

SHEET INDEX

CONTENTS	SHEET NO.	ISSUE NO.																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
SHEET INDEX SUPPORTING INFORMATION OPTION INDEX	A1	1	2																							
FS 1 100 AMP, 1Ø, RECTIFIER FS 6 PANEL FOR KS-22010 CIRCUIT BREAKERS FS 7 PANEL FOR KS-21124 CIRCUIT BREAKERS FS 8 PANEL FOR KS-22010 CIRCUIT BREAKERS FS 9 CHG BATTERY BUS AND CHG GRO BUS	B1	1	2																							
FS 2 100 AMP, 3Ø, RECTIFIER FS 4 NEGATIVE BATTERY	B2	1	2																							
FS 3 CONTROL CIRCUIT FS 5 DISCHARGE CIRCUIT	B3	1	2																							
FS 10 BACKPLANE PWB ASSEMBLY	B4	1	2																							
FS11 CONTROL CIRCUIT	B5	-	2																							
APP FIG. 1,2,3,4,5 & 6	C1	1	2																							
CIRCUIT NOTES	D1	1	2																							
EQUIPMENT NOTES INFORMATION NOTES	D2	1	1																							
CAD 1, 2, 3	G1	1	2																							
CAD 4, 5 & 6	G2	-	2																							

CONTENTS	SHEET NO.	ISSUE NO.																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

DWG ISSUE	CD ISSUE	DATE ISSUED	DRW	APPD
/	/	6-1-81	WF	FPH
2B	APPX 1B	2-25-82	ZEN	FPH
			FCR	FLB

OPTION INDEX

APP OR WRG	RATED ON ISSUE	REF NOTES	LOCATION
Z			CAD 2

SUPPORTING INFORMATION

CATEGORY	NO.
EQUIPMENT DRAWING	J86917A, J86917B
EQUIPMENT DESIGN REQ	802-679-162
MAINTENANCE SPECIFICATION	

- SHEET INDEX NOTES
- WHEN CHANGES ARE MADE IN THIS DRAWING ONLY THOSE SHEETS AFFECTED WILL BE REISSUED.
  - THIS SHEET INDEX WILL BE REISSUED AND BROUGHT UP TO DATE EACH TIME ANY SHEET OF THE DRAWING IS REISSUED, OR A NEW SHEET IS ADDED.
  - THE ISSUE NUMBER ASSIGNED TO A CHANGED OR NEW SHEET WILL BE THE SAME ISSUE NUMBER AS THAT OF THE SHEET INDEX.
  - SHEETS THAT ARE NOT CHANGED WILL RETAIN THEIR EXISTING ISSUE NUMBER.
  - THE LAST ISSUE NUMBER OF THE SHEET INDEX IS RECOGNIZED AS THE LATEST ISSUE NUMBER OF THE DRAWING AS A WHOLE.

