

# SUBSTATION AND PRIVATE BRANCH EXCHANGE PROTECTOR INSTALLATION

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## STANDARD SUPPLIES

1. Standard names of supplies required by these specifications are given below in alphabetical order. These items are listed for the convenience of the field forces in ordering and checking supply of material required for the work covered by these specifications.

Backboards:	#79 BACKBOARD #81 BACKBOARD
Bridging Connectors:	#1 BRIDGING CONNECTOR #2 BRIDGING CONNECTOR
Carrying Case:	#3-A CARRYING CASE
Clamps:	3/16" CABLE CLAMP 1/2" CABLE CLAMP BLACKBURN A 1 S GROUND CLAMP
Conduit:	1/4" WOVEN CONDUIT
Fuses:	#11-C FUSE #11-D FUSE #60-A FUSE
Knob:	C KNOB
Molding:	STATION GROUND WIRE MOLDING
Nails:	6-D GALV. WIRE SLATING NAIL 7/8" OLIVE INSIDE WIRING NAIL 1" ROOFING NAIL
Protectors:	#12-BP PROTECTOR #58-AP PROTECTOR (Includes #48 Pro- tector Mounting)
Protector Blocks:	#26 PROTECTOR BLOCK #27 PROTECTOR BLOCK
Protector Mountings:	#16 PROTECTOR MOUNTING #79-A PROTECTOR MOUNTING #80-A PROTECTOR MOUNTING #82-A PROTECTOR MOUNTING
Rods:	GROUND ROD

**Screws:** 1" #10 R. H. BRASS WOOD SCREW  
 3/4" #8 R. H. BLUED WOOD SCREW  
 1" #8 R. H. BLUED WOOD SCREW  
 1 1/2" #8 R. H. BLUED WOOD SCREW  
 2" #8 R. H. BLUED WOOD SCREW  
 2 1/2" #8 R. H. BLUED WOOD SCREW  
 2 1/2" #14 R. H. GALV. WOOD SCREW

**Screw Eye:** 1" INSULATED SCREW EYE

**Shields:** 3/16"x3/4" EXPANSION SHIELD  
 3/16"x1 5/8" EXPANSION SHIELD  
 1/4"x1" EXPANSION SHIELD

**Tape:** 3/4" (Color) FRICTION TAPE  
 3/4" RUBBER TAPE

**Toggles:** 3/16"x4" B. H. TOGGLE

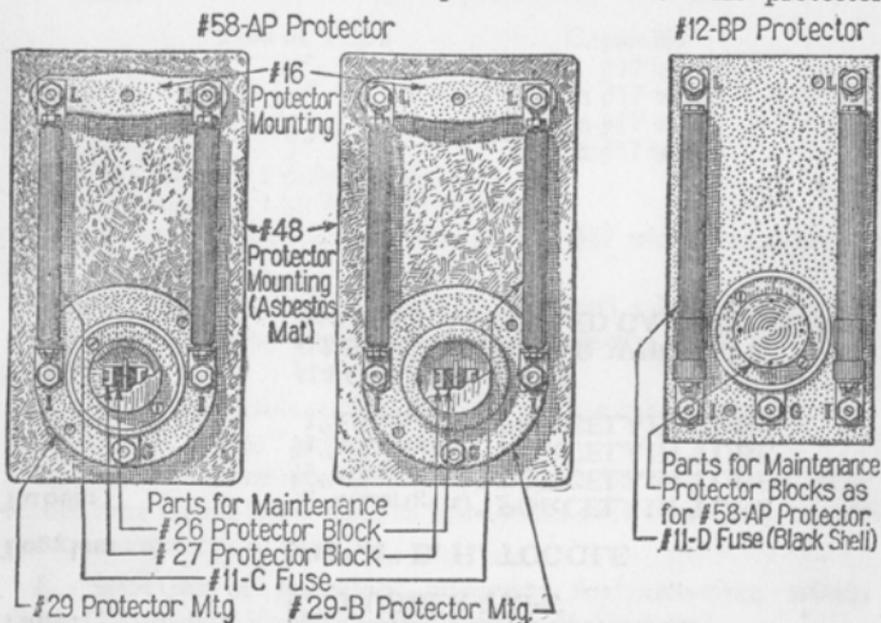
**Tubes:** 3/8"x(Length)" PORCELAIN TUBE  
 1/2"x(Length)" PORCELAIN TUBE  
 3/4"x(Length)" PORCELAIN TUBE  
 1"x(Length)" PORCELAIN TUBE

**Wire:** #14 GROUND WIRE  
 #12 SINGLE SOLID R WIRE  
 040 SOFT ANNEALED GALV. IRON WIRE

SUBSTATION  
 AND P. B. X.  
 PROTECTOR  
 INSTALLATION

## SELECTION OF SUPPLIES

2. Use the #58-AP protector at all substations (common battery, both manual and machine switching and magneto) where protection is required and where service enters in twisted pair wires. The #58-AP protector is shown throughout the specifications with the #29-B protector mounting. The #29 protector mounting shall, however, be used as the equivalent in every respect of the #29-B protector mounting. Where stock conditions warrant use #12-BP protectors as the equivalent of the #58-AP protector.



3. Where the service enters in cable, as in apartment houses, a cable protector mounting will generally be in place. In such cases install #26 and #27 protector blocks and the proper fuses on the pairs assigned for service. (See sections 46 and 47.)

4. Use #60-A fuses on all exposed private branch exchange lines. This includes trunks, generator feeders and exposed extensions but not battery feeders. (See sections 44 and 47.)

5. Use a backboard for mounting the protector when the protector cannot be mounted on a beam, ceiling, wooden wall or otherwise directly attached to support, also in cases where 3 or more protectors are installed at one time. Use the following backboards:

#79 Backboard—capacity 1 protector.

#81 Backboard—capacity 5 protectors.

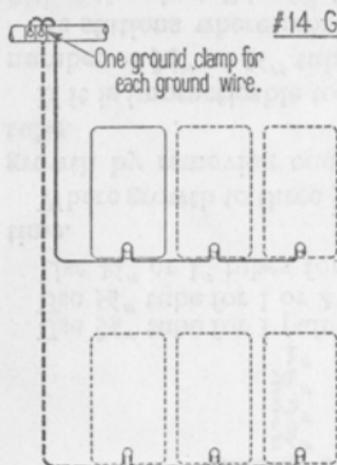
For 1 or 2 protectors (also for 3 protectors where this number will probably never be exceeded; as in three-family houses) install #79 Backboards, unless station is already provided with a #81 or other backboard which has room for more protectors.

For 4 or 5 protectors placed at one time (also for 3 protectors where this number is likely to be exceeded) install a #81 Backboard.

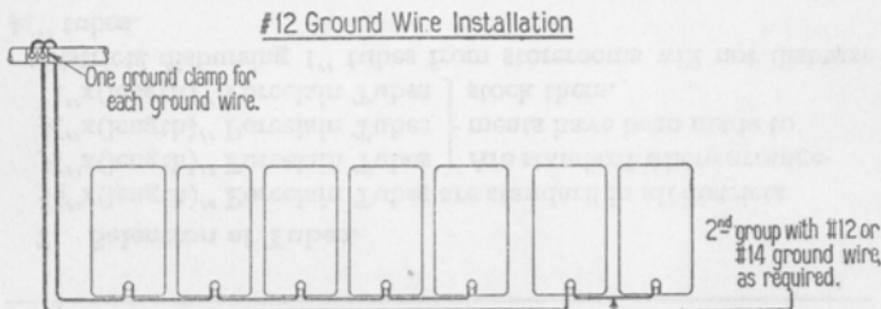
For 6 or more protectors placed at one time, install either two #81 Backboards or one #81 Backboard, and for the remainder #79 Backboards, depending upon number of protectors installed, growth expected and space available for installing backboards.

**6. Use #14 Ground Wire for 1, 2 or 3 protectors.** This wire is standard in all districts.

Use #12 Single Solid R Wire for 4 or 5 protectors. This wire is provided in districts where demand warrants carrying it in stock.



Should growth require a 4<sup>th</sup>, 5<sup>th</sup> or 6<sup>th</sup> protector, start a new group and equip with a new and separate ground wire. A strap between groups is not required. (This does not apply to ground rod installations).



**SUBSTATION  
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INSTALLATION**

## SELECTION OF SUPPLIES

**7. Selection of Tubes.**

$\frac{3}{8}$ "x(length)" Porcelain Tubes are standard in all districts.

$\frac{1}{2}$ "x(length)" Porcelain Tubes } Are standard where arrange-  
 $\frac{3}{4}$ "x(length)" Porcelain Tubes } ments have been made to  
 1"x(length)" Porcelain Tubes } stock them.

Districts disbursing 1" tubes from storerooms will not disburse  $\frac{3}{4}$ " tubes.

**Size of Tube****Capacity** $\frac{3}{8}$ "

1 pair #17 wires

 $\frac{1}{2}$ "

2 pairs #17 wires

 $\frac{3}{4}$ "

4 pairs #17 wires

1"

7 pairs #17 wires

Use  $\frac{3}{8}$ " tube for 1 pair #17 wires.

Use  $\frac{1}{2}$ " tube for 1 or 2 pairs #17 wires.

Use  $\frac{3}{4}$ " or 1" tubes for 3 or more pairs #17 wires placed at one time.

Where growth to three  $\frac{3}{8}$ " tubes has occurred, take care of further growth by removing one  $\frac{3}{8}$ " tube and replacing by a  $\frac{3}{4}$ " or 1" tube.

If it is impracticable to bore hole for a large tube, place required number of  $\frac{3}{8}$ " or  $\frac{1}{2}$ " tubes.

At stations where more lines are likely to be taken in at some future time install larger tube to provide for growth to the probable maximum number of pairs.

**8. Selection of porcelain supports for entering wires.**

Type C Porcelain Knobs are standard in all districts.

Insulated Screw Eyes are standard where arrangements have been made to stock them.

**9. Tubes at reinstallations.** Where two porcelain tubes are installed (one for each wire) and are in good condition, do not replace with single porcelain tube.

Where hard rubber tubes are installed do not reuse on reinstallations or where line or drop wires have been disconnected or cut (due to station being out of service for a part of the year). Break off projecting end of one rubber tube flush with the outside of door, window frame or wall, remove the other tube and replace with porcelain tube, after reaming out hole.

If hard rubber tubes are found in bad condition, at existing installations, replace with porcelain tube as above.

10. At reinstallations where existing #14 drop is in good condition enter through two  $\frac{3}{8}$ " porcelain tubes, one tube for each wire or one  $\frac{1}{2}$ " tube.

