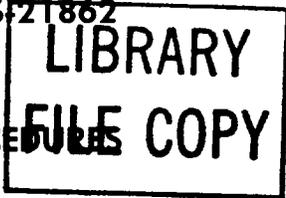


KS-15696, KS-15698, KS-21861, AND KS-21862  
BUS DUCTS  
APPLICATION AND MAINTENANCE PROCEDURES



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- (e) To add Part 4
- (f) To add Fig. 10, 11, and 12.

**1. GENERAL**

**1.01** This section covers the application and maintenance of the KS-15696, KS-15698, KS-21861, and KS-21862 bus ducts and their associated plug-in units.

**1.02** The reasons for reissuing this section are listed below. Revision arrows are used to emphasize the more significant changes. The Equipment Test List is not affected.

- (a) To revise paragraph 1.04
- (b) To add a Danger to paragraph 3.02
- (c) To revise Tables A, K, L, M, N, O, P, R, and S
- (d) To add Tables W and X

**1.03** The equipment covered by this section (Tables A through X) is used to supply commercial power to motor-generator sets, rectifiers and associated equipment. Arrangements are provided for distributing 3-phase 3-wire and 3-phase 4-wire power service up to 480-volts. A separate grounding conductor is provided in all equipment. Cable tap boxes are provided for connecting power to the duct bus bars. Covered openings at regular intervals in the bus duct enclosure provide access to the bus bars for making electrical connections by means of contact fingers on the plug-in units. The plug-in units consist of a housing for a protective device which may be either a switch and fuse or circuit breaker type. Clamping devices are provided for attaching plug-in units to the bus duct and the bus duct to the auxiliary framing.

**1.04** ♦The KS-21861 (copper) and KS-21862 (aluminum) bus ducts are improved units for use on initial installations instead of the KS-15696 and KS-15698 bus ducts. The KS-15696 bus duct is Mfr Disc. except for plug-in units (Tables L and O) which are available to permit growth usage of existing KS-15696 bus duct installations. Table L also contains a listing of circuit breaker plug-in units which have been Mfr Disc. but are still being used and may require maintenance information. KS-21861 extension bus ducts and joint covers for extending existing KS-15696 bus ducts are listed in Tables R, S, and W. Plug-in units for use with both the KS-21861 and KS-21862 bus ducts are identified as KS-21862, L—plug-in units.♦

**1.05** The bus ducts are designed for use on the No. 100-, 300-, and 700—type plants having more than three charging units. For additional information, refer to Section 802-005-150.

♦TABLE A♦

## KS-21861 AND KS-21862 BUS DUCTS

LIST NO.				AMPERE RATING
12" PLUG-IN OPENING		6" PLUG-IN OPENING		
3Ø-3W	3Ø-4W	3Ø-3W	3Ø-4W	
301	401	601	701	400
302	402	602	702	600
303	403	603	703	800
304	404	604	704	1000
305	405	605	705	400
306	406	606	706	600
307	407	607	707	800
308	408	608	708	800
309	409	609	709	400
310	410	610	710	600
311	411	611	711	800
312	412	612	712	1000

See Fig. 1 for typical Bus Duct.

TABLE B

## KS-15698 BUS DUCT

LIST NO.				AMPERE RATING
3W	4W	3W - W/GRD	4W - W/GRD	
1	201	1G	201G	400
2	202	2G	202G	600
3	203	3G	203G	800
4	204	4G	204G	1000
5	205	5G	205G	400
6	206	6G	206G	600
7	207	7G	207G	800
8	208	8G	208G	1000
9	209	9G	209G	400
10	210	10G	210G	600
11	211	11G	211G	800
12	212	12G	212G	1000

TABLE C

## KS-21861 END CLOSURE

LIST NO.		AMPERE RATING
COUPLING END	OPEN END	
61	63	400+600
62	64	800+1000

See Fig. 2 for typical End Closure.

TABLE D

## KS-21862 END CLOSURE

LIST NO.		AMPERE RATING
COUPLING END	OPEN END	
61	64	400
62	65	600+800
63	66	1000

See Fig. 2 for typical End Closure.

TABLE E

## KS-21861 AND KS-21862 CENTER TAP BOXES

LIST NO.		AMPERE RATING	ASSOC. DUCT. AMPERE RATING
3 $\phi$ -3W	3 $\phi$ -4W		
331	431	800	400
332	432	1200	600
333	433	1600	800
334	434	2000	1000

See Fig. 3 for typical Center Tap Box.

TABLE F

## KS-21861 AND KS-21862 END TAP BOXES

OPEN END DUCT		COUPLING END DUCT		AMPERE RATING
LIST NO.		LIST NO.		
3Ø-3W	3Ø-4W	3Ø-3W	3Ø-4W	
341	441	345	445	400
342	442	346	446	600
343	443	347	447	800
344	444	348	448	1000

See Fig. 4 for typical End Tap Box.

TABLE G

## KS-15698 FEED THROUGH TAP BOX

LIST NO.				BOX CAP AMP	BUS CAP AMP
3W	4W	3W-W/GRD	4W-W/GRD		
71	271	71G	271G	600	600
72	272	72G	272G	1500	600
73	273	73G	273G	1500	800
74	274	74G	274G	2000	800
75	275	75G	275G	2000	1000

TABLE H

## KS-15698 SECTION TAP BOX (LUGS NEAR FORMED END OF BUS BAR)

LIST NO.				BOX CAP AMPS	BUS CAP AMPS
3W	4W	3W-W/GRD	4W-W/GRD		
31	231	31G	231G	1200	400
32	232	32G	232G	1200	600
33	233	33G	233G	1200	800
34	234	34G	234G	1200	1000

TABLE I

## KS-15698 SECTION TAP BOX (LUGS NEAR STRAIGHT END OF BUS BAR)

LIST NO.				BOX CAP AMPS	BUS CAP AMPS
3W	4W	3W-W/GRD	4W-W/GRD		
35	235	35G	235G	1200	400
36	236	36G	236G	1200	600
37	237	37G	237G	1200	800
38	238	38G	238G	1200	1000

TABLE J

## KS-15698 END TAP BOX

LIST NO.								AMPERE RATING
FORMED END				STRAIGHT END				
3W	4W	3W-W/GRD	4W-W/GRD	3W	4W	3W-W/GRD	4W-W/GRD	
41	241	41G	241G	46	246	46G	246G	600
42	242	42G	242G	47	247	47G	247G	800
43	243	43G	243G	48	248	48G	248G	1000

♦TABLE K♦

## KS-21862 CIRCUIT BREAKER PLUG-IN UNITS \*

LIST NO.		RATING		CIRCUIT BREAKERS	
3Ø—3W	3Ø—3W	VOLTS	AMPS	NO.	AMPS (EA.)
	351	240	100	4	15
	353	240	100	4	30
	354	240	200	4	50
	355	240	200	2	90
	356	240	200	2	100
	357	480	100	4	15
	358	480	200	4	30
	359	480	100	2	50
	360	480	200	2	100
	361	240	450	1	225
	362	240	450	2	225
451		120/208	100	4	15
453		120/208	200	4	30
454		120/208	200	4	50
455		120/208	200	2	90
456		120/208	200	2	100
457		277/480	100	4	15
458		277/480	200	4	30
459		277/480	100	2	50
460		277/480	200	2	100
461		120/208	450	1	225
462		120/208	450	2	225

See Fig. 5 for typical Circuit Breaker Plug-in Unit.

