STATION PROTECTION AND GROUNDS

CONTENTS PAGE

1. GENERAL

1.01 This section covers the requirements for protection of subscriber stations (including coin telephones), provides information for identification, selection, and installation of station protectors. It identifies signaling grounds, describes bonding procedures, and outlines requirements for protecting PBX circuits.

1.02 This section is reissued to add information on the following:

- Suspected energized protectors (DANGER, paragraph 15.03).
- 142A1A and 191A2 protectors.
- C and D customer service closures.
- 106C protector in C customer service closure (Fig. 43).
- AT-7796X connector.
- 188A test set (Stop Lite), safety glasses, and rubber gloves with leather protectors.
- Restrictions on connections to aluminum conduit and conductors.
- Conversion from fuse to fuseless operation.
- Metric equivalents to English units in figure references to dimensions and wire gauge.
- Delete text, table, and figure references to No. 14 AWG ground wire, which has been rated manufacture discontinued (MD), and show it replaced by No. 12 wire.

- Rerate 93C, 93D1, and 305A2 protector mountings and 1293C protectors to MD.
- Rerate 6A3A terminal block to MD.
- Revise Tables A, B, C, D, E, F, and G.
- Change READ to CAUTION, prior to paragraph 14.01.
- Replace Fig. 65 to show current model of B ground clamp.
- Show specific omission of the DIMENSION® PBX in READ statement of paragraph 3.10 and prior to paragraph 11.01.

Revision arrows are used to emphasize the more significant changes.

1.03 Cable, wire, strand, etc, which are subject to disturbance by lightning, possible contact or induction from electric circuits in excess of 300 volts to ground, or ground potential rises from nearby power generating stations, substations, or higher voltage industrial transformers (34 kilovolts and above), are called ***exposed*** cable, wire, or strand.

1.04 Cable, wire, strand, etc, which are not subject to disturbances by lightning, possible contact or induction from electric circuits in excess of 300 volts to ground, or ground potential rises from nearby power generating stations, substations, or higher voltage industrial transformers, are called ***unexposed*** cable, wire, or strand.

1.05 In nonlightning areas, the exposure status of cable or wire is based only on power exposure. In lightning areas, protection is required regardless of power exposure.

1.06 Isolated sections of aerial cable are considered as open wire, for the purpose of determining the type of protectors required, unless the cable is effectively grounded to a multigrounded neutral of a power system.

1.07 Station protectors are used in areas where telephone plant is considered exposed as outlined in paragraph 1.03. Station protectors are designed to provide safety to customers and telephone company personnel and to limit damage to telephone equipment from abnormally high voltages. Protector units limit the magnitude of a foreign voltage at the station by arcing to ground and by shorting permanently to ground when there is excessive follow-through current.

1.08 Nearby lightning strokes can develop large potential (voltage) differences between telephone wiring, power wiring, water pipes, and building steel. Therefore, it is important these systems be bonded together on the telephone premises of the customer and the bonding conductors be as short and as straight as possible (Fig. 1).

1.09 When installing protectors at mobile home locations, refer to Section 461-220-100.

1.10 Grounding and special protection requirements for key telephone systems (KTSs) are covered in Section 518-010-105.

1.11 Stations requiring special protective measures are:

- Stations located at power substations or generating stations.
- Stations located in hazardous atmospheres containing explosive vapors, gas, or dust (Section 502-415-100).
- Customer-owned stations or stations connected to privately-owned circuits or facilities. Interfaces required for connecting to these stations are covered in other sections and will be coded on the service orders. If they are not, consult your supervisor.

1.12 Where stations are served by open wire, rural wire, or drop wire run on the same poles with primary power conductors, ***a fusible link, consisting of a 2-foot minimum length of block wire,*** must be installed at the pole serving the station as outlined in Section 460-300-121; ▶otherwise, a fused protector must be used.◀

1.13 Stations served by rural wire or drop wire that is run on jointly used poles, supporting power distribution circuits having voltages of more than 2900 volts to ground or more than 5000 volts between conductors and include a multigrounded neutral wire, may require a 118B protector. Refer to Section 624-730-200 and Part 13 of this section for requirements. The 118B protector is designed to protect telephone circuits in the event of a

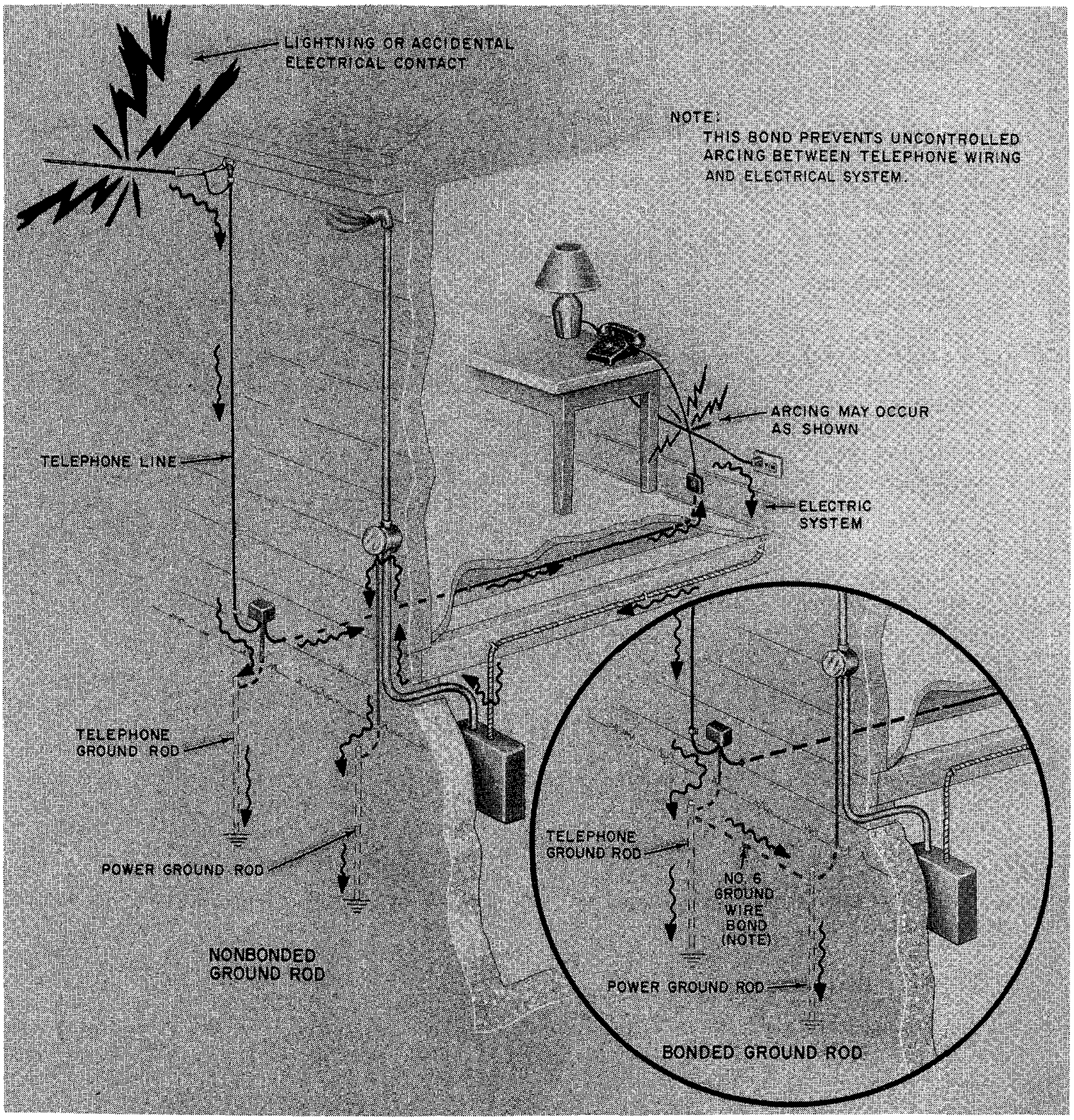


Fig. 1—How Bonding Reduces Differences of Potential Between Telephone Wiring and Electrical Systems That are Grounded to Separate Electrodes

contact between higher voltage power wires and telephone wires.

2. LOCATION OF PROTECTORS

2.01 Plan station installations so the station protectors can be grounded to the power ground wire, power service entrance conduit, power ground rod, acceptable metallic water pipe or acceptable building ground electrode, using the shortest possible length of ground wire run in the most direct route. ***Protectors should be mounted outside whenever possible.*** Fuseless station protectors installed indoors should be located near the ➧protector ground source so the ground wire can be as short as possible.➧ Fuse-type protectors installed indoors must be located as close as practical to the point of entrance of the drop wire.

2.02 Place protector in an accessible location ➧so as to minimize the possibility of➧ damage or immersion. Do not place protectors on front of buildings ➧where appearance is a significant factor➧ , in living quarters, or where a ladder is necessary for installation and maintenance. Protectors installed indoors without covers must not be located where inadvertent contact by a customer is likely. Mount protectors in a dry, well ventilated location. Mount protection underneath buildings only as a last resort.

3. SELECTING PROTECTORS, PROTECTOR MOUNTINGS, AND CLOSURES

PROTECTORS

3.01 Determine whether a fused or fuseless protector is required. A ***fused*** protector is required if any one of the following conditions exists:

(a) The station is served by open wire or rural wire and (1) the power is not multigrounded neutral, and (2) there is no acceptable water pipe for grounding.

(b) The station is served by open wire or rural wire and no bridle wire fusible link (at least 2 feet of E block wire) has been provided between the aerial wire and the drop wire.

(c) The station is served by multiple drop wire fed by open wire or multiple wire and no bridle wire fusible link has been provided.

(d) Underground service wire is connected via an encapsulated splice ➧(16A2 or 16AA2 closure with D encapsulant)➧ to 19-gauge or 22-gauge cable that is exposed (in the aerial or buried portion) to power circuits in excess of 300 volts to ground.

> ***Note:*** Where local instructions do not specify use of a fused protector, it may be necessary to consult the engineer to verify if such a condition exists.

An exception to paragraph 3.01(d) is that a fuseless protector can be installed provided it is located ***outdoors*** and mounted on a ***noncombustible surface.*** A ➧9A1A-5➧ terminal block can be used in a PC6 or PC12 closure.

(e) A battery supply circuit is fed from two or more drop wires.

3.02 If none of the conditions outlined in paragraph 3.01 exist, use Table A to select a fuseless protector. Where a fused protector is required, refer to Part 5.

3.03 The ***123A1A protector*** (Fig. 2) provides protection for one pair of wires. It consists of a nonconductive base containing three binding posts and two 2B2A protector units.

3.04 The ***123B1A protector*** (Fig. 3) provides protection for one pair of wires and is recommended for use ➧only at stations served by aerial wire (as described in paragraph 3.08)➧ . It consists of a nonconductive base containing three binding posts and two 6B1A gas tube protector units (Fig. 4) in parallel with two 2B2A protector units. The 6B1A protector units are not grounded permanently by lightning surges but may be damaged by power currents. Therefore, carbon protector backup is provided to assure fail-safe protection.

3.05 The ***123E1A protector*** (Fig. 5) provides protection for one pair of wires and is intended for use at stations served by cable or multiple wire having a high level of lightning activity. It consists of a nonconductive base containing three binding posts and two 11B1A gas tube protector units (Fig. 6). The 123E1A protector

TABLE A

FUSELESS PROTECTOR SELECTION

NUMBER OF PAIRS PROTECTED	PROTECTOR	TYPE PROTECTOR UNIT USED	SEE FIGURE NUMBER	USE		PARAGRAPH REFERENCE
				INDOOR	OUTDOOR	
1	123A1A	2B2A	2	•	•	3.03
1	123B1A	2B2A 6B1A	3	•	•	3.04
1	123E1A	11B1A	5	•	•	3.05
2	128A1A-2	2B2A	7	•	•	3.06
2	128E1A-2	11B1A	8	•	•	3.07
1-3	6A3A (MD)	2A1A or 11A1A	10		†	3.12
1-5	9A1A-5	2A1A or 11A1A	12		†	3.14
3-6	116C	2A1A or 11A1A	13		•	3.15
3-6	117B	2A1A or 11A1A	14	•		3.16
1-5	142A1A	2A1A or 11A1A	23		•	3.28

* Provide a B, C, or D customer service closure, or 150B cover, and 93D1 (MD) protector mounting for outdoor installations.

† Used in PC-type closure.

may be safely used anywhere the 123A1A protector is used.

Note: The 11B1A protector unit (Fig. 6) incorporates a 471A electron (gas) tube which provides nominal 500-volt protection. The ultimate failure mode of the 11B1A protector unit is a short circuit (to ground); therefore, it does not require the use of carbon blocks in parallel. The 471A tube is mounted in a brass cap along with a stainless steel spring, a fusible disc, and a solder tinned brass cage. These parts are arranged so heating of the tube melts the fusible disc and allows the cage to contact the grounded surface of the station protector. This short-circuits the gas tube and provides a path to ground. During a lightning surge or short duration power surge, the 471A gas tube provides a path to ground through its internal spark gap. The 11B1A protector unit can be substituted for the 2B2A protector units in the 123A1A and 128A1A-2 protectors. Station protectors equipped with 11B1A protector units are preferred over protectors which feature gas tubes in parallel with carbon blocks (eg, 123B1A) where cable or multiple wire plant is involved. The 11B1A protector unit can be identified by a circle machined into the cap and by a dab of white paint on the cap.

3.06 The ***128A1A-2 protector*** (Fig. 7 and 27) provides protection for two pairs of wires. It consists of a nonconductive base containing five

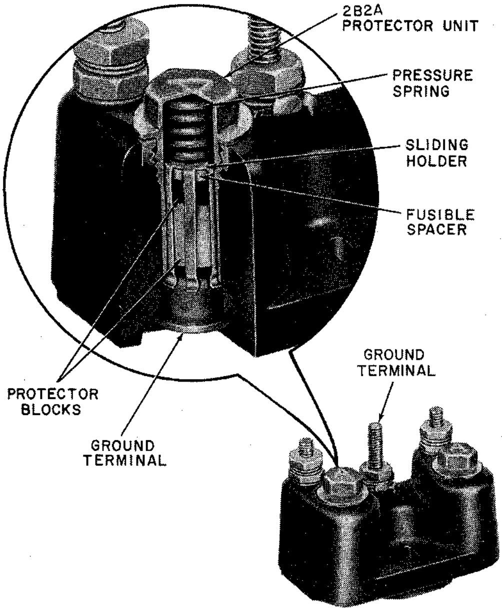


Fig. 2—123A1A Protector

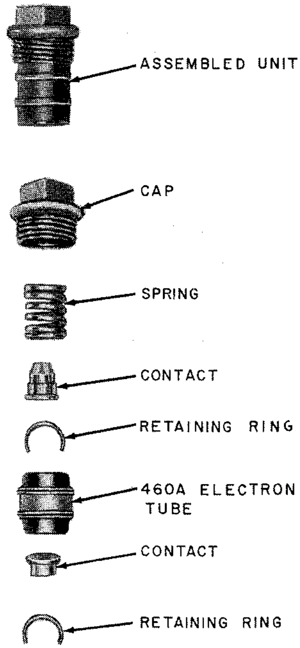


Fig. 4—6B1A Protector Unit

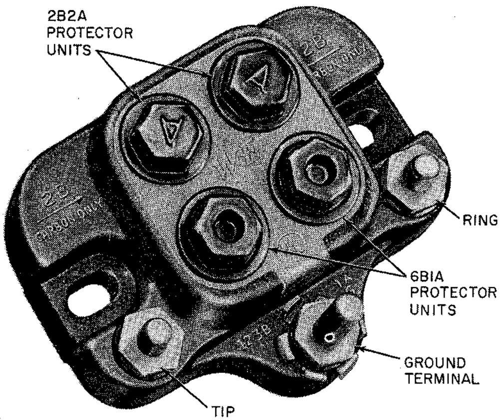


Fig. 3—123B1A Protector

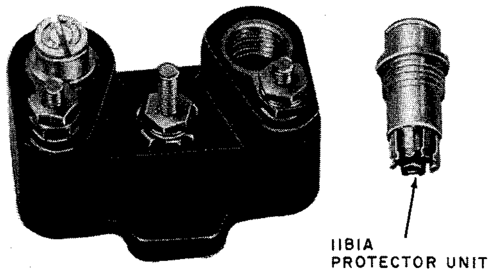


Fig. 5—123E1A Protector

binding posts and four 2B2A protector units. The bottom left and right binding posts are tip and ring for the first line, and the top left and right binding posts are tip and ring for the second line. The two bottom 2B2A protector units protect the first line, and the two top 2B2A protector units

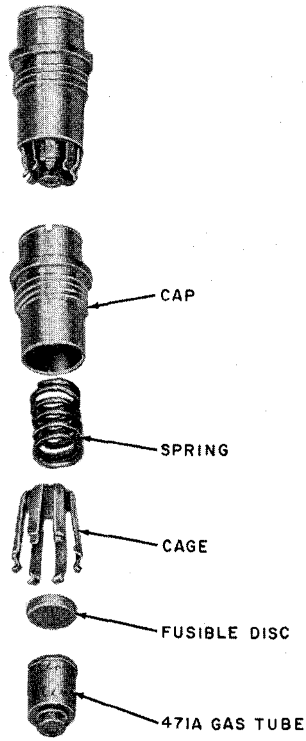


Fig. 6—11B1A Protector Unit

protect the second line. The center binding post is the ground terminal. The 128A1A-2 protector should be grounded with a ground wire no smaller than a No. 12 ground wire (Table B).

3.07 The ***128E1A-2 protector*** (Fig. 8) provides protection for two pairs of wires. It consists of a nonconductive base containing five binding posts and four 11B1A protector units. The bottom left and right binding posts are tip and ring for the first line, and the top left and right binding posts are tip and ring for the second line. The two bottom 11B1A protector units protect the first line and the two 11B1A protector units protect the second line. The center binding post is the ground terminal. The 128E1A-2 protector should be grounded with a No. 12 ground wire (Table B) and may be used anywhere the 128A1A-2 protector is used.

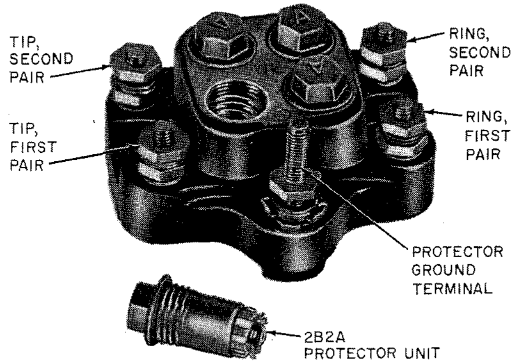


Fig. 7—128A1A Protector

♦TABLE B♦

GROUND WIRE CAPACITY

GROUND WIRE SIZE	MAXIMUM NUMBER OF PROTECTED CIRCUITS	
	FUSELESS	FUSED
No. 12 (2mm)	2	6
No. 10 (2.5mm)	6	7
No. 6 (4mm)	7 or more	8 or more

Note: The ground wire between protectors shall be the same size as the ground wire between the protector and the grounding electrode.

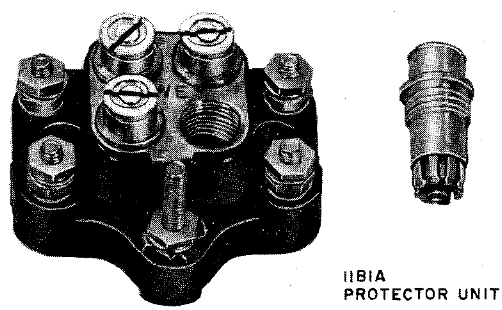


Fig. 8—128E1A-2 Protector

3.08 The 11B1A protector unit was designed for loops served by grounded shielded cable, multiple rural wire, or urban wire. The 11B1A protector unit and the 123E1A and 128E1A protectors may be used safely on loops served by C-rural wire or open wire, but the trouble reduction over carbon block protection may not be significant, depending on exposure of the loop. In cases where the loop contains a C-rural or open wire segment not exceeding 1/4 mile in length, the presence of the C-rural or open wire should not degrade performance of the gas tube. For loops having longer segments of C-rural or open wire, use the 123B1A protector where gas tube protectors are authorized.

3.09 Because of their higher cost, the 11B1A protector units and the 123E1A and 128E1A protectors should be used only in areas designated by engineering.

3.10 The 11A1A protector unit (Fig. 9) incorporates the same 471A electron (gas) tube as the 11B1A protector unit (see Note following paragraph 3.05) to provide nominal 500-volt protection. The gas tube, along with a fusible disc, is mounted in a machine threaded brass cap. The cap has a screwdriver slot and a recessed circle. The top of the cap is painted white to identify it as satisfactory for use on customer premises.

READ ***Neither the 11A1A or 11B1A protector unit should be used with 800A, 801A, and ESS 101 PBXs. ➧(DIMENSION PBX grounding must be done in accordance with Section 554-101-101.)⬅***

3.11 The parts of the 11A1A protector unit are arranged so during a sustained power fault the current causes the gas tube to heat and melt the fusible disc. This allows the spring in the protector base to move the base terminal into contact with the edge of the protector unit cap, providing a ground short. During a lightning surge, the 471A gas tube provides a path for the surge current to ground through its internal spark gap.

READ ***The 11A1A protector unit can be used as a direct field replacement for 2A1A protector units in the terminal blocks, protectors, cable terminals, and connecting blocks covered in paragraphs 3.12 through 3.23.***

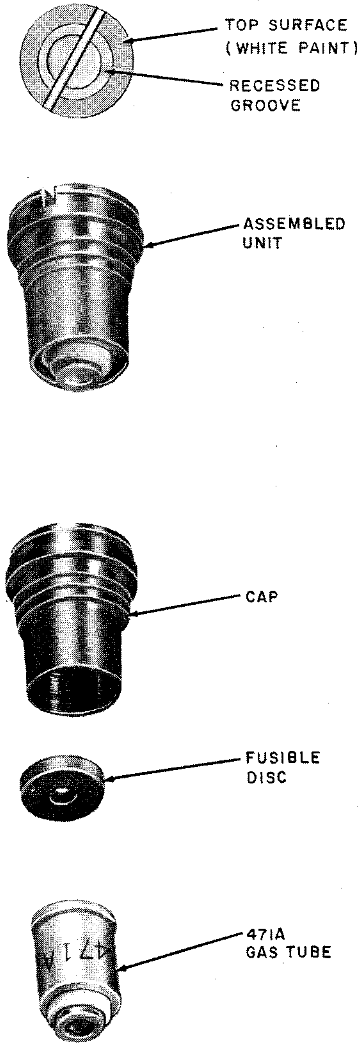


Fig. 9—11A1A Protector Unit

3.12 The ***6A3A (MD) terminal block*** (Fig. 10) can be used in lieu of fuseless station protectors where stations are served by buried cable and the cable closure (such as PC6 or PC12 cable closure) is installed on the premises served. The 6A3A (MD) terminal block mounts inside the cable closure as shown in Fig. 11. The 6A3A (MD) terminal blocks should not be used for station protectors when a PC6 or PC12 cable closure is used to feed separate buildings and is located remotely from them. Individual 123- or 128-type protectors should be provided at each building.

