CONVENTIONAL DISTRIBUTING FRAMES

TYPES OF PROTECTION

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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 correct minor errors, to incorporate information on the 305-type connector, and the 4A11C protector unit (mini-bridge lifter).

1.03 Protection for both A-type and B-type distributing frames are covered in this section.

(a) On A-type main distributing frames, the outside 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.

(b) On B-type main distributing frames, the outside cable conductors are terminated on protector mountings, 444-type jacks (301-type connector), or 300-, 303-, or ▶305◀ -type connectors on the vertical side of the frame. On separate protector frames, outside cable pairs are terminated on jacks or 302-type connectors mounted on verticals on both sides of the frame. Cables are run to terminal strips on the vertical side of a main distributing frame. Cables from the central office equipment are terminated on terminal strips mounted on the horizontal side of the main distributing frame.

Note: The term ***connector*** is applied to distinguish the newer cable terminating devices (300-, 301-, 302-, 303-, and ▶305◀ -types of connectors) from the term ***protector*** which has been applied to terminating mounting assemblies such as C50, E50, etc.

1.04 Previously manufactured 302- and 303-type connectors with solder-plated line terminals have been recoded to equip all 302- and 303-type connectors with gold-plated line terminals. When present suppliers of these connectors with solder plated terminals are exhausted, only connectors with gold-plated line terminals will be supplied.

1.05 Previous 302-type connector codes 302A2,B2,C2, etc, have been recoded 302A3,B3,C3, etc. Previous 303-type connector codes 303A2,B2,C2, etc, have been recoded 303A3,B3,C3, etc.

1.06 3A-, 4A-, and 5A-type protector units with solder-plated line pins have been manufacture discontinued. Only the protector units with gold-plated line pins will be provided when existing supplies are exhausted. The 429F plug and 5A9D protector unit (reversed tip and ring) will be provided with gold-plated line pins without recoding.

Note: Protector units with solder-plated line pins should not be used with 302-, 303-, or 305-type connectors with gold-plated terminals. Protector units with gold-plated line pins should be used in the 302-, and 303-type connectors with solder-plated line terminals when protector units with solder-plated line pins are no longer available.

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 subject to disturbance or damage from lightning, the possibility of contact with electrical circuits over 300-volts rms between conductors, or a

greater than 300-volt rms rise in ground potential or low frequency induction is classified as ***exposed.***

(b) ***Unexposed Plant:*** Telephone plant that is not subject to possible contact with electrical circuits over 300-volts rms or to the effects of lightning, rise in ground potential or low frequency induction is classified as ***unexposed.***

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.

2.04 ***Buried Plant:*** Buried plant in built-up areas is not generally considered as exposed to power but may be exposed to lightning. This situation does not change when plant is buried jointly with power company primary circuits, provided standard separation is maintained. Buried plant in urban areas is exposed if buried with random separation in a common trench with primary power circuits. If buried plant is connected to aerial plant that is exposed, then buried plant is exposed.

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 or 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

(a) ***Voltage Protection:*** Voltage protection is provided by two protector blocks for each pair. The airgap between the carbons in the protector block have an accurately spaced separation of 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.

(b) ***Current Protection:*** Current protection is provided by the use of heat coils to protect telephone equipment against damage from abnormal voltage not high enough to arc across the protector block, and abnormal current not high enough to interrupt fault current in protective cable, but still high enough to damage equipment if allowed to flow over a period of time. Such currents are referred to as ***sneak currents.*** 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 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, melting 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 currents to ground and prevents damage to central office equipment.

(c) Heat coils are used on ***all*** exposed circuits except toll circuits, 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 Carrier Systems (such as SLC-40, SLC-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 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.

5. TYPES OF PROTECTIVE APPARATUS

5.01 On a particular main distributing frame, any of the following type of protective apparatus or jacks may be found alone or in various combinations.

5.02 The following illustrations show connections as they appear on a B-type main distributing frame. Fig. 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

5.03 Figures 1 through 4 illustrate C, E, and similar type protector mountings. Table A and Fig. 5 show the present standard types of protector blocks, heat coils, and corresponding older types for C- and E-type protectors.

5.04 C-type protectors accept both heat coils and protector blocks intended for use in terminating exposed outside plant cables. The C50 accommodates 50 pairs. The C52 accommodates 52 pairs. A C-type protector is shown in Fig. 3.

5.05 E50 and E52 protector mountings accept protector blocks only (Fig. 4) and are used where current protection is not required.

444-TYPE JACKS (301-TYPE CONNECTOR)

5.06 The 444-type jacks (301-type connector) are used to terminate unexposed cable pairs. The 444-type jacks (Fig. 6) provide no protection, but are used as a terminating device. These jacks also provide access to cable pairs and central office equipment for testing and maintenance.

> ***Note:*** C- and E-type protectors are rated manufacture discontinued, whereas the 444-type jacks, and 301-type connectors are rated A and M only.

300-TYPE CONNECTOR

5.07 The 300-type connector supersedes a similar 121-type connector. All references to the 300-type connector (Fig. 7 and 8) also apply to the 121-type connector.

5.08 In the protected position, the assembled protector unit (Fig. 7) is inserted, depressed, and turned to the clockwise position so that the stripe on the cap is horizontal (Fig. 8).

5.09 In the open circuit position, the protector unit is depressed and turned 90-degrees counterclockwise from the operating position so the stripe on the cap is vertical. In this position, the cap projects further from the faceplate than when in the operated position. When in the open circuit position, the central office equipment is disconnected from the outside plant conductor. The protective carbons are still effective to protect the outside plant. When the protector unit is removed, the central office equipment is disconnected from the outside plant.

> ***Note:*** When 121-type protectors are removed, cable conductors may be automatically grounded. Before removing these protectors from circuits serving telegraph loops or other types of special circuits which have potential on the cable side, the associated equipment should be taken out of service. It may be necessary to remove connections to the cable pair to prevent equipment damage. For this reason, the modified B test clip with the M2EM cord is not recommended for use with the 121-type protector units.

5.10 The ground feeder of the protector (Fig. 7) rests against the inside surface of the grounded aluminum faceplate in either the working or open position. Ground is fed through the ground feeder to the carbon insert of the 33B protector block.

5.11 When the heat coil operates, the tip of the coil passes through the hole in the 32B protector block and makes contact with the grounded insert of the 33B protector block (Fig. 7).

302-, 303-, AND 305-TYPE CONNECTORS

5.12 Protector units designed for the 302-, 303-, and ▶305◀ -type connectors (Fig. 9) have four contact pins and one ground pin. (See exceptions in Table B.) The associated connector panels are shown in Fig. 10, 11, and ▶12.◀

5.13 Protector units containing polarity reversing circuit boards for reversing polarity on crosses in central office equipment or cable are available as follows.

(a) 429F plugs (white) with 32B and 33B protector blocks and 80A heat coils (MD) are used for reversing tip and ring (Fig. 13).

(b) 429G (rated MD) protector units (blue) with 32B and 33B protector blocks and 80A heat coils are used for reverses in office equipment.

(c) ▶5A9D protector units (white) have an "X" on top of the cap, have no protector blocks or heat coils, and do not provide protection. They are used in the 302-, 303-, and 305-type connectors to reverse tip and ring where electrical protection is not required.

5.14 The 429F, 429G, (MD) and 5A9D protector units have an "X" marked on the face of the handle to indicate that they are equipped with the polarity reversing circuit board and provide both voltage and current protection. These protector units may be used in the 302-, 303-, or 305-type connectors. A listing of protector units and their function with designation pin identification is provided in Table B.

5.15 The 4A11C protector unit (mini-bridge lifter) is a 4A-type protector unit that contains miniaturized bridge lifting resistors as well as the standard carbon blocks and heat coils (Fig. 14). It is used in central offices equipped with 302-, 303-, or 305-type connectors. This mini-bridge lifter may be used to bridge a maximum of four outside plant subscriber stations to the same central office subscriber line.◀

5.16 Small colored designation pins may be inserted at the protector unit location to identify special circuits. When used, they require insertion of protector units of the same color. When no designation pins are used, black or gray protector units should be used.

▶***Note:*** The local office should specify whether to use the designation pin on the 305-type connector, since they are difficult to see due to the orientation of the 305-type connector mounted on the main distribution frame.◀

5.17 When protector units are inserted into a jack group, each protector unit provides the following connections:

(a) Long pins connect to outside plant tip and ring

(b) Short pins connect to central office equipment tip and ring

(c) Center pin connects to ground and also serves as orientation for the protector unit.

5.18 The ▶3B protector unit and the 3A protector unit (MD)◀ provide only ***voltage protection*** (see Fig. 9) by the carbon blocks enclosed by the plastic housing. These protector units are used where sneak current protection is not required.

5.19 The 4A protector unit provides both ***voltage*** and ***sneak current protection*** (see Fig. 10) by the two pairs of carbon blocks and two heat coils enclosed by the plastic housing.

5.20 The 5A (dummy) protector unit provides ***no protection,*** but is used to complete tip and ring connections between central office equipment and outside plant ▶except the 5A2D which provides no continuity.◀

5.21 When protector units are fully inserted into the connector, outside plant and central office equipment is connected and protection is provided (except for the dummy protector units). The ground connection for heat coils and carbon blocks is provided through the center ground pin of the protector unit. The ground pin is connected to a vertical bus bar which is strapped to two horizontal bus bars. These bus bars are grounded to the protector frame by the screws securing the connector to the frame verticals.

5.22 When a protector unit is pulled out to the detent position (as a temporary function), central office equipment is disconnected to isolate outside plant cable pairs for testing purposes. In this position, protection is provided for the outside plant cable pairs. Removing the protector unit

from the connector will remove all protection. A green protector unit is installed to deprive service.

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. 15.

6.05 To connect spare conductors to the ground terminal punching (Fig. 15), 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. 16.

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 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 position 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 with 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. 17). 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. 18) shall be connected direct 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. 19.

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. 20). 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. 21), 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, used for circuits which require that the jack contacts be strapped out should be strapped as illustrated in Fig. 22. 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 illustrated in Fig. 23. 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. 24, 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. 25.

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. 17. 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. 18.

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. 26.

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. 27, 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 P conductors are to be connected to the auxiliary circuit protector, connections are made as shown in Fig. 28.

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. 29. 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. 30.

C. Class NP to Class NP

6.25 Class NP interoffice conductors looped through an office shall be cross-connected as shown in Fig. 31 unless facilities are desired for opening the line, in which case a protector shall be provided as shown in Fig. 32. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 20) 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. 33 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. 20) 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. 34.

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. 35 where the central office circuit terminates on protectors. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 20) 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. 36.

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. 37.

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. 38 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. 39. 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. 20) 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. 40. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 41. In either case, the protector associated with the

central office equipment should ordinarily be equipped with dummy metal heat coils or soldered straps (Fig. 20) 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. 42 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. 20). The equipment terminals of the protector mountings shall be cross-connected together.

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. 43. The protectors should ordinarily be equipped with dummy metal coils or soldered straps (Fig. 20) 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. 44. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 45.

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. 46 for ground return battery feeders, and as shown in Fig. 47 for metallic return battery feeders (paragraph 7.01).

7.03 The arrangements shown in Fig. 46 and 47 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 of these connected to the tip of the protector and the other connected to the ring of the protector (Fig. 46A). The central office equipment springs of protectors used for battery supply shall be connected together as shown in Fig. 46A. Where two or more cable conductors are used, all 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, thus forming a loop from the two terminals of the protector (Fig. 46B). 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. 46C).

> ***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. 47A). The springs of protectors used for battery shall be connected together. 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. 47B). 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. 46C).

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

8.02 Table C 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.

10. CONDUCTORS ON B-TYPE FRAMES

C-, E-, AND SIMILAR-TYPE PROTECTOR MOUNTINGS

A. Spare Conductors

10.01 A conductor is considered spare if it is connected to the protector but not to other office equipment.

10.02 Spare conductors shall be protected with protector units as per Table D.

B. Working Conductors

10.03 Working conductors shall be protected with protector units as per Table D.

C. Conductors Requiring Mutual Drainage Reactors (Drainage Coils) or Relay Protective Equipment

10.04 Where circuits on main frames require drainage coil or relay protector equipment to minimize interference, protector blocks shall be provided as follows.

(a) ***Protector Mountings at Main Frame:*** The protector mountings associated with circuits to which the drainage coil assembly or relay protector is connected shall be equipped with 28- and 29B-type protector blocks where the protector mountings are on 3/8-inch centers and 26- and 30-type protector blocks where the protector mountings are on 1/2-inch centers.

Note: Where the mutual drainage reactors are used, 15-type dummy blocks are used for 3/8-inch protectors or 9-type dummy blocks are used for 1/2-inch protectors. Information on mutual drainage reactors is covered in Engineering Section 876-101-100.

(b) ***Protector Mountings at Drainage Coil Assembly or Relay Protector Mounting:*** The protector mountings associated with the drainage coil assembly or relay protector shall be equipped with 26- and 27-type protector blocks.

444-TYPE JACKS (301-TYPE CONNECTOR)

A. Working Conductors Except Special Lines

10.05 The 444-type jacks provide for connecting class NP cable conductors to central office circuits through normally closed precious metal contacts. This is essentially the same as standard protectors equipped with dummy metal heat coils and dummy protector blocks. No electrical protective devices are used.

B. Special Lines

10.06 Special lines shall be equipped with markers, guards, and terminal punching insulators as specified by local instructions. A description of apparatus provided for guarding against service interruptions is covered in Section 201-220-102.

300-TYPE CONNECTORS

Note: Piece-part numbers for the colored caps and designation plates specified in the

following paragraphs for use on the 300-type connector are given in Section 201-207-801.

A. Spare Conductors

10.07 A conductor is considered spare if it is connected to the connector but not to other office equipment.

10.08 Spare conductors shall be protected. For convenience and ease of designation, the protector may be left in the open position. The white line on the cap will be vertical and the cap will protrude farther from the faceplate. The black capped assemblies serve as a designation of class P conductors. In the open position, the protective carbons (32B protector blocks) are effective. The protector units are equipped as listed in Table E.

Note: To further identify these lines, tags or other indicating devices may be used.

B. Working Conductors

10.09 Working conductors shall be provided with protector units equipped as listed in Table E.

10.10 The following four types of class P circuits requiring protection shall have protector blocks equipped as listed in Table E.

(a) Customer lines.

(b) Battery feeders.

(c) Special lines (telegraph loops, radio broadcast lines, police and fire alarms, etc).

(d) Denied lines—The protector units shall be in the open position. The white line on the cap will be vertical and the cap will protrude farther from the faceplate.

Note: To further identify these lines, tags or other identifying devices may be used.

C. Conductors Requiring Drainage Coil or Relay Protective Equipment

10.11 Where circuits on main frames require drainage coil or relay protector equipment to minimize interference, protector blocks shall be provided as follows.

