

CONVENTIONAL DISTRIBUTING FRAMES

TYPES OF PROTECTION ON A-TYPE FRAMES

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1. GENERAL

1.01 This section explains the types of protection and application of carbon blocks and heat coils used with telephone equipment for voltage and current protection of exposed telephone circuits to protect central office switching equipment.

1.02 This section is reissued to list the figures in the Table of Contents, title figures, change paragraph designations in Part 4, and add information to paragraph 4.03. Revision arrows have been used to denote the more significant changes.

1.03 Protection for A-type distributing frames is covered in this section. On A-type main distributing frames, the outside plant cable conductors terminate on terminal strips or fuse mountings. The cables from the central office equipment normally terminate on the terminals of the protector mountings. Protection is provided by heat coils and protector blocks mounted in the protector mountings which are cross-connected to the cable conductors.

Note: The term **connector** is applied to distinguish the newer cable terminating devices (300-series connectors) from the term **protector** which has been applied to terminating mounting assemblies such as C50, E50, etc.

2. PROTECTION CONSIDERATIONS

2.01 The purpose of central office protection is to ensure the safety of telephone personnel and reduce the possibility of equipment damage due to lightning and foreign voltage contacts with the outside plant.

2.02 To determine the types of protection required for a specific telephone plant, it is necessary

to determine whether the plant is considered to be **exposed** or **unexposed** as follows:

(a) **Exposed Plant:** Telephone plant that is subject to lightning, possible contact with power conductors operating at more than 300 volts to ground, power induction, or a rise in ground potential of more than 300 volts to ground, is classified as **exposed**.

(b) **Unexposed Plant:** Telephone plant not subject to the conditions described in (a).

2.03 To determine the exposure status of a plant, the possibility of changes in exposure due to changes in cable distribution systems must be considered.

3. CLASSES OF CONDUCTORS

3.01 Conductors entering a central office are generally classified according to the type of central office protection as **exposed** or **unexposed**. Protection is divided into three classes as follows:

Class P: Applies to conductors requiring full protection consisting of protector blocks and heat coils.

Class TP: Applies to conductors requiring protector blocks only.

Class NP: Applies to conductors requiring neither heat coils nor protector blocks.

Note: For administrative purposes or for engineering reasons, conductors which may be considered to be in a certain class may be placed in a different class according to local instructions.

4. PROTECTION

4.01 Voltage Protection: Voltage protection is provided by two protector blocks for each pair. The airgap between the carbons is 3 mils. One electrode of each protector block is connected to ground; the other electrode to the conductor being protected. When the voltage on the conductor exceeds the sparkover value, the conductor is grounded by arcing across the 3-mil airgap between the carbons in the protector block. The carbon will usually return to its original state after the abnormal voltage is removed. If an excessive

current flows across the airgap, the carbons may become shorted and permanently ground the conductor being protected. Protector blocks are required on **all exposed circuits** and may be used on unexposed subscriber loop circuits for plant flexibility.

4.02 Current Protection: Current protection is provided by heat coils which protect telephone equipment against damage from sneak currents. Sneak currents are foreign currents that flow through equipment to ground. They are driven by a voltage that is too low to arc over the carbon blocks and the magnitude of the current is too low to protect by fused cable conductors. Protective heat coils consist of a coil of wire wound around a metal tube. Inside the tube is a metal pin soldered to the tube with a low melting point alloy and connected to one end of the coil. The arrangement is such that the coil is in series with the conductor to be protected. If an overcurrent condition develops, the coil will heat and melt the low temperature alloy. The metal pin, under pressure of the mounting spring, will be forced through the tube to connect the line to ground. This diverts the damaging current to ground and prevents damage to central office equipment.

4.03 Heat coils are used on **all** exposed circuits except toll circuits and subscriber loop pairs terminated in high frequency carrier cabinets and pairs connected to electronic switching equipment where a separate modular protector frame is provided. Various types of carrier circuits such as SLM* subscriber loop multiplex systems, SLC* subscriber loop carrier systems (such as SLC-40, SLCC-1, etc), and T-carrier on cable pairs classified as **exposed** require heat coils. These carrier circuits, without protection, leave the equipment vulnerable to a fire hazard. Toll circuits (except T-1 carrier) do not require heat coils because they terminate on repeat coils or other impedance matching devices not subject to overheating from sneak currents. Where the number of toll circuits in a group is small compared with the exchange component, it is general practice to use the same type of terminating apparatus for the whole group for administrative reasons.

*Trademark.

5. TYPES OF PROTECTIVE APPARATUS

5.01 On any particular A-type main distributing frame, any of the following types of protective

apparatus or jacks may be found alone or in various combinations. Figure 1 shows connections for an A-type frame.

Note: Protective apparatus may be designated as protector mountings or connectors (see note in paragraph 1.03).

C-, E- AND SIMILAR-TYPE PROTECTOR MOUNTINGS

5.02 The C- and E-type protectors are used in terminating exposed outside plant cable pairs. The C-type protectors provide both current and voltage protection through the use of heat coils and carbon protector blocks. The E-type protectors provide voltage protection only through the use of protector blocks. For further information on the C- and E-type protectors, refer to Section 201-206-101. Both the C- and E-type protectors are rated manufacture discontinue (Mfr Disc).

444-TYPE JACKS (301-TYPE CONNECTOR)

5.03 The 444-type jacks (301-type connectors) are used in terminating unexposed outside plant cable pairs. The 444-type jacks provide no protection and are rated additions and maintenance (A & M) only. For further information on the 444-type jacks, refer to Section 201-206-101.

300-TYPE CONNECTOR

5.04 The 300-type connectors are used in terminating exposed outside plant cable pairs. The 300-type connector provides both current and voltage protection through the use of heat coils and carbon blocks. For further information on the 300-type connectors, refer to Section 201-207-101.

6. CONDUCTORS ON A-TYPE FRAMES

SPARE CONDUCTORS

A. Class P and TP Conductors

6.01 All spare class P and TP conductors shall be grounded except as follows.

(a) If the spare conductor is crossed with a working conductor, it shall be grounded until the cross is removed. Where the spare conductor that is crossed terminates on a terminal strip on the main frame, it should be cross-connected to a miscellaneous protector mounting equipped with protector blocks until the trouble is cleared.

(b) In central offices where the conductors terminate on fuses and cross-connections are normally run directly from the fuses to the central office circuits, spare conductors need not be grounded but shall be disconnected by removing the cross-connections.

6.02 Conductors removed from service shall be promptly connected to ground.

6.03 When ground has been removed from cable conductors which are to be placed in service, the cross-connection shall be closed through to the protector and the protector blocks promptly installed.

6.04 With 65- or similar-type terminal strips on the main frame, ground connections shall be made as shown in Fig. 2.

6.05 To connect spare conductors to the ground terminal punching (Fig. 2), 22-gauge, bare-tinned, copper wire shall be used. Two turns shall be made around the 30A terminal punching nearest the conductors to be grounded, one turn around the back tap terminal of one conductor and then twice around the back tap terminal of the other conductor. The wire does not need to be soldered but shall be wrapped tightly around the terminals.

6.06 With 91- or modified 93-type terminal strips, connections between the ground terminals and spare conductor terminals shall be made as shown in Fig. 3.

6.07 The two pairs of cable conductors directly back of the ground terminals may be connected to the ground terminal by one 22-gauge, bare-tinned, copper wire. The copper wire shall be wrapped twice around the ground terminal, once around each of the next three terminals, and then twice around the back terminal.

6.08 On the terminal strip on which the front terminals in positions 17 to 20 are used for cable conductors, the ground connection for the conductors in position 20 shall be connected to the ground terminal in position 16, using a separate wire for each pair of conductors. Ground terminal 16 shall also be used in the regular way for grounding the cable conductor terminals in position 16. Cable conductors in positions 19, 18, and 17 shall be grounded to ground terminals in positions 15, 14, and 13, respectively, in the same way. Black

insulated, 22-gauge, tinned copper wire shall be used where passing working conductors.

B. Class NP Conductors

6.09 Spare class NP conductors do not require grounding.

WORKING CONDUCTORS—TERMINATING

A. Class P Conductors

6.10 With the exception of PBX and other battery feeders (Part 7), each pair of class P conductors shall be connected to a protector mounting equipped with protector blocks and heat coils. The protector may be permanently connected to the central office or it may be a miscellaneous protector as described in Part 8.

6.11 To use more than one pair of conductors for a circuit, each pair of conductors shall be cross-connected to a separate protector mounting equipped with protector blocks and heat coils. The equipment terminals of the protectors shall be cross-connected to the protector mounting associated with the central office circuit (Fig. 4). The protector permanently wired to the central office equipment should ordinarily be equipped with dummy metal heat coils except where this might lead to accidentally omitting heat coils of adjacent class P conductors. Where the central office circuit terminates on terminal strips instead of protector mountings, the cross-connections from the miscellaneous protectors (Fig. 5) shall be connected directly to the terminals.

6.12 When using miscellaneous protectors, care must be taken to connect the outside conductors to the line terminals of the protector. These are the terminals of the springs making contact with the protector blocks.

6.13 Where it is necessary to connect auxiliary central office equipment, such as long line supervisory equipment, the conductors shall be connected and protection provided as shown in Fig. 6.

