

Bellcore

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Electrical Protection, Grounding, and Bonding for Permanent-Type Mobile Homes

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This document replaces:

Bell System Practices
Section 461-220-100
"Mobile Home Wiring Permanent Type"

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for the Electromagnetic Compatibility District (27451).

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1. INTRODUCTION

1.01 This Bellcore Practice provides bonding, grounding, and electrical protection criteria to be observed when providing telephone service to permanent-type mobile homes. A permanent-type mobile home is a full-time residential structure, seldom moved, usually set on supports such as jacks or concrete blocks, with or without decorative skirting. Some mobile homes may consist of two units, situated side by side, with the exterior covering designed to give the appearance of a single unit. Mobile homes may also serve as temporary or semipermanent business or field offices.

1.02 Reissue of this Practice is prompted by changes effective with the 1990 issue of the National Electrical Code, ANSI/NFPA 70-1990, Sections 800-30(b) and 800-41, regarding the grounding, bonding, and location of the telephone protector when providing telephone service to mobile homes. It also includes a title change to better reflect the contents of the Practice. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted. Any changes or corrections to improve this Bellcore Practice should be requested in accordance with BR 000-010-015.^[1]

1.03 The criteria contained herein do not apply to Recreational Vehicles (RVs) and trailers that are typically smaller than mobile homes and intended for frequent relocation from one site to another. Grounding, bonding, and protection of telephone wiring to nonpermanent-type mobile homes, trailers and RVs is covered in Bell System Practices Section 461-220-101.^[2] Additional information on protection, grounding, and bonding at the network interface is contained in BR 876-300-100.^[3]

1.04 The manner in which power is supplied to the mobile home as well as the location and visibility of the power service equipment or disconnecting means are determining factors in the locating, grounding, and bonding of the telephone protector. For example, power may be either "hard-wired" to the mobile home or provided by a cord and plug. Hard-wired means that permanently installed power feeder conductors, including a green wire equipment ground, are provided to the mobile home through the power service equipment or through a suitable disconnecting means and are **NOT** plug-disconnectable.

The National Electrical Code requires that the power service equipment or disconnecting means be located in sight of and not more than 30 feet from the exterior wall of the mobile home it serves. However, this arrangement may not be found at all mobile home locations. The "in sight" requirement, as it pertains to the installation of the telephone protector, means that the power service equipment or disconnecting means shall be able to be seen from any point on the perimeter of the mobile home, but not necessarily from the location of the protector. A power service equipment or disconnecting means location within or behind a building is not considered to be "in sight". A location that has been obscured by decorative fencing or shrubbery may still be considered to be "in sight" of the mobile home for the purpose of the installation of the telephone protector.

1.05 Prior to installing telephone service to a mobile home, a preliminary survey must be performed to verify the safety of the work site, and to determine where the telephone protector is to be located and how it will be grounded and bonded. Figures 1 and 2 illustrate examples of telephone distribution to mobile homes.