3.13 The 6A3A (MD) terminal block consists of a nonconductive base containing six binding posts with a 2A1A protector unit associated with each binding post. The terminal block is equipped with six color-coded 24-gauge leads (white-blue, white-orange, white-green), one to each binding post and 2A1A protector unit. Two mounting studs are provided to mount the terminal block in a cable closure and provide for ground connection.

3.14 The 9A1A-5 terminal block (Fig. 12) consists of a nonconductive base containing five pairs of binding posts, ten 2A1A protector units, ♦and replaces the 6A3A (MD) terminal block♦ . One 24-gauge insulated lead is connected internally to each binding post. The 9A1A-5 block provides facilities for protecting subscriber stations and terminating wire service. It is intended for mounting in PC-type cable closures.

3.15 The ***116C protector*** (Fig. 13) consists of a nonconductive base containing twelve binding posts, twelve 2A1A protector units, and two binding posts for signaling ground connections. The base is housed in a metal container with a hinged metal cover. The metal housing is equipped with a clamp for the station ground wire. The wire used to ground the 116C protector should be no smaller than a No. 10 (Table B). The 116C protector is designed for outdoor or indoor use and generally used with 6-pair multiple drop wire.

3.16 The ***117B protector*** (Fig. 14) consists of a nonconductive base containing twelve binding posts, twelve 2A1A protector units, one binding post for signaling ground, and one binding post (equipped with a pronged washer) for signaling ground and protector ground. The 117B protector should be grounded with a wire no smaller than a No. 10 ground wire (Table B). The 117B protector is designed for indoor use and generally used with 6-pair multiple drop wire.

3.17 Cable terminals, connecting blocks, protectors, or terminal blocks designed to protect 10, 16, 25, 50, or 100 pairs of wires, are used at apartment complexes, commercial or industrial locations. These large capacity (10 pairs or more) protectors may be referred to as multipaired protectors. Multipaired protectors (Table C) used for station protection must be equipped with:

- 2A1A or 11A1A protector unit
- A ground clamp for grounding to an approved ground electrode.

3.18 The NH16 and NH25 cable terminals are equipped with a 24-gauge stub and consists of gastight solid-cast resin blocks containing binding posts and 2A1A protectors installed in metal housings. The metal housings are equipped with a ground clamp, and the cable terminals should be grounded

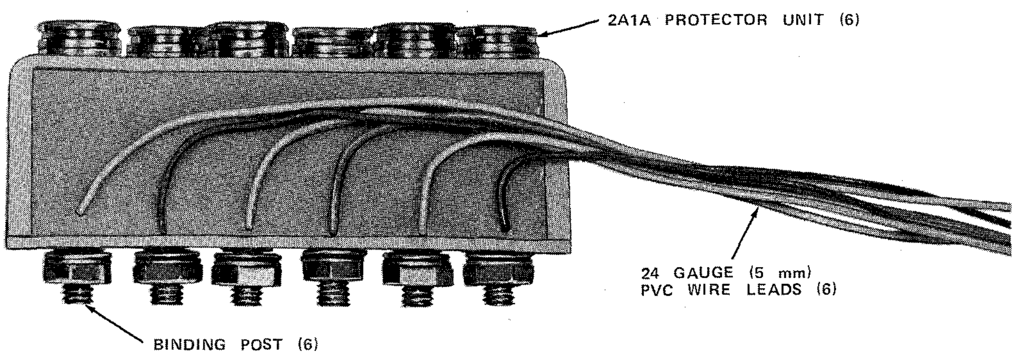


Fig. 10—♦6A3A (MD) Terminal Block♦

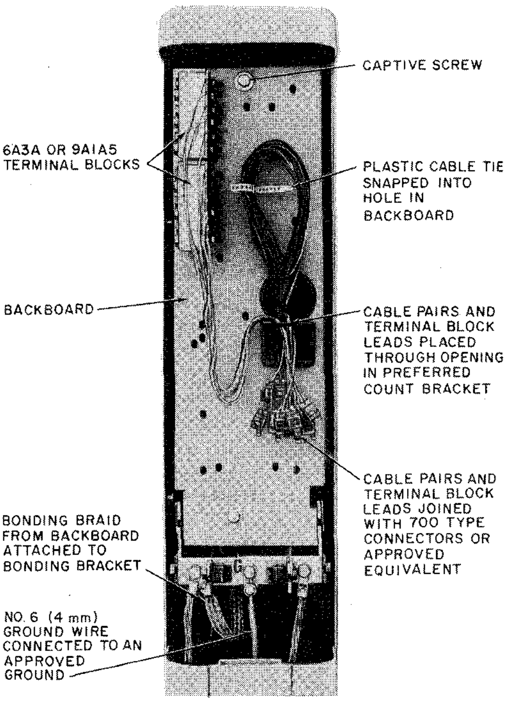


Fig. 11—♦6A3A or 9A1A5 Terminal Blocks Installed in PC6/48 Closure♦

with a wire no smaller than a No. 6 ground wire (Table B).

3.19 The NH16 cable terminal has thirty-two binding posts, thirty-two 2A1A protector units, and the housing is equipped with a hinged cover. It may be strand, pole, or wall mounted. Where the NH16 cable terminal is wall mounted on the premise of a customer, it must be bonded (grounded) to an acceptable ground (Table D).

3.20 The NH25 cable terminal (Fig. 15) has fifty binding posts, fifty 2A1A protector units, and the housing is equipped with a drop-type cover. It may be pole or wall mounted. Where the NH25 cable terminal is wall mounted on the premise of a customer, it must be bonded (grounded) to an acceptable ground (Table D).

3.21 The 1A4A-type terminal blocks (Fig. 16) are gastight cast-resin blocks equipped with binding posts, 2A1A protector units, fanning strip, ground clamp, and a removable linkage feature. The terminal blocks are available in 10-, 16-, 25-, and 50-pair sizes (Table C). The terminal blocks may be mounted in cable terminal boxes or cable terminal sections. The removable ground linkage provides a means of establishing an insulating joint, for corrosion reasons, between the lead stub and the grounds within the terminal block. The fanning strip provides a means of fanning out the connecting wires. The ground clamp permits the connection of a station protector ground. The 1A4A-type terminal blocks should be grounded with a wire no smaller than a No. 6 ground wire (Table B).

3.22 The 57B1A-type (MD) connecting blocks consist of binding posts and 2A1A protector units in injection-molded blocks (Fig. 17). The blocks are equipped with insulation-crushing hardware, fanning strips, and a ground clamp. The ground clamp permits the connection of a station protector ground. The connecting block should be grounded with a wire no smaller than a No. 6 ground wire (Table B). The connecting blocks were made in 10-, 16-, 25-, and 50-pair sizes (Table C). The 57B1A-type connecting block may be installed in G-type terminal boxes, 1A1 or H202 cable terminal sections (see Section 461-603-100).

3.23 The 134-type protectors (Fig. 18) consist of a cast-resin block containing 2A1A protector units, a 26-gauge stub cable (to serve as a fusible link), a 24-gauge terminating stub cable, and two ground lugs. The protectors are available in 16-, 25-, 50-, and 100-pairs sizes (Table C). Either of the ground lugs can be used for a protector ground, and a ground wire no smaller than a No. 6 should be used to ground the protectors (Table B). The 134-type protectors can be installed in cable closures, cable terminal sections, or on B cable terminal frames.

3.24 The 134-type protectors do not have binding posts; therefore, the terminating stub cable must be terminated on connecting blocks or spliced to cables. See Section 631-460-111 for more descriptive information and use of the 134-type protectors.

3.25 Noninsulated drop wire building attachments should be used with fuseless protectors or with fused-type protectors that have been converted to fuseless operation. See Section 460-300-123, Drop and Block Wire, Attaching, and Fastening.

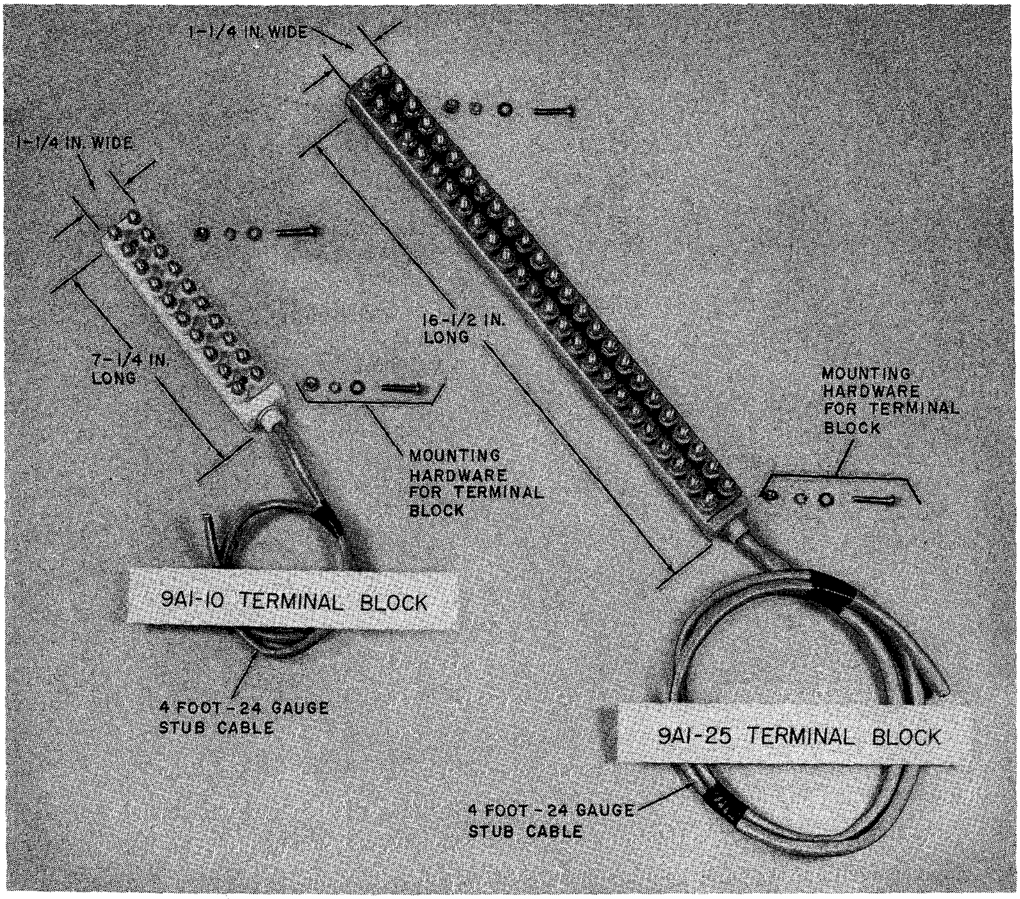


Fig. 12—➧9A1-Type Terminal Block➧

3.26 Where the 123- or 128-type protectors are installed outside, a 150B cover (Fig. 19) is installed over the protector, or the protectors may be housed in a 93D1 ➧(MD)➧ (Fig. 20), a 305A2 (Fig. 21) protector mounting, or a B customer service closure (Fig. 22). The 150B cover may be used to cover protectors installed indoors when a protective covering is required.

Caution: The 150B cover is made of semiflexible plastic and, in extremely hot locations, may become soft and not hold over the protector. In extremely cold locations, the 150B cover may become brittle and be difficult to remove from the protector. The B customer service closure or the 305A2 protector mounting is preferred in lieu of the 150B cover for extremely hot or extremely cold locations.

3.27 When using the 150B cover, bring all the wires together under a common clamp. The

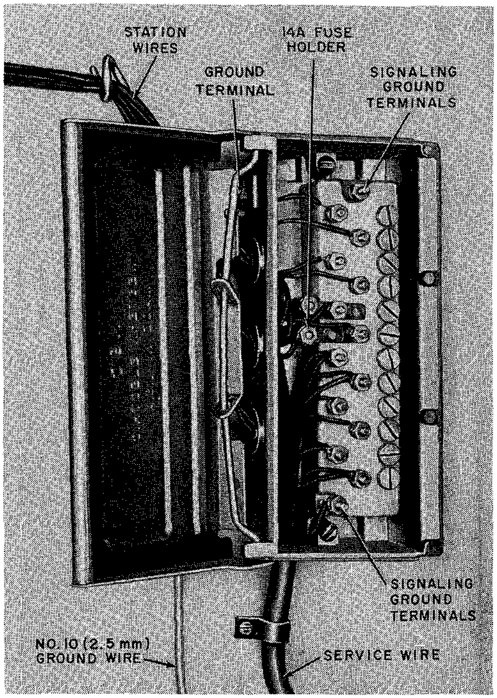


Fig. 13—116C Protector

clamp is the last attachment and is placed about 2 inches below the protector. To remove the 150B cover, grasp the sides of the cover with the thumb and forefinger and, at the same time, apply pressure with the middle finger at the central tapered portion in an upward direction. When the cover lugs clear the base of the protector, the cover may be lifted off.

3.28 The 142A1A protector (Fig. 23) is intended for use where the station is served by 5-pair service or drop wire. It consists of an insulating base with a threaded-stud grounding connector and five pairs of 2A1A protector units, though 11-type (gas filled) protector units may be used, wired to a 5-pair terminal block. It may be mounted in either a C or D customer service closure.

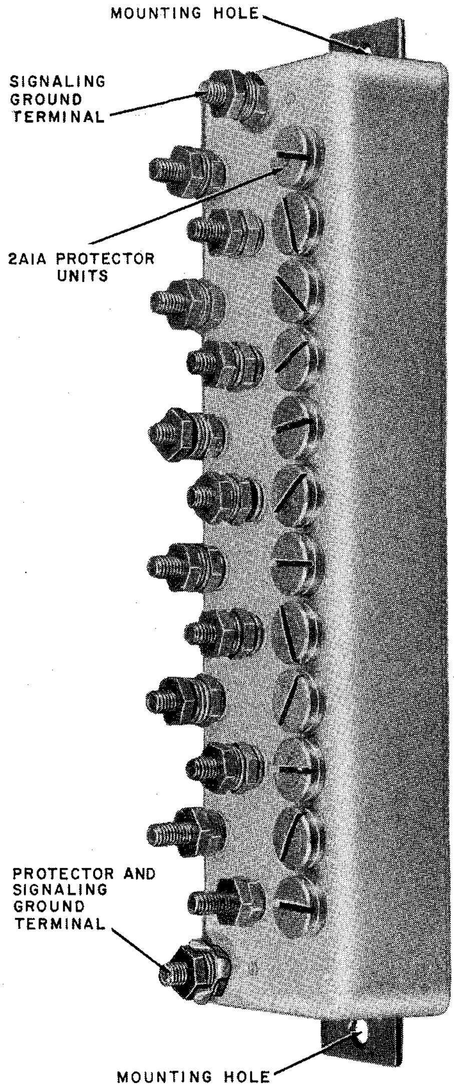


Fig. 14—117B Protector

▶TABLE C◀

MULTIPAIR STATION PROTECTORS

TYPE PROTECTOR		PAIRS PROTECTED	SEE FIGURE NUMBER	REFERENCE SECTION
Cable Terminals	NH-16	16		631-210-101
	NH-25	25	15	
Terminal Blocks	1A4A-10	10		631-440-211
	1A4A-16	16	16	
	1A4A-25	25		
	1A4A-50	50		
Connecting Blocks	57B1A-10	10	17	461-603-100
	57B1A-16	16		
	57B1A-25	25		
	57B1A-50	50		
Protectors	134A1A-16	16		631-460-111
	134A1A-25	25	18	
	134A1A-50	50		
	134A1A-100	100		

▶PROTECTOR MOUNTINGS◀

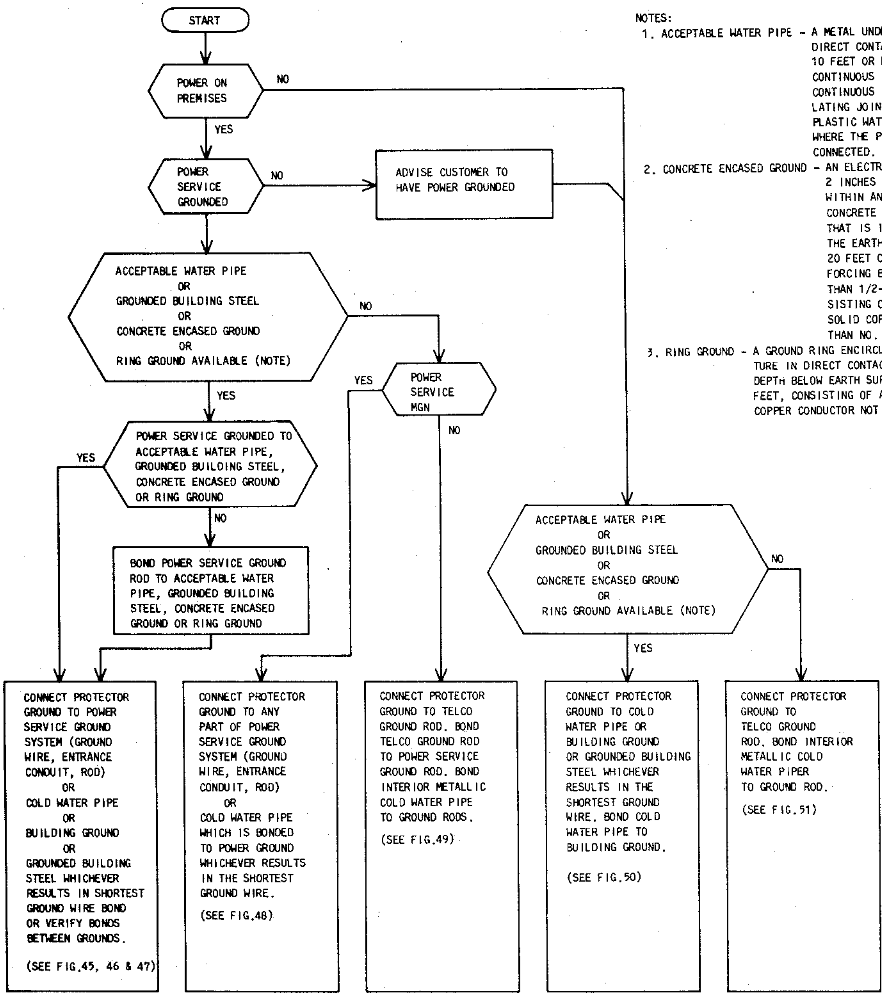
3.29 The 93D1 ▶(MD)◀ protector mounting is designed to house four 123- or 128-type protectors. It is intended to be mounted on a protector mounting post (PMP) where stations are served by buried service wire (Fig. 24) or may be installed on any flat surface.

3.30 The 93D1 ▶(MD)◀ protector mounting consists of a base, an adapter plate, a cover, a grounding connector, and four screws. The back of the base has two slotted mounting holes for installing on a flat surface and two round holes (about 1-3/4 up from the bottom) for mounting on a PMP. Two other holes in the back of the base are provided for attaching the adapter plate. Three openings in the bottom of the base are equipped with grommets as an entry for service wires, station wires, and ground wire. A knockout is provided in the back of the base. Where it is more practical for station wires to enter the back of the protector mounting, the knockout can be removed and a B plastic tube inserted through the opening. The B plastic tube offers mechanical protection to station wires. Cut the B plastic tube to the desired length and plug it to prevent an open path between the closure and the interior of the building.

3.31 The 123- and 128-type protectors are mounted in a vertical position on the adapter plate of the 93D1 ▶(MD)◀ protector mounting. The ground connector provides a method of connecting the shield of a service wire to the ground terminal of a protector mounted in one of the lower positions on the adapter plate. The ground connector is

TABLE D

SELECTION OF APPROVED GROUND



NOTES:

1. ACCEPTABLE WATER PIPE – A METAL UNDERGROUND WATER PIPE IN DIRECT CONTACT WITH THE EARTH FOR 10 FEET OR MORE AND ELECTRICALLY CONTINUOUS (OR MADE ELECTRICALLY CONTINUOUS BY BONDING AROUND INSULATING JOINTS, PLASTIC PIPE OR PLASTIC WATER METERS) TO THE POINT WHERE THE PROTECTOR GROUND WIRE IS CONNECTED.
2. CONCRETE ENCASED GROUND – AN ELECTRODE ENCASED BY AT LEAST 2 INCHES OF CONCRETE, LOCATED WITHIN AND NEAR THE BOTTOM OF A CONCRETE FOUNDATION OR FOOTING THAT IS IN DIRECT CONTACT WITH THE EARTH, CONSISTING OF AT LEAST 20 FEET OF ONE OR MORE STEEL REINFORCING BARS OR RODS OF NOT LESS THAN 1/2-INCH DIAMETER, OR CONSISTING OF AT LEAST 20 FEET OF BARE SOLID COPPER CONDUCTOR NOT SMALLER THAN NO. 4 AWG.
3. RING GROUND – A GROUND RING ENCIRCLING A BUILDING OR STRUCTURE IN DIRECT CONTACT WITH THE EARTH AT A DEPTH BELOW EARTH SURFACE NOT LESS THAN 2 1/2 FEET, CONSISTING OF AT LEAST 20 FEET OF BARE COPPER CONDUCTOR NOT SMALLER THAN NO. 2 AWG.

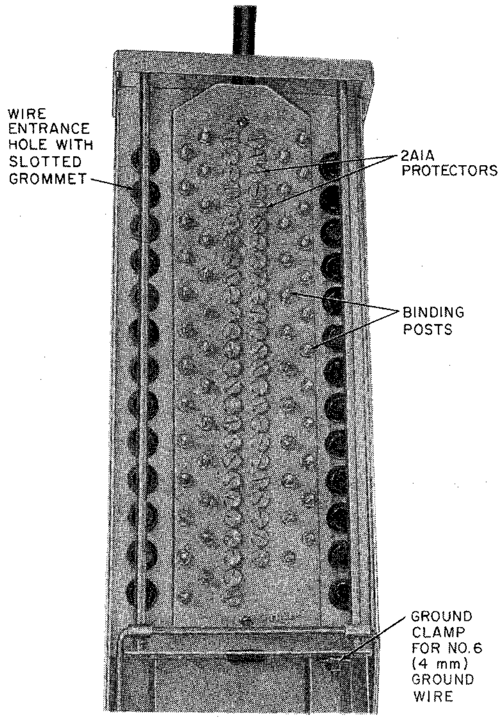


Fig. 15—♦NH25 Cable Terminal♦

connected to the shield of a service wire in the same manner as the F connector (Fig. 25).

