

MAIN DISTRIBUTING FRAMES TYPES OF PROTECTION

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1. GENERAL

1.01 This section covers the types of protection required on main distributing frames.

1.02 This section contains information previously covered in Sections 201-202-301 and 201-203-301 which have been canceled.

1.03 Both A- and B-type frames are covered in this section.

(a) On A-type main distributing frames, the outside cable conductors terminate on terminal strips or fuse mountings and the cables from the central office equipment normally terminate on the terminals of the protector mountings. Protection is provided by placing heat coils and protector blocks in the protector mounting cross-connected to the cable conductors.

(b) On B-type main distributing frames, the outside cable conductors are terminated at protector mountings, at 444-type jacks (301-type connector), or 300-, 302- or 303-type connectors on the vertical side of the frame. On separate protector frames, outside cable conductors are terminated at protector mountings and at jacks or connectors mounted on verticals on both sides of the frame from which cables are run to terminal strips on the vertical side of a main distributing frame. Cables from the central office equipment are terminated at terminal strips 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-type connectors) from the term *protector* which has been applied to cable terminating mounting assemblies such as the C50, E50 etc.

2. PROTECTION CONSIDERATIONS

2.01 The purpose of central office protection is to ensure the safety of telephone personnel and to reduce the possibility and extent of equipment

damage, in the event that foreign potential contacts the outside plant.

2.02 In considering the type of terminating apparatus required for a particular telephone plant layout, it is necessary to first determine whether the plant is considered to be exposed or unexposed.

2.03 Exposed and unexposed plants are defined as follows.

(a) **Exposed Plant:** Telephone plant that is subject to disturbance from lightning, subject to the possibility of contact with electrical circuits operating at more than 300 volts rms between conductors, or subject to 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 an electrical circuit operating at over 300 volts rms or not subject to the effects of lightning, rise in ground potential, or low frequency induction is classified as *unexposed*.

2.04 In determining the exposure status of plant, the possibility of changes in exposure due to changes in the distribution system should be considered.

2.05 Buried Plant: Plant buried in built-up urban areas is not generally considered as exposed plant, and this situation does not change when plant is buried jointly with power company primary circuits, providing standard separations are maintained. Buried plant in urban areas becomes exposed if it is buried with random separation in a common trench with primary power circuits. It may also be connected to aerial plant that is exposed, thus exposing the buried plant. Buried plant outside of built-up areas must be considered as exposed due to lightning exposure.

3. CLASSES OF CONDUCTORS

3.01 Conductors entering a central office are generally classified with regard to the type of central office protection as exposed or unexposed. The application of protection in this section 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: Sometimes for administrative purposes or for engineering reasons conductors which are usually considered to be in a certain class may be placed in a different class in accordance with local instructions.

4. PROTECTION

4.01 Protection is provided as follows.

(a) **Voltage protection** is provided by the use of two protector blocks for each pair, having an accurately spaced separation of 3 mils. One of these protector blocks is connected to ground and the other to the conductor being protected. When the voltage of the conductor becomes too high, the conductor will be grounded by arcing across the small air gap between the carbon protector blocks. If a considerable current flows across the air gap, the carbons may become permanently grounded. The protector blocks are required on **all** exposed circuits and may also be placed on unexposed subscriber loop circuits for plant flexibility.

(b) **Current protection** is provided by the use of heat coils which are used to protect the telephone equipment against external effects in which the voltage is not high enough to operate the protector block, nor the current high enough to interrupt fault current in the protective cable, but it is still high enough to damage equipment if allowed to flow over a period of time. Such currents are called **sneak currents** and are guarded against by the use of heat coils. The heat coils consist of a coil of wire wrapped around a metal tube which is connected in series with the conductor to be protected. Soldered in the tube with low melting point alloy is a metal pin which is connected to the line side of the coil. If sufficient current flows through the coil to melt the alloy, this pin will move under the pressure of the mounting spring and thus connect the line to ground. As the line is

connected to ground, the current is diverted from the central office equipment to ground, thus preventing damage to the central office equipment. 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 ESS protector frame is provided. Toll circuits do not require heat coils because they terminate on repeat coils or other impedance matching devices which are not subject to damage or overheating from sneak current flow. However, where the number of toll circuits in a group is small compared with the exchange component, it is the general practice to use the same type of terminating apparatus for the whole group for administrative reasons. Dummy heat coils may be used for the intercity complement.

5. TYPES OF PROTECTIVE APPARATUS

5.01 Protective apparatus may be designated as protector mountings or connectors (note in 1.03).

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

Note: The following illustrations show connections as they appear on a B-type main distributing frame. Fig. 2 shows how the connections are made on an A-type frame.

C-, E-, AND SIMILAR TYPE PROTECTOR MOUNTINGS

5.03 Fig. 1, 2, 3, and 4 show C- and E- and similar type protector mountings. Fig. 5 and Table A show the present standard types of protector blocks and heat coils and also the corresponding older types.

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

5.05 The E50 and E52 protector mountings are arranged for protector blocks only and are intended for use in toll cable plant where current

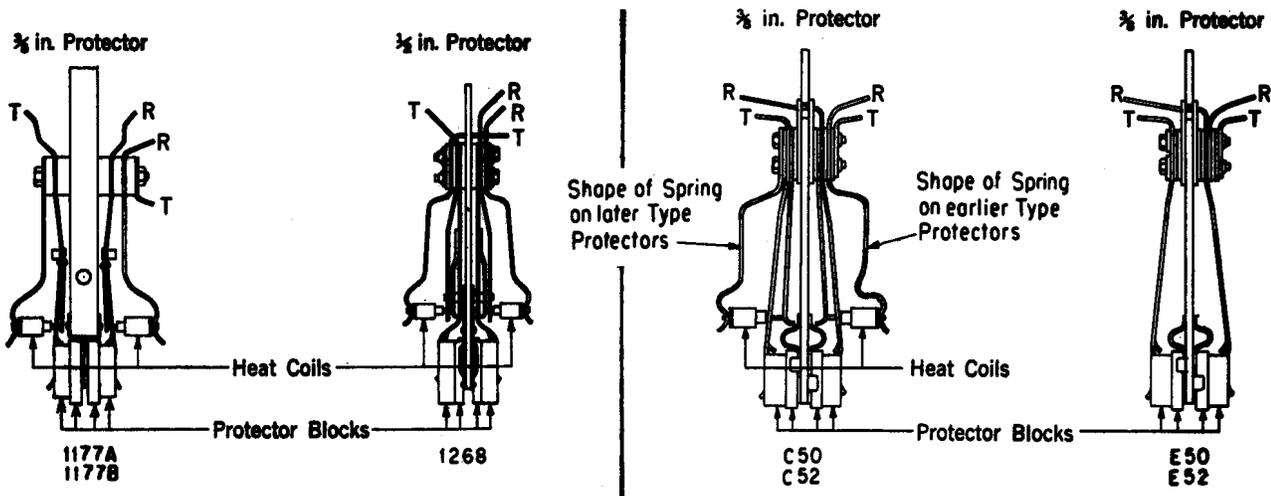


Fig. 1—C-, E-, and Similar Type Protector Mountings

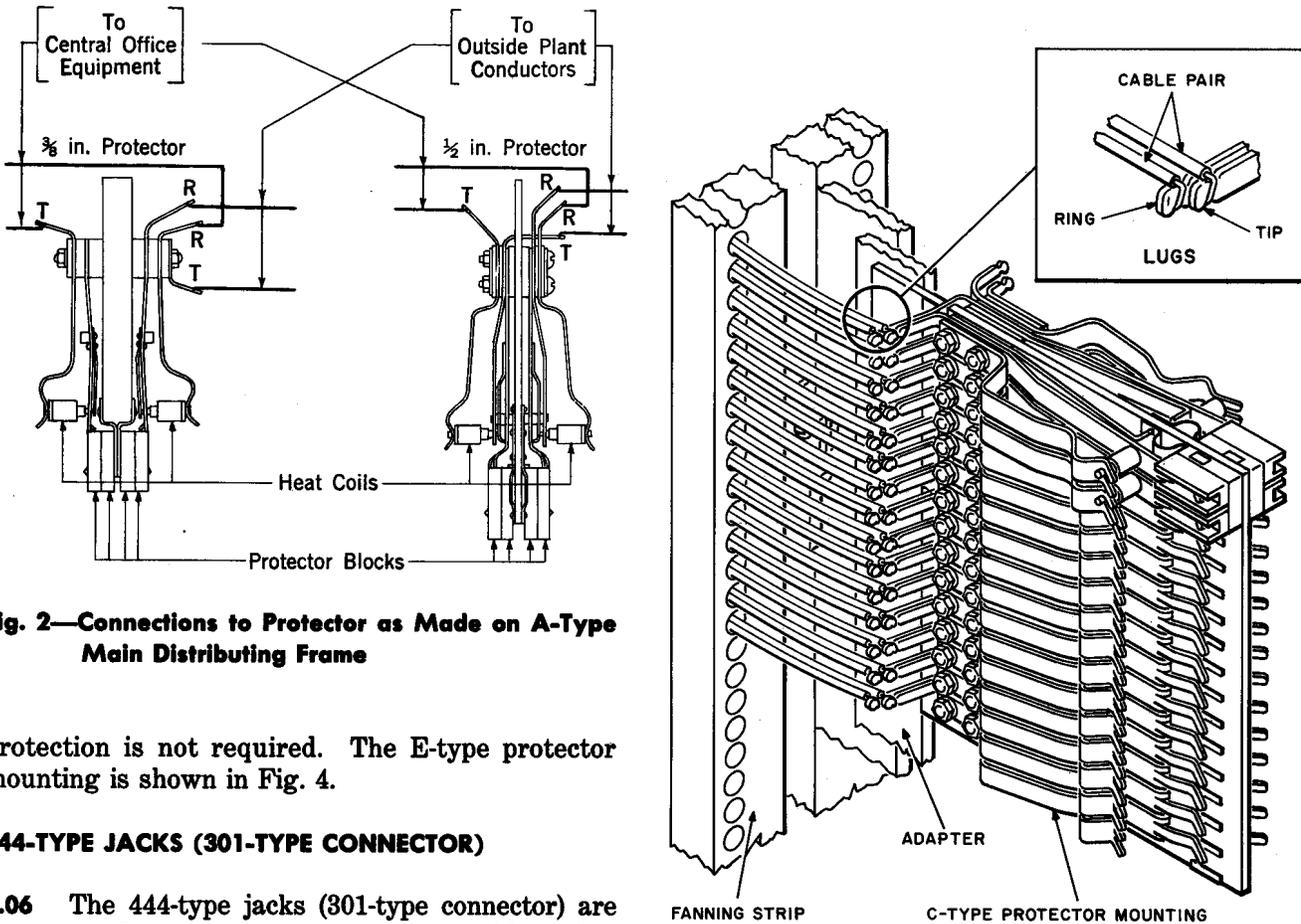


Fig. 2—Connections to Protector as Made on A-Type Main Distributing Frame

protection is not required. The E-type protector mounting is shown in Fig. 4.

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) do not provide protection,

Fig. 3—C-Type Protector Mounting

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TABLE A
PROTECTOR BLOCKS AND HEAT COILS

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

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

† Use 3-type protector micacs 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.

