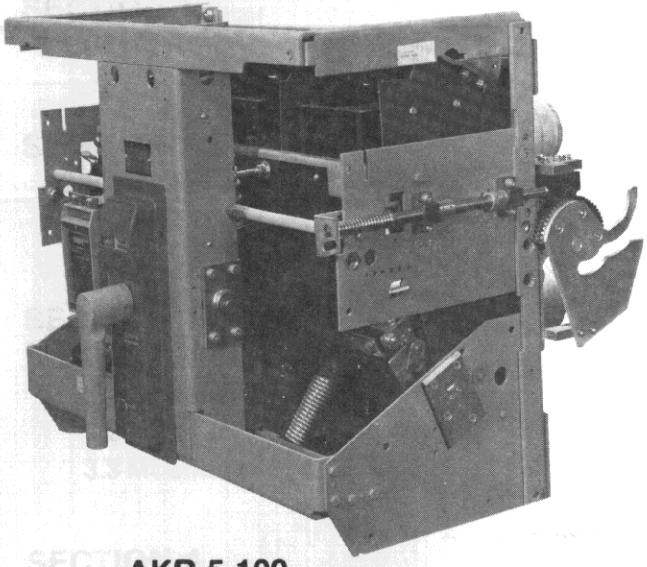
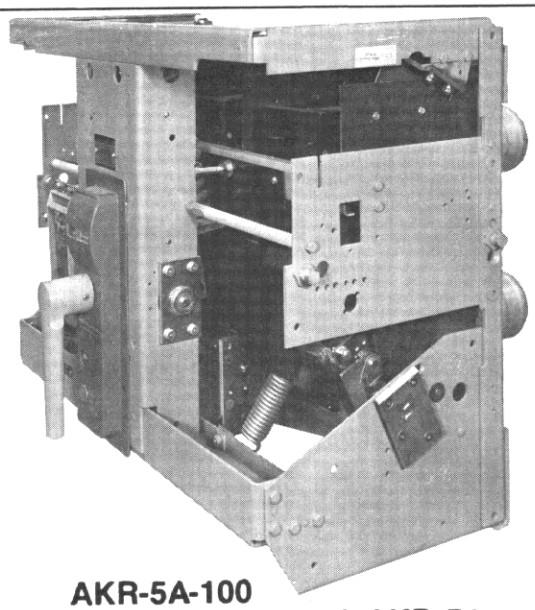
Installation
Manual

Low Voltage Power Circuit Breakers

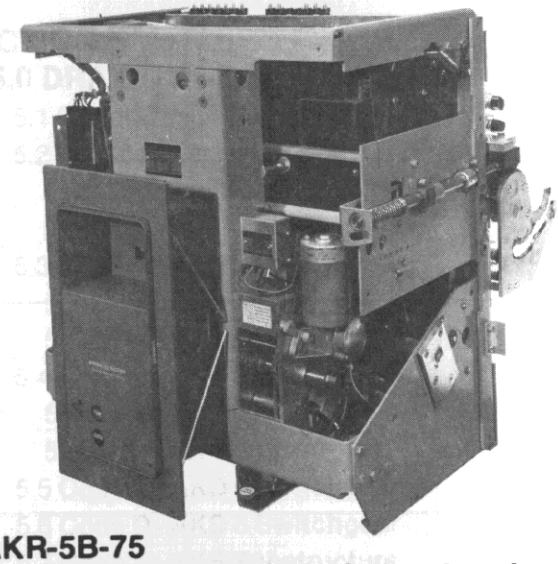
Types AKR-75/100



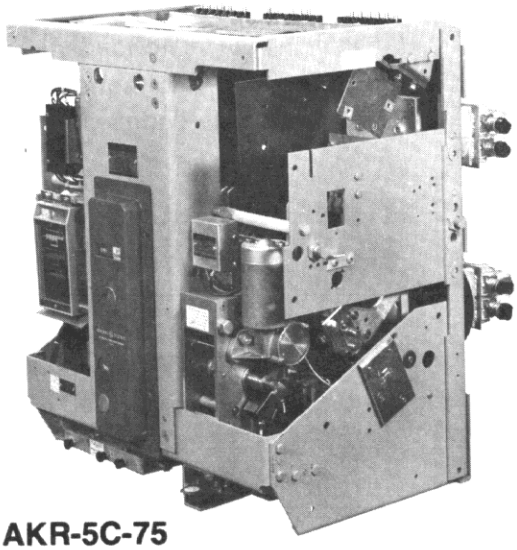
AKR-5-100
Manually operated, AKD type



AKR-5A-100
Manually operated, AKD-5 type



AKR-5B-75
Electrically operated, substructure type



AKR-5C-75
Electrically operated, AKD-6 type

GENERAL ELECTRIC

Installation and Operation of Type AKR-75 and AKR-100 Low-Voltage Power Circuit Breakers

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SECTION 1

Introduction

These instructions describe the installation and operation of the AKR-75 and AKR-100 frame size Low Voltage Power Circuit Breakers. They cover a variety of models which may differ in rating, trip device and/or mounting type as indicated in Table 1.

Table 1

FRAME SIZE (Amperes)		BREAKER DESIGNATION	MOUNTING TYPE						DEEP ESCUTCHEON	PRIMARY STUD TYPE	BREAKER WIDTH (Inches)
			DRAWOUT				Sub-Structure	Stationary			
250V. Dc	600V. Ac 50/60 Hz.		AKD	AKD-5	AKD-6	AKD-8					
4000	3000	AKR-(*)-75						X		Bar	25
			X							Tube	
		AKR-(*)A-75		X	X					Tube	
	3200	AKR-(*)B-75					X		X	Fingers	
		AKR-(*)C-75			X					Fingers	
		AKR-(*)D-75				X			X	Fingers	
		AKR-(*)F-75					X		X	Fingers	
		AKR-(*)S-75						X		Bar	
6000	4000	AKR-(*)-100	X							Tube	33
		AKR-(*)A-100		X	X					Tube	
		AKR-(*)B-100					X		X	Fingers	25
		AKR-(*)C-100			X					Fingers	
		AKR-(*)D-100				X			X	Fingers	
		AKR-(*)F-100					X		X	Fingers	
		AKR-(*)S-100						X		Bar	
		AKR-(*)W-100						X		Bar	33
SPECIAL DC BREAKERS FOR FIELD SWITCHING											
4000		ARK-N-75F	X							Tube	25
		AKR-NB-75F					X		X	Fingers	
		AKR-ND-75F				X			X	Fingers	
		AKR-NF-75F					X		X	Fingers	
		AKR-NS-75F						X		Bar	
6000		AKR-N-100F	X							Tube	33
		AKR-NB-100F					X		X	Fingers	25
		AKR-ND-100F				X			X	Fingers	
		AKR-NF-100F					X		X	Fingers	
		AKR-NS-100F						X		Bar	
		AKR-NW-100F						X		Bar	33

Example: AKR-5B-75 identifies a drawout, substructure-mounted breaker equipped with the SST trip device. The EC trip devices are electro-mechanical, refer to GEI 86157 for detailed information.

BREAKER MODELS

(*) This digit identifies the trip device:
2 = EC-1 or EC-2A. Dc only.
4 = ECS
5 = SST 50/60 Hertz only.
6 = Micro Versa Trip 50/60 Hertz only.
For detailed information on these trip devices refer to the following publication:
GEI-86157

N = Non-automatic. In addition, all non-automatic 250V. Dc breaker types carry the suffix letter D after the frame number, e.g., AKR-NB-75D.

SECTION 2

Receiving, Handling, and Storage

Before installing or operating these circuit breakers, carefully read these instructions.

Upon receipt of a circuit breaker, immediately examine for any damage or loss sustained in shipment. If injury, loss or rough handling is evident, file a damage claim at once with the transportation company and notify the nearest General Electric Sales Office.

Unpack the circuit breaker as soon as possible after it has been received. Exercise care in unpacking to avoid damage to the breaker parts. Be sure that no loose parts are missing or left in the packaging material. Blow out any dirt or loose particles of packaging material remaining on or in the breaker.

If the circuit breaker is not to be placed in service at once, store it in a clean, dry location in an upright position. Support it to prevent bending of the studs or damage to any of the breaker parts. Do not cover the breaker with packing or other material which absorbs moisture that may cause corrosion of breaker parts. A covering of kraft or other non-absorbent paper will prevent dust from settling on the breaker.

SECTION 3

Installation

3.1 CLASS 1E APPLICATION

NOTE: *Before installing in a Nuclear Class 1E application, verify that this product is intended for such use by checking the procurement records.*

3.2 LOCATION

In choosing a location for the installation of these breakers there are two factors to be considered. The first is the location's environmental impact on the breaker. Much better performance and longer life can be expected if the area is clean, dry, dust-free and well ventilated. The second is convenience for operation and maintenance. The breaker should be easily accessible to the operator and there should be sufficient space available for maintenance work.

3.3 MOUNTING TYPES

AKR-75 and -100 breakers are furnished in both drawout and stationary construction. The mounting type is identified by the second middle digit in the breaker's nameplate designation as follows:

AKR-4(†)-75, where

(†) = mounting type code letter per Table 2

TABLE 2 MOUNTING TYPE CODES

Code Letter	Breaker Type	
	Drawout	Stationary
None	AKD	— — —
A	AKD-5, 6	— — —
B	Substructure	— — —
C	AKD-6 Only	— — —
D	AKD-8	— — —
F	Substructure	— — —
S	— — —	AKR-75/100 (25" wide)
W	— — —	AKR-100 (33" wide)

SECTION 4

Stationary Breakers

These breakers are designed for mounting in a switchboard or enclosure designed and constructed by others. Mounting consists of bolting the breaker frame to a supporting structure within the switchboard or enclosure, connecting the power buses or cables, and making any necessary control connections. The front cover of the breaker enclosure may be a hinged door or a plate bolted to the panel, including a cut-out opening through which the front escutcheon of the breaker can protrude.

The surface on which the breaker is mounted must be flat to avoid internal distortion of the breaker. The supporting structure must be rigid enough to avoid any possibility of the breaker studs supporting the weight of the breaker. Minimum cutout dimensions as given by the appropriate outline drawing must be maintained to provide adequate electrical clearance. Connecting bus and cables must be rigidly supported to prevent undue stress on the breaker terminals.

Outline drawing numbers giving dimensions for designing a suitable enclosure for the stationary AKR-75 and AKR-100 types are given below.

TABLE 3

Stationary Breaker Type	Breaker Width	Outline Drawing	
		Manually Operated	Electrically Operated
AKR-( )S-75	25″	139C4560	139C4561
AKR-( )S-100	25″		
AKR-( )W-100	33″	139C4562	139C4563

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Drawout Breakers

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Drawout Breakers

5.1 GENERAL

Drawout breakers are manufactured in six different styles, identified in Table 2 by the mounting code letters None, A, B, C, D & F. The "no-letter" models are used in General Electric's AKD Switchgear. Code A breakers were later introduced with AKD-5 Switchgear and feature closed-door drawout operation. Code B and F breakers provide an alternate closed-door drawout arrangement with the stationary element furnished as a preassembled "substructure." Code C breakers are exclusively for AKD-6 Switchgear; they employ the Code A drawout mechanism but have finger-type primary studs instead of tubular. Code D breakers were introduced with the AKD-8 Switchgear and feature the Code B closed-door drawout mechanism. The construction and operation of each of these drawout styles is covered under respective headings in the following text.

NOTE: *The Code B and Code F drawout types are mutually interchangeable. The "no-letter," Code A, Code C and Code D drawout types are mutually noninterchangeable. Before attempting to insert a breaker, verify that the breaker model matches the compartment.*

The Code B, D, and F breakers are identical except for the following:

a. Position indication label. This label is mounted on the sides of the breaker's deep escutcheon and indicates the DISCONNECTED, TEST, and CONNECTED positions. The Code D breaker label indicates the proper position only in AKD 8 switchgear. The Code B and F breaker labels indicate properly only in AKR Substructures.

b. Trip device. Code D and F breakers are factory supplied with Micro-Versa Trip programmers. Code B breakers are supplied with SST or ECS programmers. (A SST/ECS to Micro-Versa Trip conversion kit is available).

c. Appearance. Code D and F breakers use a different color scheme on their deep escutcheons and labels. Also, they have a differently shaped manual operating handle.