\* For use on KS-21861 and KS-21862 bus ducts.

♦TABLE L♦

## KS-15696 CIRCUIT BREAKER PLUG-IN UNITS

LIST NO.	RATING		CIRCUIT BREAKER	
	VOLTS	AMPS	QTY	AMPS (EA.)
361A	480	450	1	225
362A	480	450	2	225
363A	480	200	2	100
451A	250	100	4	15
452A	250	100	4	30
453A	250	200	4	50
454A	250	200	2	90
455A	480	100	4	15
456A	480	100	2	50
457A	480	200	4	30
401	250	100	4	25 (MD)
401G	250	100	4	25 (MD)
402	250	100	4	15 (MD)
402G	250	100	4	15 (MD)
403B	480	100	4	15 (MD)
403G	480	100	4	15 (MD)
404B	480	100	4	10 (MD)
404G	480	100	4	10 (MD)
405	250	200	4	30 (MD)
405G	250	200	4	30 (MD)
406	250	200	4	50 (MD)
406G	250	200	4	50 (MD)
407B	480	200	4	30 (MD)
407G	480	200	4	30 (MD)
451	250	200	2	90 (MD)
451G	250	200	2	90 (MD)
452B	480	200	2	50 (MD)
452G	480	200	2	50 (MD)

♦TABLE M♦

## CIRCUIT BREAKER PLUG-IN UNITS — KS-15698

LIST NO.		FIG. NO.	RATING		CIRCUIT BREAKER	
NO. GRD	WITH GRD		VOLT	AMP	NO.	AMP (EA.)
501	501G	5	250 EQB	100	4	25
502	502G					15
503	503G					
504	504G					
505	505G		10			
506	506G					
507	507G		30			
508	508G					
509	509G		50			
510	510G					
511	511G		90			
512	512G					
513	513G		45			
514	514G					
551	551G	100				
552	552G					
553	553G	50				
554	554G					
555	555G	100				
556	556G					
557	557G	225				
558	558G					
559	559G	225				
560	560G					
561	561G	225				
562	562G					

♦TABLE N♦

## SWITCH AND FUSE PLUG-IN UNITS KS-21862\*

LIST NO.		RATING	
3Ø—3W	3Ø—4W	VOLTS	AMPS
371	—	240	30
372	—	240	60
373	—	240	100
374	—	240	200
375	—	240	400
376	—	480	30
377	—	480	60
378	—	480	100
379	—	480	200
380	—	480	400
—	471	120/408	30
—	472	120/408	60
—	473	120/408	100
—	474	120/408	200
—	475	120/408	400
—	476	277/408	30
—	477	277/408	60
—	478	277/408	100
—	479	277/408	200
—	480	277/408	400

See Fig. 6 for typical Switch and Fuse Plug-in Unit.

\* For use on KS-21861 and KS-21862 bus ducts.

♦TABLE O♦

## KS-15696 SWITCH AND FUSE PLUG-IN UNITS

LIST NO.	RATING	
	VOLTS	AMPS
471A	250	30
472A	250	60
473A	250	100
474A	250	200
475A	250	400
476A	600	30
477A	600	60
478A	600	100
479A	600	200
480A	600	400

TABLE P

KS-15698 SWITCH AND FUSE PLUG-IN UNITS

LIST NO.																AMPERE RATING	HP RATING	
3 WIRE				4 WIRE				3 WIRE PLUS GRD				4 WIRE PLUS GRD					NOM	LABEL
250V	480V	250V	480V	250V	480V	250V	480V	250V	480V	250V	480V	250V	480V	250V	480V			
51		351		251		651		51G		351G		251G		651G		30	3	7-½
	151		451		751		851		151G		451G		751G		851G		5	15
52		352		252		652		52G		352G		252G		652G		60	7-½	15
	152		452		752		852		152G		452G		752G		852G		15	30
53		353		253		653		53G		353G		253G		653G		100	15	30
	153		453		753		853		153G		453G		753G		853G		25	60
54		354		254		654		54G		354G		254G		654G		200	25	60
	154		454		754		854		154G		454G		754G		854G		50	100
55		355		255		655		55G		355G		255G		655G		400	50	100
	155		455		755		855		155G		455G		755G		855G		100	—