5.17 When the protector unit is pulled out to the detent position, the central office equipment is disconnected to isolate outside pairs for testing purposes. In this position, protection is still provided on the outside cable pair. Pulling the protector unit out completely will then remove all protection.

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 in the following cases.

- (a) If the spare conductor is crossed with a working conductor, it shall not 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 direct from the fuses to the central office circuits, spare conductors need not be grounded but shall be disconnected by the removal of the cross-connections.

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

6.03 When the 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 placed promptly.

6.04 With 65 or similar type terminal strips on the main frame, ground connections shall be made as shown in Fig. 13.

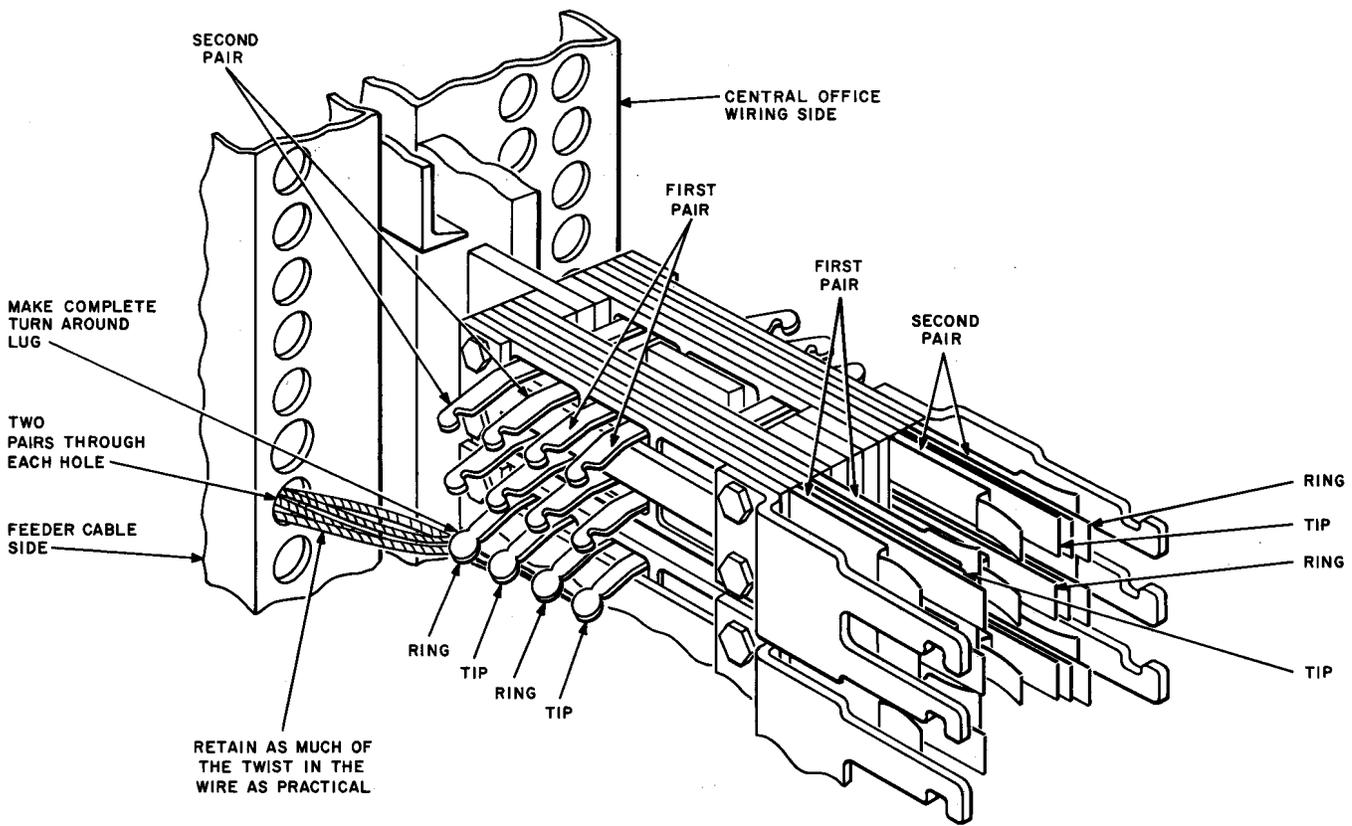


Fig. 6—444-Type Jack Mounting and Terminating

6.05 To connect spare conductors to the ground terminal punching (Fig. 13), 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. 14.

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 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

Note: In the following illustrations, C-type protector mountings are shown. If other type

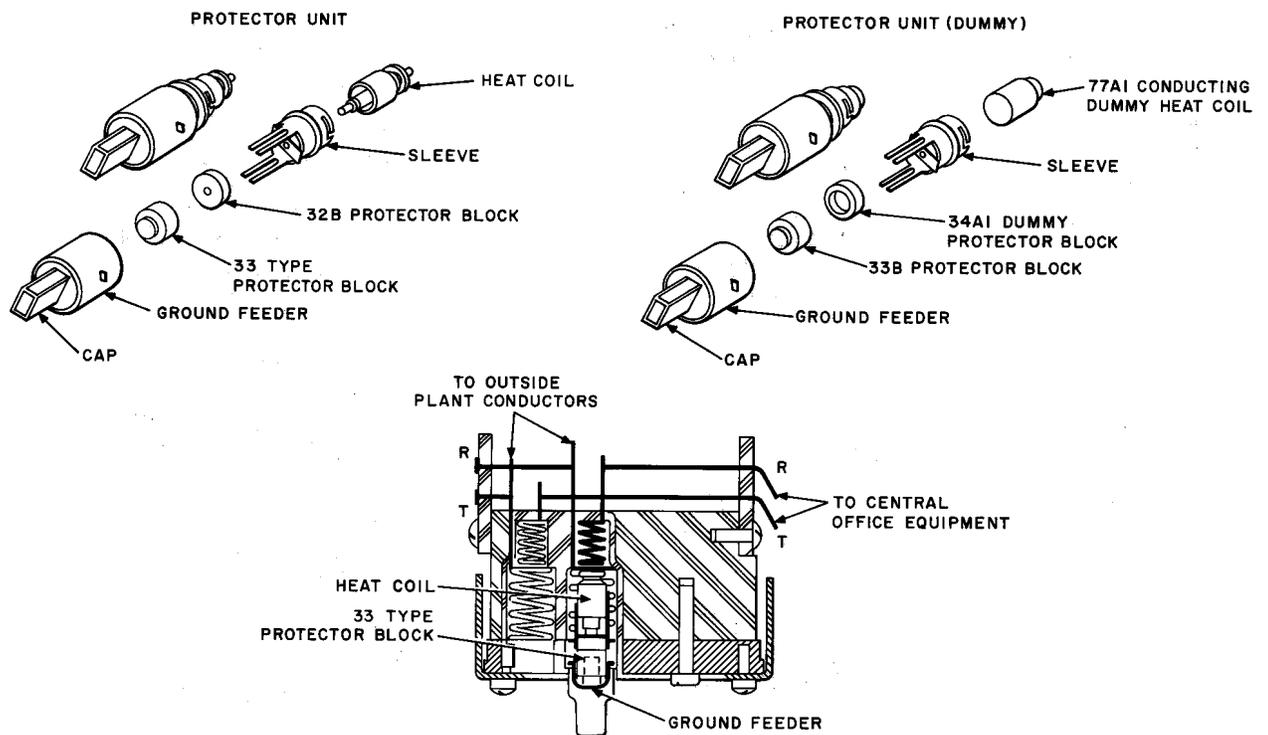


Fig. 7—300-Type Connector Assembly

protector mountings or connectors are used, connections shall be made in a similar manner and comparable heat coils and protector blocks shall be used.

A. Class P Conductors

6.10 With the exception of PBX and other battery feeders, as covered in 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 one that is permanently connected to the central office equipment or it may be a miscellaneous protector as covered in Part 8.

6.11 Where it is necessary 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. 15). 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. 16) 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. 17.

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 (Fig. 18) or soldered straps shall be provided.

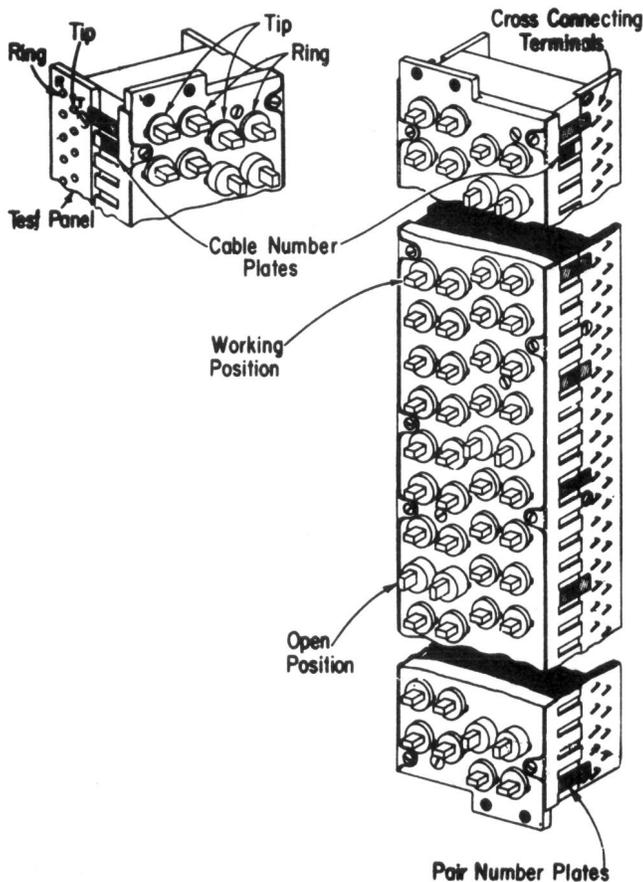


Fig. 8—300-Type Connector Mounting

6.15 Where straps are used, except on C-type protector mountings, a bare 22-gauge strap shall be soldered between the two ring terminals of the protector and piece of 22-gauge cross-connection wire, about 6 inches long, shall be soldered between the two tip terminals of the protector as shown in Fig. 18.

