

BONDING AND GROUNDING

CABLE SHEATH

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1. GENERAL

1.01 This section replaces G10.345 and describes the conditions under which bonds, grounds and insulating joints are placed on cable. Specific recommendations on the application of polyethylene sheathed cable to underground installations is provided. The details and methods of performing the work operations hereinafter specified are covered in other sections of the practices.

1.02 Special measures not included in this section but necessary for electrolysis or protection reasons will be specified on the detail plans.

2. POLYETHYLENE SHEATH CABLE

2.01 Polyethylene sheath cable shall be placed in each of the following applications:

(a) Building Entrance Cable: As new entrance cable for all buildings served by underground conduit from a manhole or pole. This includes reinforcements and replacements.

(b) Lateral and Underground Dip Cables: For all new manhole to pole or pole-to-pole underground requirements including reinforcements or replacements.

(c) Main Underground Cable: For all new installations including section replacements except where precluded by:

(1) Supply conditions (when substitution of lead sheath cable appears necessary, verify that the area involved is not unduly corrosive and that there are no dips in the conduit involved.)

(2) The presence of petroleum or other products in the duct structure which are not compatible with polyethylene.

3. AERIAL, UNDERGROUND AND BURIED CABLES

3.01 Bonding Aerial Cables: Strand and cable sheath shall be bonded together in aerial plant. The bond reduces the likelihood of arcing and burning of cable sheath when current flows between the strand and the sheath in the event that either becomes accidentally crossed with electric power or trolley wires. Bonding of the strand and cable sheath shall be in accordance with the following:

(a) Lashed Lead Sheath Cable: The lashing wire is effectively a continuous bond between the cable sheath and strand. Lashed cable supports, splices, etc., also serve as bonds. No additional bonding is required.

(b) Lead Sheath Cable in Rings: Lead sheath aerial cable supported in rings shall be bonded to the suspension strand as indicated below.

**LEAD SHEATH CABLE IN RINGS
SHEATH TO STRAND BONDS
EXCHANGE AND COMBINED TOLL EXCHANGE CABLES**

Location of Sheath to Strand Bond	Trolley Feeders or Trolley Contact Wires on Same Street or Highway	All other Locations including electric light and Power Wires
1 at or near →	first and last poles	first and last poles
2 and at every →	fifth pole	tenth pole
3 until remaining section is not more than →	8 Spans	13 Spans
or not less than →	4 Spans	4 Spans
U.G. dip or trolley wire crossover	at or near first pole on each side	
Grade clamps placed at first and last pole	No other sheath to strand bond required at these poles	
Grade clamps placed at corners and U.G. dips and on grades	No other sheath to strand bond required within four spans at these locations	

TOLL OR INTER - CITY CABLE

Place bonds as for Exchange Cable except

Where Toll cable is NOT located on the same Street or Highway with electric light, power or trolley circuits	No sheath to strand bond required
But, in the locations above where toll cable is crossed by electric light, power or trolley wires	Place sheath to strand bond at or near first pole on each side of crossing

(c) Lashed Polyethylene Sheath Cables: In polyethylene sheath cable, such as alpepeth and stalpepeth, the metallic portion of the sheath is bonded to the splice which in turn is bonded to the strand. This applies on wrapped joint lead sleeve splices and splice cases and T-type terminals. No additional bonding is required.

(d) Long Lengths of Polyethylene Sheath Cable in Lightning Areas: Where a single small size aerial polyethylene sheath cable, not paralleled by

other cables, in rural areas subject to lightning, has sheath to strand bonds at distribution terminals and splices with more than 1000 feet of cable between the bonds, it should also have additional sheath to strand bonds placed so that no portion of the cable exceeds 1000 feet without a sheath to strand bond. The method of making this bond is covered in another section of the practices.