TABLE Q

KS-15698 CHANNEL SPACER KIT

LIST NO.	APPLICATION
250	For 800 Amp and Larger Bus Ducts

◆ TABLE R ◆

KS-21861 EXTENSION DUCTS FOR USE WITH KS-15696 DUCTS

LIST NO.						DUCT LGTH (FT)	AMP RATING	NO. PLUG-IN OPENINGS		CONN. END TYPE	CONNECTING KS-15696 DUCTS LIST NO.								
3W		3W-W/GRD		4W				6-INCH*	12-INCH*		3W			3W-W/GRD			4W		
6-INCH*	12-INCH*	6-INCH*	12-INCH*	6-INCH*	12-INCH*						1PH	5PH	9PH	1PG	5PG	9PG	201PH	205PH	209PH
3056 HC	305 HC	3056 GC	305 GC	4056 NC	405 NC	8	400	13	7	COUPLING END	1PH	5PH	9PH	1PG	5PG	9PG	201PH	205PH	209PH
3096 HC	309 HC	3096 GC	309 GC	4096 NC	409 NC	5	400	7	4		2PH	6PH	10PH	2PG	6PG	10PG	202PH	206PH	210PH
3066 HC	306 HC	3066 GC	306 GC	4066 NC	406 NC	8	600	13	7		3PH	7PH	11PH	3PG	7PG	11PG	203PH	207PH	211PH
3106 HC	310 HC	3106 GC	310 GC	4106 NC	410 NC	5	600	7	4		4PH	8PH	12PH	4PG	8PG	12PG	204PH	208PH	212PH
3076 HC	307 HC	3076 GC	307 GC	4076 NC	407 NC	8	800	13	7		OPEN END	1PH	5PH	9PH	1PG	5PG	9PG	201PH	205PH
3116 HC	311 HC	3116 GC	311 GC	4116 NC	411 NC	5	800	7	4	2PH		6PH	10PH	2PG	6PG	10PG	202PH	206PH	210PH
3086 HC	308 HC	3086 GC	308 GC	4086 NC	408 NC	8	1000	13	7	3PH		7PH	11PH	3PG	7PG	11PG	203PH	207PH	211PH
3126 HC	312 HC	3126 GC	312 GC	4126 NC	412 NC	5	1000	7	4	4PH		8PH	12PH	4PG	8PG	12PG	204PH	208PH	212PH
3056 HO	305 HO	3056 GO	305 GO	4056 NO	405 NO	8	400	13	7	OPEN END		1PH	5PH	9PH	1PG	5PG	9PG	201PH	205PH
3096 HO	309 HO	3096 GO	309 GO	4096 NO	409 NO	5	400	7	4		2PH	6PH	10PH	2PG	6PG	10PG	202PH	206PH	210PH
3066 HO	306 HO	3066 GO	306 GO	4066 NO	406 NO	8	600	13	7		3PH	7PH	11PH	3PG	7PG	11PG	203PH	207PH	211PH
3106 HO	310 HO	3106 GO	310 GO	4106 NO	410 NO	5	600	7	4		4PH	8PH	12PH	4PG	8PG	12PG	204PH	208PH	212PH
3076 HO	307 HO	3076 GO	307 GO	4076 NO	407 NO	8	800	13	7										
3116 HO	311 HO	3116 GO	311 GO	4116 NO	411 NO	5	800	7	4										
3086 HO	308 HO	3086 GO	308 GO	4086 NO	408 NO	8	1000	13	7										
3126 HO	312 HO	3126 GO	312 GO	4126 NO	412 NO	5	1000	7	4										

\* Plug-in Opening Centers

◆ TABLE S ◆

**KS-21861 JOINT COVERS  
FOR USE WITH EXTENSION DUCTS IN TABLE R**

LIST NO	DUCT AMP	DUCT TYPE
21A	400 & 600	3W & 4W
22A	800 & 1000	3W & 4W
23A	400 & 600	3W-W/GRD
24A	800 & 1000	3W-W/GRD

TABLE T

**KS-21861 AND KS-21862 FEEDER BUS DUCTS**

LIST NO.		AMP	DIMENSIONS		
			HEIGHT IN.		LENGTH IN.
3Ø 3W	3Ø 4W		KS-21861	KS-21862	
301F	401F	400	4 1/8	4 1/8	120
302F	402F	600		6 1/8	
303F	403F	800	6 1/8	8 1/8	
304F	404F	1000		8 1/8	
305F	405F	400	4 1/8	4 1/8	96
306F	406F	600		6 1/8	
307F	407F	800	6 1/8	8 1/8	
308F	408F	1000		8 1/8	
309F	409F	400	4 1/8	4 1/8	60
310F	410F	600		6 1/8	
311F	411F	800	6 1/8	8 1/8	
312F	412F	1000		8 1/8	

See Fig. 7 for Details.

TABLE U

KS-21861 AND KS-21862 HORIZONTAL ELBOWS

LIST NO.		AMP	TYPE	DIMENSIONS			
3Ø 3W	3Ø 4W			A	B		
31 RL	41 RL	400	Right Hand	To Be Specified In Order (Min-1'6")			
32 RL	42 RL	600					
33 RL	43 RL	800					
34 RL	44 RL	1000					
31 LL	41 LL	400	Left Hand				
32 LL	42 LL	600					
33 LL	43 LL	800					
34 LL	44 LL	1000					

See Fig. 8 for Details

TABLE V

KS-21861 AND KS-21862 VERTICAL ELBOWS

LIST NO.		AMP	TYPE	DIMENSIONS			
3Ø 3W	3Ø 4W			A	B		
31 UL	41 UL	400	Vert Up	To Be Specified In Order (Min-1'6")			
32 UL	42 UL	600					
33 UL	43 UL	800					
34 UL	44 UL	1000					
31 DL	41 DL	400	Vert Down				
32 DL	42 DL	600					
33 DL	43 DL	800					
34 DL	44 DL	1000					

See Fig. 9 for Details

↓ TABLE W ↓  
**BUS - DUCTS - KS-21861**  
**(GROWTH DUCTS FOR KS-21861 EXTENSION DUCTS IN TABLE R)**

DUCT LGTH (FT)	LIST NO.						FOR USE WITH EXTENSION DUCTS			
	3Ø,3W	3Ø 3W/GND	3Ø ,4W	3Ø ,3W	3Ø 3W/GND	3Ø, 4W	AMP RATING	3Ø, 3W	3Ø 3W/GND	3Ø, 4W
8	305 HA	305 GA	405 NA	305 HB	305 GB	405 NB	400	305 HO 305 HC	305 GO 305 GC	405 NO 405 NC
8	306 HA	306 GA	405 NA	306 HB	306 GB	406 NB	600	306 HO 306 HC	306 GO 306 GC	406 NO 406 NC
8	307 HA	307 GA	407 NA	307 HB	307 GB	407 NB	800	307 HO 307 HC	307 GO 307 GC	407 NO 407 NC
8	308 HA	308 GA	408 NA	308 HB	308 GB	408 NB	1000	308 HO 308 HC	308 GO 308 GC	408 NO 408 NC
5	309 HA	309 GA	409 NA	309 HB	309 GB	409 NB	400	309 HC 309 HO	309 GC 309 GO	409 NC 409 NO
5	310 HA	310 GA	410 NA	310 HB	310 GB	410 NB	600	310 HO 310 HC	310 GO 310 GC	410 NO 410 NC
5	311 HA	311 GA	411 NA	311 HB	311 GB	411 NB	800	311 HC 311 HO	311 GC 311 GO	411 NC 411 NO
5	312 HA	312 GA	412 NA	312 HB	312 GB	412 NB	1000	312 HC 312 HO	312 GC 312 GO	412 NC 412 NO