**NOTICE** - NOT FOR USE OR DISCLOSURE OUTSIDE THE BELL SYSTEM EXCEPT UNDER WRITTEN AGREEMENT

1M01

POWER SYSTEMS  
CHARGE AND DISCHARGE CIRCUIT

48 VOLTS, 600 AMPS  
100 TYPE PLANTS  
151C POWER PLANT

DWG SIZE 65

ISSUE 2B

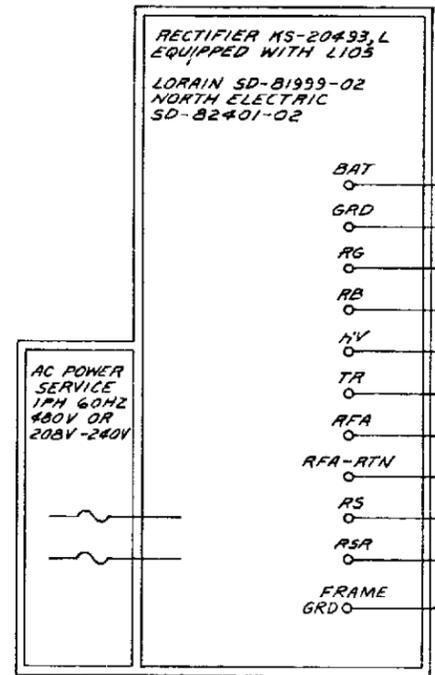
-A1 SHEETS

SELL LABORATORIES SD-82447-OI

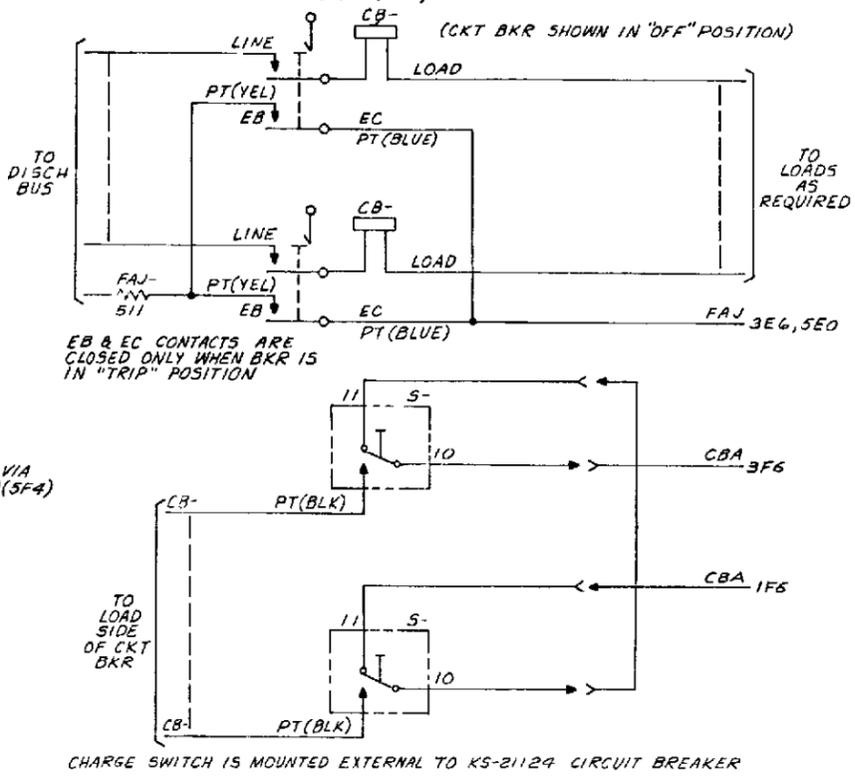
0 1 2 3 4 5 6 7 8 9

A  
B  
C  
D  
E  
F  
G  
H

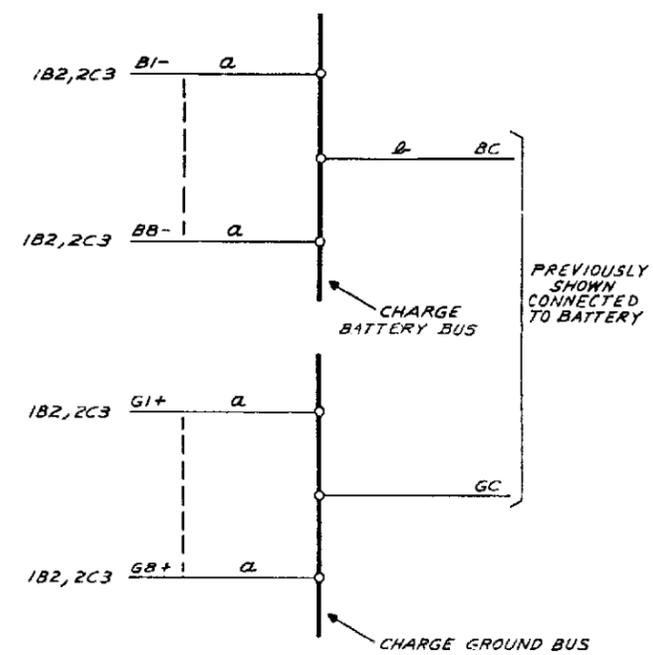
**FS 1**  
100 AMP RECTIFIER  
SEE NOTE 105



