

ELECTRICAL PROTECTION ASSEMBLY UNITS

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1. GENERAL

1.1 This section provides REA borrowers, consulting engineers, contractors, and other interested parties with technical information for use in the design and construction of REA borrowers' telephone systems. It describes the various protector and ground assembly units and discusses the more common applications of each unit.

1.2 This issue, which replaces REA TE & CM-830, "Electrical Protection Assembly Units," Issue No. 4, November 1968, and Addendum No. 1, June 1969, has been revised to conform with the "Telephone System Construction Contract," REA Form 511, revised October 1970. The assembly units which are discussed herein are described in "Specifications and Drawings for Construction of Pole Lines, Aerial Cables and Wires, Buried Cables and Wires, and Station Installations," REA Form 511a. Additional information concerning station protection assembly units can be found in REA TE & CM-701, "Station Installations," and in REA Standard PC-5 for station installation.

1.3 The more important changes include use of the PG9-6 unit as a lightning arrester in both aerial and buried plant; introduction of the FM32() unit; information on gas tube arresters for station protection; information on bonding and grounding underground plant; and revision of the FM2B unit to change .104-40% copper steel wire to .128 (#8 AWG) aluminum-clad steel wire. No significant changes have been made in the other units.

1.4 Fused type protectors are required only at stations served from noncable type plant where there is no suitable water pipe electrode nor an electric service ground which qualifies as a multigrounded neutral ground.

1.5 This section forms a bridge between the "Telephone System Construction Contract" and the more theoretical "800 Series" protection sections of the REA TE & CM. It is recommended for use by staking engineers for typical situations frequently encountered in staking. It does not include practices to be followed in unusual or complicated situations which should be specified by the borrower's consulting engineer after careful study of the specific applicable protection section.

2. MISCELLANEOUS PROTECTION ASSEMBLY UNITS FOR BURIED PLANT

2.1 Unit BM-2, Housing Ground Assembly Unit.

2.11 The BM-2 unit consists of the necessary labor and material for the installation of a 1/2" x 5' ground rod, ground rod clamp, and the required length of insulated #10 AWG tinned copper ground wire. It also includes the connection of the ground wire within the housing to the grounding connector.

2.12 The BM-2 unit is specified primarily for grounding the shield of buried cable and wire at junctions with aerial noncable type plant, and for grounding protectors where required by REA TE & CM-816, "Electrical Protection of Buried Plant." Housings generally do not require grounding.

2.2 Unit BM-2A Housing Auxiliary Ground Assembly Unit.

2.21 The BM-2A unit consists of the necessary labor and material for the installation of a grounding connector and the required length of insulated #10 AWG tinned copper ground wire from a pole ground wire to the grounding connector of a pole mounted housing installed on the same pole. This unit also includes the connection of the ground wire within the housing to the grounding connector.

2.22 The BM-2A unit is specified for grounding the shields of buried cable and wire in pole mounted housings, for protection against power contacts to exposed aerial inserts, and at junctions with aerial wire facilities as required by REA TE & CM-816.

3. GUY ASSEMBLY UNITS

3.1 Units PE1-2, 3, 4, and PE2-2, 3, 4 - Down Guys and Overhead Guys.

3.11 These units consist of the appropriate size of strand and hardware in place.

3.12 These units should be specified for all unexposed guys, and also for exposed* guys which have one end of the guy attached to a through-bolt that supports an effectively grounded cable strand. These units are not to be specified for guys under other conditions.

3.2 Units PE1-2G, 3G, 4G, and PE2-2G, 3G, 4G - Down Guys and Overhead Guys, Ground Connection Type.

3.21 These units consist of the appropriate size of strand, ground wire, grounding connectors and hardware in place connected to a grounded cable strand, or to a multigrounded neutral (MGN)** via a pole vertical ground wire.