5.2 NO CODE LETTER (AKD SWITCHGEAR) (Fig. 1)

These "no-letter" AKR-75/100 models are replacements for their AK-75 and AK-100 predecessors in AKD switchgear. The racking mechanism is breaker-mounted and the breakers are bolted to a roller-mounted tray in an arrangement similar to the B Type (see Section 5.4). In addition to the characteristics listed in Table 1, the AKD drawout has the following unique aspects:

1. There are three (3) distinct drawout positions — CONNECTED, TEST and WITHDRAWN.

2. Racking travel occurs only between the CONNECTED position and a point just short of reaching the TEST position.

3. The compartment door must be open during racking.

5.2.1 BREAKER INSERTION

1. Prior to lifting a breaker to its intended compartment location, observe the following precautions:

a. *Check the compartment to insure that it is free of foreign objects.*

b. *Verify that the breaker is the correct type for that compartment.*

c. *Insure that the breaker is OPEN.*

d. *Apply a thin, fresh coat of D50HD38 lubricant to the breaker's primary disconnects.*

e. *Insure that the racking cams on the breaker are correctly positioned for initial engagement with the pins in the compartment. To do this, insert the racking handle and rotate it fully clockwise.*

f. *If a compartment contains a keylock, it will not accept the AKR-75/100 replacement breakers as received. The AKR drawout mechanism differs from that of its predecessor AK model, causing the AKR breaker to mechanically interfere with the keylock during breaker insertion. To remedy this it will be necessary to relocate the keylock using new mounting hardware included as a modification kit. So altered, the compartment accepts both AK and AKR types.*

2. Using a suitable lifting mechanism and spreader rig, position lifting hooks at the cutout notches in the top wraparound frames of the breaker. Exercise care to avoid damage to the control wiring.

3. Open the compartment door. Keeping the rollout tray positioned inside the compartment, raise the breaker above the elevation of the tray.

4. Depress the test position stop lever and pull the tray all the way out to its WITHDRAWN position.

5. Lower the breaker over the tray until it is about one-half inch above the two dowel pins on the tray. Push the breaker back into the compartment until the rear bottom flange of the breaker rests against the guides behind the dowel pins.

6. Slowly lower and guide the breaker onto the tray so the holes in the rear flange fit over the two dowel pins. When correctly positioned on the dowel pins, the breaker's rear and side bottom flanges will rest firmly on the tray.

7. Secure the breaker to the tray by inserting and tightening two-⅜ inch hex-head screws into the front holes of its side flanges.

8. If the breaker is a manually operated type, push it into the compartment until the TEST position stop engages, preventing further travel. The breaker is now in the TEST position.

If the breaker is electrically operated, push it into the compartment until the spring discharge stop is encountered. Release this by depressing the "spring discharge" lever on the bottom of the breaker (see fig. 1), then continue pushing the breaker into the compartment until the TEST position stop engages.

NOTE: *A spring discharge stop will not be present in some AKD-type compartments originally furnished for electrically operated AK-75 and AK-100 breakers of the non-quick-close type.*

9. Depress the TEST position stop lever and push the breaker farther into the compartment until the outer surfaces of the racking cams butt against the racking pins in the housing.

10. Insert the racking handle (673D0500-636-05) on the jackscrew shaft at the upper right side of the breaker. Rotate it clockwise until the jackscrew comes to a solid stop. The breaker is now in the CONNECTED position.

5.2.2 BREAKER REMOVAL

1. With the door closed and latched, trip the breaker.

2. Open the door and insert the racking handle on the jackscrew shaft. Rotate it counterclockwise until the jackscrew comes to a solid stop. At this point the primary disconnects are disengaged.

3. Now pull the breaker out of its compartment until the test position stop engages, thereby holding the breaker in the TEST position.

4. To withdraw a manually operated breaker from TEST, depress the test position stop lever and pull the breaker out of its compartment until the tray stops. At this position the tray will be fully withdrawn against its limit stop.

The withdrawal movement for electrically operated breakers differs from the above in that the tray is stopped short of its WITHDRAWN limit by the compartment-mounted spring discharge stop. In order to complete the withdrawal, the closing springs first must be discharged by depressing the spring discharge lever on the breaker. Next, keeping this lever depressed, pull the breaker completely out against the tray limit stop. A ramp cam mounted on the compartment wall keeps the breaker trip-free during the outward travel from the TEST position.

5. Before proceeding with subsequent operations to remove the breaker from the tray, visually check the breaker's CHARGED-DISCHARGED and OPEN-CLOSED indicators to verify that the breaker is open and the springs are discharged. This precaution is particularly important at locations where AKR-75 and -100 breakers are being deployed in AKD equipments as replacements for AK-75 and -100 non-quick-close electrical models; these compartments did not need and were not equipped with a spring discharge stop.

6. Remove the two-⅜ inch hex-head screws which fasten the breaker to the compartment tray.

7. Using care to prevent damage to the wiring, attach the lifting device to the cutout notches in the top wraparound frame of the breaker.

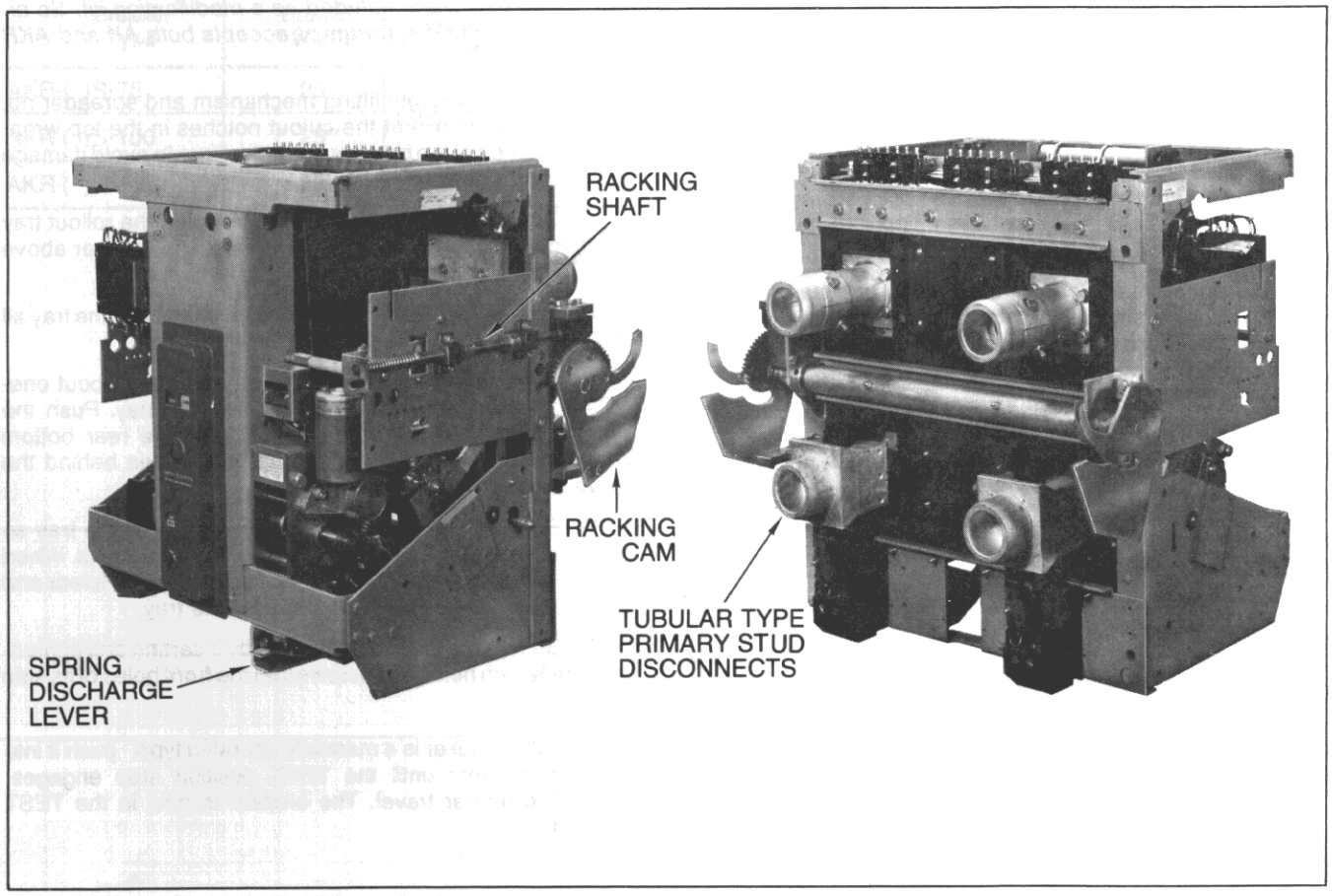

Fig. 1 AKR-2-75 electrically operated, 2-pole Dc (AKD type)

8. Lift the breaker approximately one-half inch off the dowel pins. Push the tray back into the compartment.

9. Swing the breaker forward until the primary disconnects clear the compartment. Lower the breaker onto a flat surface free of protrusions that could damage the breaker's internal parts.

5.3 CODE A (AKD SWITCHGEAR)

The drawout mechanism is equipment mounted and is externally operated by a removable racking handle. The breaker is supported by two pins protruding from each side of its frame, these engaging slots in telescoping rails fastened to the compartment walls.

The drawout operation features four positions — CONNECTED, TEST, DISCONNECTED and WITHDRAWN. In the CONNECTED position the primary and secondary disconnects are fully engaged. The breaker must be tripped before it can be racked into or out of this position. In the TEST position the primary contacts are disconnected but the secondary contacts remain engaged. This allows complete breaker operation without energizing the primary circuit. In the DISCONNECTED position neither primary nor secondary contacts are made. Breakers can be racked between these three positions with the compartment door closed. Each position is clearly identified by a rotary indicator visible through an opening in the door.

With the door open, the breaker is manually pulled out from the DISCONNECTED to the WITHDRAWN position; here the breaker is completely out of its compartment, ready for removal.

> **NOTE:** *All electrically operated AKR-75/100 breakers employ a spring discharge interlock which prevents removal of the breaker with its closing springs in the charged state. Before the breaker can be moved away from the DISCONNECTED position toward the WITHDRAWN position, it is necessary to depress and hold the breaker-mounted spring discharge lever (Fig. 2). This discharges the closing springs and releases the breaker.*

Manually operated breakers do not require this interlock because their closing springs are never propped in the fully charged position. Refer to the "Manual Closing" text in section 8.2.

5.3.1 BREAKER INSERTION (CODE A)

1. Prior to lifting a breaker to its intended compartment location, observe the following precautions:

   a. *Check the compartment to insure that it is free of foreign objects.*

   b. *Verify that the breaker is the correct type for that compartment.*

   c. *Insure that the breaker is OPEN.*

   d. *Apply a thin, fresh coat of D50HD38 lubricant to the breaker's primary disconnects.*

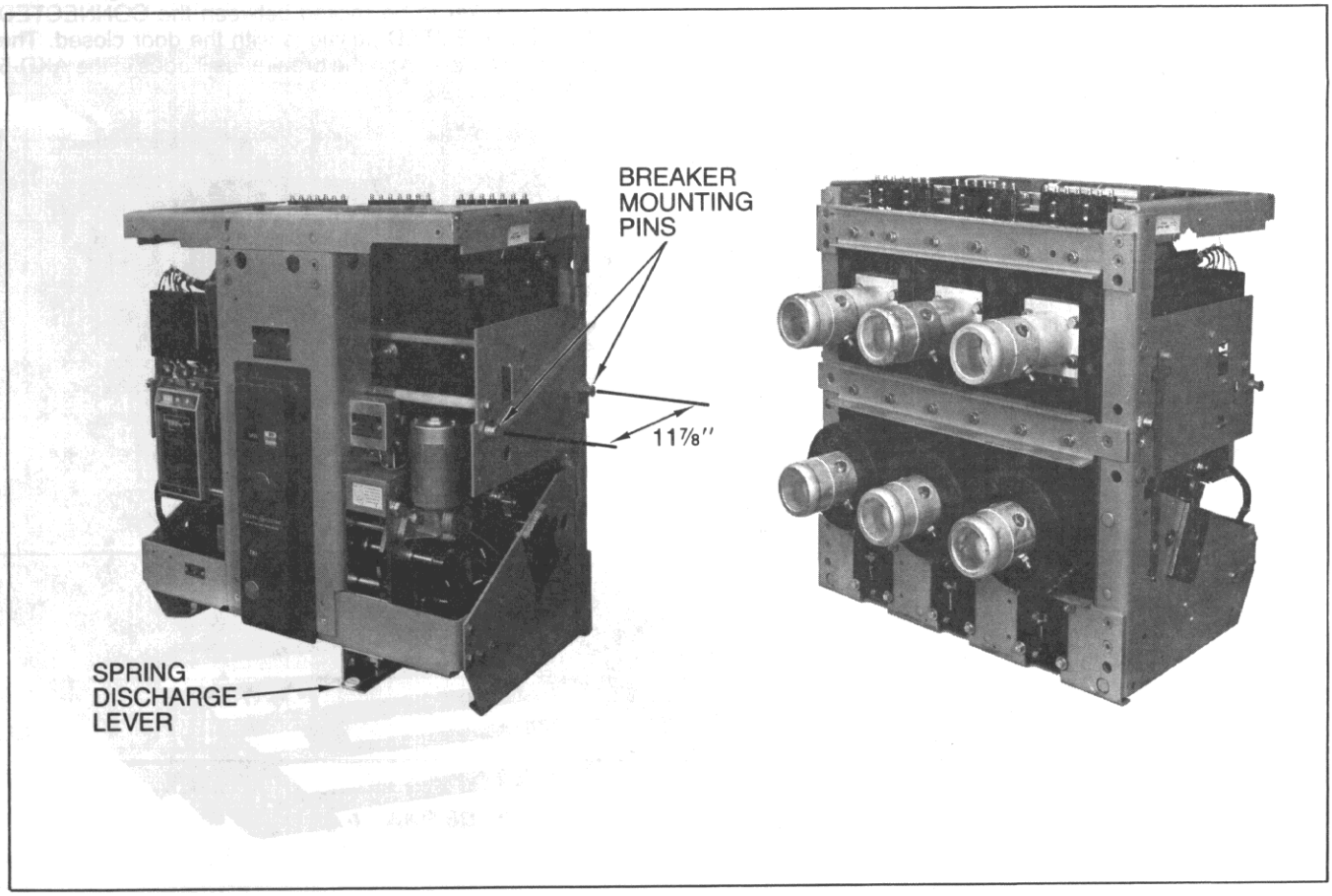

Fig. 2 AKR-5A-75 electrically operated (AKD-5, 6 type)

2. With the movable inner housing of the compartment in the CONNECTED position, insert the racking handle (part no. 673D0500-636-05) on the jackscrew shaft located at the left side of the compartment just above the position indicator.

