

**TYPES OF PROTECTION
DESCRIPTION**

"COSMIC*" I MAIN DISTRIBUTING FRAME SYSTEM

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9. DESIGNATION PINS	5	1.01 This section covers the types of protection re- quired for ♦COSMIC I main distributing frames.♦	
10. REFERENCES	5	1.02 The reasons for reissuing this section are listed below. Revision arrows are used to de- note the more significant changes. Equipment Test Lists are not affected.	
Figures		(1) Change title to COSMIC I Main Distributing Frame System Types of Protection	
1. Modular Protector Frame (ED-1A220-31)	6	(2) Change references of COSMIC to COSMIC I	
2. High Density Modular Protector Frame (ED- 97898-31)	7	(3) Add high density modular protector frame (ED-97898-31) to paragraph 4.01 and Fig. 2	
3. 302-Type-1 Connector (With Protector Units Installed)	8		
4. 308-Type-1 Connector (Without Protector Units)	9		

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- (4) Add new Fig. 5 and 6 and renumber succeeding figures.
- (5) Change Table B to Table A and change title to Class of Protection and Protectors.
- (6) Add new Table B titled Protector Units.
- (7) Add 308-type connector to paragraphs 5.03, 5.04, 5.05, 5.06, and 5.07 and Fig. 4.
- (8) Add current protection requirements for various types of circuits and also exceptions to these requirements (paragraphs 6.03, 6.04 and 6.05).
- (9) Add descriptions of 3B-, 4B-type and 4C-type protectors which replace 3A- and 4A-type [paragraphs 7.01, (a), and (b), (c), and (d) (Fig. 7, 8, and 9).]
- (10) Add description and uses of designation pin (paragraph 9.01, Table B and Fig. 4).
- (11) Add list of related BSP references.

2. PROTECTION CONSIDERATIONS

2.01 The purpose of central office protection is to ensure the safety of telephone plant personnel and to reduce the possibility and extent of equipment damage in the event that foreign potentials or currents come in contact with outside plant.

2.02 In considering the type of protection 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**. ♦Generally all aerial plant is considered **exposed**.♦

(b) **Unexposed Plant:** Telephone plant that is not subject to possible contact with an electric

cal 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: ♦(See Table A.)♦

- **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.

3.02 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. ♦PROTECTOR FRAMES (PF)♦

4.01 Three basic types of protector frames (PF) are used for COSMIC I main distributing frame installations. The modular PF (ED-1A220-31) mounts 302-type-1 connectors **only** (Fig. 1). The high

density modular PF (ED-97898-31) mounts 308-type-1 connectors **only** (Fig. 2). The low profile double-sided protector frame (LPDSPF), ED-97755-71 mounts 308-type-2 connectors only. Both of the modular PFs consist of twelve verticals for mounting connectors. The LPDSPF consists of six verticals for mounting connectors. The ED-1A220-31 PF will accept five 302-type-1 connectors per vertical. Each 302-type-1 connector will protect 100 pairs with a capacity of 500 pairs per vertical or 6000 pairs per module. The ED-97898-31 PF will accept eight 308-type-1 connectors per vertical. Each 308-type-1 connector will protect 100 pairs with a capacity of 800 pairs per vertical or 9600 pairs per module. The ED-97755-71 PF will accept sixteen 308-type-2 connectors per vertical. Each 308-type-2 connector will protect 100 pairs with a capacity of 1600 pairs per vertical or 9600 pairs per module.

5. CONNECTORS

5.01 Protector units with either solder-plated (manufactured discontinued) or gold-plated pins can be used on 302-type connector with solder-plated terminals (manufacture discontinued). Care should be taken however **not to use** protectors with solder-plated pins on 302-, or 308-type connectors that have gold-plated terminals.

Note: Solder - plated terminals were superseded by gold plated terminals because of a potentially high resistance electrical path which causes service degradation.

5.02 302-Type-1 Connector: 302-type-1 connectors (Fig. 3) used on the modular PF can be ordered with or without a 100 pair stub cable. This stub cable is available in 22 or 24 gauge size and is ordered in lengths of 30, 50, 80, 100, 150, or 200 feet.

5.03 The 302-type-1 connectors are equipped with 5-pin female, grip-type terminals to accept protector units. The four tip and ring line terminals are either gold or solder-plated, depending on the vintage of the connector ordered. Solder - plating is manufacture discontinued and has been replaced by gold. The ground terminal which, is always solder-plated, serves for protector unit orienting.

5.04 308-Type-1 Connectors: 308-type-1 connectors (Fig. 4) are used on the high density modular PF and can be obtained with or without a 100-pair stub cable of either 22- or 24-gauge size. The

stub cable length must be specified when ordering and is available in 30, 50, 80, 100, 150, and 200 feet lengths.

5.05 The 308-type-1 connectors are equipped with 5-pin female, grip-type terminals to accept protector units. The four tip and ring line terminals are always gold-plated. The ground terminal which is solder-plated, also serves for protector unit orienting.♦

5.06 308-Type-2 Connectors: 308-type-2 connectors (Fig. 5 and 6) are used on the LPDSPF and can be obtained with or without a 100-pair stub cable of either 22- or 24-gauge cable in lengths of 30, 50, 80, 100, 150 or 200 feet. This connector has a hinged mounting bracket which attaches to the vertical member of the LPDSPF. The bracket has two quick-release one-quarter turn fasteners which allow the connector panel to hing open for the connection of equipment cables.

5.07 The 308-type-2 connectors are equipped with 5-pin female, grip-type terminals to accept protector units. The four tip and ring line terminals are gold-plated. The ground terminal, which is solder-plated, also serves for protector unit orienting.♦

6. VOLTAGE AND CURRENT PROTECTION

A. Voltage Protection

6.01 Voltage Protection is provided ♦for each conductor by the use of a pair of carbon protector blocks with an accurately spaced separation between them.♦ One of the blocks is connected to the protector unit ground pin and the other to the conductor being protected. When the voltage exceeds 500 volts, the conductor will be grounded by arcing across the ♦3 mil separation♦ between the carbon protector blocks. If a heavy current flows ♦between the carbon blocks, the protector unit will operate and♦ become permanently grounded. Protector units with carbon blocks are required on **all exposed** circuits and may also be used on unexposed subscriber loop circuits to provide plant flexibility. ♦For longer life and higher reliability, protector units using gas tubes instead of carbon blocks may be used.♦

B. Current Protection

6.02 Current Protection is provided by the use of heat coils which protect the telephone

equipment against external currents with voltage too low to arc across the protector blocks or currents too low to fuse the protective cable but 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 in the protector unit. ♦A heat coil consists of a metal sleeve within which a metal pin is soldered with a low melting temperature solder. A coil of wire in series with the conductor to be protected is wrapped around the sleeve. Excessive current flowing in the coil of wire raises the temperature of the solder above its melting point. A spring then causes relative motion between the sleeve and the pin operating a mechanism to ground the conductor. The excessive currents then flow directly to ground and not through the control office equipment.♦

6.03 ♦Normally, circuits that use **exposed** cable pairs require heat coils for **sneak current** protection. These include subscriber loop pairs, subscriber loop carrier system pairs, and T-carrier system pairs. No current protection is required for toll circuit pairs, toll carrier system pairs, and subscriber "loop through" pairs. However, for ease of administration, when the quantity of toll circuit/carrier pairs on a connector is small in comparison to the subscriber pairs, the connector is fully equipped with heat coil protectors.