(e) Bonds Between Aerial Cables: Where two or more aerial cables, either lashed or ring supported are located on the same pole line, the suspension strands shall be bonded together at the locations shown in Paragraph 3.01 (b). However, where two cables are supported on the same cable suspension bolt, the bolt functions as the necessary bond. Bond telephone cables to cables of foreign ownership only when authorized on the detail plans.

(f) Branch Cables in Rings: The bonds on branch cables in rings shall be located with reference to the junction of the branch cables with the main cable. Place bonds on the branch cable at the locations shown in Paragraph 3.01 (b) except as follows: Where the branch cable is 1500 feet or less in length place one bond on the branch cable, located at the first pole from the junction.

(g) Taped Joints in Aerial Cable: Where taped joints are made in aerial cable, or types of temporary covers are applied to aerial cable sheaths as in the case of trouble cuts for locating and clearing defective pairs, maintain the sheath continuity by temporary bonding as covered in another section of the practices.

(h) Strand Continuity: Where continuity of a cable suspension strand is broken, such as may occur at corners where the strand is dead ended in both directions or where branch cables intercept the main lead, establish electrical continuity between the strands as covered in other sections of the practices.

(i) Isolated Cable Carried on Poles Jointly Used with Power Circuits: Sections of isolated cable such as those inserted in open wire lines and in excess of one span shall be bonded to a public water system. If this type of ground is not available, 20 feet of sectional ground rod shall be employed.

3.02 Bonding Underground Cables: Bond underground cables as outlined below. Where foreign signal cables appear in the same manhole with telephone cables, obtain permission from the owner and then bond them to the telephone cable in the same manner, treating other types of insulating sheath as for polyethylene unless the signal cable splices are also insulated. In this event no bond is needed unless otherwise specified.

(a) Lead Sheath Cable: The sheaths of all cables are bonded together in every manhole, with the following exceptions that, where long lengths of cable are pulled through manholes and no splice is necessary, the bond may be omitted in the intermediate manhole(s) until such time as work is done at the manhole(s). However at junction manholes, or manholes where an electrolysis drainage bond is connected, the new cable shall be bonded to the other cables at the time it is placed.

(b) Polyethylene Sheath Cable: Bond the lead sleeves or splice cases on splices in polyethylene sheathed cable to the other cables in the manhole. At intermediate manholes or pull throughs, where no opening is made in the polyethylene jacket, no bond is required.

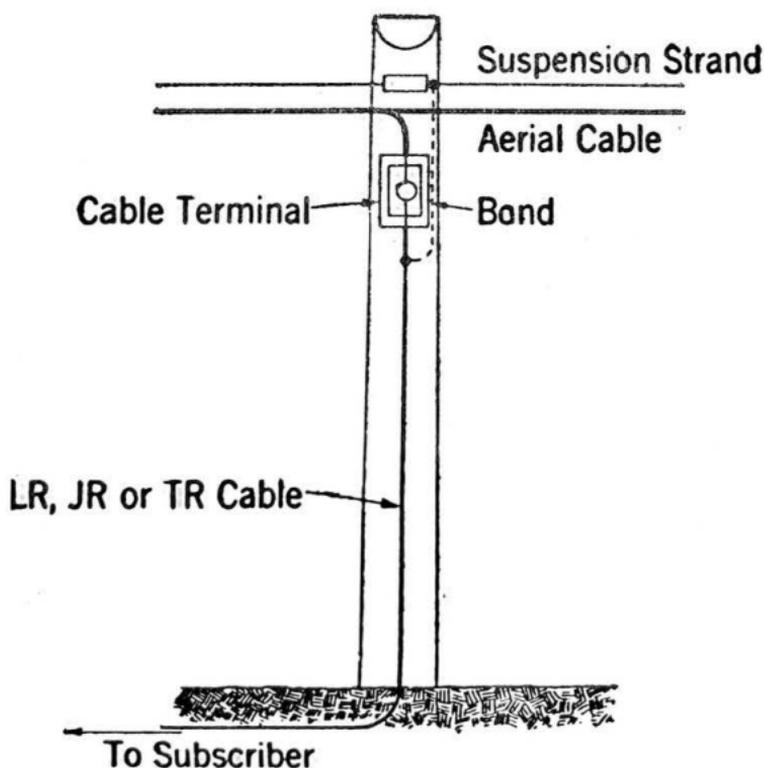
3.03 Bonding Wire and Tape Armored Cables: The armor in wire or tape armored cables shall be bonded to the sheath at each side of a splice.