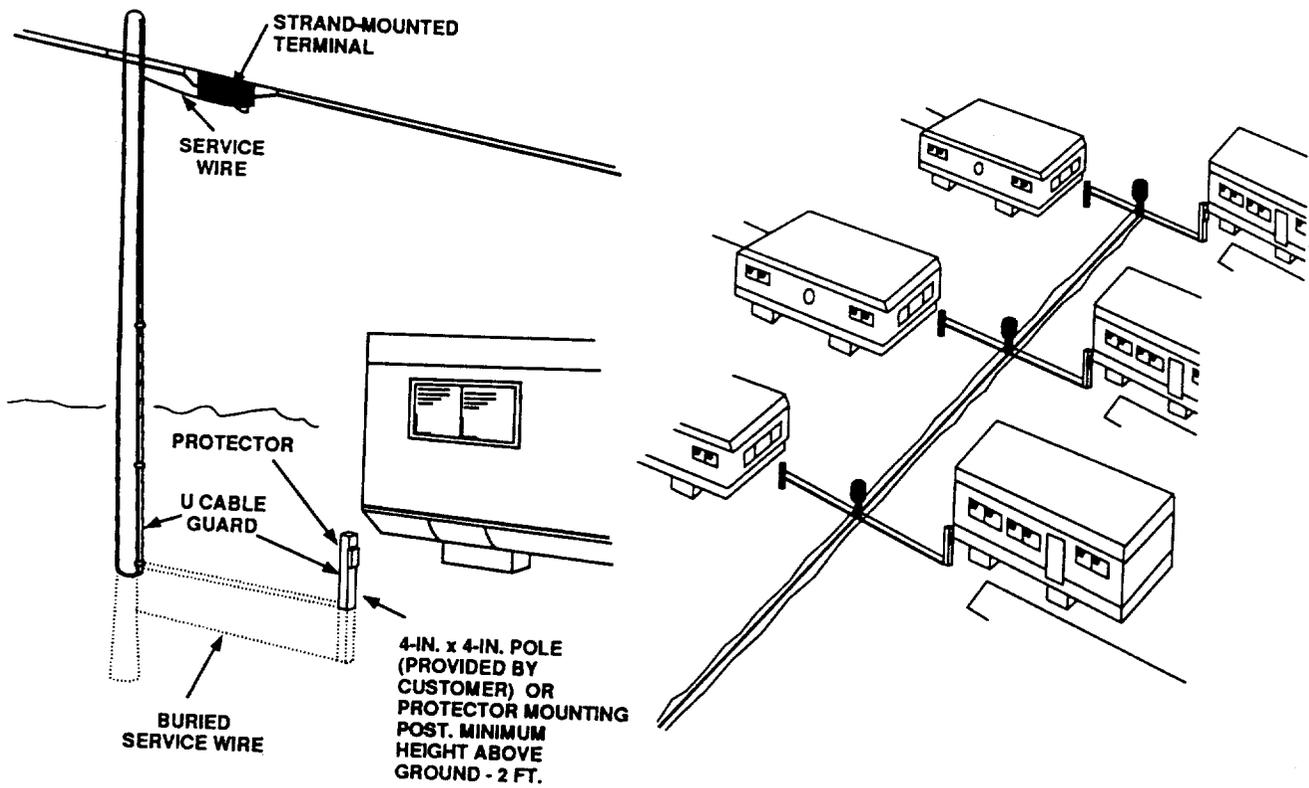


Figure 1. Examples of Buried Service Distribution

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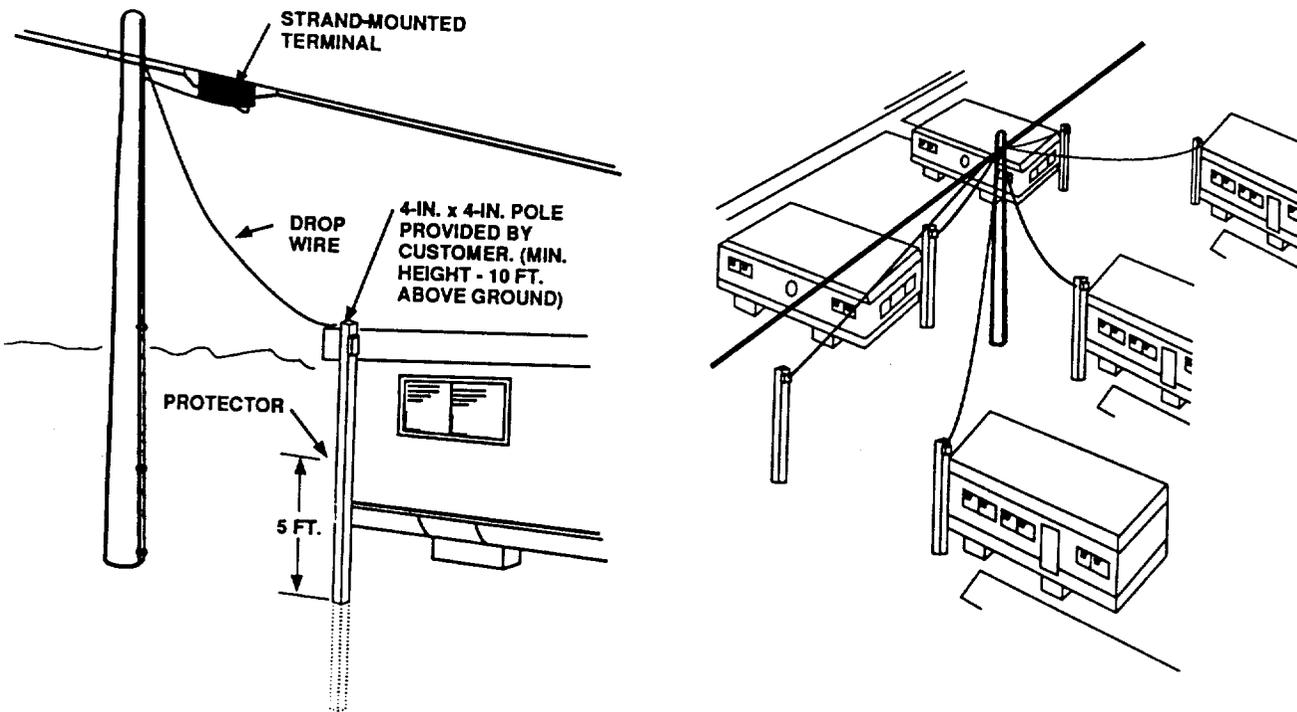


Figure 2. Examples of Aerial Service Distribution

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2. SAFETY TESTS AND SITE SURVEY

CAUTION:

ALWAYS test the chassis and skin of a mobile home with the 188A Test Set, B Voltage Tester, or equivalent, to detect foreign hazardous voltages. Defects in electrical equipment or wiring in a mobile home may energize the unit and present an electrical hazard to persons in or near it. If a hazardous condition is found to exist, the craftsman shall proceed no further until the supervisor has been informed and the condition corrected. Instances have occurred where the chassis of the mobile home has been connected to the "hot" side of the electrical wiring making it hazardous to touch or attempt to bond to a telephone ground.

- 2.01 Before making contact with the mobile home, verify the presence or absence of hazardous voltage on the mobile home body and chassis using the 188A Test Set, B Voltage Tester, or equivalent. Where a mobile home consists of two units that have been joined together to form a single unit, test the chassis and body of BOTH units. Refer to Bell System Practices Section 081-705-101,^[4] for use of the B Voltage Tester or AT&T Practice 081-705-102,^[5] for use of the 188A Test Set.
- 2.02 Select test points such as screw heads, chassis bolts, or unpainted areas where paint will not act as an insulator. Avoid cutting through paint; select an inconspicuous location to avoid marring the appearance of the mobile home. **AVOID BODILY CONTACT WITH THE MOBILE HOME DURING THIS OPERATION.**

CAUTION:

If the voltage tester indicates that any part of the mobile home is energized, do not proceed until the supervisor is notified and the condition is corrected. Also, inform the occupant and/or the mobile home park manager of any hazardous condition found.

- 2.03 Conduct a preliminary survey of the area. Makeshift pole lines and nonstandard clearances should be avoided. If unsatisfactory conditions are found, refer them to your supervisor or the outside plant engineer before proceeding with the installation.
- 2.04 Note the location of any buried or underground power service conductors to the mobile home so that they may be avoided if it is necessary to bury the telephone service wire or ground wire, or drive a ground rod.
- 2.05 Determine how power is provided to the mobile home. Is it hard-wired or plug-and-cord connected?
- 2.06 Determine the location of the power service equipment or the disconnecting means. Is it within 30 feet of the mobile home? Is it within sight of the mobile home being served?

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3. PLACING, GROUNDING, AND BONDING THE TELEPHONE PROTECTOR

3.01 The placing, grounding, and bonding requirements for the telephone protector depend upon the location and visibility of the mobile home power service equipment or the power disconnecting means, and whether the feeder conductors to the mobile home are hard-wired or plug-and-cord connected. Telephone protector placing, grounding, and bonding requirements are summarized in Table 1.

Table 1. Telephone Protector Placing, Grounding, and Bonding Requirements

Power Service	Protector Location	Grounding and Bonding Requirements
A. Hard-wired; power service equipment or disconnecting means within 30 feet and in sight of mobile home (see Paragraph 3.02).	Power service, disconnecting means, or mobile home.	Connect telephone protector ground terminal to power service equipment ground or to disconnecting means ground.
B. Plug-and-cord connected; power service equipment or disconnecting means within 30 feet and in sight of mobile home (see Paragraph 3.03).	Power service, disconnecting means, or mobile home.	Connect telephone protector ground terminal to power service equipment ground or to disconnecting means ground. Bond protector ground terminal to mobile home chassis.
C. Hard-wired or plug-and-cord connected; power service equipment or disconnecting means more than 30 feet from or not in sight of mobile home (see Paragraph 3.05).	Mobile home.	Connect telephone protector ground terminal to best available ground per Table 3. Bond protector ground terminal to mobile home chassis.

A. The power service is hard-wired, and the power service equipment or disconnecting means is located 30 feet or less from and is within sight of any point on the perimeter of the mobile home being served.

3.02 There are two options for placing the telephone protector: at the power service equipment or disconnecting means, or at the mobile home. When applying either of these options, it is not necessary to bond the protector ground terminal to the mobile home chassis. The power system equipment grounding conductor (green wire), which is part of the hard-wired ac power installation, serves as the bond to the mobile home chassis.

NOTE: Mobile homes manufactured prior to June 21, 1976, and those manufactured after that date that do not display the medallion signifying inspection by the Federal Department of Housing and Urban Development (HUD), may not have the green wire equipment grounding conductor bonded to the chassis. A bond should be placed between the protector ground terminal and the chassis for these mobile homes.

- Option (a): Place the telephone protector at the power service equipment or disconnecting means. Connect the telephone protector ground terminal to the ac power ground at the power service equipment or disconnecting means location using an insulated copper conductor as indicated in Table 2. This arrangement is illustrated in Figure 3.
- Option (b): Place the telephone protector at the mobile home. Connect the telephone protector ground terminal to the ac power ground located at the power service equipment or disconnecting means using an insulated copper conductor as indicated in Table 2. The grounding conductor should be buried deep enough to protect it from physical damage. This arrangement is illustrated in Figure 4. Where the grounding conductor is smaller than No. 6 AWG, conduit should be used for physical protection in lawn, garden or other areas where damage is likely. Nonmetallic conduit is preferred. Where metallic conduit is used, bond the conduit to the grounding conductor at both ends of the conduit run.

Table 2. Grounding Conductor Capacity

Insulated Copper Ground Wire Size (AWG)	Maximum Number of Protected Circuits	
	Fuseless	Fused
No. 12	2	6
No. 10	6	7
No. 6	7 or more	8 or more

NOTE: The bonding conductor between protector ground terminals of multiple protectors shall be the same size as the grounding conductor between the protector and the grounding electrode.