If #14 drop on building is to be reused and line wires are not long enough to reach protector, proceed as follows:

- (a) If drop has been cut because of season disconnection, connect length of #17 wire with bridging connectors to #14 drop, placing connectors between last attachment and tube. Then treat as entrance of #17 wire. Connectors must be separated at least 3 inches to avoid contact with each other and covered with two layers of rubber tape and two layers of friction tape.
- (b) On reinstallations where season disconnections are not likely, connect the new length of #17 wire with a sleeve splice and treat as entrance of #17 wire. Make splice between last and next to last attachment. If last attachment is an obsolete type of knob, replace with standard knob as required.

## LOCATING PROTECTORS AND ENTRANCES

**11. General Rules.** Select entrance so that protector will be installed:

- (a) Inside of building close to entrance, and
- (b) As near as practicable to the protector ground.

For protector ground:

Where water is supplied from a public water system use a cold water pipe connected to street main and in service.

Connection to cold water pipe may be made at any point in building except:

- (1) Where water supply for building is obtained from a tank connect only to inlet pipe. Be sure inlet pipe is connected to street main.
- (2) Where there is an insulating joint in cold water pipe connect to pipe on street side of insulating joint.

If there is no cold water pipe connected to street main use gas pipe connected to street main. Make connection between gas meter and street main. If there is no meter make connection at point where gas pipe enters building.

Where water is supplied from a private source such as a spring or well, it is the intention in general not to use these private systems for grounding protectors, as in the majority of cases such grounds are not satisfactory for telephone protection purposes. In grounding protectors where private water systems are installed, the following routine should be observed:

- (1) In the case of an ordinary private water system, use a ground rod or ground rods for the protector ground. (If the building should be connected to a public gas system, the gas service pipe can be used of course, for a protector ground.)  
In using ground rods, install one ground rod for each protector, and strap all protectors together. (See section 40.)
- (2) If the private water system is of such extent as to be comparable to a public water system, it may be used as a protector ground upon approval of the office. In such cases the final decision as to the use of such a ground will be made by a member of the plant organization who is in touch with the Chief Engineer's office, or who is otherwise familiar with the requirements to be met to make the water system satisfactory for telephone protection purposes.

Use no ground other than those specified above without specific instructions.

- (c) Avoid locating protectors in living rooms, or other generally frequented parts of the house, where appearance of protector or its operation would be objectionable to subscriber or tenant.
- (d) Locate protectors to provide, as far as practicable, a short and direct run of line wire to and on building.

A desirable location for the protector and ground wire may require a longer run of drop wire, or one harder to locate on building. In such cases, the location of protector and run of ground wire should receive first consideration consistent with specifications for DROP WIRING.

- (e) Locate where protectors will be readily accessible at reasonable hours for inspection and maintenance.

Avoid coal or wood bins, locked rooms in cellars, or other places that may be locked.

Do not place where installers or repairmen would be exposed to dangerous electric wires, moving machinery or belts, elevator weights, etc.

- (f) Do not locate protectors near flammable material.

Avoid locating in show windows or in the immediate vicinity of easily ignitable material, such as window curtains, flammable gases or dust or flying of combustible material. Where protector cannot be located inside of building because highly flammable material is present, place protector on outside of building in #82-A Protector Mounting (see section 41). The outside protector is not to be used except where the special conditions given above exist.

- (g) Locate protectors in as dry and well ventilated locations as practicable.

Do not locate in wet or excessively damp cellars or basements (as may be found where there are no windows for ventilation, in marshy districts subject to overflow, etc.) as such locations are very likely to cause wiring and protector trouble.

Avoid locations over stationary wash tubs, or where protectors would be exposed to escaping fumes (as in chemical works). Locations under water pipes are not desirable owing to tendency of pipes to sweat.

- (h) Locate protectors at least one foot from electric light or power wires, meters or other accessories.

- (i) Locate where they will not be liable to tampering or mechanical injury.

A location at least 7 feet above floor to place protector beyond reach of children is desirable.

Avoid locating in storage rooms where material may be piled against protector.

Locations at windows through which coal, wood or other articles are passed are not desirable.

- (j) A location where protector can be installed and maintained without artificial light is desirable.

## LOCATING PROTECTORS AND ENTRANCES

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**12. In detached residences** such as one or two family houses, locate protector in cellar or basement.

If no cellar or basement is available, or if on account of excessive dampness or other undesirable features protector cannot be placed in it, select location at some other point in residence as remote as possible from the generally frequented parts of the house.

Such a location can usually be obtained in rear or side entries, attics, rear or side hallways, or front hallways (when not used for living quarters).

In case a suitable location inside the house as given above cannot be obtained, an un-enclosed porch may be used if a location for the protector close under the porch ceiling, well protected from driving rain or snow can be obtained.

**13. In flats and apartment houses** the best location will ordinarily be the cellar or basement.

This location allows convenient access to protectors and permits of party line bridging at the protector if necessary.

**14. In lofts, small office buildings or factories** where no cellar is available or is unsuitable for locating protector, a location on same floor as telephone set will generally be found desirable.

Locations in or near toilets or lavatories (if readily accessible) are the most desirable, where protector is on same floor as telephone set.

**15. For basement or cellar entrances** in all types of wood frame buildings with unplastered basement or cellar ceilings, bore hole through wood wall above foundation wall, so as to clear beams or joists. Where ceilings are plastered, bore through top or side of window or door frames.

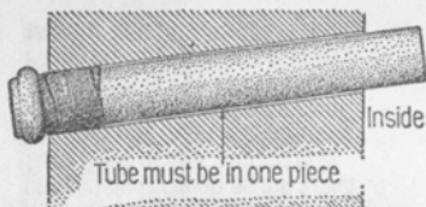
For other entrances in frame buildings, bore through top or side of window or door frames, or, if necessary, through plastered walls.

In brick, cement and stone buildings, make entrances through window or door frames. Where window and door frames are of cast or heavy metal, make entrances through wall.

Wherever practicable to avoid, do not make entrances through metal storefronts.

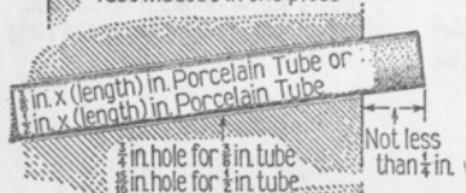
# INSTALLING TUBES AND PROTECTORS

## 16. Tubes.

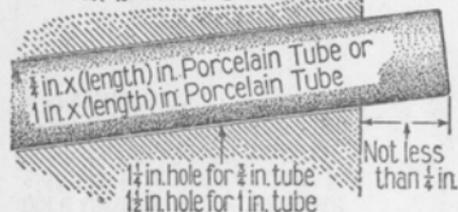


Slope tube upward from the outside, with head of the tube outside.

Tube must be securely held in place. If necessary use wrapping of tape.

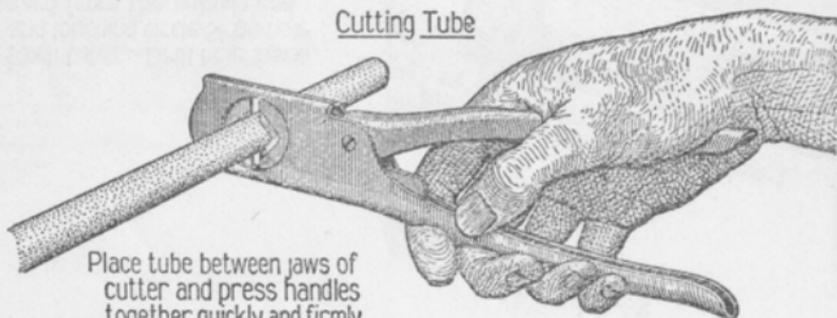


In cellar or basement entrances, if end of tube is not subject to mechanical injury, it need not be cut. In all other cases cut off any projection beyond 1 inch and ream tube as shown below.



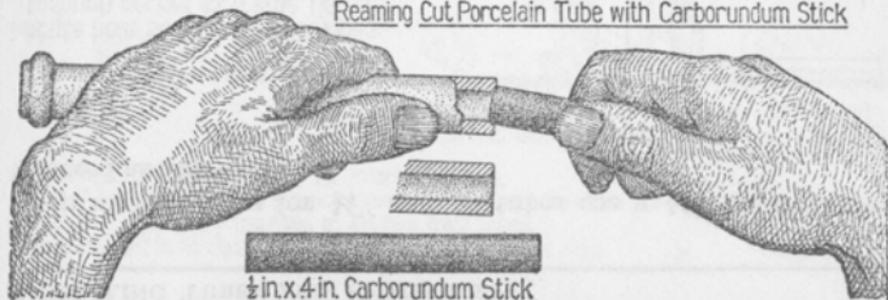
As it is impracticable to cut  $\frac{3}{8}$  in. or 1 in. tube, select length as will give least projection over  $\frac{1}{4}$  in.

### Cutting Tube



Place tube between jaws of cutter and press handles together quickly and firmly. Do not twist cutter around tube.

### Reaming Cut Porcelain Tube with Carborundum Stick

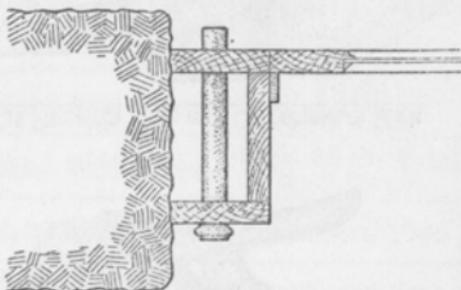


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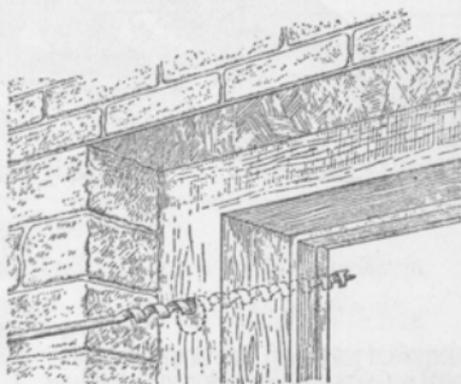
## INSTALLING TUBES AND PROTECTORS

In making holes for  $\frac{3}{4}$ " and 1" tubes use a  $\frac{3}{4}$ " bit drill and proceed as follows:

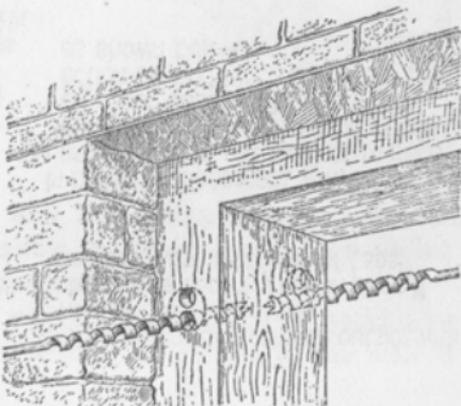
Locate hole so that tube will pass through pocket in frame. Using tube as a template mark a circle at point where hole is to be drilled.