6.16 In offices where the running of the above mentioned 6-inch cross-connection wire would be very difficult due to the close proximity of the cable form to the fanning strip and where the protector and heat coil springs are assembled by means of a single screw which is connected to the tip spring of the heat coil, such as on the 77-type (3/8 inch) protector mounting, the 6-inch cross-connection wire may be eliminated between the two tip terminals and bare strap wire substituted as follows. On the tip (left) side of the protector mounting, a bare 22-gauge wire approximately 2 inches long shall be used with a 79 cord tip soldered to one end. The 79 cord tip shall be inserted under the head of the protector assembly screw on the tip

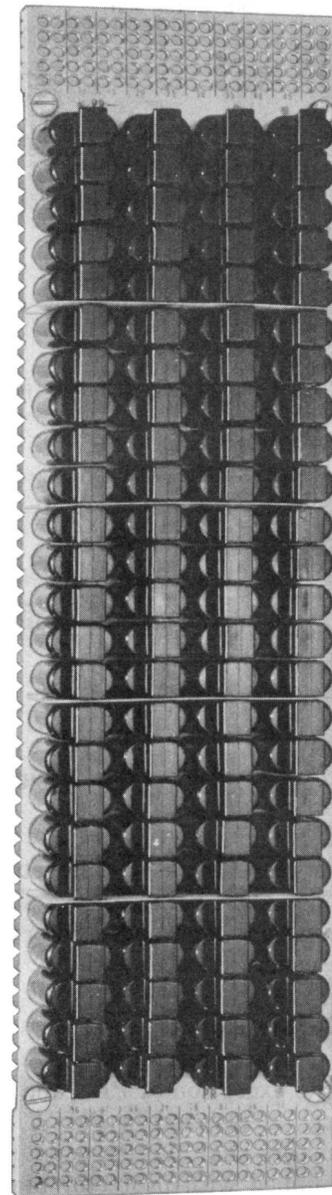
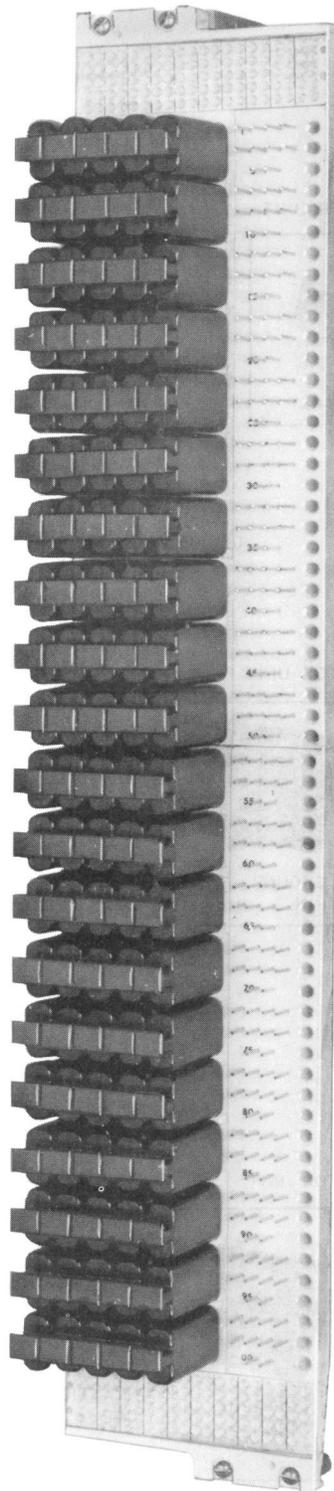


Fig. 9—302-Type Connector

side of the protector mounting and the other end of the wire shall be soldered to the tip spring soldering terminal. A 447A tool shall be used for loosening and tightening the protector screw nut.

6.17 Where straps are used on the C-type protector mounting, a pair of 22-gauge cross-connection wires about 6 inches long shall be soldered to the tip and ring terminals on the left side of the mounting, the wires shall be run through the holes



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Fig. 10—303-Type Connector

in the fanning strip, and the wires shall be soldered to the tip and ring terminals on the right side of the mounting.

Note 1: The E-type protector mountings differ from the C-type mountings in that the heat coil springs are omitted and the protector block springs are provided with two sets of terminals which are multipled together within the pile-up. One set projects on the one side for the termination of the entering cable pair and the other projects on the opposite side for connection to the jumper. Since the entering cable pair and the jumper are bridged on the protector block springs, there is no facility for opening the line for test purposes. This is also true of the 77-type and similar types of mountings when the heat coil springs are strapped to the protector block springs.

Note 2: Where wire-wrap terminals are provided, soldering of connections is omitted.

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

6.19 The omission of heat coils does not alter the practice regarding the use of protective cable or fuses in this type of conductor.

C. Class NP Conductors

6.20 With terminating class NP conductors (Fig. 19), it will not be necessary to use protectors unless protector mountings are permanently connected to the central office circuit or protector mountings are used to facilitate opening the line. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 18) 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 of straps on circuits requiring heat coil or protector block protection.

6.21 Where cable facilities terminated on 444-type jacks are used for circuits which require that the jack contacts be strapped out, the straps should be placed as shown in Fig. 20 using cross-connection wire, leaving approximately 1/2-inch slack.

6.22 Fig. 21 shows the method of placing straps using cross-connection wire where the use of shielded cable conductors and shielded cross-connection wire does not permit the passage

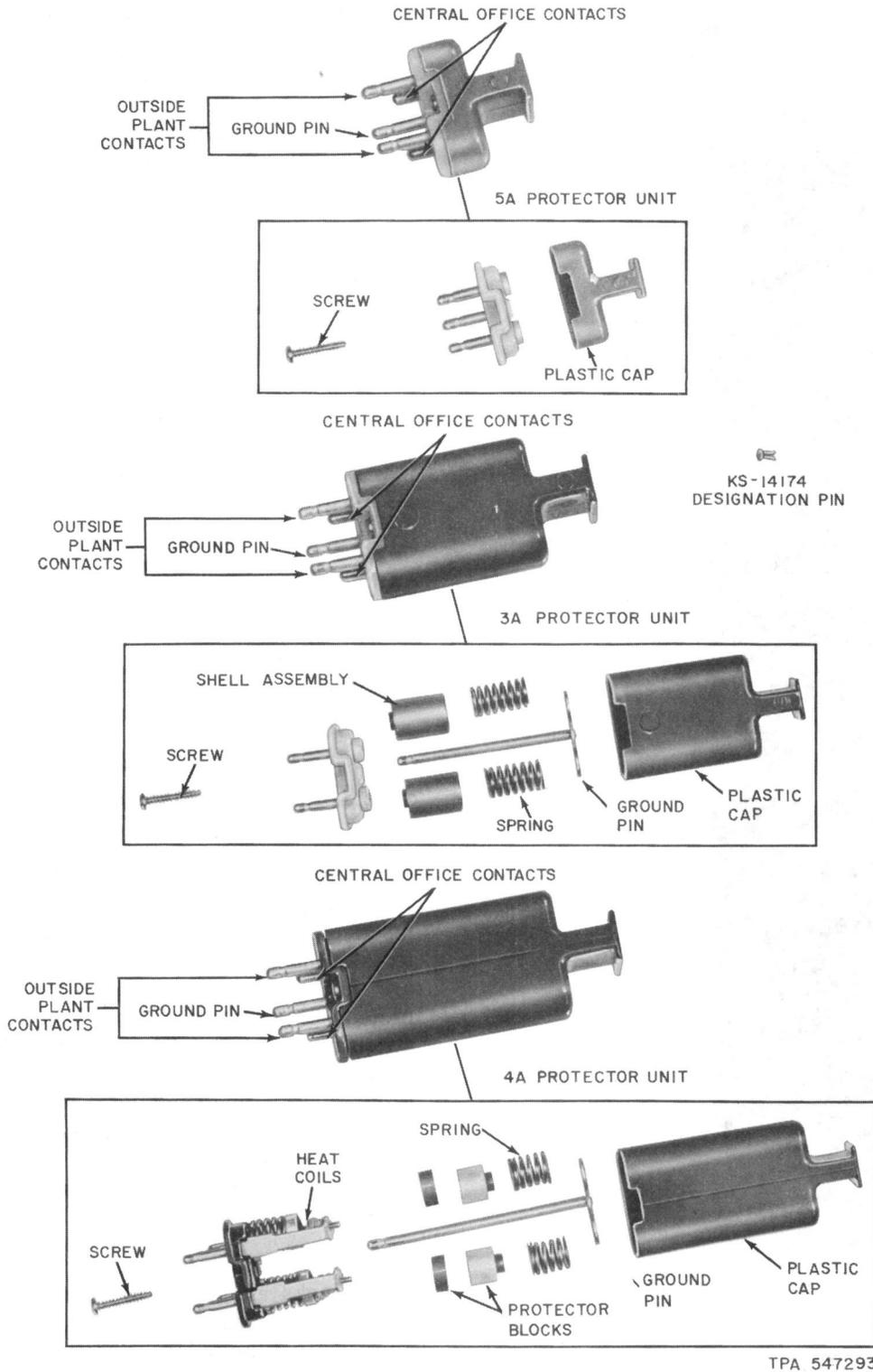


Fig. 11—Protector Units and Designation Pin (for 302-Type Connector)

of additional conductors through the fanning strip holes. Prior to placing straps in this manner, insulation from the grounded framework and grounded portions of the jack should be provided

by use of grey sheet fibre. In cases where some jumpers are already in place, the fibre may be placed in straps 6 inches long by 2 inches wide. On new facilities where there is no interference

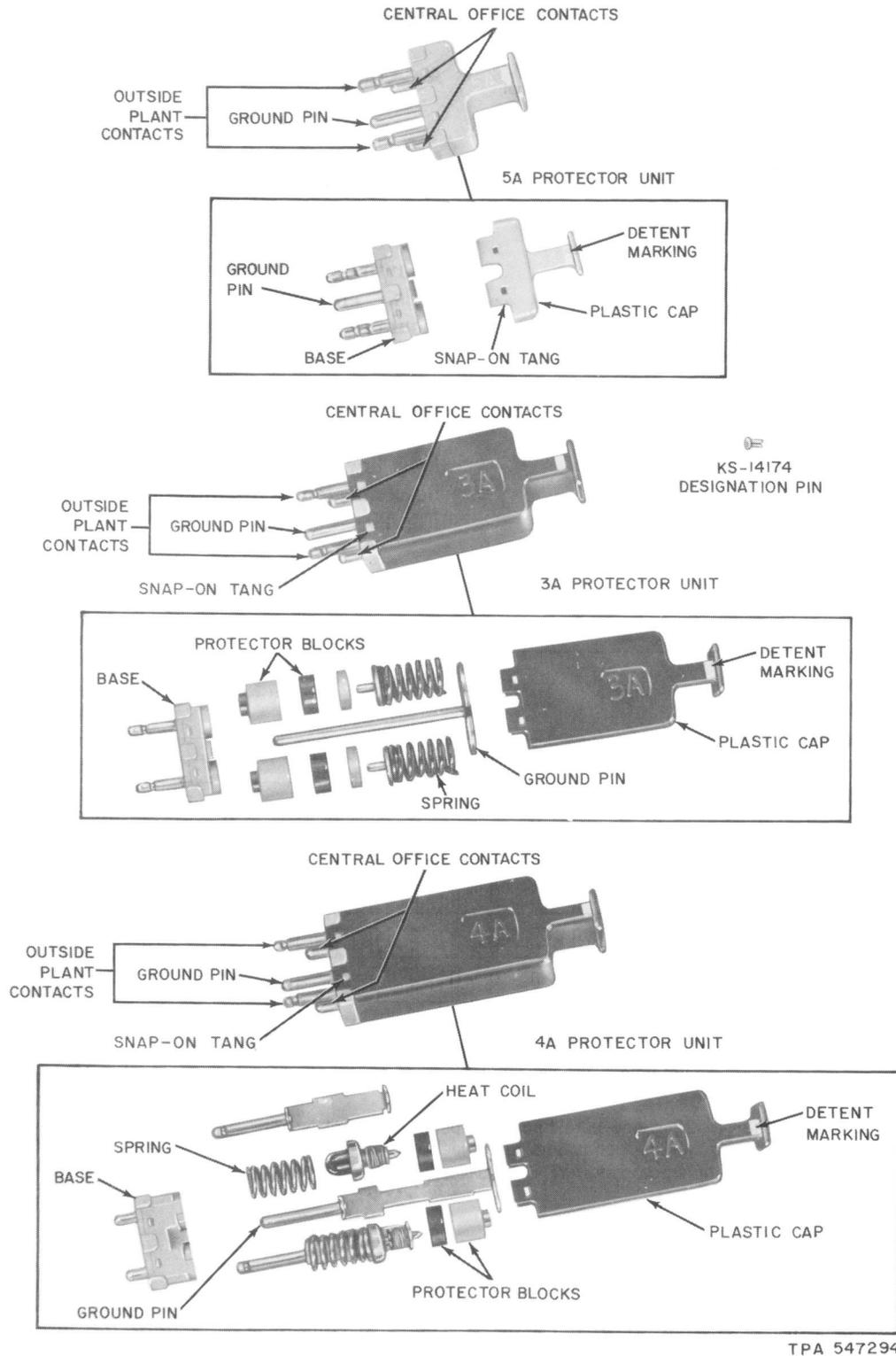


Fig. 12—Protector Units and Designation Pin (for 303-Type Connector)

from existing jumpers, the fibre may be applied in pieces 7 inches wide to fit between the horizontal members of the supporting framework. In either

case the fibre will be held in place by the straps which should be run with approximately 1/2-inch slack.