B. Class TP Conductors

6.14 Class TP conductors shall be protected by using protector blocks in the same manner as class P conductors. Metal dummy heat coils or

soldered straps shall be provided (Fig. 7). Section 201-220-301 outlines methods of making connections.

6.15 Where toll conductors do not appear in well defined groups on the main frame and cannot be readily distinguished from class P conductors, heat coils should be used to minimize the probability of accidentally omitting heat coils from the protectors of class P conductors.

Note: The omission of heat coils on toll conductors does not alter the practice regarding the use of protective cable or fuses in this type of conductor.

C. Class NP Conductors

6.16 It is not necessary to use protectors for terminating NP conductors (Fig. 8), unless protector mountings are permanently connected to central office circuits or protector mountings are used to facilitate opening the line. Dummy protector blocks and dummy heat coils or soldered straps may be used, provided conductors of all one class are connected to protectors in orderly groups. Conductors of various classes connected to protectors at random may cause the inadvertent use of dummy equipment or straps on circuits requiring heat coil or protector block protection or both.

6.17 Cable facilities, terminated on 444-type jacks and used for circuits which require that the jack contacts be strapped out, should be strapped as shown in Fig. 9. Cross-connect wire should be used, leaving approximately 1/2 inch slack.

6.18 Should the holes in the fanning strip become crowded due to the use of shielded conductors and shielded cross-connections, straps may be run as shown in Fig. 10. Prior to running straps without using the fanning strip, a 2-inch by 6-inch gray fiber sheet is used to insulate the straps from the steel framework. On new facilities, where there is no interference from existing jumpers, gray fiber, 6 inches by 7 inches wide, may be inserted between the horizontal members of the supporting framework. Both the 2-inch wide or the 7-inch wide fiber will be held in place by the straps which should be run with approximately 1/2 inch slack.

WORKING CONDUCTORS—LOOPED

A. Class P to Class P

6.19 All class P conductors looping through an office shall be protected, as shown in Fig. 11, by connecting each pair of conductors to the line terminals of separate miscellaneous protector mountings equipped with protector blocks and heat coils. The equipment terminals of the protector mountings shall be connected together.

6.20 Where it is necessary to connect through an auxiliary central office circuit, such as a long line supervisory circuit, the conductors shall be connected and protection provided as shown in Fig. 12.

6.21 Where it is necessary to bridge cable conductors looping through an office and where the bridged circuit is cabled to protectors, protection shall be provided as shown in Fig. 4. The protector permanently wired to the central office equipment should ordinarily be equipped with dummy metal heat coils except where this might lead to accidentally omitting heat coils of adjacent class P conductors. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 5.

B. Class P to Class NP

6.22 A circuit composed of class P and class NP conductors looping through an office shall be connected and protection provided as shown in Fig. 13.

6.23 Where it is necessary to connect through an auxiliary central office circuit, such as a long-line supervisory circuit, the conductors shall be connected and protection provided as shown in Fig. 14; this applies if the class P conductors are to be connected to the auxiliary circuit leads which terminate on a terminal strip. The protector permanently wired to the central office equipment should be equipped with dummy metal heat coils except where this might lead to accidentally omitting heat coils of adjacent class P conductors. If the class NP conductors are to be connected to the auxiliary circuit protector, connections are made as shown in Fig. 15.

6.24 Where it is necessary to bridge cable conductors looping through an office and

where the bridged circuit is cabled to protectors, protection shall be provided as shown in Fig. 16. The protector permanently wired to the central office equipment should be equipped with dummy metal heat coils, except where this might lead to accidentally omitting heat coils of adjacent class P conductors. Where the bridged circuit terminates on terminal strips, protection shall be provided as shown in Fig. 17.

C. Class NP to Class NP

6.25 Class NP interoffice conductors looped through an office shall be cross-connected as shown in Fig. 18 unless facilities are desired for opening the line, in which case a protector shall be provided as shown in Fig. 19. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 7) provided conductors of all one class are connected to protectors in groups. This shall not be done when conductors of various classes are connected to protectors at random as this may lead to the use of dummy equipment or straps on circuits requiring heat coil or protector block protection.

6.26 Where it is necessary to connect through an auxiliary circuit, such as a long line supervisory circuit, the conductors shall be connected and protection provided as shown in Fig. 20 if protectors are permanently connected to the auxiliary circuit or where facilities are desired for opening the line. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 7) provided conductors of all one class are connected to protectors in groups. This shall not be done when conductors of various classes are connected to protectors at random as this may lead to the use of dummy equipment or straps on circuits requiring heat coil or protector block protection. If protectors are not permanently connected to the central office circuit and facilities for opening the line are not desired, the conductors shall be cross-connected as shown in Fig. 21.

6.27 Where it is necessary to bridge cable conductors looping through an office, connection shall be made and protection provided as shown in Fig. 22 where the central office circuit terminates on protectors. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 7) provided conductors of all one class are connected to protectors in groups. This shall not be done when conductors of various classes are

connected to protectors at random as this may lead to the use of dummy equipment or straps on circuits requiring heat coil or protector block protection.

6.28 Where the central office circuit terminates on a terminal strip, cross-connections shall be made as shown in Fig. 23.

D. Class TP to Class NP

6.29 A circuit composed of class TP and class NP conductors looping through an office shall be connected and protection provided as shown in Fig. 24.

6.30 Where it is necessary to connect through a central office circuit, the conductors shall be connected and protection provided as shown in Fig. 25 if the class TP conductors are to be connected to the auxiliary circuit leads which terminate on a terminal strip. If the class TP conductors are to be connected to the auxiliary circuit protector, connections are made as shown in Fig. 26. In either case, the protector permanently wired to the central office equipment should ordinarily be equipped with dummy metal heat coils or soldered straps (Fig. 7) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

6.31 Where it is necessary to bridge cable conductors looping through an office and where the bridged circuit is cabled to protectors, protection shall be provided as shown in Fig. 27. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 28. In either case, the protector associated with the central office equipment should ordinarily be equipped with dummy metal heat coils or soldered straps (Fig. 7) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

E. Class TP to Class TP

6.32 All class TP conductors looping through an office shall be protected as shown in Fig. 29 by connecting each pair of conductors to the line terminals of separate protector mountings equipped with protector blocks and dummy metal heat coils or soldered straps (Fig. 7). The equipment terminals of the protector mountings shall be cross-connected.

6.33 Where it is necessary to connect through a central office circuit, the conductors shall be connected and protection provided as shown in Fig. 30. The protectors should ordinarily be equipped with dummy metal coils or soldered straps (Fig. 7) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

6.34 Where it is necessary to bridge cable conductors looping through an office and where the bridged circuit is cabled to protectors, protection shall be provided as shown in Fig. 31. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 32.

7. BATTERY FEEDERS ON A-TYPE FRAMES

7.01 Both the metallic return and ground return feeder arrangements are covered herein. To minimize noise effects on PBX stations and to prevent possible electrolysis damage to lead sheath cables or underground pipes, the ground return feeder arrangement shall not be used when additions or changes in the PBX facilities are involved unless authorized by specific local instructions.

7.02 Private branch exchange and other battery feeder conductors, whether single or in groups, shall be cross-connected and protected as shown in Fig. 33 for ground return battery feeders, and as shown in Fig. 34 for metallic return battery feeders (paragraph 7.01).

7.03 The arrangements shown in Fig. 33 and 34 provide for the use of protector blocks and 75A heat coils in all cases. The 75A heat coil has a yellow shell.

7.04 For ground return battery feeders, the protector which is wired to the battery fuse shall be cross-connected to the cable conductors with two 20-gauge, single cross-connection wires. One wire is connected to the tip of the protector, and the other is connected to the ring of the protector (Fig. 33A). The central office equipment has protectors with springs. These springs are used for battery supply and shall be connected together as shown in Fig. 33A. Where two or more cable conductors are used, all of the tip and ring conductors shall be strapped together. One of the cross-connection wires shall be run to one end of the strap and the other cross-connection wire run to the other end of the strap, which will form a loop from the two terminals of the protector

(Fig. 33B). Where only one cable conductor is used for a battery feeder, both cross-connections from the protector shall be run to the cable conductor terminal (Fig. 33C).

Note: One 20-gauge paired cross-connection may be used in lieu of the 20-gauge, single cross-connections where the jumpers are run through the same fanning strip hole and, if the number of such jumpers warrants the provisions of 20-gauge, paired cross-connection wire.

7.05 For metallic return battery feeders, the protector which is wired to the battery fuse shall be cross-connected to the cable conductors with 20-gauge, single cross-connection wires. One of the wires shall be connected to the tip and the other connected to the ring of the protector (Fig. 34A). The springs of protectors used for battery shall be connected. When more than one cable pair is used, all of the ring conductors shall be strapped together. One of the cross-connection wires from the protector shall be connected to the terminal at one end of the strap. The other cross-connection wire shall be connected to the other end forming a loop from the two terminals of the protector (Fig. 34B). The battery feed ground shall be connected to the tip cable conductors in the same manner except that instead of connecting the cross-connection wires to a protector, they are connected to the battery feed ground. Where only one cable pair is used for a battery and ground feeder, the two cross-connection wires from the protector shall be connected to the ring terminal of the pair. The two cross-connection wires connected to the battery feed ground shall be connected to the tip terminal (Fig. 34C).

