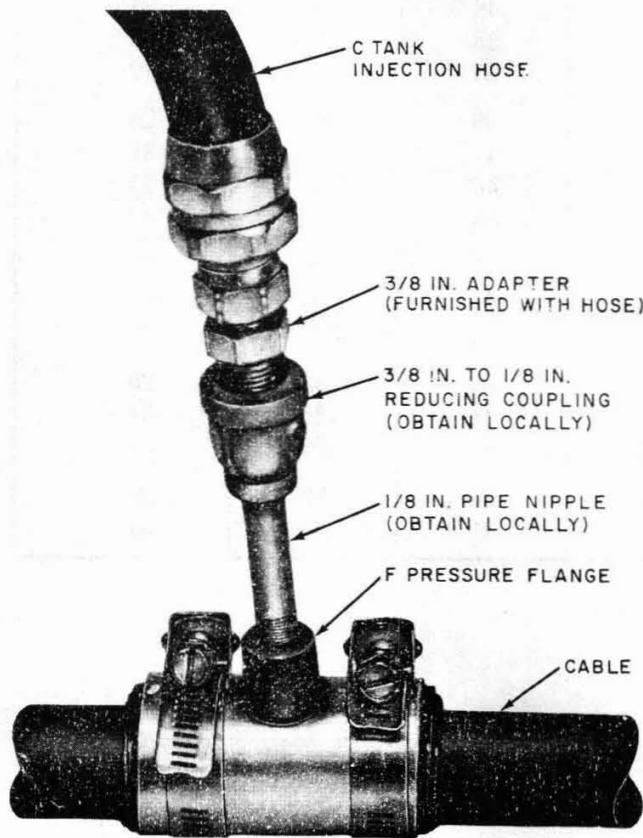


Fig. 17—Pipe Connections at Injection Point Flange

5.13 While the cable is being filled, observe the bleed point(s) for the flow of air and/or water. Little flow indicates the presence of leaks and the filling time will be lengthened accordingly.

5.14 C reclamation compound will first be observed at the bleed points with a foamy yellow appearance, indicating the mixture of water with the compound. Water beads will sink and separate to the bottom. When a clear, beadless, yellow appearance is observed, the cable is properly purged and filled with reclamation compound.

5.15 Plug the flanges at the injection and bleed points with a standard brass plug and backfill the excavations. If the excavations were previously backfilled as described in paragraph 3.09, crimp the plastic tubing tightly by doubling back the end and taping it in the crimped position. Bury the ends about a foot beneath the surface.

Danger: Wear goggles and gloves when disconnecting tubing.

5.16 When concluding a filling operation, the tank outlet valve should be left **open** when the air pressure is bled from the tank. This relieves the pressure in the cable and prevents spraying of the compound as the hose is disconnected.

Gel Time

5.17 The time interval for the C reclamation compound to gel in the cable is dependent upon the ground temperature at cable depth. At 75°F ground temperature the compound will normally gel in approximately 24 hours. At 40°F ground temperature, it will gel in approximately 48 hours.

6. CLEANING REN PUMP AND C TANK

6.01 At the end of each day of operation the REN pump, C tank and associated drum, outlet hose, and couplings must be drained and cleaned to prevent the compound from gelling overnight.

REN Pump

6.02 To clean the REN pump, hold the pump above the drum and insert a screwdriver into the foot valve to drain the compound from the lower end of the pump (Fig. 18).



Fig. 18—Draining REN Pump

6.03 Turn the pump upside down and drain the tubing and upper part of the pump. Pour the unused mixed compound into a marked container for disposal.

6.04 Pour one to two gallons of kerosene or other approved cleaning solvent into the pump drum. Reinstall the pump and operate for a minimum of two minutes in both the recirculating and pumping modes.

6.05 Drain the cleaning solvent from the pump and drum as in paragraphs 6.02 and 6.03 for disposal.

C Tank

6.06 The C tank and associated outlet hose and couplings must be cleaned at the end of each day of operation to prevent the compound from gelling overnight. Cleaning is performed as follows:

- (1) With the C tank still pressurized, pump the excess compound into containers for disposal.
- (2) When flow is stopped by the automatic shut-off valve, bleed the tank pressure and pour approximately 5 gallons of petroleum solvent, such as kerosene, or other approved solvent, into the tank through the fill hole.
- (3) Pressurize the tank to approximately 15 psi and operate the agitator crank vigorously for two to three minutes.
- (4) Open the outlet valve and purge the outlet hose and coupling with the solvent (direct the discharge into a container) until the automatic shut-off valve operates. Remove the tank cover and pour the remainder of the solvent and compound mixture into a container and dispose of it safely.