3.04 Bonding of Buried Cables: Buried exchange cables usually require no special measures as may be applied on buried toll cable. However, where

shield wires are specified, they are bonded to the aerial branch splice. They are not bonded to the other buried cable splices.

3.05 Bonding Service Cables, LR, JR or TR

- (a) Where service cable is joined to buried or underground cable at a splice and no terminal is used, bond the sheath of the service cable to the sheath of the other cable.
- (b) Where service cable is connected to a distribution terminal of an aerial cable, place a bond between the sheath of the service cable and the strand as illustrated below. Where TR service cable is used, bond the metallic tape to the lead sheath of the service cable.



3.06 Bonding of Terminals

(a) In the protected type terminals a path to ground by way of the cable sheath is necessary for the operation of the protector blocks. In the NC type of protected terminals the ground side of the protector is connected through the housing and the cable stub to the cable at the terminal splice. In the protected types of T Terminals, the terminal housing is fastened to the metal of the cable sheath at each side of the splice opening. No other bonding is necessary.

(b) Older types of distribution terminals are supplemented by the addition of protector mountings where protection is required. When protector mountings are added to an existing terminal, connect ground wire to the suspension strand by means of a strand ground clamp. On cable supported in rings, the strand and the cable sheath shall be bonded together at this location by a grade clamp or other suitable means. At locations where 1 or more cables parallel the cable with the protector mounting installed, bond the strands of all cables.

(c) At the older types of cross connecting terminal which have separate aerial and U.G. stub cables, or separate aerial cables, bond the sheaths of the cables entering the terminal.

3.07 Bonding of Other Apparatus: Apparatus external to the cable sheath, such as loading coil cases, equipment at terminal poles at locations where underground or aerial cables is extended by carrier open wire lines, apparatus cases, contactors, etc., shall be bonded to the sheath of the main cable. The bond is usually obtained at the splice between the apparatus stub cable and the main cable.

3.08 Aerial Cables at Interoffice Boundaries: At interoffice boundaries where two aerial cables that are not electrically connected anywhere in their separate routes approach each other, and the suspension

strand supporting the cables is one continuous strand, place strain insulators as covered in other sections of the practices.

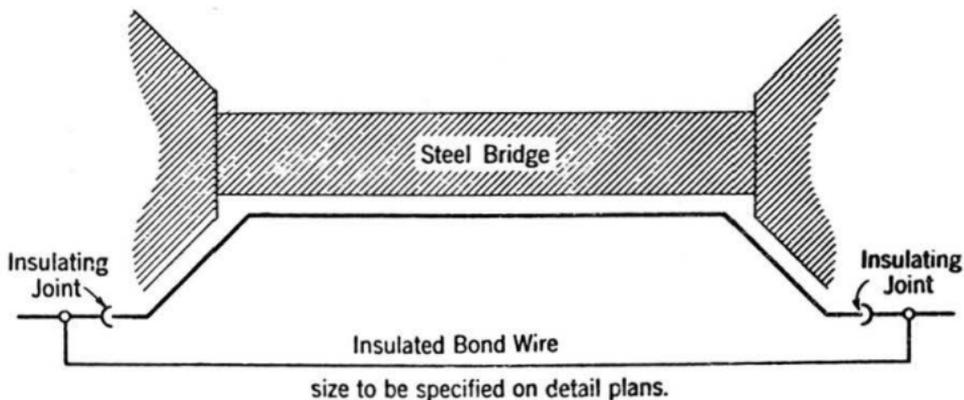
3.09 Underground and Aerial Cable Junctions: At underground and aerial cable junctions, it is sometimes necessary to isolate the underground cable plant from the aerial cable plant by means of insulating joints placed at the junctions regardless of the cable sheaths involved. The Electrolysis Department will determine the need for these insulating joints and place them as required after having determined that the cable sheath on the aerial side of the insulating joint is effectively grounded to discharge power fault currents.