> ***Note:*** When installing the 93D1 ♦(MD)♦ protector mounting on a PMP, the adapter plate must be removed to provide access to the mounting holes in the back of the protector mounting base.

3.32 The 305A2 ♦(MD)♦ protector mounting consists of a metal base and a removable metal cover. The base has two slotted mounting holes and four tapped holes, two vertical and two horizontal, for installing 123- and 128-type protectors. Two screws are furnished with the mounting. The 305A2 ♦(MD)♦ protector mounting can be mounted on any flat surface (Fig. 26) or on a PMP (Fig. 27).

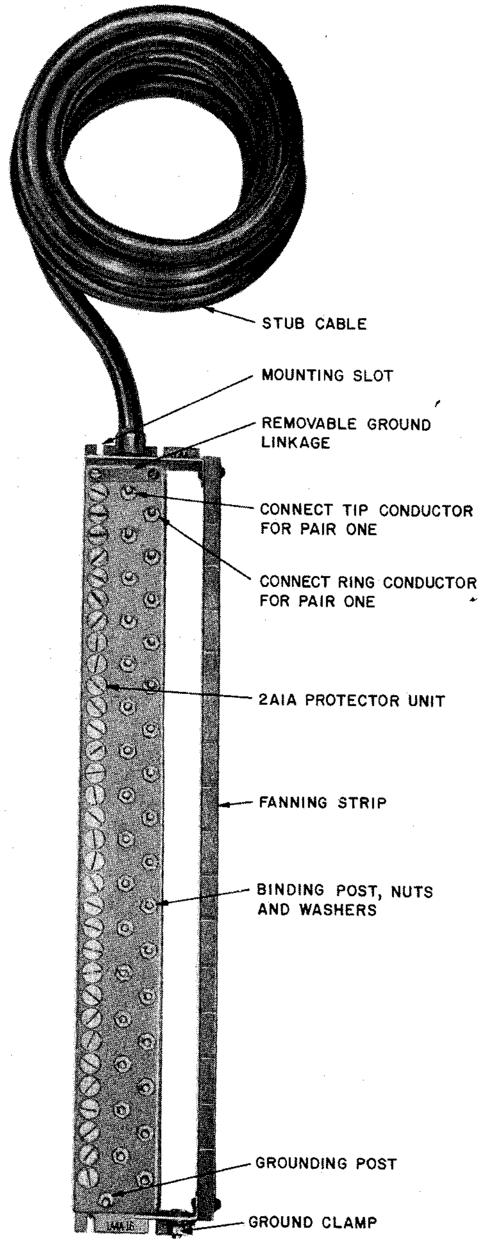


Fig. 16—1A4A-16 Terminal Block

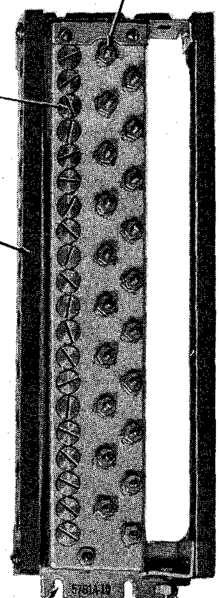


Fig. 17—57B1A-10 (MD) Connecting Block

➧CUSTOMER SERVICE CLOSURES

3.33 The AT-8813 customer service closures are used as exterior protective housings for protectors, connecting blocks, and various other telephone company devices.

3.34 The AT-8813 customer service closures come in three sizes (B, C, and D) and consists of a plastic base, removable cover, two cable ties for locking the cover to the base, and mounting screws for attaching protectors.

3.35 The B, C, or D closure can be mounted on any suitable flat surface, PMP, or a vertial or horizontal pipe. An adapter at the bottom of the base allows it to be attached to service wire conduit. A typical installation is shown in Fig. 28.➧

3.36 ➧Inside wiring (station and ground wire) can be brought into a customer service closure through either the back or bottom grommets only. Since they are constructed entirely of plastic, ground contact cannot be made through the base but must be provided by a separate ground wire. When wires enter through the back grommet, they should be protected by a length of B plastic tube inserted through the hole. Plug the tube to prevent formation of an open path between the closure and the interior of the building.

3.37 When a closure is mounted on a pipe, it should be attached with a C lashed cable support (Fig. 29). It will be necessary to break out either vertical or horizontal openings in the back of the closure with a screwdriver or similar tool.

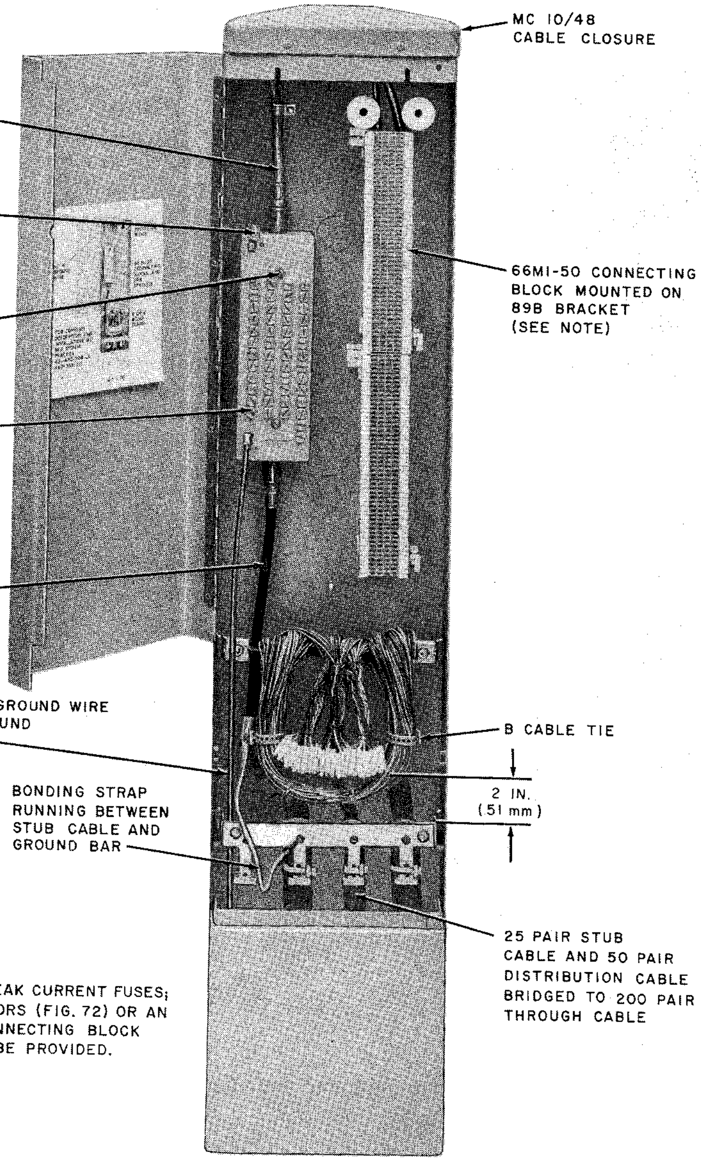
3.38 Complete instructions for installing B, C, and D customer service closures are printed on a separate sheet and packed with each new unit. More complete information on these closures is contained in Section 463-121-120.

3.39 The AT-8813 customer service closures will accommodate the following:

- B closure—a single 123- or 128-type protector
- C closure—two 123- or 128-type protectors or combination, one 106C protector, or one 142A1A protector, or a combination of protectors, 66B4-3 connecting blocks, 1A termination units, and loop electronic devices.
- D closure—up to four 123- or 128-type protectors or combinations of all previously mentioned devices.➧

PROTECTOR MOUNTING POSTS (PMP)

3.40 The protector mounting posts, PMP-38 (Fig. 30) and PMP-50, are designed to mount a 93D1 ➧(MD)➧ protector mounting, a 305A2 ➧(MD)➧ protector mounting, a 123- or 128-type protector, or a B customer service closure, where protectors are served by buried service wire. The PMP is available in 38-inch and 50-inch sizes to suit various conditions. It can be installed freestanding, at the edge of a mobile home, or can be installed on the side of a permanent building or a power service entrance conduit. When used freestanding, the



NOTE:
TO INSTALL SNEAK CURRENT FUSES; 1094A PROTECTORS (FIG. 72) OR AN ADDITIONAL CONNECTING BLOCK (FIG. 74) MUST BE PROVIDED.

Fig. 18—▶134A1A-25 Protector Installed in Cable Closure◀

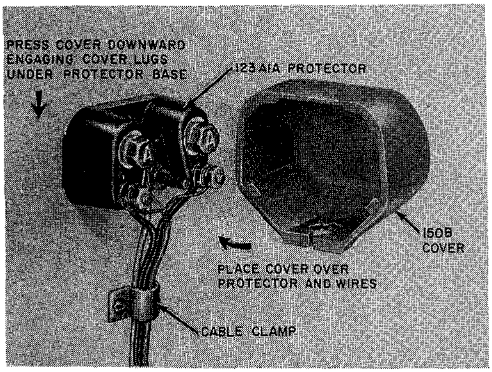


Fig. 19—150B Cover

PMP must be in the ground a minimum of 12 inches.

3.41 As the mounting plate at the top of the PMP is riveted to the stake portion, the PMP ***cannot*** be driven into the ground. This necessitates installing the mounting post as the service wire is being buried so it can be placed in the open trench. Installing the PMP as the service wire is being buried eliminates the possibility of damaging the service wire with the stake.

3.42 The PMP has an open channel in the back for the service wire. The slotted holes in the stake permit the service wire to be fastened in the channel by using plastic cable ties or metal sealing clamps. The round holes in the stake permit attachment to structures where required.

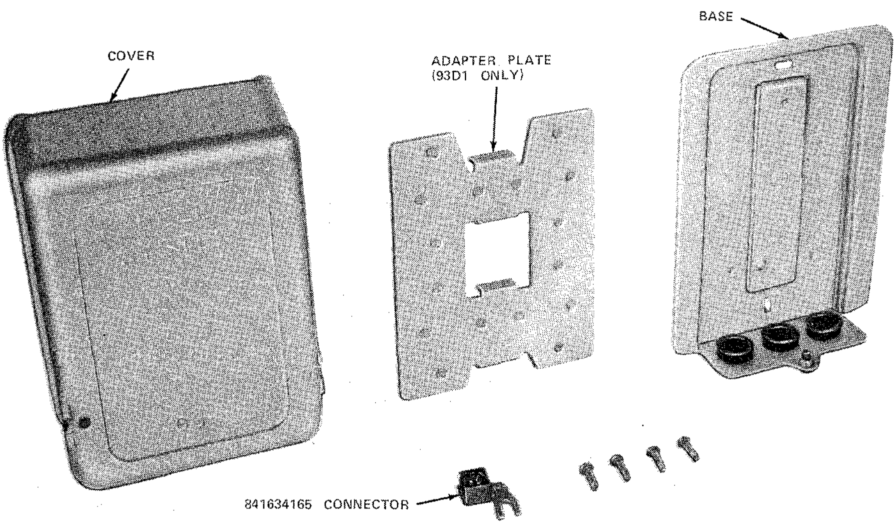


Fig. 20—♦93C (MD) and 93D (MD) Protector Mounting♦

See Fig. 24 and 27 for examples of service wire terminations.

3.43 The mounting plate at the top of the PMP has two elongated holes which can be used to attach the mounting post to structures where required. The other five holes in the mounting plate are for mounting the various protector mountings or closures.

4. INSTALLING PROTECTORS

4.01 All screws and fasteners shall be of sufficient length and size to mount protectors securely. Division 080 contains information concerning the

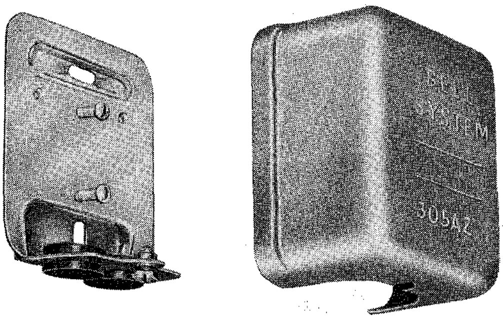


Fig. 21—305A2 (MD) Protector Mounting

various types of screws, anchors, etc, required. ▶Stainless steel screws should be used for outdoor installations.◀

4.02 Where more than one protector is installed at the same indoor location, provide a 1-inch separation when protectors are horizontally mounted and a 2-inch separation when protectors are vertically mounted (Fig. 31). When more than one 123- or 128-type protector is installed at the same outdoor location, the protectors may be installed in a ▶C or D customer service closure◀ .

4.03 Where the 150B cover is to be used with 123- or 128-type protectors, mount the protectors in an upright position to permit proper installation of the cover.

4.04 Terminate line ▶input (ie, aerial or buried drop)◀ and station wires on the protector with the ring conductors (single tracer or red wires) connected to the right-hand terminals of the protector. Unused station wire conductors should be looped back and coiled around the station wire jacket or stored in such a manner as to prevent them from coming into contact with protector terminals or bare wires.

4.05 Current production 123- and 128-type protectors are manufactured with two nuts on each line terminal. Terminate line wires under the bottom washer and nut. After tightening the bottom nuts, place station wiring under the top nuts. Use washers between wires when more than one wire is placed under a nut. Use caution when terminating small gauge station wires on the protector terminals as the wire may catch in the threads of the terminal and be cut or broken when nuts are tightened. Older 123- and 128-type protectors have one nut on each line terminal.

4.06 Make sure all nuts are tight.

4.07 Where an acceptable metallic cold water pipe is used as the ground electrode, it is preferable to install the 123- and 128-type protectors directly on the water pipe. Protectors installed in this manner are grounded with a minimum resistance to ground.

4.08 Install protectors on acceptable metallic cold water pipes using one of the following brackets:

- 72A ▶(MD)◀ bracket (Fig. 32)—use with 123A1A and 123E1A protectors for indoor location
- 90A ▶(MD)◀ bracket (Fig. 33)—use with 123B1A, 128A1A-2, or 128E1A-2 protectors for indoor location
- 114A bracket (Fig. 34)—use with 123- and 128-type protectors for indoor or outdoor locations.

4.09 The 114A bracket can also be used to install the 123- or 128-type protectors directly on power service entrance conduit.

4.10 Use the 150B cover to protect the 123- and 128-type protectors that are installed on a 114A bracket at outdoor locations.

4.11 To install the 72A ▶(MD)◀ or 90A ▶(MD)◀ bracket:

(1) Place a B station ground clamp through slots in the bracket (Fig. 35).

(2) Attach the B station ground wire clamp to an acceptable metallic cold water pipe in the usual manner.

(3) Remove the screw or bolts from the bracket and slide the protector in place, making sure the notched portion of the bracket is under the pronged washer of the ground terminal of the protector.

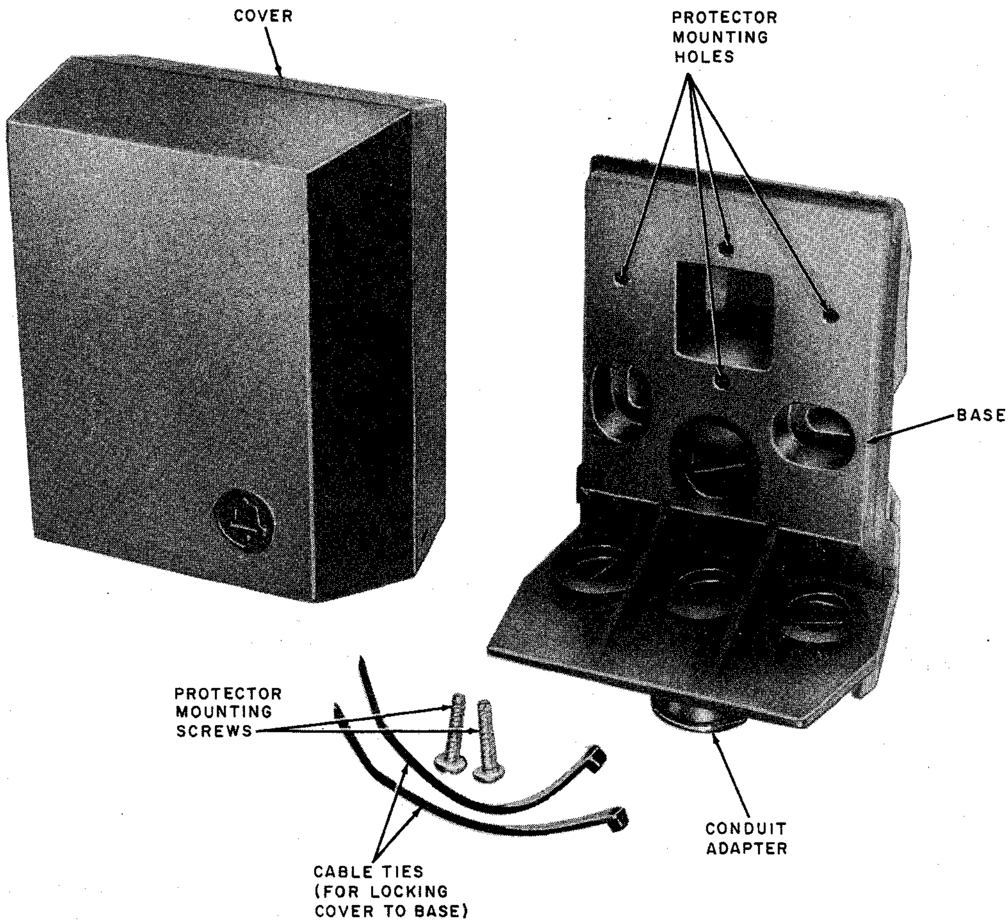


Fig. 22—B Customer Service Closure

(4) Place the mounting screw furnished with the 72A ▶(MD)◀ bracket through the bottom mounting hole of the 123- or 128-type protector and into the threaded hole in the bracket

or

Place the mounting bolts furnished with the 90A bracket through the side mounting holes of the 123- or 128-type protector and through the holes in the bracket. Thread nuts on the mounting bolts.

(5) Tighten mounting screw or bolts (Fig. 36).

(6) Install Form E-3013B. This form may be placed on the B station ground clamp (Step 2).

4.12 To install the 114A bracket:

(1) Place a B station ground clamp through slots in the bracket. Select horizontal or vertical slots in the bracket, whichever will

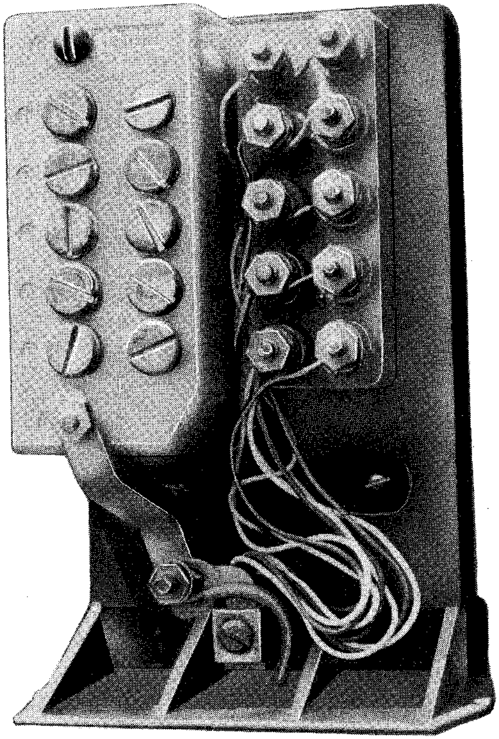


Fig. 23—▶142A1A Protector in C Customer Service Closure◀

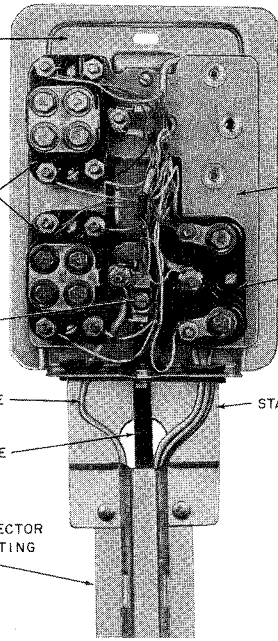


Fig. 24—▶93D1 (MD) Protector Mounting Installed on Protector Mounting Post◀

permit mounting the bracket in an upright position.

(2) Attach the B station ground clamp to an acceptable metallic cold water pipe or to the power service entrance conduit in the usual manner (Fig. 37).

(3) Mount the 123- or 128-type protector on the 114A bracket using the two No. 8-32 self-tapping screws furnished with the bracket.

(4) Connect the 2-inch length of copper wire (attached to the bracket) under the pronged washer of the protector ground terminal (Fig. 38).

(5) Connect service wire and station wires in the usual manner.

(6) Install Form E-3013B. This form may be placed on the B station ground clamp (Step 2).

(7) Install 150B cover at outdoor locations, where mechanical protection is required, or where appearance is a factor.

4.13 The 6A3A terminal blocks are installed in a PC6 (Fig. 11) or PC12 cable closure as follows:

(1) Remove upper front cover from the cable closure.

(2) Loosen captive screw at top of backboard and tilt backboard forward.

(3) Insert mounting studs of the 6A3A terminal block through the holes in the backboard (starting at the top left).

(4) Thread nuts on mounting studs and tighten.

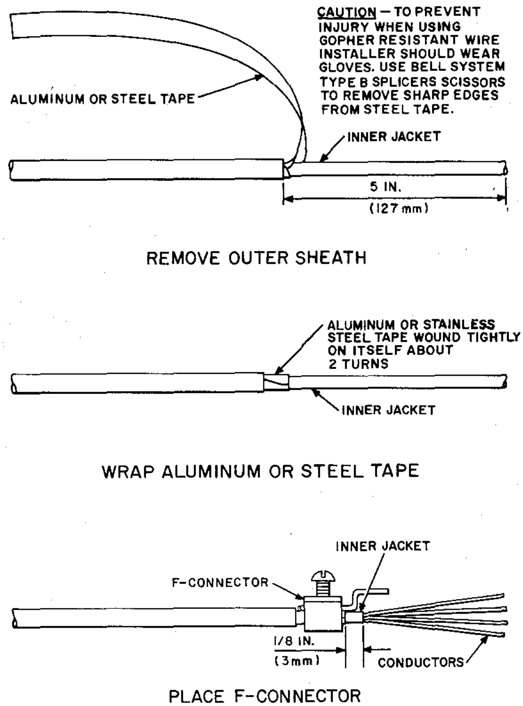


Fig. 25—Preparing B or C Service Wire for Bonding of Metal Shield

(5) Secure the backboard in the upright position.