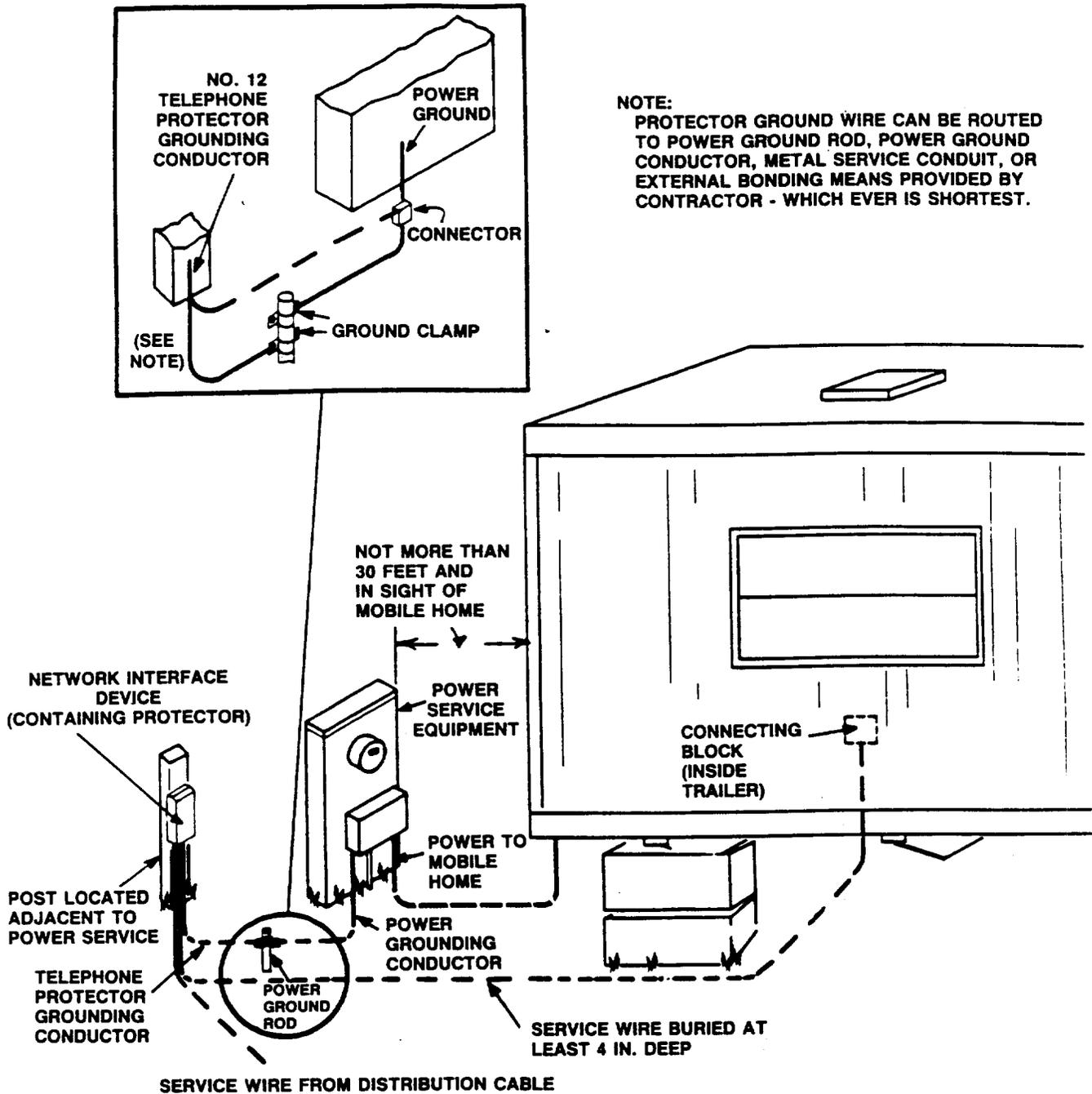


Figure 3. Buried Service — Power Service Hard-Wired and Power Service Equipment Located Not More than 30 Feet Away and in Sight of Mobile Home — Protector and Demarcation Point (Provided Via a Network Interface Device) Located at Power Service Equipment

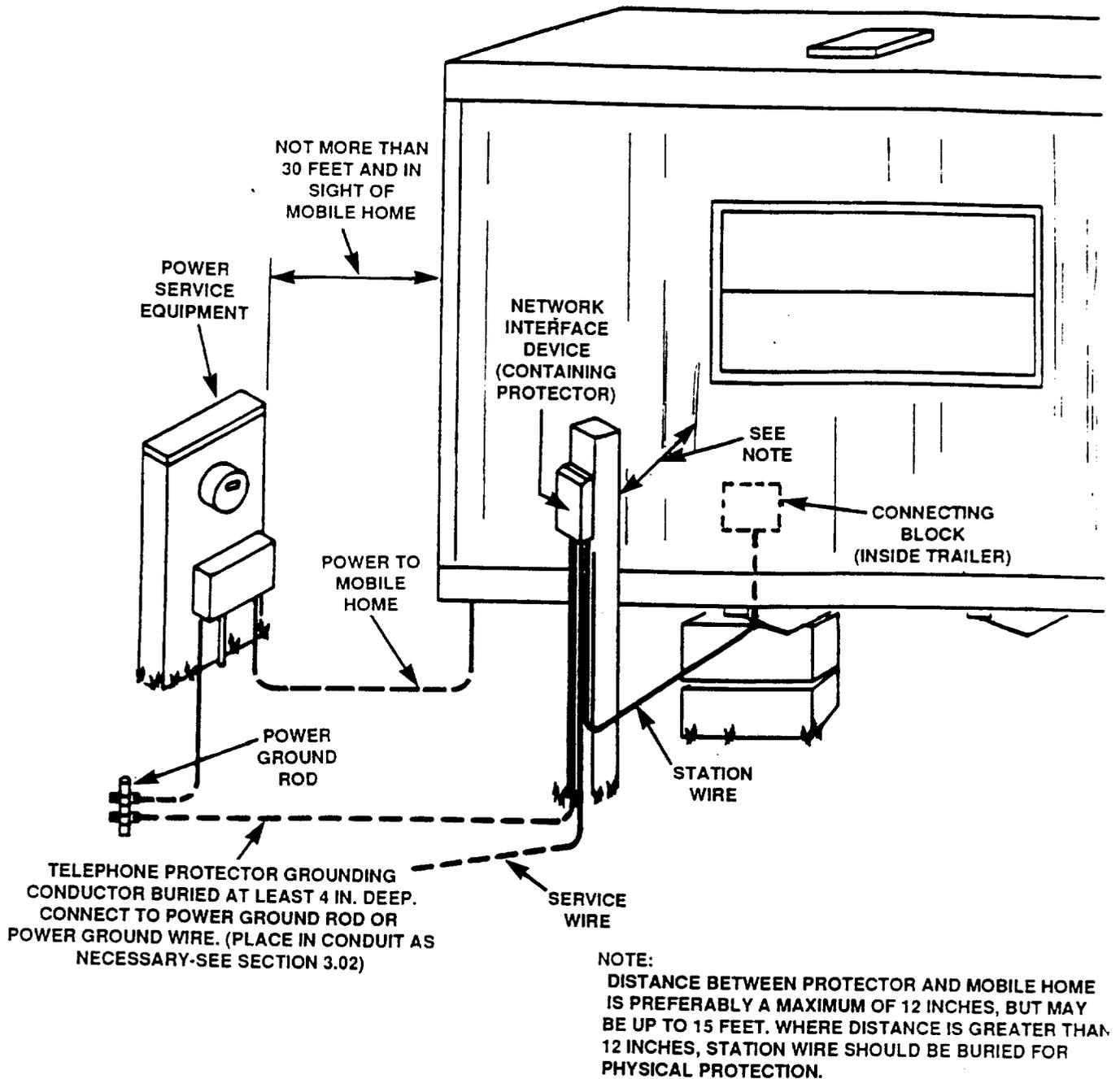


Figure 4. Buried Service — Power Service Hard-Wired and Power Service Equipment Located Not More than 30 Feet Away and in Sight of Mobile Home — Protector and Demarcation Point (Provided Via a Network Interface Device) Located at Mobile Home

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B. The power service is plug-and-cord connected, and the power service equipment or disconnecting means is located 30 feet or less from and is within sight of any point on the perimeter of the mobile home being served.