Note: One 20-gauge, paired cross-connection may be used in lieu of the two 20-gauge, single cross-connections where the jumpers are run through the same fanning strip hole and, if the number of such jumpers warrants the provision of 20-gauge, paired cross-connection wire.

8. RINGING SUPPLY ARRANGEMENTS ON A-TYPE FRAMES

8.01 Cross-connecting and multiplying arrangements for PBX and station ringing supply feeders are covered in SD-90231-01 and Section 201-220-301.

8.02 Table A indicates the number of PBX positions or PBXs that may be connected to one ringing supply resistance lamp and the number of cable pairs that may be connected to one lamp for the various types of PBXs.

9. MISCELLANEOUS A-TYPE FRAMES

9.01 The following circuits shall be protected by using heat coils and dummy protector blocks:

- (a) Test trunks from the test desk to the main frame within an office

- (b) Plugging-up lines in dial offices terminating at the main frame

- (c) Service observing lines which are arranged for connection to subscriber lines by plugging in at the main frame protectors.

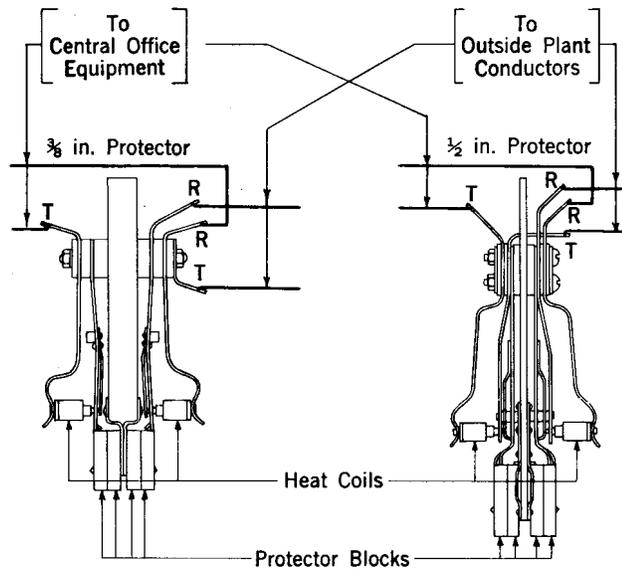


Fig. 1—Connections to Protector as Made on A-Type Main Distributing Frame

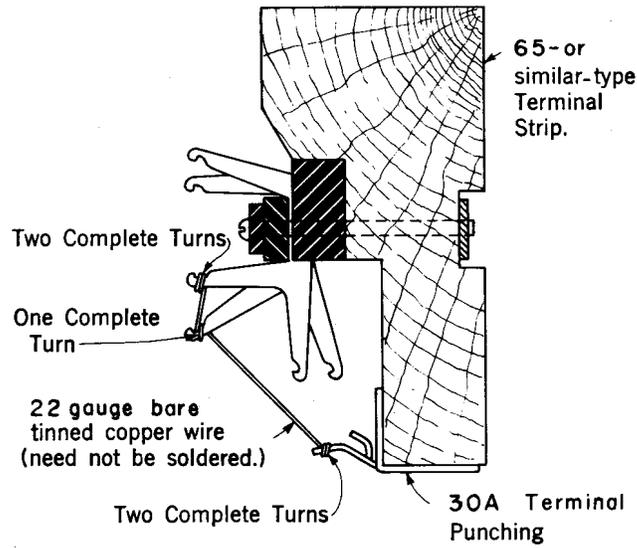


Fig. 2—Spare Conductor Ground Connection—65- or Similar Type Terminal Strip

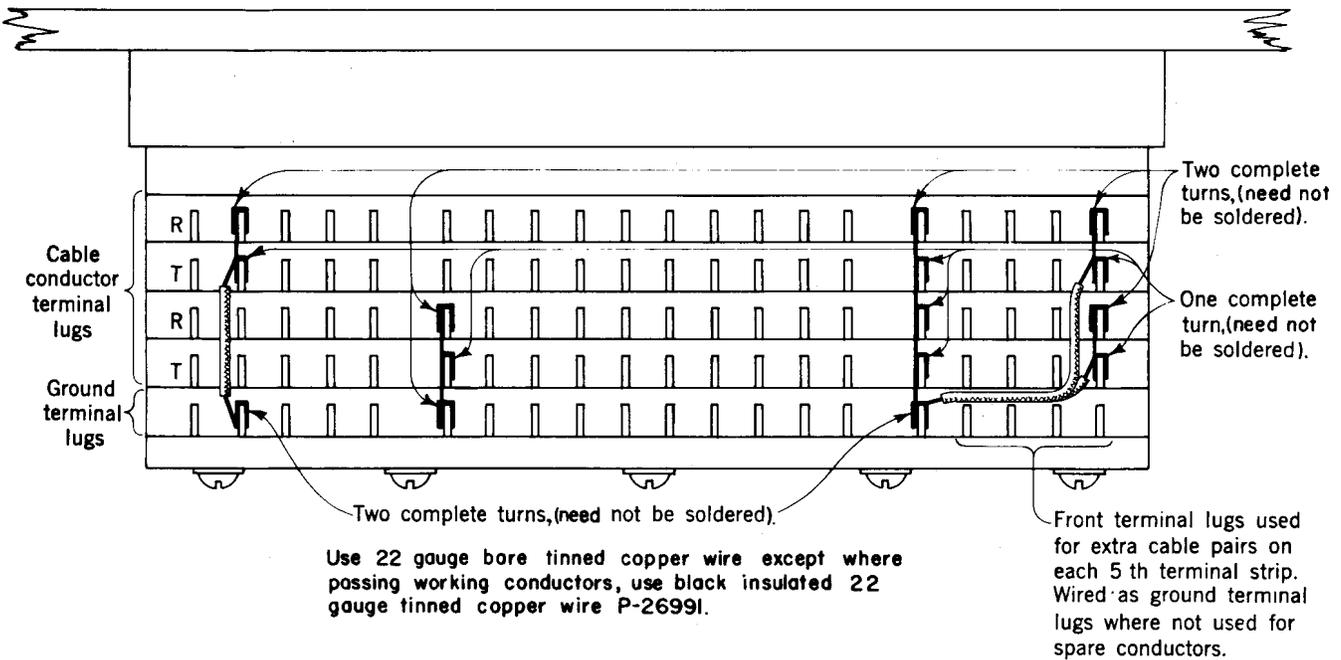


Fig. 3—Spare Conductor Ground Connection—91- or Modified 93-Type Terminal Strip

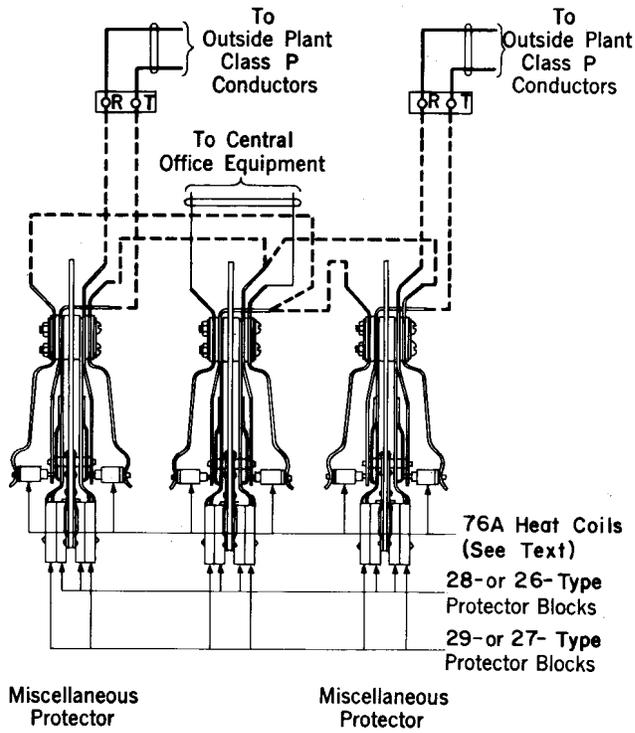


Fig. 4—Class P Conductors-Circuit Requiring More Than One Pair of Conductors

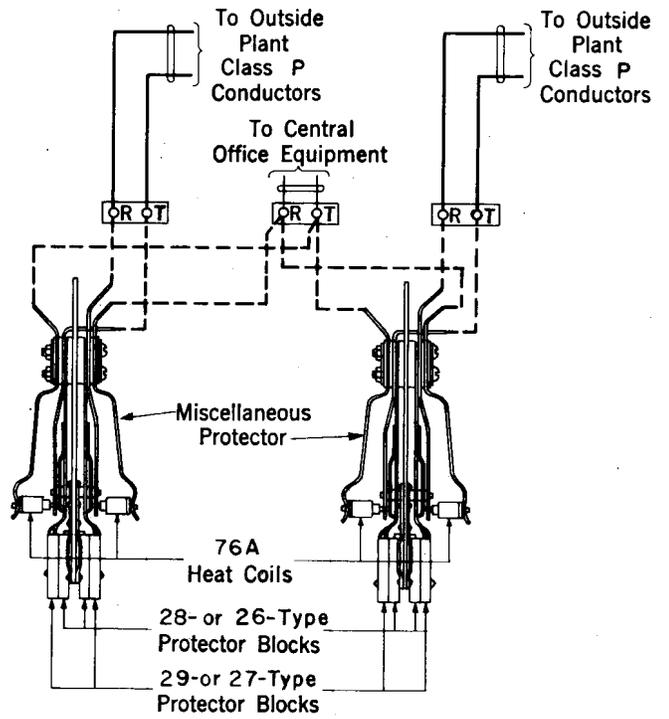


Fig. 5—Class P Conductors Terminated on Terminal Strip and Requiring More Than One Pair of Conductors