(6) Run a No. 6 ground wire from the ground connector mounted on the grounding and bonding bar to an approved grounding electrode.

(7) Join the terminal block leads to the cable pairs with approved wire connectors.

(8) When a signal ground is required and there are no facilities for a signal ground at the telephone location, a 2A ground strip can be mounted on the backboard of the cable closure and used for a signal ground terminal. The 2A ground strip must be provided separately.

(9) Using plastic cable ties, dress cable closure per Fig. 11.

(10) Replace upper front cover on the cable closure.

Note: If the station wires are being brought in through the back of the closure, it will be necessary to remove the knockout from the back of the closure. ***Seal this opening with duct seal.*** If closure is mounted on a combustible wall, place metallic conduit from the knockout through the wall.

4.14 The 116C protector is wall mounted via two screws. The protector may be mounted horizontally or vertically. When mounted horizontally, the protector should be positioned so the cover drops down.

4.15 The 117B protector is wall mounted via two screws and may be mounted in the horizontal or vertical position.

4.16 Multipair protectors are generally placed at the time cable facilities are installed or are installed as specified by detailed plans. When

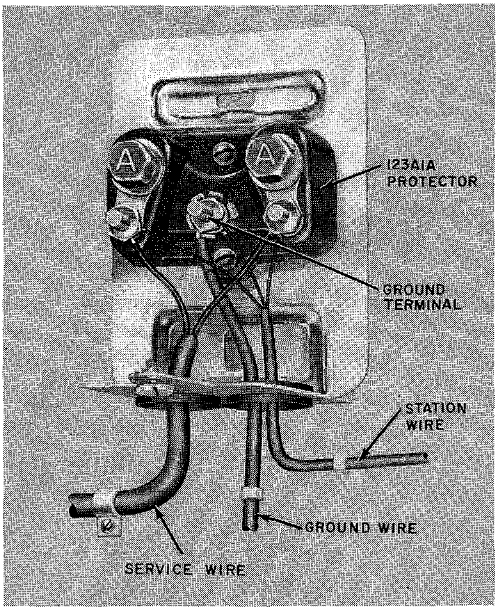


Fig. 26—123A1A Protector Installed in 305A2 (MD) Protector Mounting

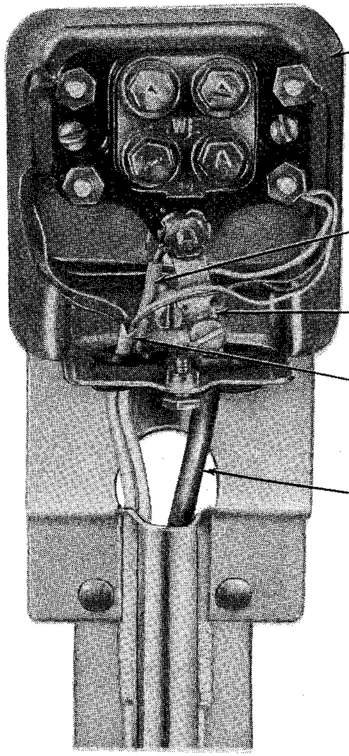


Fig. 27—➧305A2 (MD) Protector Mounting Installed on a Protector Mounting Post➧

multipair protectors are to be otherwise installed, reference should be made to the section pertaining to the particular protector being installed (Table C).

5. FUSED PROTECTORS

5.01 The 1293C ➧(MD)➧ protector (Fig. 39) is used for outdoor installations and the 106C protector (Fig. 40) is used for indoor installations. These protectors are the same except the 1293C ➧(MD)➧ protector is comprised of a 106C protector enclosed in a 93C ➧(MD)➧ protector mounting (Fig. 41).

5.02 The 106C protector consists of a base of nonconductive material containing five binding posts, two 11C fuses (Fig. 42), and two 2A1A protector units.

5.03 Where it is necessary to protect more than one pair of wires with fused-type protectors, additional 1293C ➧(MD)➧ or 106C protectors must be used.

5.04 Where the 106C protector is installed indoors, it must be mounted where the drop or service wire enters the building, keeping the length of drop or service wire within the building to a minimum.

5.05 Insulated building attachments must be used for attaching drop or service wires to combustible surfaces where fused protectors are used. Also, insulated tubing must be used where drop or service wires are fed through combustible walls.

5.06 ➧When the 106C protector is installed outdoors, use a C (Fig. 43) or D customer service closure. Where this combination is used to terminate buried service wire, mount the protector upside

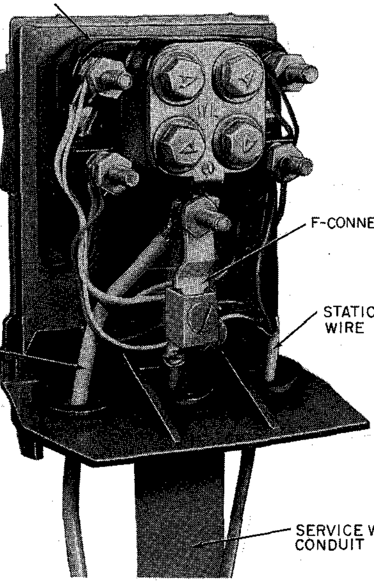


Fig. 28—Typical Protector Installation Using B Customer Service Closure

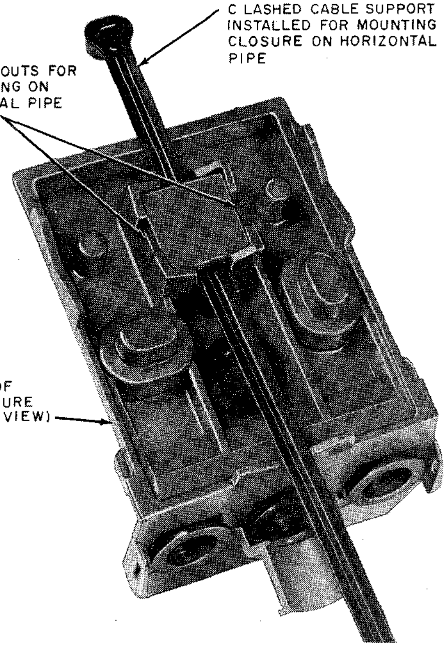


Fig. 29—Installation of C Lashed Cable Support on B Customer Service Closure

down in the closure so the ground terminal is at the bottom. This will facilitate the F connector.

The conductors of the buried service wire must be connected to the line terminals (marked L) at the top of the protector, while the station wiring must be connected to the bottom terminals (marked I).

5.07 At older installations, the 98A (MD) protector may still be in use. The 98A (MD) protector (Fig. 44) consists of a base of nonconductive material containing five binding posts, two 11C fuses, and a carbon block protector well arranged for the use of No. 26 and No. 27 protector blocks. For outside installations, the 98A (MD) protector is mounted in a 93C (MD) protector mounting.

6. GROUNDING AND BONDING

All protector grounds and bonds should be as short and as straight as practical and should be located where future visual inspections can be made. Avoid making sharp bends in grounding and bonding conductors.

6.01 Before selecting a protector ground, determine how the power service is grounded (Table D). The National Electrical Code (NEC) requires that, where available, an acceptable metal underground water pipe system shall always be used as the grounding electrode for the power system and the telephone protector. (An acceptable water pipe electrode is one that has at least 10 feet of metallic pipe buried in the earth and may be either part of a municipal water system or a private well.) The code also requires that, if an acceptable water pipe is not available, the interior metal cold water pipe of the premises must always be bonded to the power ground. Where an acceptable water pipe system is not available, the power service may be grounded to any of the following:

- The metal frame or steel of a building where effectively grounded

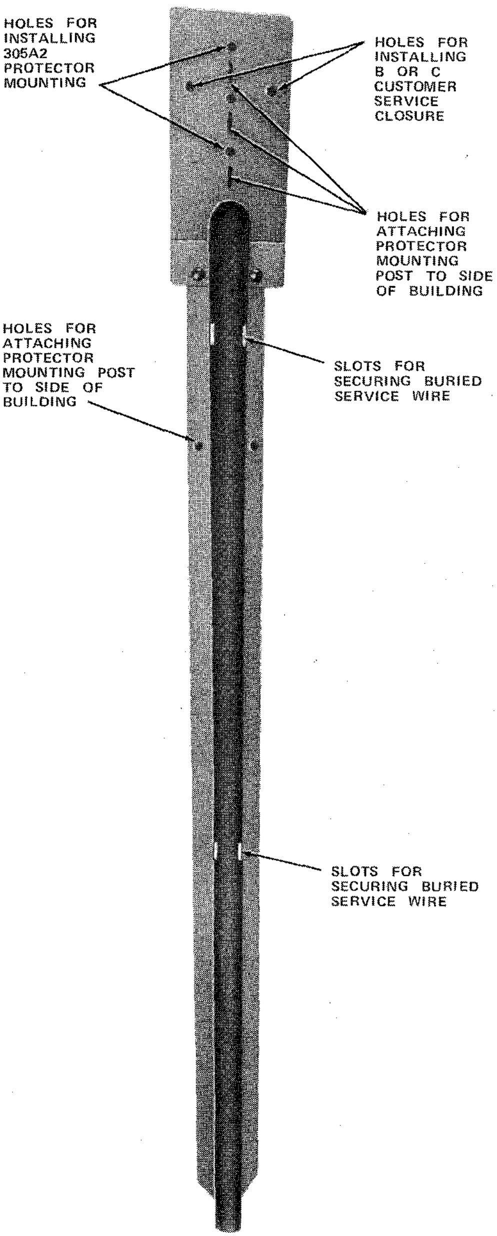


Fig. 30—♦Protector Mounting Post (PMP)♦

- Bare No. 4 or larger copper wire or steel reenforcing rod not less than 20 feet in length and encased in the concrete footing of the building

- A ground rod, galvanized pipe or plate buried in the earth.

6.02 Do not connect station protector ground wires to:

- Gas pipes
- Electrical service branch circuit conduit
- Armor of BX cable
- Interior of any electrical box
- ♦Aluminum conductors or conduit.

6.03 Connections may be made to aluminum power service ground conductors only when it is necessary to bond to an interior metallic water pipe. See Table F for proper connector for aluminum attachments.♦

6.04 Station protectors installed at locations with the power grounded to an acceptable water pipe, as described in paragraph 6.01, should be grounded as shown in Fig. 45 or installed directly on the water pipe.

6.05 Station protectors installed at locations where the power is grounded to a concrete encased electrode or to grounded building steel should be grounded as shown in Fig. 46 and 47.

6.06 Where the power is grounded to a ground rod and an acceptable water pipe or building ground does not exist, it is necessary to know if the power service is MGN (multigrounded neutral). This information should be obtained according to local instructions. Station protectors installed where an MGN power system is grounded to a ground rod should be grounded as shown in Fig. 48. Where a non-MGN power system is grounded to a ground rod, protectors should be grounded as shown in Fig. 49.

6.07 ♦The current NEC stipulates the electric service must use a ground rod in addition to a water pipe ground. Where the power is grounded in this manner, it is unnecessary to install

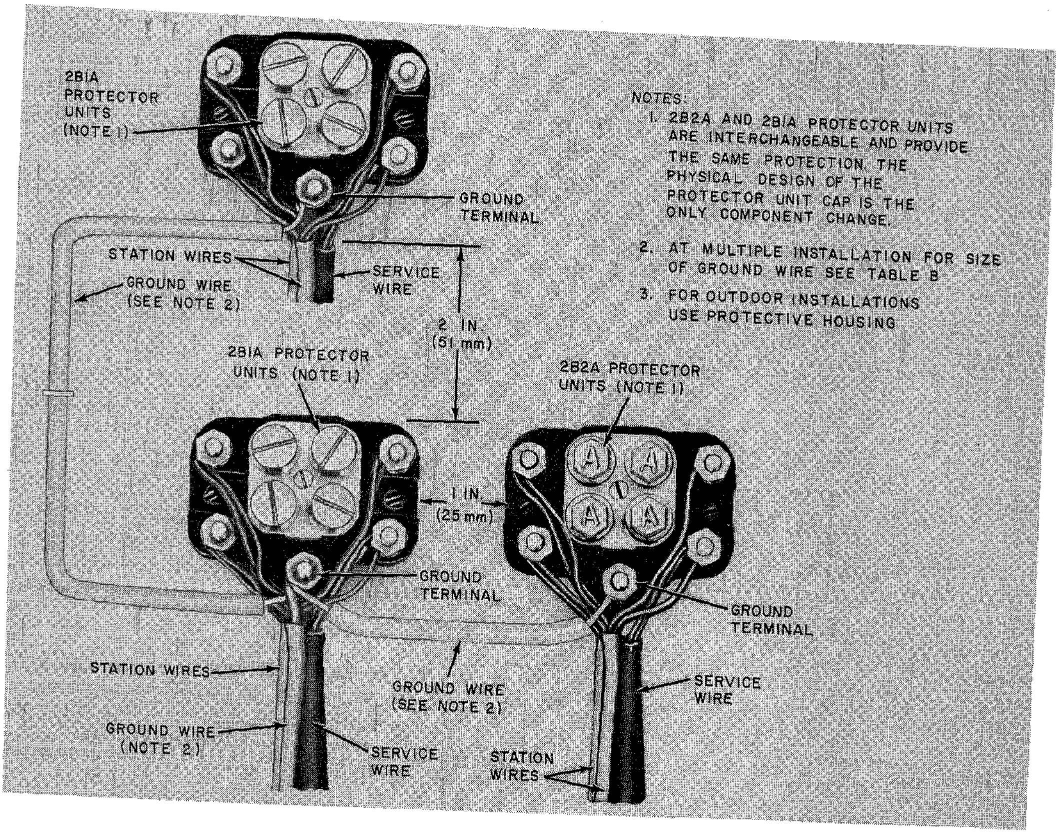


Fig. 31—♦Installation Protectors in Multiple♦

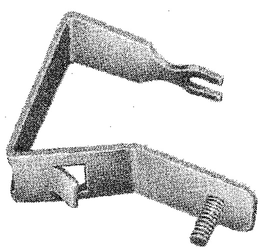


Fig. 32—72A Bracket

a separate ground rod, and the protector should be grounded as shown in Fig. 45.♦

6.08 ***Where the power ground is not bonded to the interior metal cold water pipe as described in paragraph 6.01, place a bond between the power service ground and the cold water pipe using a No. 6 ground wire.***

6.09 Telephone service may be installed where a power ground is not provided. However, the customer should be informed immediately of the need for a power ground and be requested to notify the telephone company when the ground has been provided. The procedure for notifying the

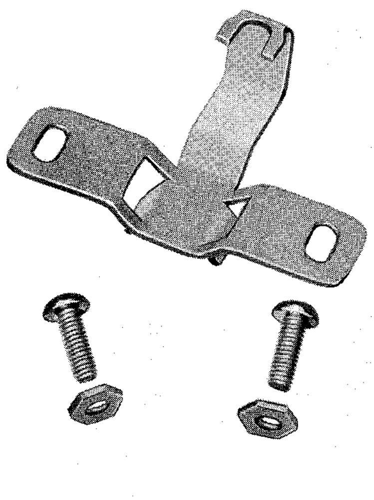


Fig. 33—▶90A Bracket

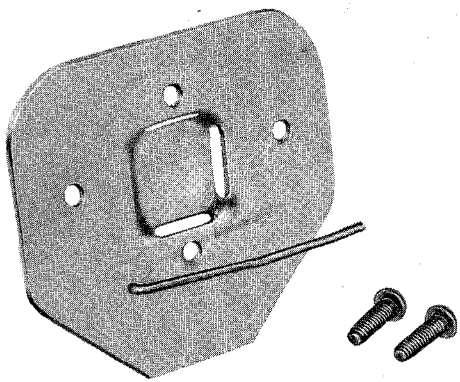


Fig. 34—114A Bracket

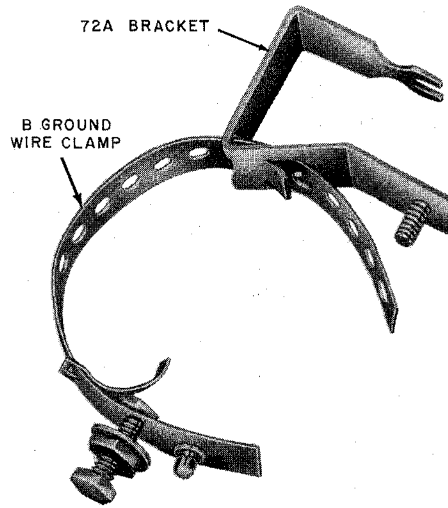


Fig. 35—B Station Ground Clamp Through Slots in 72A Bracket

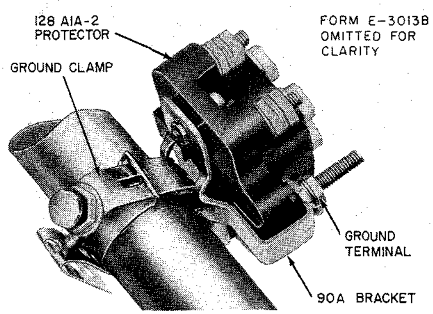


Fig. 36—Protector Installated on Metallic Water Pipe

customer shall be covered by local instructions. Station protectors installed where there is no power, or the power ground is inaccessible, should be grounded as shown in Fig. 50 or 51.

THINK ***Caution should be exercised on visits (installation or repair) to locations where structures are under construction or are being remodeled. At these locations, temporary power and water pipe arrangements are often encountered. Therefore, it is very important to select a ground electrode of a permanent nature. Also, ground wire runs***

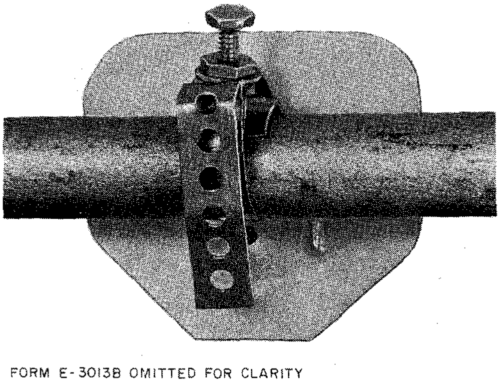


Fig. 37—114A Bracket Installed on Water Pipe or Power Entrance Conduit

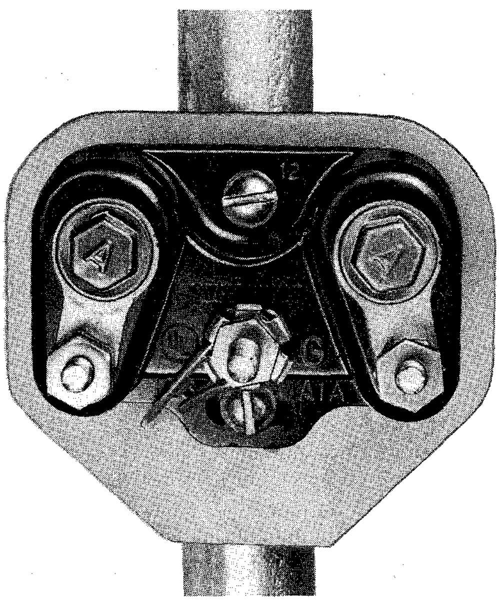


Fig. 38—Ground Wire of 114A Bracket Connected to Protector Ground Terminal

should be made in such a manner they will not be removed, changed, broken, or present a hazard.

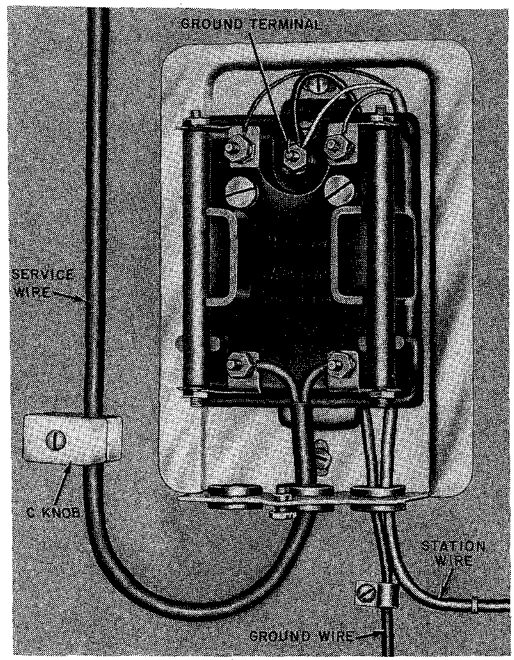


Fig. 39—1293C (MD) Protector, Cover Removed

6.10 Use Table D to select the best protector ground. Table D is designed to help identify the best ground electrode available for most job situations. The decision blocks contain questions regarding the conditions for grounding, the responses to which will lead to the selection of an acceptable ground. The table should be followed until the last block in the path is reached. The referenced notes and figures (Fig. 45 through 51) provide additional information and installation procedures.

6.11 See Table E for ground clamp selection. See Table F and Fig. 25, 52, 53, 54, and 55 for wire connectors. Connections to building steel may be made by using a C or D insulator support (Fig. 56).

6.12 ♦Do not connect protector grounds to ***aluminum power ground conductors.***♦

6.13 If the power ground wire is enclosed in metallic armor or conduit, the metallic armor

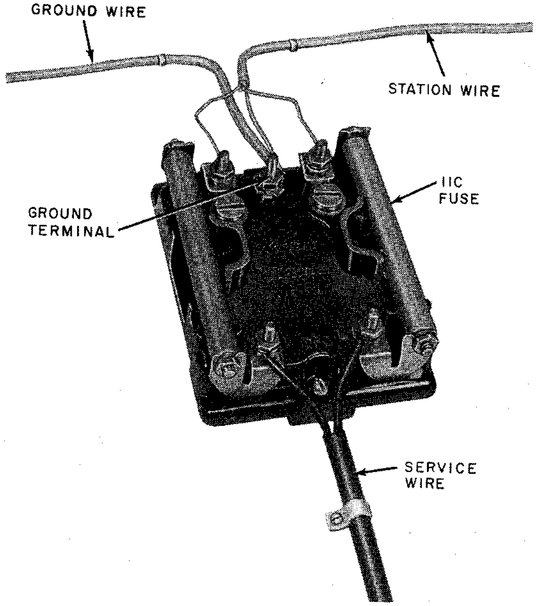


Fig. 40—106C Protector

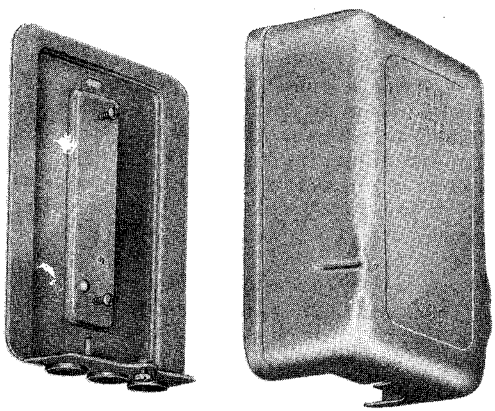


Fig. 41—93C (MD) Protector Mounting

or conduit may be considered as the grounding conductor when making connections.