3.22 These units should be specified to meet National Electrical Safety Code (NEC) requirements for exposed guys primarily on joint use poles carrying "wye" connected electric supply circuits. These units should also be specified in preference to insulated guy units for exposed guys on nonjoint poles, provided an effective ground consisting of a cable strand or an MGN is readily available.

3.3 Units PE1-2S, 3S, 4S, and PE2-2S, 3S, 4S - Down Guys and Overhead Guys, Strain Insulator Type.

3.31 These units consist of the appropriate size of strand, strain insulators, and hardware in place.

3.32 These units should be specified to meet NEC requirements for exposed guys on joint use poles that use insulated guys to hold the electric power wire load.

4. PROTECTED CABLE TERMINAL ASSEMBLY UNITS

4.1 Units PGLC-10, 16, 20, 26 and PGLD-10, 16, 20, 26 - Protected Cable Terminal, Without Stub, Strand-Mounted.

4.11 These units consist of fully protected strand-mounted cable terminals without stubs, in place and spliced. They are intended primarily for lightning protection of paper-insulated cables.

4.12 These units are to be specified at junctions between paper- and plastic-insulated conductors to meet the lightning protection requirements of REA TE & CM-815, "Electrical Protection of Aerial Cable," and REA TE & CM-816, "Electrical Protection of Buried Plant."

*See Section 650, "Guys and Anchors on Wire and Cable Lines," paragraph entitled "Guys Requiring Electrical Protection" for definition of exposed guys.
 **The term MGN "multigrounded neutral" is used in this section to mean the neutral conductor of a wye-connected electric supply system, provided the neutral conductor has at least four grounds in each mile of line in addition to the ground connections at individual services, and provided the primary and secondary neutrals are solidly interconnected.

5. PROTECTED TERMINAL BLOCK ASSEMBLY UNITS

5.1 Units PG14-1 and PG14-3 - One- and Three-Pair Protected Terminal Blocks.

5.11 The PG14-1 and PG14-3 units consist of one- and three-pair protected terminal blocks with single leads, mounted in place in an enclosure, and connected to the conductors of the cable as specified by the Engineer. The arresters used in these terminal blocks may be either 800-volt gas tubes or 6 to 10 mil gap carbon arresters as specified by the Engineer.

5.12 These units should be specified primarily for lightning protection to plastic-insulated cable in accordance with requirements of REA TE & CM-815. It is intended that these units be specified only for unusually severe exposures such as fire towers and radio towers.

5.13 At junctions of buried cable or wire with conductor facilities of any type or length serving severely exposed stations, PG14 assemblies should be installed in the buried plant housing, and the shield of the buried cable or wire should be connected to the grounding connector of the buried housing by use of a bonding harness.

5.14 Connections from the terminal block to the cable pairs should be made with the leads furnished as a part of the terminal block, as shown on Construction Drawing 312-1.

5.2 Units PG17-1 and PG17-3 - One- and Three-Pair Protected Terminal Blocks.

5.21 The PG17-1 and PG17-3 units consist of one- and three-pair protected terminal blocks with single leads, mounted in place in an enclosure, and connected to the conductors of Figure 8 multipair distribution wire (MPDW) as specified. These units are the same as the PG14-1 and PG14-3 units but apply to MPDW instead of cable. Different assembly unit numbers are assigned for accounting purposes.

5.22 These units should be specified primarily for lightning protection to MPDW in accordance with the requirements of REA TE & CM-821, "Multipair Distribution Wire Protection."

5.23 These units should also be specified at junctions with buried plant when MPDW is used to extend circuits to severely exposed stations.

5.24 Connections from the terminal block to the MPDW should be made as shown on Construction Drawing 312-1.

6. UNPROTECTED TYPE TERMINAL BLOCK ASSEMBLY UNITS

6.1 Unit PG9-6 - Six Pair Unprotected Terminal Block with Single Leads.

6.11 The PG9-6 unit consists of an unprotected terminal block, mounted in place in an enclosure or housing (separately specified) and connected to the conductors of the cable as specified by the Engineer.