6.04 Toll circuit/carrier pairs do not require heat coil current protection because their repeat coil terminations are not subject to overheating from **sneak currents**. Subscriber "loop through" pairs do not require heat coil current protection because there is no equipment at the "loop through" office to protect.

6.05 ♦Protector units that provide sneak current protection also provide voltage protection as described in paragraph 6.01♦

7. PROTECTOR UNITS

7.01 Protector units for ♦COSMIC I♦ main distributing frame equipment ♦(Table B)♦ consists of the elements necessary to provide the required level of protection packaged in a plug-in unit ♦(Fig. 7).♦ See ♦Table A♦ for class of protection and protector units used. The types of protector units are as follows:

(a) ♦**5A-Type Protector Unit:** The 5A protector unit (Fig. 7) contains neither heat coils nor

carbon protector blocks and provides no protection (**class NP**). It is a dummy unit which is used to complete tip and ring continuity between outside plant and central office equipment. The 5A2D protector unit, however, is used to deny service and the 5A9D is used to reverse the line tip and ring.

(b) **3B-Type Protector Unit:** The 3B protector unit (Fig. 7) is a direct replacement for the 3A-type. This protector contains either two pairs of carbon blocks or two gas tubes to provide voltage protection only (class TP) for the tip and ring conductors.

(c) **4B-Type Protector Unit:** The 4B protector unit (Fig. 7) is a direct replacement for the 4A-type. This unit contains either two pairs of carbon blocks or two gas tubes and provides **current** and **voltage** protection (class P) for the tip and ring conductors. 4B-type protector units are also used to provide additional features. The 4B9C protector (Fig. 8) is used for **line reversing**. The 4B11C protector unit (Fig. 9) is used to provide **bridge lifter** features.♦

(d) **4C-Type Protector Unit:** ♦The 4C protector unit may be equipped with two gas tubes instead of two pair of carbon blocks. These gas tube units provide longer life and reliability than those using carbon blocks.♦

7.02 When the protector units are fully inserted into the connector, the outside plant and central office equipment are connected and protection is provided. Ground, for protection purposes, is provided for the heat coils and carbon blocks through the ground pin of the protector unit. The ground pin is connected to a bus bar. The bus bars are grounded by the mounting screws securing the connector to the protector frame.

7.03 When the protector unit is pulled out to the detent position, the central office equipment is disconnected to isolate outside cable pairs for testing purposes and to deny service. In this position, ♦voltage♦ protection is still provided on the outside ♦plant♦ cable pair ♦(except for the 5A-type protector unit). Use of the detent position is used only to deny service temporarily. If service is to be denied for any length of time, a denied service protector unit (green housing) should be installed.♦ Pulling the protector unit out completely will remove all protection ♦and open the circuit.♦

7.04 When the protector units are inserted into the connector panel, they provide the following contact for one pair:

- (a) Tip and ring to outside plant conductor (long pins)
- (b) Tip and ring to central office equipment (short pins)
- (c) Ground, which also serves as an orienting pin (center pin).

8. SPECIAL SERVICE PROTECTION

8.01 Special lines with high priority require special service protection. Protector units are color coded according to the type of service they serve as shown in Table A. Colored designation pins are inserted into the connector (Fig. 4) beneath the protector unit in all but standard service applications to designate the color of the housing protector to be used. 20A circuit guards (Fig. 10) are used to prevent accidental removal of special service circuit protector units.

8.02 The 20A circuit guard is a brass cross-shaped metal guard designed to prevent accidental removal of the protector units from the 302, 308-type connector. It is used on protector units serving circuits requiring special service protection or special safeguarding measures. Its design permits use on 3B-, 4B-, or 5A-type protectors. When the 20A circuit guard is installed, use of the designation pin is discontinued for the affected circuit.

9. DESIGNATION PINS

9.01 The color of the protector unit housing identifies the type of circuit application. In addition, a KS-14174 designation pin, having the same color as the protector unit housing, except black, marks the particular terminal group that is associated with the circuit. Table B shows the various, KS-14174 designation pin, list numbers, color, and the corresponding protector unit. The 308-type connector terminal field location for the designation pin is shown in Fig. 4. The 302-type connector location is exactly the same. The local office specifies when designation pins are to be used.

10. REFERENCES

10.01 The following Bell System Practices contain related information.

201-208-100	3-, 4-, 5-Type Protector Units, Description
201-208-101	302-, and 308-Type Connectors, Description
201-219-101	Protector Frames, Description
201-222-101	COSMIC I Main Distributing Frame System - Description.
201-222-103	Common Systems Main Inter-Connecting Frame (COSMIC), Warning Markers and Guards

