SUBSCRIBER BUILDING
CABLE AND TERMINAL GROUNDING

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1. GENERAL

1.01 This section describes the purpose and methods used for bonding and grounding entrance feeder cables, intrabuilding network cables, and cable terminals within subscriber premises. A glossary of terms is included in part 6.

1.02 This section is reissued to:

- Add entrance requirements pertaining to waterproof cable
- Add bonding and grounding information for subscriber buildings
- Add grounding information for 3A- and 4A-type terminal sections.

Revision arrows are used to emphasize the more significant changes.

1.03 When using terminal blocks and/or protectors for terminating feeder cables in subscriber buildings, refer to the sections listed in Table A for proper grounding and/or bonding procedures.

1.04 Where more than one protected terminal is installed, they must be bonded together as shown in Fig. 1.

1.05

Cables entering power stations, radio stations, etc, require special consideration. The treatment must be specified on detailed plans and engineering work prints. For specific detail read 876-310-100 and 876-210-100.

2. PURPOSE OF GROUNDING

2.01 The purpose of grounding a cable sheath is to limit voltages that may be present on the cable sheath from external sources such as lightning or accidental power facility contact with the cable sheath. Grounding the cable sheath will provide a path to ground for voltage surges.

2.02 When multiple cables enter a subscriber building they must be bonded together to reduce the overall resistance to ground and to equalize the potentials which might otherwise appear between cable sheaths. The continuity of the grounding path must be maintained at all times. The length of the ground wire must be as short as possible, free of sharp bends and continuous to provide a low-resistance path to ground.

2.03 Cable plant that is effectively grounded yields the following benefits:

(a) Exposed cable

(1) Safety to the public

(2) Safety to telephone company personnel

(3) A minimum of damage during severe electrical storms

(4) A minimum of service interruptions

(5) Noise suppression.

(b) Unexposed cable

(1) Noise suppression

(2) The proper operation of telephone equipment on the premises.

3. GROUNDING AND BONDING

3.01 →The approved ground to be used as a protector ground and to ground the cable shield shall be shown on the work prints by the engineer. Figure 2 provides a flowchart for selecting an approved ground and notifying customer when ground is not accessible.←

Care must be exercised before installing cable and terminal grounds in subscriber buildings where the structure is under construction or being remodeled. At these locations, temporary power and water pipe arrangements are often encountered. It is important to select a ground electrode of a permanent nature.

A. Selecting Grounds

3.02 →The first choice for approved ground is some part of the power grounding system (Fig. 3). The National Electrical Code requires that the telephone and power grounds be bonded and that an accessible means be provided at the electrical service for bonding other systems, such as telephone, to the power. This means may consist of an accessible metallic service entrance conduit, a power grounding conductor (see note), or a connector located on the exterior of the power service raceway or power service equipment (circuit breaker panel.)

Note: In some cases this may be a ground conductor from the interior of the circuit breaker panel which has been left accessible.

3.03 A protector or protected building terminal designed to serve more than six pair must be connected to the power ground with a No. 6 AWG copper ground wire. The protector or protected building terminal should be placed near the power service entrance to minimize the length of the telephone grounding conductor. This connection must be made even though the cable sheath is grounded.←

3.04 Metal power service entrance conduit may be used for the cable and building terminal ground. The power service entrance conduit is the metallic conduit through which the power service conductors feeding the premises enter the box containing the main power breaker or fuse. If the power ground is encased in metallic conduit, the ground clamp can be attached to this conduit.

3.05 **Do not** connect grounds to the following:

- Gas pipe
- Electric service branch circuit conduit
- Armor of BX cable
- Interior of any electrical box.

3.06 →In large buildings the power service ground may be inaccessible or not easily identified. An approved ground may be obtained by connection to a telephone ground rod array and the building steel or a metallic water pipe. Where it can be established that the power ground is bonded to the metallic interior water pipe system and to the building structural steel, it is acceptable to use either of these as approved grounds if the power ground is inaccessible. Where it is doubtful or where it is known that these systems have not been bonded together and the power ground is inaccessible, the only choice for an approved ground is three driven ground rods located at least six feet apart and bonded together with #6 AWG copper conductor. When using telephone ground rods, they must be grounded to the building steel and the interior metallic water piping system. See Fig. 4. ←

B. Installing Ground Wire

3.07 A continuous length of No. 6 AWG copper ground wire is used for cable terminal grounds. If a splice in this ground wire is necessary, consider the following.

- A ground wire run can only have one splice
- **Do not** splice existing ground wire runs of less than 10 feet in length. Install a new ground wire of proper length.
- **Do not** install a smaller gauge wire to extend a large gauge wire.
- Use the proper size sleeve, ground bus, or wire connector for splicing ground wires. **Do not** improvise by using other improper types.
- Concealed ground wire runs may be spliced if the continuity of the existing wire is tested and if the splice will be accessible.
- **Do not** tape ground wire splices.
- A ground wire run must be as straight as possible.

C. Grounding Hardware

3.08 The selection of ground clamps and wire connectors used for cable and terminal grounding is listed in Tables B and C. Figures 5 through 10 illustrate the application of the ground clamps listed in Table B. **Figure 11 illustrate the** connections listed in Table C.