6.12 This unit is intended to be specified primarily as a connection block to connect drop wires to aerial cable plant. However, REA TE & CM-815, Issue No. 4, April 1969, and REA TE & CM-816, Issue No. 3, July 1969, have expanded its application to cover use of this terminal block as a lightning arrester in certain situations in place of a washer gap terminal block.

6.13 As a lightning arrester this unit should be specified in aerial cable enclosures at junctions between open wire and aerial plastic cable.

6.14 As a lightning arrester for buried plant, this unit should be specified in buried plant housings at junctions between open wire and buried plant, in conjunction with the BM32 () assembly unit.

6.15 With either aerial cable or buried cable or wire, at cable dead-ends where some circuits are extended by open wire, all cable pairs should be terminated by splicing to 24-gauge leads of PG9-6 terminal blocks. At open wire tap points along the cable route, enough PG9-6 terminal blocks should be installed to terminate all pairs that are extended by open wire. The number of cable pairs terminated should equal the number of pairs of terminal studs installed.

6.16 Where an aerial drop is used with buried plant, a PG9-6 terminal block should be installed in the buried plant housing. The 24-gauge leads of the terminal block should be spliced to the appropriate pair or pairs of the buried cable or wire and the drop wire conductors should be terminated on the studs of the terminal block. The purpose of the PG9-6 terminal block in this application is to provide a suitable means of terminating drop wire conductors, and to provide 24-gauge fuse link protection to the buried cable or wire in accordance with REA TE & CM-816.

7. GROUND ASSEMBLY UNITS

7.1 Unit PM1 - Pole Lightning Protection Assembly.

7.11 The PM1 unit consists of a length of any standard type of bare or insulated single conductor line wire stapled to a pole from the top to the butt.

7.12 This unit should be specified primarily for pole protection against lightning in accordance with REA TE & CM-820, "Open Wire Circuit Protection," and REA TE & CM-815.

7.2 Unit PM2 - Pole Ground Assembly.

7.21 The PM2 unit consists of a #10 AWG bare copper wire stapled from the top of a pole to slightly below the ground line, a ground rod clamp, and a 1/2" x 5' ground rod.

7.22 The PM2 unit does not produce a low resistance ground except in extremely low earth resistivity areas. This unit, usually in parallel with one or more PM2-1 units, may also be specified for grounding lightning arrester assemblies, power contact protectors, cable suspension strands, and MPDW support wires, where no MGN or other low resistance ground electrode is readily available. (See REA TE & CM-815, 820, and 821.)

7.23 The PM2 unit may be specified for lightning protection of poles already installed (REA TE & CM-820).

7.3 Unit PM2-1 - Auxiliary Ground Rod Assembly.

7.31 The PM2-1 unit consist of a 8-foot ground rod, grounding connector, ground rod clamp, and a length of #10 AWG bare copper ground wire.

7.32 This unit is specified to supplement a PM2, BM2, or P1-8 unit when a sufficiently low resistance cannot be obtained with a PM2, BM2, or P1-8 unit. This condition will usually occur in high earth-resistivity areas.

7.4 Unit PM2A - Ground Wire Assembly.

7.41 The PM2A unit consists of a #10 AWG bare copper ground wire with grounding connectors and hardware.

7.42 The principal use of this unit is to ground cable support strands and MPDW support wires by bonding to a pole vertical ground wire which is connected to an MGN, as required by REA TE & CM-815 and 821. This unit may also be specified in combination with PM2 pole ground assembly units if a MGN is not available.

7.43 Where more than one cable is carried on separate through-bolts on the same poles the bonds required at intervals are included in the cable or wire units and are not considered to be PM2A units. See Guide Drawing 209-1.

7.5 Unit PM2B - Aerial Ground Wire Assembly Unit.

7.51 The PM2B unit formerly consisted of a .104-40 copper covered steel wire, deadend clevises, #10 AWG bare copper ground wire, grounding and bridging connectors, and hardware. Because .104-40 wire is no longer included in the "List of Materials Acceptable for Use on Telephone Systems of REA Borrowers" action has been initiated to change item "nv" of this assembly unit from .104-40% copper-covered steel to .128" (#8 AWG) aluminum-clad steel.