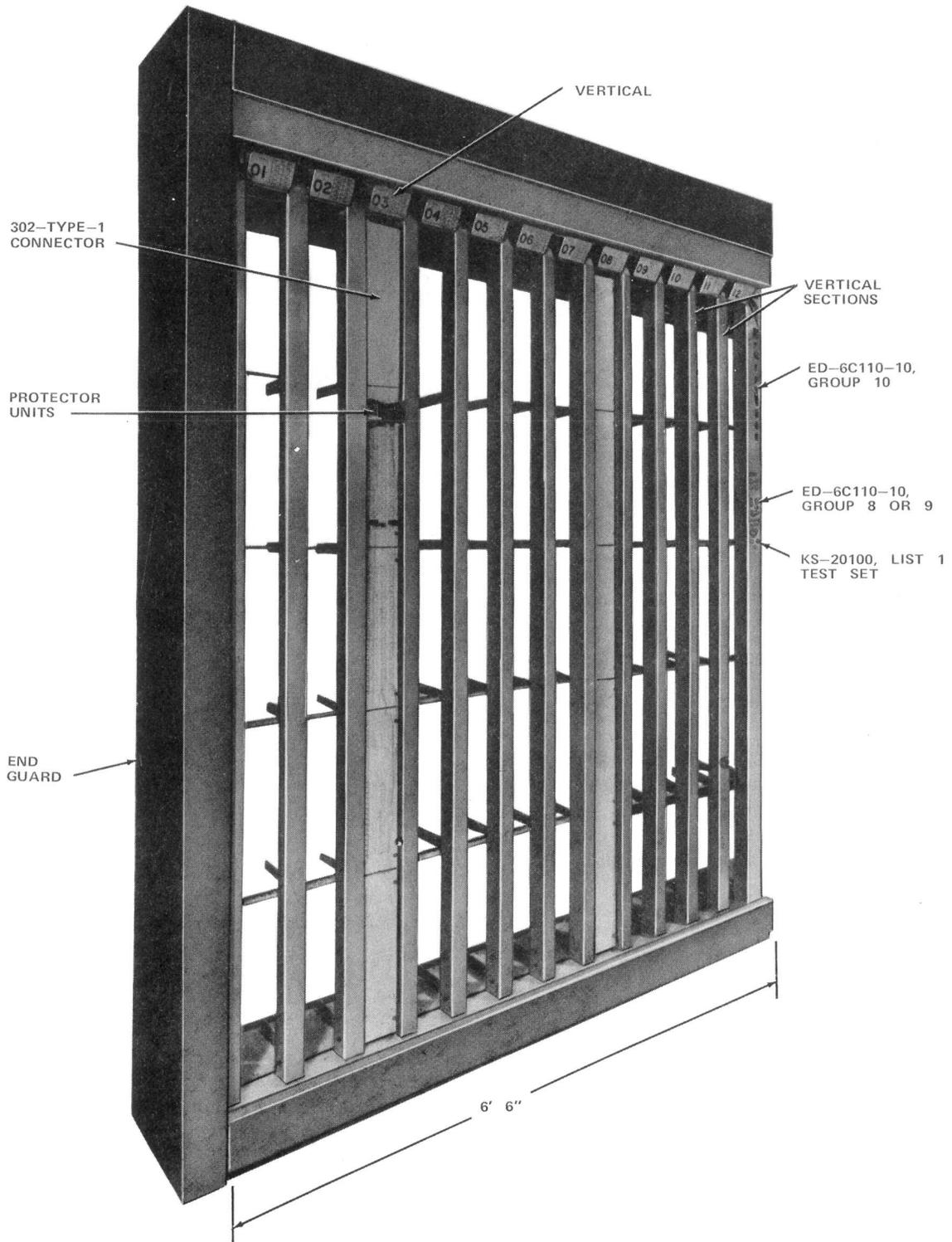


Fig. 1—Modular Protector Frame (ED-1A220-31)

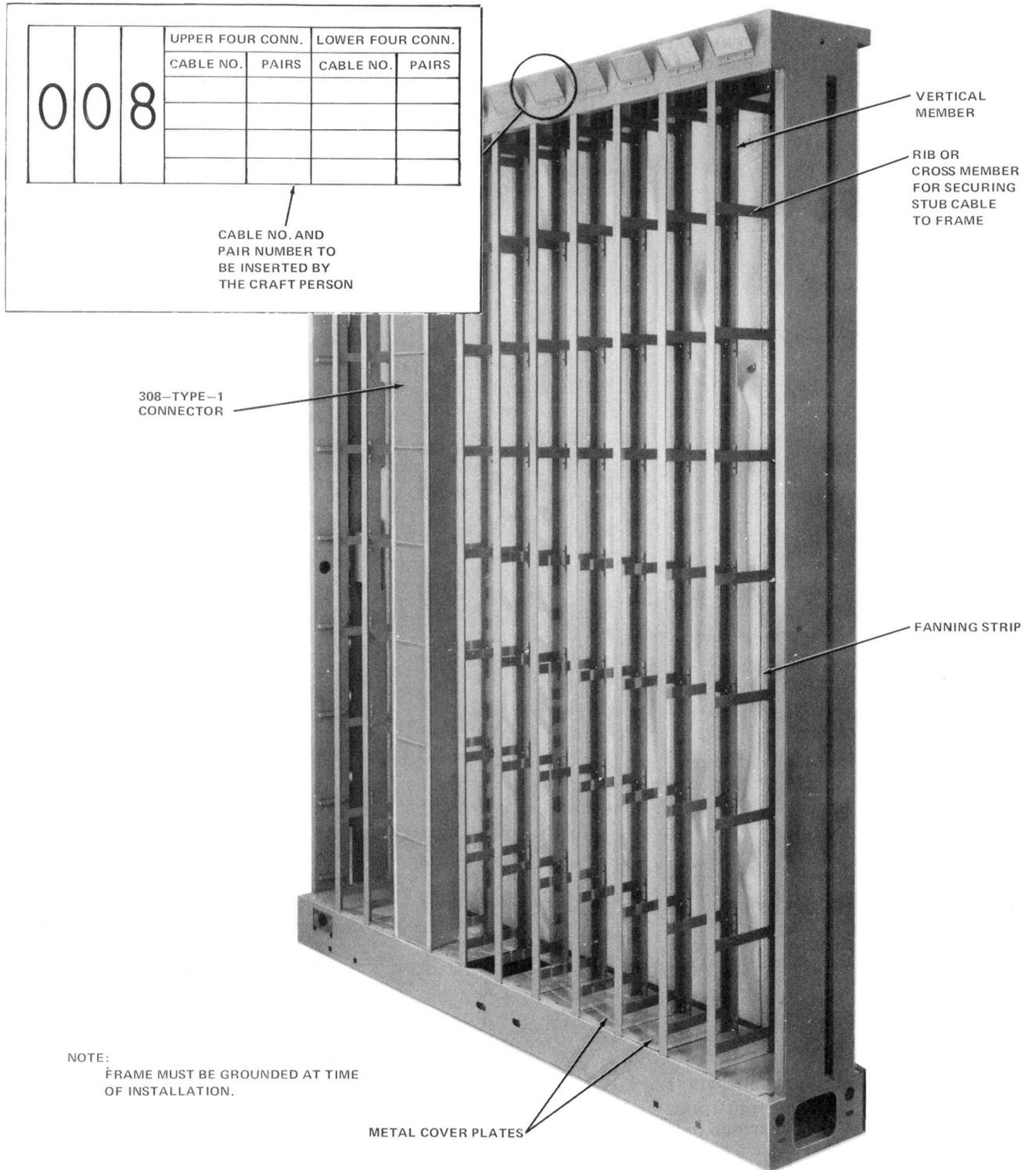


Fig. 2—High Density Modular Protector Frame (ED-97898-31)