6.14 Metallic power service entrance conduit may be used for the protector ground instead of the power ground wire, and the protector can be mounted on the entrance conduit by using a 114A bracket. (Refer to paragraph 4.12 for installation of the 114A bracket.) The power service entrance conduit is the conduit through which the power service conductors feeding the premises enter the box containing the main power breaker or fuse.

6.15 Where protectors are located so that running wire to an acceptable water pipe results in a shorter length of wire than if run to the power ground, the water pipe may be used, ***provided the water pipe is bonded to the power ground.*** An acceptable metallic water pipe is the preferred ground where the power ground is inaccessible or there is no power.

6.16 When installing a protector directly on a metallic water pipe or when connecting the protector ground wire to a water pipe, ***make***

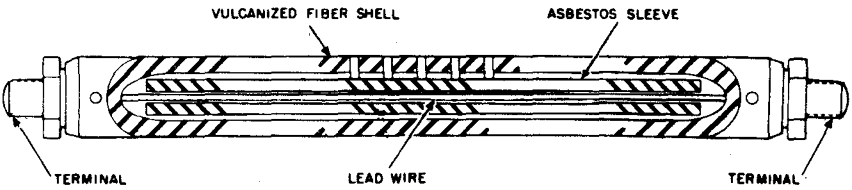


Fig. 42—11-Type Station Line Fuse

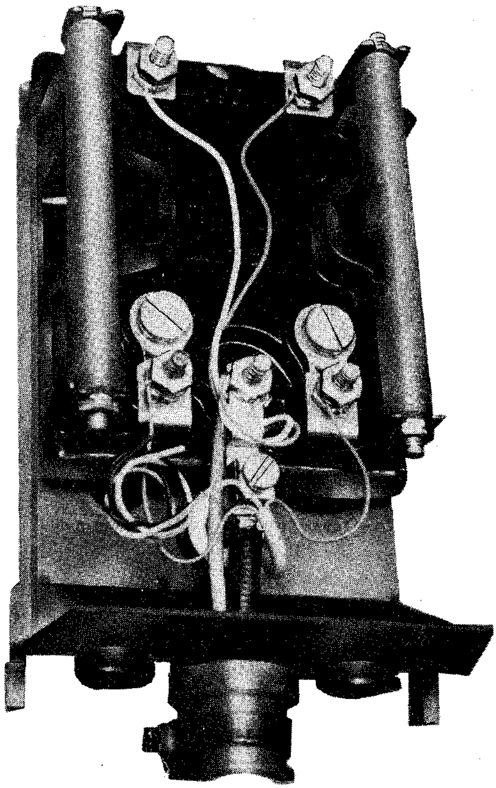


Fig. 43—♦106C Protector in C Customer Service Closure♦

sure the pipe is metallic for at least 10 feet in the earth where it leaves the premises. Determine that there are ***no*** insulating joints, plastic sections, or plastic water meters in the water pipe on which a protector is to be mounted or the ground wire is to be connected. Avoid water pipes having meters, pumps, or valves that may be removed for maintenance. ***Where such pipes must be used, install a bond (of No. 6 ground wire) around the meter, pump, or valve, so the continuity to ground will not be broken.*** ♦When these requirements are in doubt or conditions cannot be met, an alternate ground source must be provided (Table D).♦

6.17 Protectors located remotely from the power service may be grounded to an ***unacceptable*** metallic water pipe or to building steel ***provided that the water pipe or building steel is bonded to the power service ground.*** This is preferable to making very long ground wire runs to the power service ground or to a remote acceptable water pipe.

6.18 Where it is necessary to multiple protector ground terminals, select the proper size ground wire for the number of protectors to be installed, including anticipated growth (Table B). Where more than one protector is installed, use the same size ground wire between protectors as used between the protector and the grounding electrode.

6.19 A continuous length of ground wire should be used for a protector ground. However, the ground wire may be spliced using a sleeve-type splice. When splicing ground wire, consider the following:

- Do not splice new ground wire runs
- Do not splice existing ground wire runs of less than 10 feet
- When splicing an existing ground wire, do not use a smaller gauge wire to extend a larger gauge wire

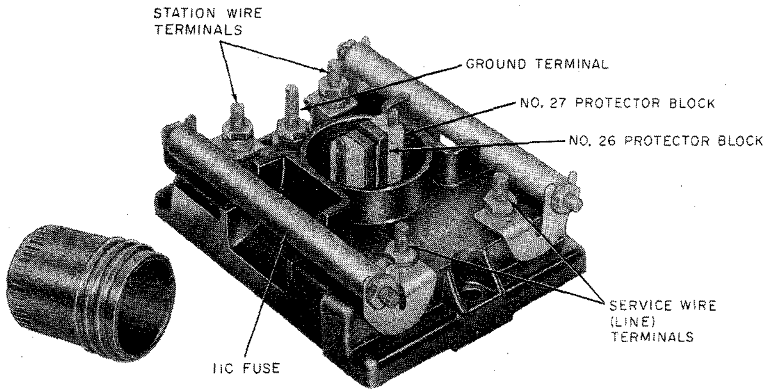


Fig. 44—98A (MD) Protector

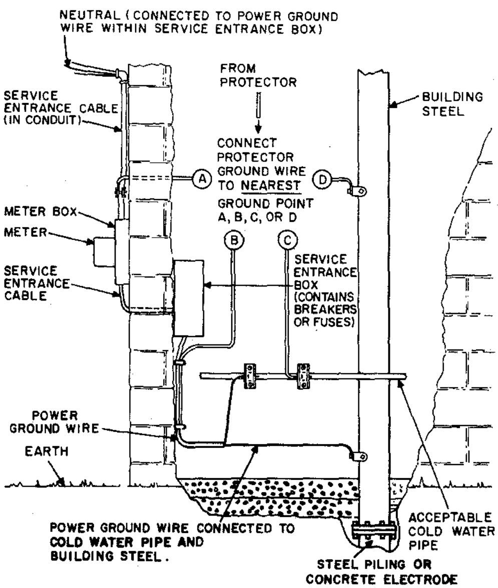


Fig. 45—Acceptable Water System or Building Ground (Power Service Grounded to Cold Water Pipe or Building Steel)

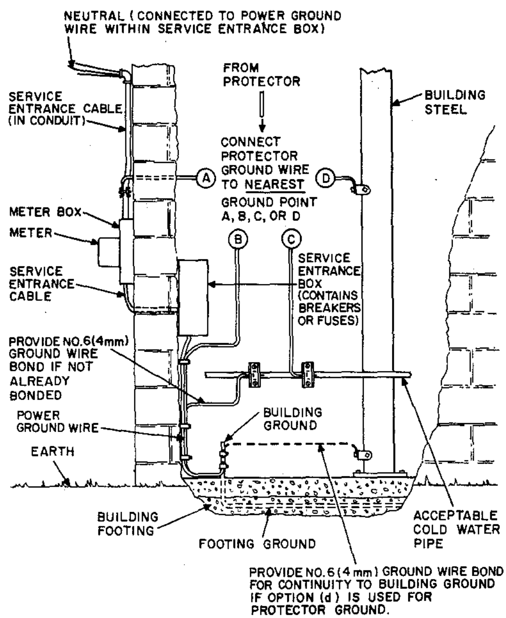


Fig. 46—Acceptable Water System or Building Ground (Power Service Grounded to Footing Ground)

- Concealed ground wire runs may be spliced with the proper size sleeve and wire if the continuity of existing wire is checked and the splice will be accessible
- Do not tape ground wire splices
- Do not locate splice at a corner or turn

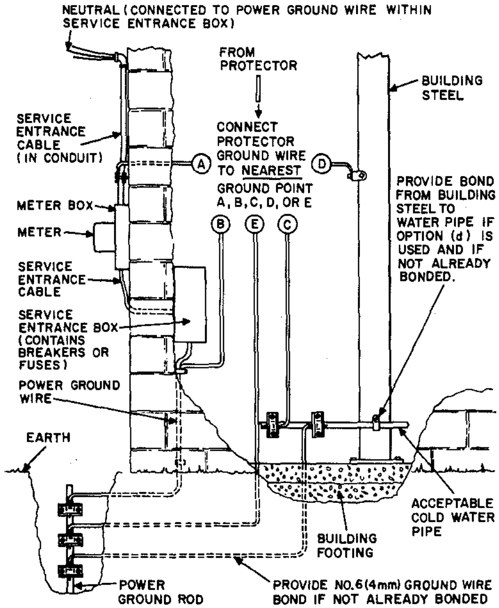


Fig. 47—▶Acceptable Water System (Power Grounded to Ground Rod)◀

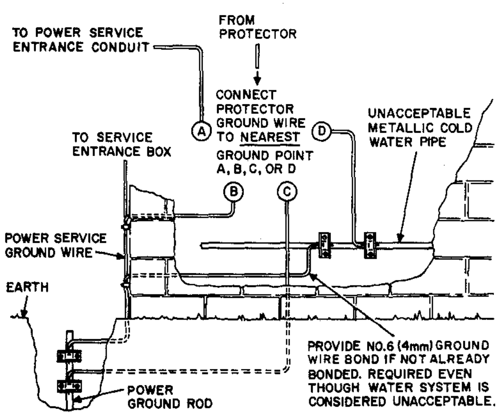


Fig. 48—▶Unacceptable Water System or Building Ground (Multigrounded Neutral Power System Grounded to Ground Rod)◀

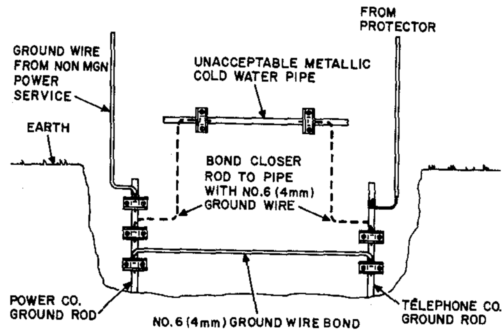


Fig. 49—▶Unacceptable Water System or Building Ground (Nonmultigrounded Neutral Power System Grounded to Ground Rod)◀

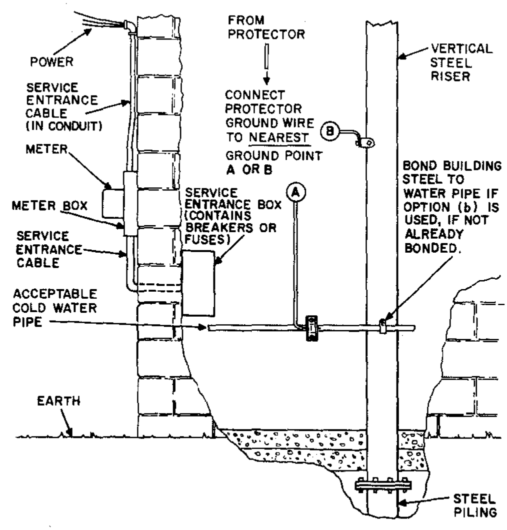


Fig. 50—Acceptable Water System or Building Ground (Power Service Not Grounded)

- A ground wire run shall have no more than one splice.

▶*Note:* Connection to a protector ground terminal or lug ***does not*** constitute a splice.◀

6.20 Refer to Section 461-200-205 for sleeves for splicing ground wire and sleeve pressing tools required.

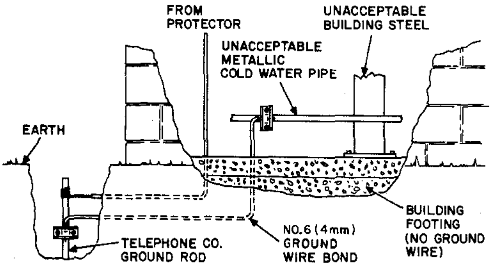


Fig. 51—♦Unacceptable Water System or Building Ground (Power Service Not Grounded)♦

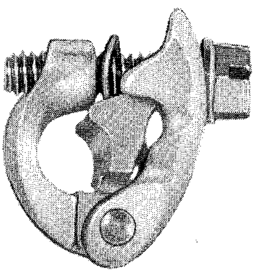


Fig. 52—E Connector

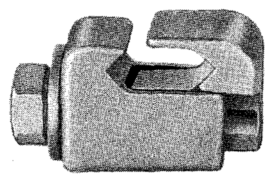


Fig. 53—AT-7796X Connector

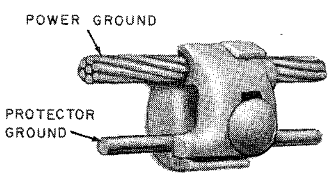


Fig. 54—Blackburn PAC3 Connector

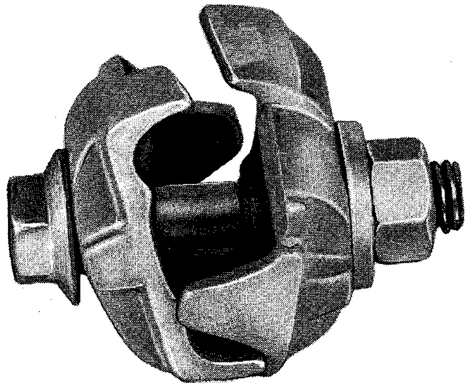


Fig. 55—Fargo GA610C Connector

6.21 Form E-3013B (Fig. 57) should be placed at all ground wire terminations to warn people not to disturb clamps or wire.

6.22 The B station ground clamp (Fig. 58) is installed as follows:

(1) Clean pipe thoroughly.

(2) Back off locknut to head of set screw.

(3) Back off set screw until it does not protrude through the soldered nut.

(4) Place Form E-3013B on strap. Bend strap around pipe and place strap on the rivet using hole in strap that provides the least slack.

(5) Bend strap sharply at next hole beyond rivet.

(6) Tighten set screw. If the set screw is tightened excessively, the clamp will break or set screw will slip off center and copper pipe may be dented. When fastening clamp to copper pipe, avoid making a dent in the pipe that is more than barely perceptible.

(7) Place ground wire under the washer and tighten locknut (Fig. 59).

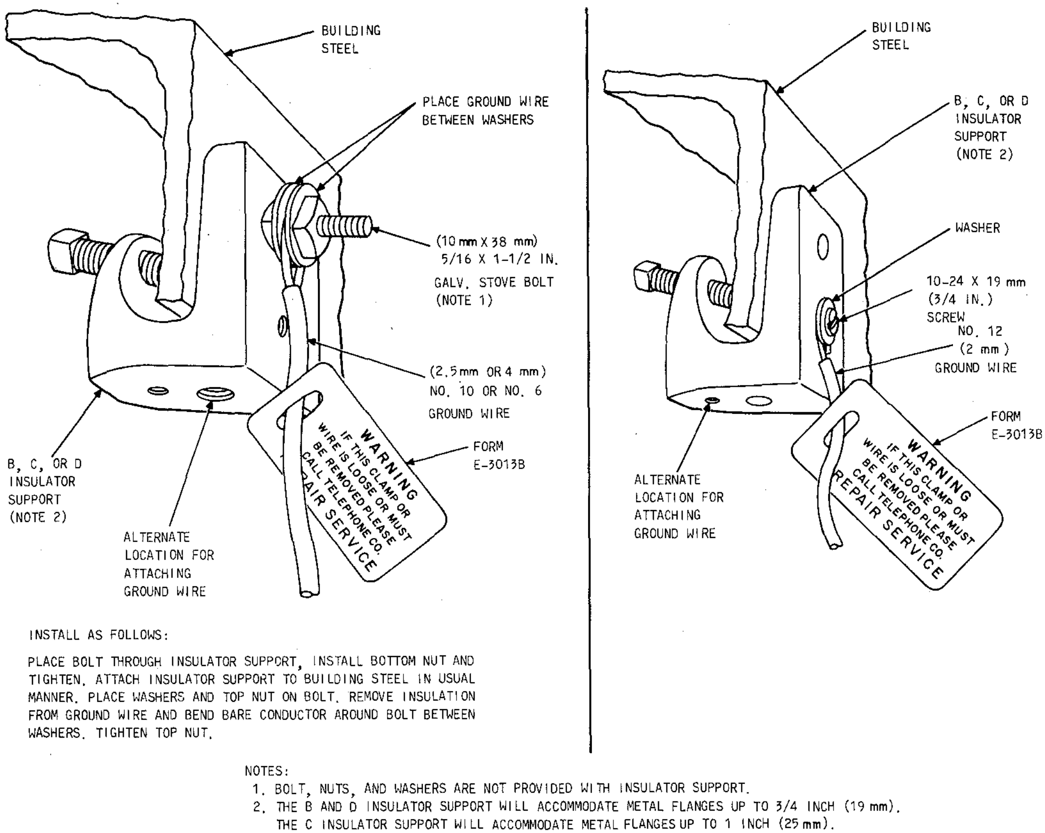


Fig. 56—▶Grounding to Building Steel◀

6.23 The L ground clamp (Fig. 60) is used to terminate No. 6 ground wire and is installed in the following manner:

(1) Clean pipe thoroughly.

(2) Remove approximately 1 inch of insulation from the ground wire and clean conductor.

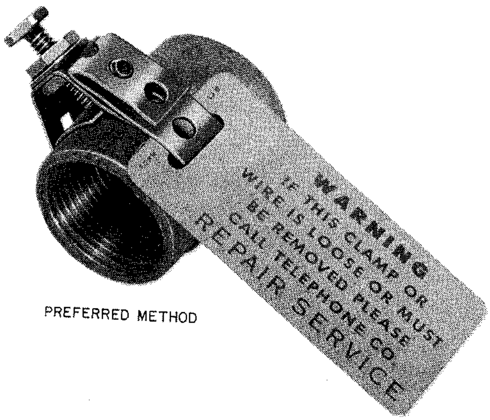
(3) Remove the lower nut and the square washer from the bolt of the ground clamp.

(4) Insert the ground wire conductor into the smaller loop of the ground clamp and secure it by tightening the upper nut on the bolt (Fig. 61).

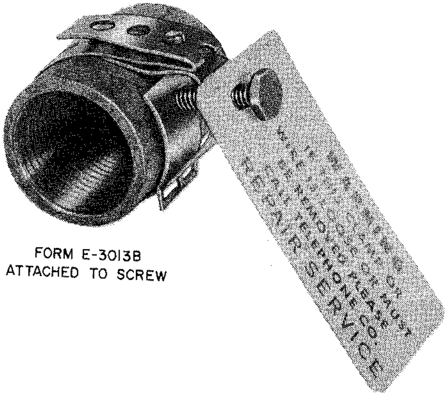
(5) Bend the strap around the pipe and engage the bolt with the farthest possible hole from the end of the strap. (On pipes larger than 3 inches, fasten two straps together [Fig. 62].)

(6) Mount the square washer and lower nut on the bolt of the initial clamp and tighten nut.

(7) Break off excess strap at the square washer and cut off excess length of bolt if it interferes with the installation of the clamp or projects in a hazardous manner (Fig. 63). (See Fig. 64 for typical installations of L ground clamp.)



PREFERRED METHOD



FORM E-3013B
ATTACHED TO SCREW

Fig. 57—Form E-3013B Attached to B Station Ground Clamp

(8) Attach Form E-3013B.

6.24 The B ground clamp (Fig. 65) is installed as follows:

(1) Clear pipe, conduit, or ground rod thoroughly.

(2) Remove approximately 1 inch of insulation from ground wire and clean conductor.

(3) Insert bare end of ground wire under the clamp saddle. Do not place wire directly on the screw.

(4) Tighten the upper screw snug.

(5) Place clamp over ground electrode.

(6) Place Form E-3013B over machine screw, between top and bottom parts of clamp.

(7) Tighten both screws firmly.

6.25 Locate ground clamps at accessible points where they will not be subject to excessive movement, vibration, or damage. Where a pipe is not firmly secured or is subject to vibration, tape the ground wire to the pipe in close proximity to the ground clamp.

6.26 The shield or armor of a small diameter cable, service wire, or underground wire is connected to the ground terminal of a station protector using an F connector. The F connector has a spade tip which can be placed under the pronged washer of the protector ground terminal.

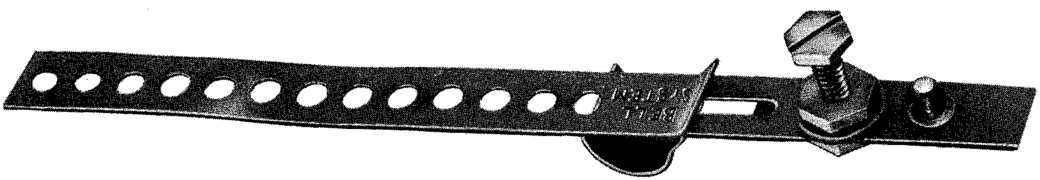


Fig. 58—B Station Ground Clamp

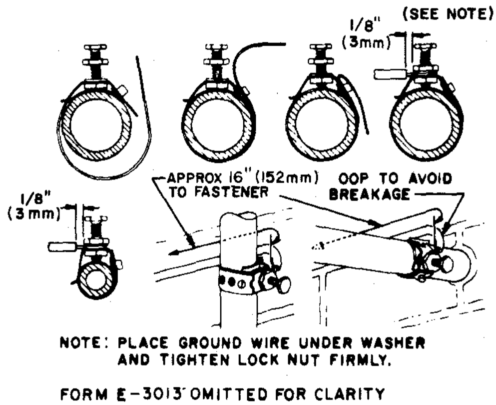


Fig. 59—Installing B Station Ground Clamp

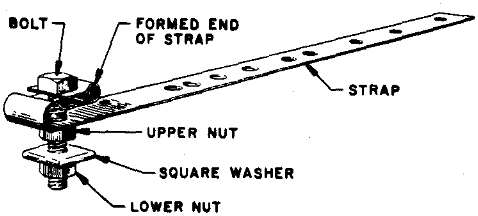


Fig. 60—L Ground Clamp

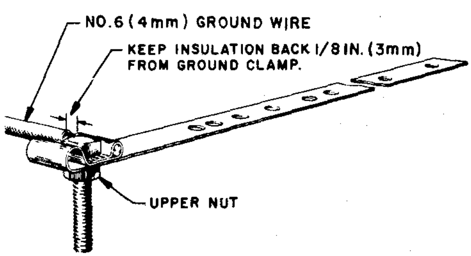


Fig. 61—Attaching No. 6 Ground Wire to L Ground Clamp

The method for installing the F connector on the shield of B or C service wire and connecting service wire to a protector is shown in Fig. 25 and 28.