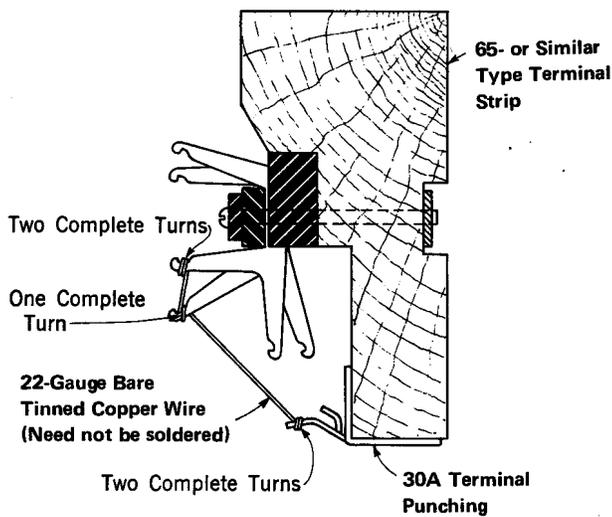


Fig. 13

WORKING CONDUCTORS—LOOPE

A. Class P to Class P

6.23 All class P conductors looping through an office shall be protected, as shown in Fig. 22, 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.

6.24 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. 23.

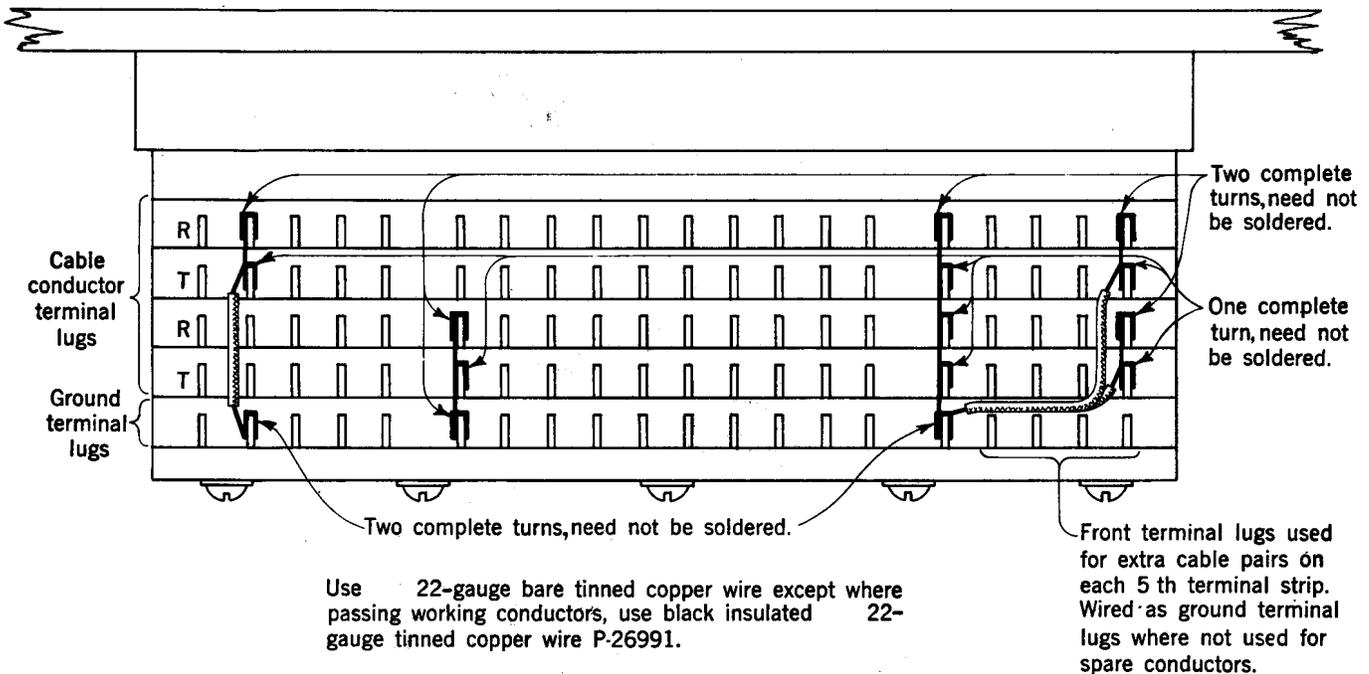


Fig. 14

6.25 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. 15. 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. 16.

B. Class P to Class NP

6.26 A circuit composed of class P and class NP conductors looping through an office shall

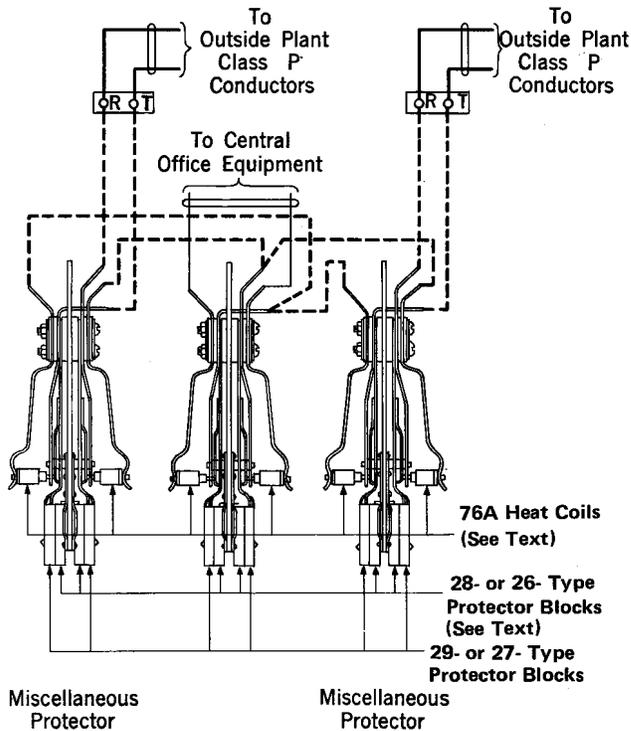


Fig. 15

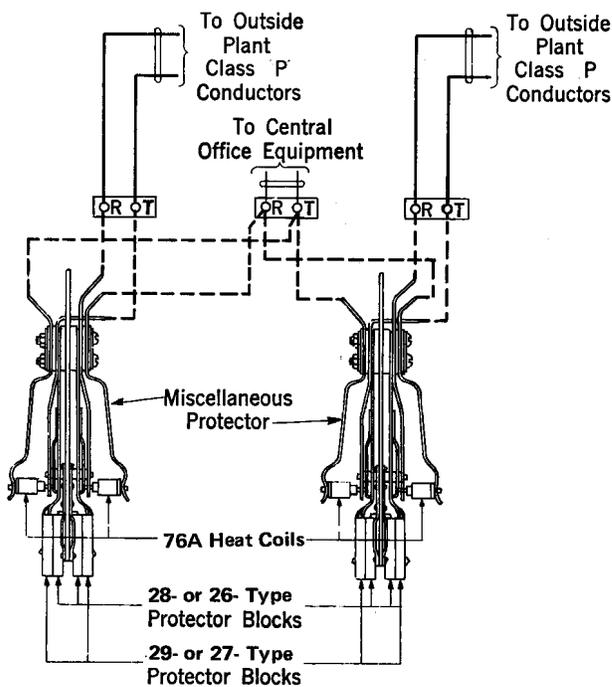


Fig. 16

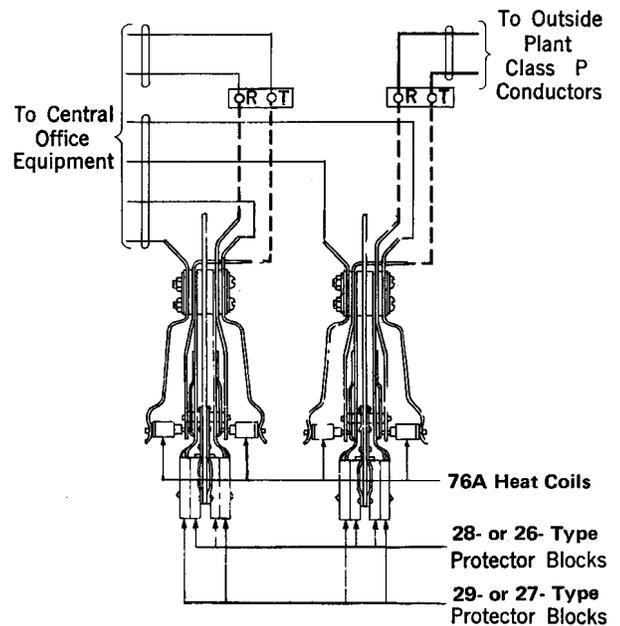


Fig. 17

be connected and protection provided as shown in Fig. 24.

6.27 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 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 ordinarily 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. 26.

6.28 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. 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 bridged circuit terminates on terminal strips, protection shall be provided as shown in Fig. 28.