3.10 Underground Dips

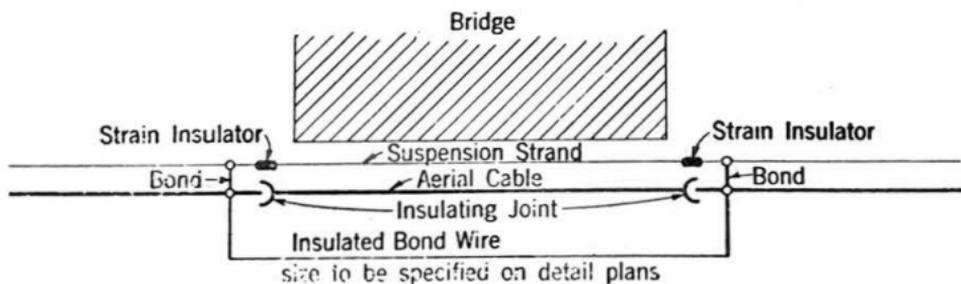
- (a) Where lead sheath underground dips or submarine cables are placed in aerial cable leads, the Electrolysis Department will determine the need for insulating joints and place them as required.
- (b) Where polyethylene sheath cable is used, no insulating joints will be required.

3.11 Bridge Structures

- (a) Only nonmetallic outer sheath cable should be attached to steel or reinforced concrete bridges. Under such conditions, no insulating joint is required.
- (b) When it becomes necessary to isolate existing lead sheath cable from such structures, the following sketch is applicable:



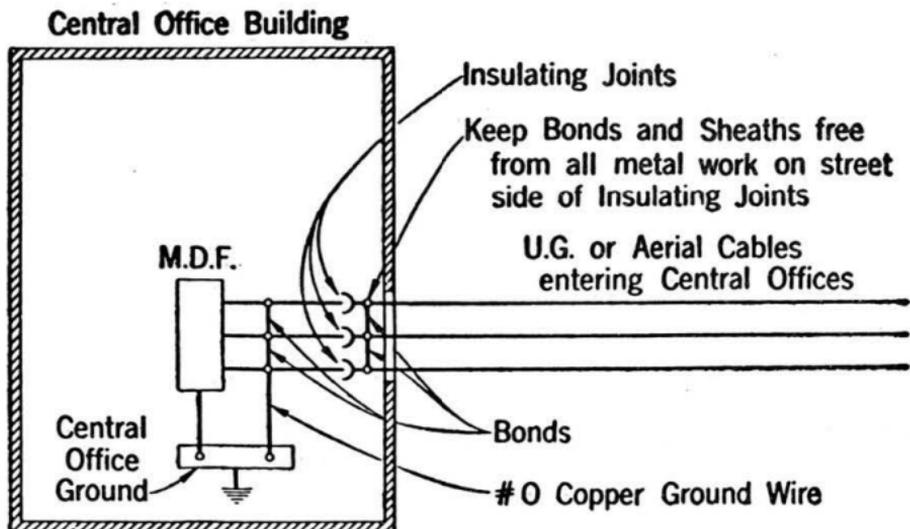
(c) Where cable is supported by suspension strand not insulated from the bridge structure, insulating joints are required in the cable sheath. Place strain insulators in the strand directly above the insulating joints, and place a bond between the strand and cable sheath on the side of each insulating joint away from the bridge as shown in the following sketch:



4. CENTRAL OFFICE ENTRANCE CABLES

4.01 Insulated Central Offices: In those central office buildings in which the Electrolysis Department has determined the need for and obtained the required approval for the placement of insulating joints proceed as follows:

- (a) Place insulating joints in all cables inside the building as close to the cable entrance as practicable. Detail plans for new cables entering existing insulated offices should provide for this requirement. The cable on the street side of these joints must be insulated from the metal cable rack and the vault framework and metal in the building walls, floors, etc.
- (b) The sheaths of all lead sheathed cables shall be bonded together between the insulating joint and the cable entrance. This is not necessary on polyethylene sheath cables, as bonds at the first splice outside the office are sufficient.
- (c) The sheaths of all cables shall be bonded together on the office side of the insulating joints and connected to the central office ground with No. 0 ground wire as illustrated in sub paragraph (e). On lead sheath cables, bond the sheaths together at the upright closest to the insulating joints. On polyethylene sheath cables, the bond can be made at the splice at the end of the polyethylene sheath and the bond may be connected to an adjacent lead sheath cable.
- (d) After cable placing operations have been completed in a cable vault, take care not to leave a lead sheath cable shunted across existing insulating joints. If it is not convenient to cut in an insulating joint immediately after placing the cable and prior to splicing the cable, the cable on the office side of the existing insulating joint must be insulated from the cable hooks and racks by wooden saddles, strips of rubber tape, etc., until the insulating joint is placed.
- (e) The use of insulating joints in central office buildings is illustrated below.

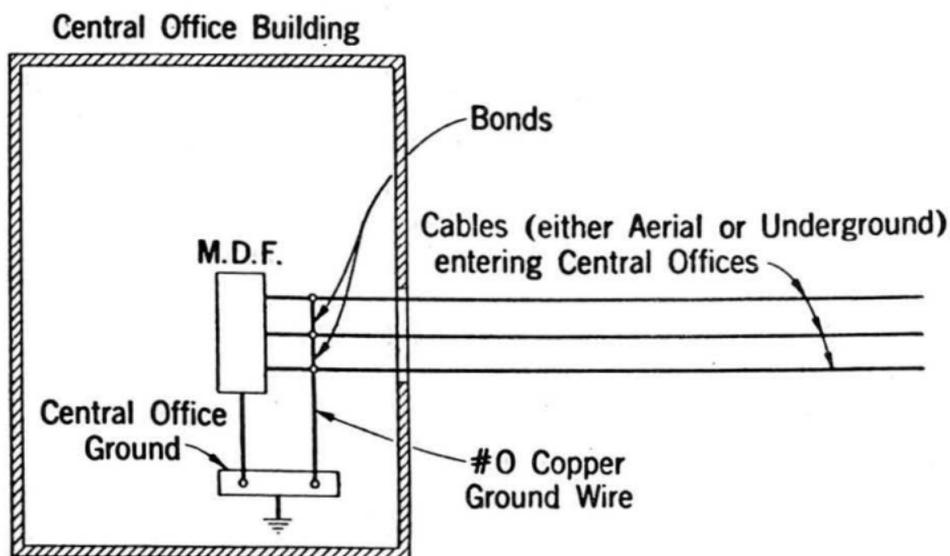


4.02 Uninsulated Central Offices: For those central offices where insulation is not a requirement proceed as follows:

(a) The sheaths of all cables shall be bonded together inside the building and connected to the central office ground with No. 0 ground wire as illustrated in sub paragraph (c).

(b) At underground entrances the bonds and the ground may be connected in the cable vault near the point of entrance to the building or in the splicing chamber.