↓ TABLE X ↓  
**KS-21861 AND KS-21862 JOINT COVERS**

LIST NO	DUCT AMP
21	400 & 600
22	800 & 1000

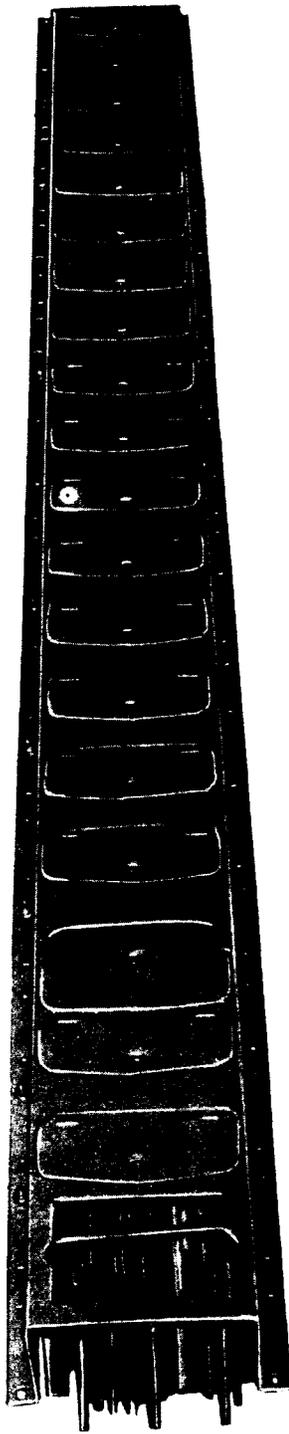


Fig. 1—KS-21861 and KS-21862 Bus Ducts

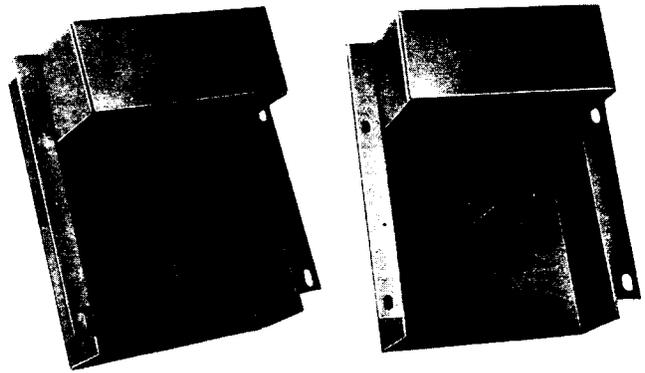


Fig. 2—End Closures

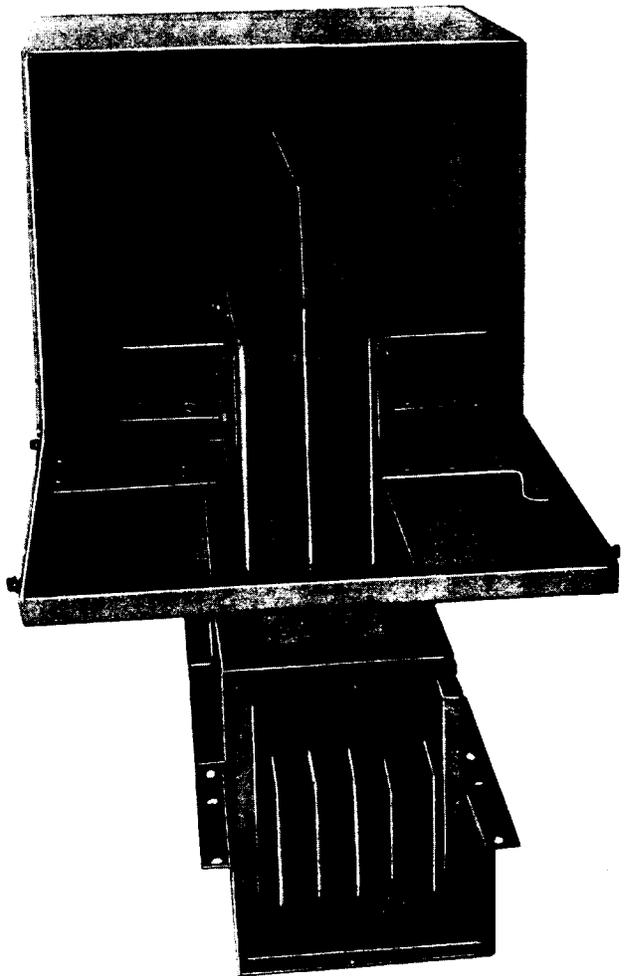


Fig. 3—Center Tap Box—Internal View

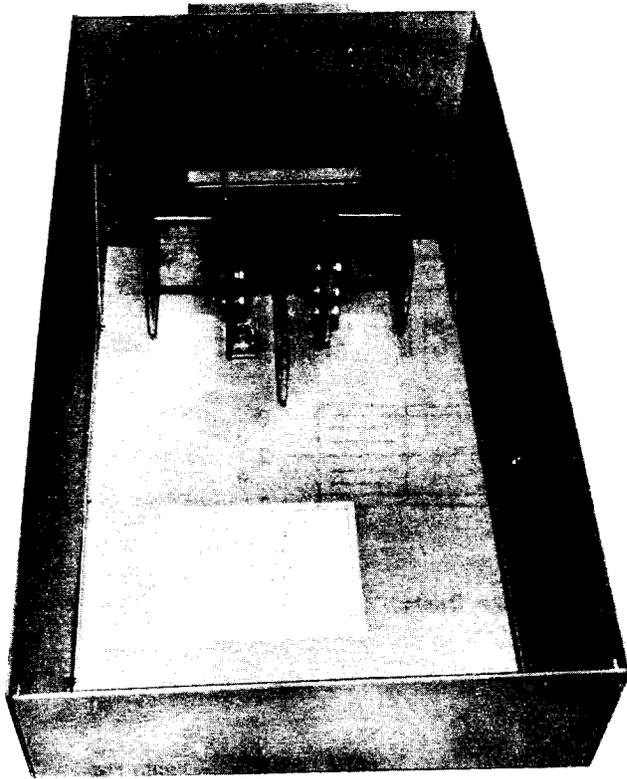


Fig. 4—End Tap Box—Internal View

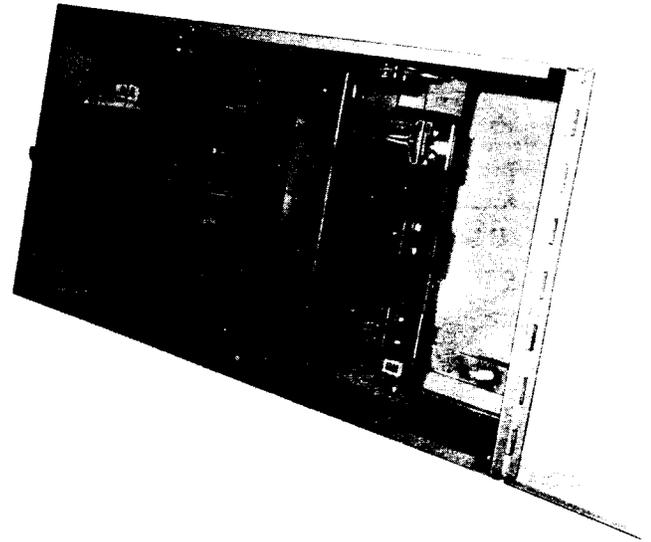


Fig. 6—Switch and Fuse Plug-In Unit—Internal View

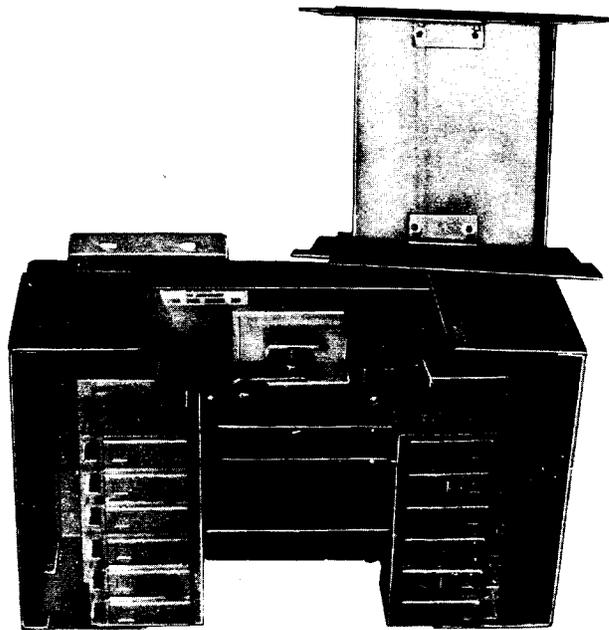


Fig. 5—Circuit Breaker Plug-In Unit—Internal View

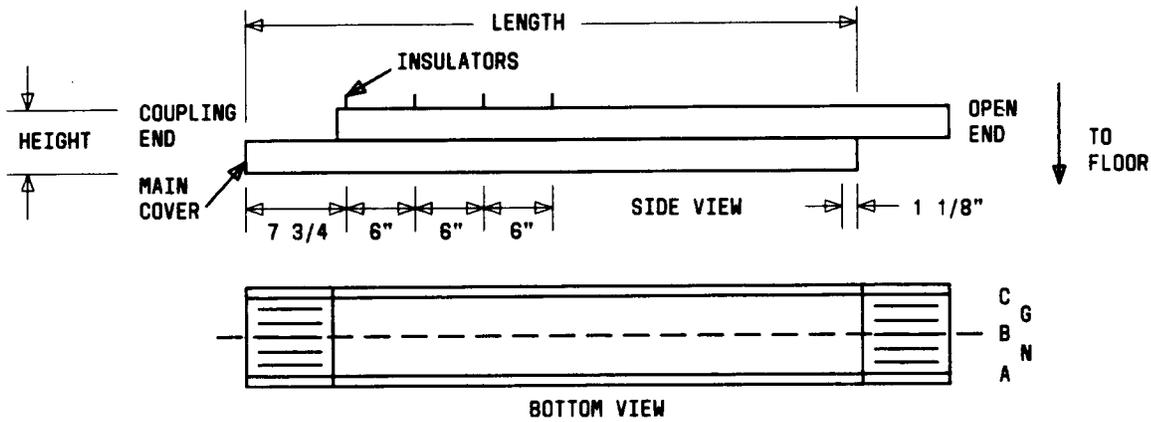


Fig. 7—KS-21861 and KS-21862 Feeder Bus Ducts

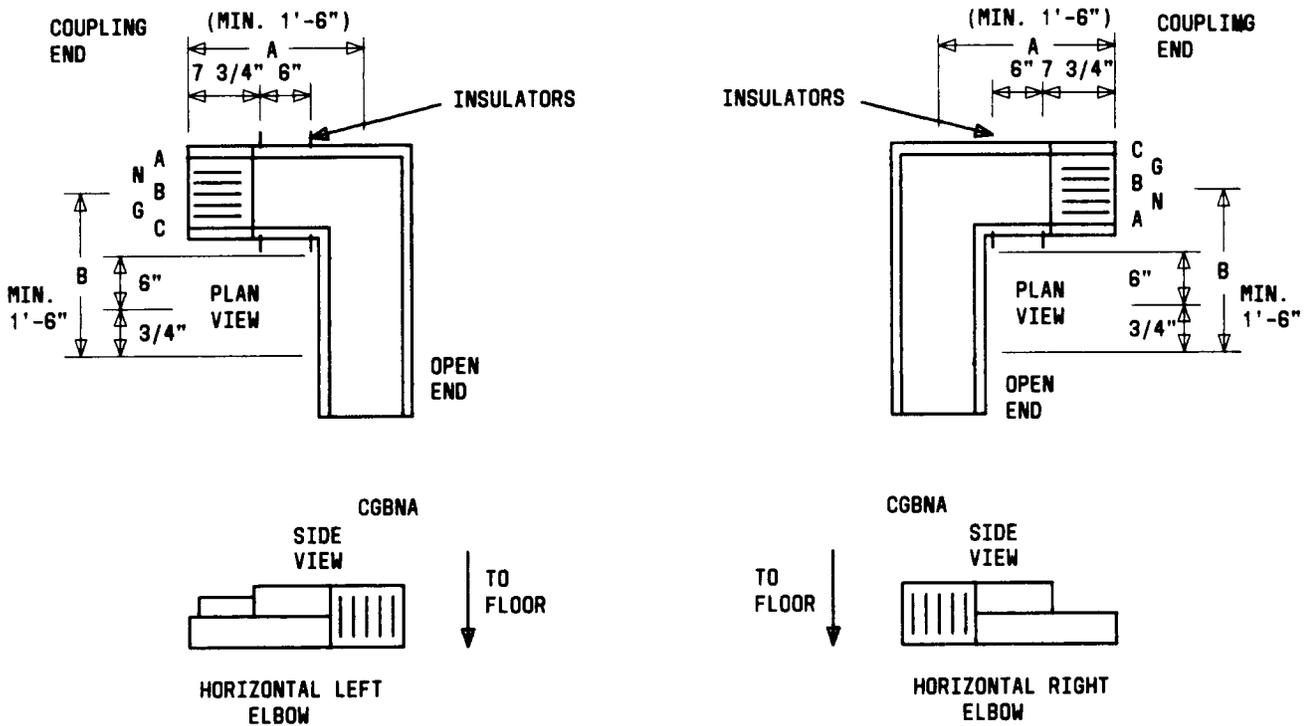


Fig. 8—KS-21861 and KS-21862 Horizontal Elbows

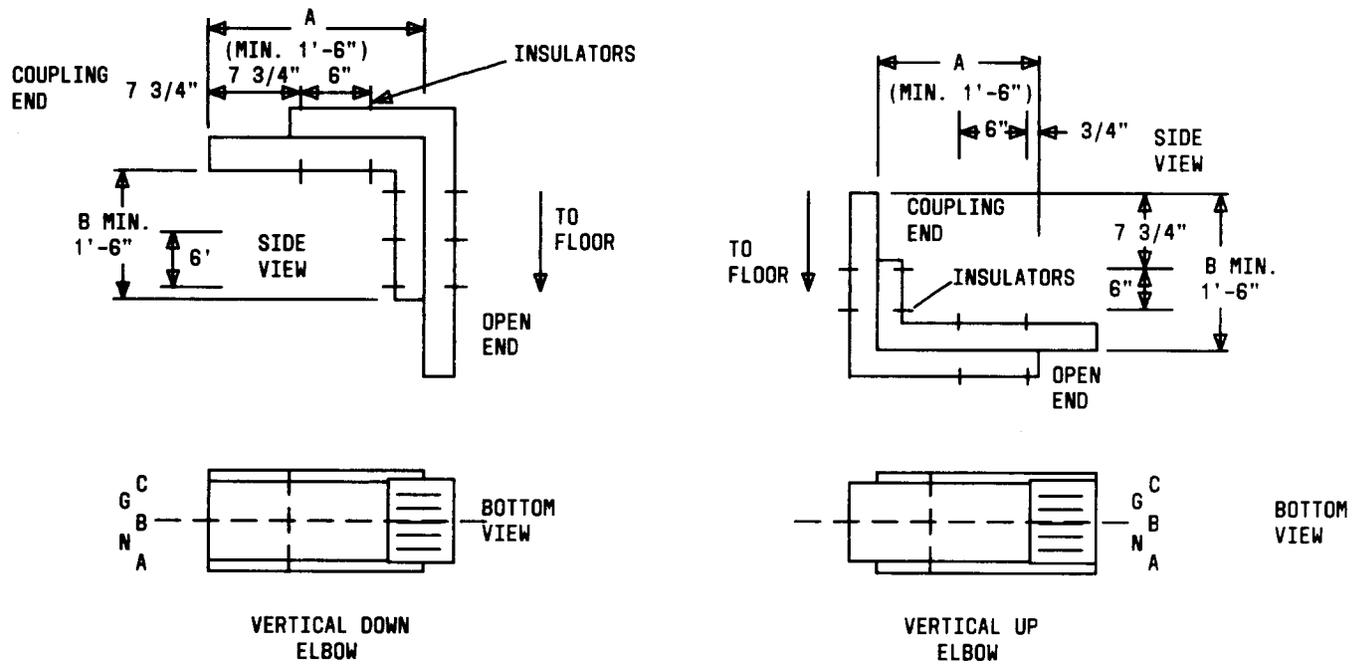


Fig. 9—KS-21861 AND KS-21862 Vertical Elbows

## 2. APPARATUS

**2.01 List of Tools, Materials, and Test Equipment:** The following Tools, Materials, and Test Equipment are used in this section.

TOOLS	DESCRIPTION
AT-7825	4-Inch E Screwdriver
KS-2993	Brush (or equivalent)
KS-14377, L5	Vacuum cleaner (or equivalent equipped with a KS-14377, L30 flexible nozzle (or equivalent))

## MATERIALS

KS-2423	Twill Cloth
—	NO-OX-ID Grade A Compound
—	SYN-LEK I Cleaning Compound (Aerosol Spray) (Selig Chemical Ind., Atlanta, Ga.)

## TEST EQUIPMENT

—	Megger (500-volts)
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## 3. INSPECTION AND MAINTENANCE