3.09 A form must be placed on all ground wire terminations to warn against disturbance of clamps or wire.

4. RULES FOR GROUNDING EXPOSED CABLES, UNEXPOSED CABLES, AND INSULATING JOINTS

A. Exposed Cable

4.01 Splices in exposed building entrance cables containing less than 400 pairs must be enclosed in a metallic splice case. This will provide a safe closure around cable pairs that could carry excessive current under fault conditions. Nonmetallic closures for cables 400 pairs and larger are judged to be acceptable under fault conditions.

4.02 Exposed cable entering a subscriber's building must be grounded as close to the entrance as possible but not more than 50 feet from the entrance. Where cable enters the building in conduit, the point at which the cable emerges from this conduit is considered the entrance point. See Fig. 12.

4.03 All splices in exposed entrance cables containing fewer than 400 pairs and located on the CO side of the protector **must be enclosed in a metallic splice case**. See Fig. 13.

4.04 Splices in exposed entrance cables containing 400 or more pairs can be enclosed in a nonmetallic splice closure. Where the closure bonding device across the splice is equivalent to #6 AWG ground wire, the bonding requirement is the same as for a metallic splice case. When the closure bonding device is not equivalent to #6 AWG, the cable shield on the CO side of the splice must be bonded to the protector ground terminal or the protector ground electrode, whichever is closer. This must be done even when the protector is installed within 50 feet of the building entrance (Fig. 14).

4.05 →**Caution: Waterproof cable is not fire resistant.** ← When waterproof cable is used for building entrances, the following requirements must apply.

- →Waterproof cable may not extend more than 50 feet into a building.←
- A metallic splice case must be used on all splices regardless of cable size.
- The cable shield must be bonded to the building ground within 50 feet of the entrance.
- →Waterproof cable may not be used as distribution cable in a building.
- Conductors of waterproof cable must not be terminated on a connector or protector block.←
- A transition must be made to →intrabuilding network cable within 50 feet of the building entrance point← and the splice must be enclosed with a metallic splice case.

B. Unexposed Cable

4.06 When the cable shield of unexposed cable is electrically continuous, the cable is considered adequately grounded if the cable is bonded to ground in a grounded metallic terminal housing. Shield continuity must be maintained at all times for the cable to be adequately grounded.

C. Insulating Joints

4.07 When insulating joints and a parallel capacitor are installed inside a building, the cable must be grounded on the building side of the insulating joint. A No. 6 AWG copper ground wire →or equivalent gauge bonding ribbon ← must be attached to the cable shield on the building side of the insulating joint and terminated to an approved ground (Fig. 15). If there is more than one entrance cable, they must be bonded together on the street side of the insulating joint. The cables, together with all associated metal (such as capacitors, pressure pipes, and bonding ribbon), must be insulated from ground on the street side of the insulating joint.

4.08 The methods used for grounding and bonding splice closures are described and illustrated in the appropriate practices pertaining to the type of closure used.

5. GROUNDING INTRABUILDING NETWORK CABLE

5.01 →Feeder cable and intrabuilding network cable shields must be electrically continuous.← If the intrabuilding cable shield is or can be bonded to an effectively grounded protector or metal terminal housing, such bonding is adequate and no other direct connection to ground is necessary.

5.02 Where, for electrolysis reasons, a separation between the →intrabuilding network cable← and exposed feeder cable sheaths is provided either by an insulating joint or 1A4A-type terminal with the linkage removed, no bond shall be placed around the insulating joint on the terminal. In these cases, run a No. 6 AWG copper ground wire from a convenient point on the →intrabuilding network← cable shield to the protector ground by any method described in this section which may apply.

Note: Metallic terminal sections, unless equipped with backboards, do not provide electrical separation between feeder and →intrabuilding network← cable shields since electrical continuity is maintained through the metal terminal section.

5.03 When unexposed feeder and → intrabuilding network ← cables are terminated on unprotected terminal blocks such as the 66-type, ground the cable shields in the metal terminal housings as described in Sections 631-460-201 and 631-470-201. The terminal housing must in turn be grounded by running a No. 6 AWG copper ground wire to an approved ground. Figure **16** illustrates bonding of the →intrabuilding network← and feeder cable shields to the grounded metal housing by using bond clamps.

5.04 →When feeder and intrabuilding network cables are terminated on unprotected terminal blocks in 3A- or 4A-type terminal sections, the terminal section must be grounded. There are bonding brackets located on the top and bottom parts of the cable terminal sections (Fig. 17). Either bonding bracket may be grounded by using a No. 6 AWG copper grounding wire attached to an approved ground. Section 631-400-101 describes the joining of two or more cable terminal sections. Multiple cable terminal sections that are joined should be grounded as shown in Fig. **18**. ←

5.05 When openings are made or taped splices are left in → intrabuilding network← cable (other than insulating joints), shield continuity must be maintained.

6. GLOSSARY OF TERMS

6.01 In order to provide a common language base for the terms used in this and related sections, the following definitions are given.

Bond(ing) — The electrical interconnection of conductive parts designed to maintain a common electrical potential.

Building Ground — An acceptable ground connection provided by building construction steel in contact with earth ground or a bare copper wire encased in concrete building footing.