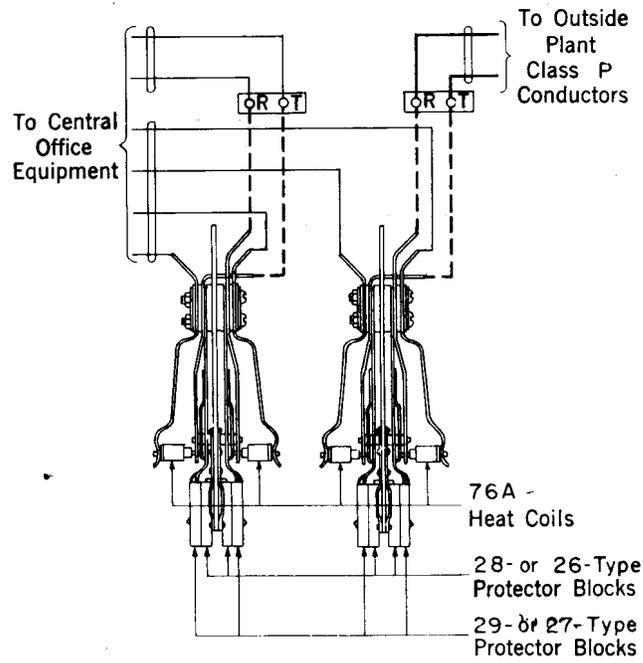


Fig. 6—Class P Conductors—Connection to Auxiliary Central Office Equipment

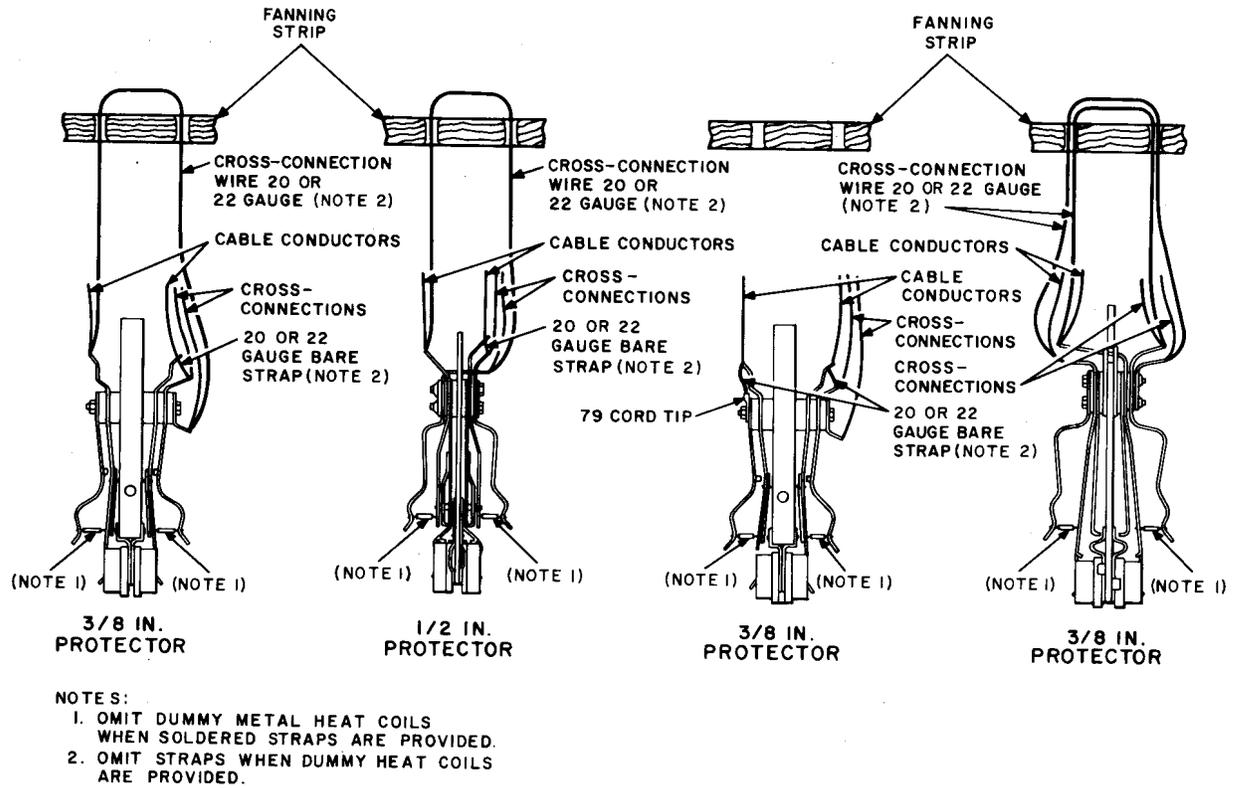


Fig. 7—Class TP Conductors—Connections

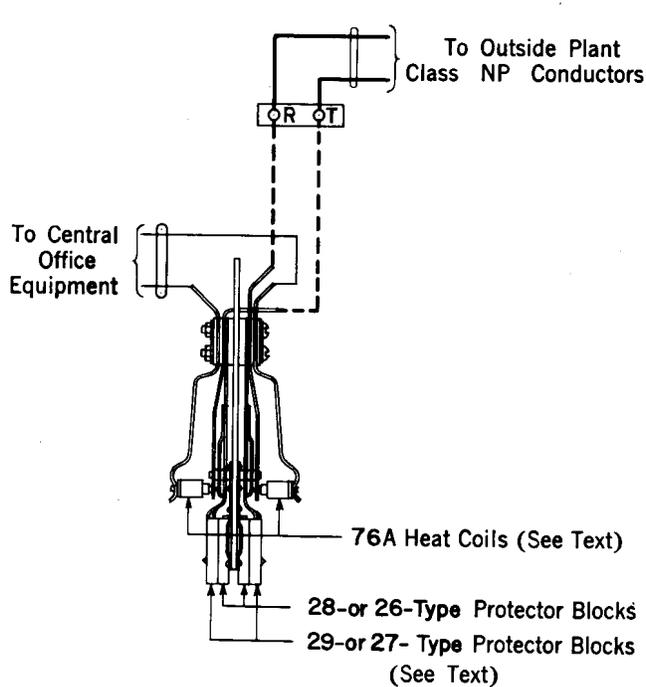


Fig. 8—Class NP Conductors—Connections

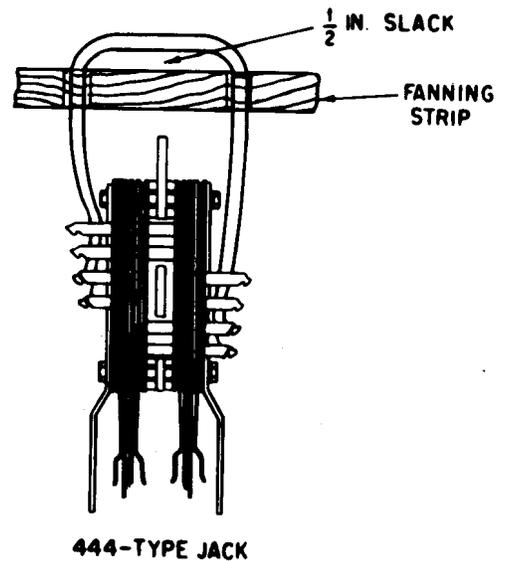


Fig. 9—Class NP Conductors—Cable Facilities Terminated on 444-Jacks Requiring Straps on Jack Contacts

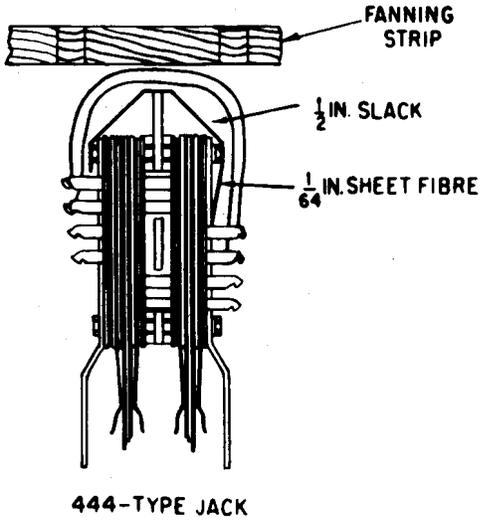


Fig. 10—Class NP Conductors—Cable Facilities Terminated on 444-Jacks Requiring Straps on Jack Contacts—Holes in Fanning Strip Blocked