**3.01** Bus ducts and associated parts are constructed for long and trouble-free service; therefore, maintenance is performed on an "as required" basis. The following procedures are for use when inspection and maintenance are required.

## BUS DUCTS

**3.02** Inspection and maintenance procedures for bus ducts are as follows:

**⚠Danger:** Bus ducts shall be de-energized before preceding with any work which might result in accidental short circuiting of live parts or shock hazards.⚠

- (a) Remove appreciable accumulations of dust or dirt using a brush, vacuum cleaner, or lint-free rags. Do not use blowers or compressed air for cleaning.
- (b) Inspect all visible or accessible electrical joint connections for evidence of overheating.

(c) Check tightness of all joint fasteners. (KS-21861 and KS-21862 bus duct joint fasteners are not "live" and may be checked without turning off power).

(d) Disassemble, replace or clean bus bar joints or terminations which are badly discolored, corroded, pitted or show evidence of having been subjected to high temperatures.

**Caution:** Do not remove plating on aluminum parts in joints or terminations. Damaged aluminum parts should normally be replaced.

(e) Perform insulation resistance test as follows:

- (1) Turn off all tap-off and/or plug-in devices.
- (2) Isolate the bus by disconnecting all connections to transformers, switchboards, meters, power factor correction equipment, etc.
- (3) Using megger (at least 500-volts) check for short circuits and grounds.

**Note:** Megger (megohm) readings vary inversely with the length of run and width or number of bars per phase. Readings will also vary with humidity. Readings of less than 1 megohm for a 100-foot run should be investigated.

## PLUG-IN UNITS

**⚠Danger:** Remove entire circuit breaker plug-in, or de-energize bus duct during breaker replacement. Fuse plug-in units may be serviced, provided the switch is in the OFF position and a check made, with a meter, to confirm that no potential is on the fuse terminals.