7.52 This unit is specified primarily as an aerial ground wire to make an MGN available on a telephone pole at inspan crossings for grounding power contact protectors as required by REA TE & CM-820. Use of this unit is limited to situations where it is impracticable to obtain joint pole crossings and where it is also impracticable to reach the power pole by trenching. Before specifying this unit in any project the acceptability of the PM2B unit to the power company should be determined. This unit should also be specified where it offers the most advantageous means of obtaining the MGN ground connections required by REA TE & CM-815 and 821 for such uses as grounding the outer ends of aerial cable, buffer protectors, and MPDW support wires.

7.6 Unit PM22 - Central Office Grounding System.

7.61 The PM22 unit consists of the necessary ground rods, clamps, ground wire, connectors, trenching, backfilling, bonding the ground rods together, bonding to the MDF, to the electric power system ground, and to the water system (if available) to make a central office ground installation which meets the requirements of REA TE & CM-810, "Central Office Electrical Protection." The installation should be in accordance with detailed Plans and Specifications.

7.7 Counterpoise Ground Unit.

7.71 Where counterpoise grounds are required by REA TE & CM-825, "Situations Requiring Special Protection," a suitable special unit drawing should be prepared by the project Engineer. One recommended form of counterpoise ground unit consists of six or more #6 AWG (or larger) bare copper conductors connected together at a single point and extending radially from the common point at approximately 60° angles to each other for a distance of at least 50 feet. The whole assembly should be trenched to a depth of approximately 3 feet if practicable. There are numerous other acceptable forms of counterpoise that may be used where indicated by local conditions.

7.8 This unit should be specified only where a low resistance ground is required and it is impracticable to obtain it by means of a connection to an MGN, buried metallic piping system, any other existing low resistance ground electrodes, or driven grounds (REA TE & CM-825).

8. MISCELLANEOUS ASSEMBLY UNITS

8.1 Unit PM32 () - Open Wire Junction with Buried Plant.

8.11 The PM32 () is a new unit consisting of #14 gauge bridle wire, bridging connectors, bridle rings and wire guard in place as shown on Construction Drawing 970. The figure within the parentheses designates the number of open wire pairs. This unit includes the connection of the bridle wire to both the line wire and to the studs of the terminal block or blocks (separately specified) within the buried plant housing. Number 14-gauge bridle wire is used in this assembly because 24-gauge fuse links are provided on the separately specified terminal blocks.

8.2 Underground Cable Bonding and Grounding Arrangement.

8.21 The shields of all underground cables in a duct system are required to be bonded together in every manhole where splicing is required. There is no specific assembly unit assigned to this bonding. The bonding materials necessary, consisting of bonding ribbon and bonding ribbon clamps and/or #10 AWG bare copper ground wire and clamps, should be installed in manholes as directed by the Engineer in each manhole as part of Section U - Underground Cable Assembly Unit, in REA Form 511d, "Specifications and Drawings for Underground Cable Installation."

8.22 Where required, the Underground Cable Assembly Unit shall also include grounding of cable shields as specified by the Engineer.

9. STATION PROTECTOR ASSEMBLY UNITS

9.01 General

9.011 The selection of station protectors and station protector grounds should be in accordance with Tables 2 and 3 of REA TE & CM-701. All air gap arresters used in station protectors shall be white-coded units (nominal 500 volts dc). Gas tube station protectors not previously mentioned in this section shall be equipped with nominal 350 volts dc breakdown tubes. In all instances grounding and bonding conductor runs should be as short as practicable and should be run as straight as practicable. Except in unusual situations, grounding conductor runs and/or bonding conductor runs should not exceed 35 feet in length.