(a) ***Protector Mountings at Main Frame:*** The protector mountings associated with circuits to which the drainage coil assembly or relay protector is connected shall be equipped with 32B and 33A protector blocks.

Note: Where the mutual drainage reactors are used, the 34A1 dummy protector is used with the 33B block in place of the 32B and 33A combination.

(b) ***Protector Mountings at Drainage Coil Assembly or Relay Protector Mounting:*** The protector mountings associated with the drainage coil assembly or relay protector shall be equipped with 32B and 33B protector blocks.

302-, 303-, AND 305-TYPE CONNECTORS

Note: Code designations for the colored protector unit covers, designation pins, etc, as specified in the following paragraphs for use on 302-, 303-, and ▶305◀ -type connectors are given in Section 201-208-802.

A. Spare Conductors

10.12 A conductor is considered spare if it is connected to the connector but not to other office equipment.

10.13 Spare conductors shall be provided with protector units as listed in Table F.

B. Working Conductors

10.14 Working conductors shall be provided with protector units as listed in Table F.

TABLE A

PROTECTOR BLOCKS AND HEAT COILS FOR C AND E PROTECTORS

TYPE OF BLOCK OR COIL			STANDARD	OLDER TYPES (MD)
Protector Blocks	Ground Side Line Side	3/8-inch mounting	28 ‡29	*11 *12
	Ground Side Line Side	1/2-inch mounting	26 ‡27	†1 †2
Dummy Protector Blocks	3/8-inch Mounting 1/2-inch Mounting		15 9	— —
Heat Coils	Battery Feeders All Other Lines Requiring Heat Coils		75A 76A	— 41, 67, 73A
Dummy Heat Coils	Metal Insulating		40 § 72A	66, 68 § 70A

* Use 9-type protector micas with 11- and 12-type protector blocks.

† Use 3-type protector micas with 1- and 2-type protector blocks.

‡ Use 29B- and 30-type protector blocks instead of 29- and 27-type, respectively, where the MDF protector mountings are connected to drainage coil assemblies.

§ The 70A and 72A dummy heat coils are insulating dummy coils used in the protectors of lines which are to be kept open as an indication that regular heat coils are not to be put in.

TABLE B

PROTECTOR UNITS USED ON 302-, 303-, AND 305-TYPE CONNECTORS

SEE NOTE	CODE	CAP AND DESIGNATION PIN COLOR	PROTECTOR BLOCKS (1 PAIR EACH)	HEAT COILS (2 EACH)	FUSIBLE ALLOY DISCS	CONTACT PIN PLATING	CIRCUIT IDENTIFICATION	LIST NO. OF KS-14174 DESIGNATION
5	3B1A	Black	32A & 33B	None	Yes	Gold	Standard Circuit	*
2	3B2A	Green	32A & 33B	None	Yes	Gold	Open Circuit	4
	3B3A	Red	32A & 33B	None	Yes	Gold	Special Circuit	7
	3B4A	Yellow	32A & 33B	None	Yes	Gold	PBX Battery	5
1,5	3B5A	Black	32A & 33B	None	Yes	Solder	Standard Circuit	*
1,2	3B6A	Green	32A & 33B	None	Yes	Solder	Open Circuit	4
1	3B7A	Red	32A & 33B	None	Yes	Solder	Special Circuit	7
1	3B8A	Yellow	32A & 33B	None	Yes	Solder	PBX Battery	5
5	4A1C	Black	32B & 33B	80A	No	Gold	Standard Circuit	*
2	4A2C	Green	32B & 33B	81A	No	Gold	Open Circuit	4
	4A3C	Red	32B & 33B	80A	No	Gold	Special Circuit	7
	4A4C	Yellow	32B & 33B	79A	No	Gold	PBX Battery	5
1,5	4A5C	Black	32B & 33B	80A	No	Solder	Standard Circuit	*
1,2	4A6C	Green	32B & 33B	81A	No	Solder	Open Circuit	4
1	4A7C	Red	32B & 33B	80A	No	Solder	Special Circuit	7
1	4A8C	Yellow	32B & 33B	79A	No	Solder	PBX Battery	5
4	4A11C	Orange	32B & 33B	80A	No	Gold	Bridge Lifter	2
3,6	429F	White	32B & 33B	80A	No	Gold	Reversed Tip and Ring	
5	5A1D	Gray	None	None	No	Gold	Standard Circuit	*
2	5A2D	Green	None	None	No	Gold	Open Circuit	4
	5A3D	Red	None	None	No	Gold	Special Circuit	7
	5A4D	Yellow	None	None	No	Gold	PBX Battery	5
1,5	5A5D	Gray	None	None	No	Solder	Standard Circuit	*
1,2	5A6D	Green	None	None	No	Solder	Open Circuit	4
1	5A7D	Red	None	None	No	Solder	Special Circuit	7
1	5A8D	Yellow	None	None	No	Solder	PBX Battery	5
3	5A9D	White	None	None	No	Gold	Reversed Tip and Ring	

Notes:

1. Manufacture discontinued protector units — equipped with solder-plated contact pins for use in connectors of previous design with solder-plated contact terminals (302A2, 302B2, 303A2, and 303B2 which are manufacture discontinued). After existing stocks are exhausted, only protector units with gold-plated contact pins will be available for use in either the new or existing connectors.
2. No continuity between outside plant and central office.
3. Line reversing feature. (Previous designs were equipped with solder-plated contact pins).
4. Mini-bridge lifter (contains 410A Switch).
5. If no designation pin is used, standard circuit is indicated.
6. Designation is plug instead of protector unit.

TABLE C

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.

TABLE D

C-, E-, AND SIMILAR TYPE PROTECTOR MOUNTINGS

ITEM	CLASS P	CLASS NP	CLASS TP
Spare Conductors	Protector Blocks No Heat Coils	Dummy Protector Blocks No Heat Coils	Protector Blocks No Heat Coils
Working Conductors	*Customer Lines* Protector Blocks and Heat Coils	*Working Lines* Dummy Protector Blocks, Metal Dummy Heat Coils, or Soldered Straps *(Note 2)*	*Working Lines* Protector Blocks, Metal Dummy Heat Coils, or Soldered Straps *(Note 2)*
	Battery Feeders Protector Blocks and Yellow 75A Heat Coils		
	Special Lines (Note 3) Protector Blocks, Heat Coils, Guards KS-14539 or Equivalent, Terminal Punching Insulators, Indicators KS-6660 or Equivalent *(Note 4)*	*Speical Lines (Note 3)* Dummy Protector Blocks, Metal Dummy Heat Coils or Soldered Straps *(Note 2)*, Terminal Punching Insulators, Indicators KS-6660 or Equivalent, Guards KS-14539 or Equivalent *(Note 4)*	*Special Lines (Note 3)* Protector Blocks, Metal Dummy Heat Coils or Soldered Straps *(Note 2)*, Terminal Punching Insulators, Indicators KS-6660 or Equivalent, Guards KS-14539 or Equivalent *(Note 4)*
	Denied Lines Protector Blocks Insulating Dummy Heat Coils		

Notes:

1. Where TP or NP conductors do not appear on the main frame in well defined groups which readily distinguish them from class P conductors, heat coils and protector blocks should be used in order to minimize the probability of accidentally omitting such protection from class P conductor terminations.
2. Not required where heat coil springs are not provided.
3. Procedures for the protection of special lines against service interruptions are covered in Section 201-220-301.
4. A description of apparatus provided for guarding against service interruptions is covered in Section 201-220-103.

TABLE E

300-TYPE CONNECTORS

ITEM	CLASS P	CLASS NP	CLASS TP
Spare Conductor	Protector Blocks, 76A Heat Coils, and Black Caps	Dummy Protector Blocks, Metal Dummy Heat Coils, Gray Caps, and Gray Designation Plates	Protector Blocks, Metal Dummy Heat Coils, Gray Caps, and Gray Designation Plates
Working Conductors	*Customer Lines* Protector Blocks, 76A Heat Coils, and Black Caps	Dummy Protector Blocks, Metal Dummy Heat Coils, Gray Caps, and Gray Designation Plates	Protector Blocks, Metal Dummy Heat Coils, Black Caps, and Gray Designation Plates
	Battery Feeders Protector Blocks, Yellow 75A Heat Coils, Yellow Caps, and Yellow Designation Plates		
	Special Lines (Note 1) Protector Blocks, Heat Coils*, Red Caps, and Red Designation Plates *(Note 2)*	*Special Lines (Note 1)* Dummy Protector Blocks, Metal Dummy Heat Coils, Red Caps, and Red Designation Plates *(Note 2)*	*Special Lines (Note 1)* Protector Blocks, Metal Dummy Heat Coils, Red Caps, and Red Designation Plates *(Note 2)*
	Denied Lines Protector Blocks, No Heat Coils, Green Caps, and Green Designation Plates *(Note 3)*		

Notes:

1. Procedures for the protection of special lines against service interruptions are covered in Section 201-220-301.
2. A description of apparatus provided for guarding against service interruptions is covered in Section 201-220-103.
3. To avoid restoring service to a customer line with a protector unit containing a green cap, heat coils are not used in the protector unit.

* The heat coils will be specified locally.

TABLE F

PROTECTORS AND CLASS OF PROTECTION

ITEM	CLASS P	CLASS TP	CLASS NP
Spare Conductors	4A1C Protector Unit Black Caps No Designation Pins	3B1A Protector Unit Black Caps No Designation Pins	5A1D Protector Unit Gray Caps No Designation Pins
Working Conductors	*Customer Lines*		
	4A1C Protector Unit Black Caps No Designation Pins	3B1A Protector Unit Black Caps No Designation Pins	5A1D Protector Unit Gray Caps No Designation Pins
	Battery Feeders		
	4A4C Protector Unit Yellow Caps Yellow Designation Pins	3B4A Protector Unit Yellow Caps Yellow Designation Pins	5A4D Protector Unit Yellow Caps Yellow Designation Pins
	Special Service Circuit (Note 1)		
	4A3C Protector Unit Red Caps Red Designation Pins	3B3A Protector Unit Red Caps Red Designation Pins	5A3D Protector Unit Red Caps Red Designation Pins
	Denied Circuit		
	4A2C Protector Unit (Note 2) Green Caps Green Designation Pins	3B2A Protector Unit Green Caps Green Designation Pins	5A2D Protector Unit Green Caps Green Designation Pins

Protector units with solder plated pins should only be used with 302A2-, or 302B2-type connectors equipped with solder plated terminals.

Notes:

1. A description of apparatus provided for guarding against service interruptions is covered in Section 201-221-103.
2. No continuity between outside plant and central office.