⚠

**3.03** Inspection and maintenance procedures for plug-in units are as follows:

- (a) Examine fuse clips for signs of overheating and looseness. Replace fuse clips if spring pressure is sufficient.
- (b) Examine insulating materials for signs of deterioration and sealing compounds for signs of melting. Replace insulating parts and assemblies when the sealing compound has melted.

- (c) Examine all contact areas for evidence of contamination or corrosion. Sand contaminated or corroded areas lightly and coat with NO-OX-ID Grade A compound.
- (d) Examine all readily accessible arc chutes and insulating parts for cracks or breakage and for arc spatter, sooty deposits, oil or cracking.
- (e) Clean off arc spatter, oil and sooty deposits. Replace the device if appreciable material has burned away or if parts are charred or cracked.
- (f) Lubricate the operating parts of switch mechanisms, etc.
  - (1) Use clean, nonmetallic, light grease or oil as instructed.
  - (2) Do **not** oil or grease parts of molded case circuit breakers.
  - (3) Sliding copper contacts, operating mechanisms and interlocks may be lubricated with clean, light grease.
  - (4) Wipe off excess lubrication to avoid catching dirt.
- (g) Check the operation of all mechanical components as follows:

**Note:** Verify that spares are available prior to the removal of any defective devices.

- (1) Check all switch operator mechanisms and external operators of circuit breakers. Make sure each operator mechanism quickly and positively throws contacts fully ON and fully OFF. (See paragraph 4 for repair and/or replacement procedures for faulty circuit breakers.)