3.03 The options for placing the telephone protector are the same as in A (see Paragraph 3.01).

However, when the power service is plug-and-cord connected, the telephone protector ground terminal **MUST** be bonded to the mobile home chassis.

CAUTION:

Grounding and bonding of the telephone protector shall be completed before any installation work is started when the power is nonpermanent (plug-and-cord connected).

Option (a): Place the telephone protector at the power service equipment or disconnecting means. Connect the telephone protector ground terminal to the ac power ground at the power service equipment or disconnecting means location using an insulated copper conductor as indicated in Table 2. Using a No. 12 AWG or larger wire, bond the telephone protector ground terminal to the mobile home chassis. This arrangement is illustrated in Figure 5.

Option (b): Place the telephone protector at the mobile home. Connect the telephone protector ground terminal to the ac power ground located at the power service equipment or disconnecting means using an insulated copper conductor as indicated in Table 2. Using a No. 12 AWG or larger wire, bond the telephone protector ground terminal to the mobile home chassis. This arrangement is illustrated in Figure 6.

3.04 The bonding and grounding conductors should be buried deep enough to protect them from physical damage. Where bonding and grounding conductors are smaller than No. 6 AWG, conduit should be used for physical protection in lawn, garden or other areas where damage is likely. Nonmetallic conduit is preferred. Where metallic conduit is used, bond the conduit to the grounding or bonding conductor at both ends of the conduit run.

C. The power service is hard-wired or plug-and-cord connected, and the power service equipment or disconnecting means is located more than 30 feet from the mobile home or is not within sight of any point on the perimeter of the mobile home being served.

3.05 Place the telephone protector at the mobile home. Bond the telephone protector ground terminal to the mobile home chassis using a No. 12 AWG or larger copper conductor. Using an insulated copper conductor, per Table 2, connect the telephone protector ground terminal to the best available ground at the mobile home as indicated in Table 3. If there is no existing available grounding electrode at the mobile home, per Table 3, drive a telephone ground rod (minimum of 5 feet long and 1/2 inch in diameter). This arrangement is illustrated in Figure 7.

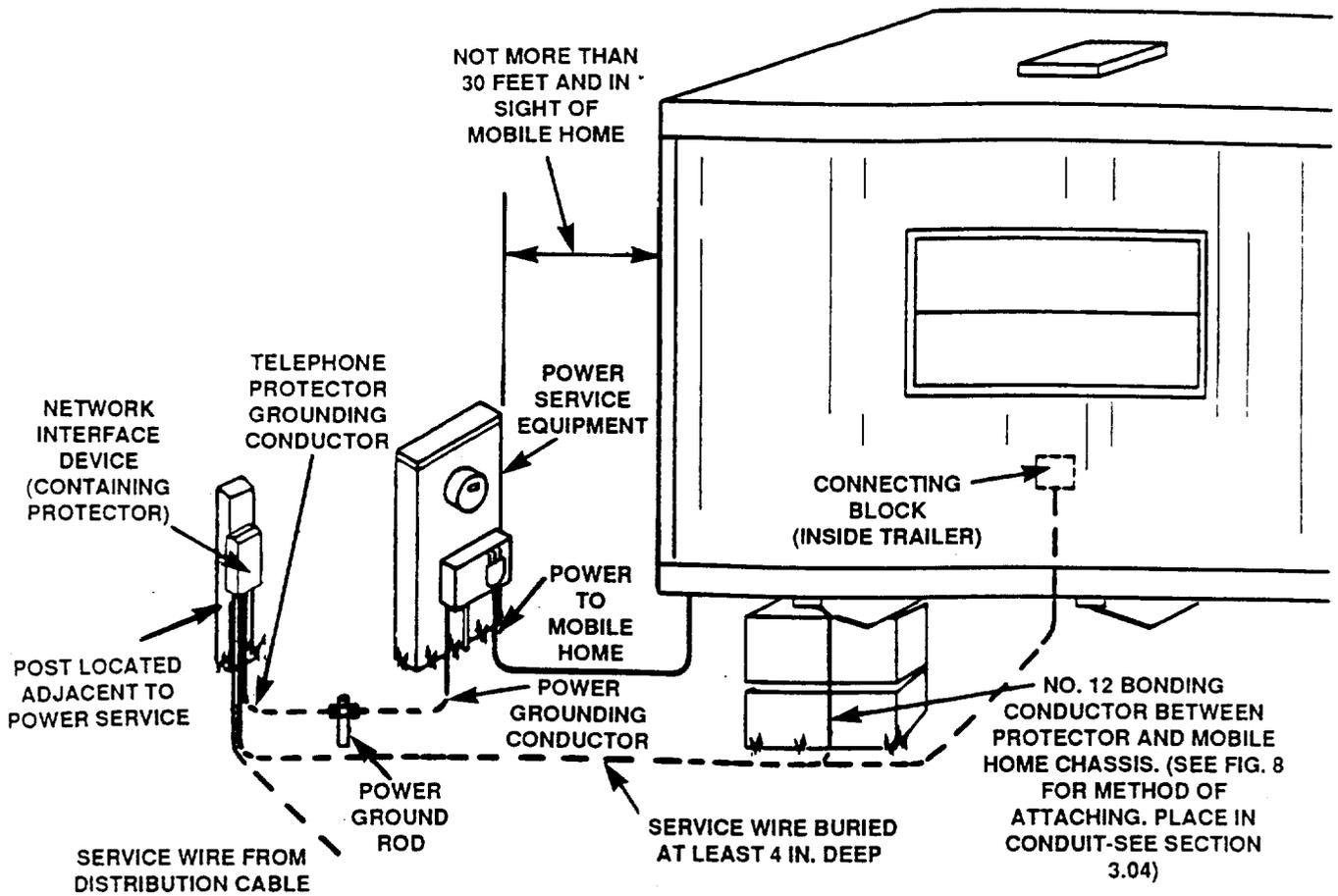


Figure 5. Buried Service — Power Service Plug-and-Cord Connected and Power Service Equipment Located Not More than 30 Feet Away and in Sight of Mobile Home — Protector and Demarcation Point (Provided Via a Network Interface Device) Located at Power Service Equipment