For  $\frac{3}{4}$  inch tubes:- Drill hole inside of and touching circle. Slope hole upward from the outside and bore through to the opposite side. Mark another circle on this opposite side. Saw remaining wood away on both sides, using a keyhole saw.

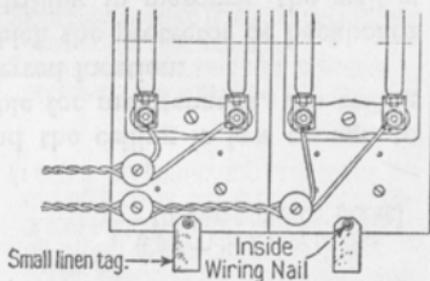
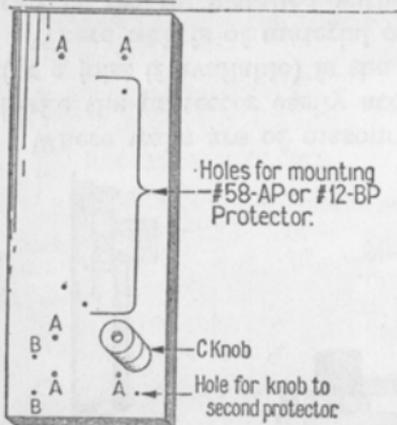


For 1 inch tubes:- Drill one hole completely through as for  $\frac{3}{4}$  inch tube. Then drill a second hole as shown through one side only. Mark a circle on other side of frame and drill a second hole. Finish hole by sawing remaining wood away on both sides of frame.



## 17. Mounting backboards.

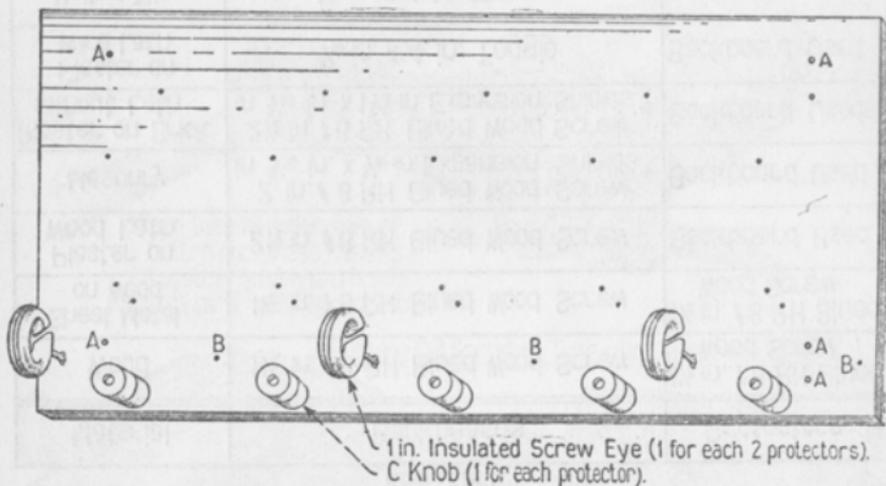
### #79 Backboard



Where in multiple installations, it is found desirable to tag the protector, a small linen tag shall be attached as shown.

In mounting backboard use holes "A" for attaching screws.  
Choice of 6 holes, but only 2 screws required, 1 above and 1 below protector. When mounting on masonry use holes as will best clear seams.  
Holes "B" are for knobs when entrance is at left.

### #81 Backboard



In mounting backboard use holes "A" for attaching screws.  
Choice of 6 holes, but only 4 screws required, 2 above and 1 on each side below protector. When mounting on masonry use holes as will best clear seams.  
Holes "B" are for 1 in. Insulated Screw Eyes when entrance is at right.

**SUBSTATION  
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PROTECTOR  
INSTALLATION**

## INSTALLING TUBES AND PROTECTORS

### 18. Fasteners for mounting protectors and backboards.

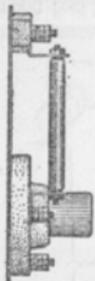
#### FASTENERS

Material	Backboards	Protectors
Wood	1½ in. #8 RH Blued Wood Screw	1½ in. #8 RH Blued Wood Screw
Sheet Metal on Wood	1½ in. #8 RH Blued Wood Screw	1½ in. #8 RH Blued Wood Screw
Plaster on Wood Lath	2½ in. #8 RH Blued Wood Screw	Backboard Used
Masonry	2 in. #8 RH Blued Wood Screw in ¾ in. x ¾ in. Expansion Shields*	Backboard Used
Plaster on Brick without Lath	2½ in. #8 RH Blued Wood Screw in ¾ in. x 1½ in. Expansion Shields*	Backboard Used
Plaster on Wire Lath	¾ in. x 4 in. Toggle	Backboard Used
Hollow Tile	¾ in. x 4 in. Toggle	Backboard Used

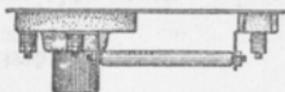
\* Or Approved Equivalent.

### 19. Protectors may be mounted either on walls or ceilings.

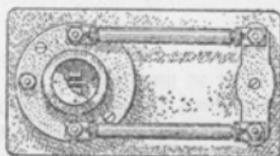
On Walls or Joists



On Ceilings



Do not Mount this Way



(Carbon dust may bridge the two protector blocks)

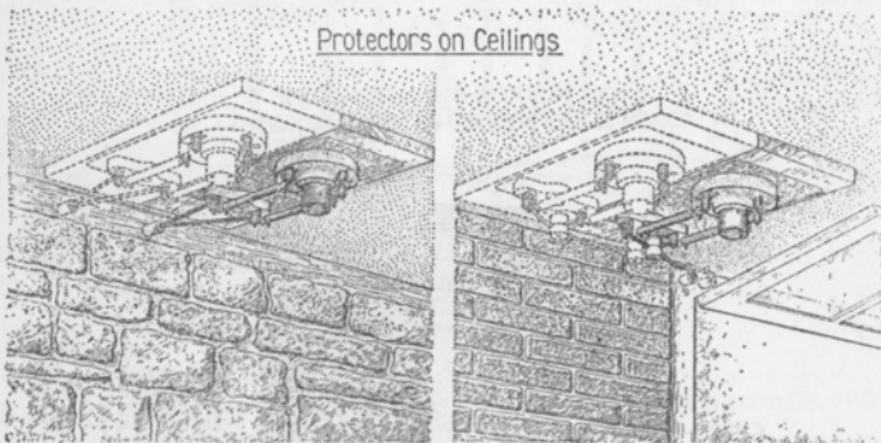
Where walls are of masonry and the ceiling is low enough to make the protector easily accessible for maintenance, the ceiling (or a joist if available) is the preferred location.

Where wall is of material on which the protector or backboard can be readily installed without drilling in masonry, the wall is the preferred location.

Where a #81 Backboard is used it should always be installed on a wall, irrespective of wall construction.

20. Where cellar ceiling is plastered and the probable maximum number of protectors will not exceed two, install as shown below. Where the foundation sill projects below the ceiling, the preferred entrance is through the sill. Otherwise enter through the window frame and see that window can be opened fully without striking protector or wiring.

Protectors on Ceilings

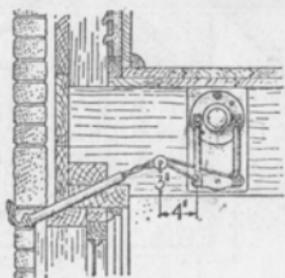
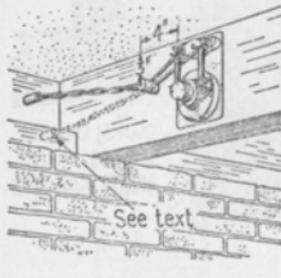


21. Where cellar ceiling is not plastered the protector should be installed on a joist or under the floor. Where the depth of joist is 9 1/2" or more the joist is preferable. No backboards are required.

Protector on Joist  
Entrance through Window or Sill

Protector under Floor  
Beam too shallow for Protector

Protector on Joist  
Entrance through Window Frame



Place protector reasonably close to wall.

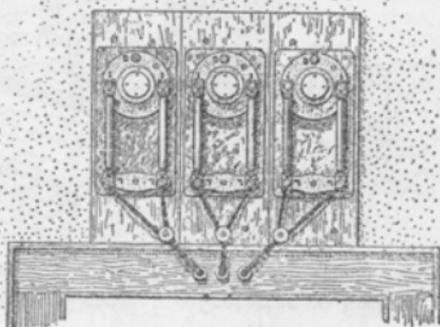
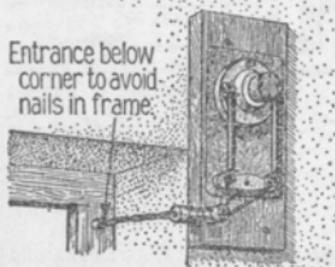
Be careful that screws do not penetrate through floor.

Run wires on side of beam rather than on bottom.

Where space above foundation sill is filled with brick (acting as fire stop) make entrance through foundation sill as shown by dotted lines.

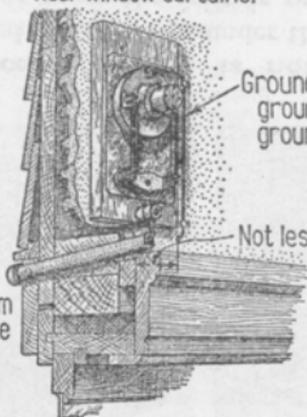
## INSTALLING TUBES AND PROTECTORS

22. When protector is mounted on a wall install as follows:



Do not place protectors near window curtains.

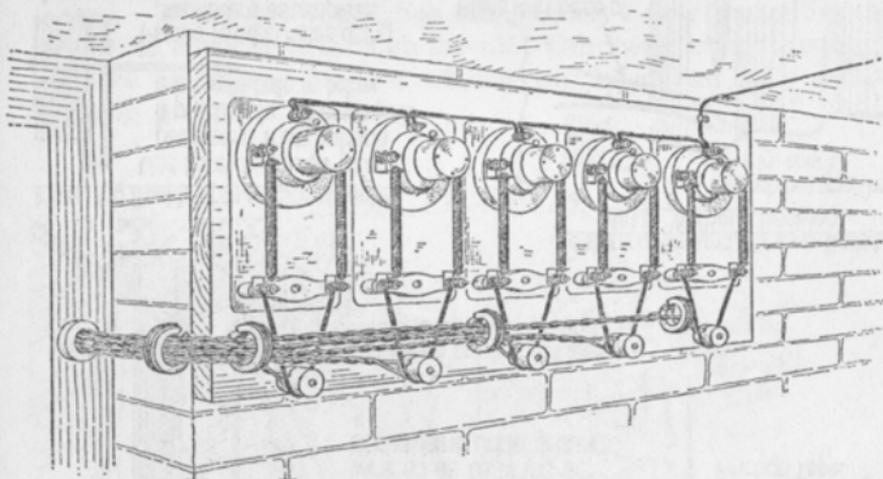
In finished rooms where appearance of backboard would be objectionable, install protector without backboard. Be sure that all of the fasteners enter lath.