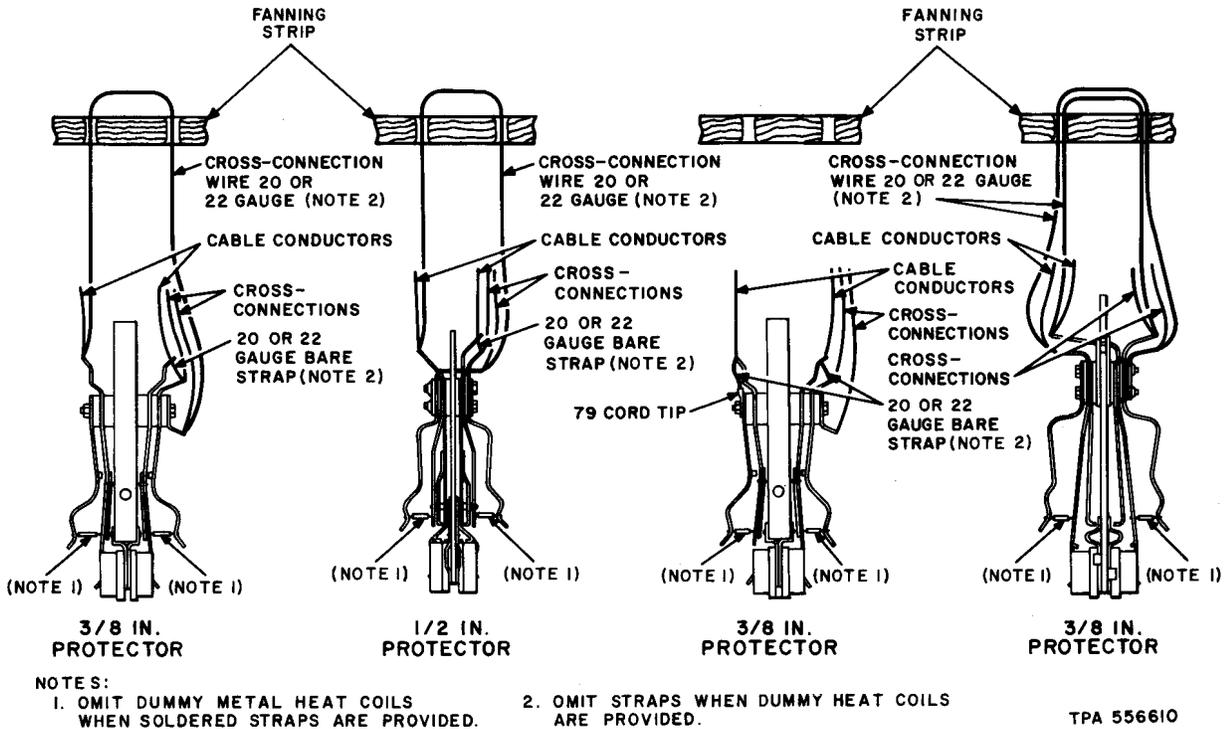


Fig. 18

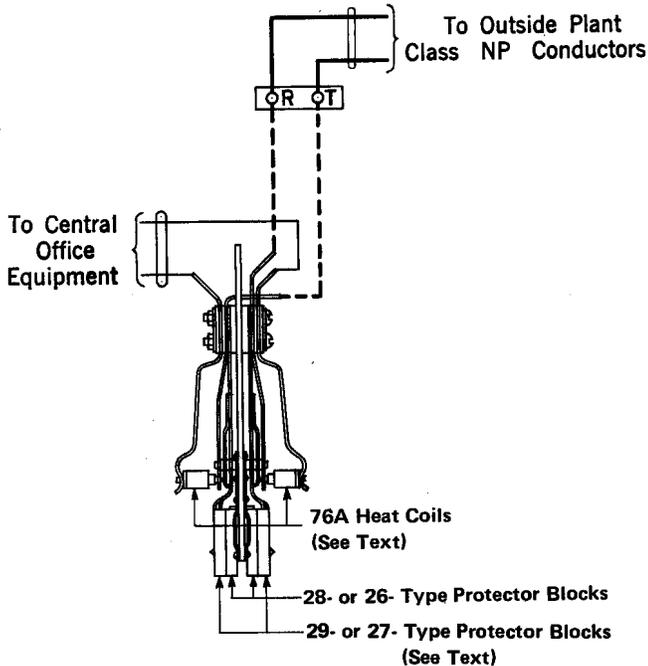


Fig. 19

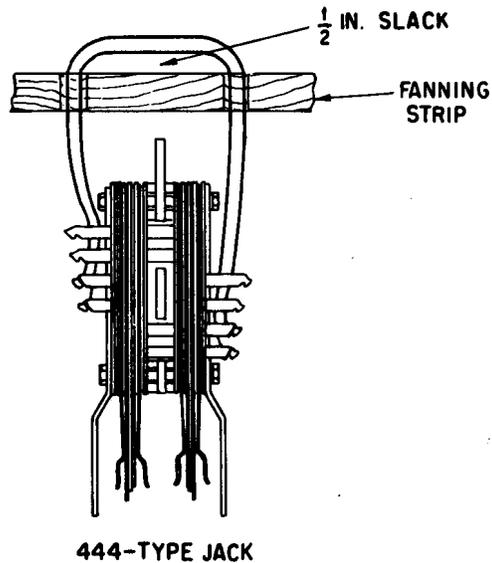


Fig. 20

C. Class NP to Class NP

6.29 Class NP interoffice conductors looped through an office shall be cross-connected

as shown in Fig. 29 unless facilities are desired for opening the line, in which case a protector shall be provided as shown in Fig. 30. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 18) provided conductors of all one class are connected to protectors in groups. This shall not be done when conductors

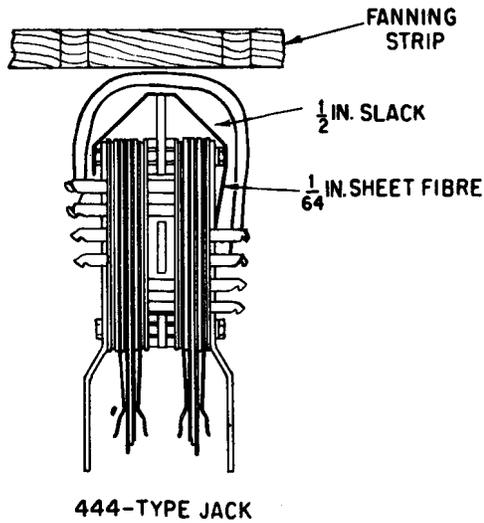


Fig. 21

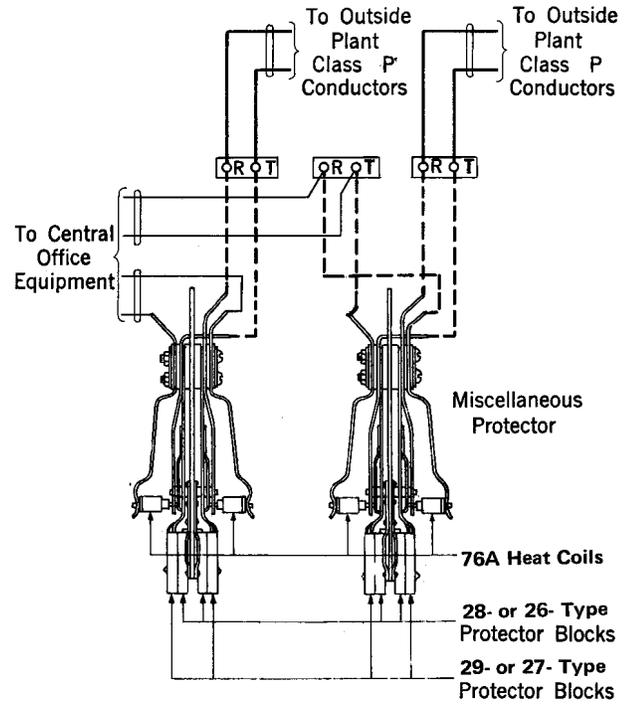


Fig. 23

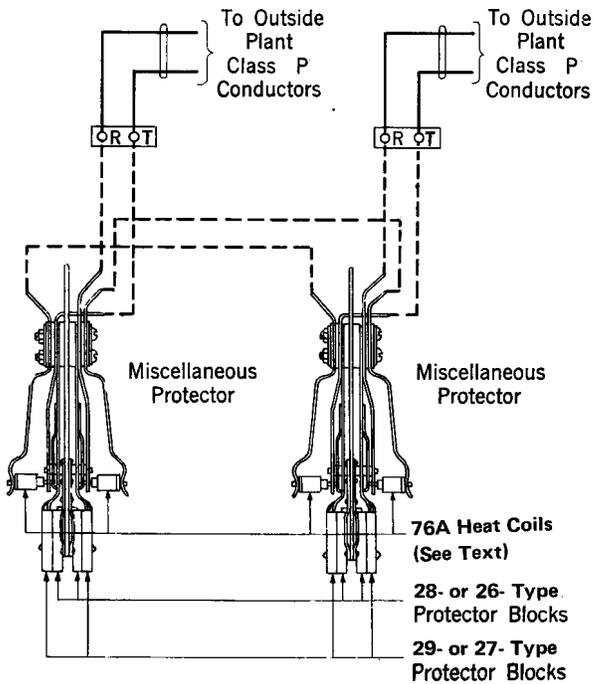


Fig. 22

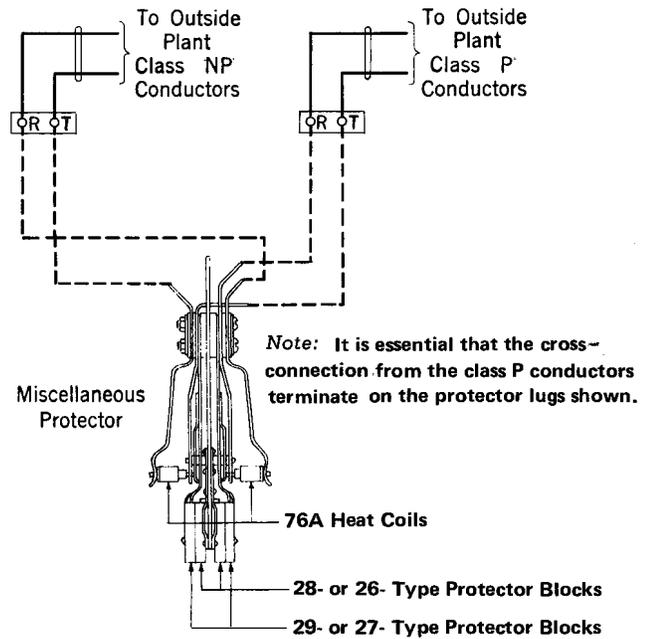


Fig. 24

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.