3. Rotate the handle counterclockwise until the jackscrew stops — the indicator should read DISC.

4. Remove the racking handle and open the compartment door.

5. Rotate the two track-lock links and pull the right track to the limit of its travel.

6. Using a lifting device, raise the breaker until the breaker mounting pins are approximately one-inch above the tracks. Use care to avoid damage to the breaker wiring.

7. Pull the left track out to the limit of its travel and lower the breaker so its mounting pins drop into the slots in the track. Remove the lifting device.

8. Push the breaker in against the track stops. On electrically operated breakers, be sure to depress the spring discharge lever while doing so. Rotate the two track-lock links to lock the breaker in place. Close the compartment door.

9. Insert the racking handle on the jackscrew shaft and rotate it clockwise to move breaker into the compartment. Breaker is in CONNECTED position when jackscrew stops. The indicator should read CONN.

10. Orient the jackscrew so that its slotted sleeve is free to move outward, otherwise the breaker will remain trip-free.

5.3.2 BREAKER REMOVAL (CODE A)

1. Trip the breaker. Insert the racking handle into the jackscrew shaft.

2. Rotate the handle counterclockwise until the jackscrew stops. Indicator should read DISC.

3. Remove the racking handle and open the compartment door.

4. Rotate the two track-lock links and pull the breaker out to the track travel limit. This is the WITHDRAWN position. If the breaker is electrically operated, the breaker-mounted Spring Discharge lever must be depressed to permit withdrawal.

NOTE: *Spring discharge interlocks were not required and are not present in existing compartments originally furnished for non-quick-close type electrically operated AK-75/100 breakers. Regardless of whether this interlocking hardware is present in a compartment, ALWAYS verify that the closing springs are discharged and the breaker is tripped OPEN before removal is attempted.*

5. Attach lifting hooks at the cutouts in the top wraparound frame and raise the breaker until its mounting pins clear the track slots.

6. Push the tracks into the compartment so that the breaker can be lowered to a smooth surface free of protrusions that could damage the internal parts of the breaker.

5.4 CODE B (AKR SUBSTRUCTURE) (Figs. 3, 4)

The AKR substructure is a self-contained, open-type framework serving as the stationary receptacle for a drawout breaker. Featuring closed-door type drawout operation, it is designed for convenient mounting in individual breaker compartments of drawout switchgear equipments. It provides means for making the primary and secondary connections to the removable breaker element and is factory aligned.

The breakers are bolted to a roller-mounted tray which is part of the substructure. The racking mechanism is breaker-mounted. The racking handle is inserted through the compartment door and acts to rotate slotted racking cams on each side of the breaker frame. The cams engage fixed pins mounted on both side plates of the substructure, moving the breaker in and out through the same four positions described for the Code A Types — CONNECTED, TEST, DISCONNECTED, WITHDRAWN. Breaker position is registered directly by markings on the right side of the escutcheon which appear as it emerges through the door cutout.

All AKR B breakers for use in substructures are equipped with a "deep" escutcheon instead of the standard escutcheon employed on all other models. This configuration allows the breaker to be racked between the CONNECTED and DISCONNECTED positions with the door closed. The door does not move with the breaker as it does in the AKD-5 and AKD-6 models.

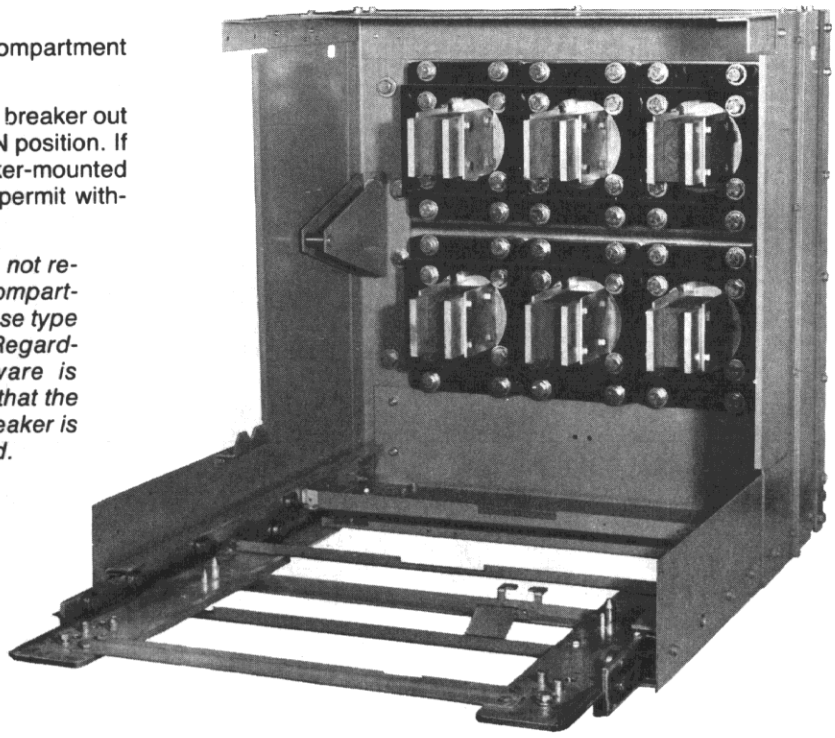

Fig. 3 AKR drawout substructure Cat. No. TAK8SS02 3200 amperes

5.4.1 BREAKER INSERTION (CODE B)

1. Prior to lifting a breaker to its intended compartment location, observe the following precautions:

   a. *Check the compartment to insure that it is free of foreign objects.*

   b. *Verify that the breaker is the correct type for that compartment.*

   c. *Insure that the breaker is OPEN.*

   d. *Apply a thin, fresh coat of D50HD38 lubricant to the breaker's primary disconnects.*

   e. *Insure that the racking cams on the breaker are correctly positioned for initial engagement with the pins in the compartment. To do this, insert the racking handle and rotate it fully counterclockwise.*

2. Using a suitable lifting mechanism and spreader rig, position lifting hooks at the cutout notches in the top wrap-around frames of the breaker. Exercise care to avoid damage to the control wiring.

3. Open the compartment door. Keeping the rollout tray positioned inside the compartment, raise the breaker above the elevation of the tray.

4. Pull the tray all the way out to its WITHDRAWN limit.

5. Lower the breaker over the tray until it is about one-half inch above the two dowel pins on the tray. Push the breaker back into the compartment until the rear bottom flange of the breaker rests against the guides behind the dowel pins.

6. Slowly lower and guide the breaker onto the tray so the holes in the rear flange fit over the two dowel pins. When correctly positioned on the dowel pins, the breaker's rear and side bottom flanges will rest firmly on the tray.

7. Secure the breaker to the tray by inserting and tightening two-⅜ inch hex head screws into the front holes of its side flanges.

8. Push the breaker into the compartment until the spring discharge stop engages, preventing further movement. This is the DISCONNECTED position. At this point the racking cams are positioned to engage the fixed racking pins in the compartment, ready to begin the racking motion.

It is to be noted that manually operated breaker models do not employ a spring discharge interlock. It is unnecessary because their operating mechanism never statically positions the springs in a fully-charged state. However, to provide necessary means for mechanically securing the breaker in the DISCONNECTED position, a position stop is employed. It has a release lever marked "Push to Withdraw" and is located in the same place as the spring discharge release lever on electrically operated breakers — see Fig. 4.

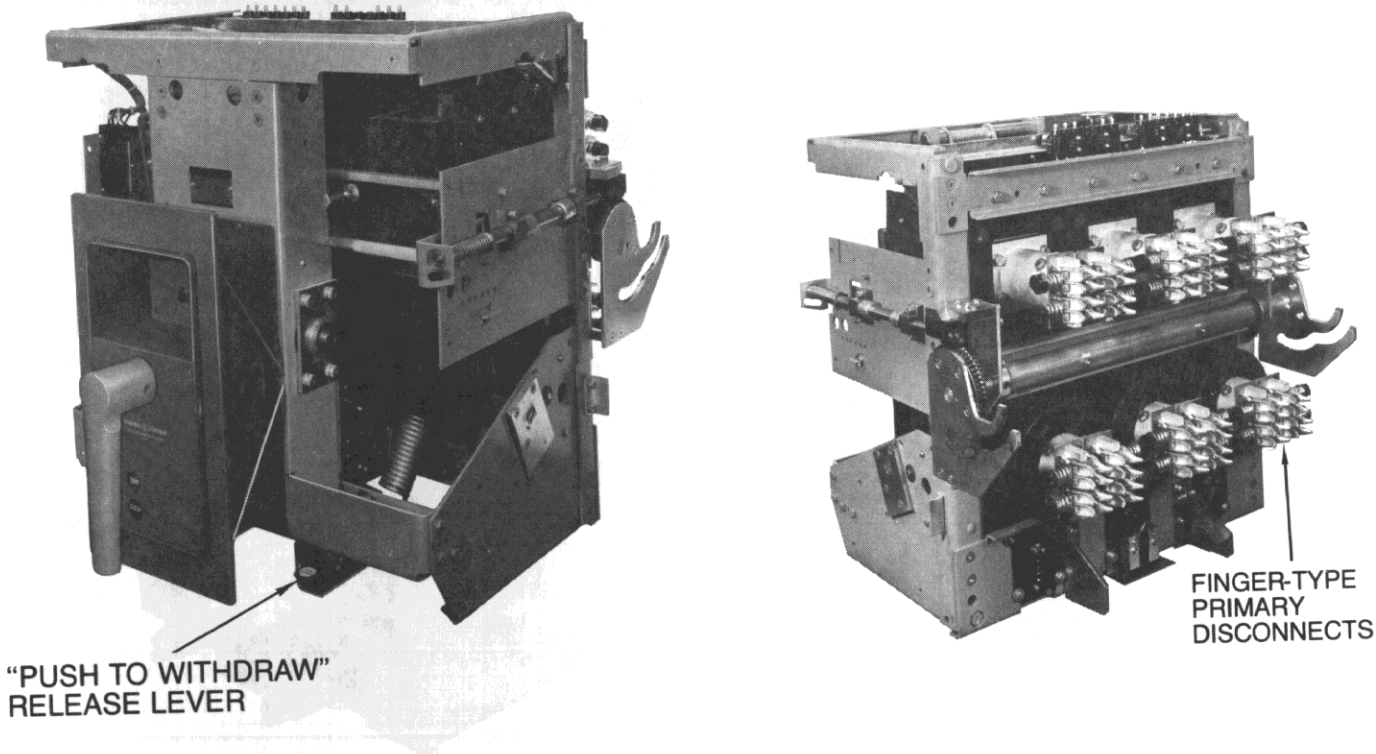

Fig. 4 AKR-5B-75 manually operated (substructure type)

9. Close the compartment door. Insert the racking handle (part no. 568B731G1) through the opening at the upper right of the door and onto the jackscrew shaft. By rotating the handle clockwise, move the breaker through the TEST position into the CONNECTED position; the latter is indicated when the jackscrew comes to a solid stop. All three positions — DISCONNECTED, TEST and CONNECTED — are indexed on the right side of the breaker escutcheon.