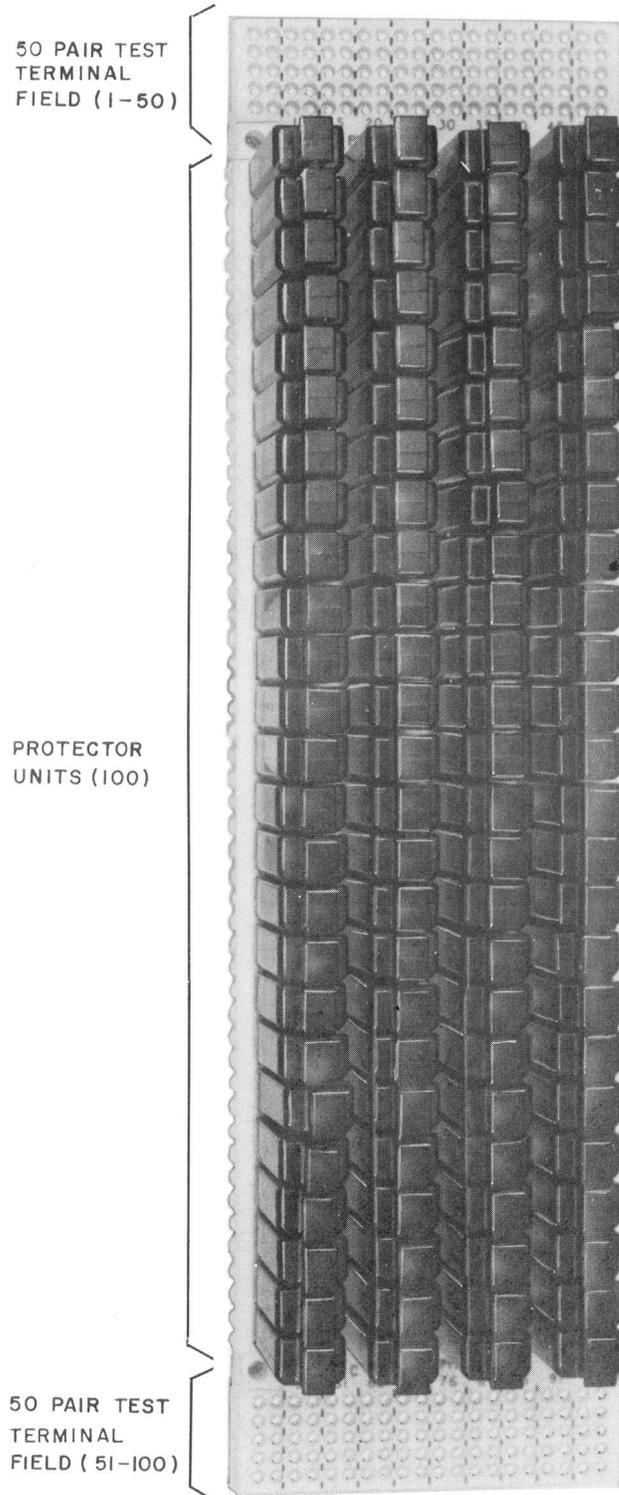
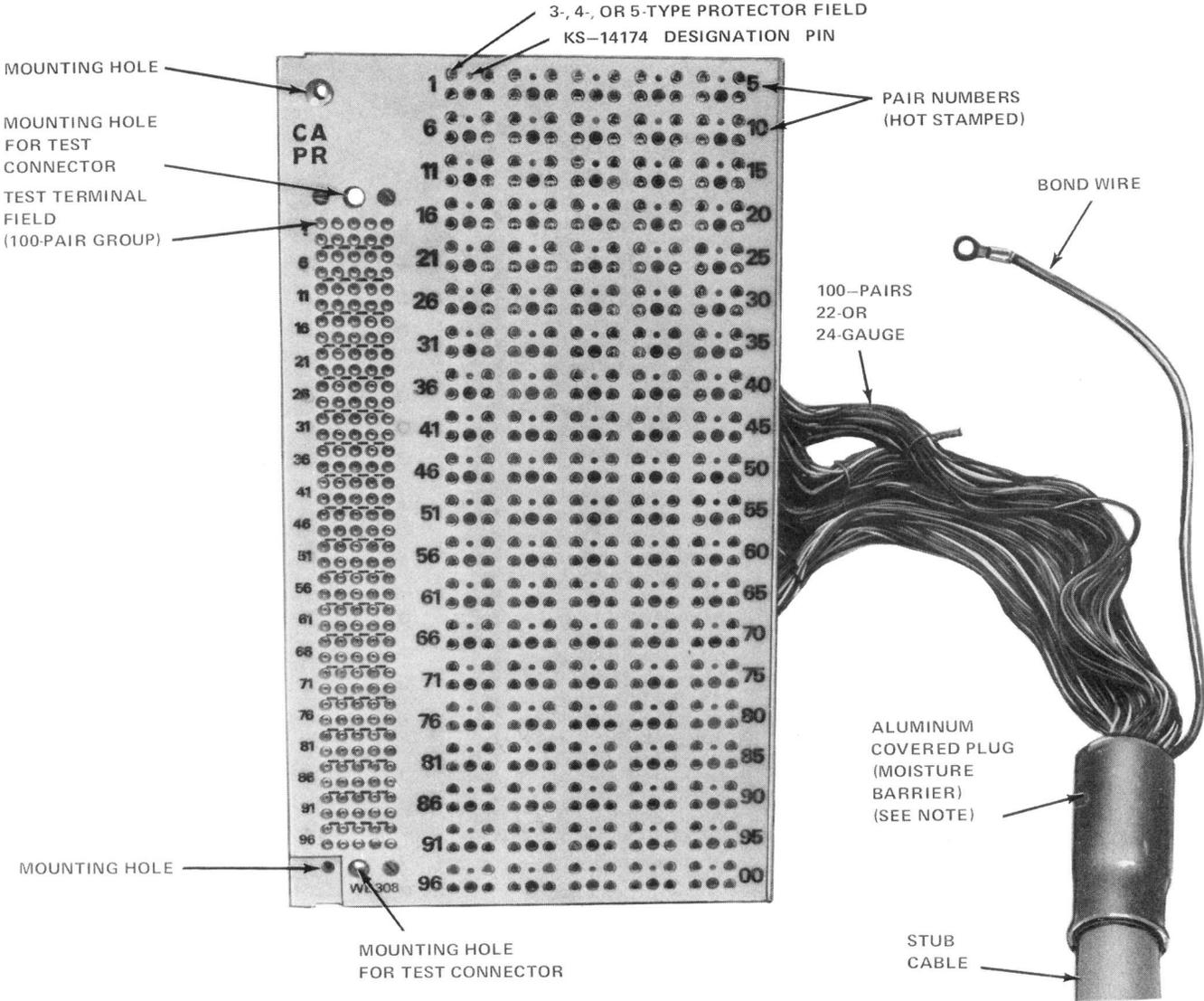


Fig. 3—302-Type-1 Connector (With Protector Units Installed)



NOTE:
FACTORY-INSTALLED PLUG PREVENTS MOISTURE FROM ENTERING THE CO SPLICE DUE TO "BREATHING" ACTION OF CABLE DURING CHANGES IN TEMPERATURE.