**FS 7**  
KS-21124 CIRCUIT BREAKERS  
SEE NOTES 105, 107, 203, AND 204

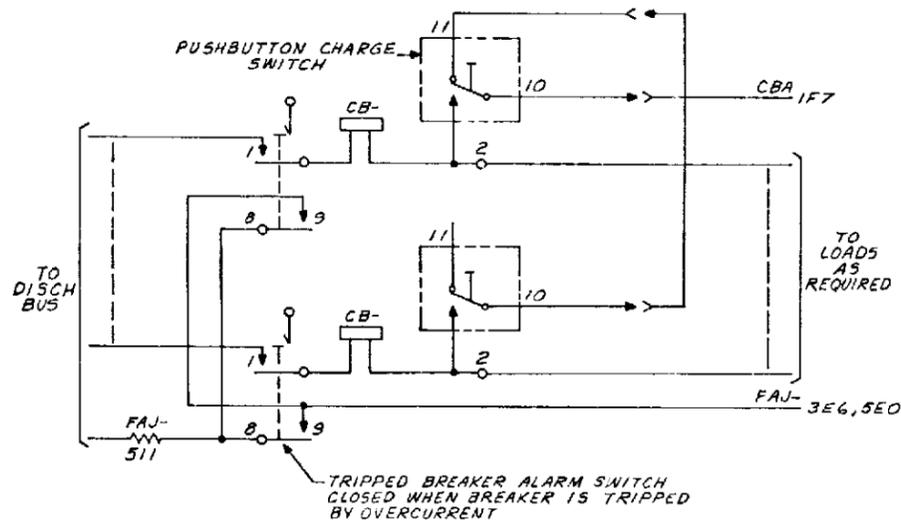


**FS 9 (MFR DISC)**  
CHARGE BATTERY BUS AND  
CHARGE GROUND BUS  
SEE NOTE 105



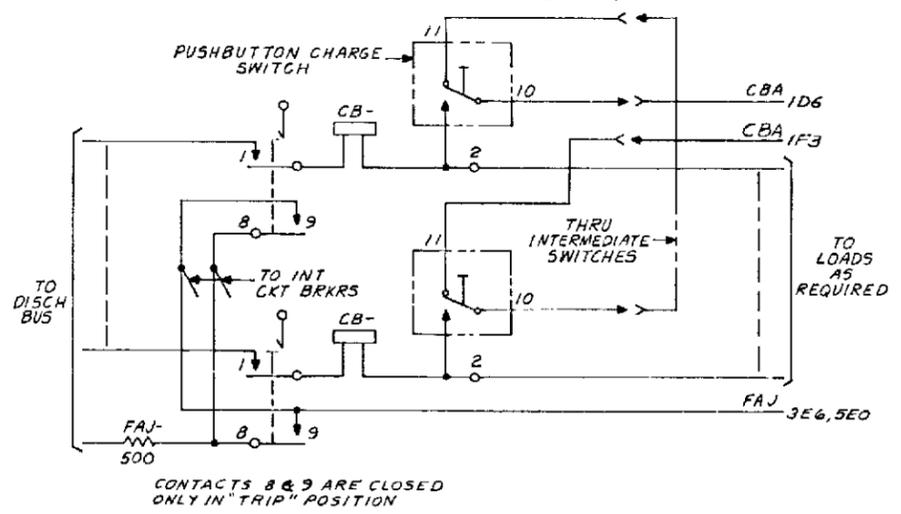
**FS 6**

KS-22012 CIRCUIT BREAKERS  
SEE NOTES 105, 203, AND 204  
(CIRCUIT BREAKER SHOWN IN "OFF" POSITION)



**FS 8**

KS-22010 CIRCUIT BREAKERS  
SEE NOTES 105, 203, AND 204  
(CIRCUIT BREAKER SHOWN IN "OFF" POSITION)