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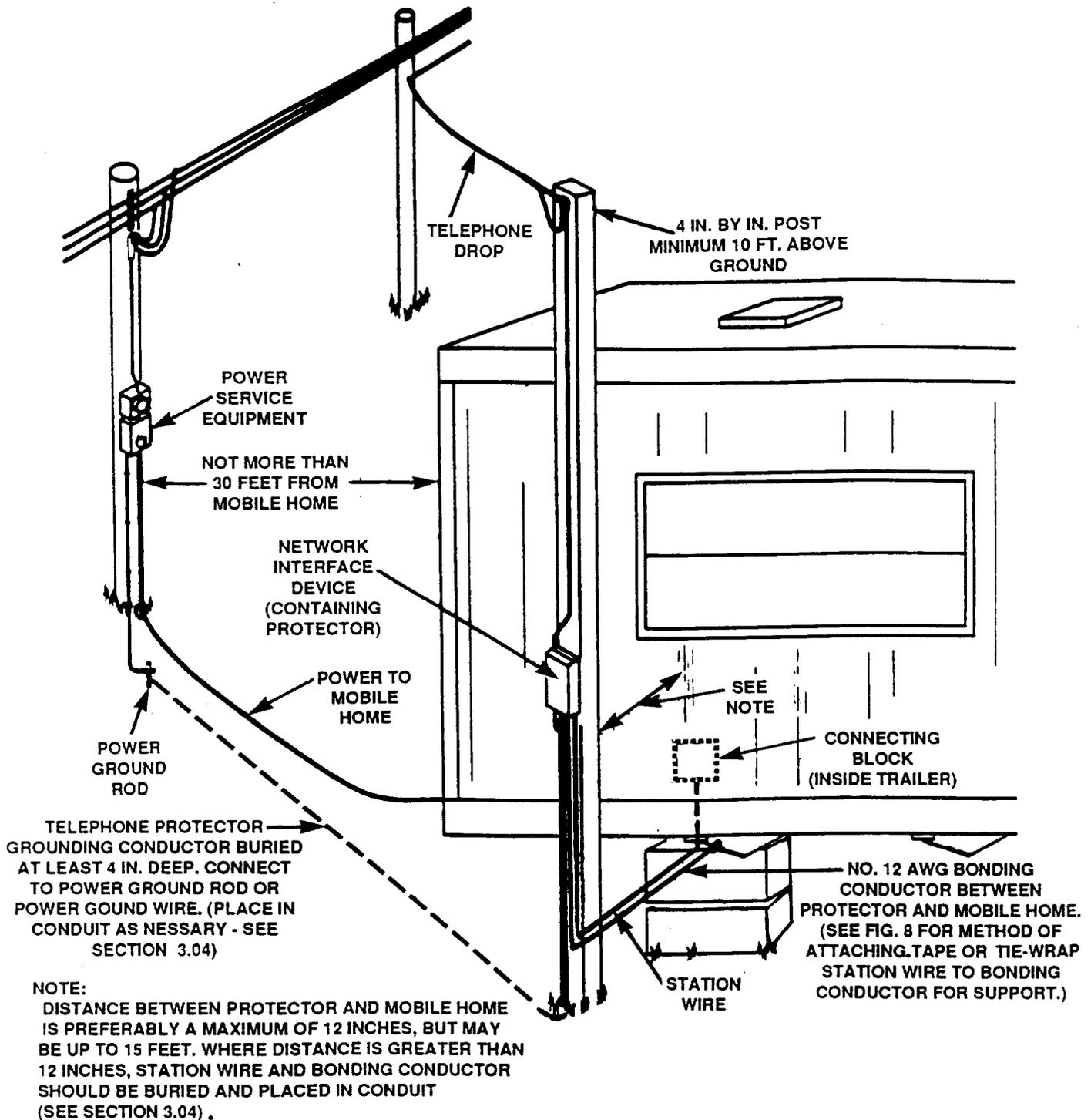
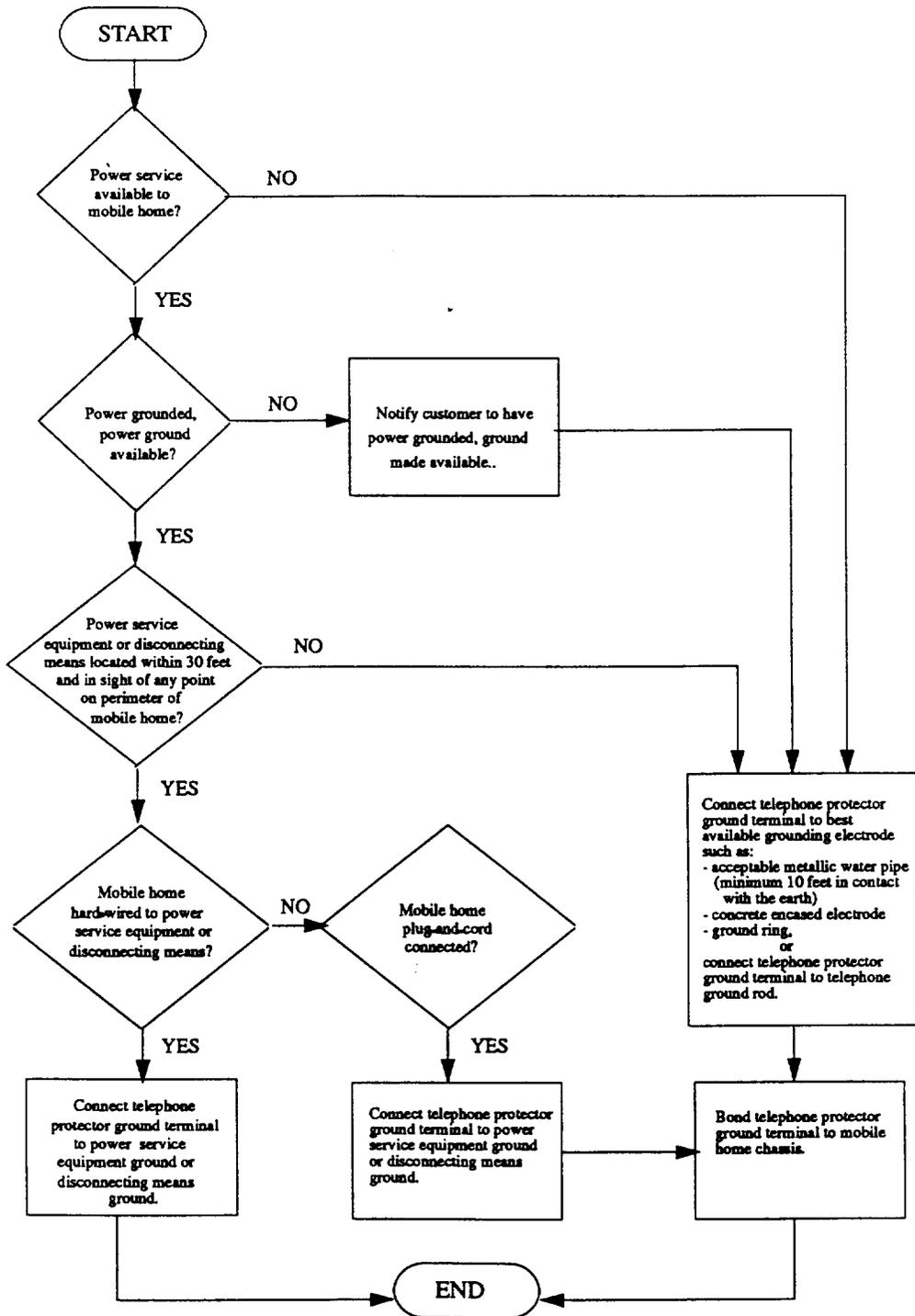


Figure 6. Aerial Service — Power Service Plug-and-Cord Connected and Power Service Equipment Located Not More than 30 Feet Away and in Sight of Mobile Home — Protector and Demarcation Point (Provided Via a Network Interface Device) Located at Mobile Home