5.4.2 BREAKER REMOVAL (CODE B)

1. With the door closed and latched, trip the breaker.

2. Insert the racking handle and rotate it counterclockwise until the breaker travels from CONNECTED through TEST to the DISCONNECTED position, as indicated by the jackscrew coming to a solid stop. This operation should be performed with the door closed.

3. Open the door. On electrically operated breakers, depress the Spring Discharge lever to discharge the breaker's closing springs. While holding this lever depressed, pull the breaker all the way out to its WITHDRAWN position.

On manually operated breakers this release lever is labeled "Push to Withdraw". See Section 5.4.1.

4. Before proceeding with subsequent operations to remove the breaker from the compartment, visually check the breaker's spring charge and close indicators to verify that the breaker is open and the springs are discharged.

5. Remove the two-⅜ inch hex head screws which fasten the breaker to the compartment tray.

6. Attach the lifting device to the cutout notches in the top wraparound frame of the breaker, using care to prevent damage to the wiring.

7. Lift the breaker approximately one-half inch off the dowel pins. Push the tray back into the compartment.

8. Swing the breaker forward until the primary disconnects clear the compartment. Lower the breaker onto a flat surface free of protrusions that could damage the breaker's internal parts.

5.5 CODE C (AKD-6 SWITCHGEAR) (Fig. 5)

These breakers employ the same drawout arrangement as the Code A models described in Section 5.3. Their drawout operation and breaker insertion/removal procedures are identical, but they differ significantly in other aspects. As indicated in Table 1, the AKR-( )C-75 is a 3200A Ac frame size compared to the 3000A A model. The AKR-( )C-100 is narrower than AKR-( )A-100 (25 versus 33 inches). All C models employ finger-type primary disconnects instead of the tubular studs of the A types per fig. 2.

5.6 CODE D (AKD-8 SWITCHGEAR) (Fig. 6)

The AKD-8 Switchgear uses the AKR substructure style closed door drawout mechanism. The breaker is bolted to a roller-mounted tray. The drawout operation, breaker insertion, and breaker removal is identical to the Code B (AKR substructure) breakers described on pages 8-10. See Section 5.1 for differences between Code B and D breakers.

5.7 CODE F (AKR SUBSTRUCTURE) (Fig. 7)

Code F breakers are identical to Code B except for appearance details and trip device (refer to Section 1.0). The drawout operation, breaker insertion, and breaker removal is described under Code B breakers in Section 5.4.

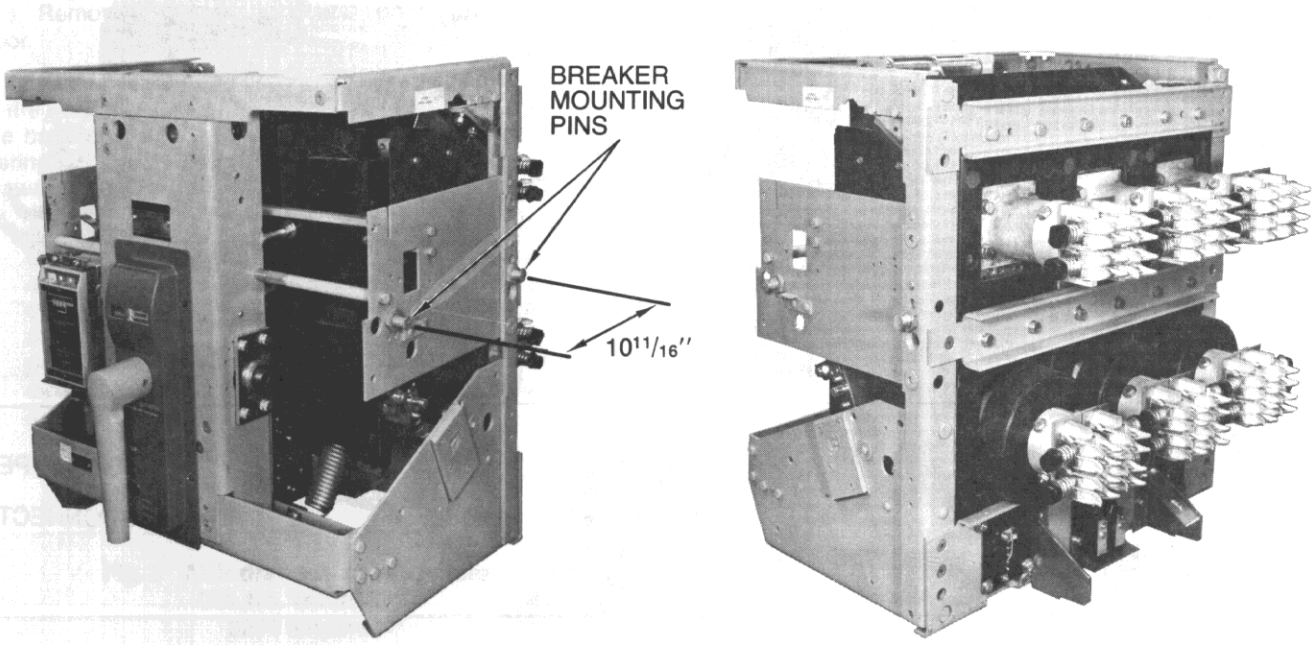

Fig. 5 AKR-5C-75 manually operated (AKD-6 type)

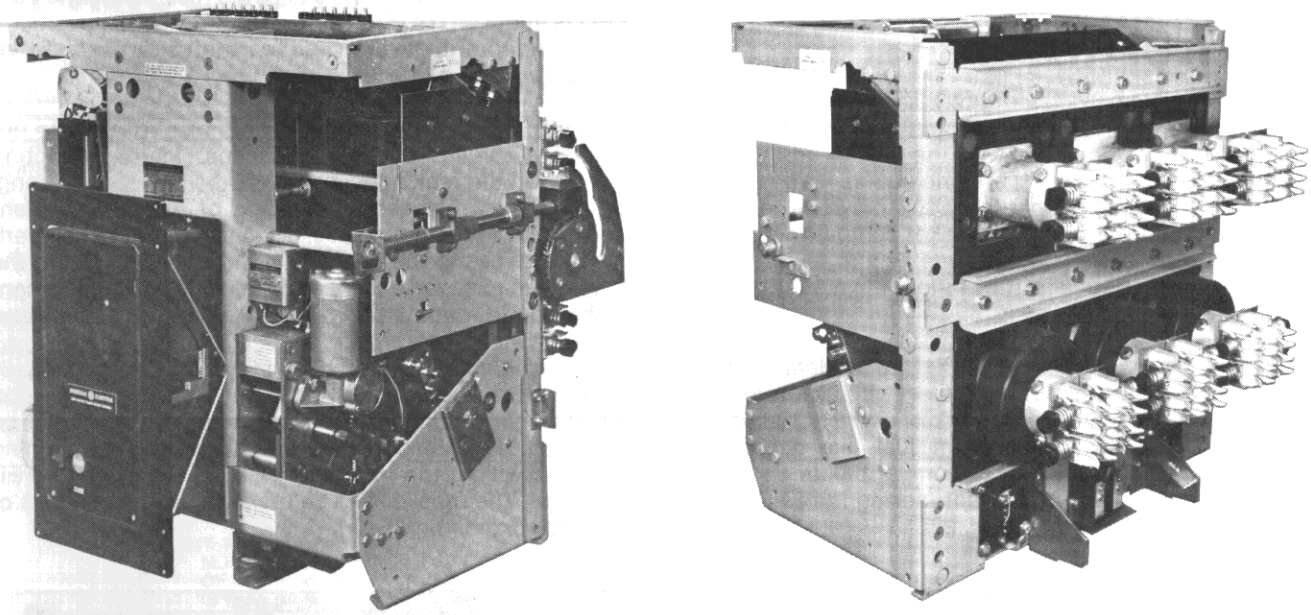

FIG. 6 AKR-6D-75 ELECTRICALLY OPERATED (AKD-8-TYPE)

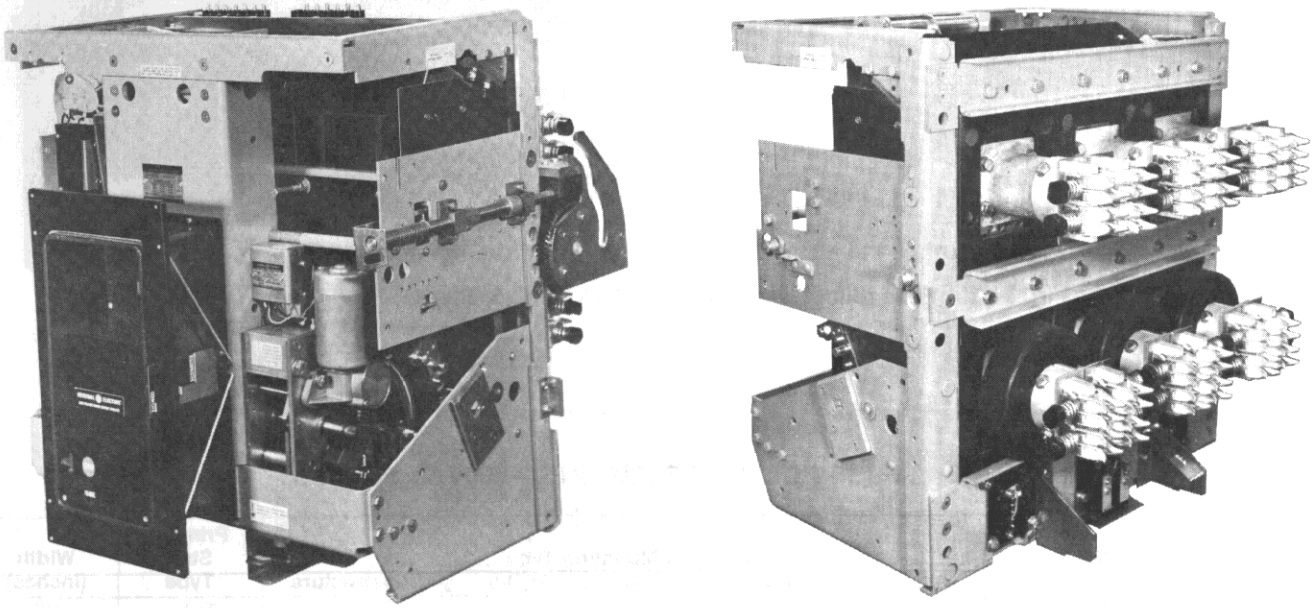

FIG. 7 AKR-6F-75 ELECTRICALLY OPERATED (SUBSTRUCTURE TYPE)

SECTION 6

Fuse Rollout Elements

When the system available short circuit current exceeds the rating of an AKR-75 or -100 breaker, current limiting fuses can be used in series with the breaker to increase the short circuit rating of the combination. When used, such fuses are housed in a separate drawout compartment located adjacent to the breaker compartment; they are mounted on a drawout carriage similar to a breaker frame and referred to as a fuse rollout element (FRO). A typical model is shown in Fig. 8.

As listed in Table 4, these FRO's are available in four drawout styles, each employing the same type drawout mechanism as its companion breaker. The FRO is racked into and out of its compartment just like a breaker. However, the fuse and breaker compartments each are equipped with keylocks to prevent racking the FRO when its associated breaker is closed.

All FRO models except the AKD type feature a hinged, perforated steel screen in front of the fuses. This panel can be opened to allow access to the fuses only when the FRO is in the WITHDRAWN position. In all other positions an interference angle attached to its left side prevents the panel from being opened.

Unlike the other three types, AKD fuse rollouts do not employ a screen in front of the fuses. Instead of acting directly on the racking mechanism, the keylock is arranged to prevent inadvertent opening of the compartment door. So long as the breaker is closed, the FRO compartment door cannot be opened. If the breaker is open, the key can be removed and inserted in the FRO compartment lock; the FRO compartment door then can be opened and the element racked at will.

Operation of the breaker compartment keylock is the same for all models. With the breaker open, the key can be removed; this extendes the lock bolt, thereby maintaining the breaker in a trip free state while in the CONNECTED position. The breaker can be racked at will regardless of the keylock position.