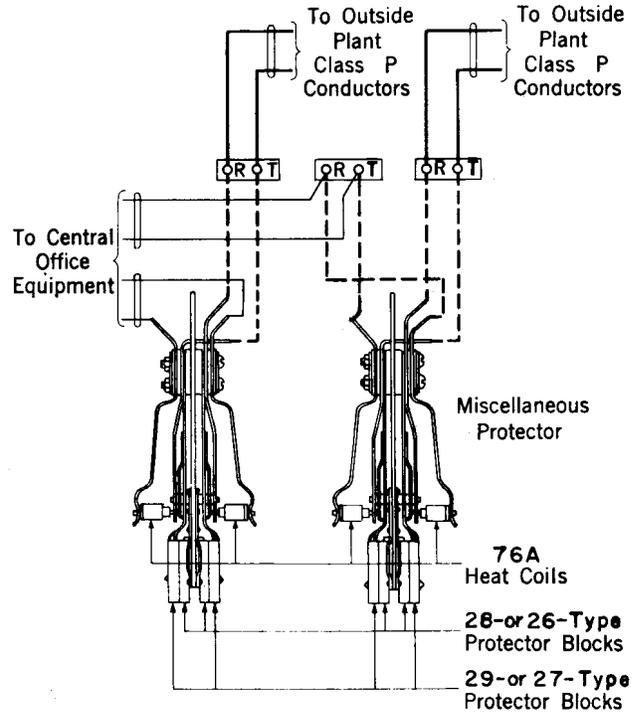


Fig. 12—Class P to Class P Conductors—Having Central Office and Auxiliary Line Circuits

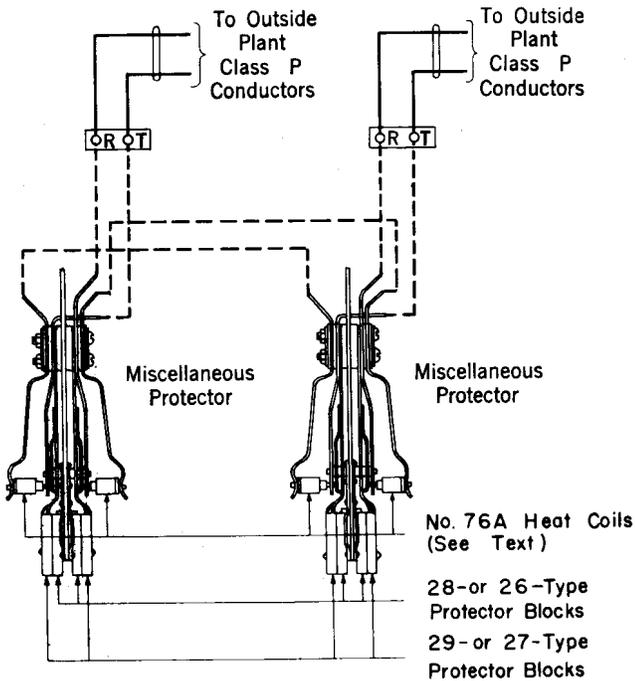


Fig. 11—Class P to Class P Conductors—Looped

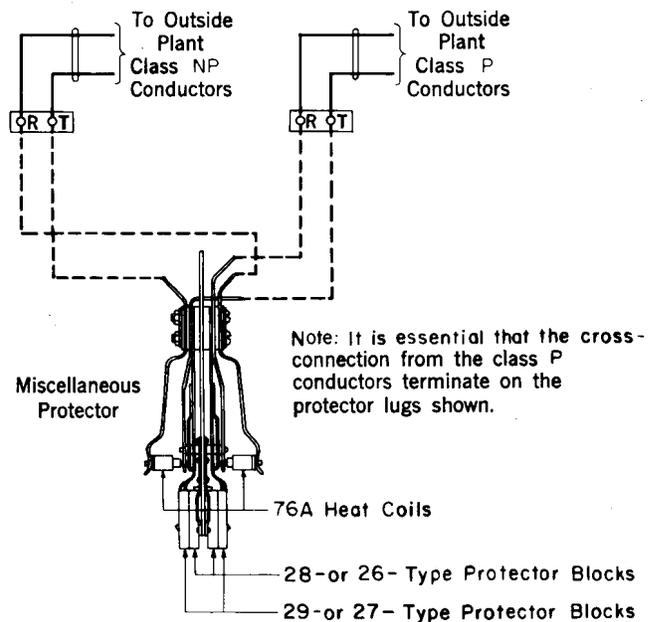


Fig. 13—Class NP to Class P Conductors—Looped

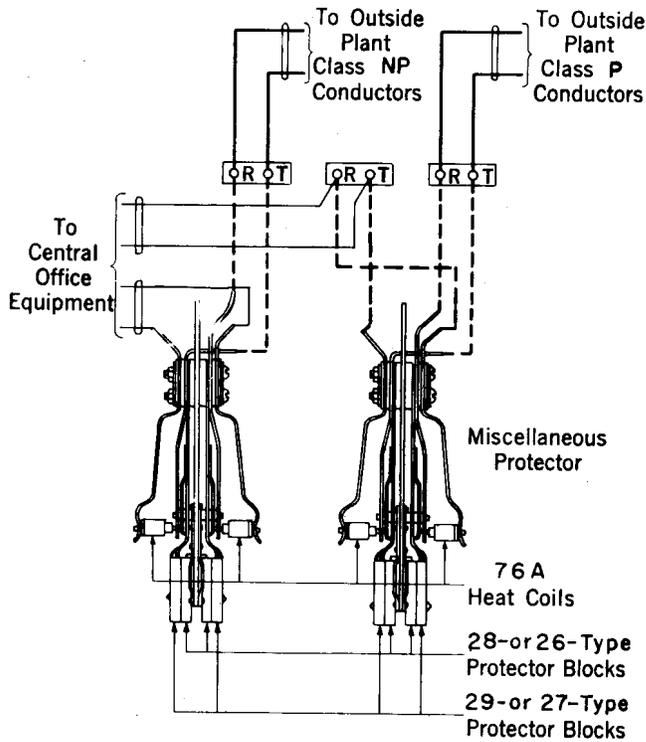


Fig. 14—Class P to Class NP Conductors—Looped—Having Auxiliary Line Circuit Connected to Class P Conductors

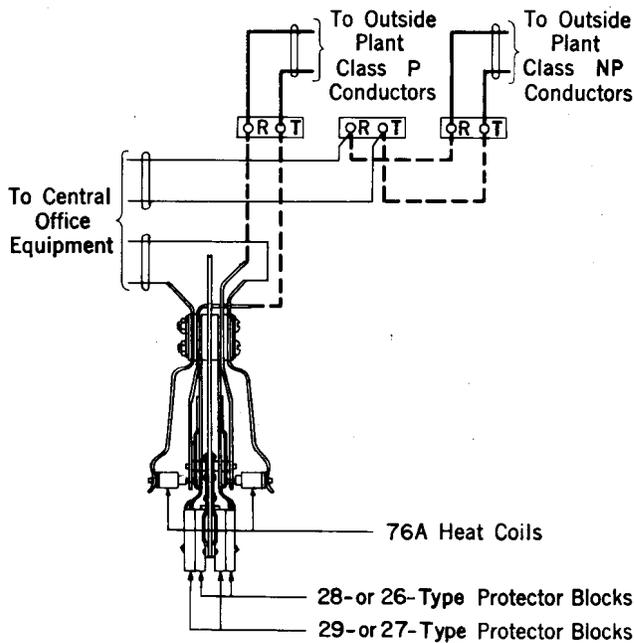


Fig. 15—Class P to Class NP Conductors—Looped—Having Auxiliary Line Circuit Connected to Class NP Conductors

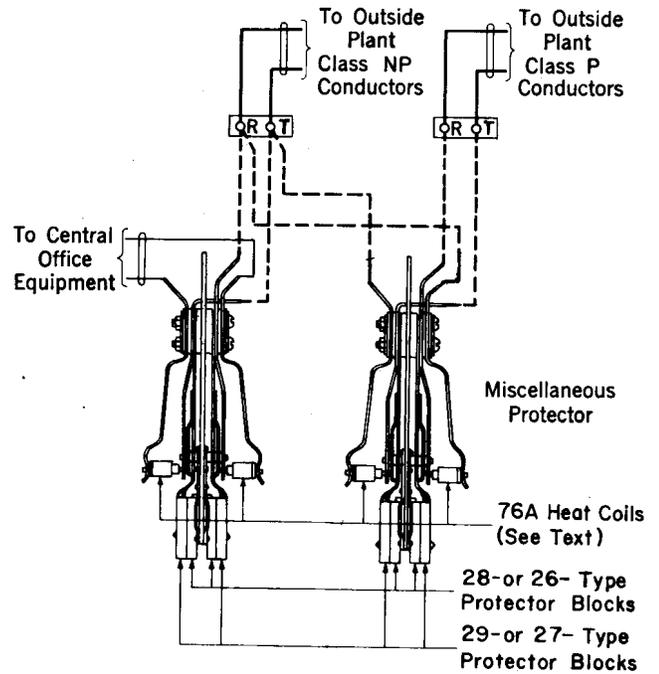


Fig. 16—Class P to Class NP Conductors—Looped—Bridged to Central Office Equipment Terminated on a Protector