**Warning:** *Verify that circuit breakers which have been tripped due to violent operation are operating properly (contacts not welded together).*

- (2) Check the mechanisms of all electrical and mechanical interlocks and padlocking means.
- (3) Check for missing or broken parts, proper spring tension, free movement, rusting or corrosion, dirt, and excessive wear.

- (h) Retighten all wire connections.
- (i) Check fuses to make sure they have the proper ampere rating and interrupting rating. Make sure that noncurrent-limiting fuses are never used as replacements for current-limiting fuses. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the wrong type of fuses.
- (j) Check the insulation resistance of devices prior to their reinstallation on the busway.

#### 4. **CIRCUIT BREAKER REPAIR AND/OR REPLACEMENT**

**4.01** The major trouble with the circuit breakers is an intermittent non-turn-on condition. This trouble occurs mostly in the Frank Adam type circuit breakers used in the KS-15696, Frank Adam and GTE Sylvania, circuit breaker plug-in units (Fig. 10). It has been determined that the prime cause of this problem is excessive internal friction due to a build-up of dust and dirt, etc.

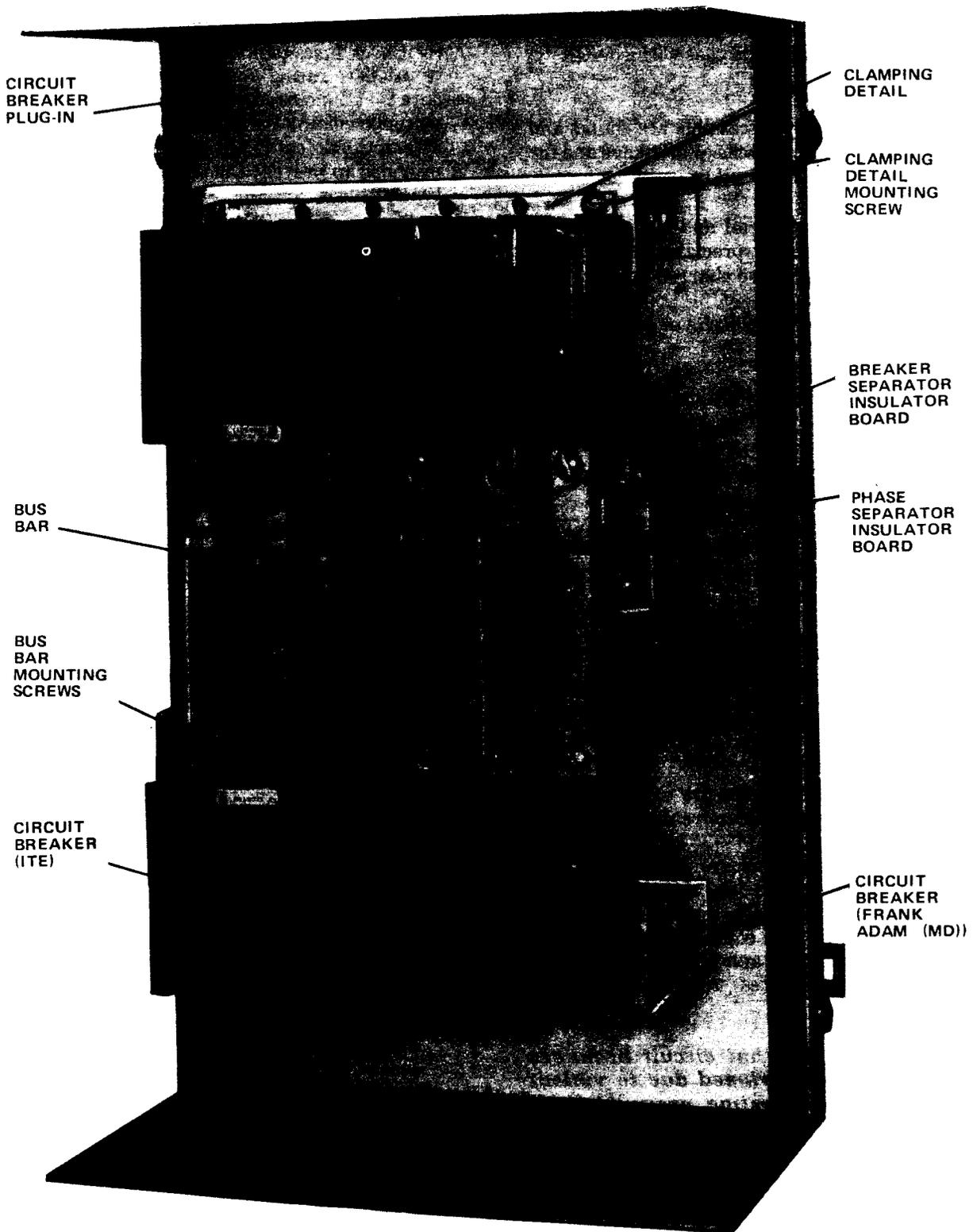
**4.02** To relieve the sticking condition, the circuit breaker should be cleaned and lubricated in accordance with the procedures in paragraph 4.03. If this does not resolve the problem, replace the individual circuit breakers in accordance with paragraph 4.04, or replace the entire plug-in unit.

**4.03** Clean and lubricate the faulty circuit breakers as follows:

- (a) Turn off the unit(s) (rectifiers, motor generator sets, etc) whose ac service is protected by the faulty breaker.

**Note:** Refer to the applicable Bell System Practice for shutdown instructions. If there is no internal shut-off for the applicable unit, the wiring must be disconnected or the bus duct de-energized. If the bus duct is de-energized, all local safety procedures must be followed to prevent the bus duct being energized while the unit is being worked on.

- (b) Spray a small amount of cleaner/lubricant (SYN-LEK I) into opening around handle. Immediately move the handle between the OFF and ON positions several times. Repeat if necessary. (This should correct the non-turn-on condition. If fault is not corrected, replace circuit breaker per paragraph 4.04).



♦ Fig. 10— Circuit Breaker Plug-In—Cover Removed♦

- (c) Set circuit breaker to OFF.
- (d) Restore protected unit to operating condition or reenergize the bus duct.
- (e) Set circuit breakers in bus duct unit to ON.