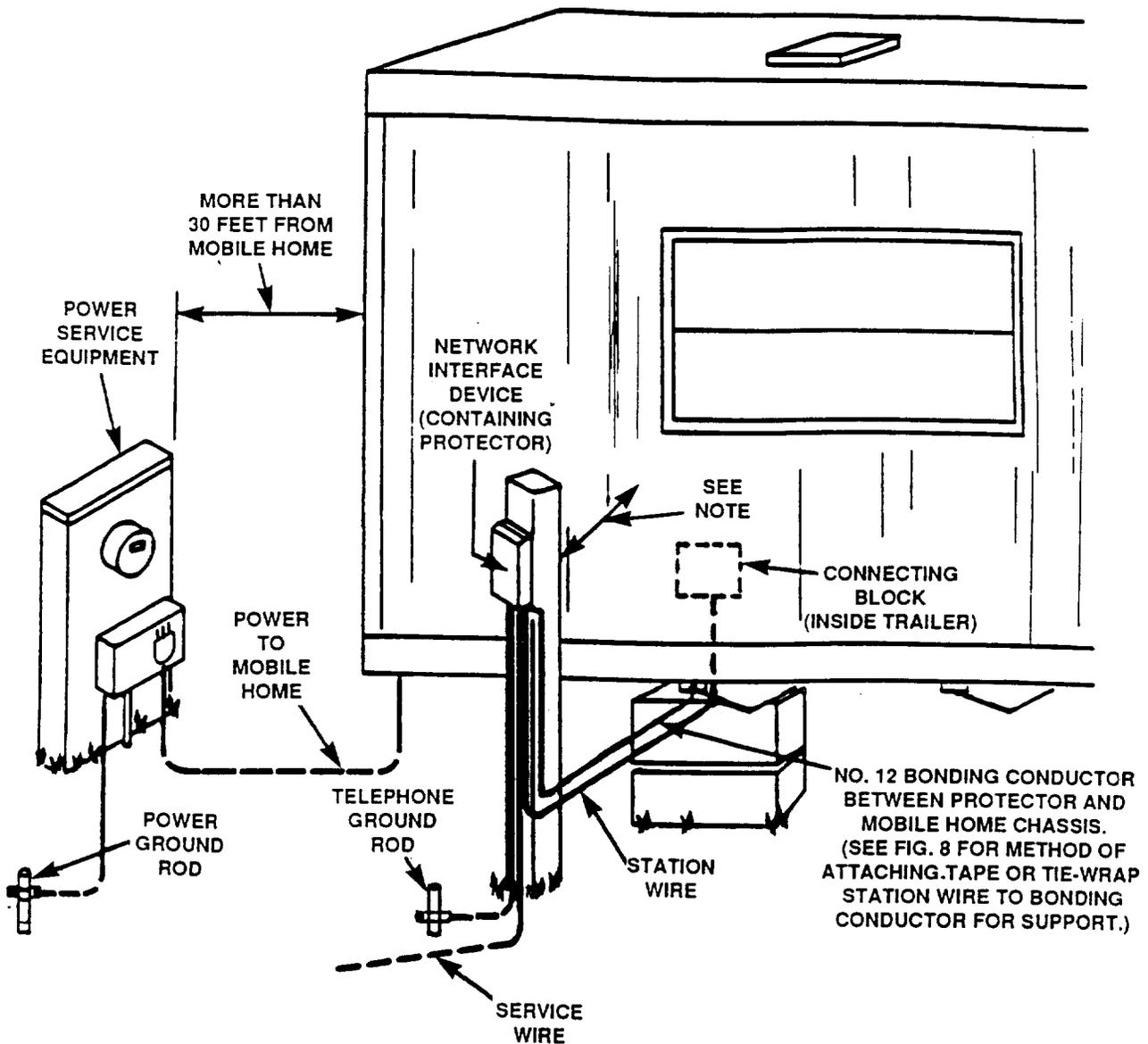
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Table 3. Bonding and Grounding at Mobile Homes



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NOTE:
DISTANCE BETWEEN PROTECTOR AND MOBILE HOME IS PREFERABLY A MAXIMUM OF 12 INCHES, BUT MAY BE UP TO 15 FEET. WHERE DISTANCE IS GREATER THAN 12 INCHES, STATION WIRE AND BONDING CONDUCTOR SHOULD BE BURIED AND PLACED IN CONDUIT .
(SEE SECTION 3.04)

Figure 7. Buried Service — Power Service Hard-Wired or Plug-and-Cord Connected and Power Service Equipment Located More than 30 Feet Away or Not in Sight of Mobile Home — Protector and Demarcation Point (Provided Via a Network Interface Device) Located at Mobile Home

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4. TELEPHONE PROTECTOR INSTALLATION CONSIDERATIONS

4.01 When the protector is to be located at the mobile home, rather than at the power service equipment or disconnecting means location, it may be mounted directly on the mobile home **(WITH THE MOBILE HOME OWNER'S PERMISSION)**. Alternatively, it may be mounted on a post adjacent to the mobile home, preferably within 12 inches, but not more than 15 feet away. The following are options when mounting the telephone protector adjacent to the mobile home.

Option (a): A wood post that has been installed by the customer or telephone company.

Option (b): A metal power service conduit.

Option (c): A telephone-company-provided Protector Mounting Post (PMP).

5. INSTALLING THE PROTECTOR GROUND AND GROUNDING CONDUCTOR

5.01 The ac power service ground is the first choice for a grounding electrode for the telephone protector ground. If the power service ground is unavailable (i.e., located more than 30 feet from or not in sight of the mobile home), then other approved electrodes may be used. These include a metallic water pipe (with at least 10 feet in contact with the earth), concrete encased electrode, ground ring, or telephone ground rod.

5.02 Rubber gloves shall be worn while driving a ground rod. Avoid bodily contact with the ground rod during this operation.

CAUTION:

After driving the ground rod, the B Voltage Tester, 188A Test Set or equivalent shall be used to verify that a hazardous voltage condition does not exist on the ground rod. If voltage is detected on the ground rod, do not proceed until the supervisor is notified and the condition corrected.

5.03 The telephone protector grounding conductor shall be insulated and sized according to the number of protectors being grounded, as shown in Table 2. The telephone protector grounding conductor shall be run to the protector grounding electrode (power service ground or other grounding electrode) by the shortest and straightest route possible. Where the power service ground or grounding electrode is not located close to the protector, the grounding conductor shall be buried to protect it from physical damage.

5.04 Telephone service may be installed where there is power on the premises, but a power ground is not provided or is unavailable. However, the customer should be informed immediately of the need for a power ground and should be requested to notify the telephone company when the ground has been made available so that the telephone company may return to place the bond between the power and telephone grounds, as necessary. The procedure for notifying the customer shall be covered by local instructions. Where telephone service is already being provided and there is no power ground, the same procedure shall be followed.

5.05 Separate grounding electrodes, as may occur at older installations or where telephone service has been installed before the power service ground was available, shall be bonded together to limit the potential difference between them and between their associated wiring systems. Bonding shall be accomplished by using a minimum No. 6 AWG bonding conductor that is buried deep enough to protect it from physical damage.

NOTE: If the telephone and power grounding systems are not bonded, arcing may occur as a result of the potential difference that may exist between the telephone and power wiring during lightning and power fault events.

6. BONDING CHASSIS TO PROTECTOR GROUND TERMINAL

6.01 Where the power service equipment or disconnecting means is more than 30 feet from the mobile home, is not in sight of the mobile home, or the mobile home is powered via plug-and-cord, a bond is required between the mobile home chassis and the telephone protector ground terminal.

CAUTION:

The mobile home chassis shall be bonded directly to the ground terminal post on the protector. This bond must be placed before any installation work at the mobile home is begun. The bond shall be placed after the mobile home has been tested for hazardous voltage using a voltage tester and the protector grounding conductor installed, but before attaching any other wiring to the mobile home.

6.02 Use a No. 12 AWG or larger wire for bonding the mobile home chassis to the telephone protector ground terminal. For convenience, the bonding wire can be the same size as the protector ground wire. This will permit the protector ground wire to be looped around the protector ground terminal and extended to the chassis to serve as a continuous bonding wire as well. Use a chassis or I-beam bonding clamp (Figure 8) or other appropriate means to connect the bonding wire to the chassis of the mobile home. (See TA-NWT-001075^[6] for generic requirements for bonding hardware.)