6.30 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. 31 where protectors are permanently connected to the auxiliary circuit or where facilities are desired for opening

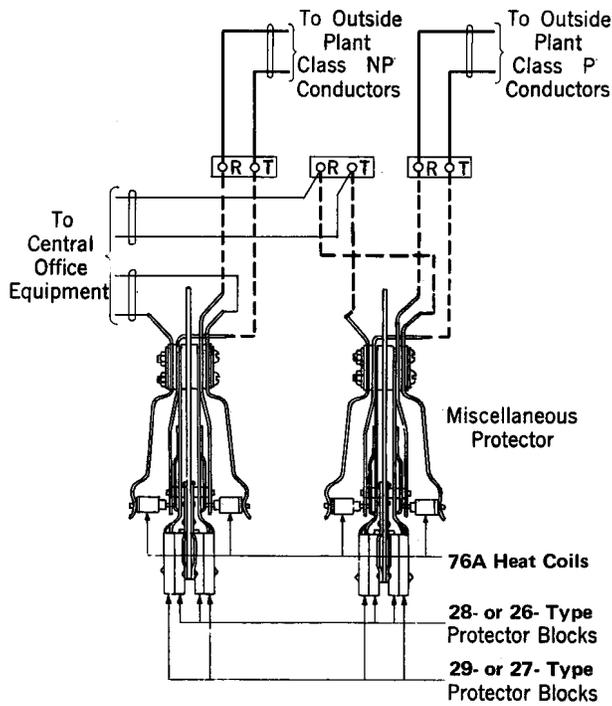


Fig. 25

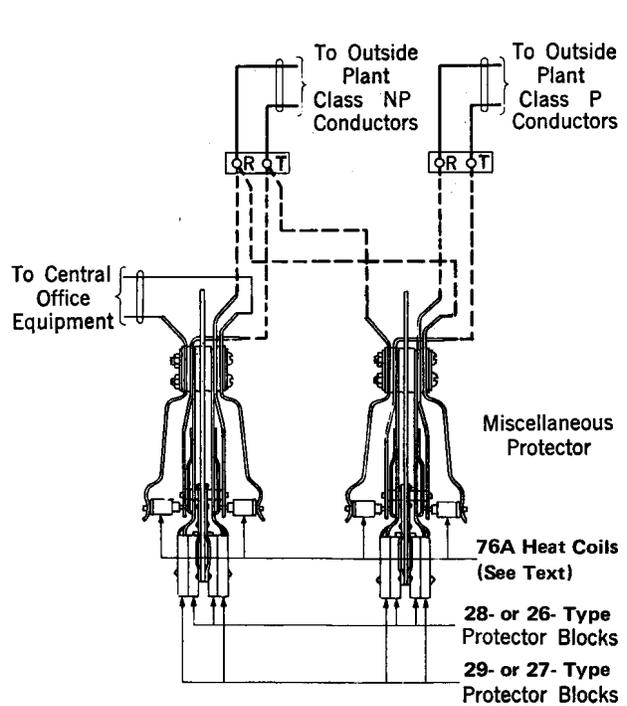


Fig. 27

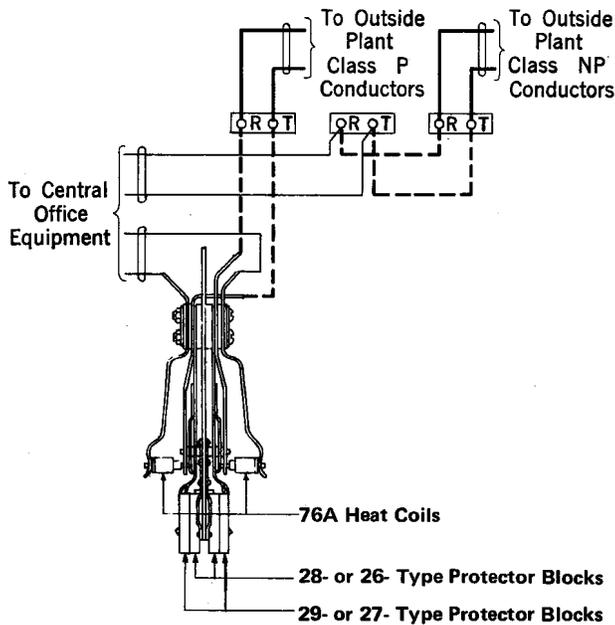


Fig. 26

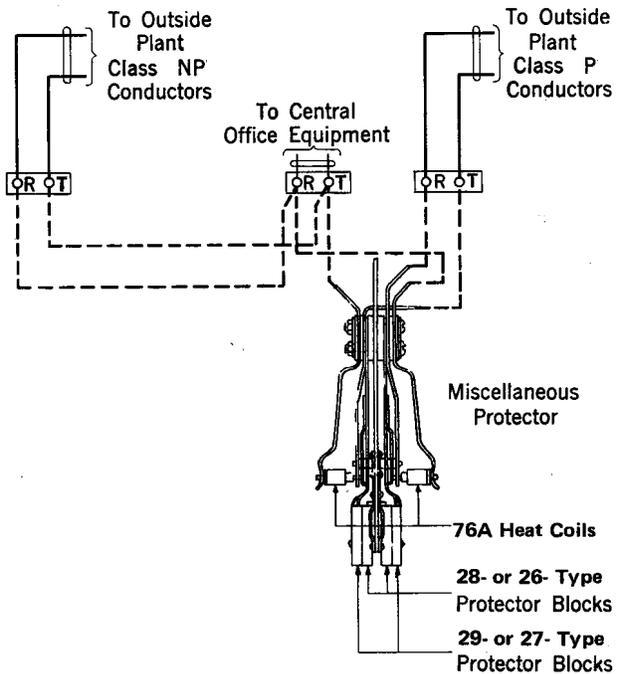


Fig. 28

the line. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 18) 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 at this may lead to the use of dummy equipment or straps on circuits requiring heat coil or protector block protection.

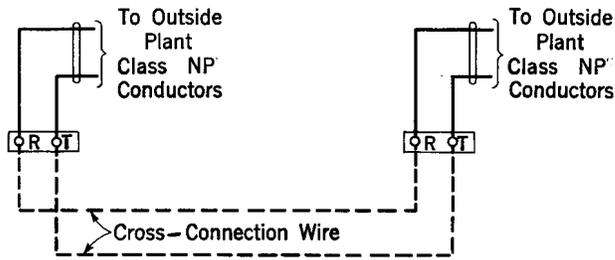


Fig. 29

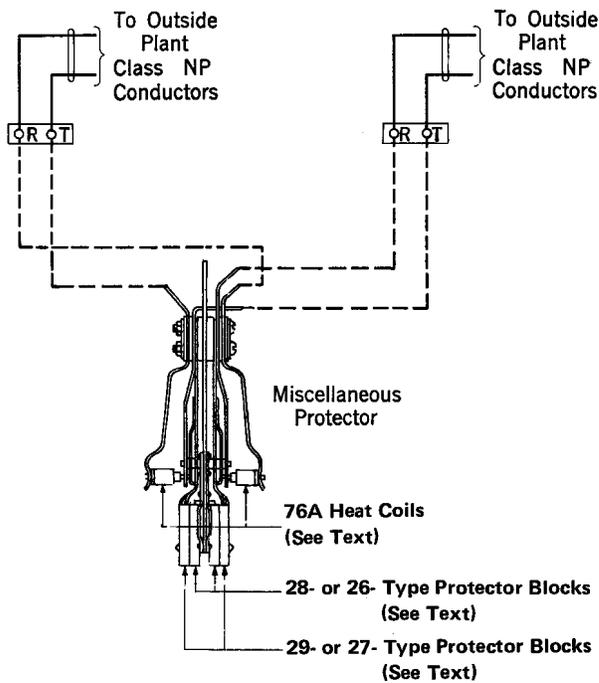


Fig. 30

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. 32.

6.31 Where it is necessary to bridge cable conductors looping through an office, connection shall be made and protection provided as shown in Fig. 33 where the central office circuit terminates on protectors. Dummy protector blocks and dummy heat coils or soldered straps may be used (Fig. 18) 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

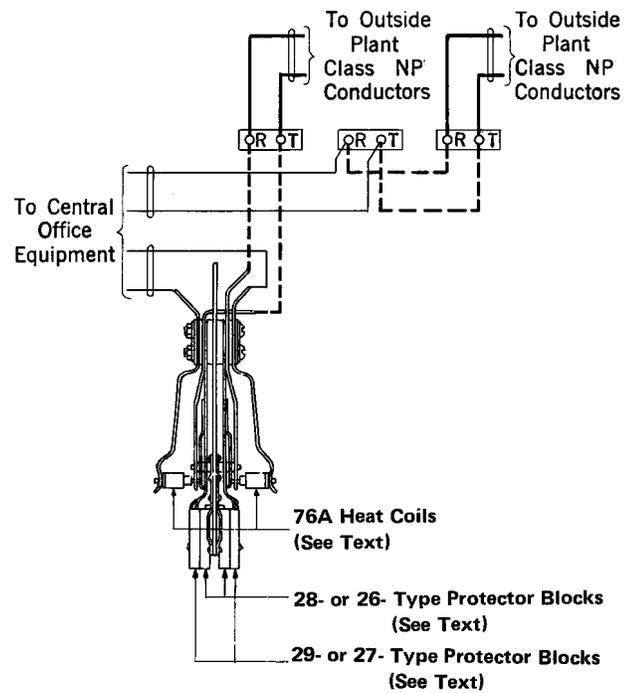


Fig. 31

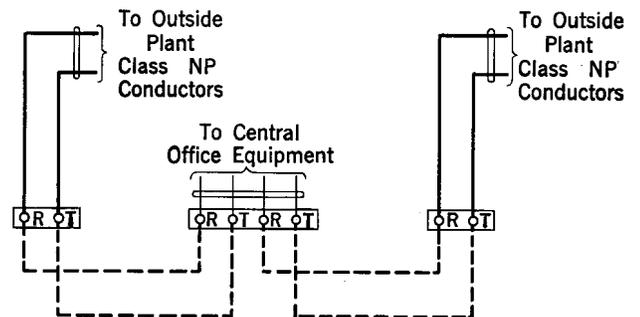


Fig. 32

to the use of dummy equipment or straps on circuits requiring heat coil or protector block protection.

6.32 Where the central office circuit terminates on a terminal strip, cross-connections shall be made as shown in Fig. 34.

D. Class TP to Class NP

6.33 A circuit composed of class TP and class NP conductors looping through an office shall be connected and protection provided as shown in Fig. 35.

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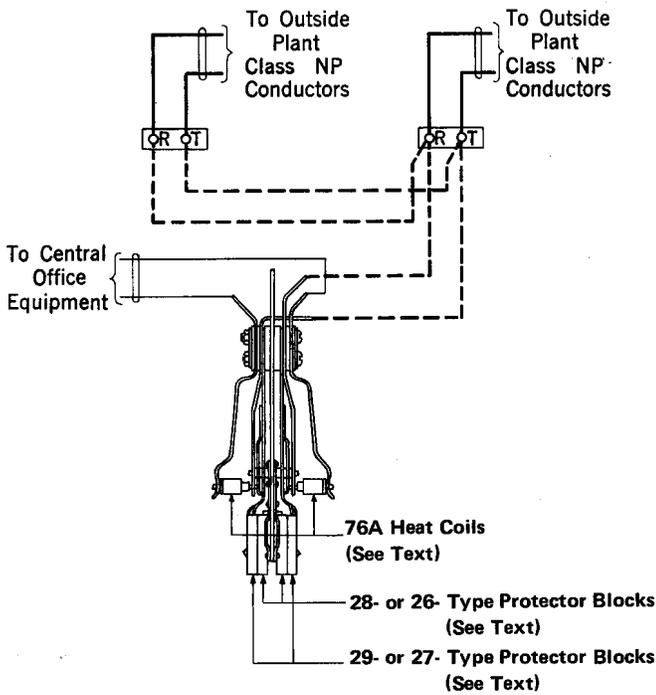