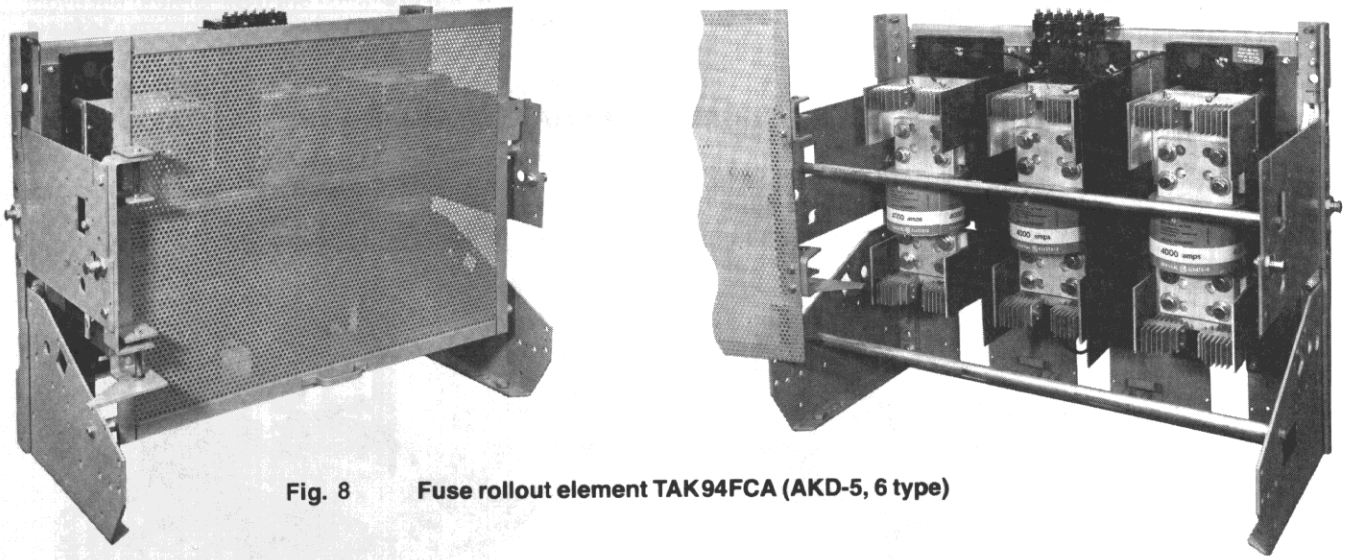

Fig. 8 Fuse rollout element TAK94FCA (AKD-5, 6 type)

TABLE 4 FUSE ROLLOUT ELEMENTS—600VAc, 50/60 Hz.

Frame Size (Amperes)	Cat. No.	Drawout Mounting Type					Primary Stud Type	Width (Inches)
		AKD	ADK-5	AKD-6	AKD-8	Substructure		
3000	TAK83FCO	X					Tube	25
	TAK83FCA		X	X			Tube	25
3200	TAK83FCB					X	Fingers	25
	TAK83FCC			X			Fingers	25
	TAK83FCD				X		Fingers	25
4000	TAK94FCO	X					Tube	33
	TAK94FCA		X	X			Tube	33
	TAK94FCB					X	Fingers	25
	TAK94FCC			X			Fingers	25
	TAK94FCD				X		Fingers	25

SECTION 7

Connections

7.1 Primary Power 14

7.2 Secondary Control 14

The outgoing connections to a breaker's accessories and control devices must be in accordance with the specific wiring diagram applicable to that breaker.

7.1 PRIMARY POWER

In all electrical connections good joint conductivity is a must. When making power connections to stationary breakers, the mating joint surfaces must be clean and have a smooth finish. They should be parallel and firmly bolted or clamped together. In addition, the bus or cable conductors must have ample ampacity to prevent overheating.

7.2 SECONDARY CONTROL

Control connections to stationary breakers are made to a terminal board mounted on the breaker. Figure 9 shows typical closing and tripping connections. If equipped with an overcurrent trip device which includes a ground fault element for use on 4-wire circuits, an additional terminal board is provided on the breaker for connecting to the equipment-mounted neutral sensor (physically located in the neutral conductor).

On drawout breakers the control circuits terminate in the breaker compartment on the stationary portion of separable secondary disconnects — see fig. 10.

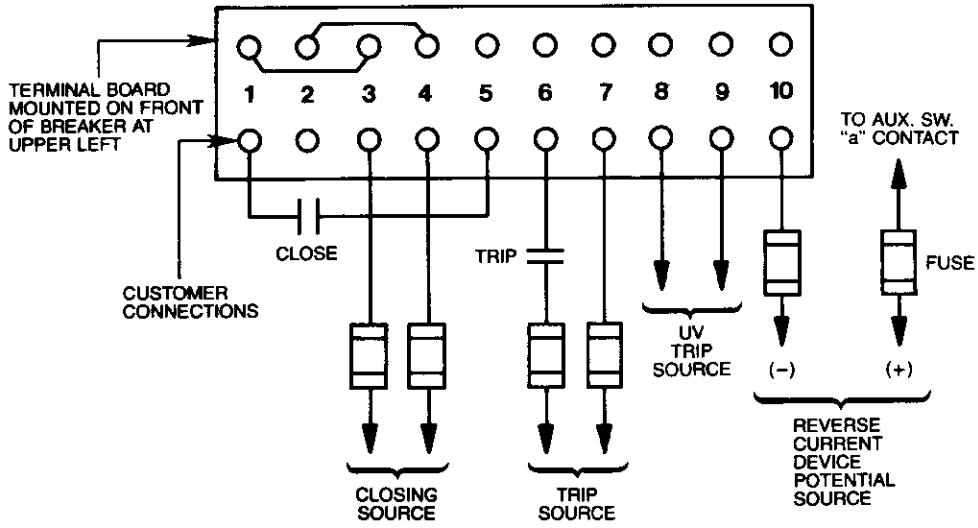

Fig. 9 Control connections to stationary breakers — front view.

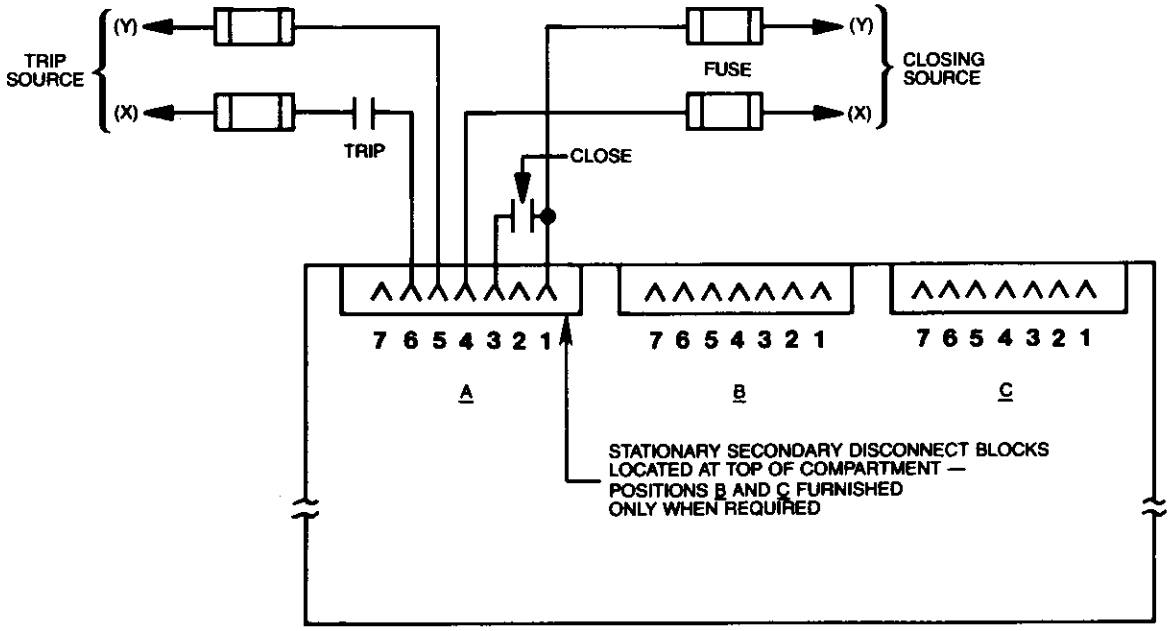

Fig. 10 Control connections to drawout breakers — front view of breaker compartment.

SECTION 8

Operation

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8.2 Manual Closing 15
8.3 Electrical Closing 15
8.4 Tripping 16
8.5 Current Rating For Auxiliary Devices 16

8.1 GENERAL

The AKR-75 and AKR-100 breakers are closed by the discharging of the energy stored in the closing springs of the breaker. As the closing springs are discharged, the energy is directed into the closing cam of the breaker which causes the moveable breaker contacts to be forced against the stationary contacts, and, at the same time causes the opening springs to be charged so they may open the breaker during a subsequent opening operation.

8.2 MANUAL CLOSING

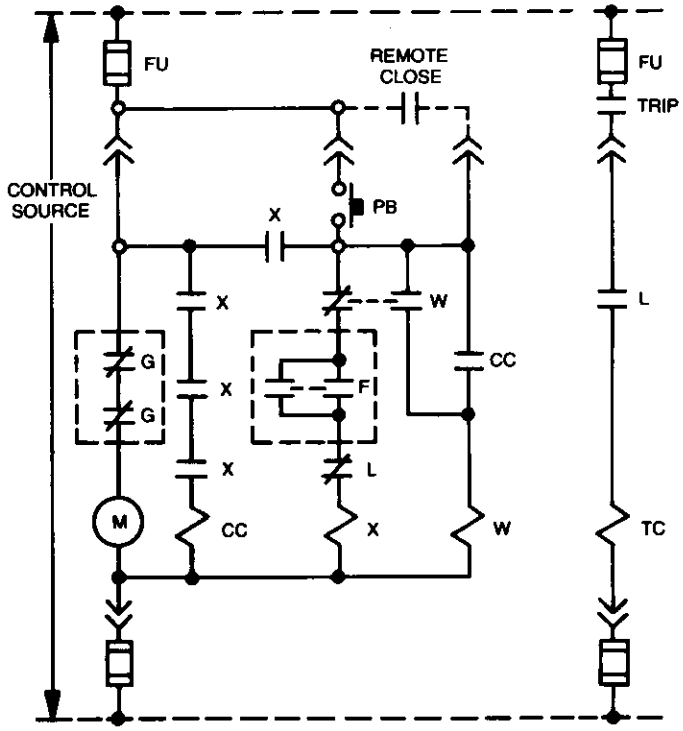
Manually operated breakers are equipped with a handle which extends from the escutcheon of the breaker. Alternately rotating the closing handle counterclockwise then clockwise through approximately 120 degrees of rotation through four complete cycles will cause the breaker to close. During the four counterclockwise movements and the first three clockwise movements of the handle, the springs are progressively charged. After approximately seven degrees travel of the fourth clockwise handle movement, the spring charge mechanism is driven "over center" and the energy stored in the closing springs is directed into the closing cam and causes the breaker to close. A charge-indicator, numbered one to four, visible through the breaker escutcheon, indicates the number of complete handle movements that have been performed.

8.3 ELECTRICAL CLOSING

On electrically operated breakers the closing springs are charged by a gear motor. With the springs discharged, voltage applied to the control circuit will energize the motor through the "G" switch contacts — see fig. 11. The motor, through the gear reduction output crank, compresses the closing springs until they are fully charged. As this fully charged position is reached, mechanically operated switches "F" and "G" reverse their shown position, the "G" switch deenergizing the motor and the "F" switch establishing a circuit to the "X" relay. At the same time, a mechanical prop is positioned to prevent the discharge of the fully charged closing spring.

With the closing spring propped fully-charged, the breaker is ready for closing. This may be accomplished electrically by depressing the closing switch on the breaker (if so equipped) or by a remote closing switch. Operation of the closing switch energizes the "X" relay, which in turn energizes the closing solenoid. This removes the prop, releasing the closing springs to close the breaker.

As the closing relay is energized, it energizes anti-pump relay "W". If the closing switch is maintained closed, the anti-pump relay will remain picked-up to prevent a second closing operation on the breaker in the event it is tripped open automatically. The closing impulse must be released and reapplied before a second closing operation can occur.



LEGEND

CC — CLOSING SOLENOID
F — CUTOFF SWITCH, CLOSED WHEN CLOSING SPRING IS FULLY CHARGED.
G — CUTOFF SWITCH. OPEN WHEN CLOSING SPRING IS FULLY CHARGED.
L — AUXILIARY SWITCH
M — CHARGING MOTOR
PB — CLOSE PUSHBUTTON ON BREAKER ESCUTCHEON, OPTIONAL.
TC — SHUNT TRIP DEVICE
W — ANTI-PUMP RELAY
X — CONTROL RELAY

FIG. 11 Elementary diagram for electrically operated drawout breaker.
Contact positions are shown with breaker open and closing springs discharged.

8.4 TRIPPING

In the closed position, the breaker's movable contacts are held in by a toggle linkage. The breaker is tripped open by displacing a mechanism latch which allows this toggle linkage to collapse. The trip latch is rigidly fastened to a horizontal trip shaft running from left to right through the breaker. In turn, the trip shaft carries paddles actuated by the manual trip button and the various other trip devices — overcurrent, reverse current, shunt trip, undervoltage, open fuse lockout. Viewing the breaker from the right, rotating the trip shaft counterclockwise trips the breaker; clockwise movement resets the mechanism latch.