Cold Water Pipe Ground — An acceptable ground connection provided by a continuous buried metal pipe with at least 10 feet of length in moist earth and carrying cold water into the building.

Exposed Facilities — Any cable facilities subject to the effects of lightning, power crosses, power induction, or differences in ground potential over 300V.

Fuse — An overcurrent protective device with a circuit opening fusible part that is heated and severed by the passage of excessive current through it.

Fuse Cable — A length of protective cable having 24- or 26-gauge copper conductors that is inserted in the plant and intended to fuse open to prevent foreign power currents. →The fuse cable must be two wire gauges smaller than the cable it is intended to protect.← It does not protect against lightning currents.

Ground — A conducting connection between a circuit or equipment and the earth.

Grounding Terminal — A suitable bar, bus, terminal strip, or binding post terminal whereby grounding and bonding conductors can be connected.

High Rise Building — Any multistory building over three stories of structural steel or reinforced concrete construction.

Insulating Joint — An opening in a cable sheath where the continuity of the sheath, shield, and moisture barriers are deliberately interrupted to prevent the flow of electrolytic currents that may cause corrosion.

→Intrabuilding Network Cable — A cable in a building that extends the outside plant distribution facilities to equipment rooms, cross-connection points, or other distribution points. This cable was formerly referred to as riser cable.

Network Terminating Wire — Wire installed for a specific network service that is used to connect the intrabuilding facilities to the network interface.←

Protector — A device used to limit foreign voltages on telephone conductors.

Protector Ground Conductor — A wire run from the ground lug on the protector to an approved ground by the shortest and straightest route.

Protector Unit — A device containing carbon blocks or a gas tube, in combination with shorting devices and/or heat coils, that screws or plugs into a protector, protected terminal, connecting block, or central office connector.