9.012 Fuseless station protectors should be used rather than fused type protectors except where stations served by noncable type plant cannot be provided with a ground to a suitable metallic water pipe and/or an MGN. Acceptable gas tube station protectors are always of the fuseless type.

9.013 The National Electrical Code (NEC) requires fusing coordination between open wire MPDW or cable circuit conductors exposed* to power contacts in excess of 300 volts to ground, and the drop wire, protector, and ground wire, for all fuseless protector installations. When conventional #18 AWG drop wire is used, the fuse link may consist of (1) the exposed conductors themselves if #24 AWG or smaller, (2) #24 AWG copper leads, or (3) #20 AWG 30% conductivity bridle wire. REA construction practices provide suitable fuse links for this purpose. If Figure 8 drop wire (#17½ AWG copper) is used, the fuse link may consist of item (2) or (3) above or #19, #22, #24, or #26 AWG cable conductors provided the station protector is included on the "List of Materials Acceptable for Use on Telephone Systems of REA Borrowers." Fuse links are not required for stations served by buried wire (used as buried services) from unexposed buried plant, but are required between aerial drop wires and buried plant. (See REA TE & CM-816) See Construction Drawing 952 in Form 511a for protection of buried wire and cable from power contact to aerial inserts.

9.014 Additional information on subscriber station protection can be found in REA Form 511a, REA TE & CM-701, and 805 "Subscriber Station Protection," and REA Standard PC-5. Fuseless station protector assembly units are identified by the suffix "F" after the basic unit designation. Grounding arrangements are the same for either fuseless or fused type protectors and are included in the drawings in REA Form 511a. Fused type protector units are discussed in Paragraph 9.14.

9.015 Where a station is served by buried service wire (BKB unit), connection of the shield of the buried wire to the ground terminal of the station protector in accordance with Drawing 962-1 of REA Form 511a is required as part of the BKB unit.

9.02 Unit P1-1F - Outside Fuseless Station Protector (Metallic Pipe System Ground).

9.021 The P1-1F unit consists of an outside fuseless type station protector and a ground connection to a water pipe.

9.022 This is the preferred grounding arrangement if the water pipe is a suitable ground electrode** and should be used whenever practicable regardless of the type of electric supply system if the electric service is grounded to the same piping system.

*Exposed is defined as being in such a position that in case of failure of supports or insulation, contact with another circuit may result.

**In order that a water pipe may be considered a "ground electrode" it must be cold water pipe of a continuous metallic underground water pipe system having at least 10 feet of buried metallic pipe.

9.023 This unit may also be specified in buildings equipped with continuous metallic pipes within the building but having nonmetallic pipes or insulated joints between the building and well or main, provided (1) the metallic pipe can be reached with a short #14 AWG insulated copper ground wire run (less than 15 feet), and (2) the building is served by an MGN power system which is bonded to the metallic pipe and in addition is grounded to a driven rod.

9.024 This is also the preferred ground where there is no electric service at the premises or where there is no electric service ground, provided the water pipe is a suitable ground electrode.

9.03 Unit P1-1AF - Outside Fuseless Station Protector (Metallic Pipe System Ground with Bond to Electric Ground).

9.031 The P1-1AF unit is similar to the P1-1F unit except that it includes a #6 AWG bare copper bond to the electric service ground.

9.032 The P1-1AF unit should be specified in instances where the building has a suitable water pipe ground electrode and a separate electric service ground electrode, but the two are not bonded together.

9.033 The P1-1AF unit should also be specified where a building is equipped with continuous metallic pipes within the building but having non-metallic pipes or insulated joints between the building and the well or main, provided (1) the metallic pipe can be reached with a short #14 AWG insulated copper wire run (less than 15 feet) and the electric service grounding conductor can be reached from some other point on the metallic pipe with a short #6 AWG bare copper wire run (less than 8 feet), and (2) the building is served by an MGN power system (whose grounding conductor is not already bonded to the metallic pipe).