In addition to tripping the breaker, some devices hold the breaker trip free, i.e., prevent the contacts from closing even though a closing impulse is applied to the mechanism. Such devices are the undervoltage, bell alarm and lockout, electric lockout, open fuse lockout, and the key operated locks. These devices and the drawout mechanism interlocks must be in the reset position before the breaker can be closed.

Breakers employed in conjunction with fuse rollout elements should be equipped with an open fuse lockout device (OFLO). This OFLO is a special trip device having three (3) shunt trip elements (one per phase), the coil of each being connected across its corresponding fuse in the fuse rollout unit. Connections are made via the C secondary disconnect block on the breaker thru the B secondary disconnect block on the fuse rollout unit.

The arc voltage generated by a blown fuse activates its OFLO shunt trip coil, thereby tripping the breaker and preventing single phase power from being supplied to the load. An indicator on the OFLO device signals which fuse is blown. The breaker cannot be closed until the blown fuse is acknowledged by resetting the OFLO, and presumably replacing the blown fuse.

8.5 CURRENT RATINGS FOR AUXILIARY DEVICES

TABLE 5. CURRENT RATINGS FOR AUXILIARY DEVICES

Type Load or P.F.	Voltage		Interrupting Rating (Amps)	
	Nominal	Range	Auxiliary Switch	Bell Alarm Switch
Resistance	48 dc	38-56	25.00	—
	125 dc	100-140	11.00	2.5
	250 dc	200-280	2.00	0.9
	600 dc	508-672	0.45	0.3
Electro-Magnet	48 dc	38-56	15.00	—
	125 dc	100-140	6.25	2.5
	250 dc	200-280	1.75	0.9
	600 dc	508-672	0.35	0.3
75-85% Lagging	120 ac	104-127	75.0	30.0
	240 ac	208-254	50.0	15.0
	480 ac	416-508	25.0	7.0
	600 ac	520-635	12.0	5.0
30-35% Lagging	120 ac	104-127	50.0	30.0
	240 ac	208-254	25.0	15.0
	480 ac	416-508	12.0	7.0
	600 ac	520-635	8.0	5.0
Continuous Rating (Amps)			*20.0	*10.0
Closing Rating (Amps) 30-35% PF or resistive			50.0	30.0

*On drawout breakers, limited to the 5 ampere continuous rating of #16 gage wire.

SECTION 9

Maintenance

9.1 Inspection 17
9.2 Lubrication 17
9.3 Reference Publications 17

9.1 INSPECTION

Periodic inspection of the circuit breaker is recommended at least once a year. More frequent inspections are recommended where severe load conditions, dust, moisture or other unfavorable conditions exist, or if the vital nature of the load warrants it.

Always inspect the breaker after a short-circuit current has been interrupted.

At the time of inspection, the following checks should be made after the breaker has been deenergized:

1. Manually operate the breaker several times, checking for obstructions or excessive friction. Manual closing of an electrically operated breaker may be performed by the following two steps:

(1) Install maintenance crank (568B386G1) to the motor gear reducer shaft on the front right side of the breaker. Ratchet the maintenance crank up and down until the springs are fully charged as indicated by the distinct click as the prop is set and prevents any further charging of the closing springs. After the prop is set do not apply undue force to the maintenance handle.

(2) Depress the "Spring Discharge" lever located under the horizontal support on the front frame. The springs should discharge and if the latch is properly reset, the breaker will close.

2. Electrically operate the breaker several times to check performance of the electrical accessories.

3. Visually check the breaker for loose hardware on the breaker and the bottom of the compartment for any hardware that has fallen from the breaker.

4. Remove the arc quenchers and inspect the arc quenchers and contacts for breakage or excessive burning.

5. The performance of the solid-state current trip devices may be checked with a suitable test set. Check electromechanical devices for positive trip in accordance with the instructions in Maintenance Manual.

6. Check insulating parts for evidence of overheating and for cracks that indicate excessive thermal aging.

9.2 LUBRICATION

In general, the circuit breaker requires moderate lubrication. Bearing points and sliding surfaces should be lubricated at the regular inspection periods with a thin film of GE Lubricant D50HD38 (Mobil 28). Before lubricating, remove any hardened grease and dirt from latch and bearing surfaces with kerosene. ALL EXCESS LUBRICANT SHOULD BE REMOVED WITH A CLEAN CLOTH TO AVOID ACCUMULATION OF DIRT OR DUST.

On drawout breakers the contact surface of the disconnect studs should be cleaned and greased with GE Lubricant D50HD38.

9.3 REFERENCE PUBLICATIONS

These instructions provide information of a general nature on the installation and operation of Type AKR power circuit breakers. For more detailed information such as might be needed for overhauling, trouble shooting or replacing parts of the breaker, refer to the following instruction manuals applicable to the AKR-75 and AKR-100 breakers.

Maintenance Manual	GEK-64460
Renewal Parts	GEF-4552
EC Trip Devices	GEI-86157
ECS/SST Test Sets:	
Cat. TAK-TS1	GEK-64454
Cat. TAK-TS2	GEK-73300-1

SECTION 10

Interchangeability of Drawout Breakers

10.1 General 19
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10.3 Code A Types 19
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Interchangeability of Drawout Breakers

10.1 GENERAL

Low-voltage switchgear practice requires that drawout breaker elements of the same ampere frame size be physically interchangeable. Electrical interchangeability of secondary and control circuits, of course, requires duplicate wiring. The six drawout styles (AKD, A, B, C, D & F) of the AKR-75 and - 100 models satisfy this requirement in varying degree. The B, C, D and F types, being of more recent design, limit interchangeability within a given frame size to those units having the same voltage rating; rejection of unwanted types thus is more selective than that of the earlier AKD and AKD-5 models. The individual interchangeability patterns are illustrated in Fig. 12.

The AKR-75/100 B, C, D, and F models are identical in height and width. These breakers are equipped with the means to prevent inadvertent interchange of the B, D and F types with the C type in the 3200 and 4000 ampere sizes.

Rejection means are not required on the AKD and Code A breakers; the -100 frame is wider than the -75, making them inherently non-interchangeable.

10.2 NO-LETTER AKD TYPES

As the Fig. 12 directional arrows indicate, all AKD elements are interchangeable within each frame size.

Considering that the AKR-75 AKD, B and D type breaker models are identical in width and employ very similar drawout mechanisms, rejection plates are added to the AKD AKR-75 models to prevent their insertion into B type substructures and AKD-8 switchgear. See Fig.13 .

10.3 CODE A TYPES

Interchangeability is identical to that of the AKD type.

10.4 CODE B TYPES

Interchangeability within and between frame sizes is prevented by the rejection system of Fig. 15. Variously positioned pins on the drawout tray must align with matching holes and notches in rejection plates bolted to the breaker's bottom flanges. An incorrect style breaker presents a mismatch and will not seat on the tray.

Because the B-type drawout mechanism is nearly identical to the AKD type, all B elements include additional means to reject them from AKD compartments. An outrigger bracket is attached to the right edge of the rear frame of each B breaker per Fig. 14. This interferes with the ramp cam on the right wall of the AKD compartment and prevents entry of the B unit.

10.5 CODE C TYPES

All C elements are unique and non-interchangeable within and between frame sizes. This is accomplished by the rejection hardware system of Fig. 15. Variously positioned interference pins on the rollout tracks cooperate with notched brackets fastened to the breaker's side plates. When insertion of the wrong breaker is attempted, the pins and notches do not align, thereby preventing the breaker from seating into the track slots.

C elements employ the A-type drawout mechanism, but in modified form to prevent interchangeability with the A units. The modification spaces the breaker's right side mounting pins on shorter centers (10-11/16) than those on the left side (11-7/8). See Fig. 12.

10.6 CODE D TYPES

Interchangeability is identical to that of the Code B type.

10.7 CODE F TYPES

Interchangeability is identical to that of the Code B type.

10.8 "E-TYPE" REJECTION

Some installations require that breakers serving essential circuits be segregated from identical models deployed elsewhere in the power system. The segregation is physical and is accomplished by supplemental rejection hardware added to the breaker and its drawout compartment.

In this publication these special category breakers are designated as "E-type". They are interchangeable as follows:

- E-type compartments reject standard breakers.
- Standard compartments accept E-type breakers.

E-type rejection is an optional feature available on B, C and D code breakers only.

On Code B, D and F breakers, the E-type rejection feature is provided via an extra hole in each bottom flange engaging corresponding pins added to the drawout tray. See Fig. 17.

On Code C breakers, E-type rejection is achieved by notching the breaker's right side plate to clear a special rejection pin added to the right slide rail. See Fig. 18.

All E-type breakers have the suffix letter E added to the middle digits of their designation as shown by the following example: AKR-4BE-75.

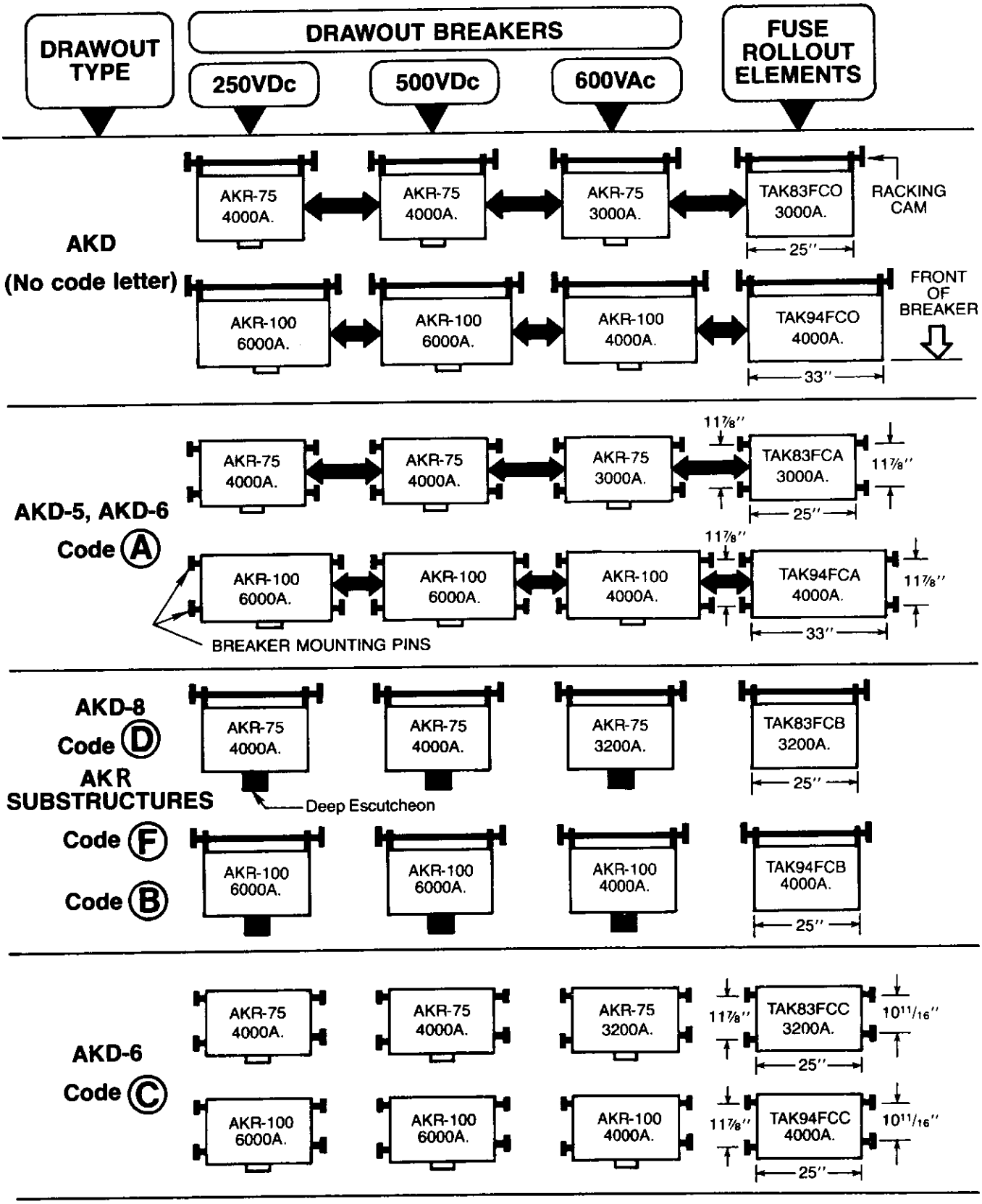


Fig. 12 Drawout breaker interchangeability chart, plan view. All breaker units joined by ⟷ fit the same compartment. All others have unique mounting and are not interchangeable.