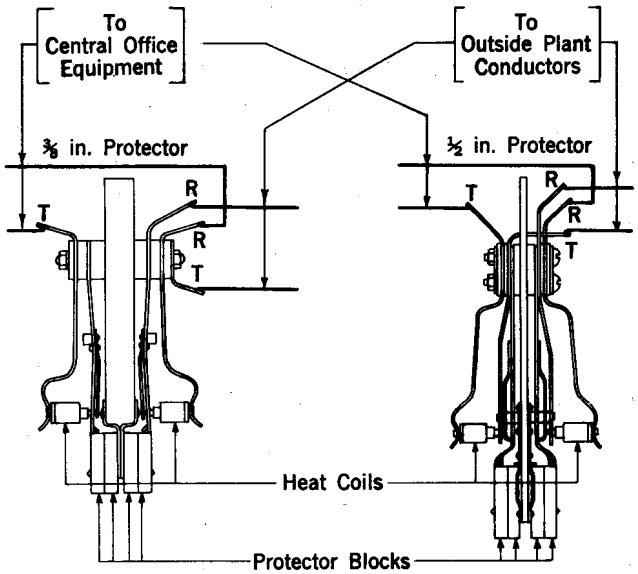


Fig. 1—Connections to Protector as Made on A-Type Main Distributing Frame

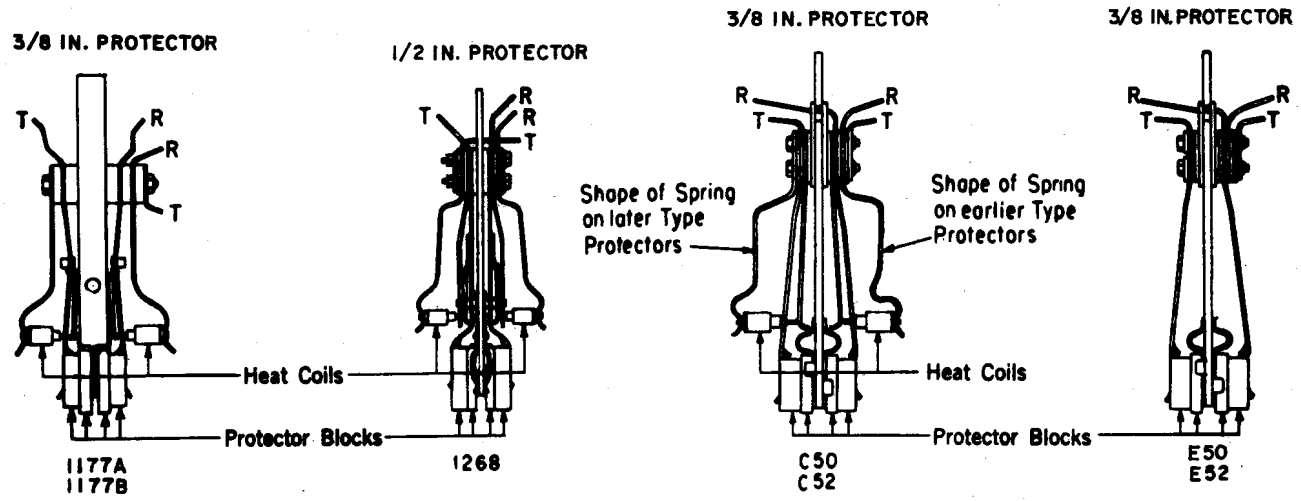


Fig. 2—C-, E-, and Similar-Type Protector Mountings

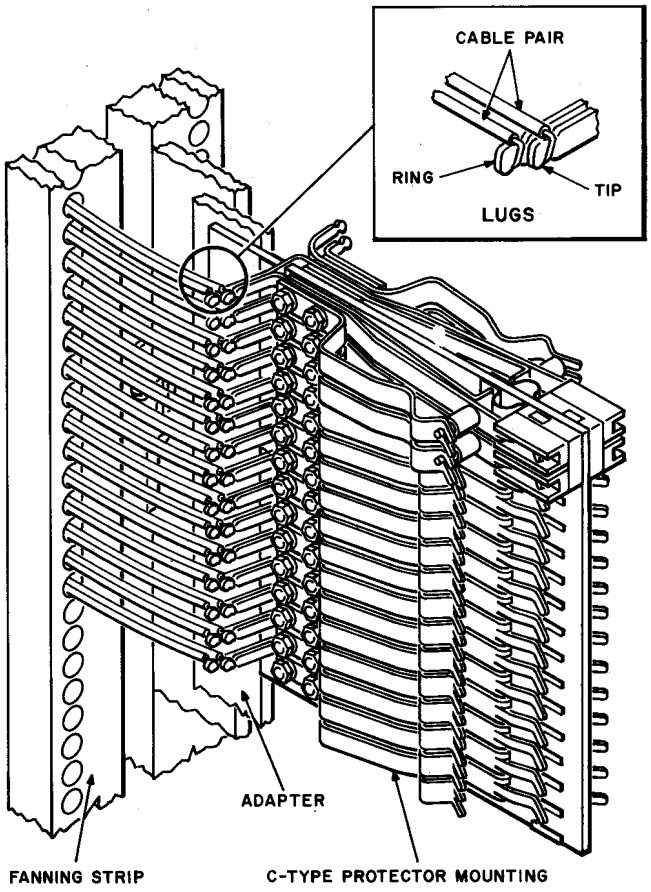


Fig. 3—C-Type Protector Mounting

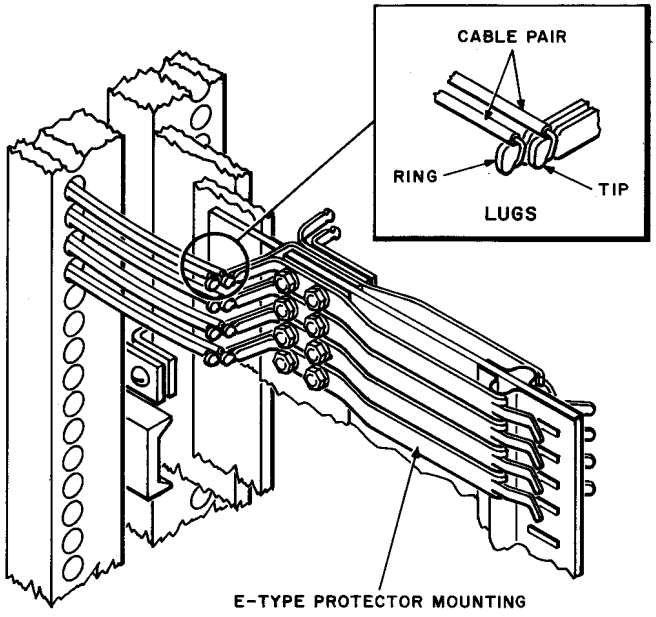


Fig. 4—E-Type Protector Mounting

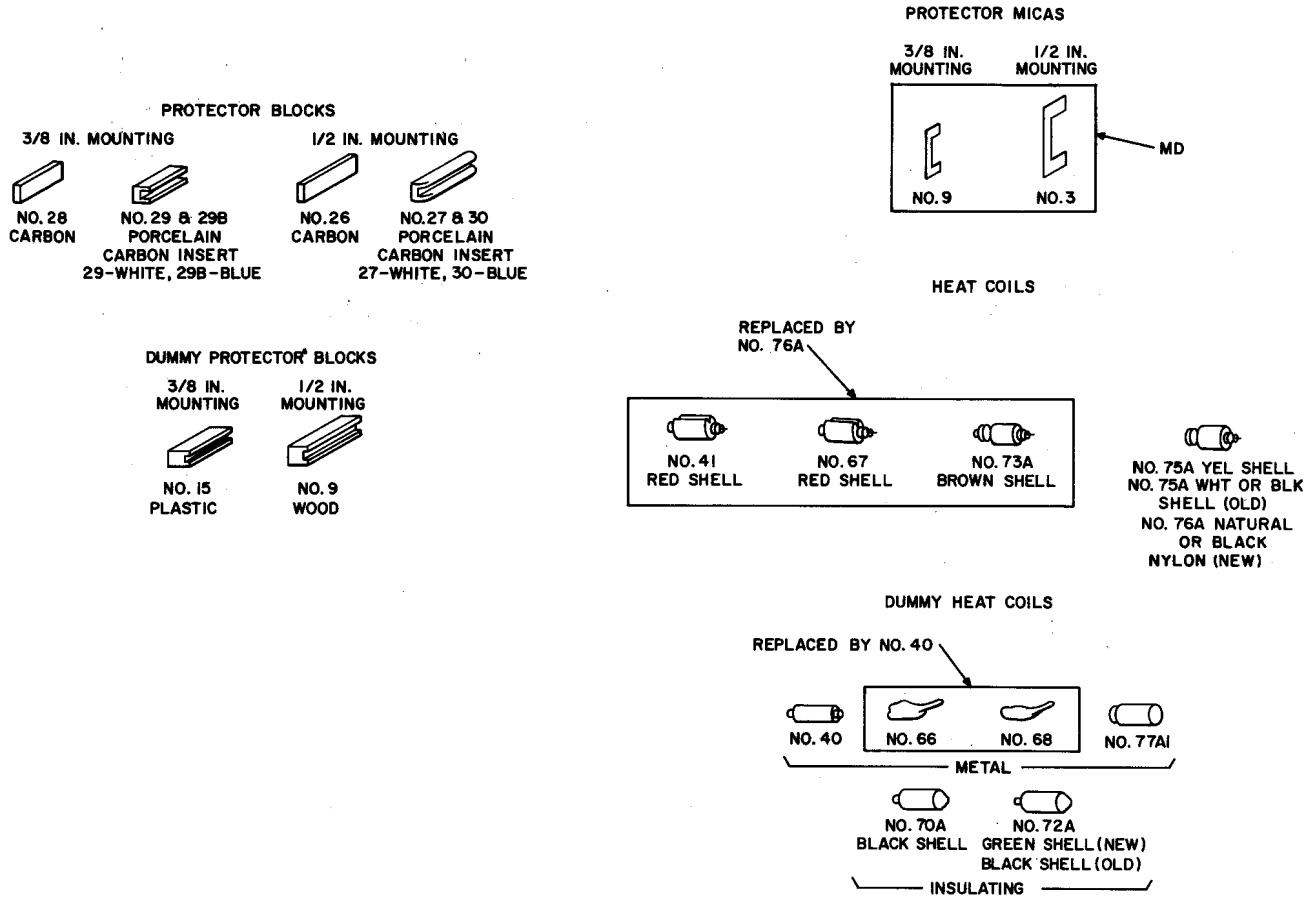


Fig. 5—Types of Protector Blocks and Heat Coils

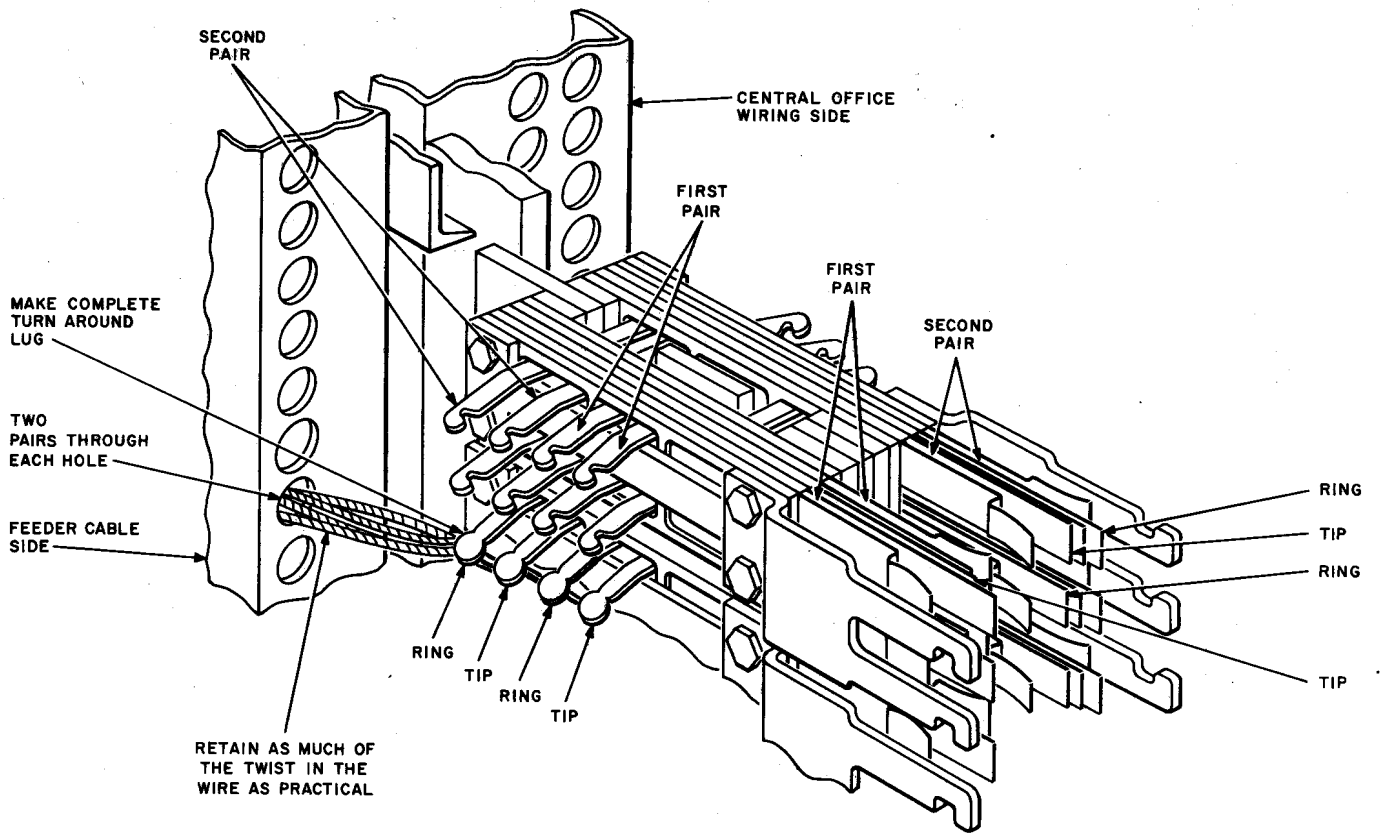


Fig. 6—444-Type Jack Mounting and Terminating

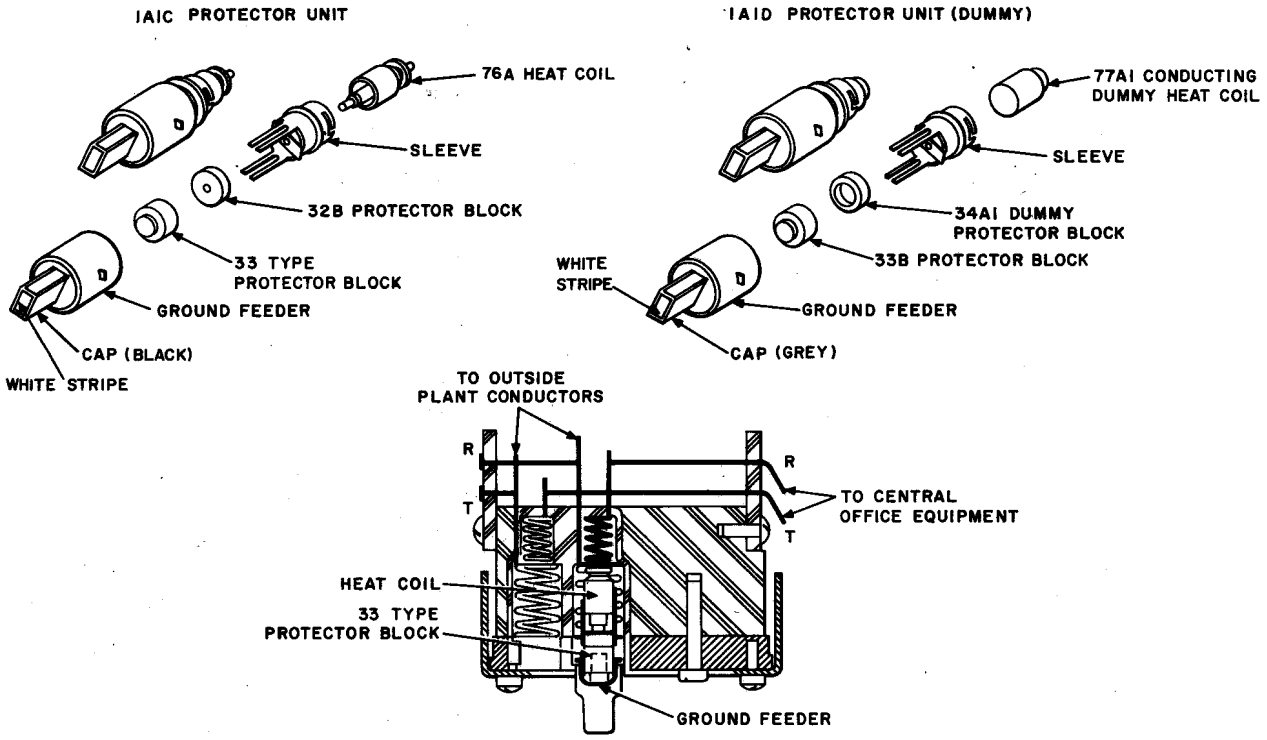


Fig. 7—300-Type Connector Assembly

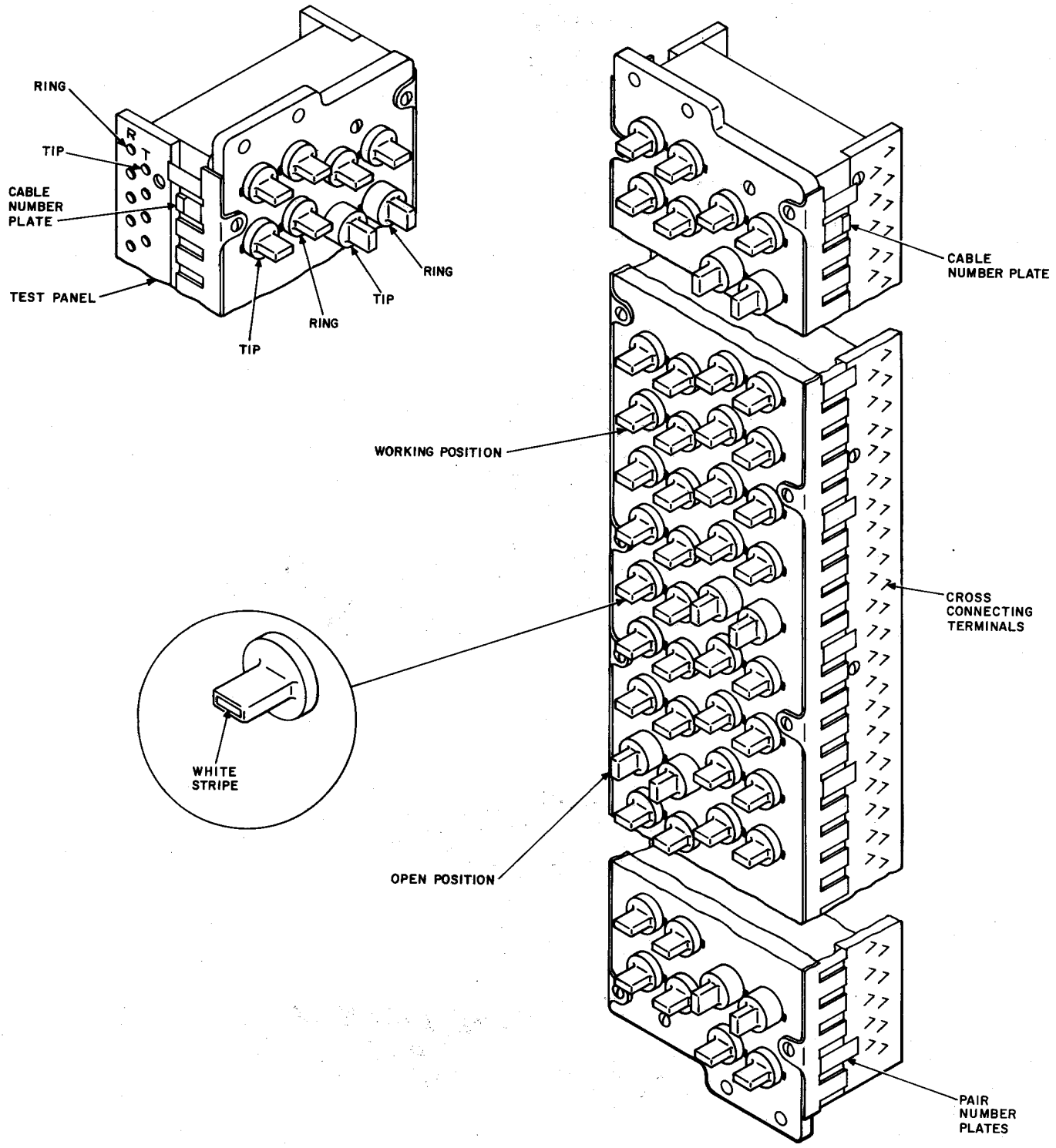