6.03 Where the telephone protector is located on or within 12 inches of the mobile home, the chassis bonding wire may be run directly to the mobile home chassis. Where the telephone protector is located more than 12 inches from the mobile home, the chassis bonding wire shall be buried at least 4 inches deep between the protector location and the mobile home. Where necessary, the bonding wire should be protected by conduit as outlined in Paragraph 3.04.

CAUTION:

When digging is required to bury wire, use only tools with handles made of wood or other insulating materials to prevent electrical shock in case of contact with energized objects.

7. LOCATION OF THE DEMARCATION POINT AND PLACEMENT OF THE NETWORK INTERFACE DEVICE

7.01 The location of the Demarcation Point (DP) is governed by Federal Communications Commission (FCC) and local regulatory authority rules. The FCC, in Title 47, Code of Federal Regulations, Part 68,^[7] has defined the DP as the point at which the exchange carrier's facilities end and the customer's wiring, terminal equipment or protective apparatus begins. In single-unit installations, the DP is located within 12 inches of the telephone protector, or, if there is no telephone protector, within 12 inches of where the exchange carrier's wire enters the customer's premises. In existing single-unit locations, customers may access carrier-installed wire up to within 12 inches of the protector. A premises, as indicated by the FCC, may be a dwelling unit, other building, or a legal unit of property such as a lot on which a dwelling unit is located.

7.02 The exchange carrier-installed facilities constituting the DP may consist of wire or a registration jack. A Network Interface Device (NID) may be provided as a part of the regulated service. However, the exchange carrier is permitted the option of placing wire, a connecting block, or a terminal to serve as the DP.

7.03 The telephone protector (and NID) may be located at the power service equipment as described in Paragraph 3.02, Option (a), or at the mobile home. If a NID is not used, the DP should be within 12 inches of the telephone protector. Local practice should dictate the location of the DP and NID, subject to the constraints of FCC and local regulatory rules. Figures 3 through 7 serve as illustrations of possible DP and NID installation configurations, but are by no means all-inclusive or controlling.

7.04 For generic requirements covering Network Interface Devices (NIDs), see TR-TSY-000049.^[8]

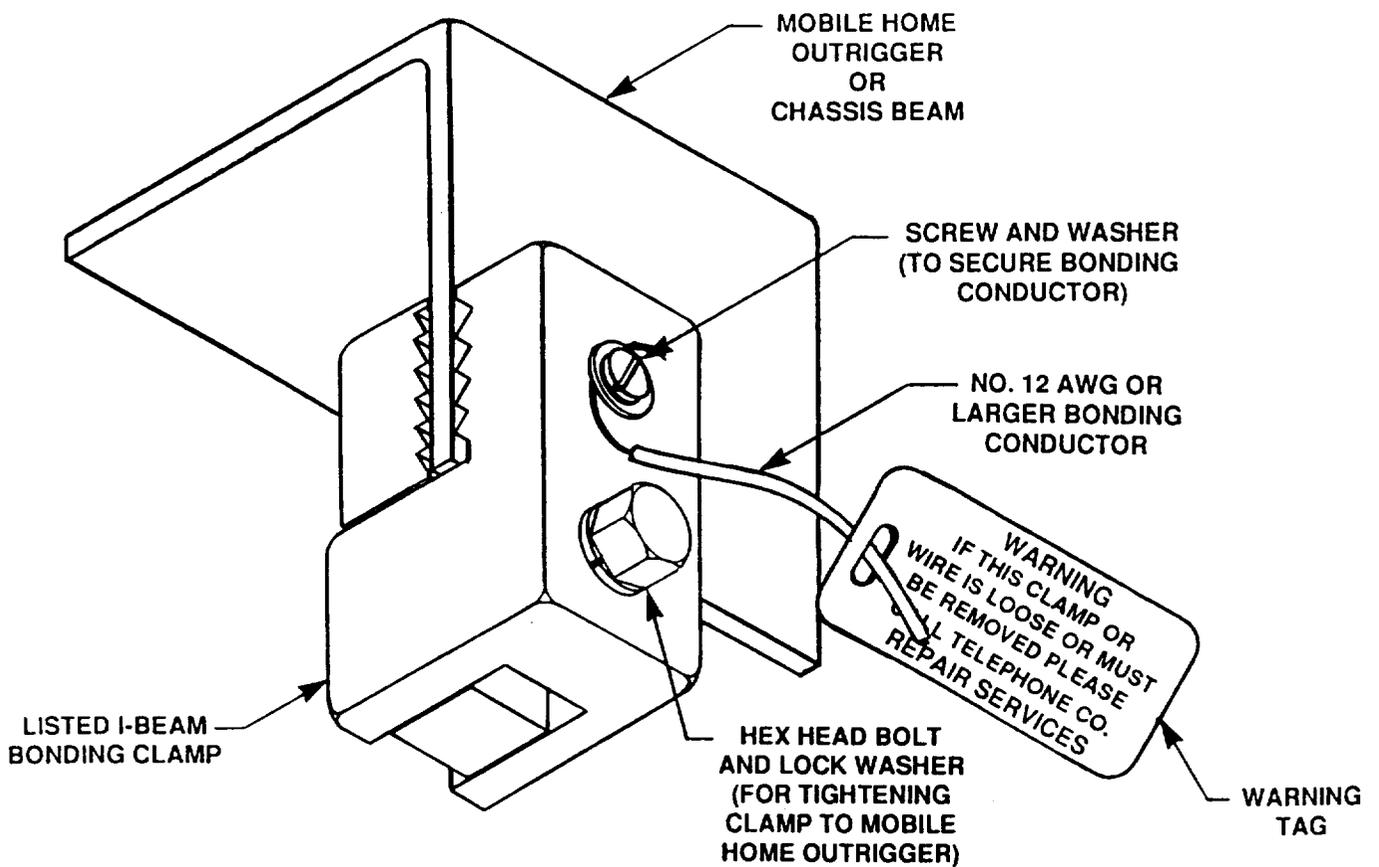


Figure 8. Bonding to Mobile Home Chassis

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8. INSTALLING SERVICE OR DROP WIRE

- 8.01 Service to a mobile home may be provided via buried service wire or an aerial drop wire.
- 8.02 Aerial drop wire must never be attached directly to the mobile home as this will disrupt the integrity of the skin and may not provide sufficient physical support for the drop wire. The customer shall provide a post of minimum dimensions of 4 inches by 4 inches by 10 feet above the ground. All standard wiring clearances must be observed.
- 8.03 Service wire may be in place and buried to within proximity of the mobile home and left coiled for future provision of service.

CAUTION:

Before handling the unterminated service wire, test the shield with the voltage tester to make sure it is not energized. If voltage is detected, proceed no further until you have notified your supervisor and the condition is corrected.

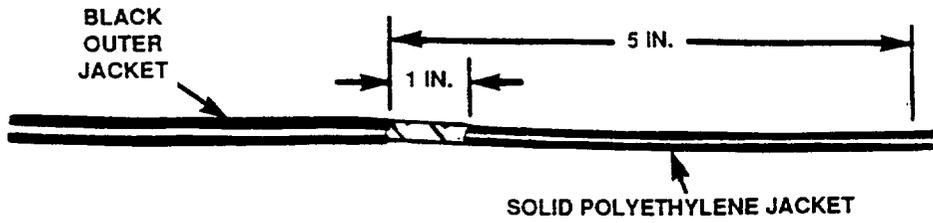
- 8.04 When terminating service wire on the protector, connect the shield of the wire to the protector ground terminal using an F-type connector as shown in Figures 9 and 10. Refer to Bell System Practices Section 460-300-143,^[9] for detailed information on terminating buried service wire.