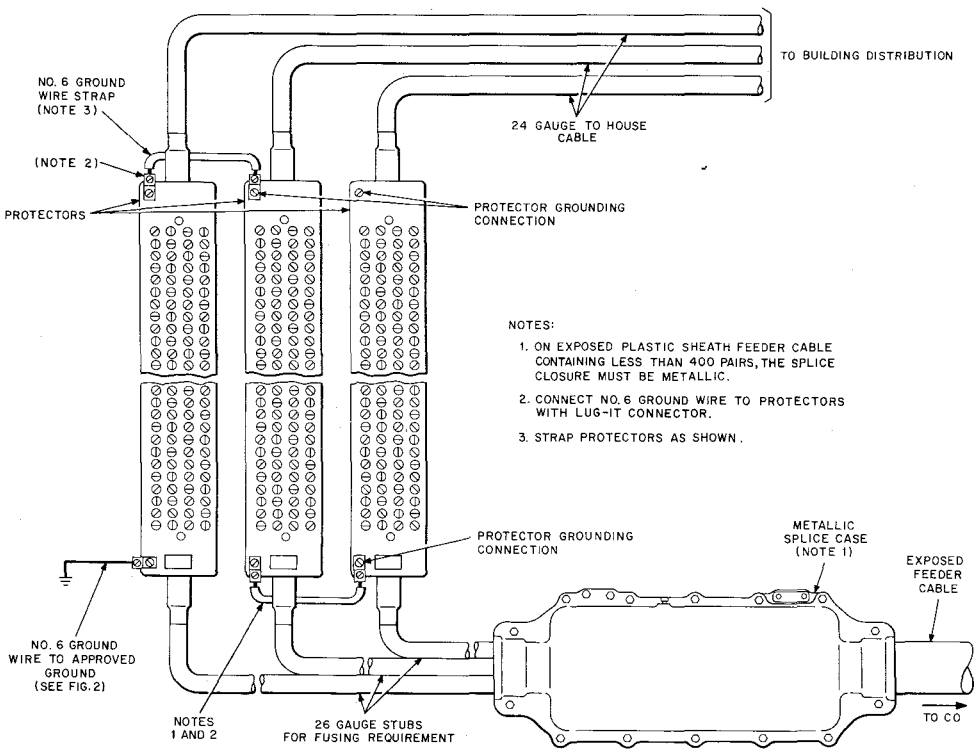


Fig. 1—Grounding 134-Type Protectors

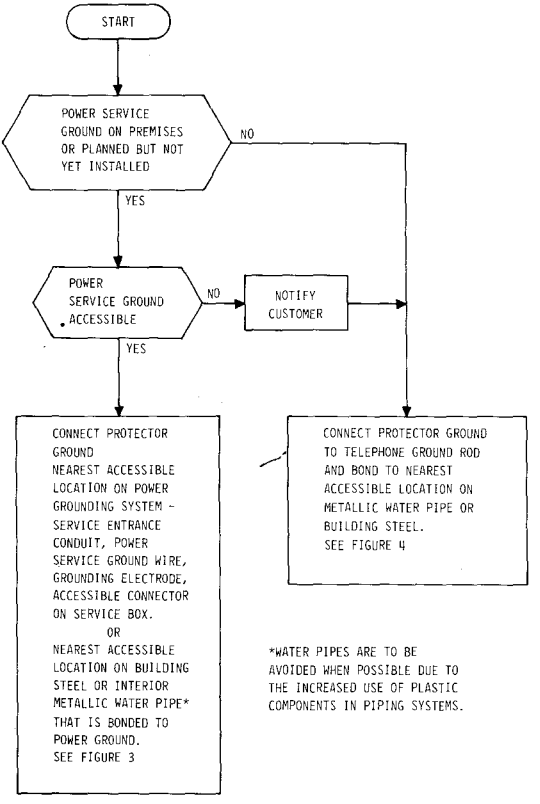


Fig. 2—Selecting an Approved Ground

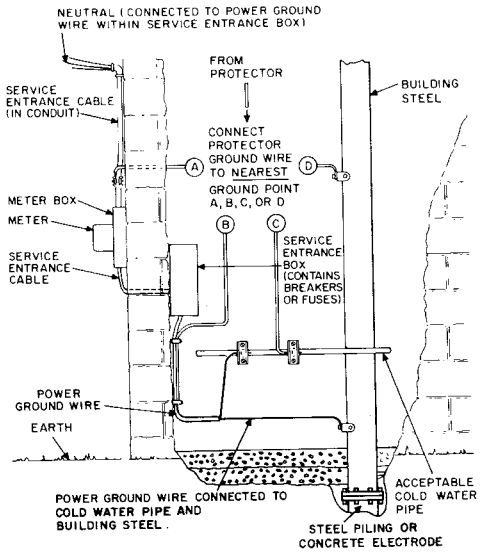


Fig. 3—Acceptable Grounding Connections to the Power Ground

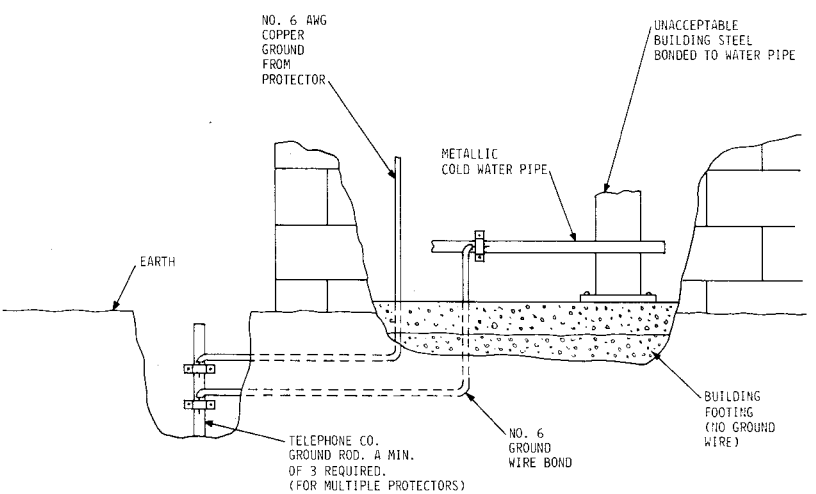
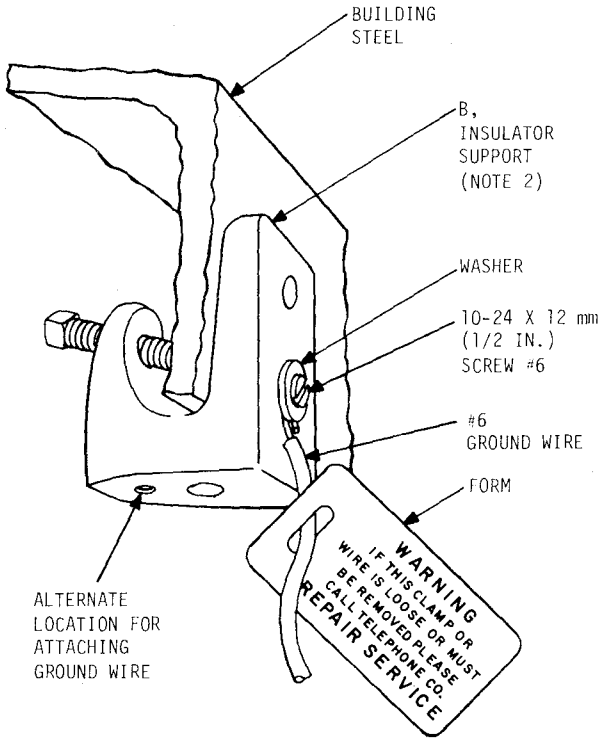


Fig. 4—Acceptable Ground Connections When Power Service is Not Grounded, Not Accessible or When There is No Power on the Premises



INSTALL AS FOLLOWS:

HOLD INSULATOR SUPPORT ON BUILDING STEEL, PLACE BOLT THROUGH INSULATOR SUPPORT AND TIGHTEN TO HOLD SUPPORT IN PLACE. PLACE WASHERS AND SCREW LOOSELY INTO SUPPORT. REMOVE INSULATION FROM GROUND WIRE AND BEND BARE CONDUCTOR AROUND SCREW BETWEEN WASHERS. TIGHTEN SCREW. MAKE SURE BOLT IS TIGHT.