Fig. 33

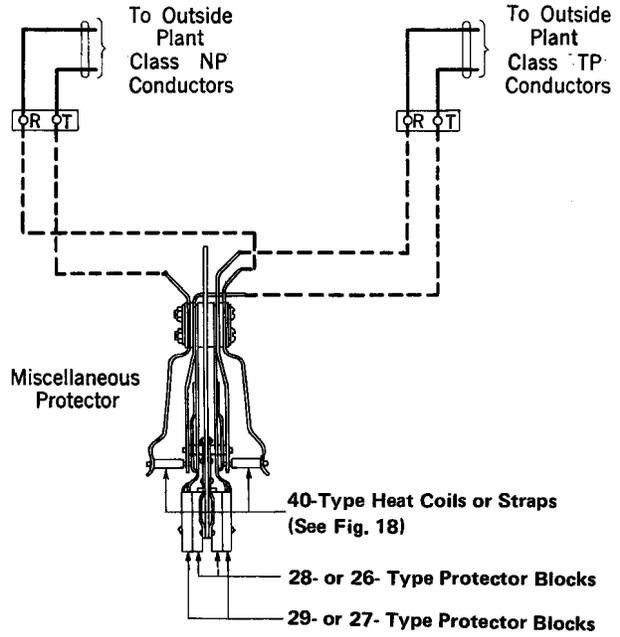


Fig. 35

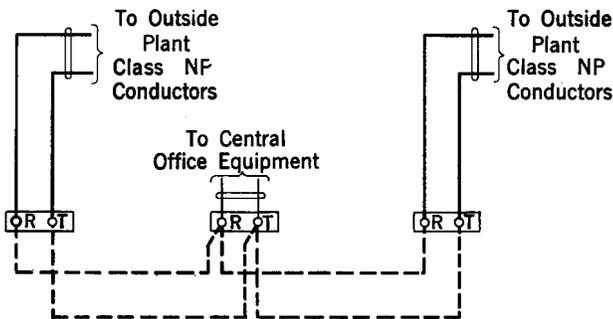


Fig. 34

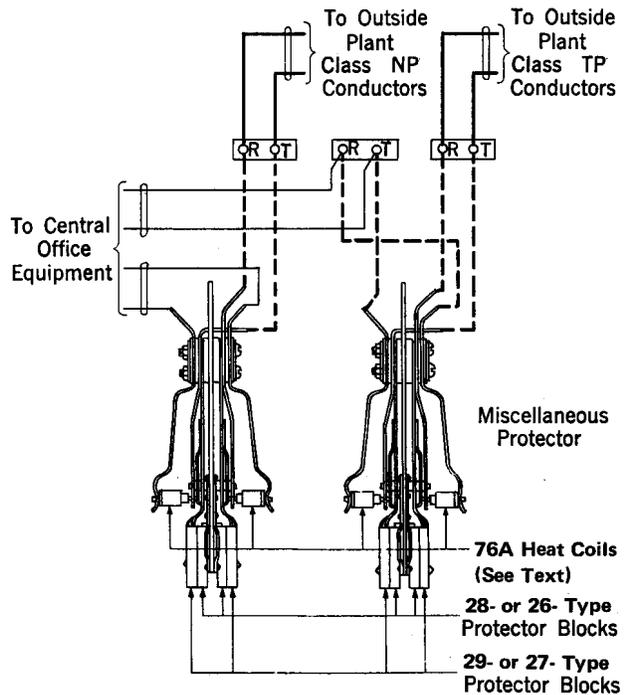


Fig. 36

6.34 Where it is necessary to connect through a central office circuit, the conductors shall be connected and protection provided as shown in Fig. 36 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. 37. 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. 18) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

6.35 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. 38. Where the circuit terminates on terminal strips,

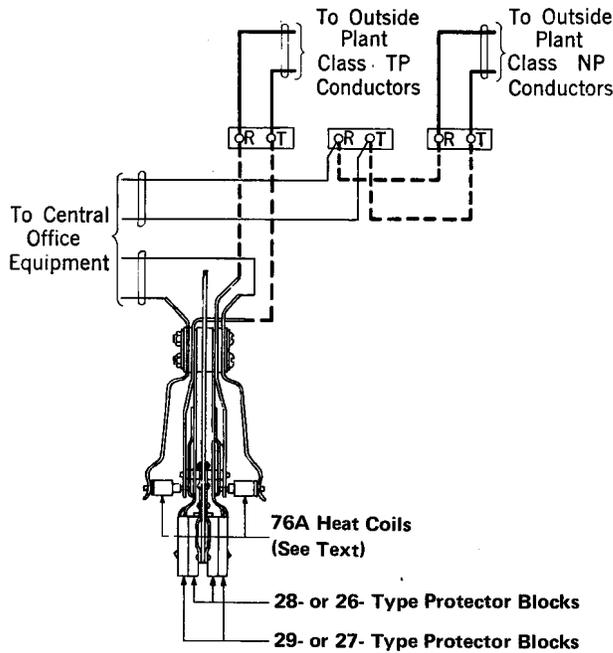


Fig. 37

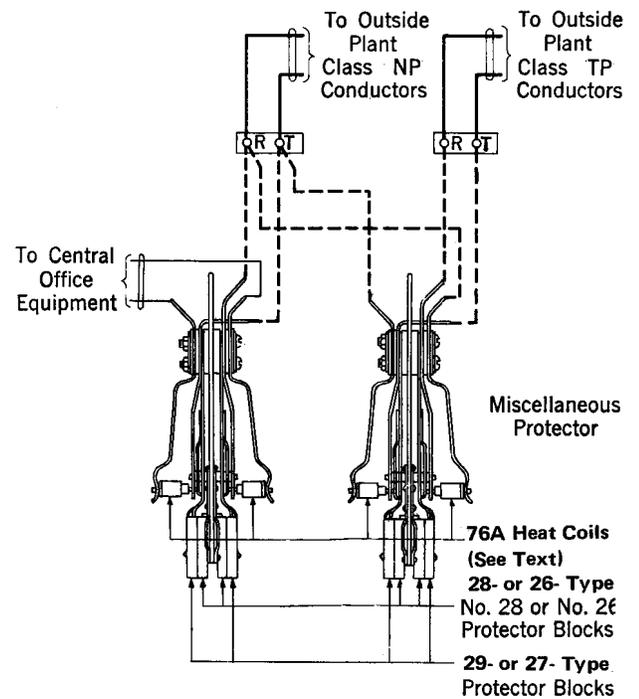


Fig. 38

protection shall be provided as shown in Fig. 39. In either case the protector associated with the central office equipment should ordinarily be equipped with dummy metal heat coils or soldered straps (Fig. 18) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

E. Class TP to Class TP

6.36 All class TP conductors looping through an office shall be protected as shown in Fig. 40 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. 18). The equipment terminals of the protector mountings shall be cross-connected together.

6.37 Where it is necessary to connect through a central office circuit, the conductors shall be connected and protection provided as shown in Fig. 41. The protectors should ordinarily be equipped with dummy metal coils or soldered straps (Fig. 18) except where this might lead to accidentally omitting heat coils from adjacent class P conductors.

6.38 Where it is necessary to bridge cable conductors looping through an office and where the bridged circuit is cabled to protectors,

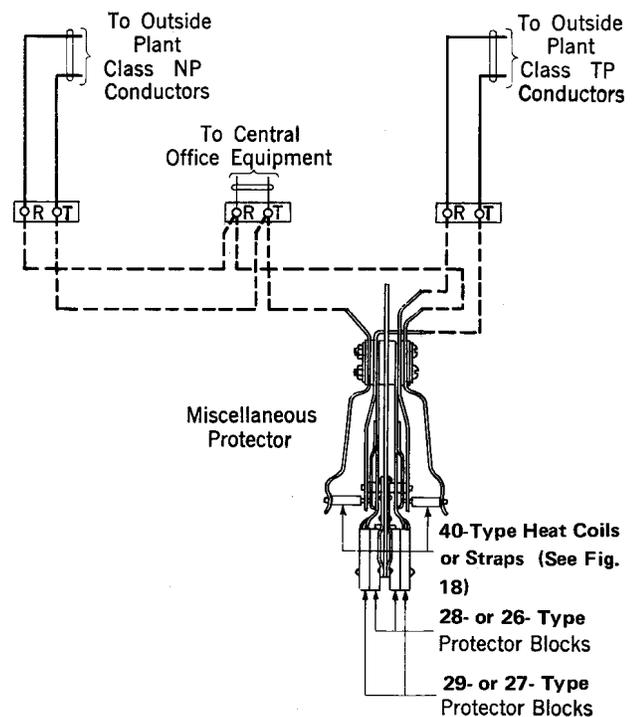


Fig. 39

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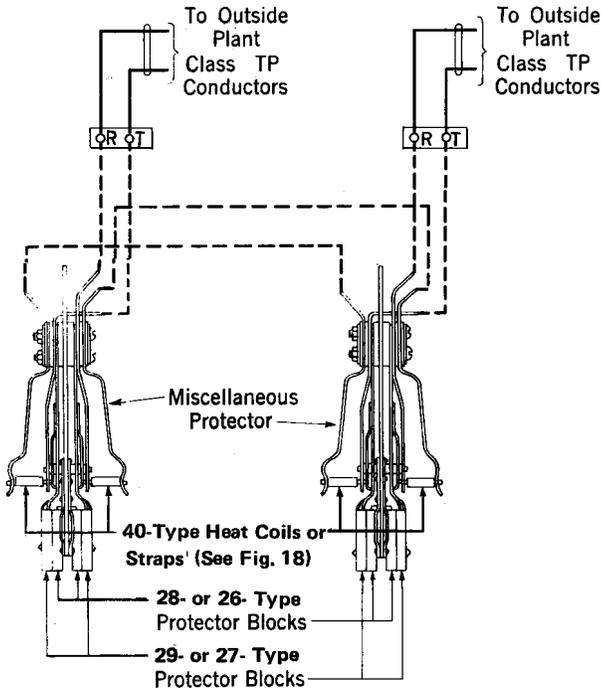