9. WIRING BETWEEN THE DP AND THE MOBILE HOME

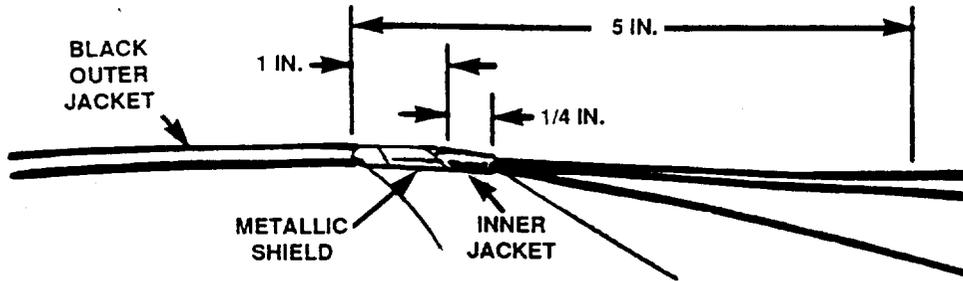
- 9.01 Wiring between the DP and the mobile home is not considered part of the regulated exchange carrier service and is shown for illustrative purposes only. The wiring between the DP and the mobile home will differ depending on whether the DP is located at the mobile home, or at the power service equipment or disconnecting means. Where the DP is located at the mobile home, either on an adjacent post (within 12 inches) or attached to the mobile home itself, inside station wire may be run directly from the DP to the mobile home.
- 9.02 When the DP is located at the power service equipment or disconnecting means, bury station wire or service wire at least 4 inches deep between the DP and the mobile home. The metallic shield of the service wire should be cut off at the mobile home end and taped to avoid injury from sharp edges.
- 9.03 The station or service wire may be terminated on a connecting block within the mobile home, which serves as a bridging block for the customer's premises wire. The connecting block should be mounted where mounting screws will engage a wall stud for mechanical support.
- 9.04 Wiring runs on the outside of the mobile home should be attached to the frame outriggers, eliminating the need to crawl under the mobile home to attach the wire. Wire should be attached using a bridle ring or by clamping to an insulator support with a ground wire or drop wire clamp. Typical mobile home construction is shown in Figure 11.

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A - BURIED WIRE

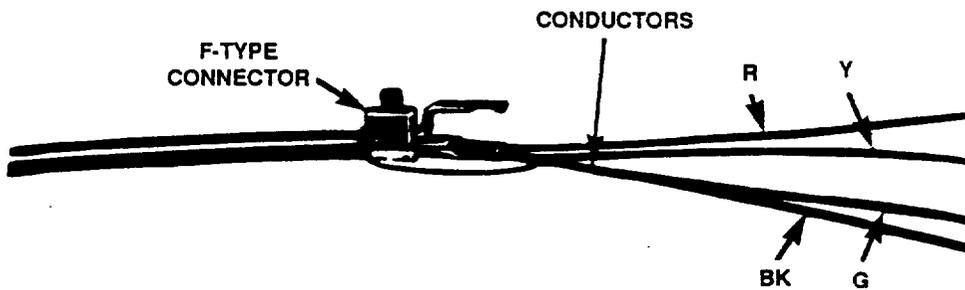


B - SERVICE WIRE (2 OR 5 PAIR)

Figure 9. Sheath Preparation for Placing F-Type Connector



A - BURIED WIRE



B - SERVICE WIRE (2 OR 5 PAIR)

Figure 10. F-Type Connector on Service Wire

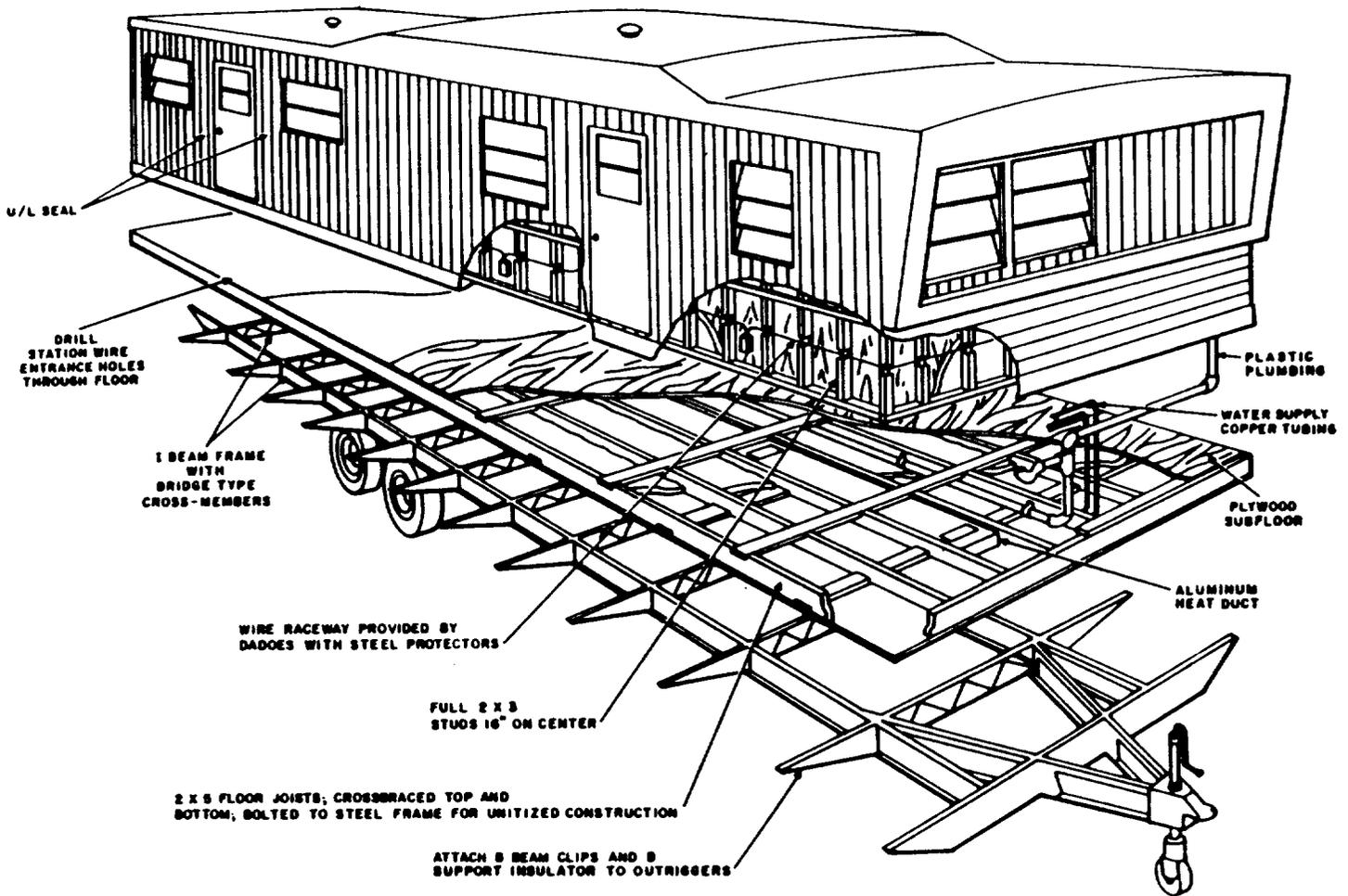


Figure 11. Typical Mobile Home Construction

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