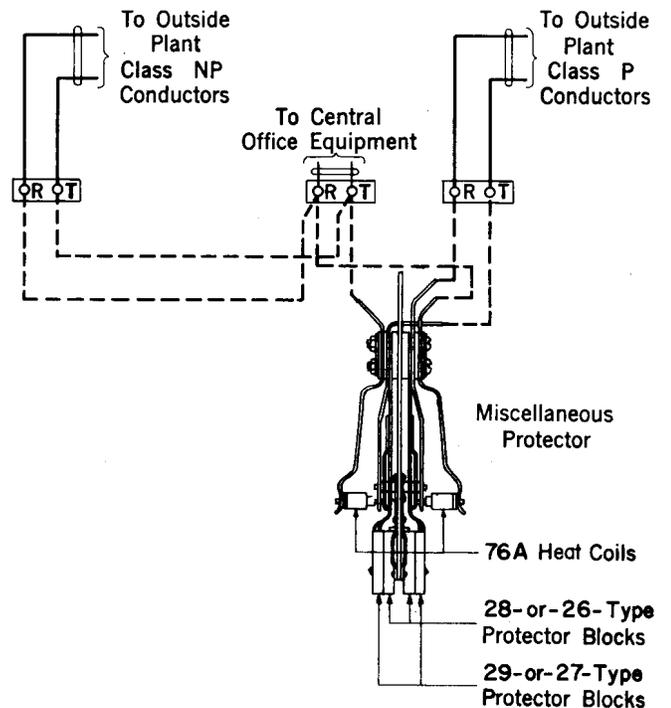


Fig. 17—Class P to Class NP Conductors—Looped—Bridged to Central Office Equipment Terminated on a Terminal Strip

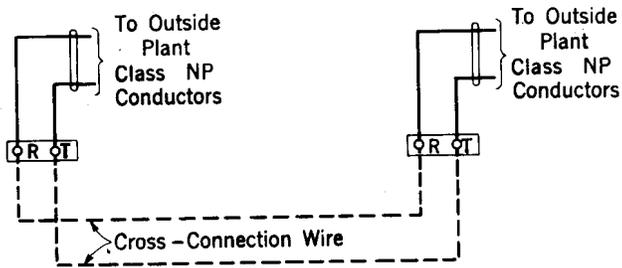


Fig. 18—Class NP to Class NP Conductors Looped—No Facility for Opening Loop

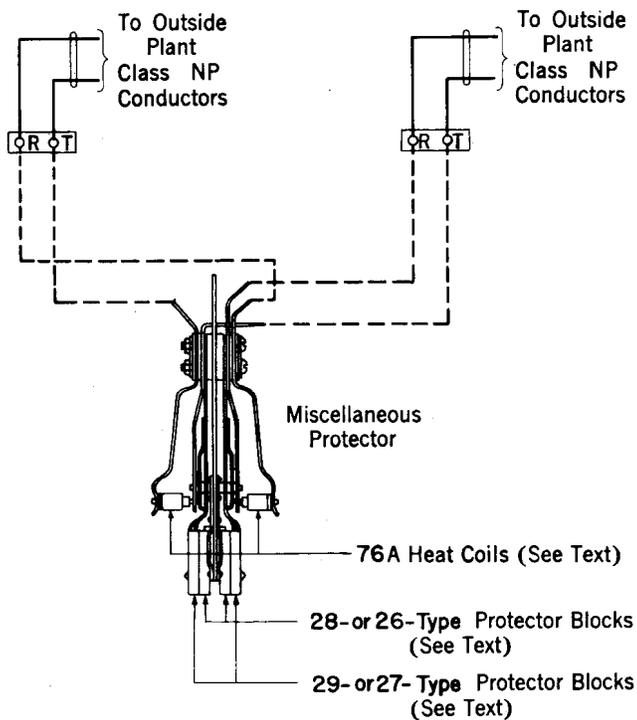


Fig. 19—Class NP to Class NP Conductors—Looped—Having Facility for Opening Loop

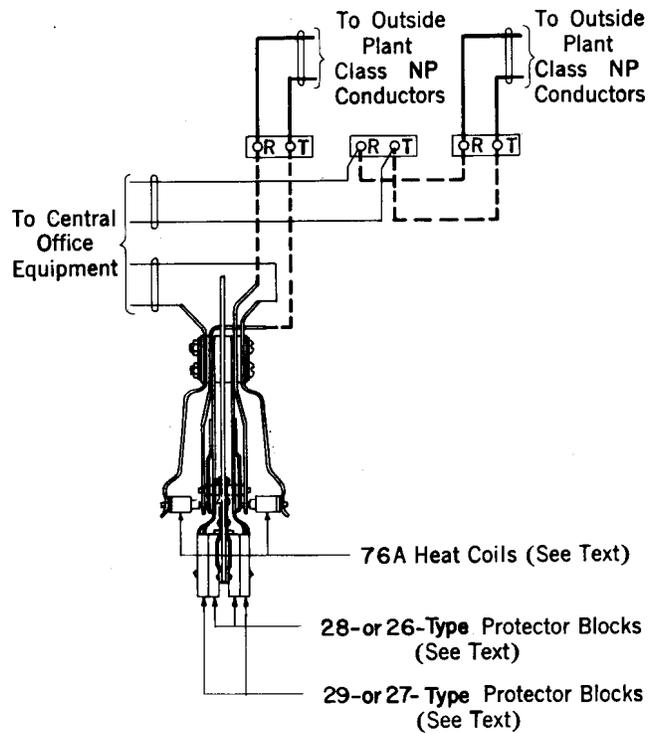


Fig. 20—Class NP to Class NP Conductors—Looped—Bridged to Auxiliary Line Circuit with Facility for Opening Loop

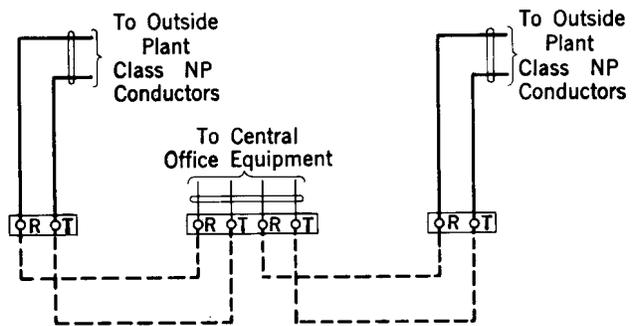


Fig. 21—Class NP to Class NP Conductors—Looped—Bridged to Auxiliary Line Circuit—No Facility for Opening Loop

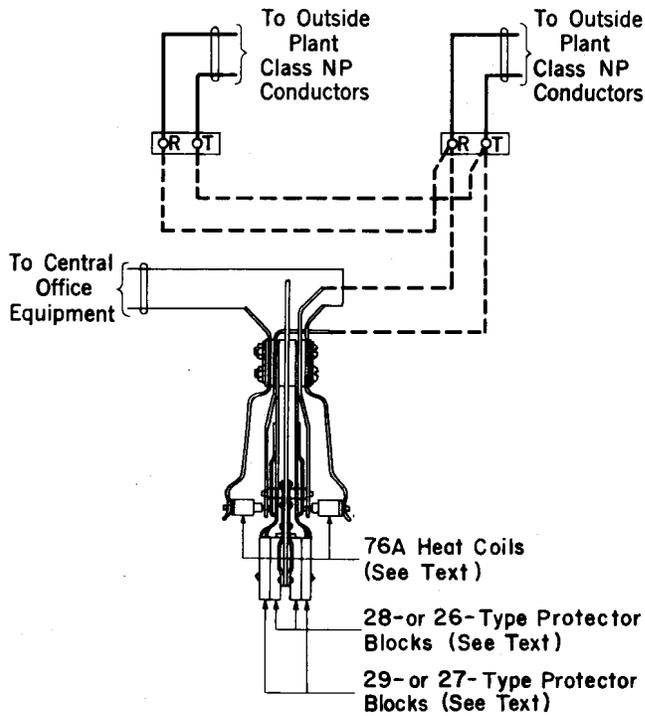


Fig. 22—Class NP to Class NP Conductors—Looped—Bridged to Central Office Equipment Terminated on Protector

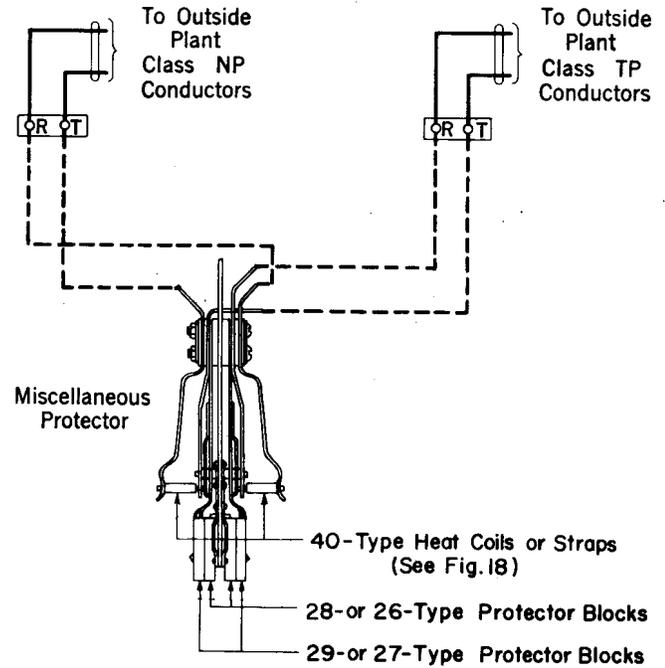


Fig. 24—Class NP to Class TP Conductors—Looped

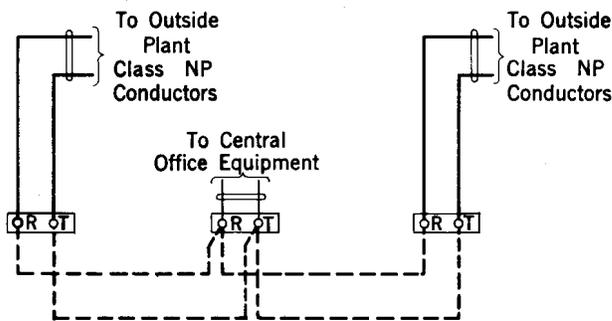


Fig. 23—Class NP to Class NP Conductors—Looped—Bridged to Central Office Equipment Terminated on Terminal Strips