Fig. 4—308-Type-1 Connector (Without Protector Units)

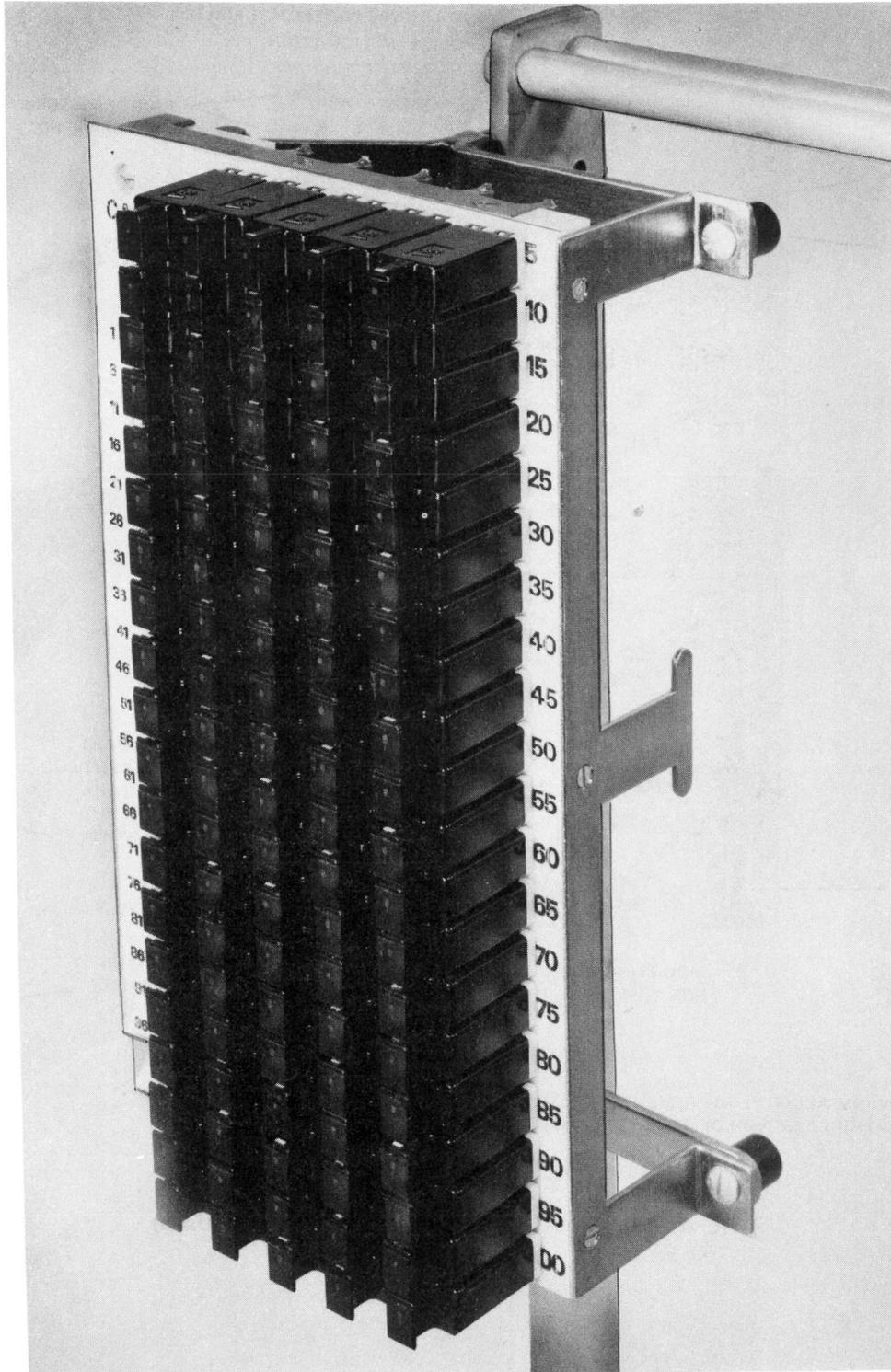


Fig. 5—308-Type-2 Connector

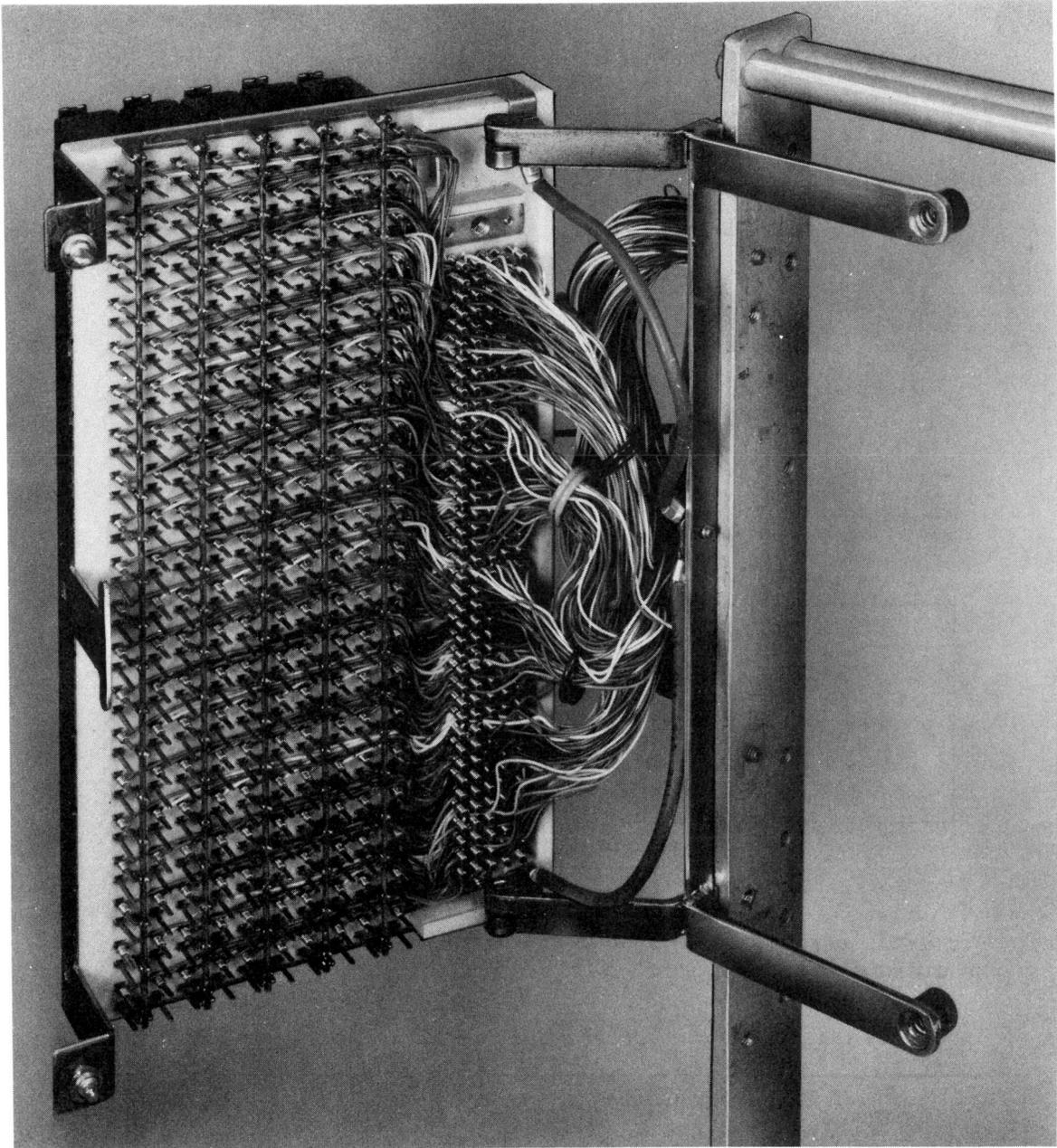