9.04 Unit P1-2F - Outside Fuseless Station Protector (Electric System Ground).

9.041 The P1-2F unit consists of an outside fuseless type station protector and a buried #14 AWG insulated copper ground wire connected from the protector to the ground rod of a multigrounded neutral (MGN) electric service. The trenching distance generally should not exceed about 30 feet. Insulated wire is required by the National Electrical Code (NEC) for that portion of ground wire runs attached to the building. Insulated wire is specified by REA for the buried portion to avoid splicing and to reduce the number of stock items required.

9.042 This method of grounding should be used at subscribers' premises served by an MGN type of electric service which is bonded to a suitable water pipe electrode, if it is more economical than a P1-1F or a P1-3F unit. This unit may also be specified if it is impracticable to use the method described in the P1-1F unit or if no water system serves the premises.

9.043 The connection to the rod should be made below the electric service ground clamp by means of a ground clamp, item "aj." The electric service ground clamp should not be loosened or disturbed in any way. This required a jaw type ground clamp. As of April 1971, there was no supplier of a suitable jaw clamp, for use on copper or copper-covered steel ground rods. Until such time as a supplier is listed in the List of Materials for this application, the Engineer should specify modification of this unit to require connection of the telephone grounding conductor to the electric service grounding conductor by means of an item "me" grounding connector instead of connection to the ground rod.

9.05 Unit P1-3F - Outside Fuseless Station Protection (Electric System Ground).

9.051 The P1-3F unit consists of an outside fuseless type station protector and a #14 AWG insulated copper ground wire connected from the protector to the grounding conductor of an MGN type of electric service. The horizontal distance between the protector and the electric service grounding conductor generally should not exceed approximately 35 feet. The ground wire in this unit is run on the side of the building and is connected to the electric service grounding conductor by means of a compression connector.

9.052 This unit is electrically equivalent to the P1-2F unit and should be specified in preference to a P1-2F unit when it is more economical, or where trenching is impracticable, and where the appearance of the ground wire run on the side of the building is not objectionable. If local authorities object to the connection of the telephone ground wire to the electric grounding conductor, specify a special unit which provides for connection of the telephone grounding conductor to the electric ground electrode as described in Paragraph 9.043.

9.06 Unit P1-4F - Outside Fuseless Station Protector - Ground Rod with Bond to Electric Ground.

9.061 The P1-4F unit consists of an outside fuseless type station protector, a #14 AWG insulated copper ground wire, a ground rod, and a buried #6 AWG bare copper bond to the electric service grounding conductor where the trenching distance does not generally exceed about 30 feet.

9.062 This unit provides the preferred method of grounding only in the following situations: Where (1) no metallic water pipe of any type of water system is available, (2) the electric system is other than an MGN type and the service is grounded by means of a driven electrode, and (3) a P1-5F unit would be objectionable. This unit is normally specified only at stations served from cable plant (aerial or buried) or buried wire.

9.063 This unit may also be specified as a second or third choice ground under certain conditions. (See Table 1 of REA TE & CM-701)

9.07 Unit P1-5F - Outside Fuseless Protector (Ground Rod with Bond to Electric Ground).

9.071 The P1-5F unit consists of an outside fuseless type station protector, a #14 AWG insulated copper ground wire, a ground rod, and a #6 AWG bare copper bond to the electric service grounding conductor, where the horizontal distance between the protector and electric service ground lead does not generally exceed approximately 35 feet.

9.072 This unit is equivalent to the P1-4F unit except that the bonding conductor is run on the side of the building instead of being buried. The same limitations in use apply to the P1-5F as apply to the P1-4F. The P1-5F unit should be specified in preference to the P1-4F unit where trenching is impracticable and where the appearance of the conductor run on the building is not objectionable.

9.08 There are no longer P1-6F or P1-6 assembly units. Use of these units or their equivalent is no longer permissible. These units consisted of a station protector and a #14 ground wire connected only to a single driven ground rod. They were included as "last resort" units in issues of Form 511 prior to February 1968.