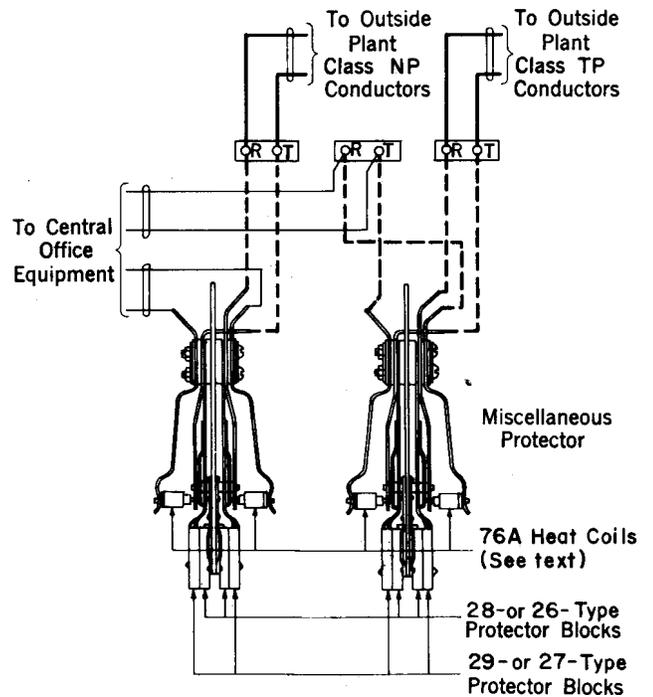


Fig. 25—Class NP to Class TP Conductors—Looped—Class TP Conductors Connected to Auxiliary Line Circuit Terminated on a Terminal Strip

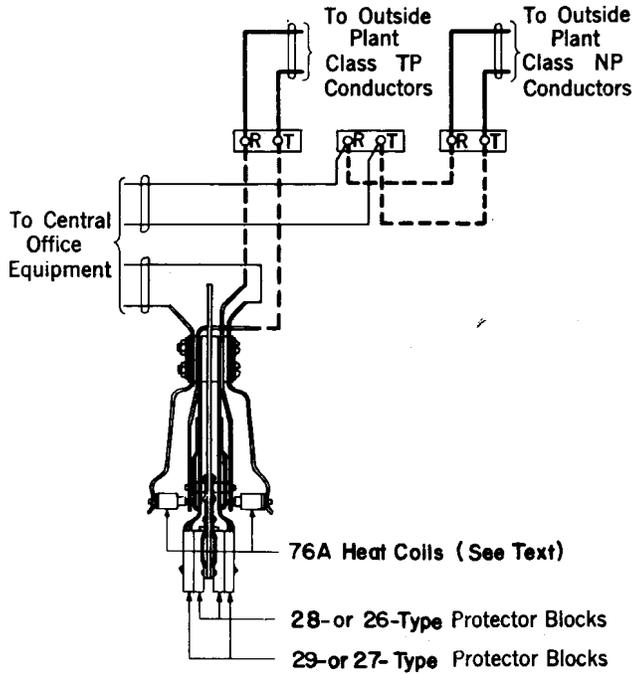


Fig. 26—Class NP to Class TP Conductors—Looped—Class TP Conductors Connected to Auxiliary Line Circuit Terminated on a Protector

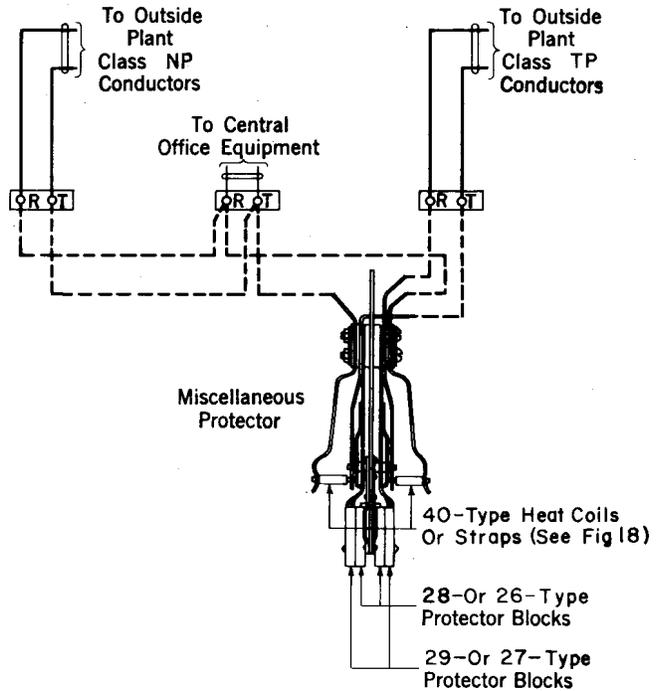


Fig. 28—Class NP to Class TP Conductors—Looped—Bridged to Central Office Equipment Terminated on Terminal Strip

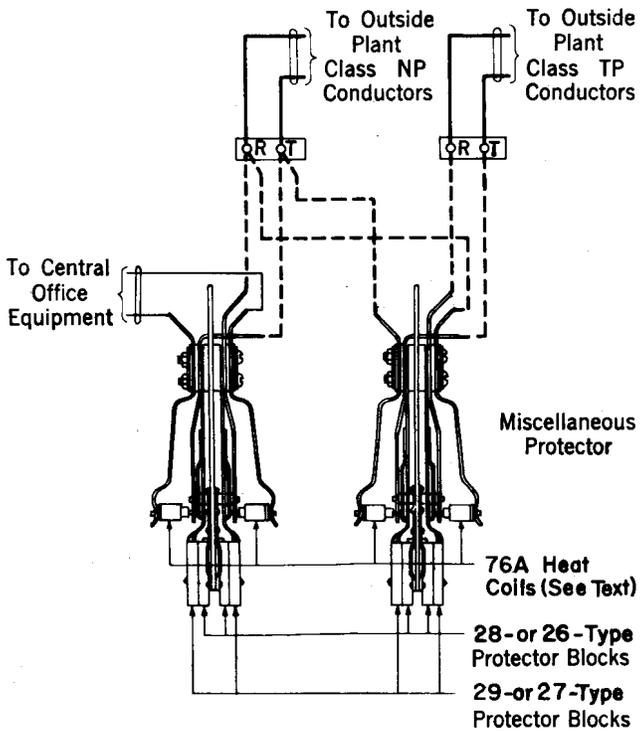


Fig. 27—Class NP to Class TP Conductors—Looped—Bridged to Central Office Equipment Terminated on Protectors