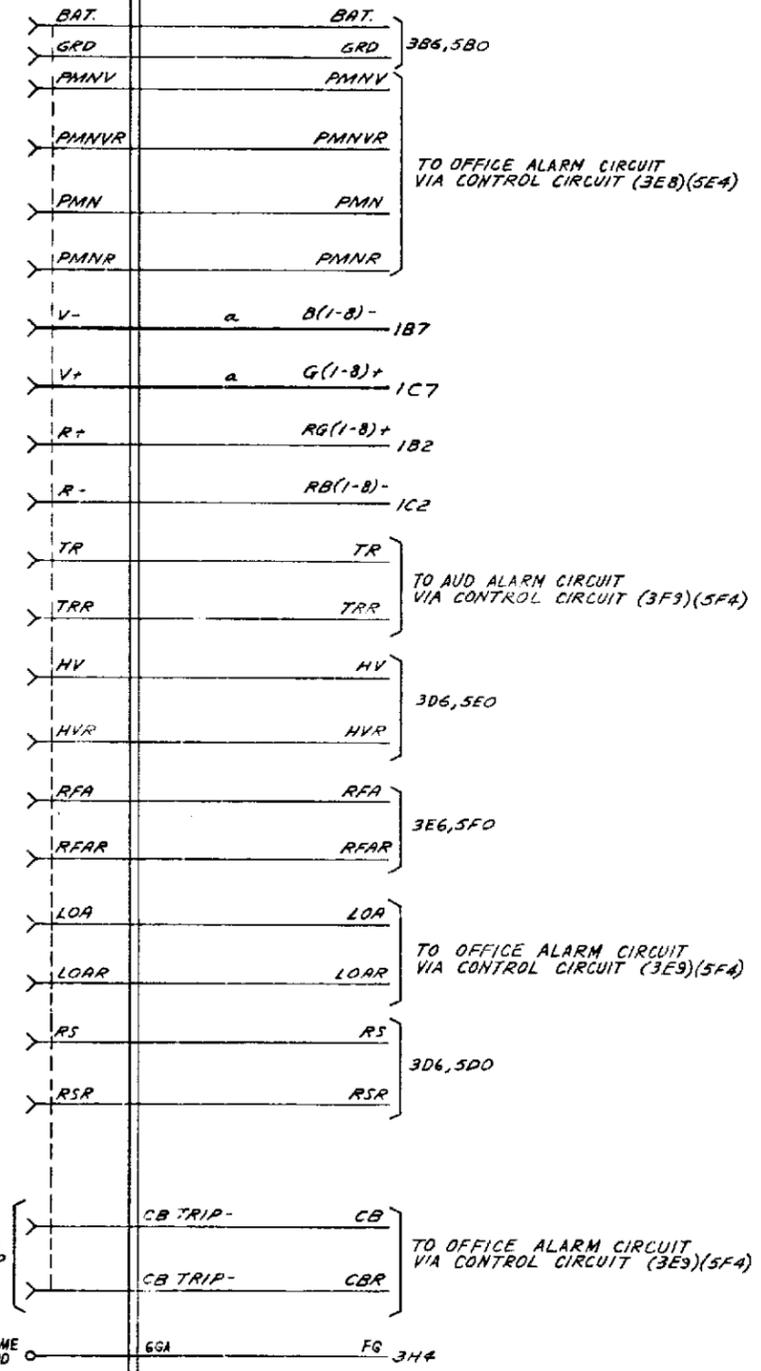


CHARGE AND DISCHARGE CIRCUIT	DWG SIZE	ISSUE
	65	2B
GELL LABORATORIES	SD-82447-01	B1

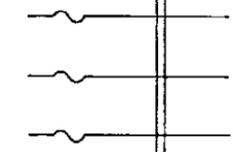
0 1 2 3 4 5 6 7 8 9

**FS 2**  
100 AMP RECTIFIER  
SEE NOTES 105 & 106

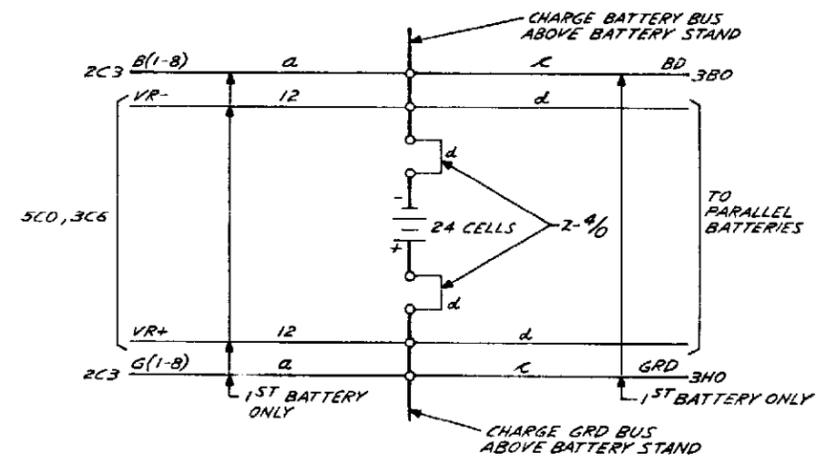
RECTIFIER  