9.09 Unit P1-7F - Inside Fuseless Station Protector (Pipe System Ground).

9.091 The P1-7F unit consists of an inside mounted fuseless type station protector and #14 AWG insulated copper ground wire connected to a water pipe ground electrode.

9.092 This unit may be specified where an outside mounted protector is likely to be damaged frequently, such as in a narrow alley, or where there are serious objections to an outside mounted protector from appearance considerations. Use of this method of station protection may also be desirable instead of outside mounted units in severe atmospheric corrosion areas.

9.093 Where a protector is mounted inside a building on which insulated drop wire attachments are required, the drop wire must usually enter the building through an insulating tube. The insulating tube may be omitted where the entering conductors are enclosed in a grounded metallic shield or pass through masonry.

9.10 Unit P1-8F - Outside Fuseless Station Protectors (Ground Rod with Bond to Water Pipe).

9.101 The P1-8F unit consists of an outside fuseless type station protector, a #14 AWG insulated copper ground wire, a ground rod, and a #14 AWG insulated copper bond to a water pipe that does not have a 10-foot length of buried metallic pipe.

9.102 This unit is not a preferred unit because it does not use a preferred ground. It should, therefore, be avoided wherever it is practicable to obtain a preferred ground.

9.103 The application of this unit is restricted by the NEC rules for use of fuseless station protectors, to stations served either directly by a cable having an effectively grounded metal shield, or by drop wires connected to such a cable.

9.11 Unit P1-9F - Outside Fuseless Station Protector (Ground Rod with Bond to Water Pipe and to Electric Ground).

9.111 The P1-9F unit consists of an outside fuseless type station protector a #14 AWG insulated copper ground wire, a ground rod, a #14 AWG insulated copper bond to a water pipe which does not qualify as a suitable ground electrode, and a trenched #6 AWG bare copper bond to an electric service ground rod.

9.112 This unit is intended to be specified primarily in situations where (1) the telephone drop wire cannot be brought in close to the electric service ground, (2) the electric service is grounded to a driven rod and is not bonded to the water piping system, and (3) a continuous metallic water piping system exists within the building but has less than 10 feet of its continuous metallic length buried. (Note: This situation frequently occurs where nonmetallic pipe is used between the building and the well.) Except for the situation described in 9.114 this unit is normally specified only with non-MGN electric systems. When specified for application with non-MGN type electric systems, fuseless protectors may be used if the station is served from cable type plant.

9.113 Paragraph 9.043 applies also to this unit.

9.114 This unit may also be specified where no electric service ground exists in or on the building but an MGN ground exists on a nearby yard pole, and conditions are favorable for trenching.

9.12 Unit P1-10F - Outside Fuseless Station Protector (Ground Rod with Bond to Water Pipe and to Electric Ground).

9.121 The P1-10F unit consists of an outside fuseless station protector, a #14 AWG insulated copper ground wire, a ground rod, a #14 AWG insulated copper bond to a water pipe, and a #16 AWG bare copper bond to an electric service grounding conductor.

9.122 This unit is equivalent to the P1-9F unit except that the #6 AWG bonding conductor is run on the side of the building instead of being trenched. The P1-10F unit should be specified in preference to the P1-9F unit where trenching is impracticable and where the appearance of the conductor run on the building is not objectionable.

9.13 Outside mounted multipair fuseless station protector assemblies of 2 to 6 protectors are now available and are recommended instead of multiple installations of single-pair protectors on buildings served by 2 to 6 lines. Inside mounted multipair fuseless protector assemblies expandable from 2 pairs to 36 pairs are also available and are recommended where a number of stations are served from a cable brought directly into the building. Electrically, each protector unit is equivalent to a single pair fuseless station protector. See REA Standard PC-5, "Station Installations," for installation details.