**4.04** To replace faulty circuit breakers, it is necessary that the plug-in unit be completely de-energized (dead). This may be accomplished by two methods which are as follows:

- (1) De-energize the bus duct and replace circuit breaker with the plug-in unit in place.
- (2) De-energize the bus duct, unplug the plug-in unit if possible, replace the faulty circuit breaker, and reinstall the plug-in unit. (The only advantage to unplugging the unit is that this will allow the bus duct to be reenergized during the replacement period). The following procedures are primarily for replacing the circuit breaker with the plug-in unit in place.

- (a) De-energize the bus duct unit.
- (b) Tag and secure, in the OFF position, the disconnect device providing power to the bus duct, in accordance with local safety standards.

**Note:** The disconnect device is usually a transfer switch or breaker or a disconnect switch or breaker.

(c) Disconnect power factor correction capacitors, if any, from the bus duct associated with the plug-in unit.

(d) Remove the plug-in cover using a 4-inch E screwdriver.

**Note:** The circuit breaker separator, Fig. 10, may fall out when cover is removed.

(e) Verify, using a KS-14510, L11, meter, or equivalent, that power to the plug-in unit is off. (Check phase-to-phase on input side of circuit breaker to be replaced).

(f) Remove and tag wiring from load side of faulty circuit breaker.

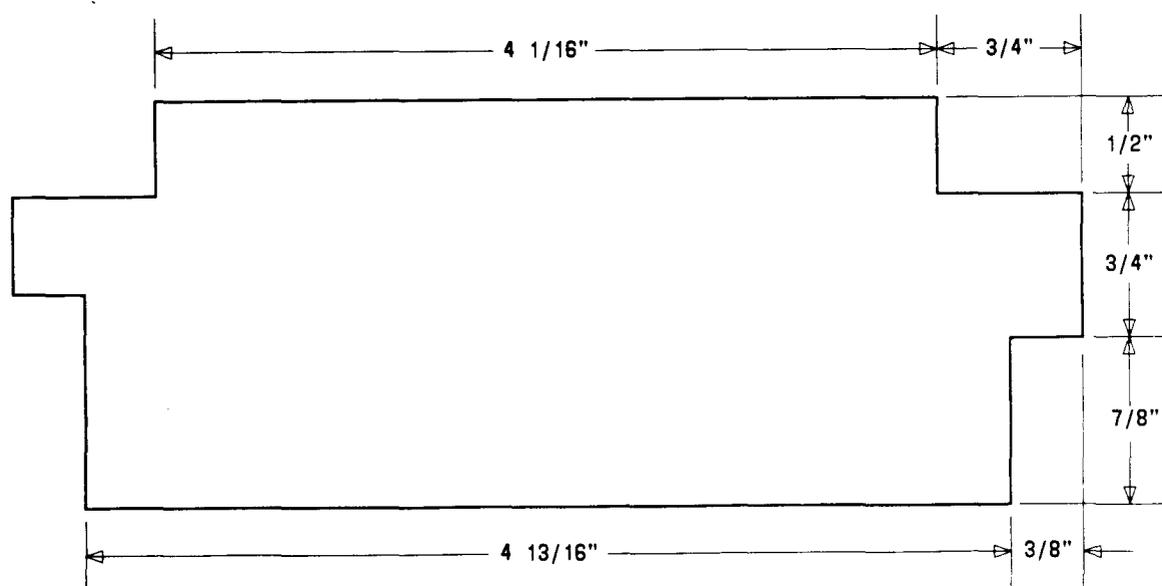
**Note:** When more than one breaker is to be replaced, work on only one breaker at a time.

(g) Place tape across insulator boards to hold them in place.

(h) Tag or mark with tape the end of the two-phase separator insulator boards next to the faulty circuit breaker.

(i) Remove bus bar mounting screws from supply side of faulty circuit breaker.

(j) Remove one screw from the faulty circuit breaker side of the clamping detail and loosen the other screw of the clamping detail.



◆ Fig. 11—Phase Separator Insulator Board (Modified) ◆

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(k) Remove defective circuit breaker, taking care to retain all insulator boards and spacers, if any.

(l) If the faulty circuit breaker is a Frank Adam type and being replaced with an ITE breaker, modify the phase separator insulator boards to fit the new ITE circuit breaker slots per Fig. 11. Modify one or both ends as required.

(m) If the faulty breaker is a Frank Adam type (Mfr Disc.), it may be replaced with an ITE/EQB type of corresponding capacity.

(n) Install new circuit breaker, spacers, if any, all insulator boards, and clamping detail screws.

**Note:** If ITE breakers are being used to replace Frank Adam type, use No. 12 (24 x 1/2-inch) panel screws per Fig. 12 to attach the supply side of the circuit breaker to the bus bar.

Use the No. 12 screws as self-tapping screws to cut threads in the ITE breaker contacts before installing the breaker into the plug-in unit. Use care when tightening screws not to strip the threads.

(o) Reconnect load side wiring to circuit breaker.

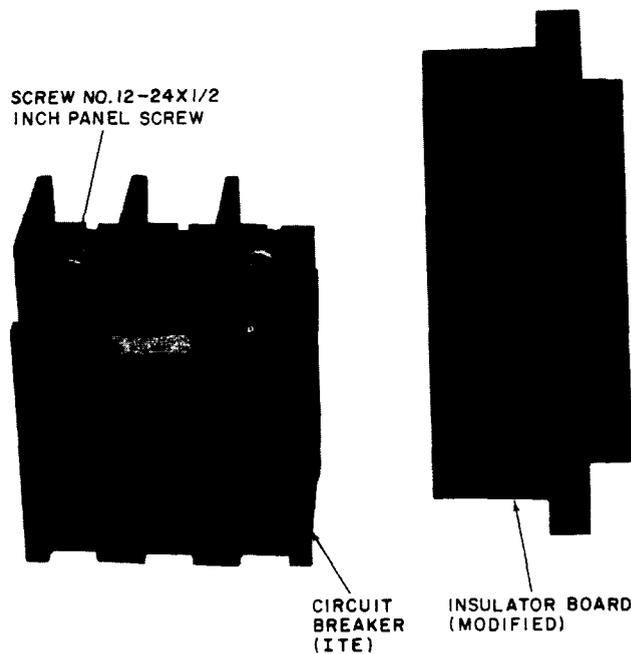
(p) Install plug-in cover.

(q) Set all plug-in circuit breakers to OFF.

(r) Reenergize the bus duct and remove warning tags if any were used.

(s) Restore all units to operating condition per applicable Bell System Practices.

(t) Set plug-in circuit breakers to ON.♦



♦ Fig. 12— Replacement Hardware and Insulator Board ♦