Tube enters above trim wherever practicable

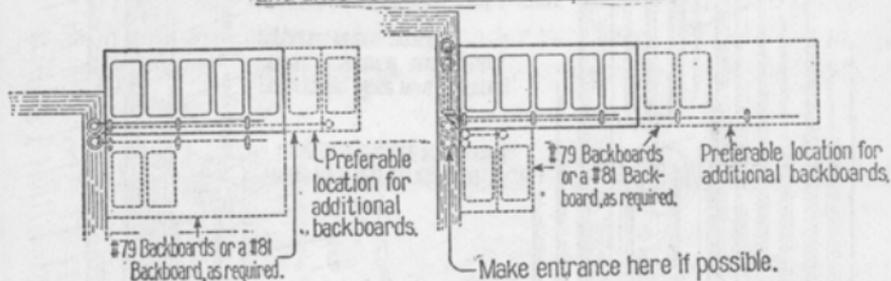
Protector may be placed at side of window if impracticable to mount as shown.

## 23. Installations with #81 backboards.

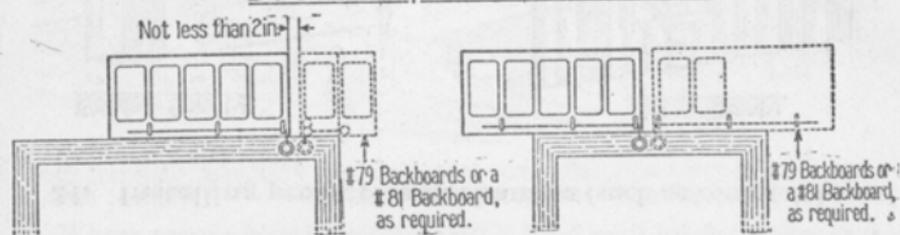


If further growth takes place after the full capacity of a #81 Backboard has been reached, install either #79 Backboards or a #81 Backboard, as required. When practicable make original installation so that additional backboard can be placed, if necessary.

### Entrance at Side of Window or Door Frame



### Entrance at Top of Window or Door Frame

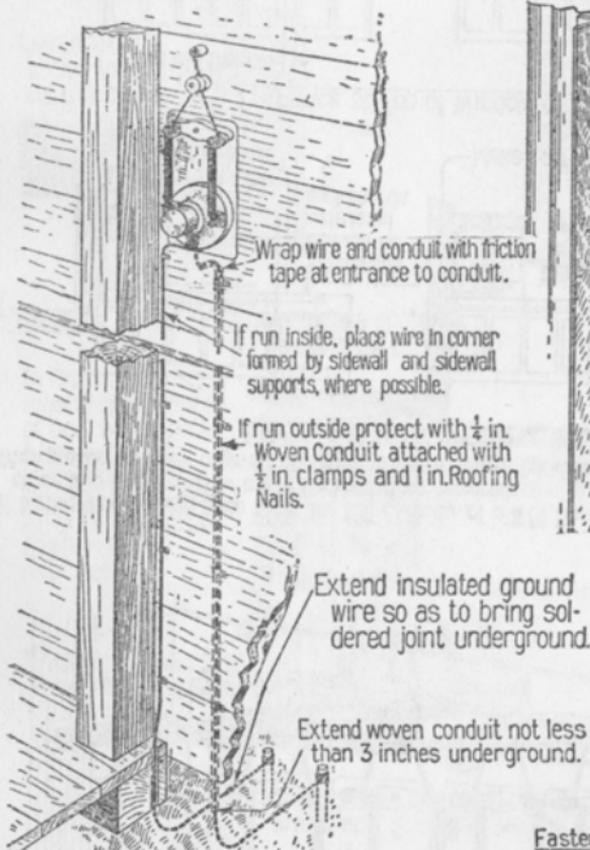


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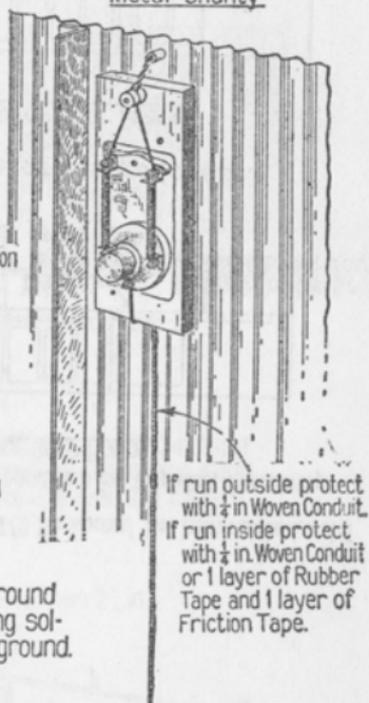
## INSTALLING TUBES AND PROTECTORS

### 24. Installing protectors in shanties (such as contractors and switchmen's shanties).

#### Wooden Shanty



#### Metal Shanty



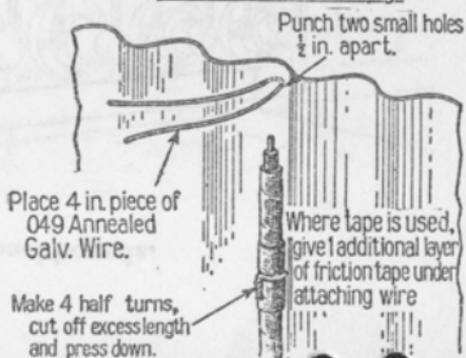
#### Installing Backboards on Sheet Metal

Use screws driven into backboard from outside if practicable. Otherwise use toggle bolts as below.



- 1-Make two  $\frac{3}{8}$  in. holes using backboard as template.
- 2-Remove wings from toggles.
- 3-Mount backboard and bolts, and replace wings.
- 4-Nick excess length of bolt with file and break off with pliers.

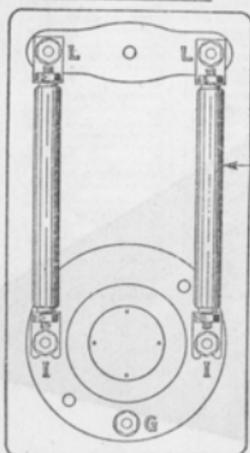
#### Fastening Ground Wire on Sheet Metal Without Backing



## INSTALLING PROTECTOR PARTS

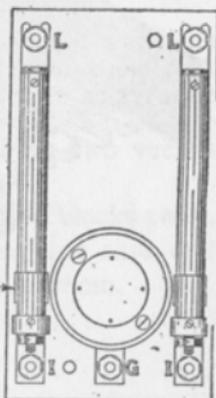
25. Install fuses as shown below.

#58-AP Protector



Turn fuses so that slots face asbestos mat.

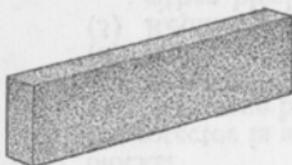
#12-BP Protector



Clips must grip the fuse tightly.

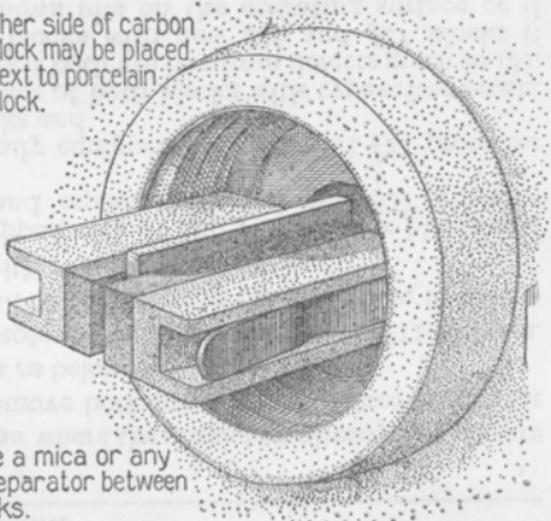
26. After protector is mounted installer shall remove and inspect the protector blocks. If blocks are satisfactory (see section 27) reinstall as shown below. Be careful to see that the blocks are properly seated in the protector.

#26 Protector Block

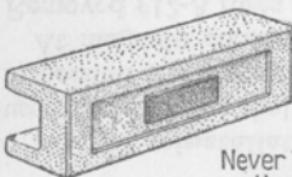


Either side of carbon block may be placed next to porcelain block.

Assembly



#27 Protector Block



Never use a mica or any other separator between the blocks.

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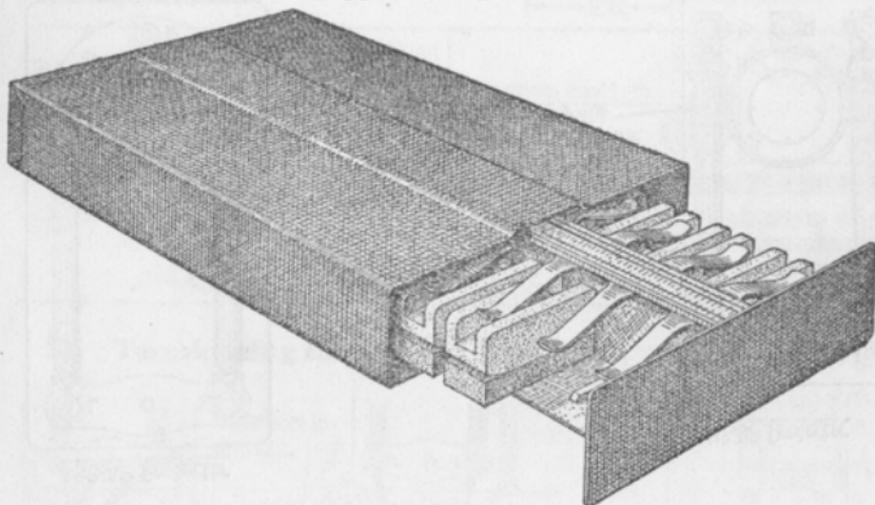
## INSTALLING PROTECTOR PARTS

**27. At reinstallations** where the protectors already in place are used the installer shall remove both fuses and protector blocks for inspection and disposition as below.