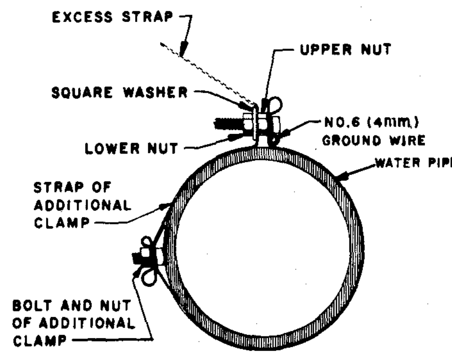


Fig. 62—Attaching L Ground Clamp to Pipes Larger Than 3 Inches

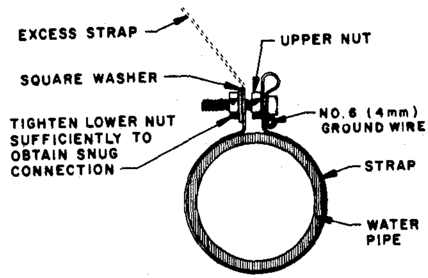


Fig. 63—Attaching L Ground Clamp to 3-Inch and Smaller Pipe

7. SIGNALING GROUND

7.01 Where a signaling ground is required, the protector ground should be used as a first choice. At unexposed stations where there is no protector and telephone apparatus is connected to a telephone company-provided power unit (operated from a commercial power source), the signaling ground should be connected to the power unit ground or to a ground that is bonded to the commercial power ground (Table D). Where there is no protector and the telephone apparatus is not associated with commercial power, any ground suitable for a protector ground should be used (Table D). The shield of a buried service wire or cable may also be used.

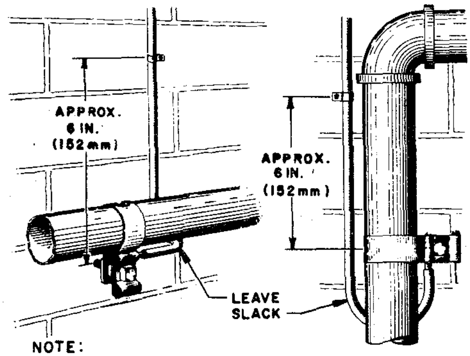


Fig. 64—Typical Installation—L Ground Clamp

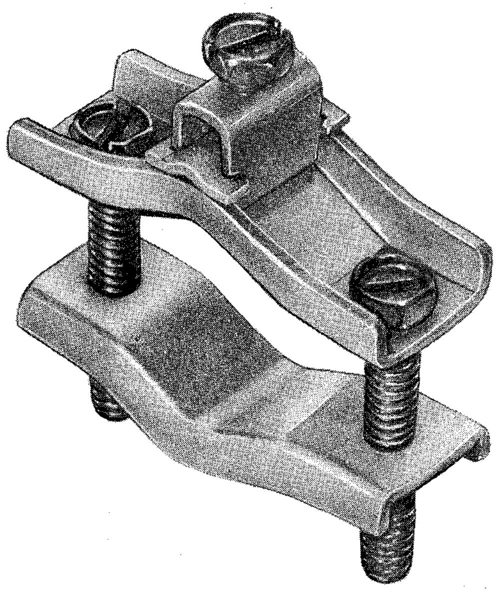


Fig. 65—B Ground Clamp

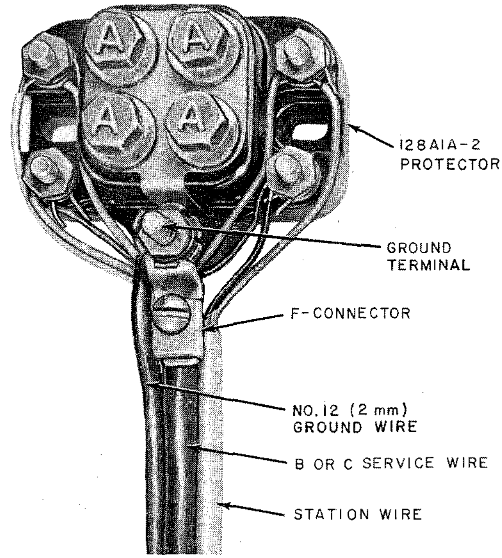


Fig. 66—Service Wire on Protector

7.02 Ground strips are available to provide signal ground terminals (or binding posts) in cable closures, cable terminals, cable terminal sections, or terminal boxes. Where the ground strips are mounted in terminals or on surfaces that are not grounded to a cable sheath or by a separate ground wire, it is necessary to install a No. 12 ground wire from the ground strip to an acceptable ground electrode (Table D).

7.03 The 2A ground strip (Fig. 67) consists of a brass plate with two binding posts. The plate has a "U"-shaped slot for a mounting screw and a depressed tab which prevents the ground strip from turning after it is installed. The 2A ground strip has a capacity of 14 wires. The 2A ground strip installed in a GA-type cable terminal is illustrated in Fig. 68. The 2A ground strip can also be installed on the backboard of a PC6 or PC12 cable closure.

7.04 The 2B ground strip (Fig. 69) consists of an assembly of the 2A ground strip and a mounting bracket (Table G). See Fig. 70 for a typical installation of the 2B ground strip.

7.05 The 4-type ground strips are angular-metal brackets equipped with terminal screws and two binding posts. They are used with 102-type adapters when installed with connecting blocks (Table G). See Fig. 71 and 72 for typical 4-type ground-strip installations.

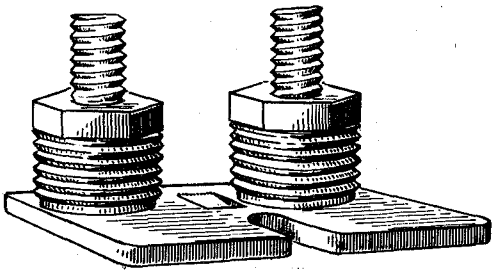


Fig. 67—2A Ground Strip

7.06 The 5A ground strip (Fig. 73) consists of a brass plate with two binding posts. It is intended for use in 10- and 16-pair NC, NE, NF, and NH cable terminals. A hole is provided in the plate of the 5A ground strip for mounting it in a cable terminal using the screw which holds the terminal block in the terminal housing (Fig. 74). The 5A ground strip has a capacity of ten wires.

7.07 The 6A ground strip (Fig. 75) consists of a brass plate with two binding posts. It is intended for use in 26-pair NC, NE, NF, and NH cable terminals and is mounted in the same manner as the 5A strip (Fig. 76). The 6A ground strip has a capacity of ten wires.

> ***Note:*** The NE cable terminals are not provided with grounded housings; therefore, it is necessary to place a bond between the 5A or 6A ground strip and the cable sheath (or to an acceptable ground as outlined in Table D) using a ground wire no smaller than a No. 12 ground wire.

8. COIN STATION GROUND

8.01 The protector ground should be used as first choice for a coin-station ground.

8.02 At unexposed coin stations where there is no protector, any ground that is suitable for a protector ground may be used as a coin ground (Table D).

8.03 Outdoor coin telephones are installed on metal shelves, metal mountings, or in metal booths. If the associated protector ground terminal

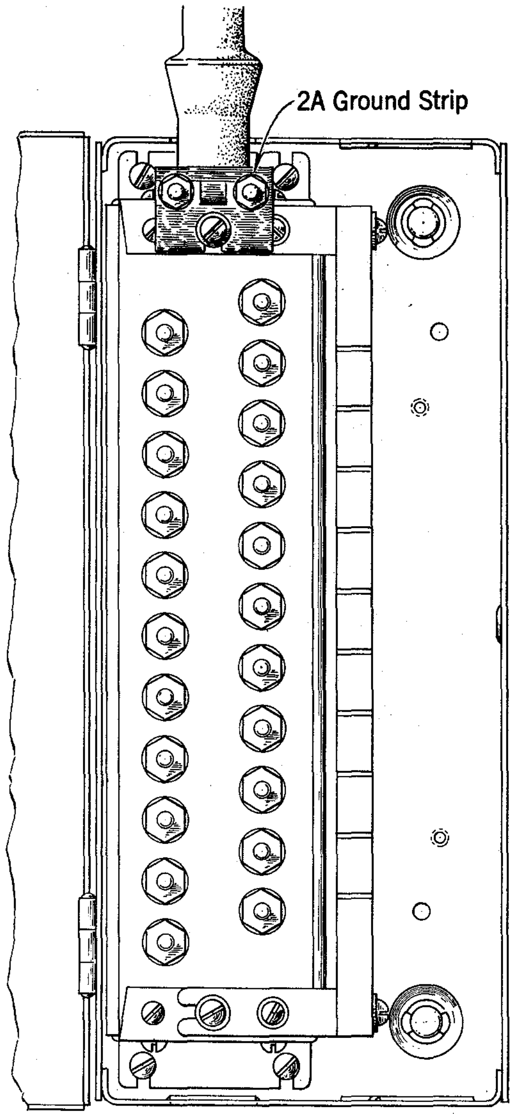


Fig. 68—2A Ground Strip Installed in GA-Type Cable Terminal

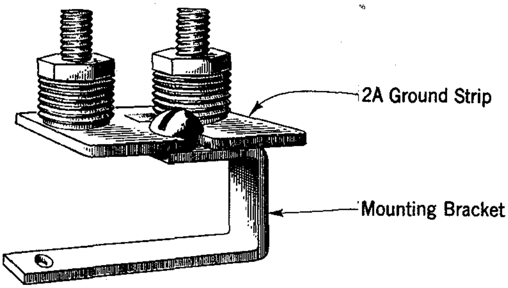


Fig. 69—2B Ground Strip

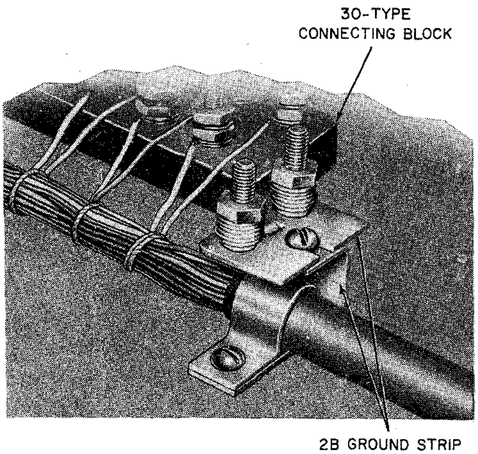


Fig. 70—Typical Installation of 2B Ground Strip

is not already bonded to the shelf, mounting, or booth, this bond must be made using a ground wire no smaller than a No. 12 ground wire.

8.04 When a coin telephone is installed outdoors, a ground rod for protector grounding must be installed unless:

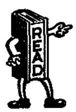
(1) At least 10 feet of metallic conduit buried in permanently moist soil is connected to the coin shelf, mounting, or booth

or

(2) The power ground rod of an MGN power system is bonded to the coin shelf, mounting, or booth with a ground wire no smaller than a No. 6 ground wire

or

(3) An acceptable metal water pipe is bonded to the coin shelf, mounting, or booth with a ground wire no smaller than a No. 6 ground wire.



The grounding conductor (third wire of an electrical wiring system) must never be used as the protector ground.

9. LOCATING AND INSTALLING GROUND RODS

Danger: Avoid personal injury by protecting eyes and hands when driving ground rods. Wear safety glasses and rubber gloves with leather protectors.

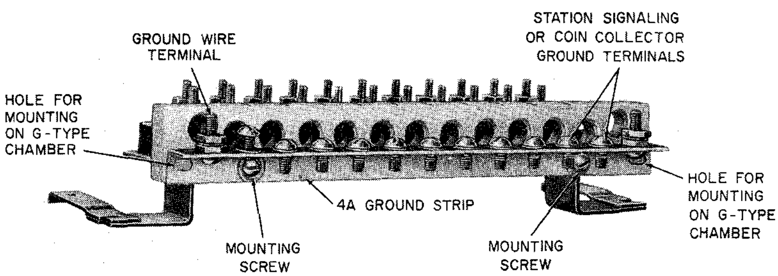


Fig. 71—Typical Installation of 4A Ground Strip

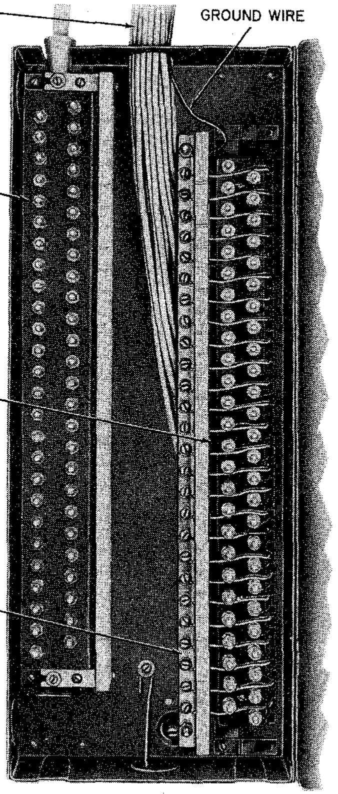


Fig. 72—Typical Installation of 4C Ground Strip

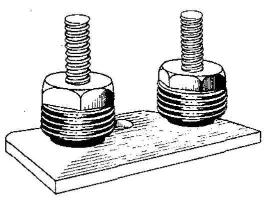


Fig. 73—5A Ground Strip

9.01 Rubber gloves with leather protectors must be worn when driving a ground rod. Avoid bodily contact with the ground rod during this operation. On completion of driving a ground rod, ➧a voltage tester, eg, 188A test set (Stop Lite) or B-voltage tester, ***must*** be used to verify that no voltage condition exists on the ground rod. (Rubber gloves must be worn to test ground when B-voltage tester is used.)➧ If voltage is detected, ***do not proceed*** until the supervisor is notified and the condition corrected.

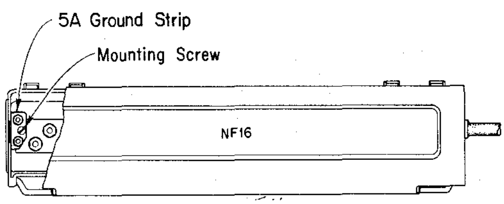


Fig. 74—5A Ground Strip Installed in NF16 Cable Terminal

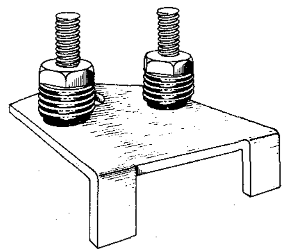


Fig. 75—6A Ground Strip

9.02 Locate and install ground rods as follows:

(a) Where least likely to be damaged or tampered with

(b) As near as practical to masonry walls in earth-floor basements

(c) Approximately 12 inches from outside walls (Fig. 77)

(d) Approximately 2 feet from base of wooden poles or posts where conditions permit

(e) At least 6 feet from power or lightning protection ground rods.

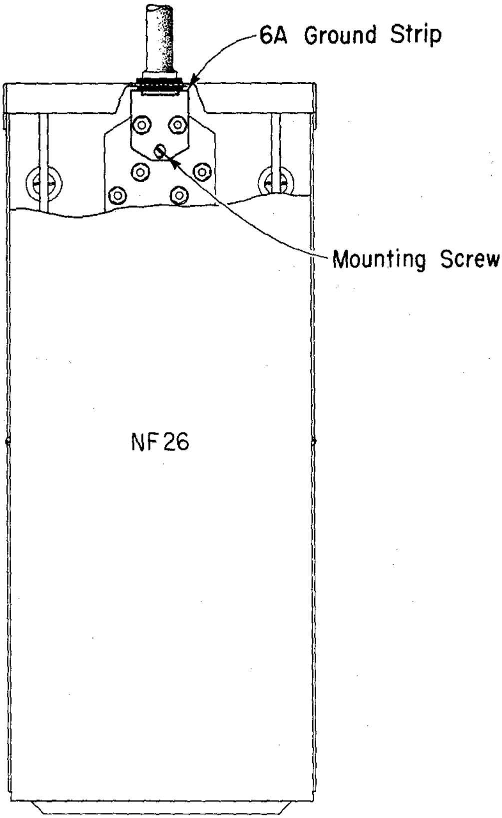


Fig. 76—6A Ground Strip Installed in NF26 Cable Terminal

9.03 Do not unspiral the tail wire attached to the ground rod until just before driving operation is complete. Drive ground rods until the top of the rod is approximately 3 inches below ground level. Increase depth where digging is likely. ♦Use the AT-8911 B trenching tool, or other suitable shovel, to excavate ground to obtain the 3-inch depth.♦

9.04 Avoid making ground wire runs where the wire may be damaged or tampered with. If such locations cannot be avoided, protect the ground wire with station ground wire molding.

THINK ***Check with property owner or manager regarding the location of any underground electric power cable, water, gas, or fuel tank installations before driving a ground rod.***

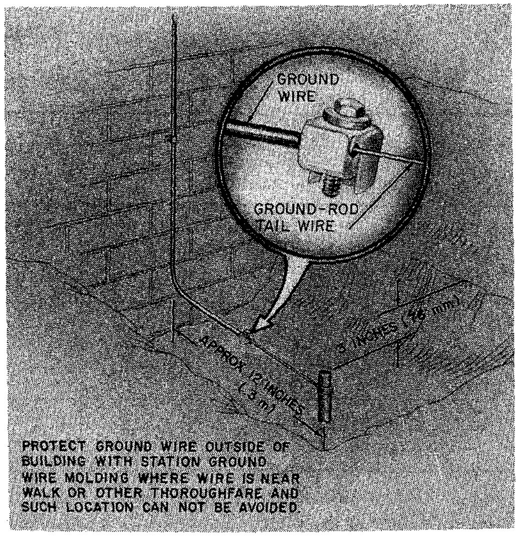


Fig. 77—♦Ground Rod Installed Near Wall♦

9.05 Inspect ground rods before and after driving to make certain that tail wires are not broken. If the tail wire is broken, replace ground rod or use a suitable ground clamp of size or type as listed in Table E.

9.06 ♦After the No. 10 or No. 12 station ground wire is installed, it is attached to the ground rod tail wire with a size 6 AT-7796X connector (Fig. 77). Tighten the ground rod tail and ground wire securely in the connector; ***do not tape this connection.*** If a 6-gauge ground wire must be terminated on the ground rod, select the proper ground clamp per Table E.♦

9.07 When two or more protectors requiring ground rods are installed at the same location, proceed as follows:

> ***Note:*** Use the proper size station ground wire as listed in Table B.

(a) If a power ground rod is not available, install a ground rod for each protector. Bond all

▶TABLE E◀

GROUND CLAMPS

GROUND CLAMP		SEE FIGURE NUMBER	WIRE SIZE	GROUND ELECTRODE (SIZE IN INCHES)	USE
B Station Ground Clamp	6-3/4"	58	No. 12 or	3/8 — 1-3/4	Connect protector ground to water pipe or power service entrance conduit or mount 72A, 90A, or 114A bracket.
	12-1/2"	—	No. 10	1-7/8 — 3	
L Ground Clamp		60	No. 6	1 — 3	Connect protector ground or bond to water pipe or power service entrance conduit.
B Ground Clamp (See Note)		65	No. 6	1/2 — 1	Connect protector ground or bond to ground rod or water pipe.

Note: Use caution when attaching the B ground clamp to copper pipes. The pipes can be damaged by the wire loop in the clamp if the clamp is tightened excessively.

protectors together. Select wire connectors from Table F. No more than three ground rods need be placed. Space ground rods at least 6 feet apart (Fig. 78).

(b) If a power ground rod is available, one telephone ground rod is sufficient. Bond all protectors together and bond telephone ground rod to power ground rod (Fig. 48).

9.08 Multiple station protectors, such as the 116- or 117-type, should ***not*** be connected to a single telephone ground rod unless the rod is bonded to the power system ground rod. If a power system ground rod is not available, a multiple station protector may be connected to an array of three telephone ground rods, spaced at least 6 feet apart, and bonded together with No. 6 ground wire (Fig. 78).

9.09 Always bond ground rods using No. 6 ground wire.

10. INSTALLING SNEAK CURRENT FUSES

10.01 Sneak current fuses are required to provide additional protection for:

- No. 1 and No. 2 ESS Centrex data link cabinet trunks
- No. 1 and No. 2 ESS Centrex attendant trunks
- PBX trunk circuits
- PBX ▶(other than DIMENSION)◀ off-premise ▶stations exposed to power◀
- PBX battery or ringing feed circuits
- Certain special circuits or leased lines.

10.02 Sneak current is foreign current, caused by a "cross" with or induction from power conductors. The sneak current is too low to burn open fusible links of wire or cable and of insufficient voltage to arc over protector blocks or protector units.

10.03 Sneak current protection is provided by the use of heat coils or 60A and 60D fuses ▶in a variety of mountings◀ .

10.04 The 60A and 60D fuses (Fig. 79) are rated 0.350 ampere and differ only in arrangement for mounting. The 60A fuse has a spade terminal and is used with the 94A protector mounting (Fig. 80). The 60D fuse is mounted in a 14A fuse holder (Fig. 81) or 1094A protector (Fig. 82), ▶or 191A1-20 protector (Fig. 83)◀ .

TABLE F

WIRE CONNECTORS

CONNECTOR	FIGURE NUMBER	CONDUCTOR SIZE	USE
E Connector Size 1	52	No. 12 through 4	Connect or bond ground wire to bare power ground wire.
E Connector Size 2		No. 12 through 1/0 and 8 through 4 armored ground wire	Connect or bond ground wire to armored power ground wire.
At 7796X Size 6 Size 4 Size 2	53	No. 12 through 6 No. 8 through 4 No. 6 through 2	(a) Ground station ground wire to ground rod tail wire. (b) Ground shield of cable or buried service wire at terminals or cable closures.
Blackburn PAC3	54	No. 6 through 8 copper to No. 2 through 4 aluminum	Connect No. 6 ground wire to aluminum power ground wire for bonding.
FARGO GA610C	55		
F Connector	25 —	No. 6	(a) Connect service wire shield to protector ground terminal. (b) Connect No. 6 ground wire to ground bracket of cable closure housing.

14A FUSE HOLDER

10.05 A typical installation of the 14A fuse holder and 60D fuse is shown in Fig. 84. The fuse holder fits on the binding post (under the bottom nut) of a protector, protector terminal, or connecting block. One end of the 60D fuse attaches to the fuse holder and the station wire is connected to the other end. This places the fuse in series with the line. As only one station wire can be attached to a fuse, a connecting block arrangement is required to terminate additional station wires.

10.06 Where 134A1A protectors and 66- or 68-type connecting blocks are employed, it is not possible to mount the 14A fuse holder. Therefore, when sneak current fuses are required, one of the following alternatives must be used:

(1) Install an additional connecting block, such as a 57A2-10 or 57A2-16 connecting block, in order to mount the 14A fuse holder as shown in Fig. 85.