NOTES:

1. BOLT, SCREW, AND WASHERS ARE NOT PROVIDED WITH SUPPORT.
2. THE B INSULATOR SUPPORT WILL ACCOMMODATE METAL FLANGES UP TO 1/2 INCH

Fig. 5—Grounding to Building Steel

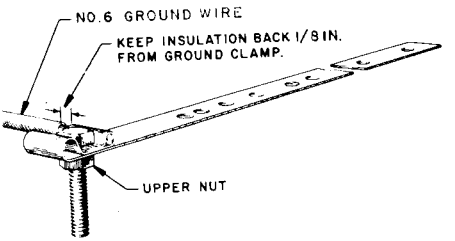


Fig. 6—Attaching No. 6 Ground Wire to L Ground Clamp

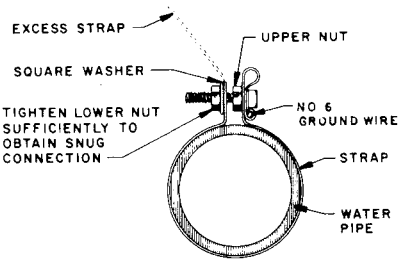


Fig. 7—Attaching L Ground Clamp to 3-inch or Smaller Pipe

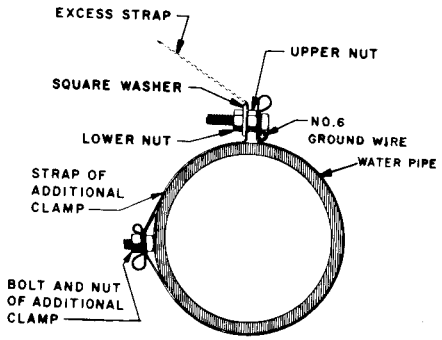


Fig. 8—Attaching L Ground Clamp to Pipes Larger Than 3 Inches

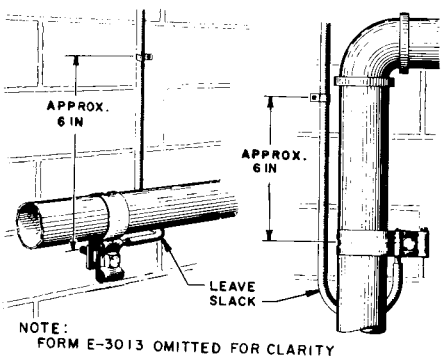


Fig. 9—Typical Installation — L Ground Clamp

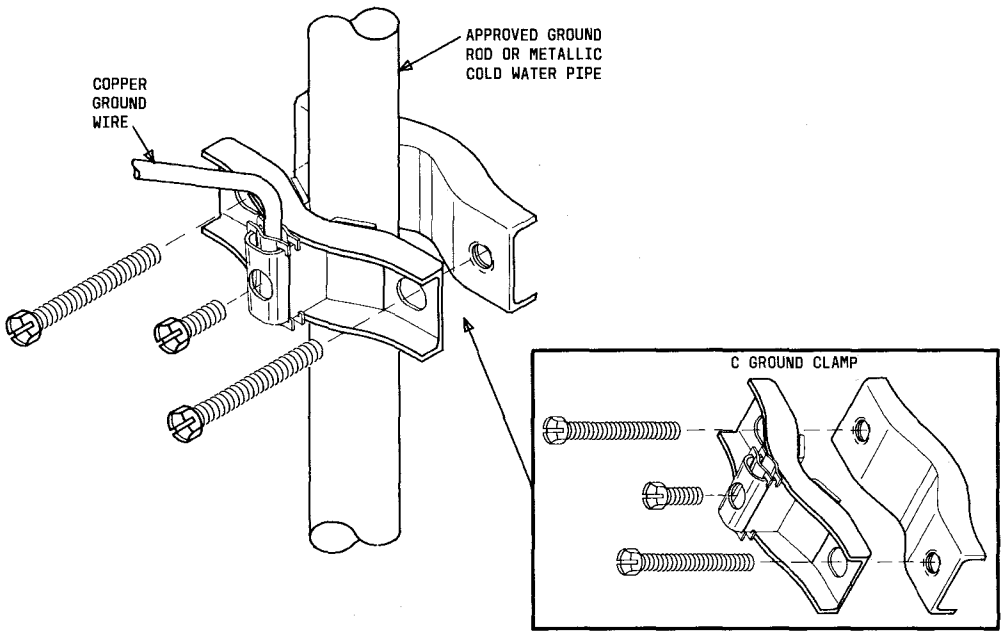


Fig. 10—Typical Installation — C Ground Clamp