Fig. 8—300-Type Connector Mounting

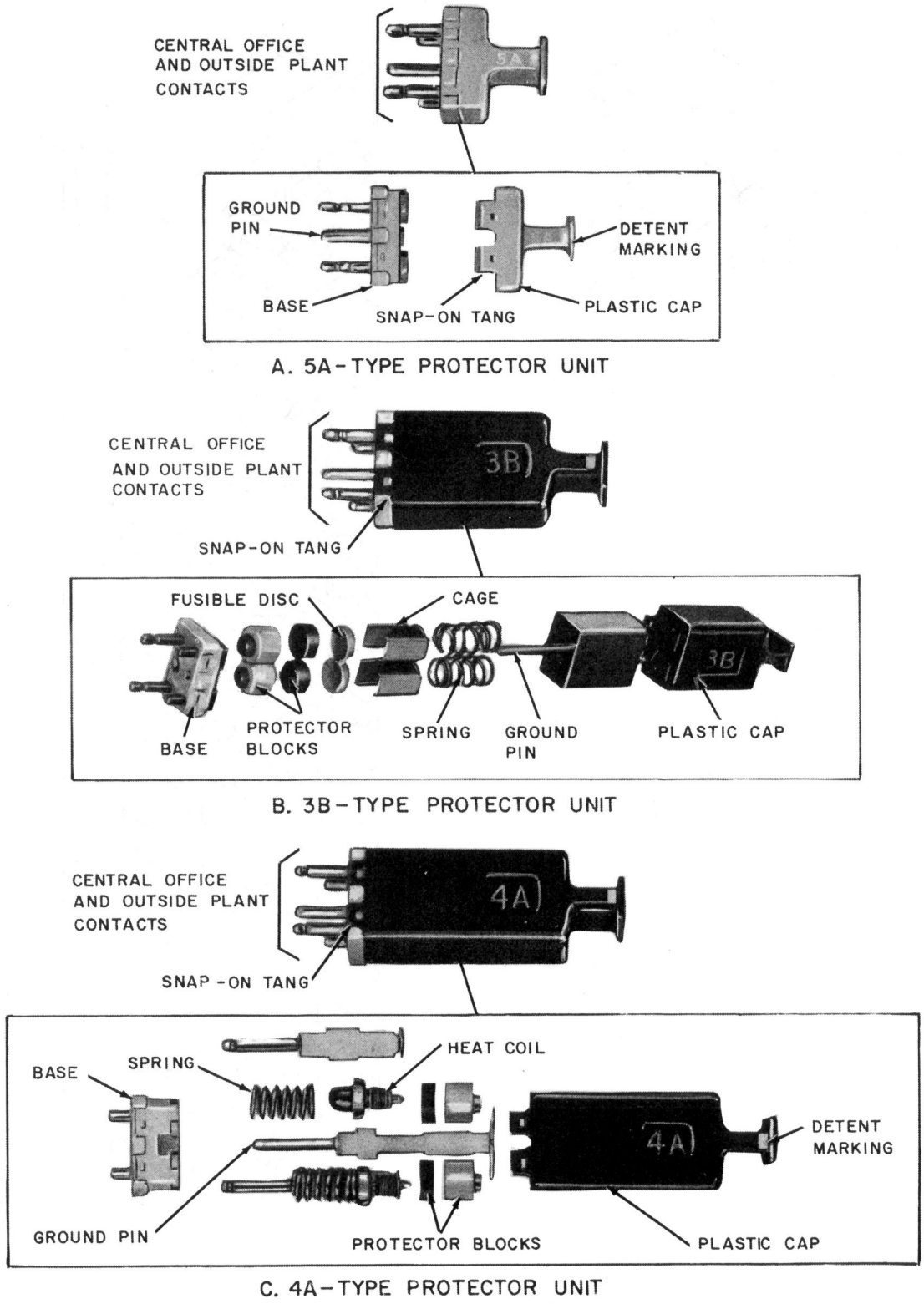


Fig. 9—Protector Units for 302-, 303-, and 305-Type Connectors

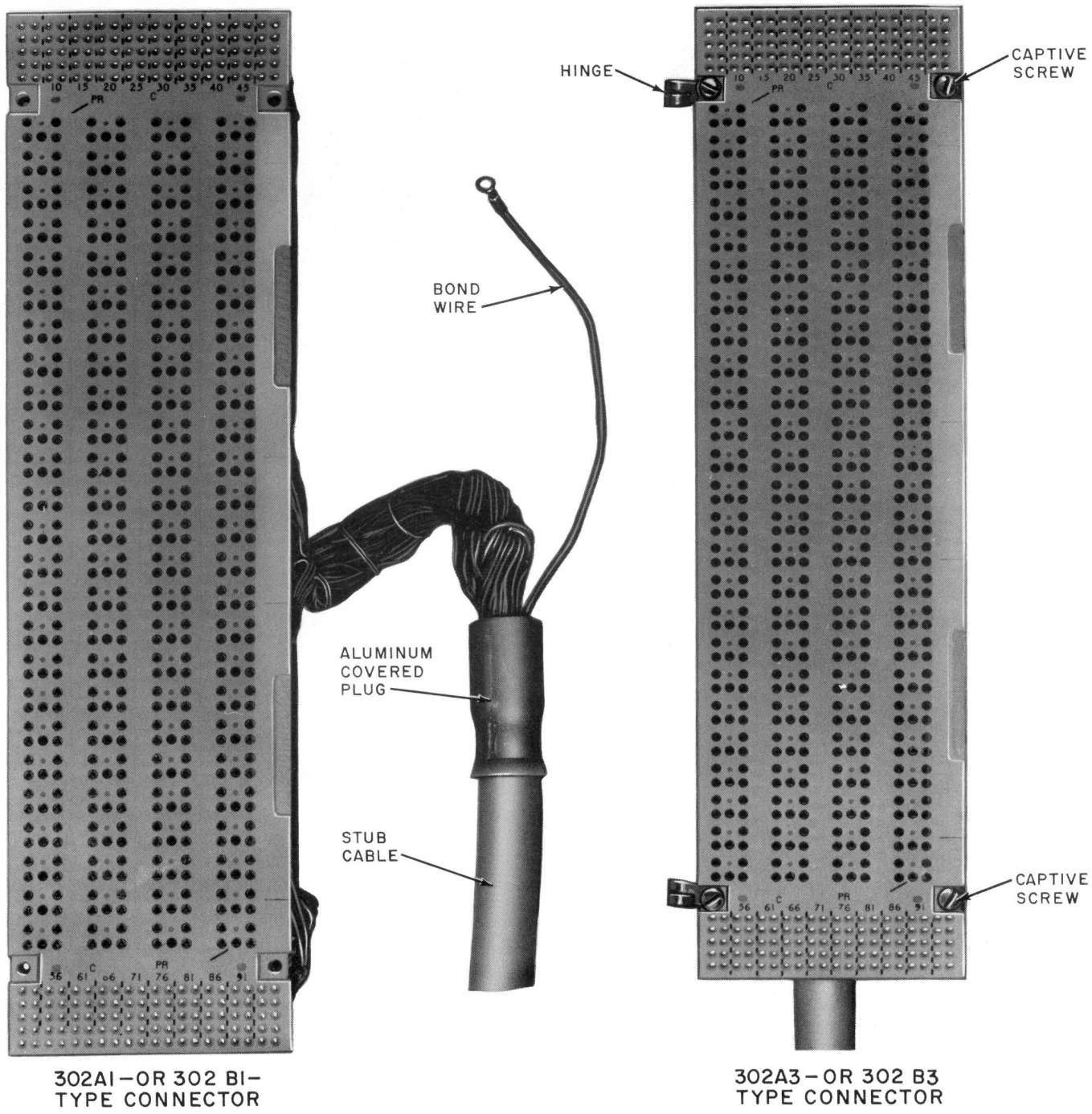


Fig. 10—302-Type Connectors

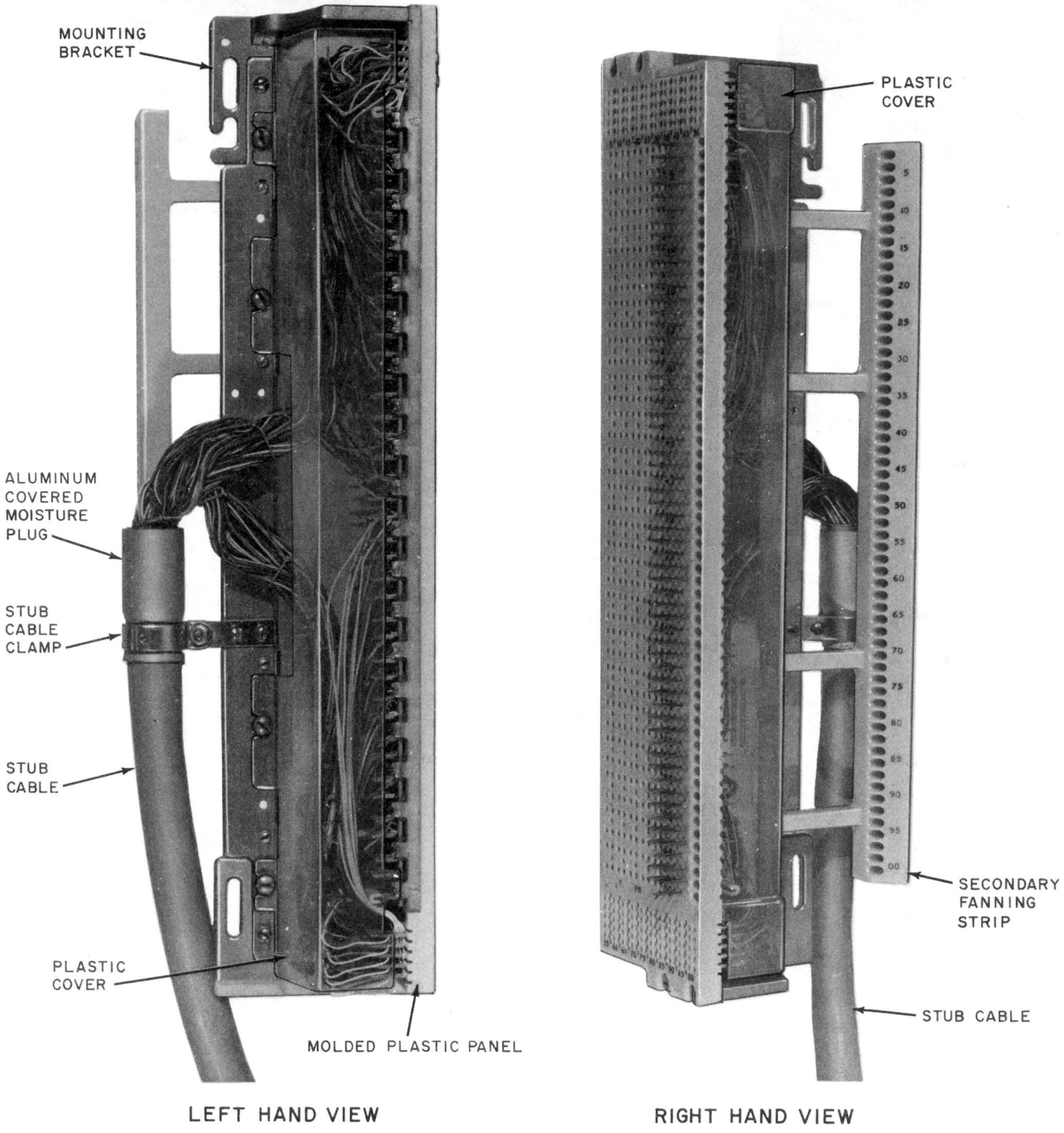


Fig. 11—303-Type Connector

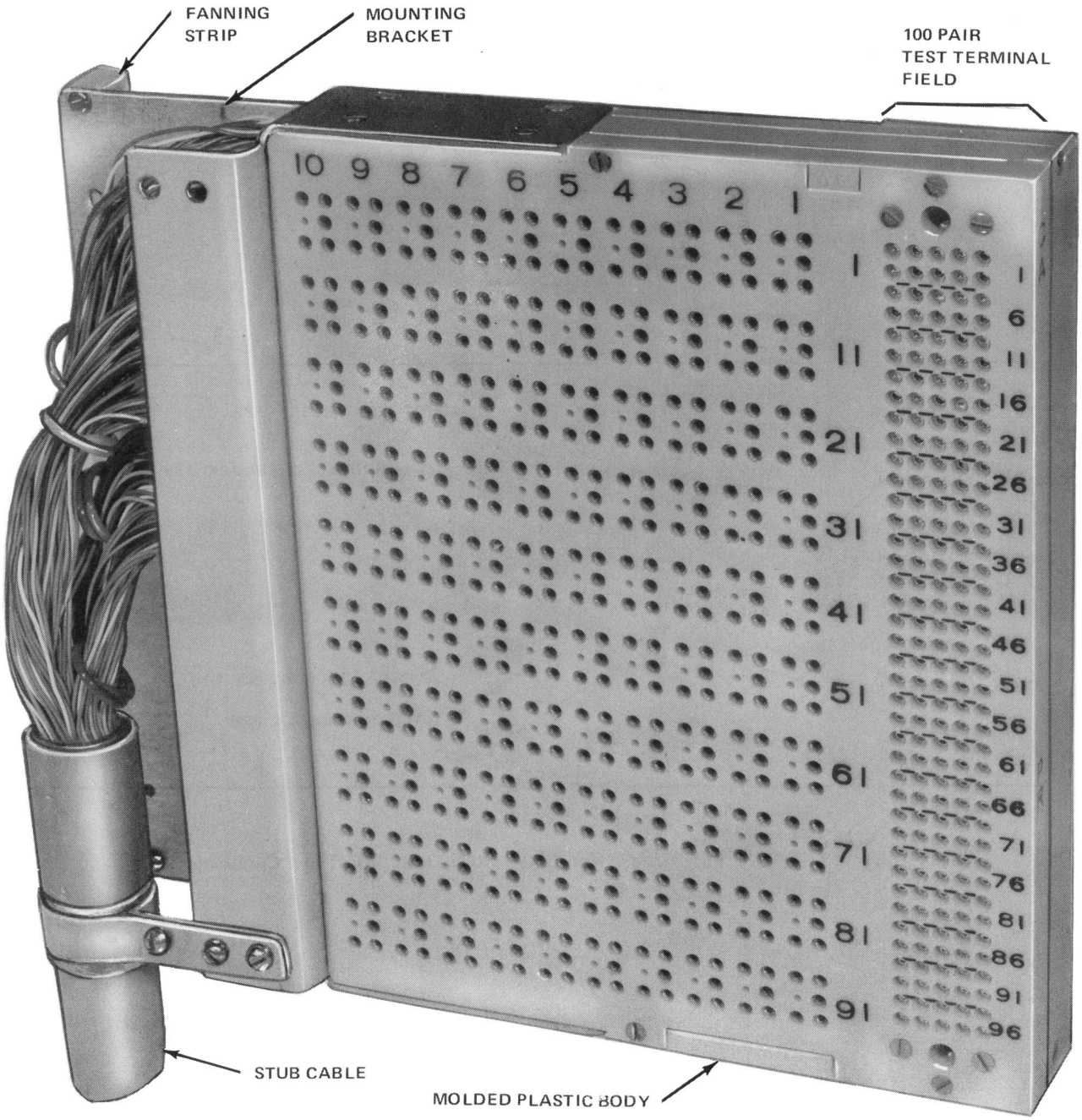


Fig. 12—305-Type Connector

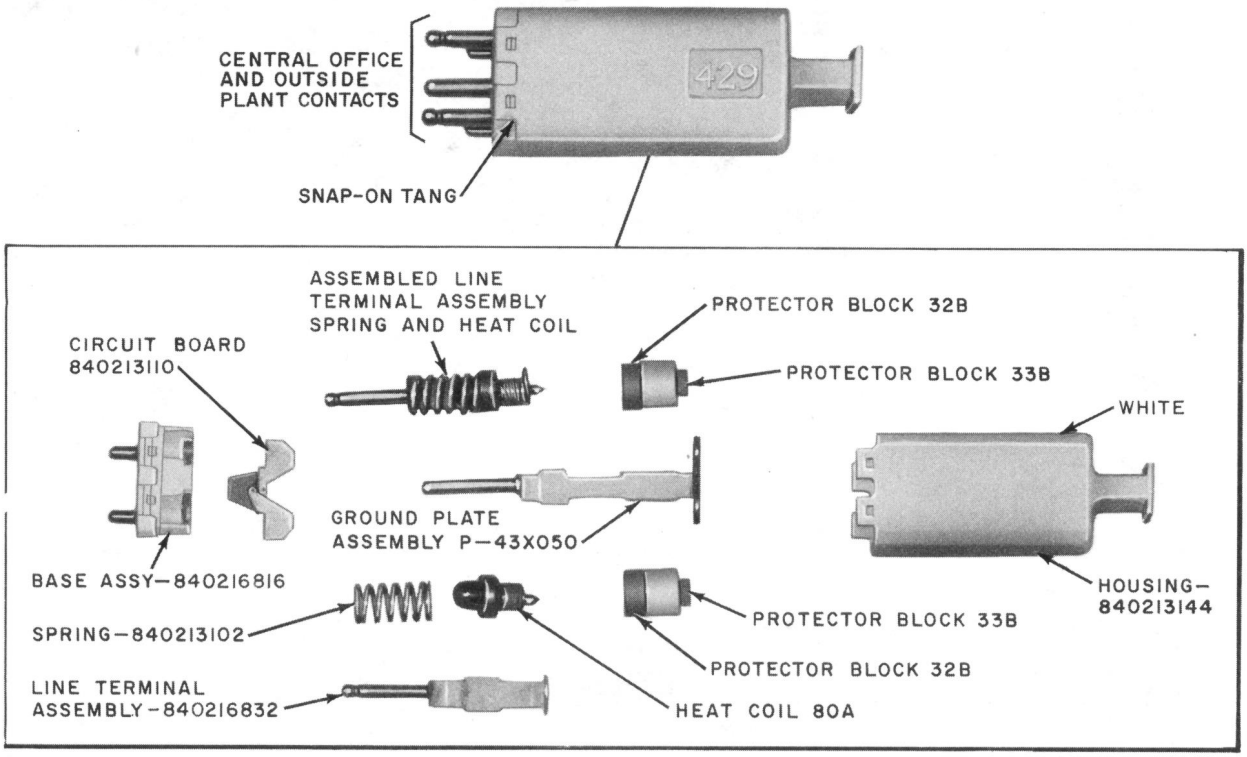


Fig. 13—429F Plug Units (For 302-, 303-, and 305-Type Connectors)

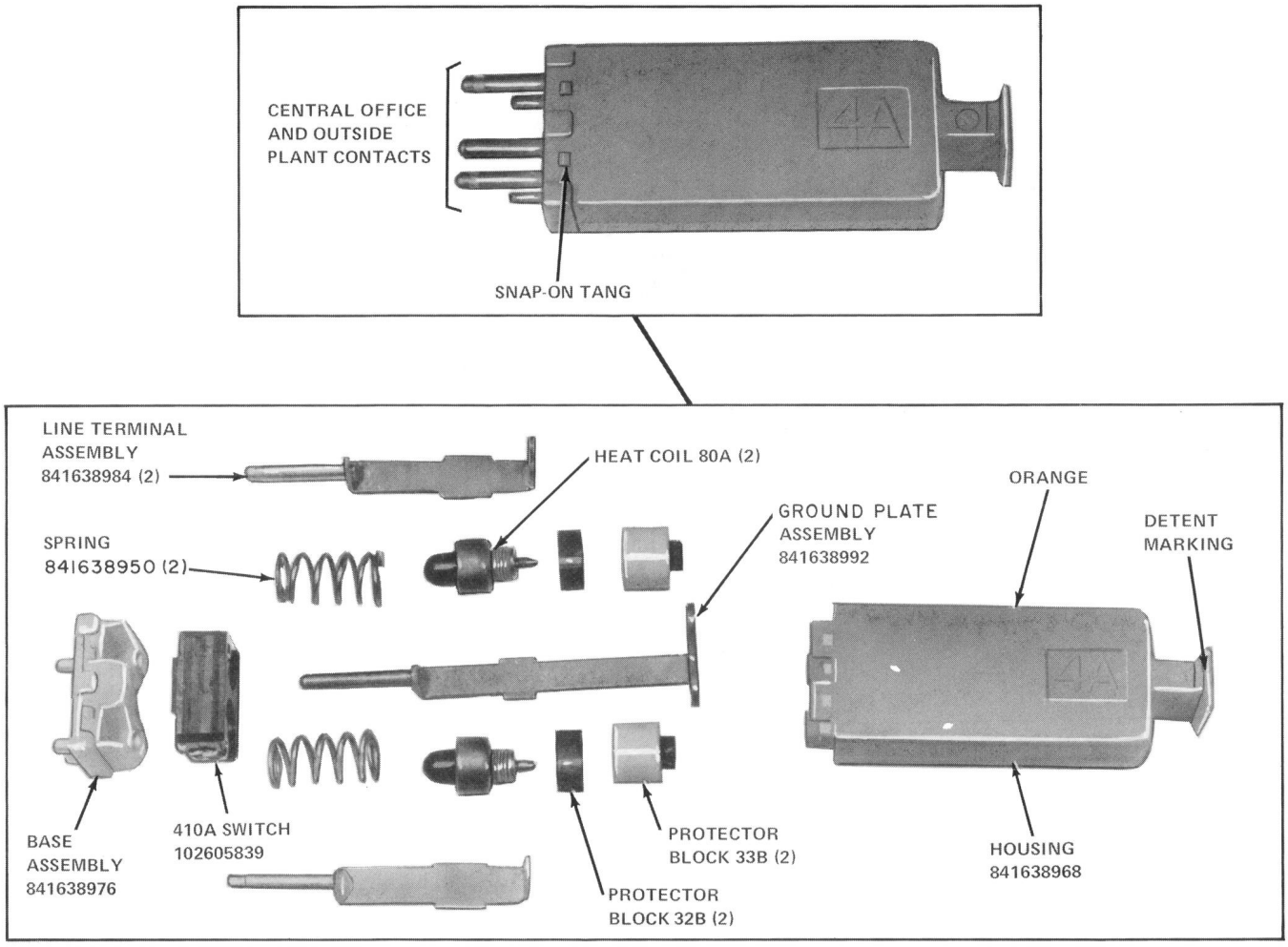


Fig. 14—4A11C Protector Unit (Mini-bridge Lifter)

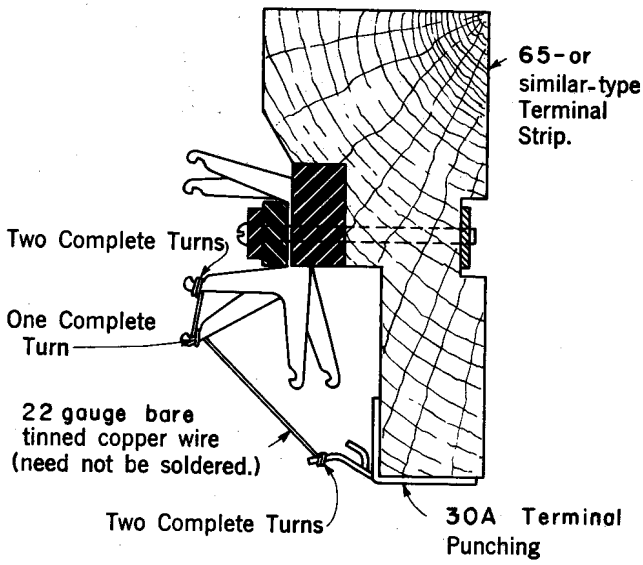

65-or similar-type Terminal Strip.