(2) Use the 1094A protector, one for each pair of wires

(3) Use the 191A1-20 protector for up to 20 exposed pairs.

1094A PROTECTOR

10.07 The 1094A protector consists of a metal base with two No. 94A protector mountings and two 60D fuses (Fig. 82). When installed outdoors, the 1094A protector is mounted in a 93C (MD) protector mounting.

191A1-20 PROTECTOR

10.08 The 191A1-20 protector (Fig. 83) is a combination protector and terminating field intended for use with 66-type quick-connect hardware.

♦TABLE G♦

GROUND STRIPS

TYPE	BINDING POSTS	TERMINALS	WIRE CAPACITY (QUANTITY)	USED WITH	FIGURE NUMBER
2A	2	—	14	GA-type cable terminal, PC6 or PC12 cable closure	67
2B	2	—	14	30- and 31-type connecting blocks	69
4A	2	11	11	102B adapters when installed with connecting blocks	71
4B	2	16	16	102C adapters when installed with connecting blocks	—
4C	2	26	26	102D adapters when installed with connecting blocks	72
5A	2	—	10	10- and 16-pair NC, NE, NF, and NH cable terminals	73
6A	2	—	10	26-pair NC, NE, NF, and NH cable terminals	75

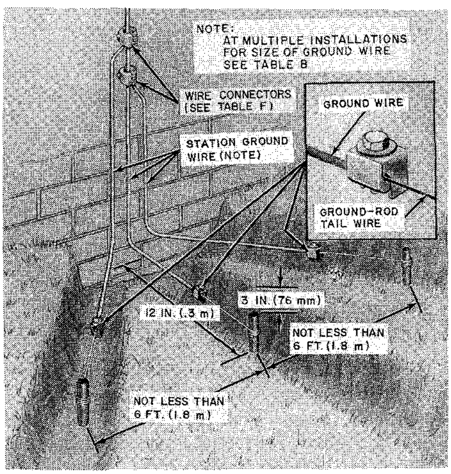


Fig. 78—♦Three Ground Rods♦

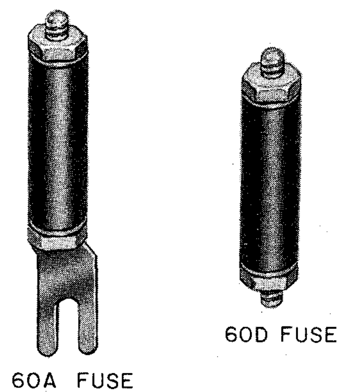


Fig. 79—60A and 60D Fuses

It is factory wired and equipped with forty 60D fuses which will provide sneak current protection for 20 exposed pairs.

10.09 The base of the 191A1-20 protector is identical to the 66-type connecting block

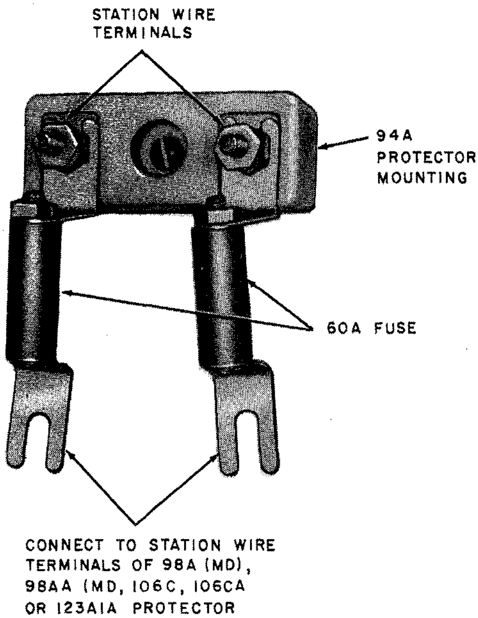


Fig. 80—60A Fuses Connected to 94A Protector Mounting

allowing the protector to be mounted on an 89B bracket.

10.10 A wiring diagram of the 191A1-20 protector is shown in Fig. 86. Pairs requiring sneak current protection are cross-connected to the 191A1-20 protector as indicated (TIP IN, RING IN). Factory wiring is provided through the fuses to TIP OUT and RING OUT connectors.

10.11 To replace a fuse in the 191A1-20 protector, follow the steps indicated in Fig. 87 and 88.◀

11. PBX PROTECTION

▶***Neither 11A1A or 11B1A protector unit should be used with 800A, 801A, and ESS 101 PBXs. (DIMENSION, PBX grounding must be done in accordance with Section 554-101-101.)***◀

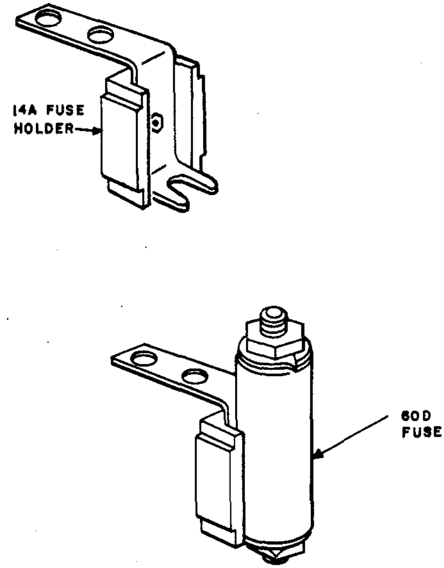
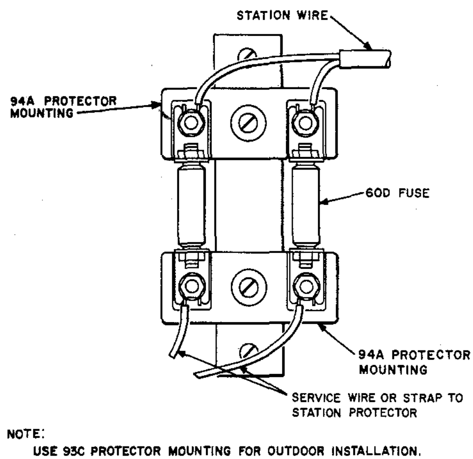


Fig. 81—14A Fuse Holder



NOTE:
USE 93C PROTECTOR MOUNTING FOR OUTDOOR INSTALLATION.

Fig. 82—1094A Protector

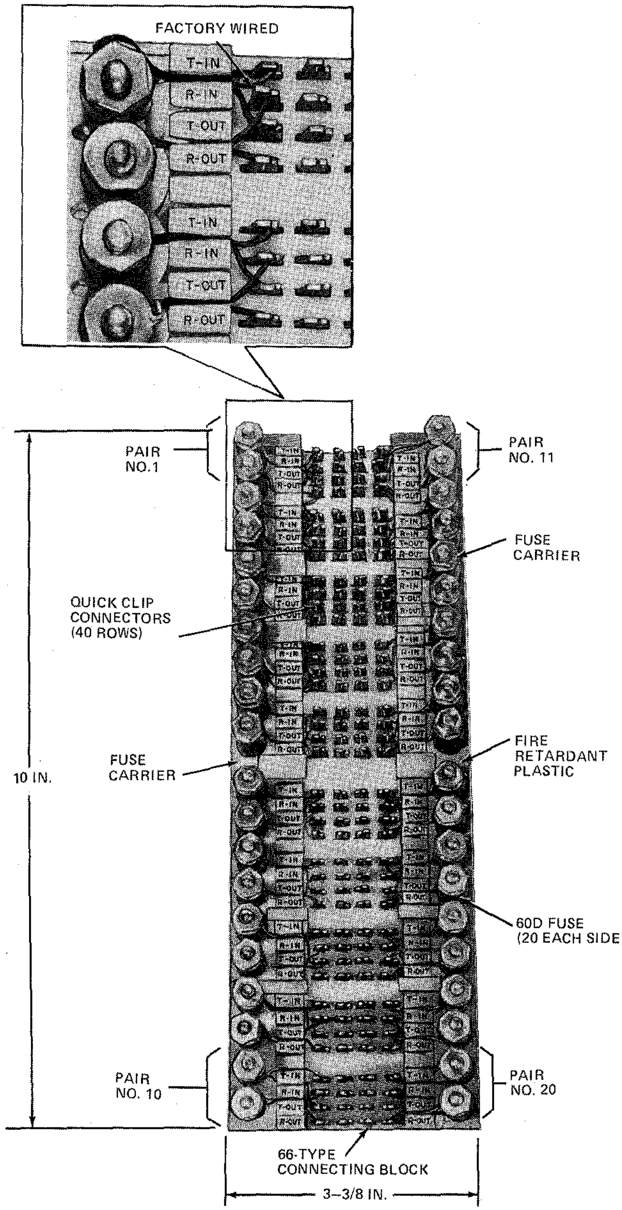


Fig. 83—▶191A1-20 Protector◀

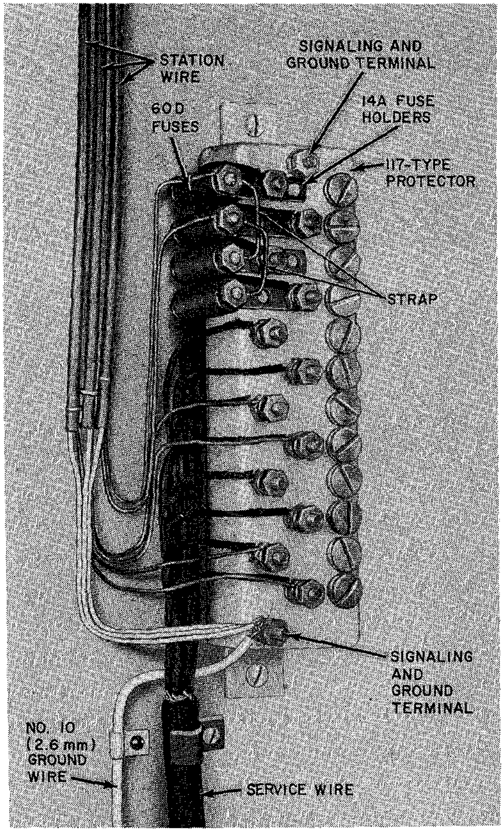


Fig. 84—Method of Installing 60D Fuses and 14A Fuse Holder on 117-Type Protector (Battery Feed Circuit Illustrated)

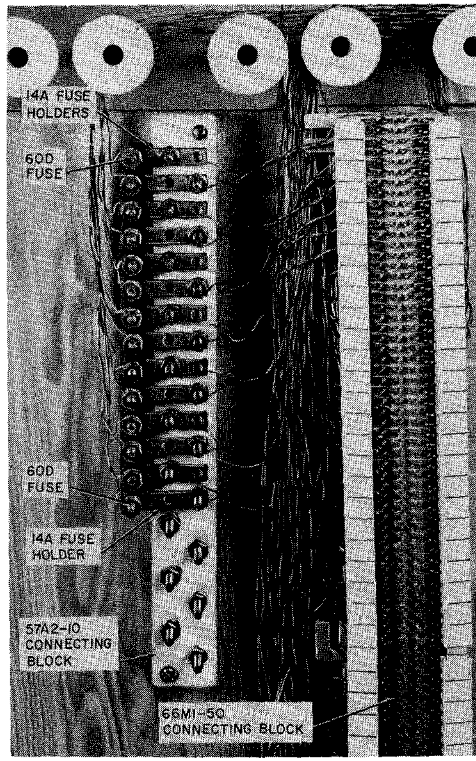


Fig. 85—Sneak Current Fuse Arrangement for 66M1-50 Connecting Block

11.01 In addition to the preceding requirements covering bonding, grounding, and sneak current protection, the following protective measures must be applied at PBX locations.

11.02 The shield of building entrance cables must be bonded to an acceptable ground electrode (Table D). Building entrance cables terminating in 1A4A terminal blocks, NH-type cable terminals, or 134A1A protectors, can be grounded by connecting the ground clamp or ground lug of the terminal block, terminal, or protector, to an acceptable grounding electrode with a No. 6 ground wire. This ground wire ***must*** be installed. The sheath of a building entrance cable is ***not*** a grounding electrode.

11.03 The PBX signaling ground must be connected to the protector ground.

11.04 Sneak current fuses must be provided as specified in paragraph 10.01, or heat coils must be used.

11.05 Exposed off-premises extensions must be provided with protectors at the station end as well as at the PBX end. ➧If exposed to power, sneak current protection is also required.➧

11.06 An older type PBX may have battery and ringing voltages supplied from the central

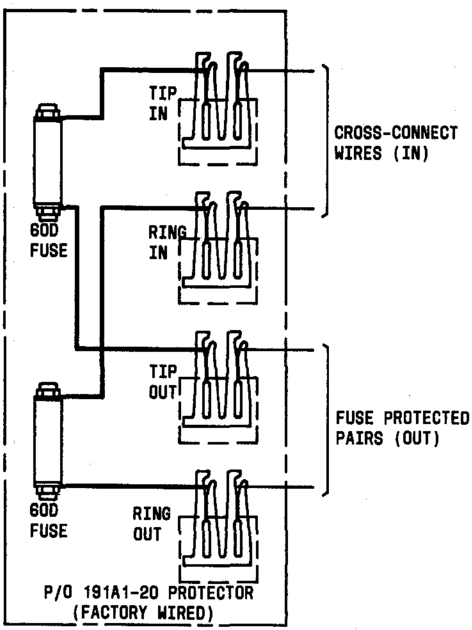


Fig. 86—◆191A1-20 Protector—Wiring Diagram◆

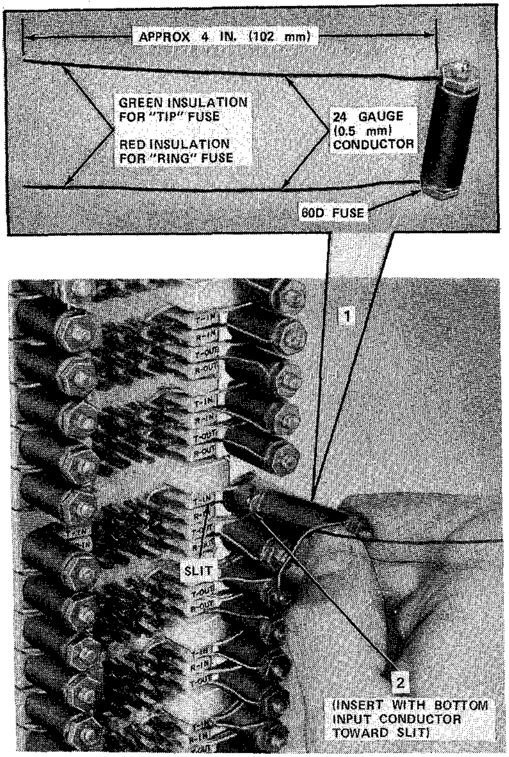


Fig. 87—◆Replacing Fuse◆

office. Also, some newer type PBXs may have battery and ringing voltages supplied from the central office for reserve power in the event of a commercial power failure. When two or more cable pairs are used in multiple to supply battery and these pairs are extended by two or more drop wires, fused-type protectors are required. When the battery supply is extended by a single drop wire, ◆fused protectors◆ are not required. Ringing feeder circuits are fused with 60E fuses.

11.07 The 1094A protector, which may be used where station protectors are not required, used with 134A1A-type protectors or for ringing feeder circuits is shown in Fig. 82.

11.08 Two battery feeder pairs terminated at a 117-type protector equipped with 14A fuse holder and 60D fuses are illustrated in Fig. 84. The pairs are strapped on the PBX side of the fuses.

11.09 A fuseless protector equipped with 60A fuses for outdoor installations is shown in Fig. 89.

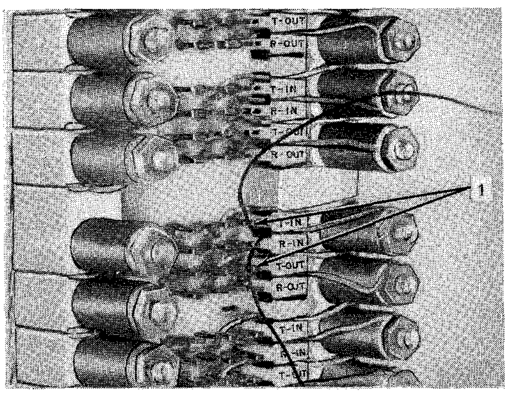


Fig. 88—◆Fuse Replaced◆

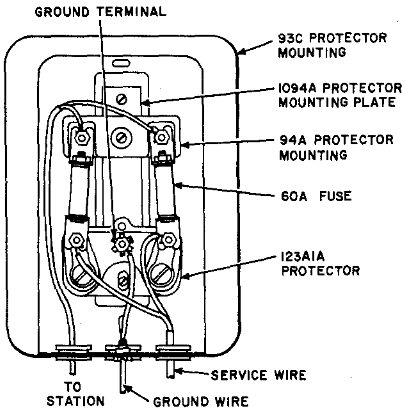


Fig. 89—Fuseless Protector Equipped With Sneak Current Fuses, Outdoor Installation

11.10 A fused protector equipped with 60A fuses is shown in Fig. 90. A converted protector equipped with 60A fuses is shown in Fig. 91.

11.11 Two battery feeder pairs terminated on fuseless station protectors equipped with 60A fuses and bridged to one station wire are shown in Fig. 92.

11.12 A maximum of three service wires furnishing battery for a system may be terminated on one fused protector and must be bridged on the line side of the protector (Fig. 93). In the event more than three service wires are required to extend a battery feed circuit, additional protectors must be installed (Fig. 94). Use two 11C fuses, one for the tip conductors and one for the ring conductors. If it is necessary to strap the conductors at the binding posts, remove the 2A1A protector units and substitute 2A1D (dummy) protector units where fuses have been removed as shown in Fig. 94. On disconnects, replace the 2A1D protector units with 2A1A protector units and replace fuses.

12. EXPOSED DROP WIRES CONNECTED TO UNEXPOSED CABLE

12.01 Drop wires, connected to an unexposed cable terminal and extending into an exposed area, expose both the subscriber station and the distribution cable. To avoid changing the status of the unexposed cable, protectors are required at the junction of the drop wire and the cable.

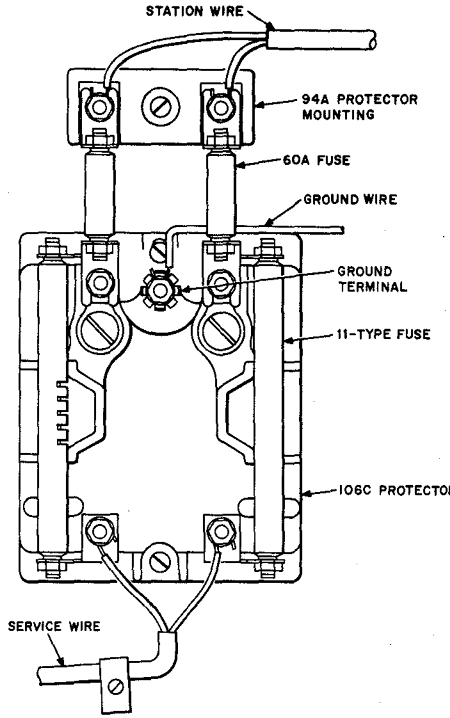


Fig. 90—60A Fuses Used With 94A Protector Mounting and 106C Protector

It is extremely important that telephone craft personnel be informed of locations as described in paragraph 12.01. If service orders do not specify protection required or the cable terminals are not specifically identified, local instructions must provide this information. Where there is any doubt on the part of the telephone craft force, maximum protection should be provided, treating telephone stations as exposed stations.

12.02 Where an exposed drop wire is to be connected to an unexposed pair of 19-gauge

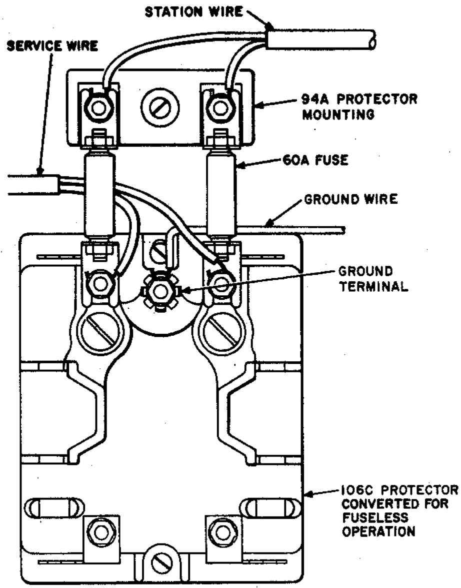


Fig. 91—▶60A Fuses Used With 94A Protector Mounting and Converted 106C Protector◀

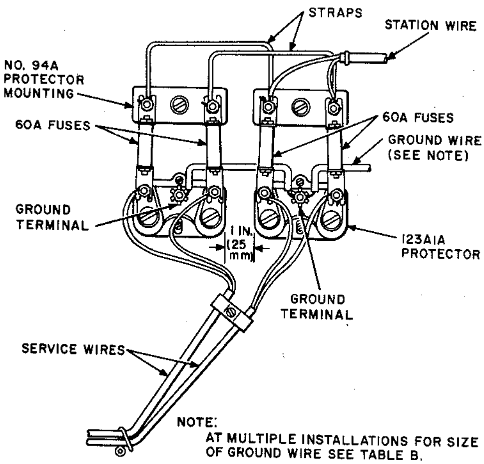


Fig. 92—▶Fuseless Protectors Used for Bridging Service Wires on Battery Feed Circuits◀

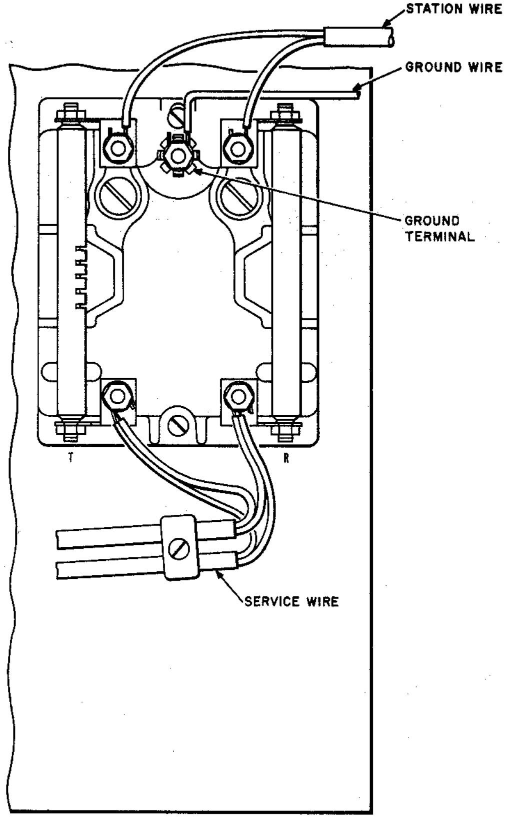
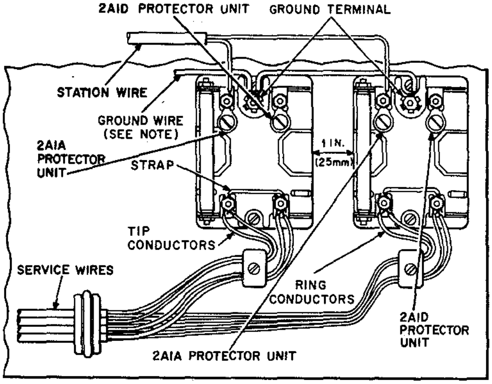


Fig. 93—Two Service Wires Bridged at Fused Protectors

or 22-gauge cable, a fusible link of bridle wire is required between the cable pair and the drop wire, in addition to the protector. In addition, a fusible link is required between the exposed section and a fuseless station protector. Otherwise, a fused protector must be used.