Fig. 40

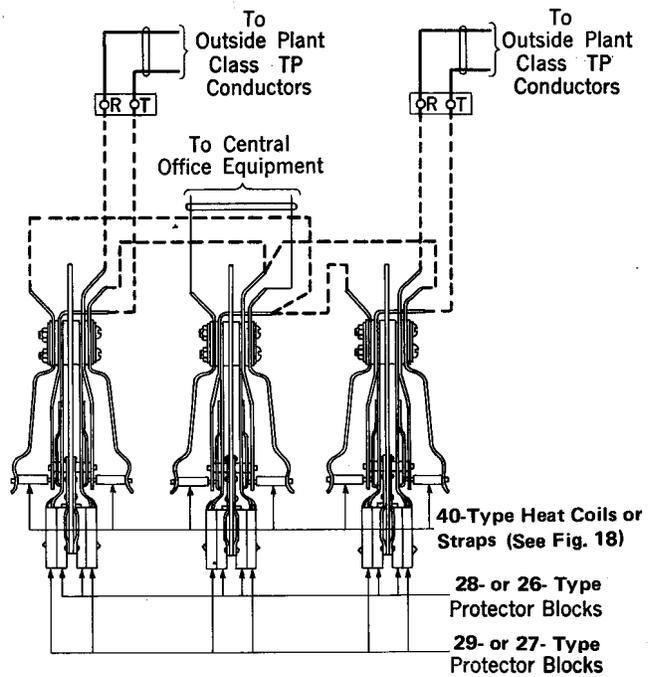


Fig. 42

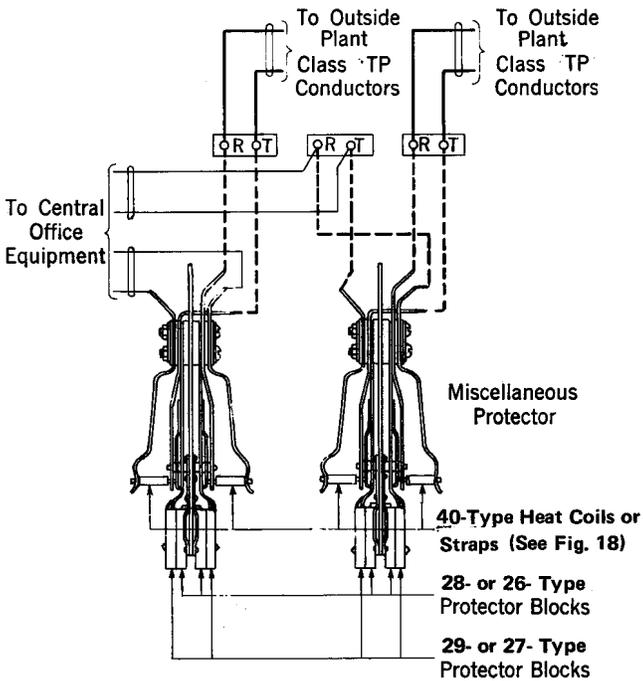


Fig. 41

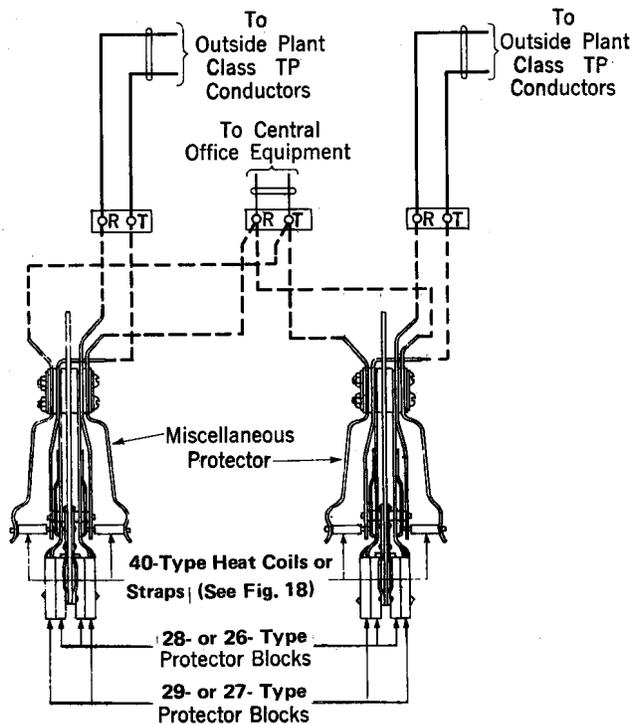


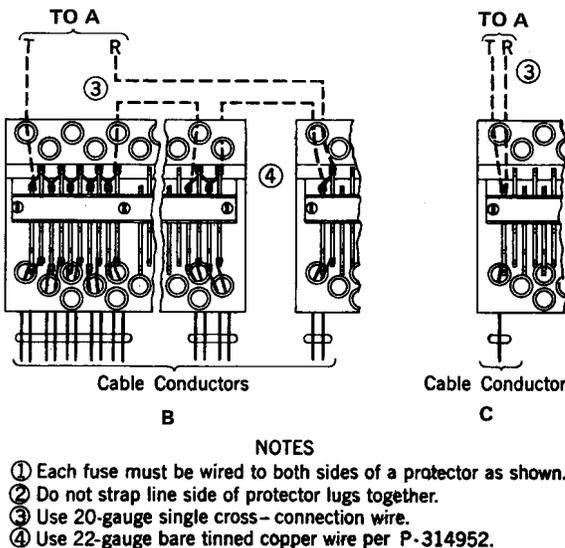
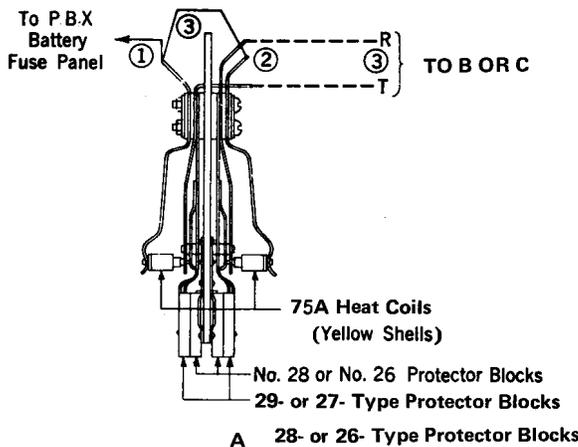
Fig. 43

protection shall be provided as shown in Fig. 42. Where the circuit terminates on terminal strips, protection shall be provided as shown in Fig. 43.

7. BATTERY FEEDERS ON A-TYPE FRAMES

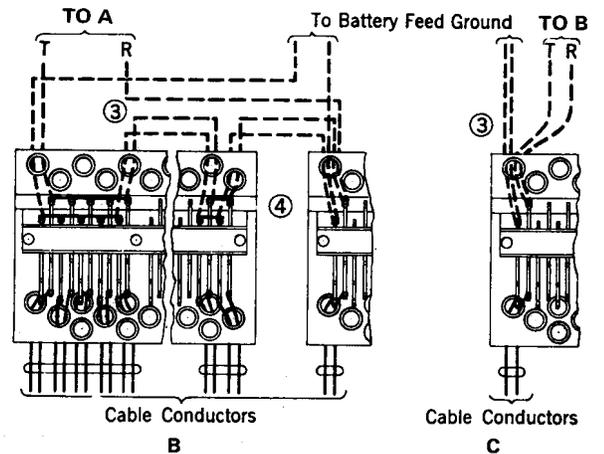
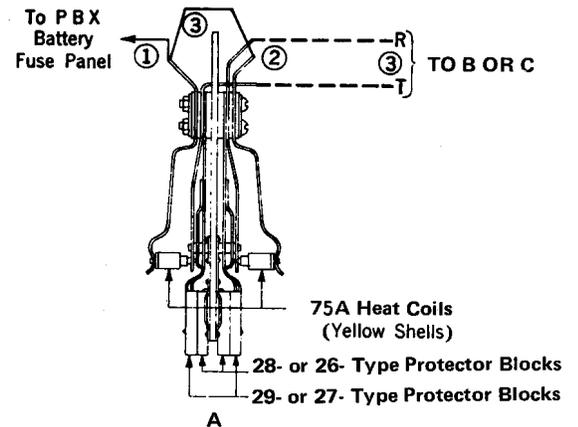
7.01 Both the metallic return and ground return feeder arrangements are covered herein. To minimize noise effects on PBX stations and to prevent possible electrolysis damage to lead sheath cables or underground pipes, the ground return feeder arrangement shall not be used when additions or changes in 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. 44 for ground return battery feeders and as shown in Fig. 45 for metallic return battery feeders (7.01)



- 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. 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. 45

7.03 The arrangements shown in Fig. 44 and 45 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. 44A). The central office equipment springs of protectors used for battery supply shall be connected together as shown in Fig. 44A. 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. 44B). 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. 44C).

Note: One 20-gauge paired cross-connection may be substituted for the two 20-gauge single cross-connections specified above 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 in the office.

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 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. 45A). The central office equipment springs of protectors used for battery supply shall be connected together as shown in Fig. 45A. Where more than one cable pair is used, all of the ring conductors shall be strapped together and one of the cross-connection wires from the protector shall be connected to the terminal at one end of this strap and the other cross-connection wire shall be connected to the other end of the strap, thus forming a loop from the two terminals of the protector (Fig. 45B). The battery feed ground shall be connected to the tip cable conductors in like manner with the exception 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 cable pair and the two cross-connection wires connected to the battery feed ground shall be connected to the tip terminal (Fig 45C).

Note: One 20-gauge paired cross-connection may be substituted for the two 20-gauge single cross-connections specified above 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 in the office.

8. RINGING SUPPLY ARRANGEMENTS ON A-TYPE FRAMES

8.01 Cross-connecting and multiplying arrangements for PBX and station ringing supply feeders are covered on SD-90231-01.

8.02 Table B 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 Test trunks from the test desk to the main frame within an office, plugging-up lines in dial offices terminating at the main frame, and service observing lines which are arranged for connection to subscriber lines by plugging in at the main frame protectors shall be protected by using heat coils and dummy protector blocks.

10. CONDUCTORS ON B-TYPE FRAMES

PROTECTOR MOUNTINGS C-, E-, AND SIMILAR TYPES

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 provided with protector units equipped as listed in Table C.

B. Working Conductors

10.03 Working conductors are provided with protector units equipped as listed in Table C.

C. Conductors Requiring Drainage Coil 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

TABLE B

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 of 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.

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.

(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 201-203-102.

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 Protector units associated with spare conductors shall be in the open position;

TABLE C

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	<i>Customer Lines</i> Protector Blocks and Heat Coils*	<i>Working Lines</i> Dummy Protector Blocks, Metal Dummy Heat Coils, or Soldered Straps (Note 2)	<i>Working Lines</i> Protector Blocks, Metal Dummy Heat Coils, or Soldered Straps (Note 2)
	<i>Battery Feeders</i> Protector Blocks and Yellow 75A Heat Coils*		
	<i>Special Lines (Note 3)</i> Protector Blocks, Heat Coils*, Guards KS-14539 or Equiva- lent, Terminal Punching Insulators, Indicators KS-6660 or Equivalent (Note 4)	<i>Special Lines (Note 3)</i> Dummy Protector Blocks, Metal Dummy Heat Coils or Soldered Straps (Note 2), Terminal Punching Insulators, Indicators KS-6660 or Equivalent, Guards KS-14539 or Equiva- lent (Note 4)	<i>Special Lines (Note 3)</i> Protector Blocks, Metal Dummy Heat Coils or Soldered Straps (Note 2), Terminal Punching Insulators, Indicators KS-6660 or Equivalent, Guards KS-14539 or Equiva- lent (Note 4)
	<i>Denied Lines</i> Protector Blocks Insulating Dummy Heat Coils*		

*The heat coils will be specified locally.

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 069-120-801.
4. A description of apparatus provided for guarding against service interruptions is covered in Section 201-203-102.

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 D.

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 D.

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

- (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- and 303-TYPE CONNECTORS

Note: Piece-part numbers for the colored protector unit covers, designation pins, etc, as specified in the following paragraphs for use on 302- and 303-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 E.

B. Working Conductors

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

TABLE D

300-TYPE CONNECTORS

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

*The heat coils will be specified locally.

Notes:

1. Procedures for the protection of special lines against service interruptions are covered in Section 069-120-801.
2. A description of apparatus provided for guarding against service interruptions is covered in Section 201-203-102.
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.

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