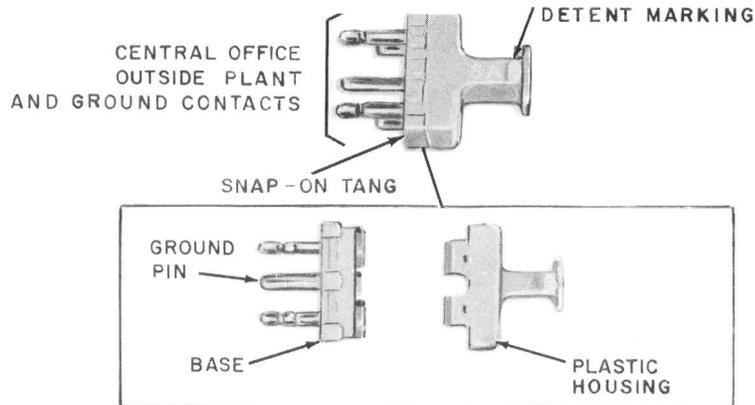
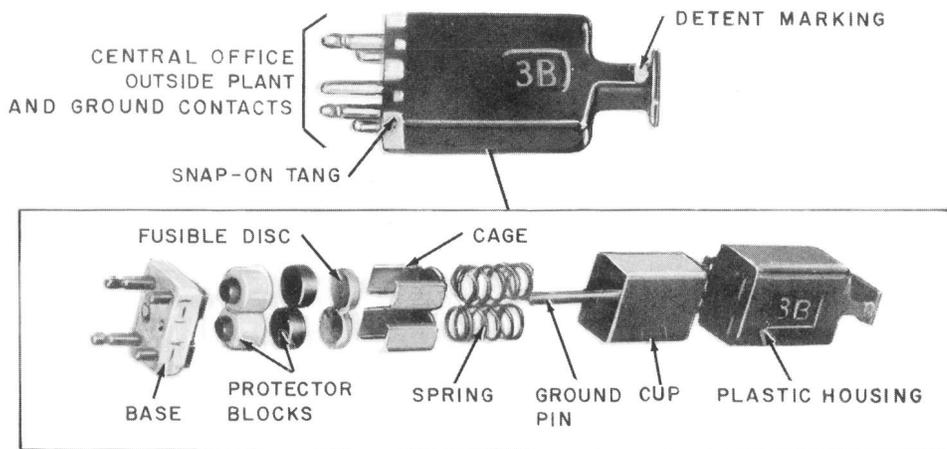


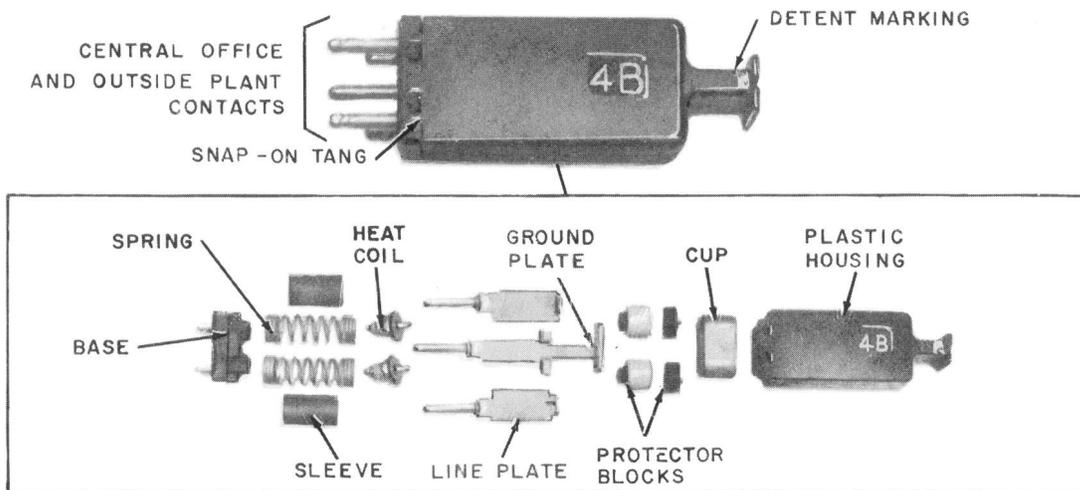
Fig. 6—308-Type-2 Connector—Opened on Hinges