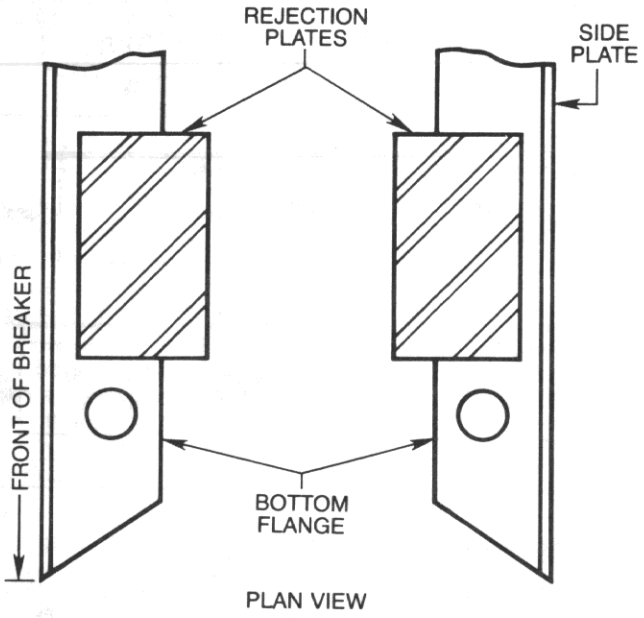


Fig. 13 Rejection hardware on AKR-75 AKD type units to prevent insertion into B-type substructures and AKD-8 Switchgear.

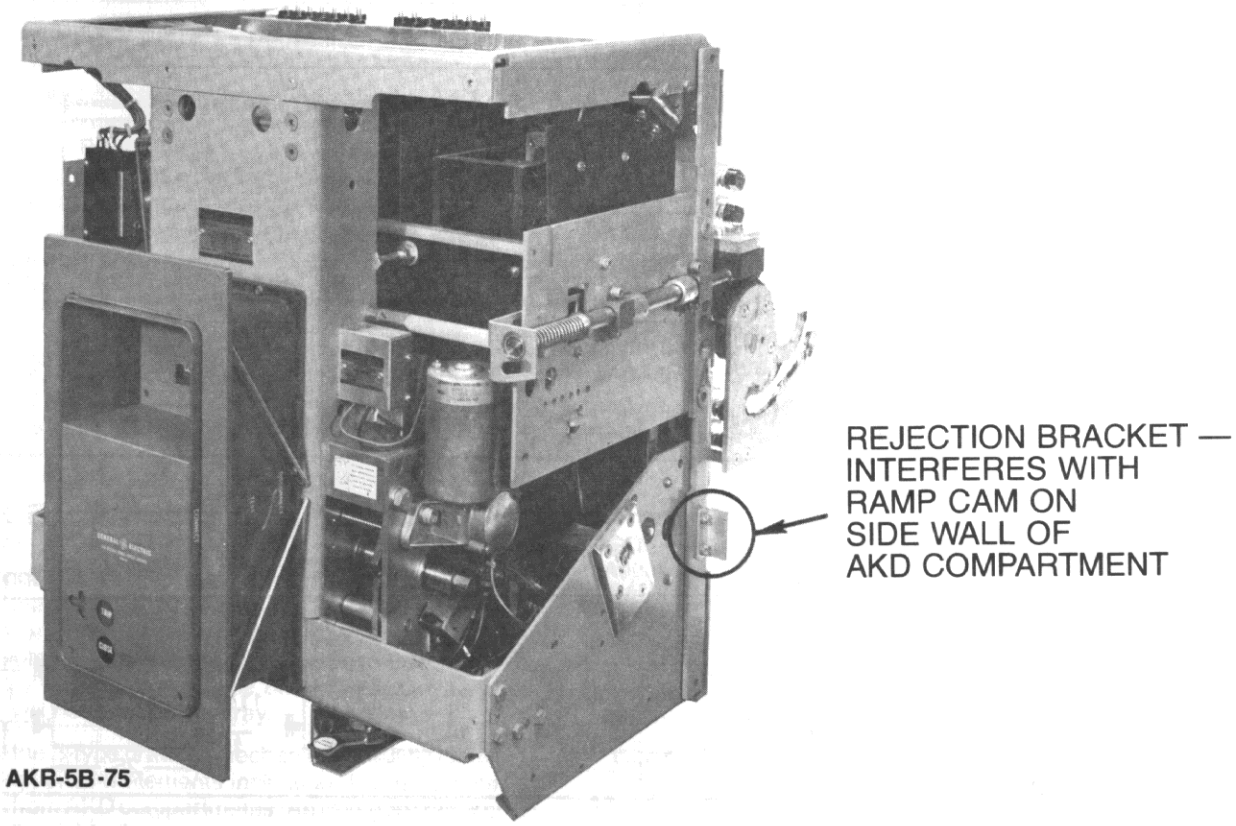
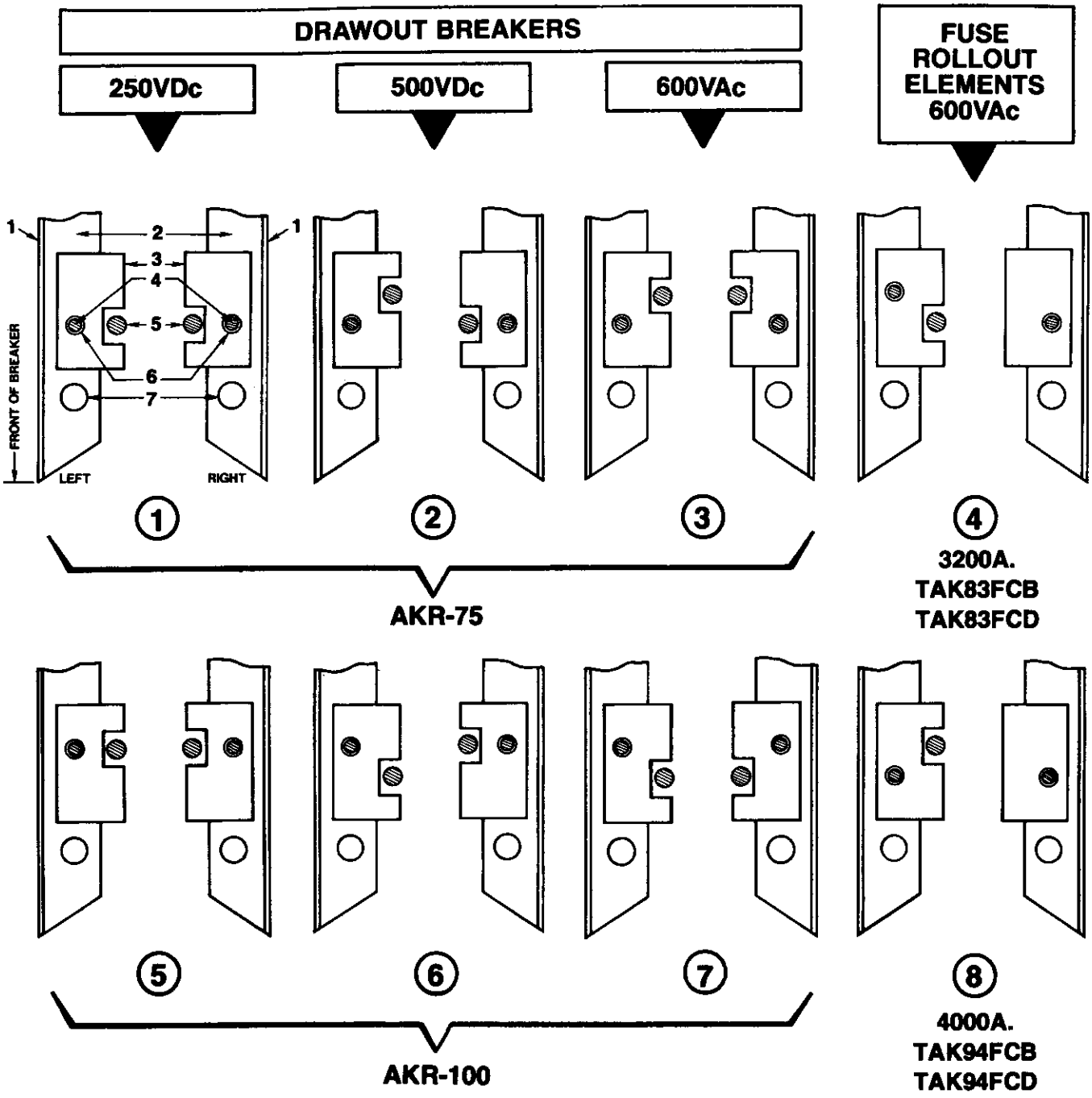


Fig. 14 Rejection means on AKR-75/100 code B, D and F type drawout breakers to exclude them from AKD type compartments.



1—Breaker side plate
2—Bottom flange of side plate
3—Rejection plate
4—⅜" diam. pin in drawout tray
5—½" diam. pin in drawout tray
6—Clearance hole in plate and flange
7—Breaker mounting bolt hole

Fig. 15 Rejection hardware on AKR-75/100 Code B, D and F type drawout breaker elements. Plan views.

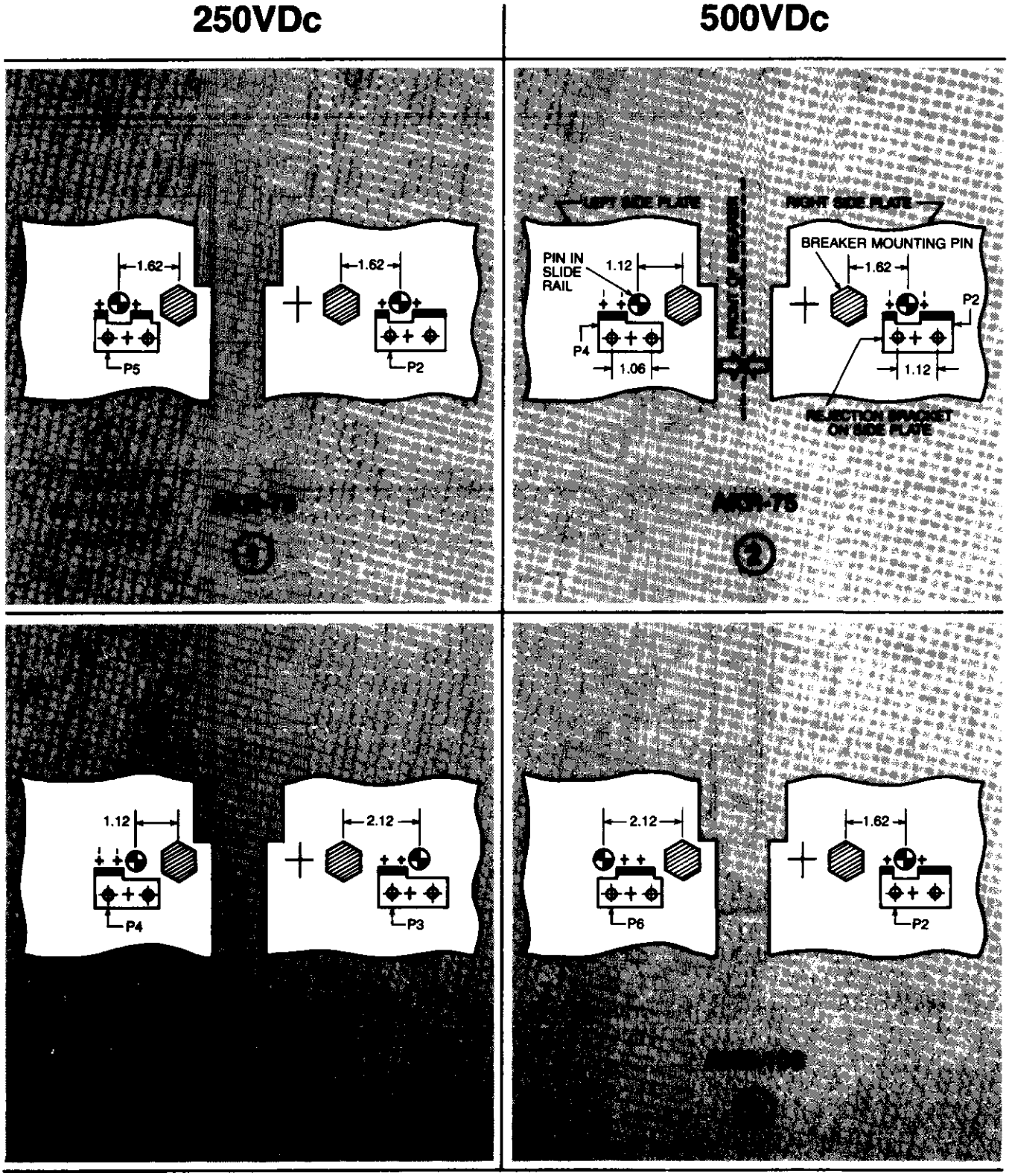
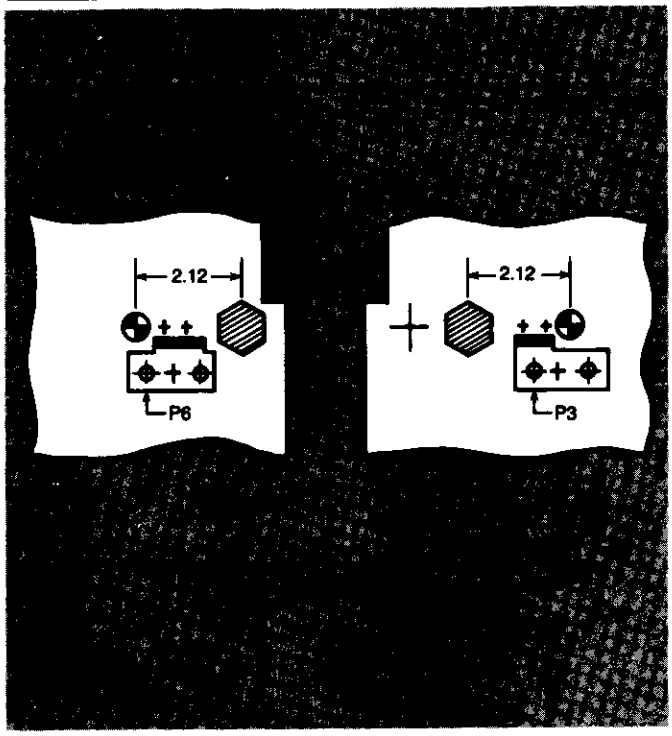
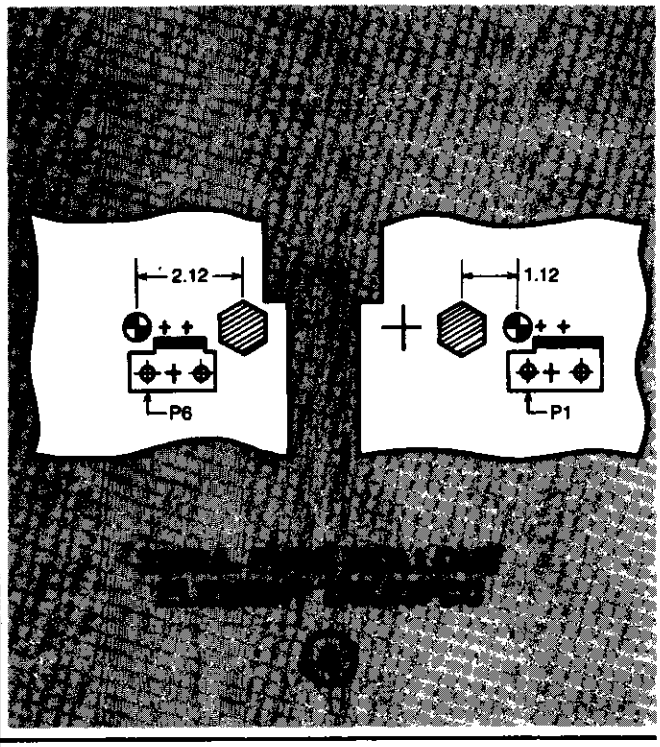