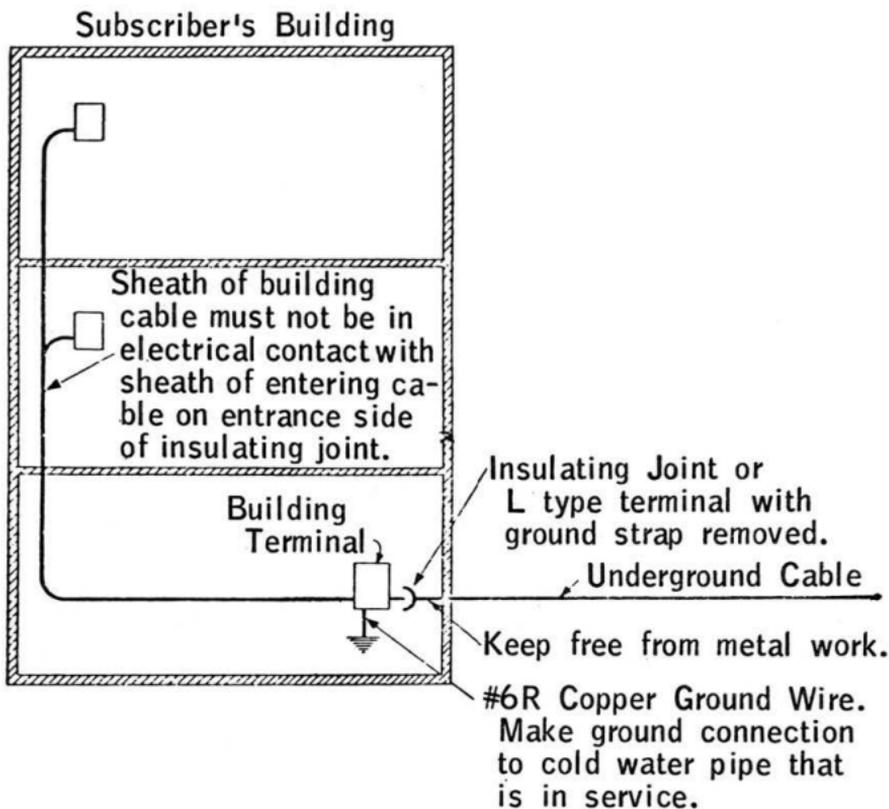
(c) At aerial entrances the bonds and the ground connection is made as close to the building entrance as practicable.



5. SUBSCRIBER BUILDING ENTRANCE CABLES

5.01 Underground Cable Entrances from a Manhole

- (a) An insulating joint shall be specified and placed in the entering polyethylene cable sheath. This joint shall be reasonably close to the cable entrance and the cable shall be adequately grounded on the house side of the insulating joint.
- (b) The use of insulating joints in subscribers' buildings fed in this fashion is illustrated below:



(c) For existing building entrance cables in this category, regardless of type of sheath, the Electrolysis Department will determine the need for insulating joints and place them as required.

(d) Service cable, LR, JR or TR, entering subscriber's bldg. shall be considered exempt from the insulating and grounding requirements specified.

5.02 Underground Cable Entrances from a Pole: In general the entering cable should be grounded as close to the building entrance as is practicable except as follows:

(a) Since polyethylene sheath cable will usually be employed for these installations, the ground provided at the building terminal location will usually fulfill this grounding requirement.

(b) Service cables, LR, JR or TR, (which will be bonded to the distribution cable at the pole), are exempt from this grounding requirement except as indicated in Paragraph 5.06 below.

5.03 Aerial Cable Entrances: Where polyethylene sheath cable is employed, treat as in Paragraph 5.02 above. Lead sheath cables should be grounded as close to the building entrance as possible.

5.04 Cables Entering Power Stations: Special treatment when and if required will be specified on the detail plans.

5.05 Bonding House Cable: House cable sheath and entering cable sheath should be bonded together at the main cable terminal with No. 6 ground wire when not otherwise electrically connected. When an insulated joint is provided in the entering cable, this bond must be on the building side of the insulated joint.

5.06 At radio stations, airport traffic control facilities, etc., connect the cable sheath to the station ground.