A. 5A-TYPE PROTECTOR UNIT



B. 3B-TYPE PROTECTOR UNIT



C. 4B-TYPE PROTECTOR UNIT

Fig. 7—Protector Units

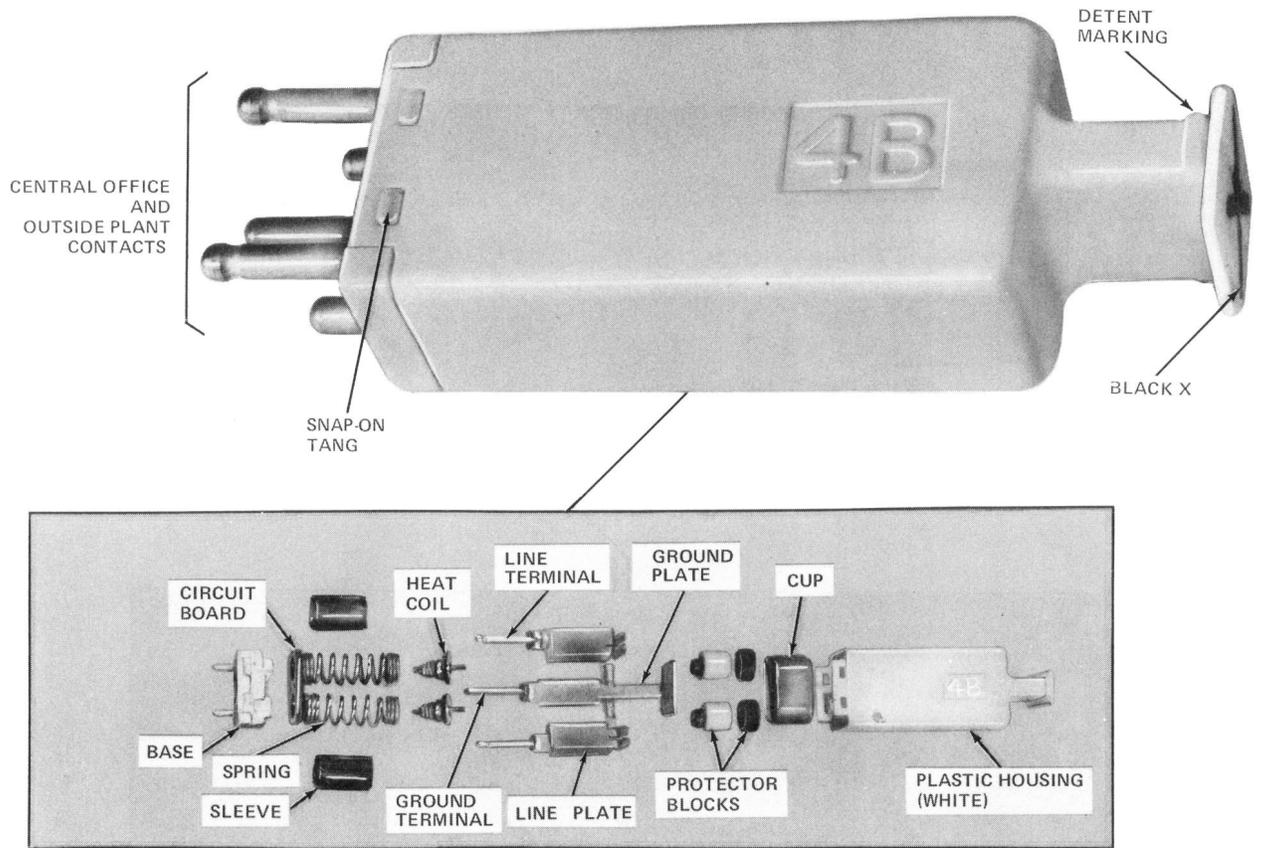


Fig. 8—4B9C Protector Unit (Line Reversing)

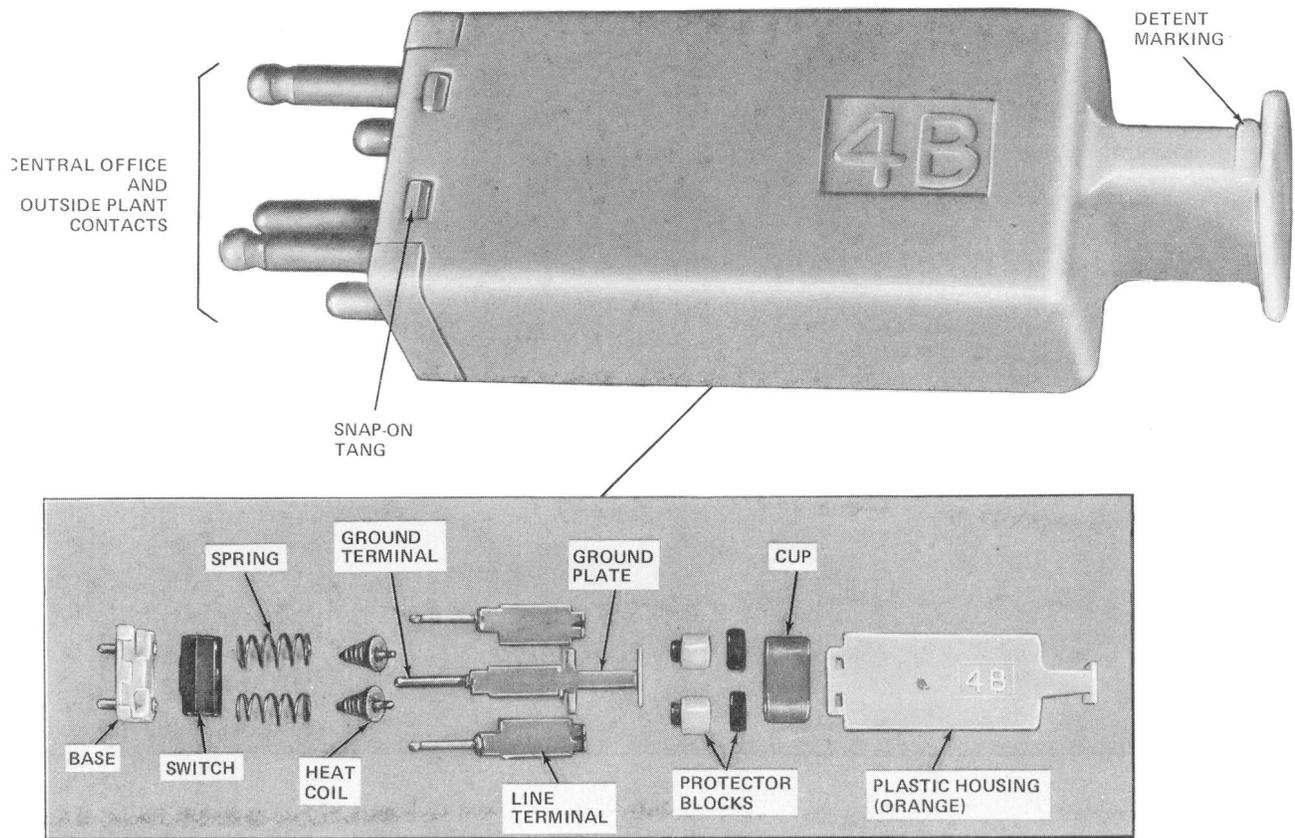


Fig. 9—4B11C Protector Unit (Minibridge Lifter)