Two Complete Turns
One Complete Turn
22 gauge bare tinned copper wire (need not be soldered.)
Two Complete Turns
30A Terminal Punching

Fig. 15—

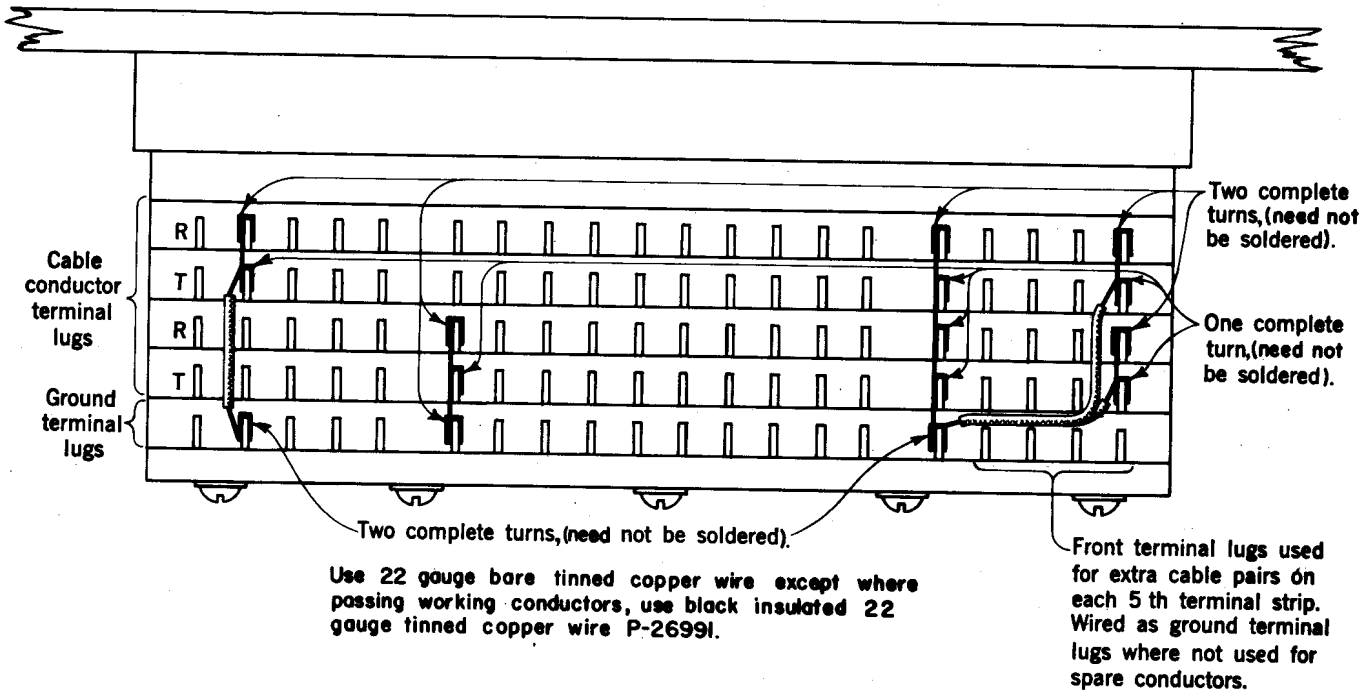

Cable conductor terminal lugs
Ground terminal lugs
R
T
R
T
Two complete turns,(need not be soldered).
One complete turn,(need not be soldered).
Two complete turns,(need not be soldered).
Use 22 gauge bare tinned copper wire except where passing working conductors, use black insulated 22 gauge tinned copper wire P-2699I.
Front terminal lugs used for extra cable pairs on each 5 th terminal strip. Wired as ground terminal lugs where not used for spare conductors.