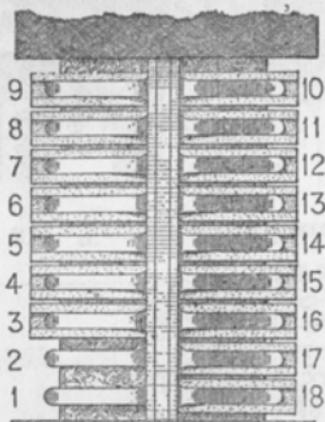
At magneto stations replace the #12-A fuses with #11-D fuses. Removed #12-A fuses shall be recovered to the storeroom to be disposed of in accordance with routine.

- (a) If protector is equipped with #1 and #2 protector blocks and #3 mica remove and replace with #26 and #27 protector blocks.
- (b) If protector is already equipped with #26 and #27 protector blocks remove blocks and
  - (1) Brush the surface of both blocks with typewriter brush.
  - (2) Reinstall blocks if both are free from defects given in (3).
  - (3) Replace both blocks with new #26 and #27 blocks if either block shows pits on the operating surface or if there is a black deposit on porcelain which extends from carbon insert to raised edge of porcelain block.
  - (4) Do not replace blocks because of discoloration of carbon surfaces.

**28. Use a #3-A Carrying Case** for carrying spare protector blocks. This is a pocket size carrying case having 18 retaining clips, 16 of which should be equipped with protector block assemblies.



It is the intention that at all times the case will have two empty clips which will serve to separate the defective from the good protector blocks. Therefore, in using the case:



- (a) Remove a defective protector block assembly from protector and place under clip 1 of the carrying case.
- (b) Remove the assembly of good blocks from clip 3 and place in protector. This will leave clips 2 and 3 vacant.
- (c) Continue in sequence until the supply of good blocks is about exhausted. Always keep the good blocks separated from the defective blocks by two vacant clips.

Do not throw defective blocks away. Place them in the carrying case and recover them to the storeroom.

## INSTALLING LINE WIRES FROM TUBE TO PROTECTOR

29. **Line wires** between tube and protector must neither touch nor be movable into permanent contact with any object except the supporting knobs or insulated screw eyes. Use C Knobs or 1" Insulated Screw Eyes for supporting wires between tube and protector.

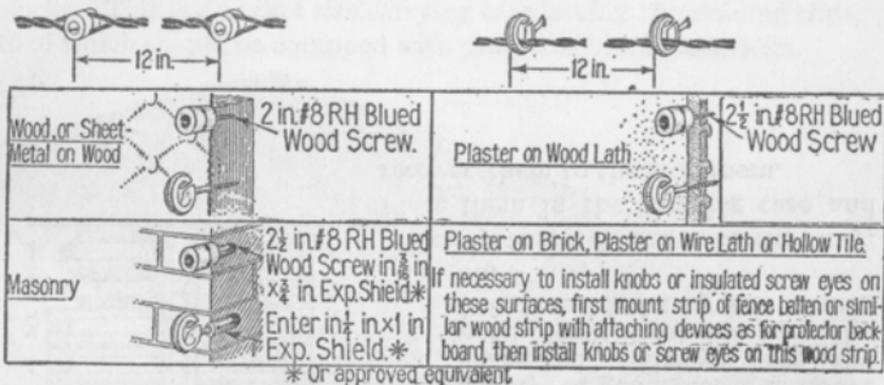
Do not conceal wires between entrance tube and protector.

If absolutely necessary to run line wires within 2 inches of any other wires, pipes or other metallic objects, protect with porcelain tube as required in Section 34 for crossing open electric light wires.

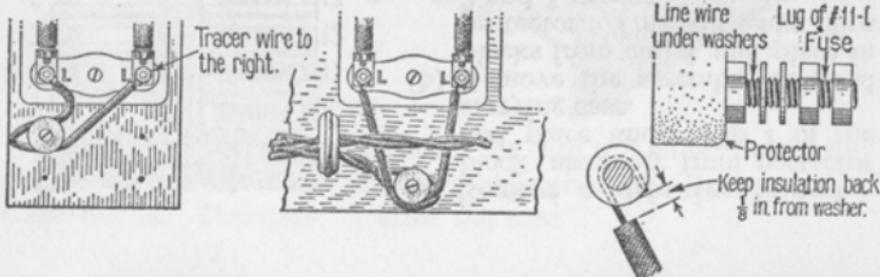
If porcelain tube slopes upward from outside, no drip loop (made by loop in wire) or taping is required. If the tube does not slope upward, make 1½" drip loop just below tube, wrap wires with friction tape at entrance to tube and wedge tightly into end of tube.

If run of line wires installed on knobs increases to more than 3 pairs, start a new group of three, or if impracticable to start a new group, remove knobs and run wires through insulated screw eyes.

### 30. Attaching Line Wires.



### 31. Terminating Line Wires.

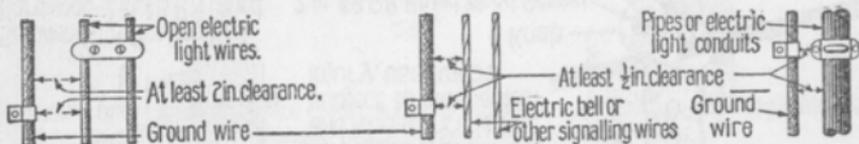


## INSTALLING PROTECTOR GROUND WIRE

### 32. General Rules.

- (a) Run as direct as practicable from protector to ground. Have no spirals in wire or bends sharper than a right angle.
- (b) The ground wire shall be in one piece without joints. A separate piece of wire may be used for strapping to protectors added to original installation (up to capacity of ground wire). (See Section 38.)
- (c) Run the wire where least likely to be broken or detached. Spanning open spaces as from beam to beam is not desirable, unless wire will be protected from mechanical injury. Avoid spanning where boxes, trunks or other such objects are likely to be stored. When run parallel to wall on beams keep within three inches of wall.
- (d) The ground and instrument wires from the same protector may be in contact, but must be under separate fasteners. Do not twist them together.
- (e) Always run ground wire open. Do not run in metal pipes or metal conduits or within partitions.
- (f) Do not run ground wire near or across foreign wires (especially light and power wires) or metal pipes or conduits if it can be avoided.

If minimum clearances shown below cannot be obtained, protect ground wire (both where crossing and running parallel to foreign wires and pipes) according to Section 34.



Also protect (as described in section 34) ground wire crossing light and power wires where it appears that the wires may come within two inches of each other, due to sagging or bending.

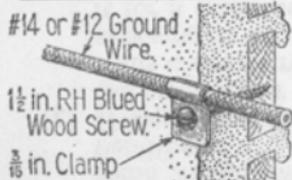
- (g) If necessary to guard ground wire from mechanical injury (as on poles or where ground wire on the outside of building walls is near a roadway, sidewalk or pathway, thus necessarily exposing it to tampering by unauthorized persons) protect it for a distance of eight feet from the ground by  $\frac{1}{4}$ " woven conduit or station ground wire moulding.

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## INSTALLING PROTECTOR GROUND WIRE

### 33. Attaching ground wire.

#### Plaster on Wood Lath



#### Woodwork



Softwood-1 in. Roofing Nail  
Hardwood-3/4 in. #8 RH Blue Wood Screw.

#### Masonry



#### Hollow Tile



#### Masonry

1 in. #10 RH Brass Wood Screw



4 in. piece of #14 Ground Wire with the Insulation removed.

Insert screw in 3/16 in. x 3/4 in. expansion shield. Drill hole for shield so that top of head of screw will be flush with masonry.

#### INSIDE

#### Cinder Concrete or Plaster Block

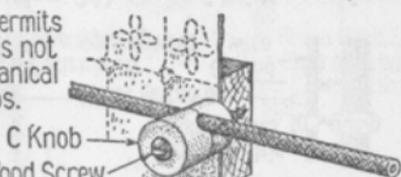


#### Plaster Board

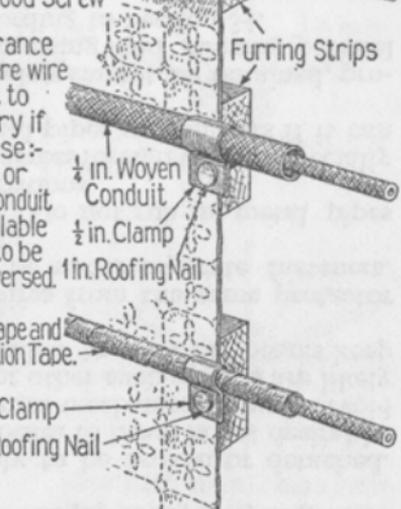


#### Metal Sheathed Side Walls or Ceilings

Where appearance permits and where wire is not subject to mechanical injury, use knobs.



Where good appearance is essential or where wire would be subject to mechanical injury if run on knobs, use:-  
A-Woven conduit or  
B-Where woven conduit is not readily available use tape, layers to be half lapped and reversed.



#### OUTSIDE

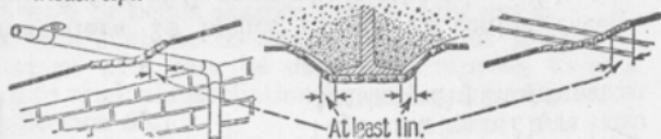
#### Woodwork



### 34. Crossing or paralleling other wires or metallic objects.

Crossing gas pipes, electric light conduit, metal work, electric bell or other signalling wires, or telephone wires not connected to same protector.

Where within  $\frac{1}{2}$  in. apply woven conduit to ground wire or 1 layer rubber tape and 1 layer friction tape.



Securing the woven conduit.

Woven conduit should always be secured either by taping or by clamping.

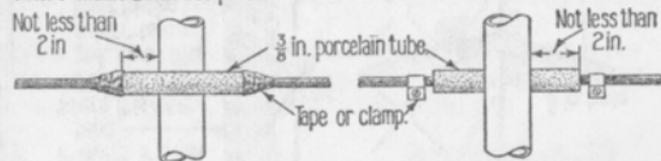


Crossing water pipes.

Water pipes are liable to sweat under certain conditions. Where practicable therefore, water pipes should be crossed above rather than below. Where within  $\frac{1}{2}$  inch give ground wire 1 layer rubber tape and 1 layer friction tape.

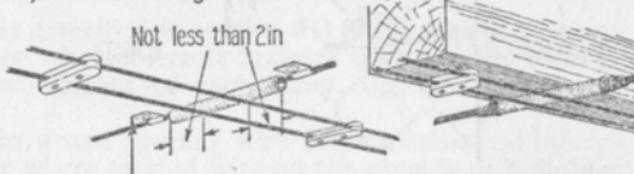
Crossing steam pipes.