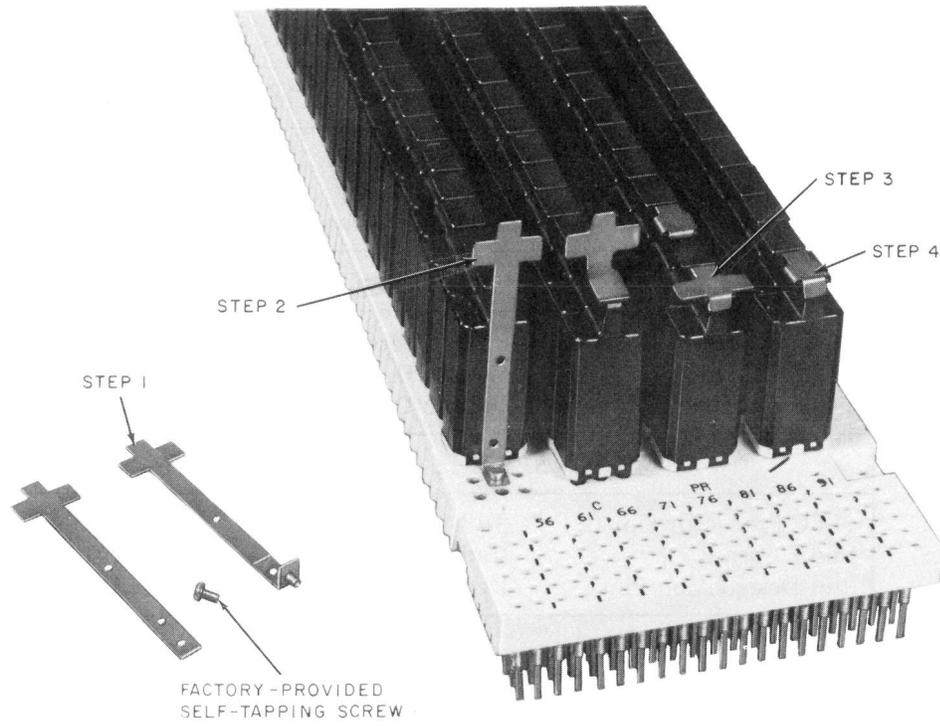


Fig. 10—20A Circuit Guard

◆ TABLE A ◆

CLASS OF PROTECTION AND PROTECTORS

ITEM	CLASS P	CLASS TP	CLASS NP
Spare Conductors	4B1C Protector Unit Black Housing No Designation Pins	3B1A Protector Unit Black Housing No Designation Pins	5A1D Protector Unit Gray Housing No Designation Pins
WORKING CONDUCTORS	<i>CUSTOMER LINES</i>		
	4B1C Protector Unit Black Housing No Designation Pins	3B1A Protector Unit Black Housing No Designation Pins	5A1D Protector Unit Gray Housing No Designation Pins
	<i>BATTERY FEEDERS</i>		
	4B4C Protector Unit Yellow Housing Yellow Designation Pins	3B4A Protector Unit Yellow Housing Yellow Designation Pins	5A4D Protector Unit Yellow Housing Yellow Designation Pins
	<i>SPECIAL SERVICE CIRCUITS</i>		
	4B3C Protector Unit Red Housing Red Designation Pins	3B3A Protector Unit Red Housing Red Designation Pins	5A3D Protector Unit Red Housing Red Designation Pins
	<i>DENIED CIRCUIT</i>		
	4B2C Protector Unit Green Housing Green Designation Pins	3B2A Protector Unit Green Housing Green Designation Pins	5A2D Protector Unit Green Housing Green Designation Pins

◆ TABLE B ◆

PROTECTOR UNITS

STANDARD CODE	SUPERSEDED CODES	HOUSING COLOR	HANDLE MARKING	VOLTAGE PROTECTION		SNEAK CURRENT PROTECTION	DUMMY PROTECTOR UNIT	APPLICATION
				CARBON BLOCKS	GAS TUBES			
3B1A 3B2A ¹ 3B3A 3B4A	3A1A, 3A5A, 3B5A 3A2A, 3A6A, 3B6A 3A3A, 3A7A, 3B7A 3A4A, 3A8A, 3B8A	Black Green Red Yellow	None	Yes	No	No	No	Standard Circuit Open Circuit Special Circuit PBX Battery
3B1E 3B2E ¹ 3B3E 3B4E	None	Black Green Red Yellow	0 0 0 0	No	Yes	No	No	Standard Circuit Open Circuit Special Circuit PBX Battery
4B1C 4B2C ¹ 4B3C 4B4C	4A1C, 4A5C 4A2C, 4A6C 4A3C, 4A7C 4A4C, 4A8C	Black Green Red Yellow	None	Yes	No	Yes	No	Standard Circuit Open Circuit Special Circuit PBX Battery
4B9C	429F PLUG	White	X	Yes	No	Yes	No	Reverse Tip and Ring
4B11C	4A11C	Orange	None	Yes	No	Yes	No	Mini-Bridge Lifter
4B12C	None	Gray	None	No	No	No	Yes	4-type Dummy w/o Test Lamp
4B1E 4B2E ¹ 4B3E 4B4E	None	Black Green Red Yellow	0 0 0 0	No	Yes	Yes	No	Standard Circuit Open Circuit Special Circuit PBX Battery
4B9E	None	White	X	No	Yes	Yes	No	Reverse Tip and Ring
4B11E	None	Orange	0	No	Yes	Yes	No	Mini-Bridge Lifter
4C1C 4C2C ¹ 4C3C 4C4C	None	Black Green Red Yellow	None	Yes	No	Yes	No	Standard Circuit Open Circuit Special Circuit PBX Battery
4C9C	None	White	X	Yes	No	Yes	No	Reverse Tip and Ring
4C11C	None	Orange	None	Yes	No	Yes	No	Mini-Bridge Lifter
4C12C	None	Gray	None	No	No	No	Yes	4-Type Dummy w/Test Lamp
5A1D 5A2D ¹ 5A3D 5A4D 5A9D	5A5D 5A6D 5A7D 5A8D 5A9D	Gray Green Red Yellow White	None None None None X	No	No	No	Yes	Standard Circuit Open Circuit Special Circuit PBX Battery Reverse Tip and Ring
4C1E 4C2E 4C3E 4C4E 4C9E		Black Green Red Yellow White	None X	No	Yes	Yes	No	Standard Circuit Open Circuit Special Circuit PBX Battery Reverse Tip and Ring
4C11E		Orange	None	No	Yes	Yes	No	Mini-Bridge Lifter

¹ No continuity between outside plant and central office.