Fig. 16—

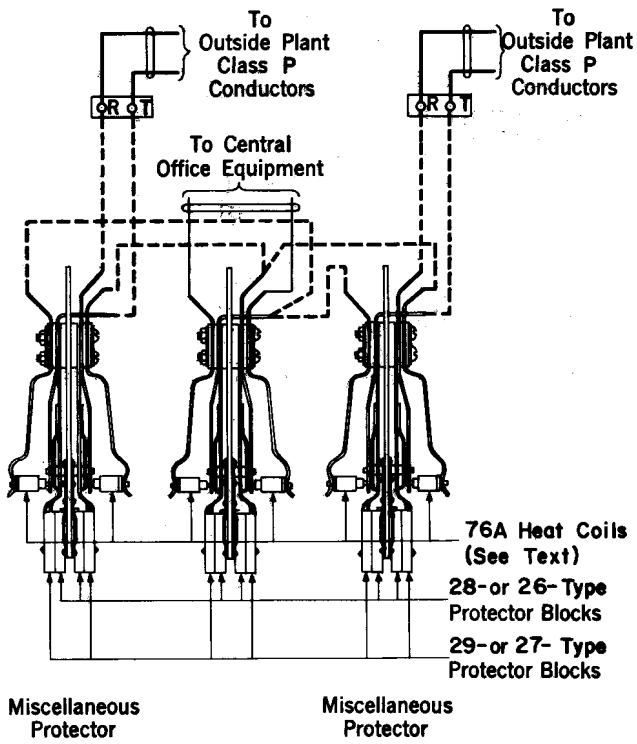


Fig. 17—

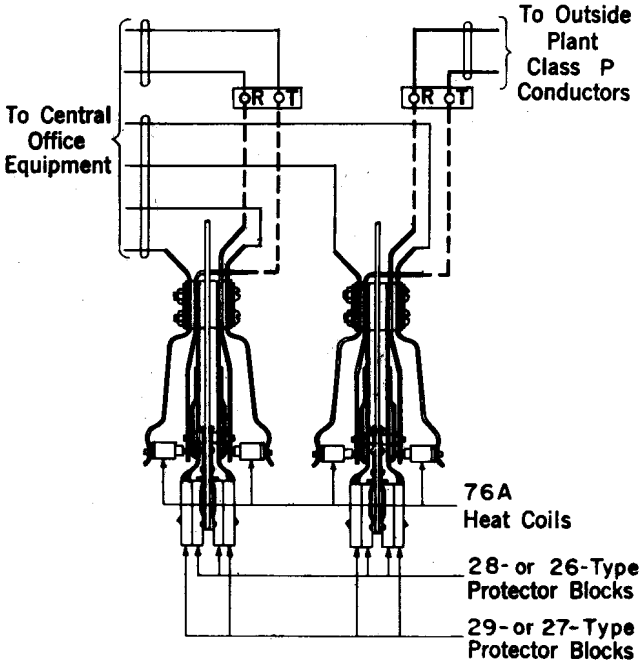


Fig. 19—

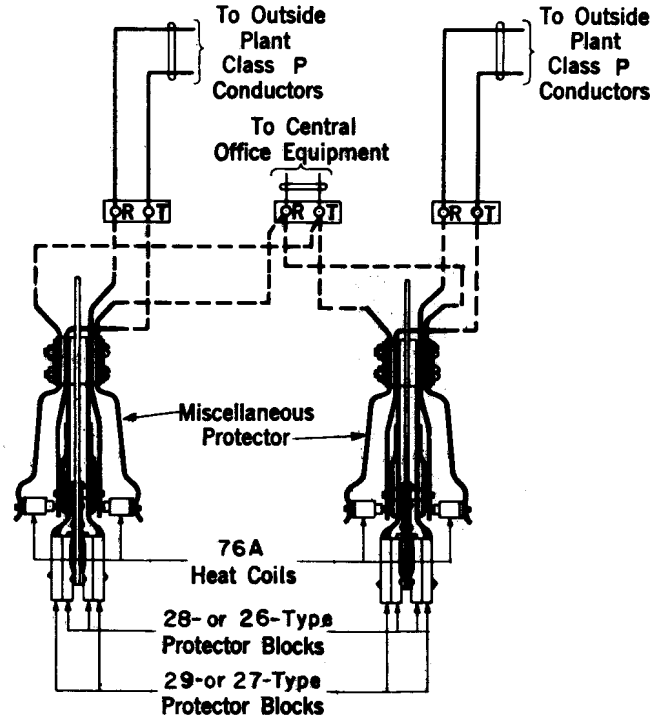
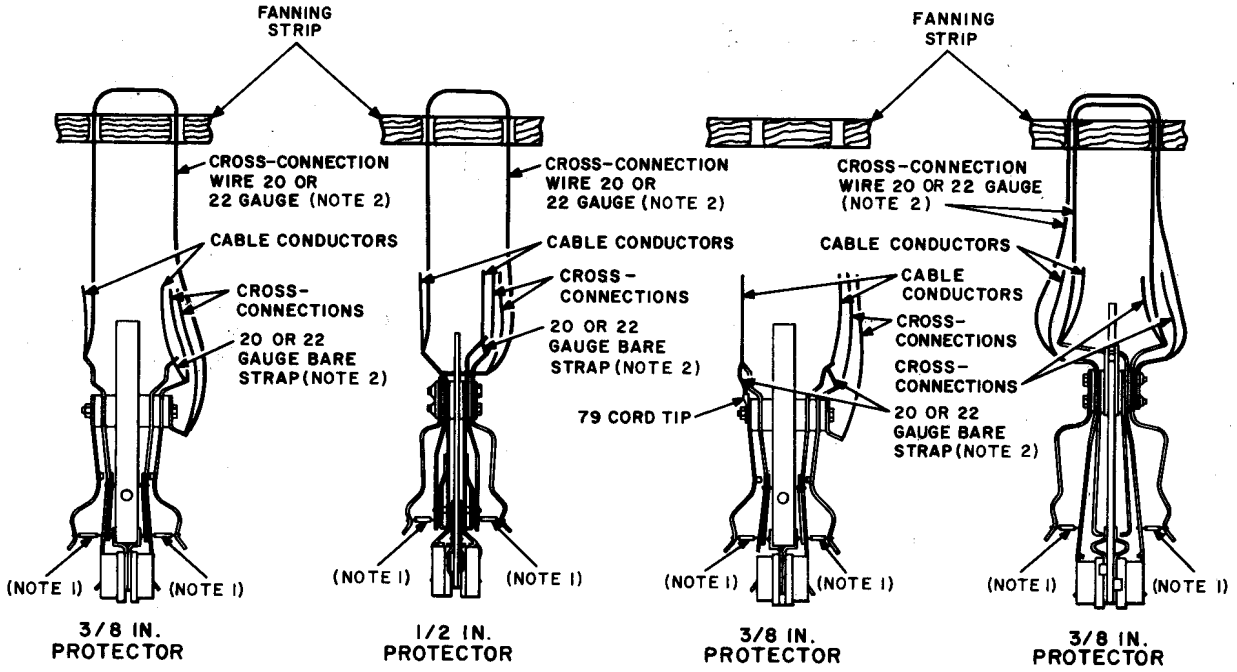


Fig. 18—



NOTES:
1. OMIT DUMMY METAL HEAT COILS WHEN SOLDERED STRAPS ARE PROVIDED.
2. OMIT STRAPS WHEN DUMMY HEAT COILS ARE PROVIDED.