9.14 Units P1-1 through P1-5 and P1-8 through P1-10.

9.141 These units are identical to the P1-1F through P1-5F and P1-8F through P1-10F units except that they include fused type protectors instead of fuseless type protectors. Maintenance of fused type protectors is more expensive than fuseless protectors, the protection afforded to the premises is not as good as that of fuseless protectors, and if the fuses blow before a power contact is deenergized a fused protector constitutes a personnel shock hazard that would not exist with a fuseless protector. For these reasons fused type protectors are permitted only under the conditions stated in paragraph 1.4 and 9.012 herein. See TE & CM-805.

9.142 There is no P1-7 unit. Fused type protectors should not be mounted inside because of maintenance considerations.

9.143 The principal application for the P1-8 unit is in situations where (1) an electric service ground does not exist at the premises, (2) a water system exists but does not qualify as a suitable ground electrode, and (3) the station is served by noncable type plant.

9.15 Gas Tube Station Protectors

9.151 Gas tube station protectors which have been accepted by REA may be used in place of carbon gap type fuseless station protectors in locations where experience has shown maintenance of carbon blocks to be excessive. Gas tube station protector installations are subject to the same limitations and must meet the same requirements that are applicable to fuseless station protectors equipped with air gap carbon arresters.

9.152 No assembly unit designations for gas tube station protectors are included in the present Form 511a. The Engineer must, therefore, assign special assembly unit designations if gas tube station protectors are specified. The suffix letter "G" is recommended for this purpose in place of the suffix "F."

10. LIGHTNING ARRESTER ASSEMBLY UNITS

10.1 Units P3-1 and P3-5 - Lightning Arresters, Single and Five-Pair.

10.11 The P3-1 and P3-5 units consist of lightning arrester assemblies equipped with carbon block or gas tube arresters, a #10 AWG bare copper ground wire connected to a pole ground wire, and all associated jumpers and hardware. The carbon lightning arresters furnished with this unit are blue coded or yellow coded.

10.12 These units should be specified primarily where lightning "buffer" protection is needed for paper-insulated cable on nonjoint use open wire leads. The yellow coded arresters should be specified by the Engineer for buffer protection to reduce maintenance. These units should not be used as "buffer" protectors on circuits equipped with power contact protectors installed within one mile of the cable deadend. Their use would be a needless duplication because the power contact protectors will function as cable buffer protectors (REA TE & CM-815 and 820).

10.13 The P3-1 and P3-5 units equipped with blue coded arrester units should be specified where the Engineer has specified that protection be added to an existing unprotected cable terminal on paper-insulated cable plant.

11. OPEN WIRE PROTECTOR ASSEMBLY UNITS

11.1 Unit P4-1 - Open Wire Power Contact Protector, Single Pair with Leads.

11.11 The P4-1 unit consists of a single pair power contact protector with leads, hardware, and connectors.

11.12 This unit should be specified principally on open wire lines for protection against power contacts. It is the principal device for obtaining the required coordinated electrical protection in the event of a power contact. (See REA TE & CM-820 for further information on the application of this unit.)

11.2 Unit P6-1A - Open Wire Drainage Unit (Inductor-Capacitor Type) Joint Use (Connection to Ground Rod).

11.21 The P6-1A unit is a crossarm mounted unit consisting of an open wire single inductor-capacitor type of drainage unit, with bridle wire, connectors, ground wire, ground rod, and hardware.

11.22 This unit provides drainage for one joint use open wire circuit. It should be specified on circuits requiring drainage which are strung on poles carrying other than MGN type power circuits. (See REA TE & CM-820 for additional information on application of this unit.)

11.3 Unit P6-1C - Open Wire Drainage Unit (Inductor-Capacitor Type) Joint Use (Connection to MGN).

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11.31 The P6-1C unit is identical to the P6-1A unit except that it is grounded by connecting it to a pole vertical ground wire connected to an MGN.

11.32 This unit should be specified on open wire circuits requiring drainage which are strung on poles carrying MGN type power circuits. (See REA TE & CM-820 for details on the application of this unit.)