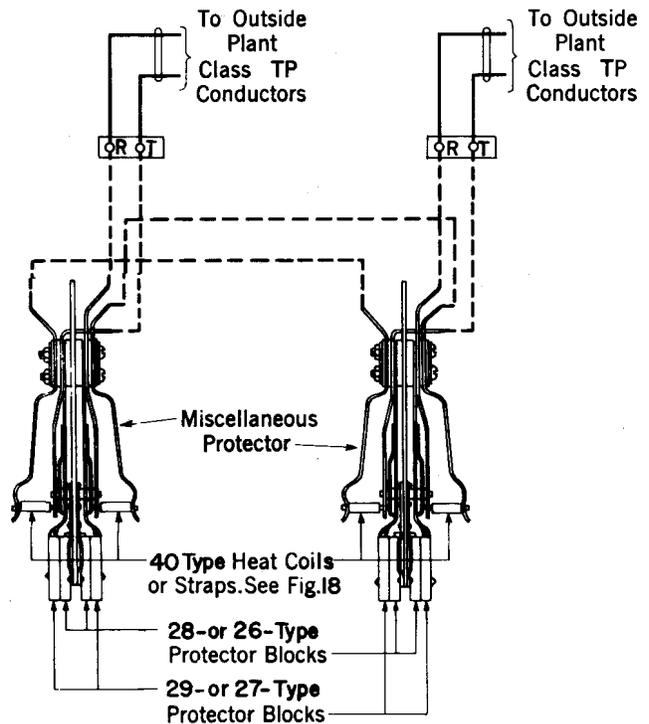


Fig. 29—Class TP to Class TP Conductors—Looped

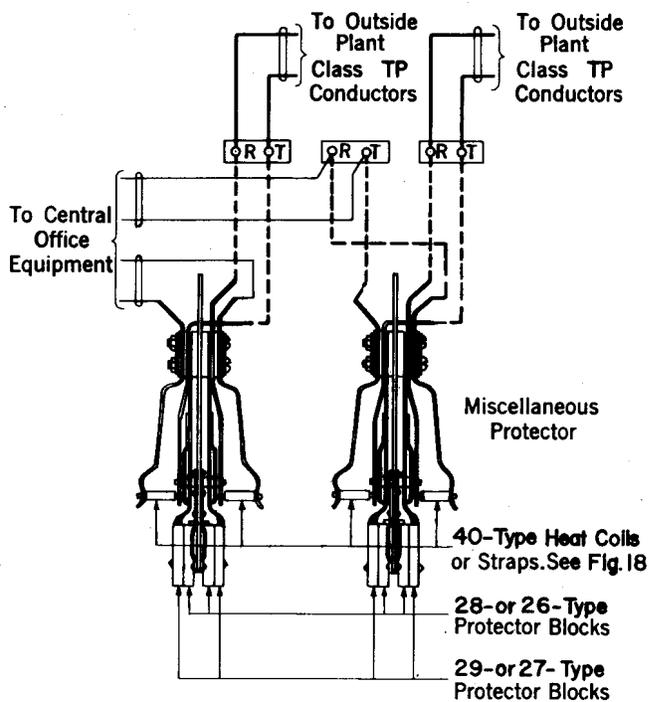


Fig. 30—Class TP to Class TP Conductors—Looped Through Central Office Circuit

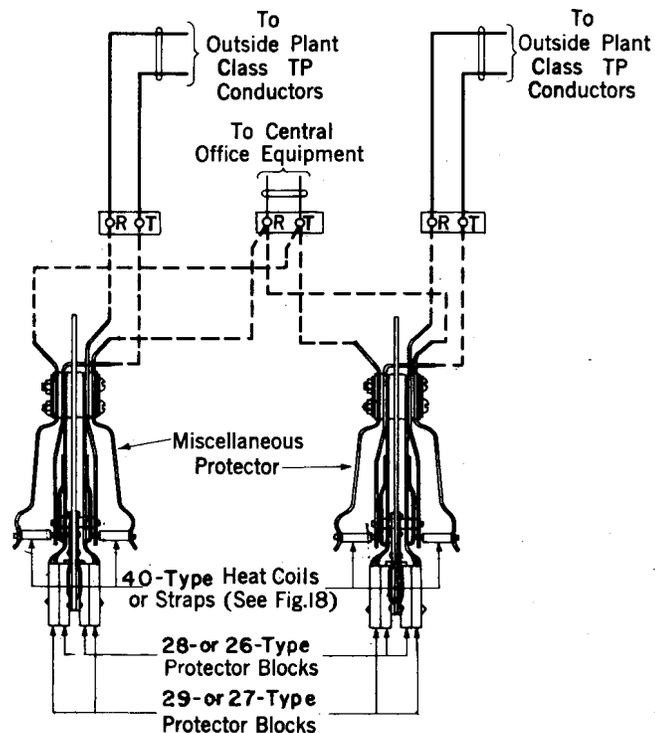


Fig. 32—Class TP to Class TP Conductors—Looped—Bridged to Central Office Equipment Terminated on Terminal Strip

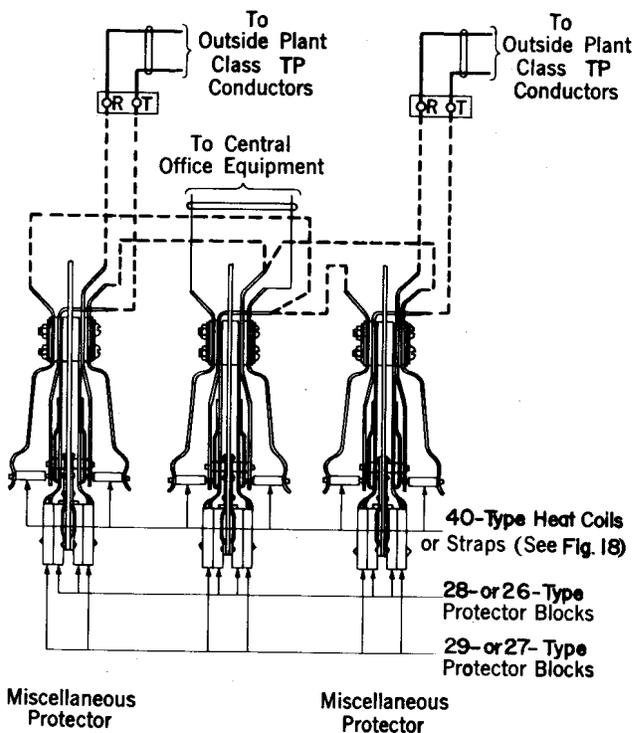
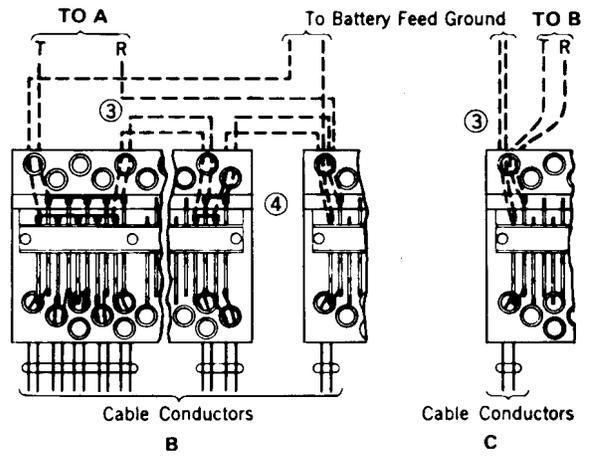
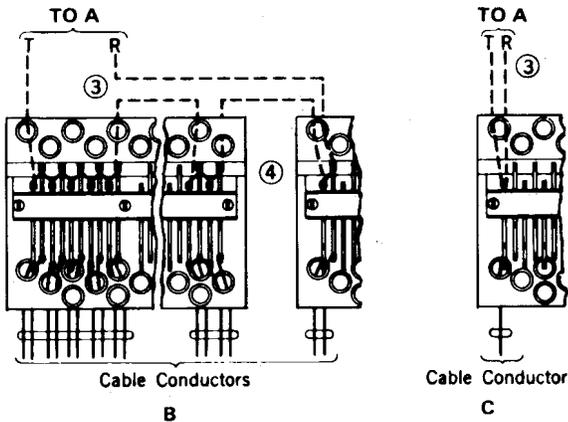
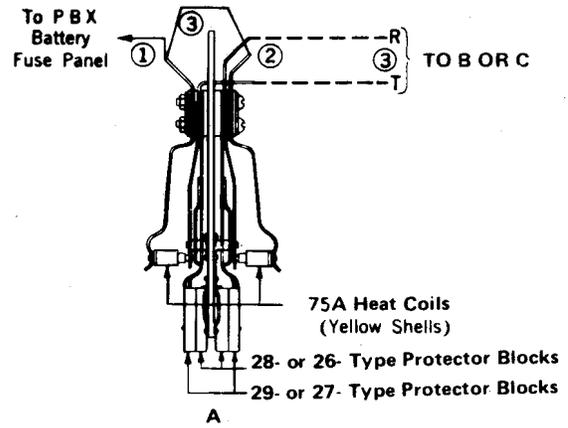
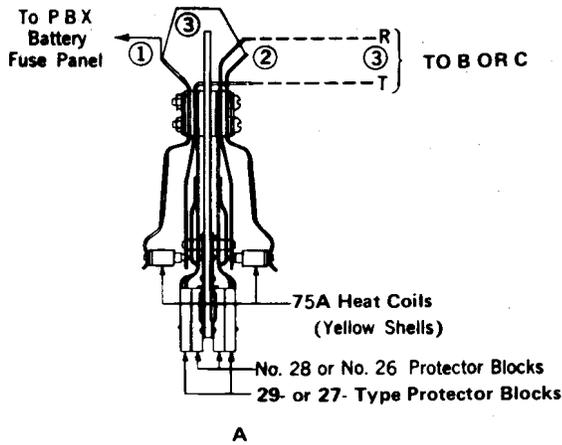


Fig. 31—Class TP to Class TP Conductors—Looped—Bridged to Central Office Equipment Terminated on Protector



NOTES

- ① Each fuse must be wired to both sides of a protector as shown.
- ② Do not strap line side of protector lugs together.
- ③ Use 20-gauge single cross-connection wire.
- ④ Use 22-gauge bare tinned copper wire per P-314952.

NOTES

- ① Each fuse must be wired to both sides of a protector as shown.
- ② Do not strap line side of protector lugs together.
- ③ Use 20-gauge single cross-connection wire.
- ④ Use 22-gauge bare tinned copper wire per P-314952.

Fig. 33—Battery Feed Conductors—Ground Return—Protection

Fig. 34—Battery Feed Conductors—Metallic Return—Protection

TABLE A

RINGING SUPPLY FOR PBXs

TYPE OF PBX OR STATION EQUIPMENT	TYPE OF RINGING	NO. OF POSITIONS OR PBXs PER LAMP	NO. OF AND TYPE OF LAMP	NO. OF CABLE PAIRS CONNECTED TO ONE LAMP
Manual	Continuous	10 Positions (Same or different PBX or group of buzzers for station equipment) (See Note.)	One 8-D, 8-G, 12-D, 12-G, 13-D or 13-G	1 to 10 pairs
Manual Position on Dial PBX				
740 PBX if equipped with long dial lines or trunks				
740 Dial	Machine	1 PBX	One 8-G, 12-G or 13-G	One or more pairs to provide the required conductivity
750 or 755 Dial	Continuous	1 PBX	One 8-D, 8-G, 12-D, 12-G, 13-D or 13-G	

Note: Station equipment supplied from one ringing lamp located at the station equipment should be considered as the equivalent of one PBX position.