Where within  $\frac{1}{2}$  inch use porcelain tube.



Crossing open electric light wires.

Where crossing within 2 inches, use a  $\frac{3}{8}$  in. porcelain tube projecting at least 2 inches beyond the electric light wires and in one piece.



As close to tube as practicable.

Crossing wooden electric light moulding.

No taping, or other protection required. Do not attach to the moulding.



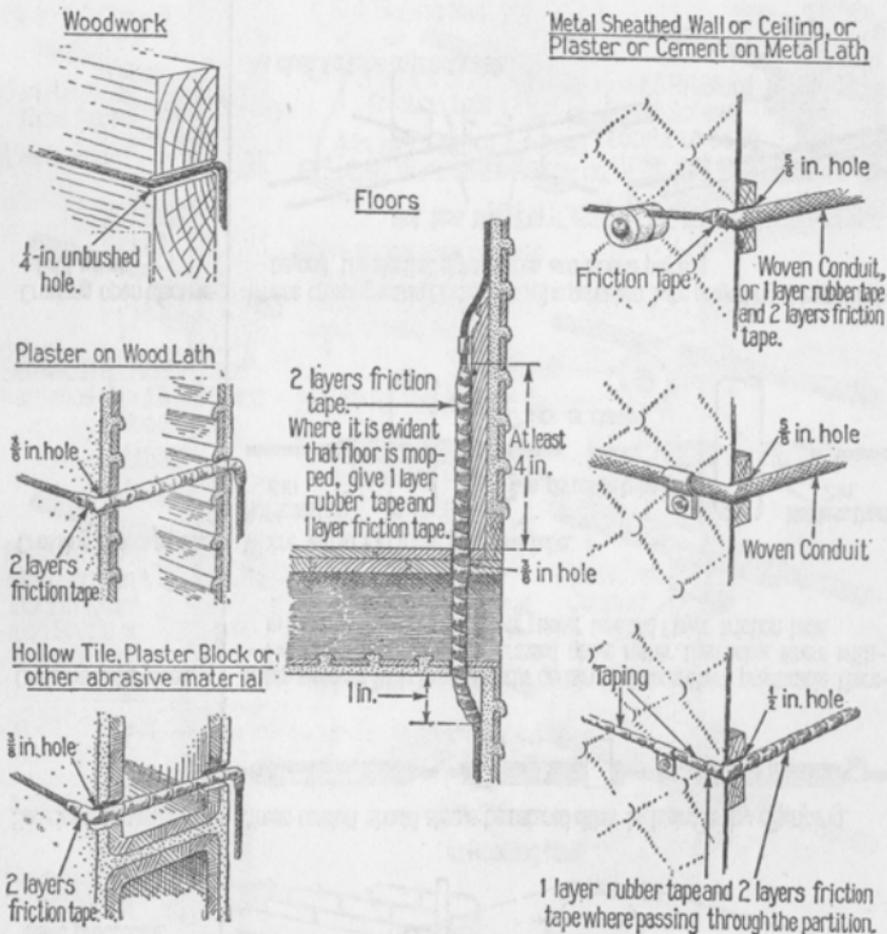
Crossing instrument wires connected to the same protector.

No protection required.

## INSTALLING PROTECTOR GROUND WIRE

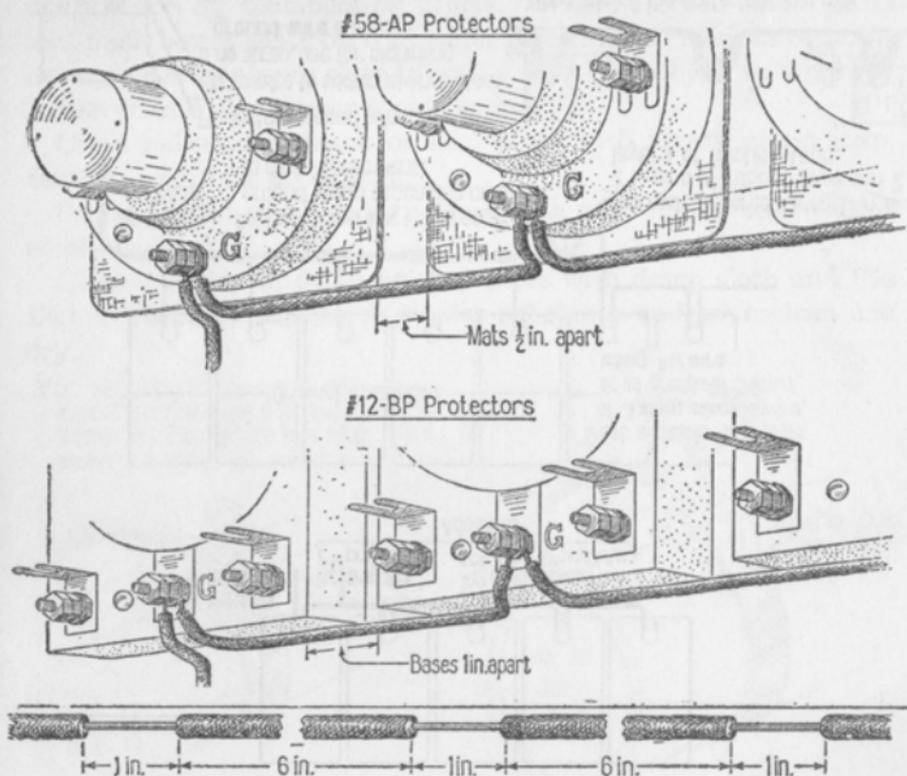
### 35. Passing through floors and walls.

Instrument wires and ground wire shall be run through separate holes. The layers of tape are to be half lapped and reversed.

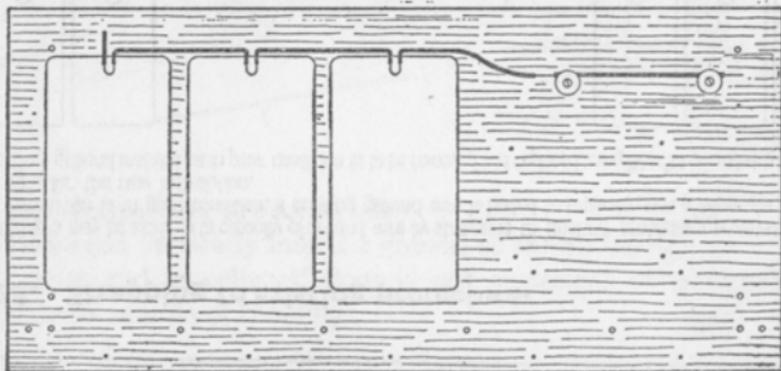


**36. Space all fasteners** 24 inches center to center except where wire is within 5 feet of floor or where otherwise subject to injury or displacement. In such cases space fasteners 12 inches center to center. When run on beams (see sec. 32) place fastener on every beam.

### 37. Terminating on two or more protectors.



When installing less than 5 protectors on a # 81 Backboard, place enough ground wire to reach 5 protectors so that strapping will not be required in case of growth. Skin wire for five ground post connections when making original installation and fasten excess length with C Knobs and screws, using screw holes drilled for protectors.

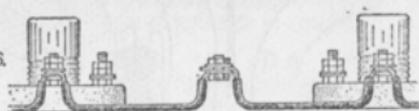
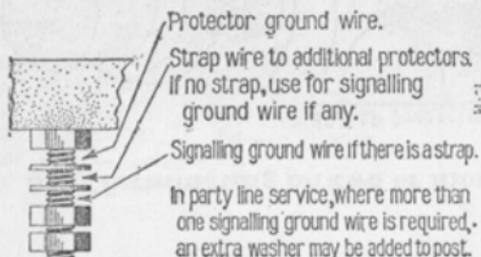
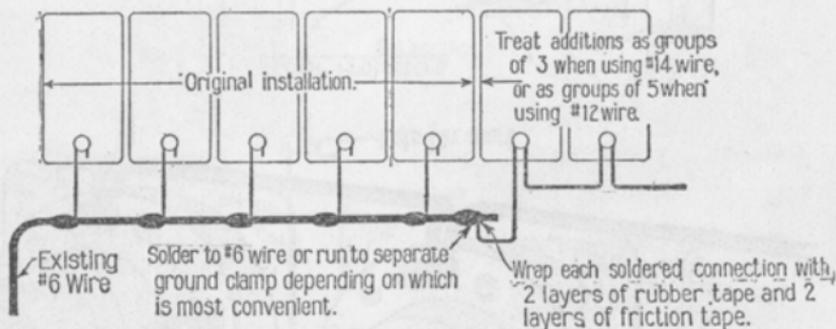
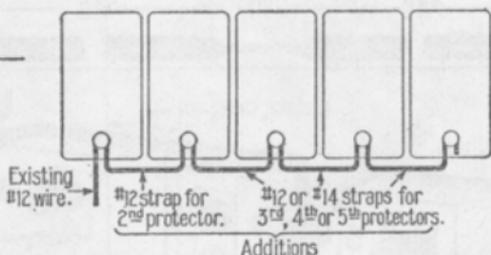
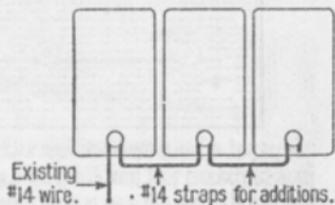
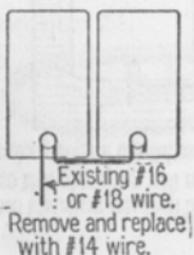


**SUBSTATION  
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## INSTALLING PROTECTOR GROUND WIRE

### 38. Strapping to existing protectors.

Protectors may be added up to capacity of ground wire by strapping to existing protectors, provided ground installation is in good condition. If existing ground wire is loaded to capacity, run a separate ground wire for the new installation. Existing ground installation in poor condition is to be removed and replaced, using #12 or #14 ground wire as required.