Fig. 20—

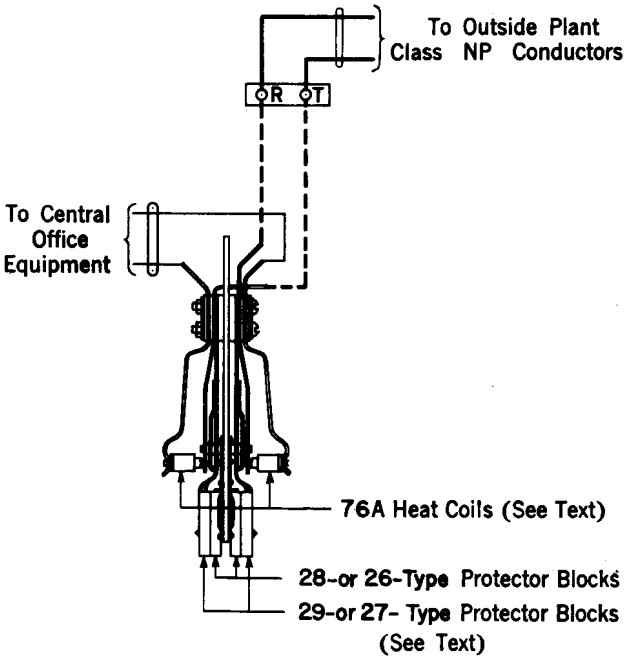


Fig. 21—

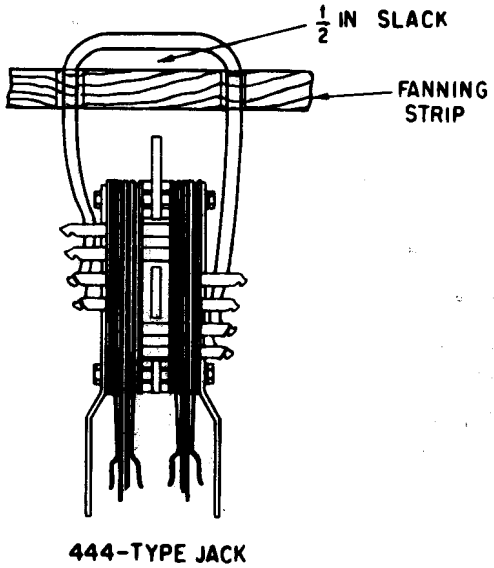


Fig. 22—

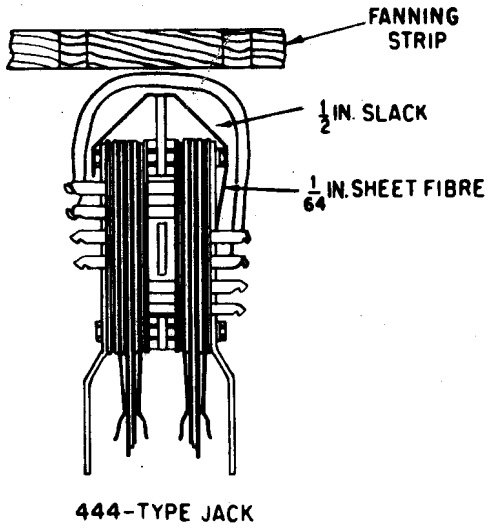


Fig. 23—

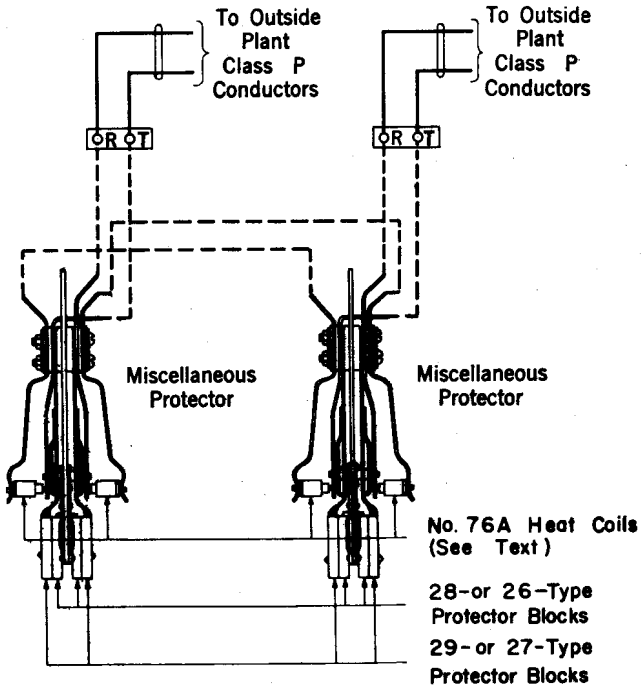


Fig. 24—

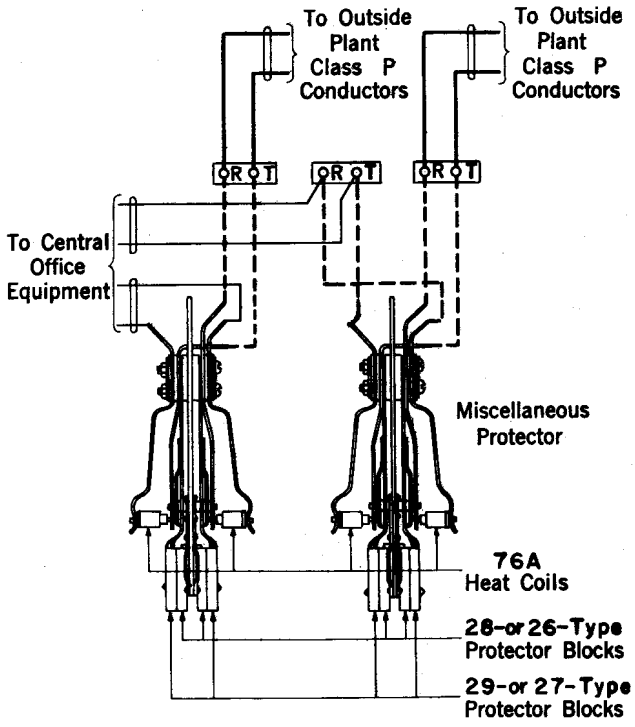


Fig. 25—

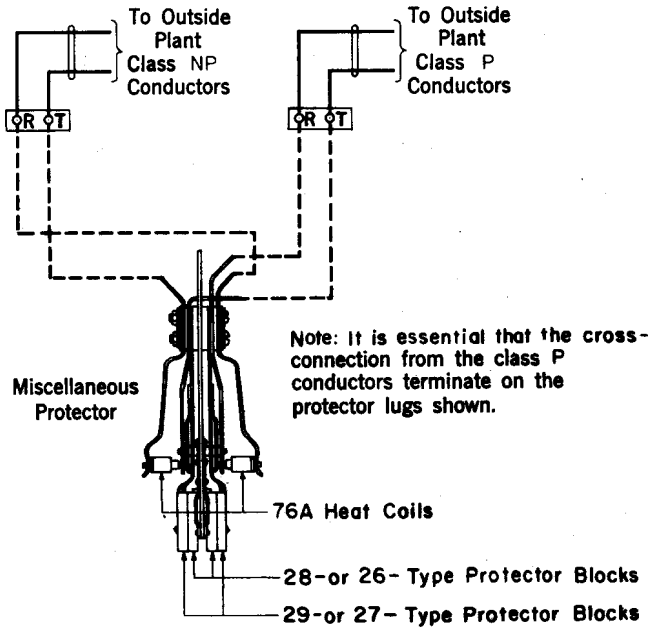


Fig. 26—

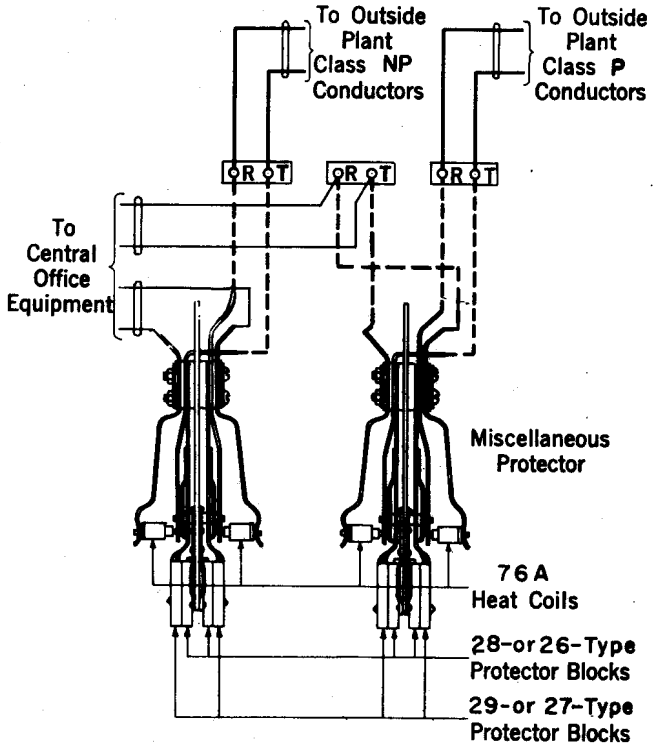


Fig. 27—

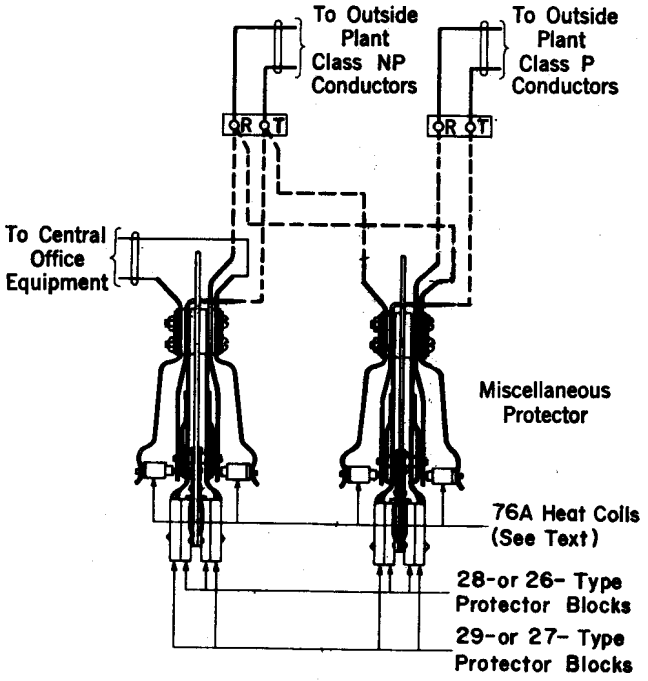


Fig. 29—

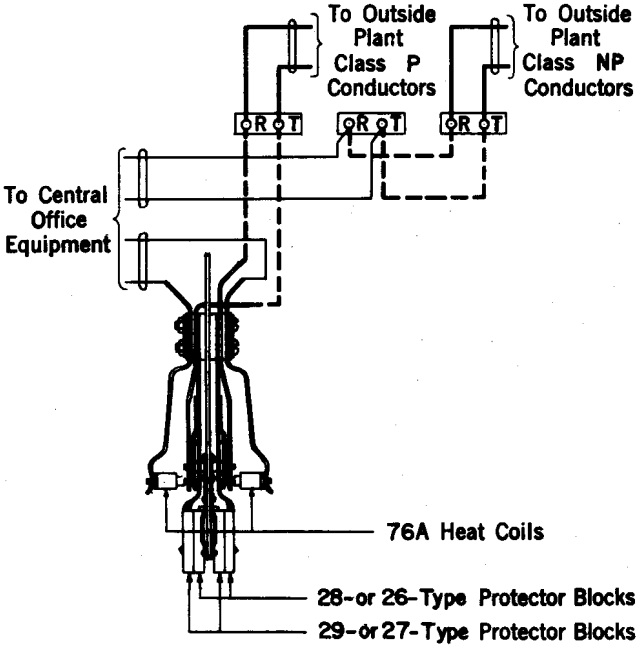


Fig. 28—

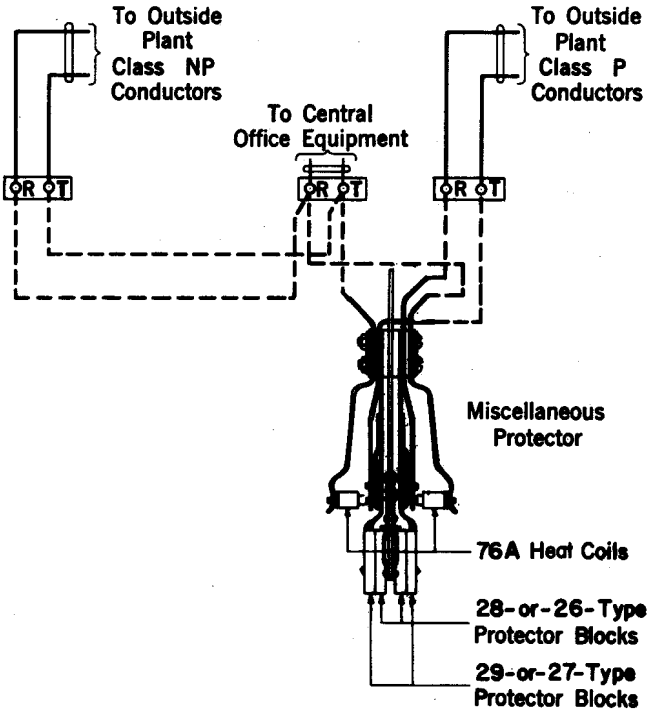


Fig. 30—

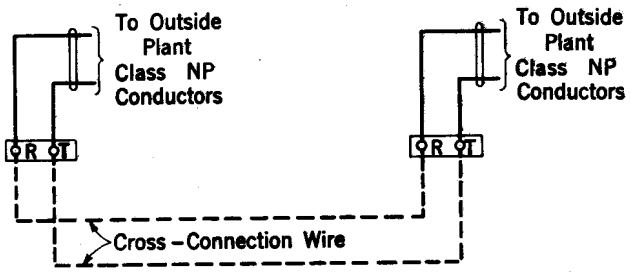


Fig. 31—

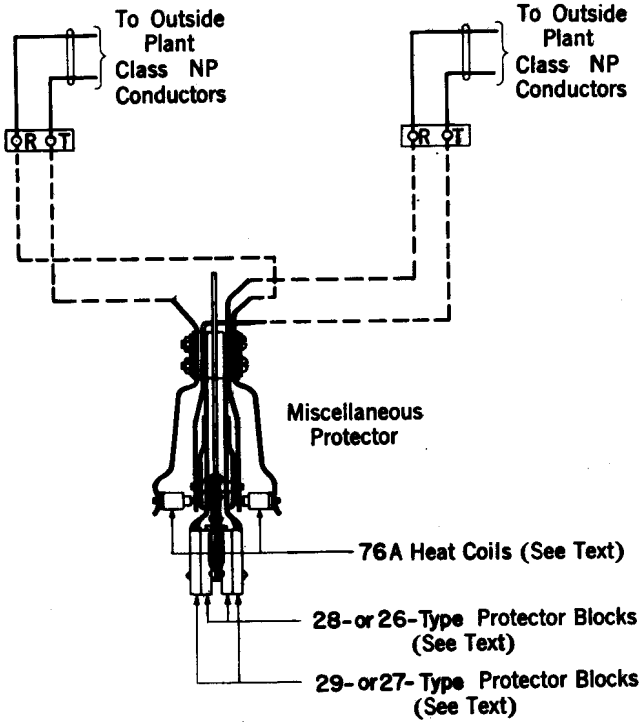


Fig. 32—

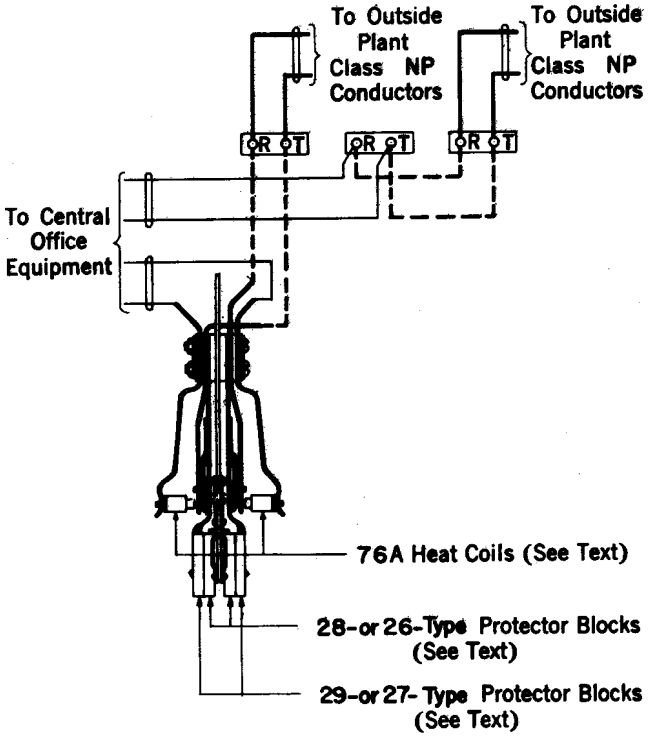


Fig. 33—

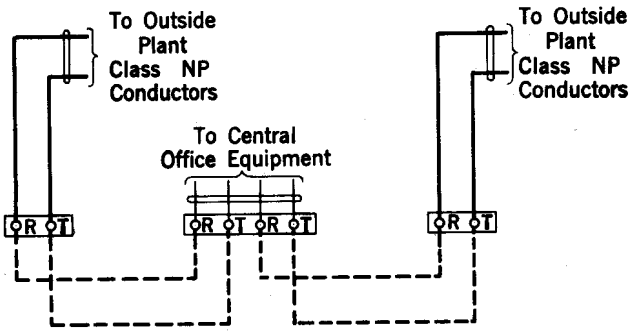


Fig. 34—

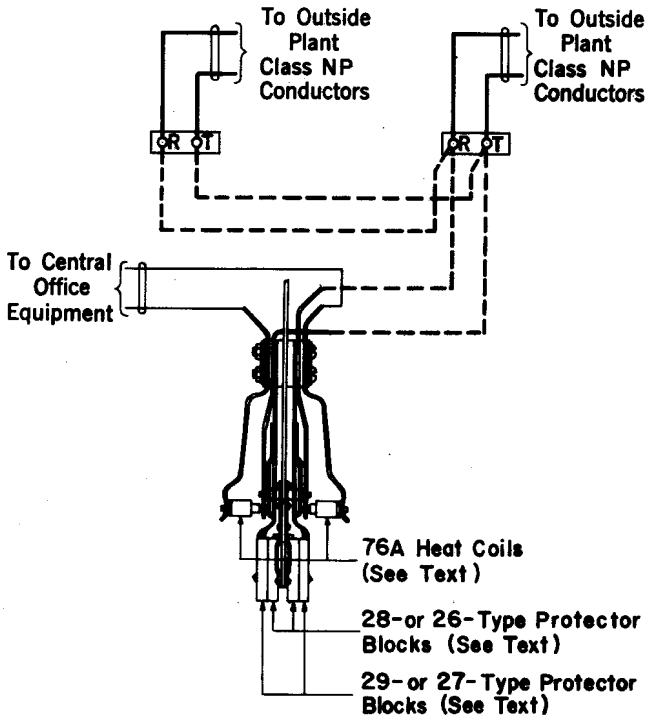
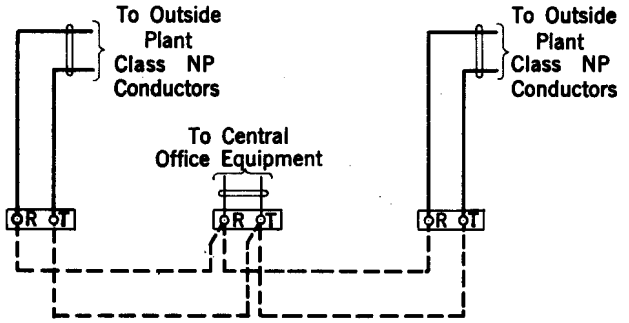


Fig. 35—



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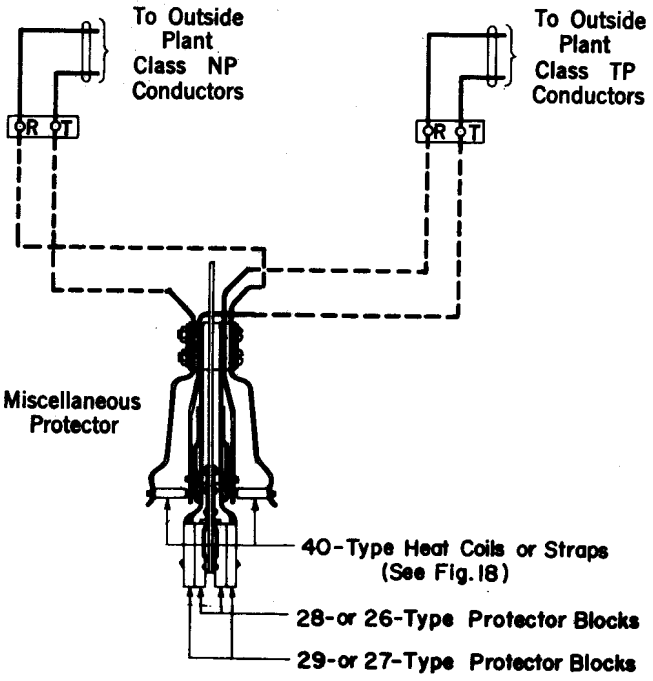