12.03 Protectors must be installed at station locations as well as at terminal locations when exposed drop wires are connected to unexposed cables.

12.04 Where exposed drop or block wires are to be connected to unexposed cables terminated in 49-type terminals, install 3A3-3 protected terminal blocks in place of the unprotected blocks.



NOTE:
AT MULTIPLE INSTALLATIONS FOR SIZE OF GROUND WIRES SEE TABLE B.

Fig. 94—Bridging Four Pairs at Fused Protectors

12.05 Typical wall and pole installations, using protectors for cable protection, are shown in Fig. 95 through 98.

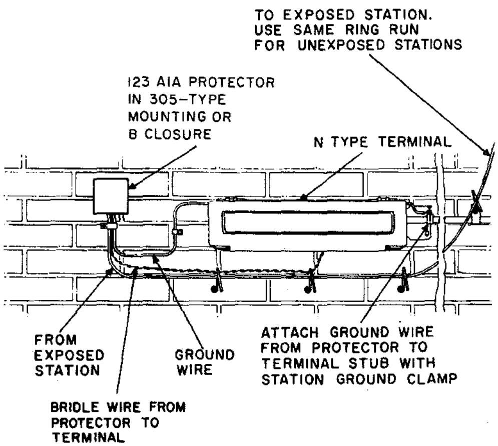


Fig. 95—N-Type Terminal, Wall Installation

NOTE:
ATTACH GROUND WIRE TO 51 TYPE BRACKET WITH CABLE LASHING CLAMP.
(ON N TYPE TERMINAL, ATTACH GROUND WIRE TO CABLE STUB WITH STATION GROUND CLAMP.)

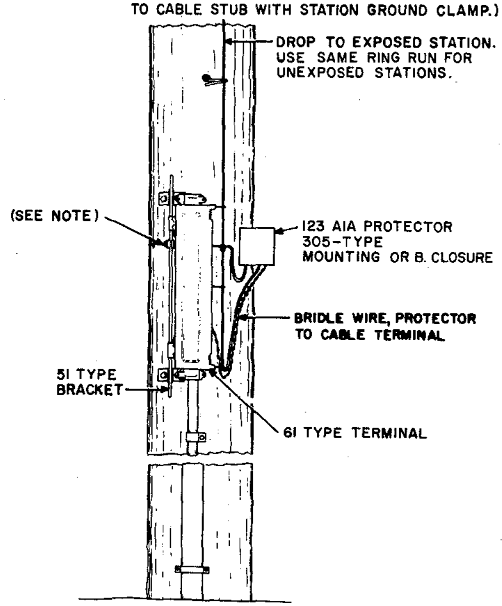


Fig. 96—N- or 61-Type Terminal, Pole Installation

13. 118B PROTECTOR

13.01 The 118B protector (Fig. 99), which supersedes the 99C protector, is designed to protect telephone circuits in the event of an accidental contact between power wires (of the MGN-type and carrying over 2000 volts) and telephone wires. The 118B protector consists of three carbon electrodes, having 0.020-inch gaps, mounted on a porcelain base and enclosed in a rubber case (Fig. 100). Three No. 14 gauge insulated wire leads extend from the bottom of the protector. One lead, 72-inches long, is connected to ground (of the MGN power) and two leads, 36-inches long, are connected to the telephone line wires.

13.02 The 118B protectors are connected to drop wires (Fig. 101) or rural wires (Fig. 102) as specified by detailed plans, telephone company engineering or supervisory instructions. The 118B

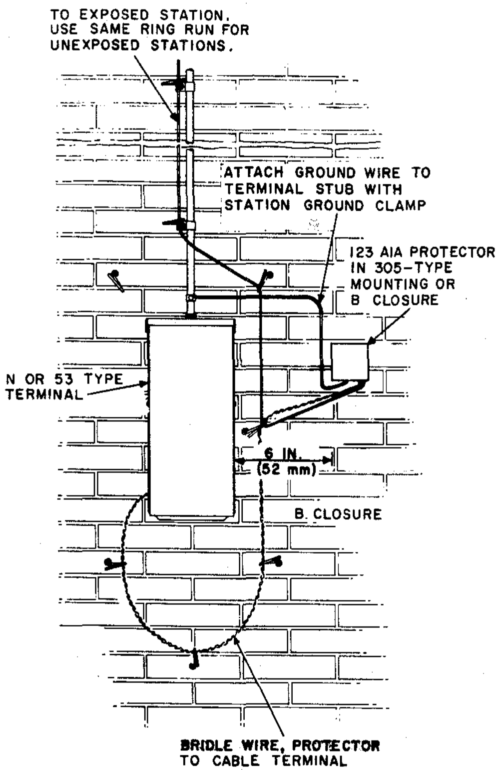


Fig. 97—▶N- or 53-Type Terminal, Wall Installation◀

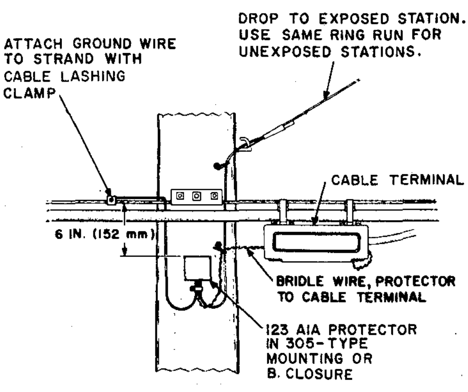


Fig. 98—▶N-Type Terminal, Strand Mounted◀

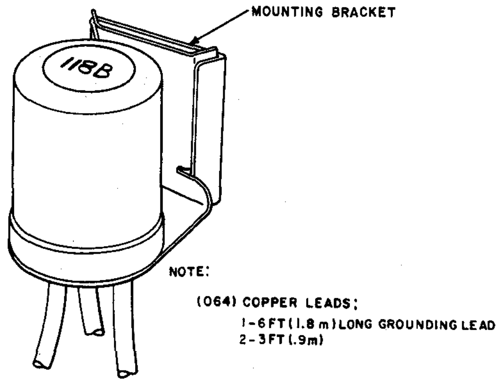


Fig. 99—▶118B Protector◀

protector provides protection for a single drop wire or rural wire; however, the length of a drop wire or rural wire run may dictate the installation of additional protectors on the same drop wire or rural wire.

13.03 Drop wires and rural wires, run on higher voltage joint use poles, do not require a 118B protector:

- Where wire runs (including branch runs) are 1000 feet or less in length
- Where wire runs are attached directly below aerial cables supported by effectively grounded strands.

13.04 Refer to Section 624-730-200 for additional information and illustrations for installing the 118B protector on rural wire.

13.05 Do not remove 118B protectors from dead circuits on joint use poles.

13.06 It is preferable to connect the ground wire of the 118B protector to a power vertical grounding conductor that is connected to both the power system multigrounded neutral wire and to a ground electrode. Grounding conductors on transformer poles which meet this requirement are satisfactory. ***Grounding conductors from power lightning arresters shall not be used unless they are connected to the power neutral wire.*** Where local instructions

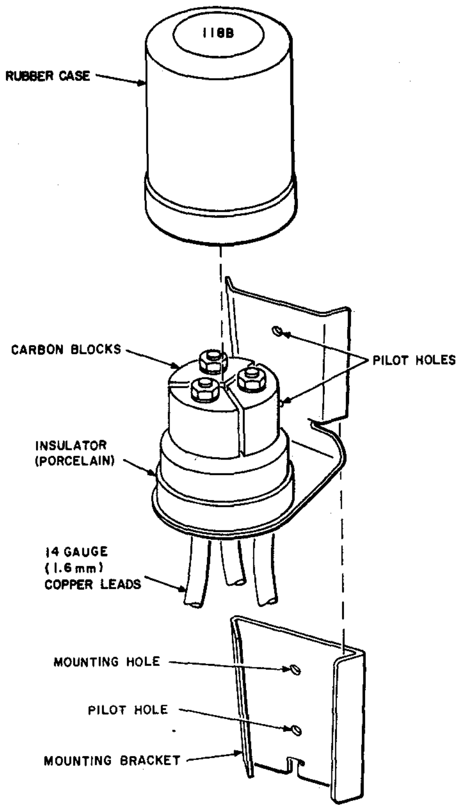


Fig. 100—♦118B Protector, Disassembled♦

and the power company permit, the connection between the ground lead of the 118B protector and the vertical grounding conductor may be made by telephone company personnel.

Danger: The power vertical grounding conductor shall be tested with a ♦188A test set (Stop Lite) or a B-voltage tester as described in Section 081-705-102 or 081-705-101, respectively,♦ before making this connection.

13.07 Where the power company has installed an aluminum vertical grounding conductor, do not use an AT-7796X connector due to the likelihood of corrosive chemical reaction between copper and aluminum. Make the grounding connection to an aluminum vertical grounding conductor with a Blackburn PAC3 or Fargo GA6100 connector.

13.08 When a 118B protector is to be installed at locations where there are no power system vertical grounding conductors, install a ground rod at the base of the pole and run No. 6 ground wire from the ground rod to the top of the telephone space and leave coiled at that point an additional length (usually about 6 feet) sufficient to reach the power neutral wire. ***Power company personnel shall make the connection to the power neutral wire.*** Report all such installations to the supervisor immediately so arrangements may be made to have the grounding conductor connected to the power neutral as soon as practical.

♦Danger: Avoid personal injury by protecting eyes and hands when driving ground rods. Wear safety glasses and rubber gloves with leather protectors♦

Danger: Do not perform any work in the power company space on the pole.

13.09 To install a ground rod and vertical grounding conductor:

(a) Drive a ground rod about 2 feet from the base of the pole with the top of the rod at least 3 inches below ground level. The ground rod should be located so the grounding conductor may be run on the side of the pole reserved for power company attachments.

(b) Connect the vertical grounding conductor (No. 6 ground wire) directly to the ground rod with a B ground clamp.

(c) Fasten the grounding conductor to the pole at 18-inch intervals with 1-1/4 inch B staples.

(d) Where ground wire molding is used, fasten it to the pole with cable straps and strap nails at 4-foot intervals.

13.10 The 118B protector is self-cleaning and generally should require no maintenance. It is possible, however, that an operation will

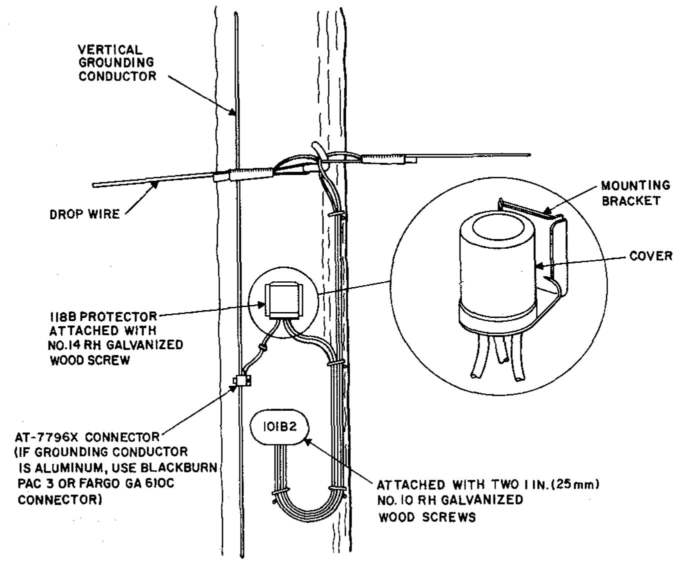


Fig. 101—118B Protector Connected to Drop Wire

cause the cover to be blown off or to rupture. When working on drop wires or rural wires connected to such a damaged protector, notify the supervisor or proceed according to local instructions.

14. CONVERTING PROTECTORS

Caution: When converting station protectors on SSM (Special Safeguarding Measures) and/or SSP (Special Service Protection) lines, arrangements must be made to have the special lines taken out of service before doing any work on the protector, since this work could readily cause service interruptions.

14.01 Fused protectors at stations not subject to conditions as outlined in paragraph 3.01, should be converted to fuseless operation or replaced by the 123- or 128-type protectors. Do not convert fused protectors to fuseless operation where the station is served by open, rural, or urban wire. If fuseless protection is required, a 123- or 128-type protector must be installed as a replacement.

14.02 The 98A (MD) protector (Fig. 44) can be converted to fuseless operation by adding two 121A adapters and two 213A connectors (Fig. 103) as follows:

(1) Disconnect line wires.

(2) Remove cap and protector blocks.

(3) Insert the 121A adapters all the way into the protector well with the flat side against the ground electrode.

(4) Check for ground at all protector terminals. With the protector blocks removed, the adapter should provide solid ground to the terminals.

Note: A check for ground may be made using the 1013A hand test set. With the TALK/MON switch of the test set in the TALK position, connect one cord clip to the ring side of the (working) line wire and, with the other cord clip, tap each line terminal of the protector. A pronounced click will be

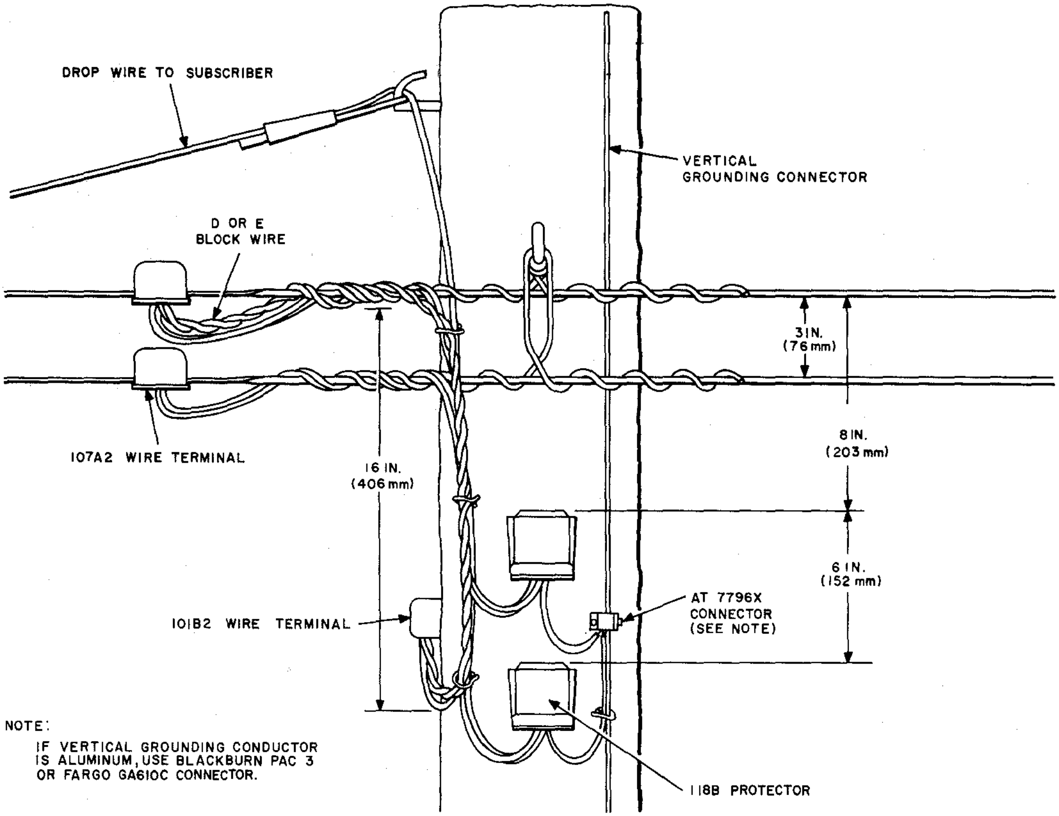


Fig. 102—118B Protectors Connected to Rural Wires

heard in the test set receiver when protector terminals are grounded.

(5) Remove adapters from protector well and assemble each adapter with a No. 26 and a No. 27 protector block.

(6) Install assemblies in protector well. Check for grounds; line terminals should not be grounded.

(7) Where requirements of (4) and (6) are not met, discard adapters and replace with other adapters. If requirements cannot be met on the second attempt, do not try to convert the protector; install a 123- or 128-type protector instead. Do not attempt to bend or adjust the adapter tabs or protector block springs.

(8) Reinstall cap.

(9) Connect line wires using care not to reverse tip and ring.

Note: The line wire may be moved to the station side of the protector if it is of sufficient length. If not, proceed to next step.

(10) Loosen nuts on 11C fuses.

(11) Insert 213A connectors over each fuse with end inside fuse clips. In cases where fuses

have shrunk slightly, one or both connector ends may be placed outside of fuse clips. Some bowing of the connectors is not considered objectionable.

(12) Tighten nuts on fuses (Fig. 104).

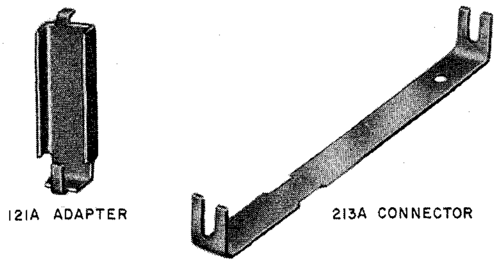


Fig. 103—121A Adapter and 213A Connector

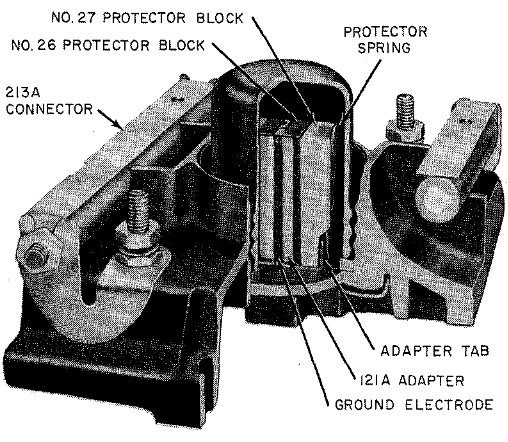


Fig. 104—Converted 98A (MD) Protector

14.03 The 106C and the 1293C ♦(MD)♦ protectors may be converted to fuseless operation by ♦connecting the aerial or buried drop input line♦ wires directly to the station side of the protector, provided the line wires are of sufficient length. The fuses may then be removed (Fig. 105). Where the input line wires are too short to reach the station side of the protector, install two 213A connectors as described in paragraph 14.02(11). The 106C protector is equipped with 2A1A protector units; therefore, adapters are not required (Fig. 106).

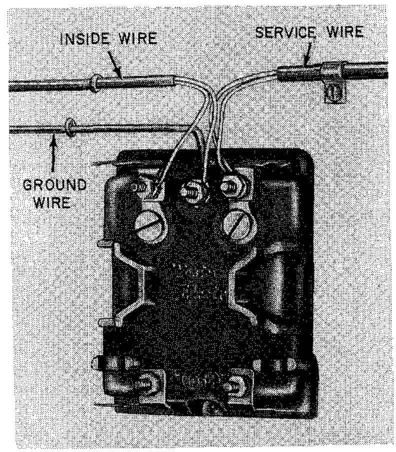


Fig. 105—Alternate Method of Converting 106C Protector

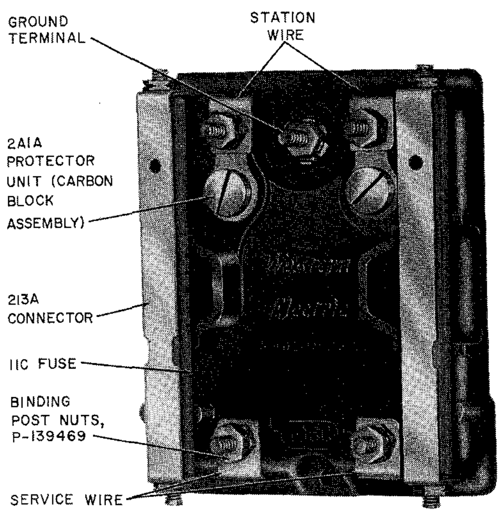


Fig. 106—Converted 106C Protector

14.04 The 106A (MD) protector cannot be converted to fuseless operation because of insufficient current-carrying capacity.

15. MAINTENANCE

15.01 When making station visits, inspect the telephone grounding system. If the protector ground is not connected to the best available ground electrode in accordance with Table D, change the ground conductor. ***Make sure the protector ground, power service ground, and interior metallic water pipe are bonded together. If the protector and power are grounded to separate ground rods, make sure the ground rods are bonded together.***

15.02 Inspect the ground wire, ground clamps and connectors for broken or disconnected wires or loose connections. Replace hardware if defective, damaged, or badly corroded. Make sure the ground wire tag (Form E-3013B) is in place.

> ***Note:*** ♦It is not necessary to replace No. 14 (MD) ground wire in existing installations unless it is defective or used to ground more than one circuit.♦

15.03 Replace grounded protector units, operated protector blocks, open fuses, and defective or badly corroded protectors. Replace protector units or protector blocks with proper types. ***Do not use yellow or blue protector blocks.***

> ♦***Danger: If for any reason, it is suspected that the protector is energized, DO NOT attempt to remove protector blocks. Verify presence or absence of voltage with a voltage tester. if energized, notify supervisor and proceed no further.***♦

15.04 The 2B1A and 2B2A protector units are equivalent and either may be used in a 123A1A or 128A1A-2 protector. The 2B1A has a slotted screw-type cap while the 2B2A has a 3/8-inch hexagonal cap which requires the 216B tool for removal.

15.05 The 123B1A protector uses two 6B1A (gas tube) protector units in parallel with two 2B2A (carbon) protector units. When replacing protector units in the 123B1A protector, be sure to install the 2B2A protector units in the wells marked "CARBON ONLY" (Fig. 3).

15.06 The 111A (MD) protector uses 2A1A protector units instead of the 2B1A or 2B2A protector units.

15.07 When visiting PBX or KTS locations, make sure the proper size ground wire connects the protector ground terminal to the best available grounding electrode (Tables B and D). A cable shield or sheath is not an acceptable grounding electrode.