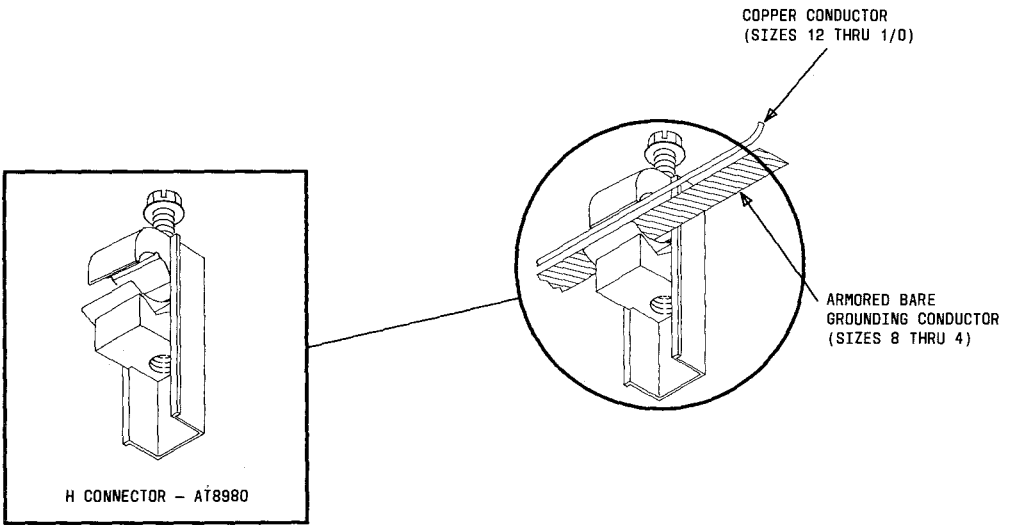


Fig. 11—H Connectors (AT-8980)

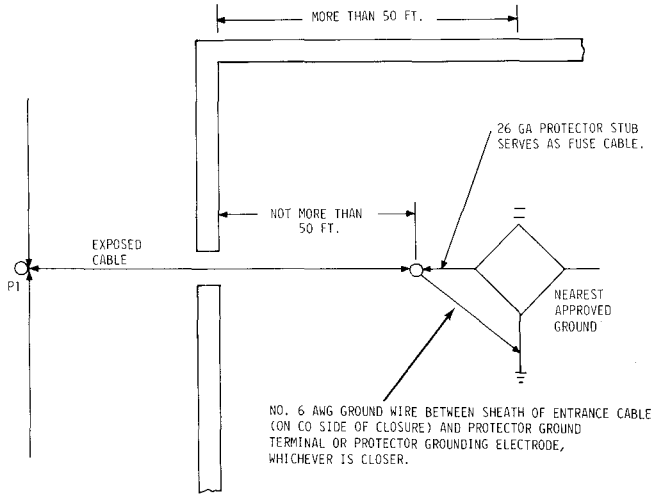


Fig. 12—Exposed Building Entrance Cable with Protector More Than 50 Feet from Cable Entrance Point

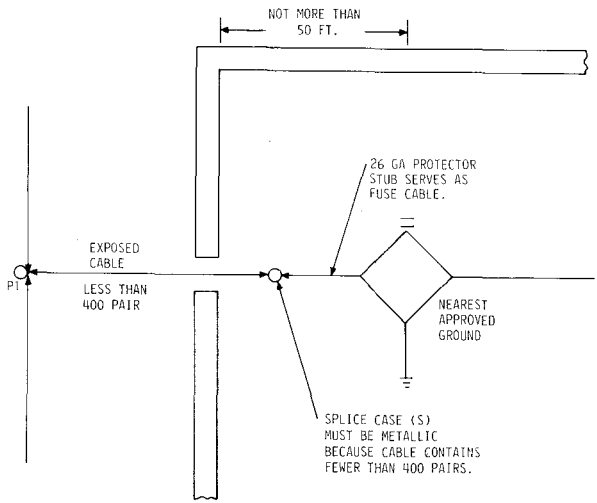


Fig. 13—Exposed Building Entrance Cable with Protector Not More Than 50 Feet from Cable Entrance Point

NOTE:
WHEN BONDING ACROSS SPLICE IS EQUIVALENT TO #6 AWG AND PROTECTOR GROUND IS WITHIN 50 FT. OF ENTRANCE, NO ADDITIONAL SPLICE GROUND IS REQUIRED.

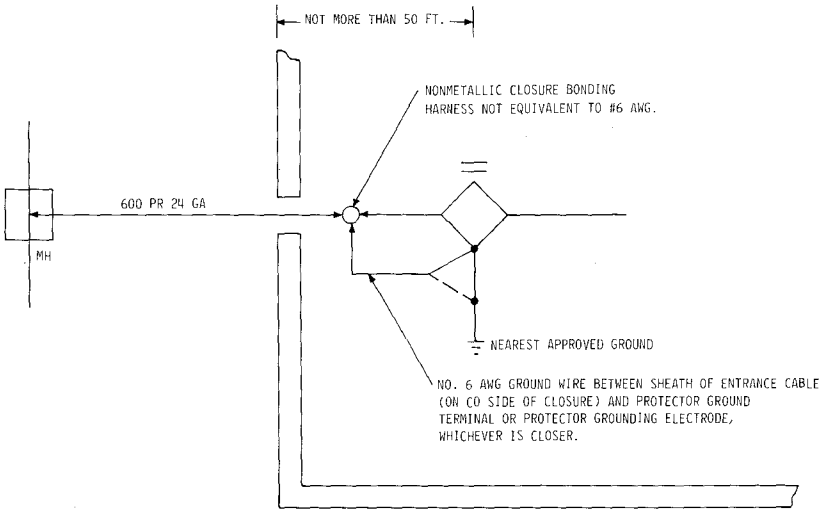


Fig. 14—Exposed Building Entrance Cable with Nonmetallic Closure Installed Ahead of Protectors