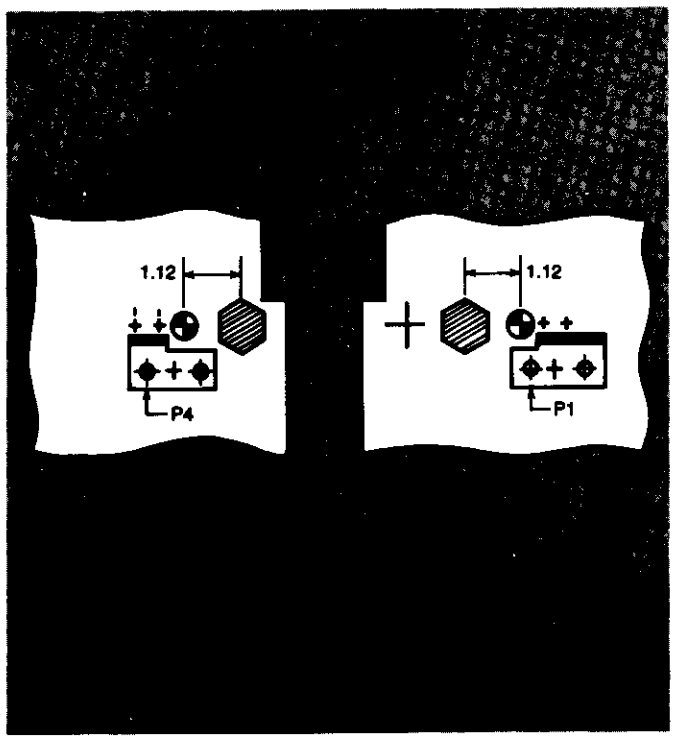
FIG. 16 Rejection hardware on AKR-75/100 Code C type drawout breaker elements — side views.

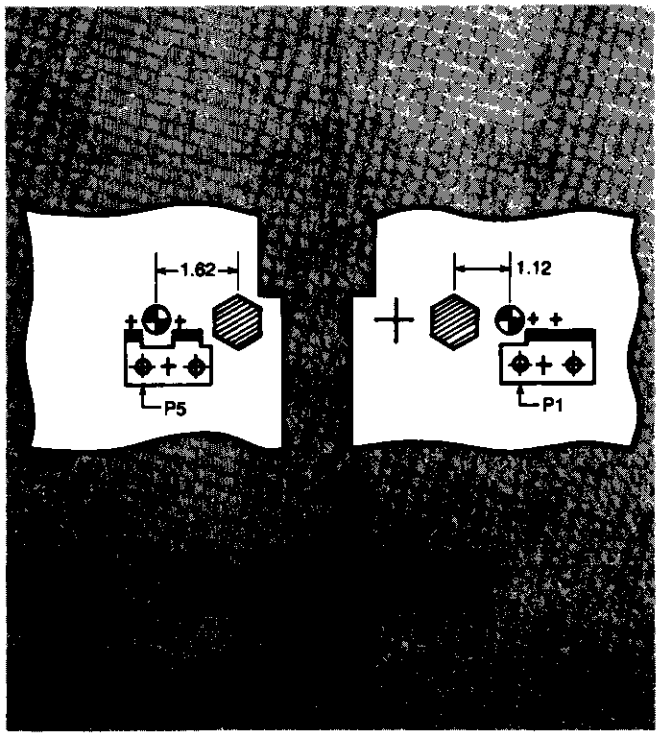
600VAc



600VAc







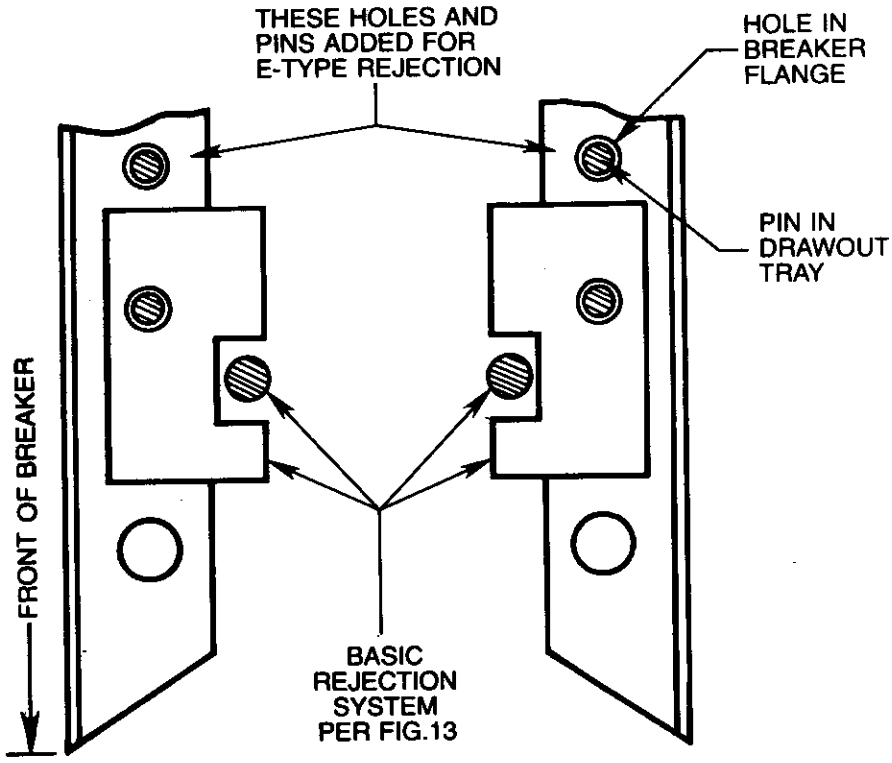


Fig. 17 Optional "E-Type" rejection hardware on AKR-75/100 Code B,D and F type drawout breaker elements.

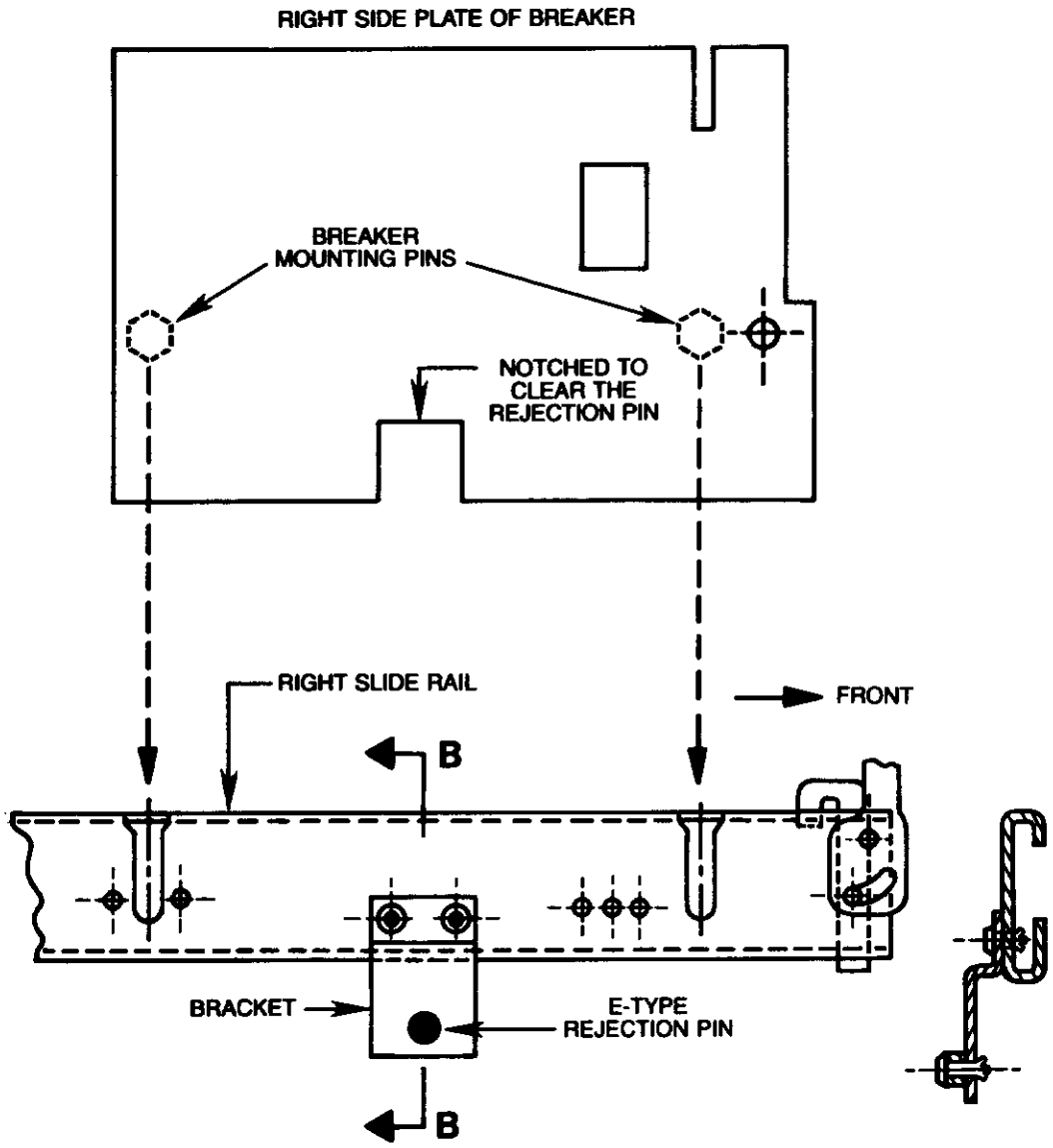


Fig. 18 Optional "E-Type" rejection system on AKR-75/100 Code C drawout breaker elements.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company. These instructions are intended for use by qualified personnel only.

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