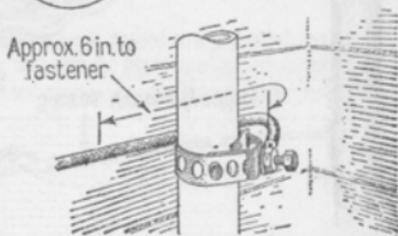
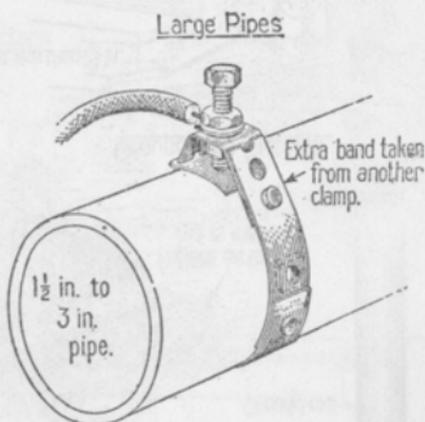
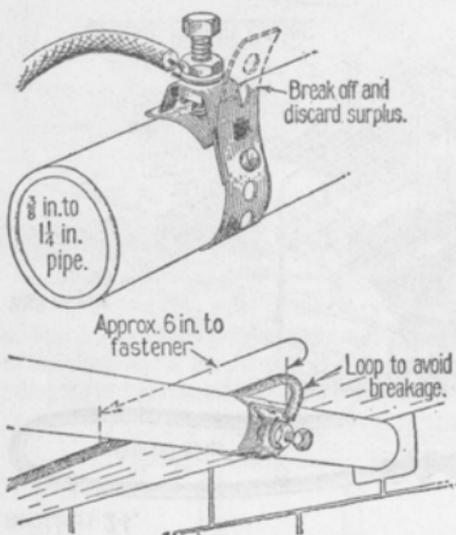
39. **Locate ground clamp** where least liable to injury or disturbance by plumbers or others. Where located under sinks and wash bowls, place on cold water pipe close up to sinks or bowls or on cold water pipes close to wall. On pipes subject to vibration locate ground clamp near a pipe support.

Clean galvanized, black or lead pipes with emery paper strip. Use fresh strip for each clamp.

Scrape rusted or very dirty pipes with edge of file before using emery paper strip.

Clean nicked or other finished pipes with damp cloth and Old Dutch Cleanser, Sapolio or similar substance and wipe clean and dry.

After installing clamp break off excess strip leaving one hole beyond pin. Place ground wire under washer and tighten lock nut firmly.



#### 40. **Installing ground rod.**

Drive rod vertically into the ground as shown below.

Locate rod in cellar if floor is not cemented or waterproofed, otherwise outside of building.

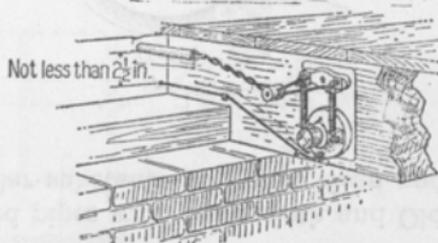
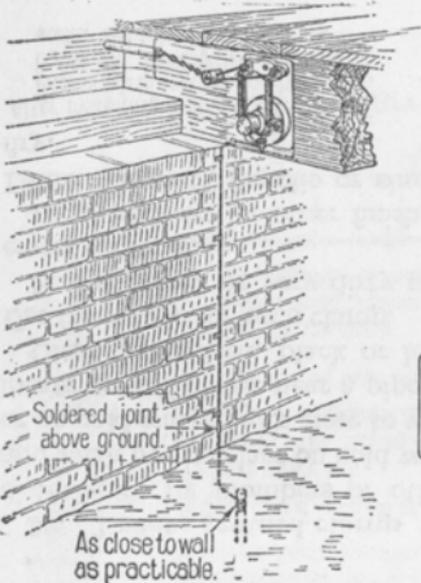
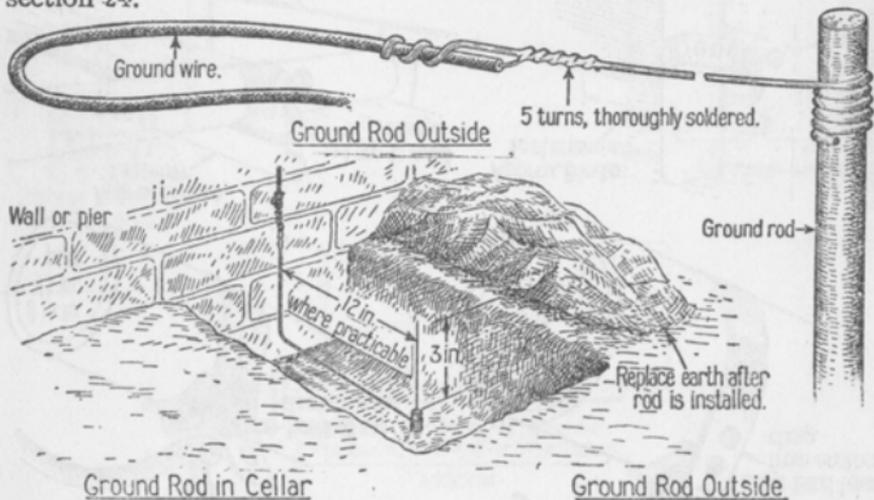
**SUBSTATION  
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## INSTALLING PROTECTOR GROUND WIRE

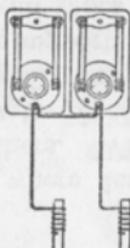
Locate rod and ground wire to it where least liable to injury and tampering. Avoid placing rod in public alleys or on street or sidewalk side when buildings are on or near street or sidewalk line.

Inspect rod after driving and make sure that wire joints are not broken. If broken at rod install another rod.

Joint should be above ground in all cases except as specified in section 24.



Protect ground wire outside of building with woven conduit or station ground wire moulding where wire is near walk or other thoroughfare. Wrap wire and conduit with friction tape at entrance to conduit.

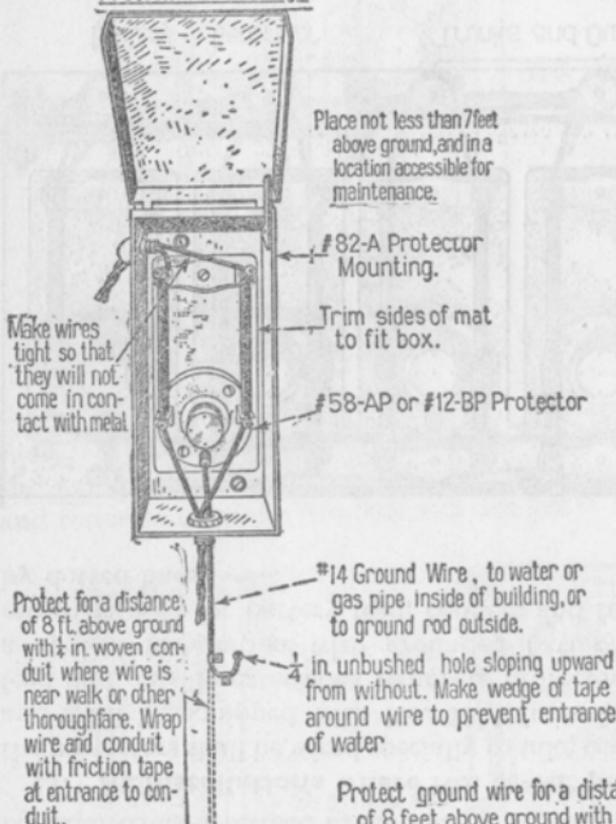


In ground rod installations, all protectors shall be strapped together with ground wire. A ground rod and ground wire shall be placed for each protector; drive rods at least 12 inches apart.

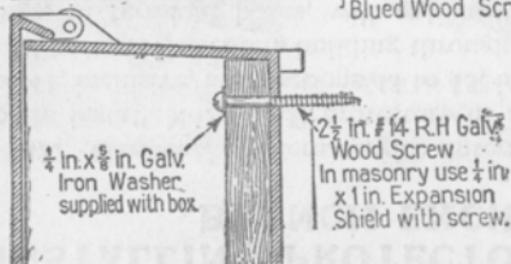
# INSTALLING PROTECTORS ON BUILDINGS AND POLES

41. Place protector in #82-A Protector Mounting for protecting subscriber's sets placed outdoors (such as police call box) or where it is necessary (see Sec. 11) to place protector on outside of building.

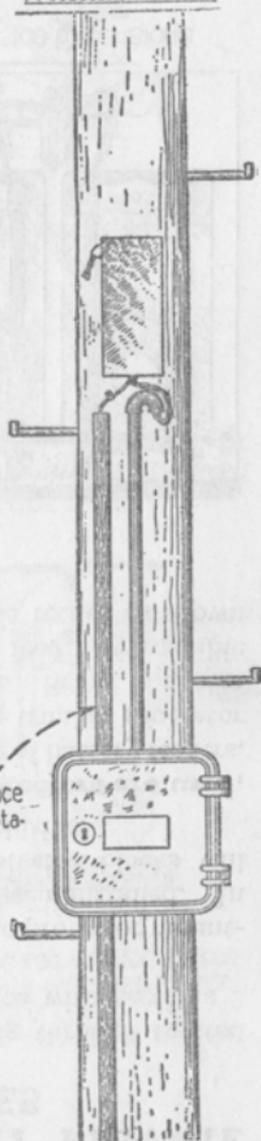
## Protectors on Buildings



## Attaching #82-A Protector Mounting



## Protectors on Poles



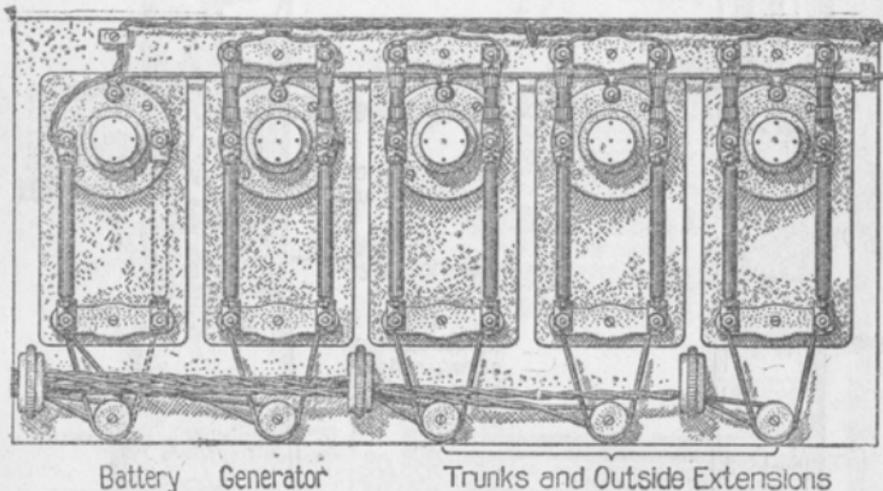
**SUBSTATION  
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## INSTALLING PROTECTORS AT PRIVATE BRANCH EXCHANGES

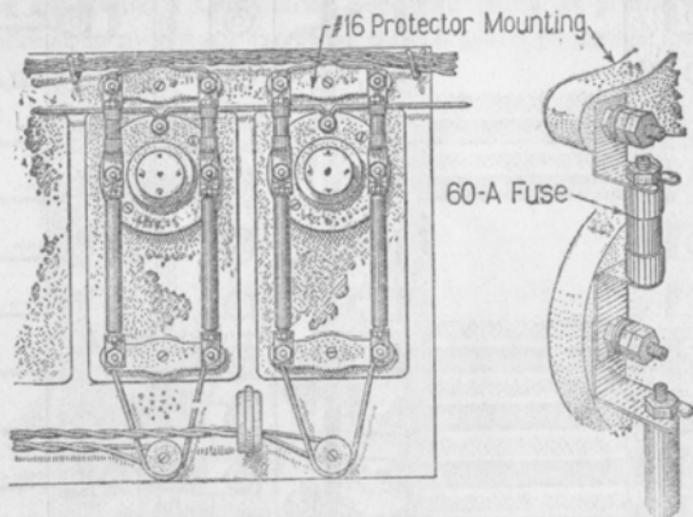
**42. General.** Where service enters building through twisted pairs install No. 58-AP protectors in accordance with sections 2 to 41, inclusive, and sections 43 to 45, inclusive.