Fig. 37—

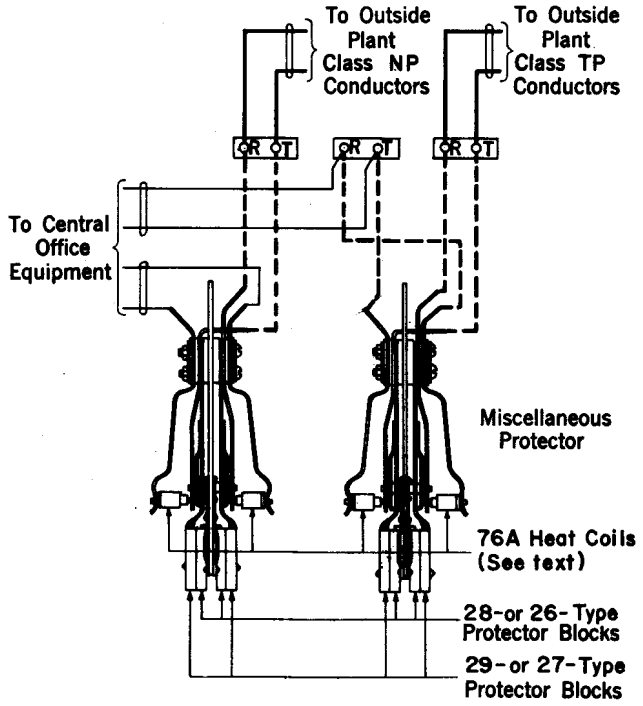


Fig. 38—

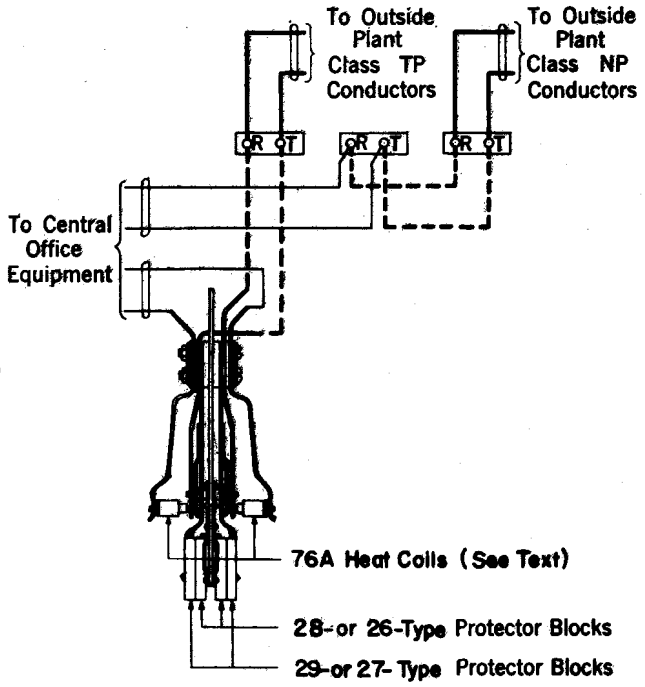


Fig. 39—

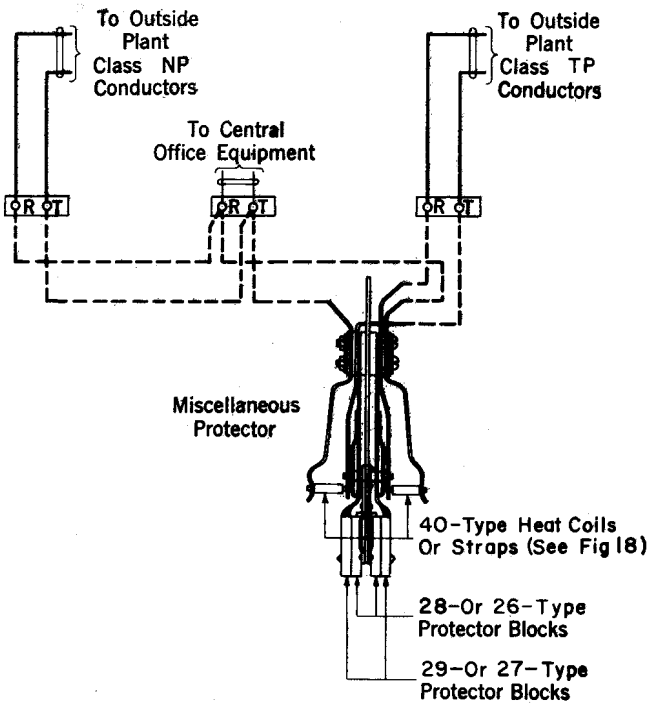


Fig. 41—

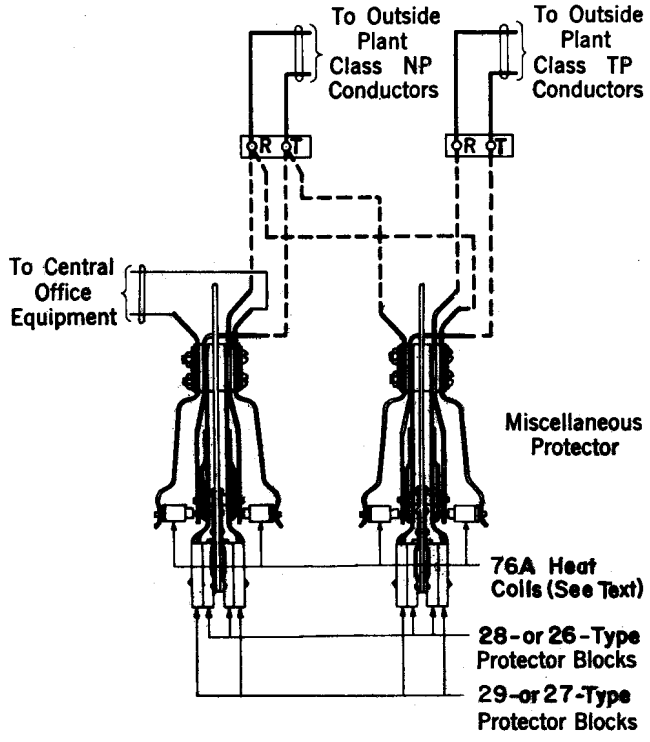


Fig. 40—

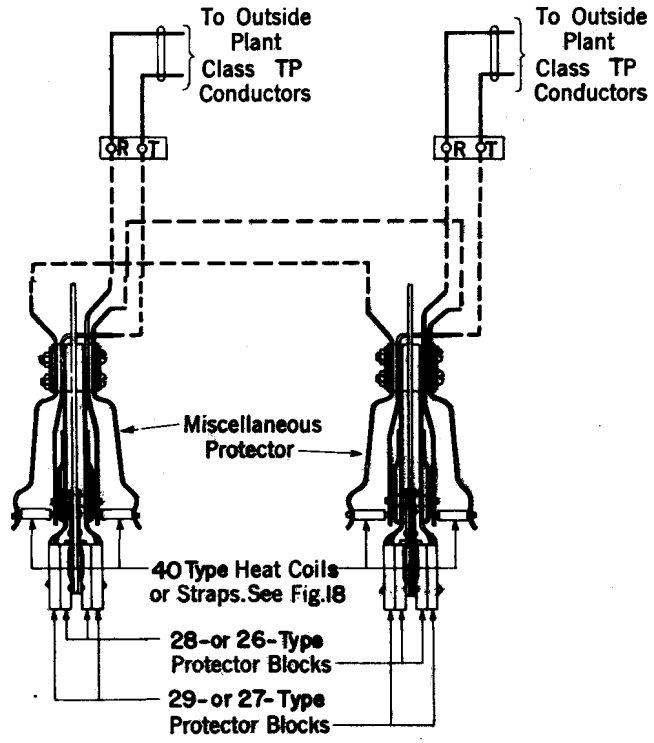


Fig. 42—

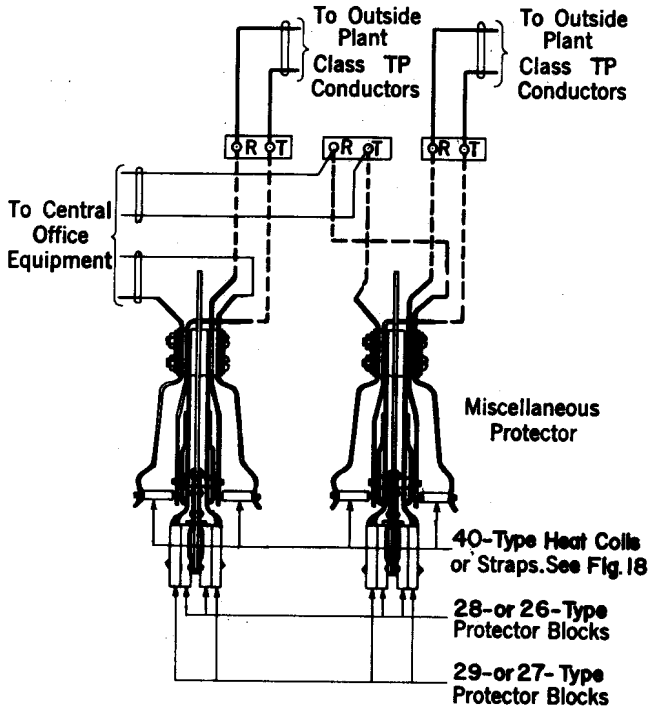


Fig. 43—

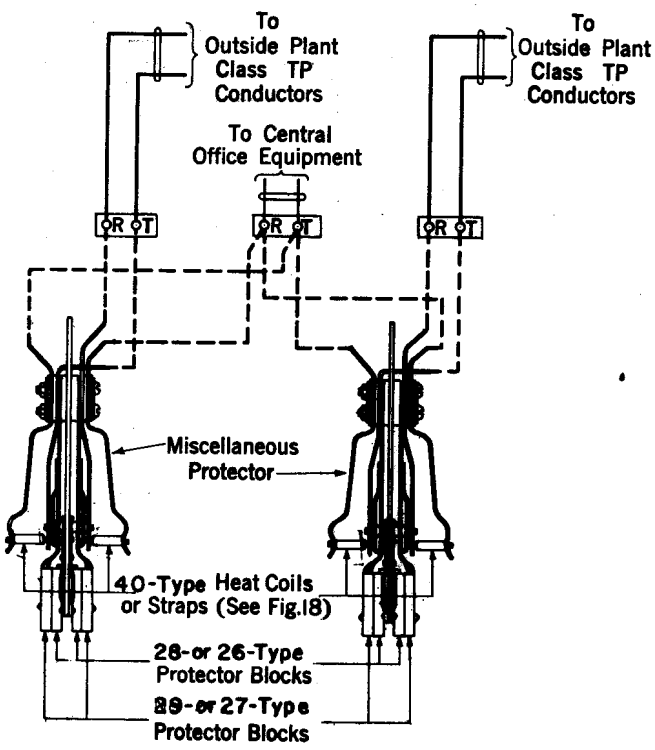


Fig. 45—

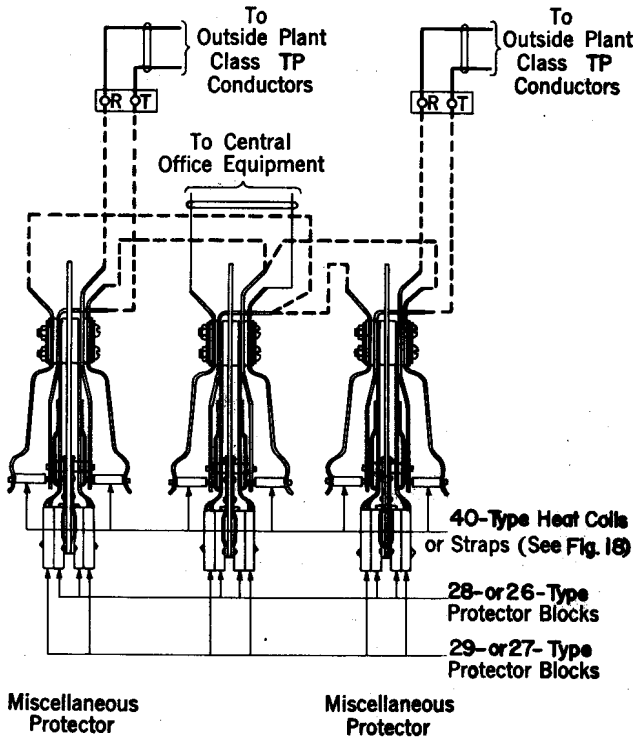
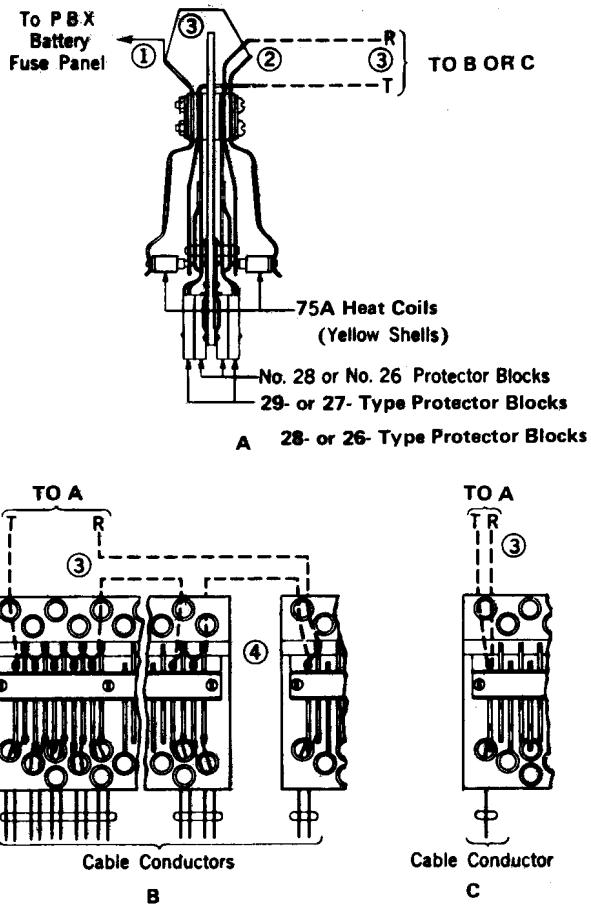


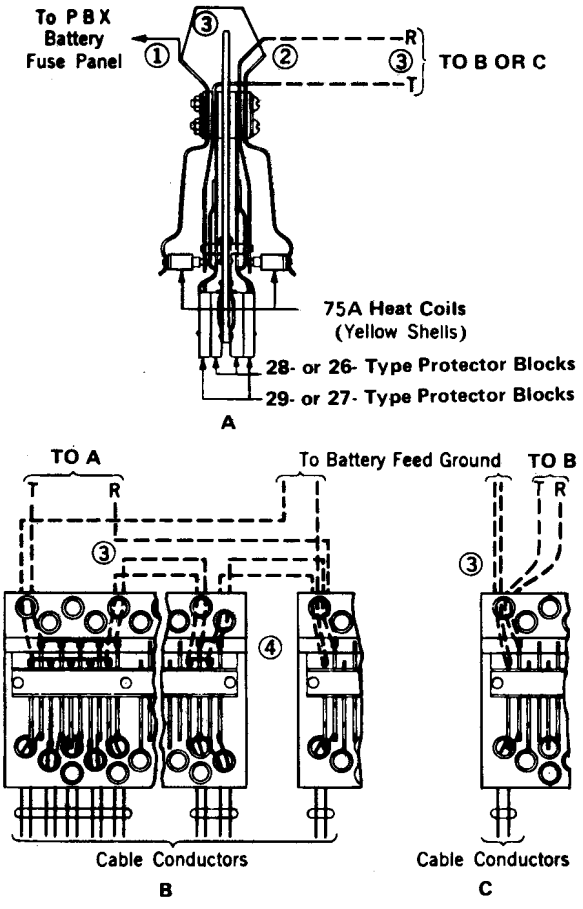
Fig. 44—



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. 46—



NOTES

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④ Use 22-gauge bare tinned copper wire per P-314952.

Fig. 47—