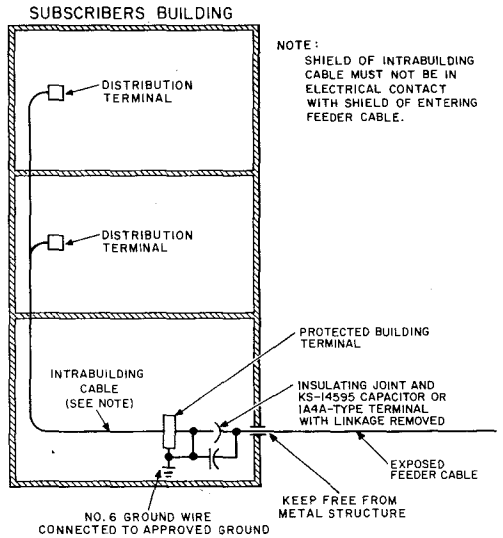


Fig. 15—Insulating Joint in Building

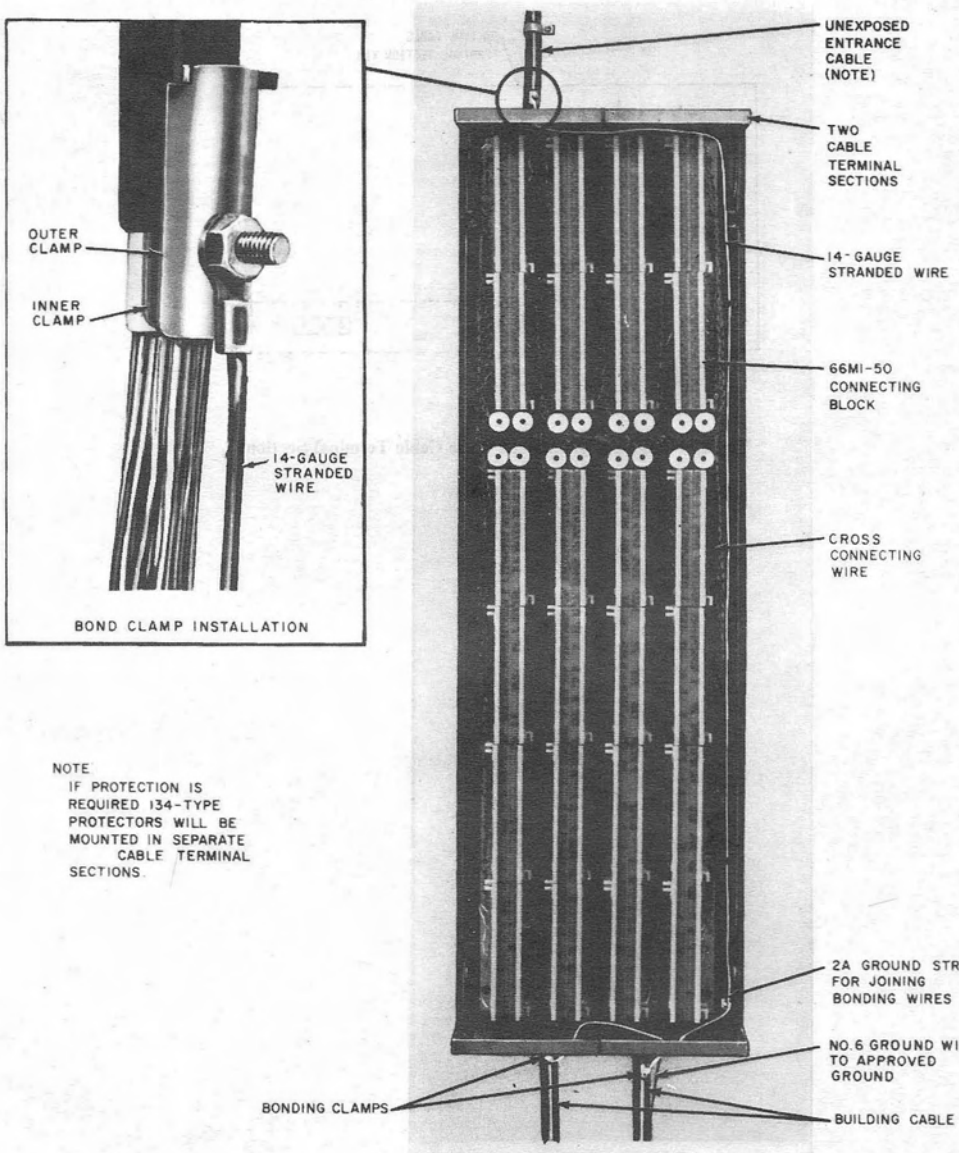


Fig. 16—Grounding Unexposed Feeder Cable and House Cable

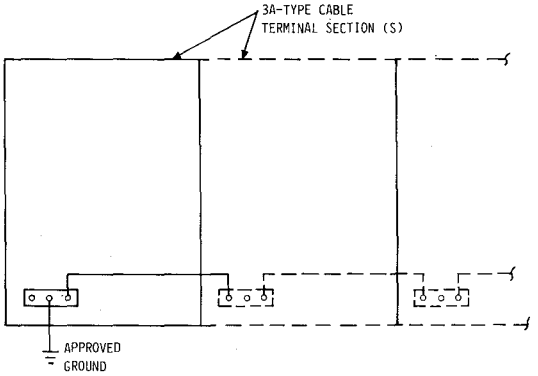


Fig. 17—Bonding 3A- and 4A-Type Cable Terminal Sections

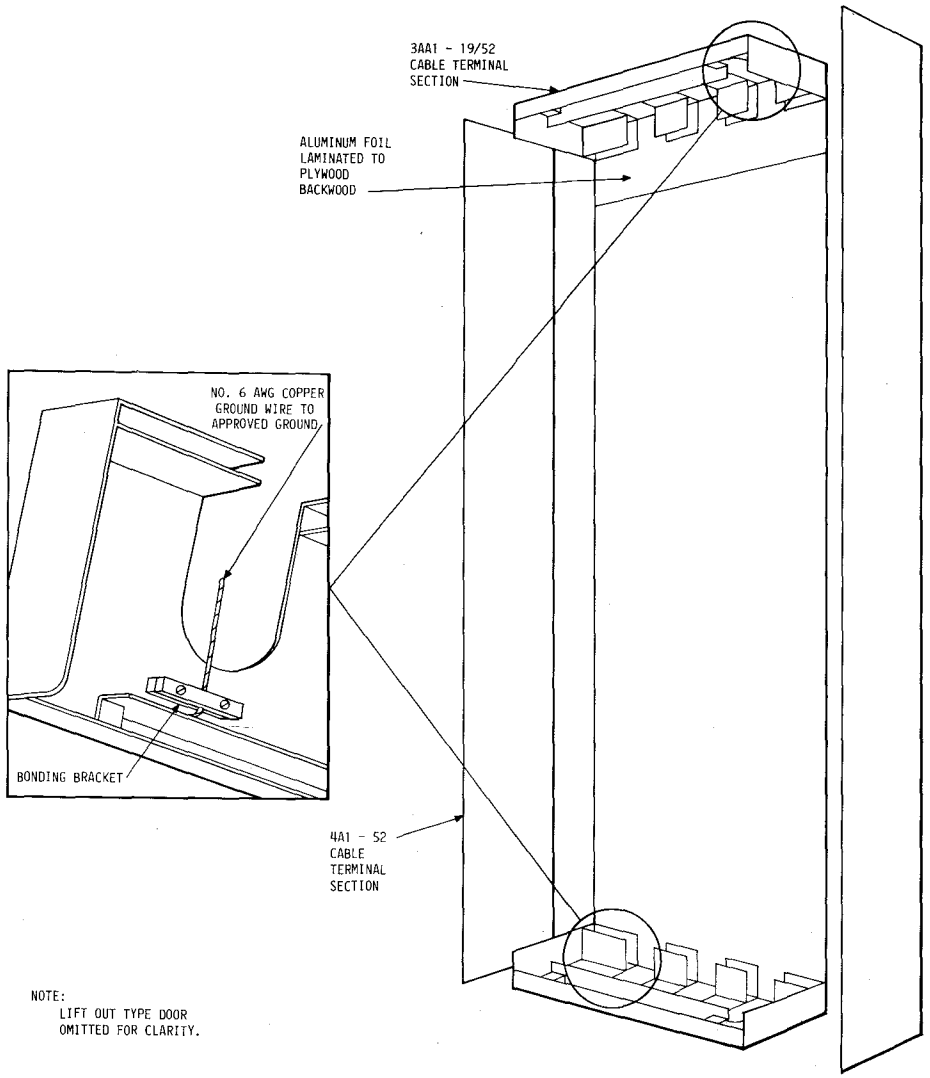


Fig. 18—Bonding of Multiple 3A-Type Cable Terminal Sections

TABLE A

GUIDELINES FOR GROUNDING AND BONDING

TYPE TERMINAL BLOCK OR PROTECTOR*	REFERENCE SECTION
1A4A Terminal Block	631-440-211
134-Type Protector	631-460-111 and 631-460-201
188-Type Protector	631-460-113
189-Type Protector	631-460-114
190-Type Protector	631-460-115

*OR EQUIVALENT

TABLE B

GROUND CLAMPS

TYPE OF GROUND CLAMP*	FIG. NO.	PIPE CONDUIT GROUND ROD (INCHES)	FOR TERMINATING NO. 6 AWG COPPER GROUND WIRE
L Ground Clamp	6 thru 9	1 thru 3 and larger	On water pipe or on service entrance conduit
C Ground Clamp	10	1/2 thru 1-1/4	On ground rod or water pipe
Building Steel Ground Clamp (Note)	5	—	On building structural steel

*OR EQUIVALENT

TABLE C

WIRE CONNECTORS

TYPE CONNECTOR*	CONDUCTOR SIZE (AWG)	USE
H1 Connector (Fig. 11)	No. 12 thru 4 copper	Connect No. 12 through No. 4 conductors in any combination of these sizes
H2 Connector (Fig. 11)	No. 12 thru 4 and 8 thru 1/0	Connect or bond ground wire to armored power ground wire or power ground wire
B. Aluminum Connector AT-8984B	No. 6 thru 12 copper to No. 1/0 thru 8 aluminum	Connect No. 8 thru 12 AWG copper ground wire to aluminum power ground wire for bonding

*OR EQUIVALENT