Where service enters building through cable the protector mountings, in terminal boxes, will ordinarily have been installed. In these cases only installation of fuses and protector blocks will be required as described in sections 46 to 48, inclusive.

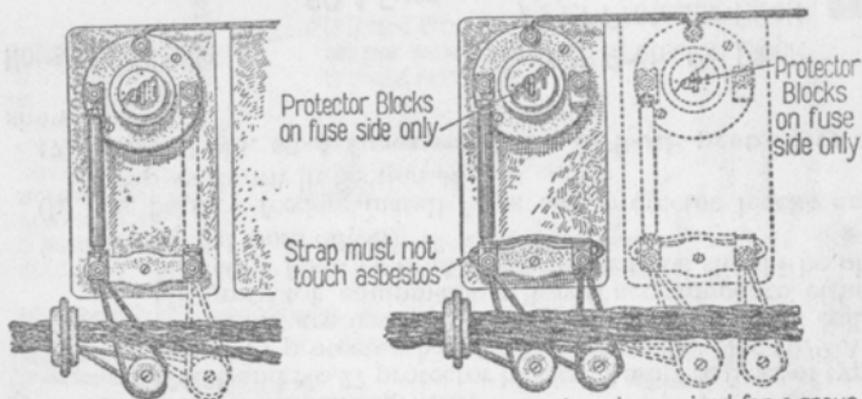
**43. At installations where No. 58-AP protectors are used,** the protectors shall be wired specially to take care of battery feeders, and shall be equipped with No. 60-A fuses for trunks, generator feed and outside extensions requiring protectors. Below is shown a typical installation with grounded battery feed. If metallic return is used for battery feed, connect and fuse return as shown by dotted lines.



44. To install the No. 60-A fuses in connection with a No. 58-AP protector, use a No. 16 protector mounting as shown below.



45. If the battery feed consists of more than one conductor all of the conductors in any one group must be strapped at the protector and connected to only one fuse and one set of protector blocks.



If metallic return is used, connect and fuse return as shown in dotted lines.

If more than one drop is required for a group of battery feed, terminate and strap as shown in solid. If metallic return is used connect and fuse return on protector as shown by dotted lines.

INSTALLATION INSTRUCTIONS FOR THE PROTECTOR

**SUBSTATION  
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## INSTALLING PROTECTORS AT PRIVATE BRANCH EXCHANGES

46. Where service enters building through cable, the installer shall do the following work:

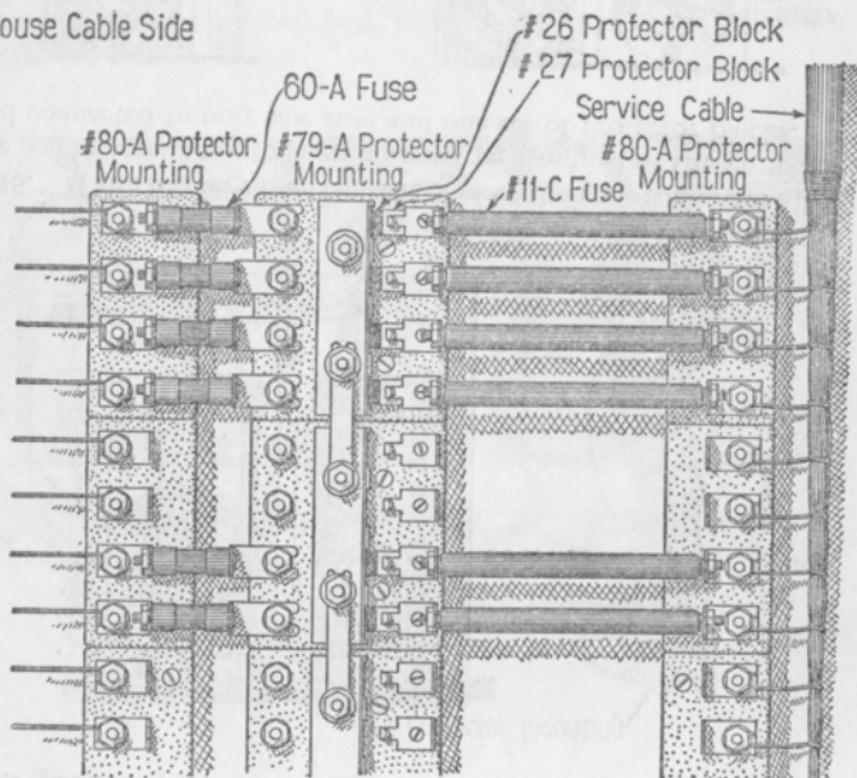
- (a) On all trunks, generator feeds and outside extensions equip the protector mounting with:

No.26 and No.27 protector blocks. 7 ampere fuses of type suited to protector No. 60-A fuses where No. 1079-AP protectors are used; otherwise use standard heat coils. (If protector equipment will not accommodate either No. 60-A fuses or heat coils, instructions should be obtained from office.)

- (b) On battery feeders install fuses and protector blocks and strap as shown in Section 48.

47. Install No. 60-A fuses with No. 1079-AP protectors as shown below.

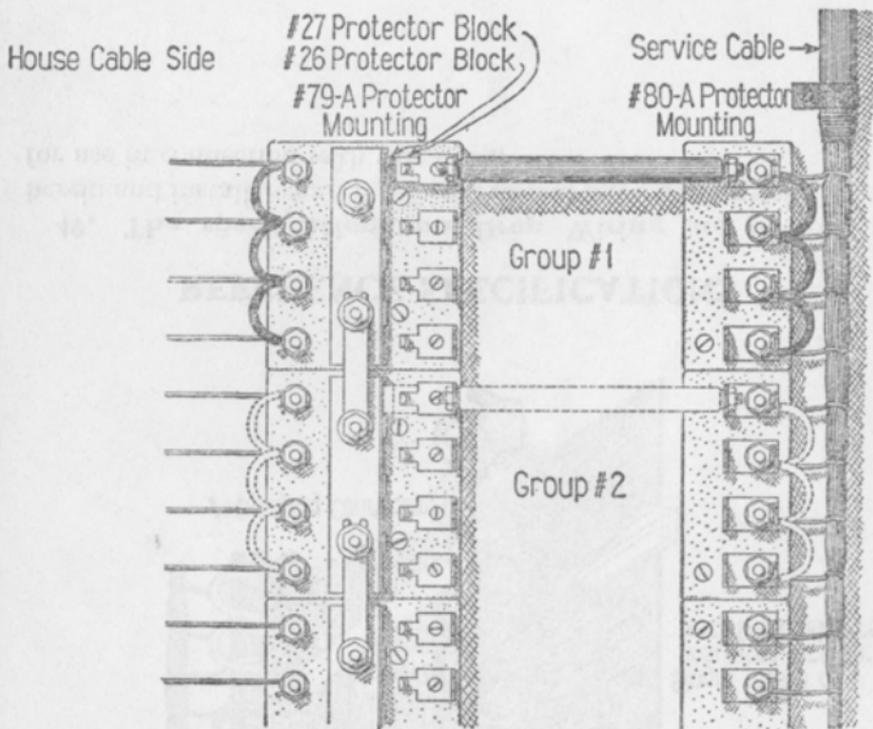
House Cable Side



If a pair does not require #60-A fuse protection, strap from the #80-A protector mounting to the #79-A protector mounting with standard cross-connecting wire instead of using #60-A fuses.

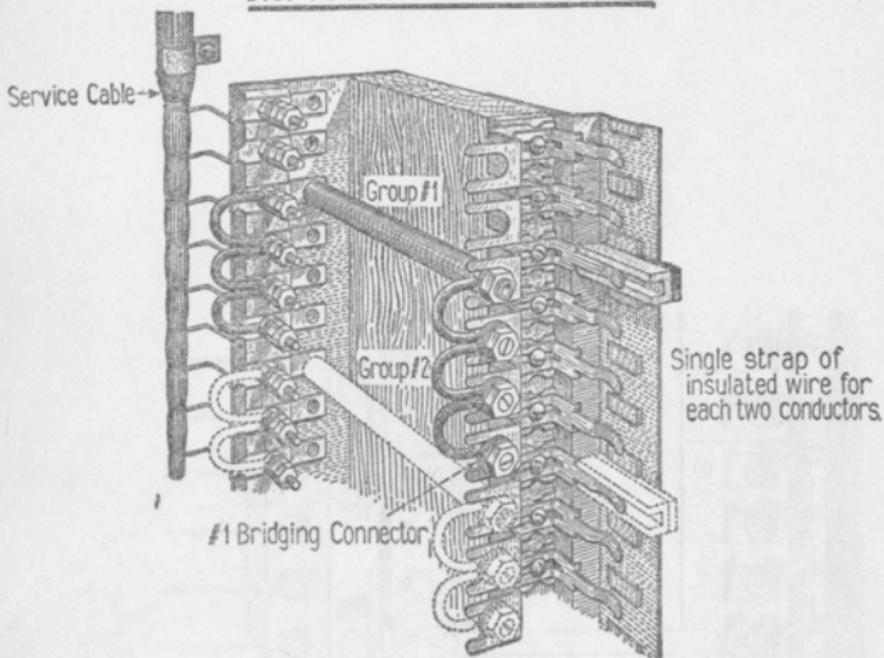
48. Where battery feed consists of more than one conductor, strap all conductors in any one group at both the incoming and house cable side. Connect through a single fuse and one set of protector blocks. If metallic return is used fuse and strap return in the same manner as the battery.

No. 1079-AP Protector.



## INSTALLING PROTECTORS AT PRIVATE BRANCH EXCHANGES

### No. 74-A Protector Mounting.



## REFERENCE SPECIFICATIONS

49. The specifications on Drop Wiring are referred to herein and installers and repairmen should have these specifications for use in connection with this work.