208/240 VOLT AC INPUT  
48 VOLT OUTPUT  
J87437A  
SD-82398-01



AC POWER SERVICE  
208/240V 3Ø  
OR 480V 60HZ



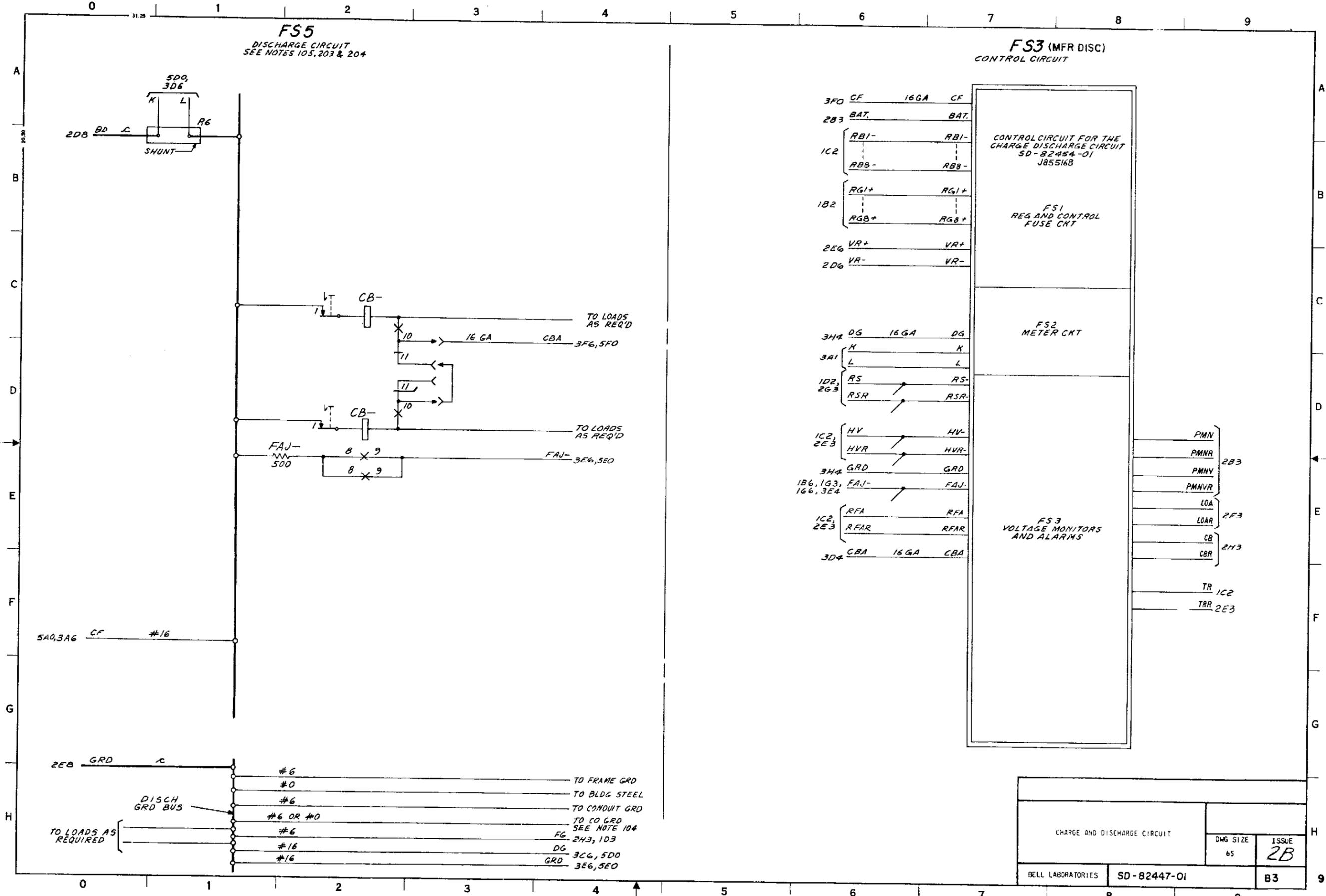
**FS 4**  
NEGATIVE BATTERY  
SEE NOTES 105 AND 202



CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		65	2B
BELL LABORATORIES	SD-82447-01	82	

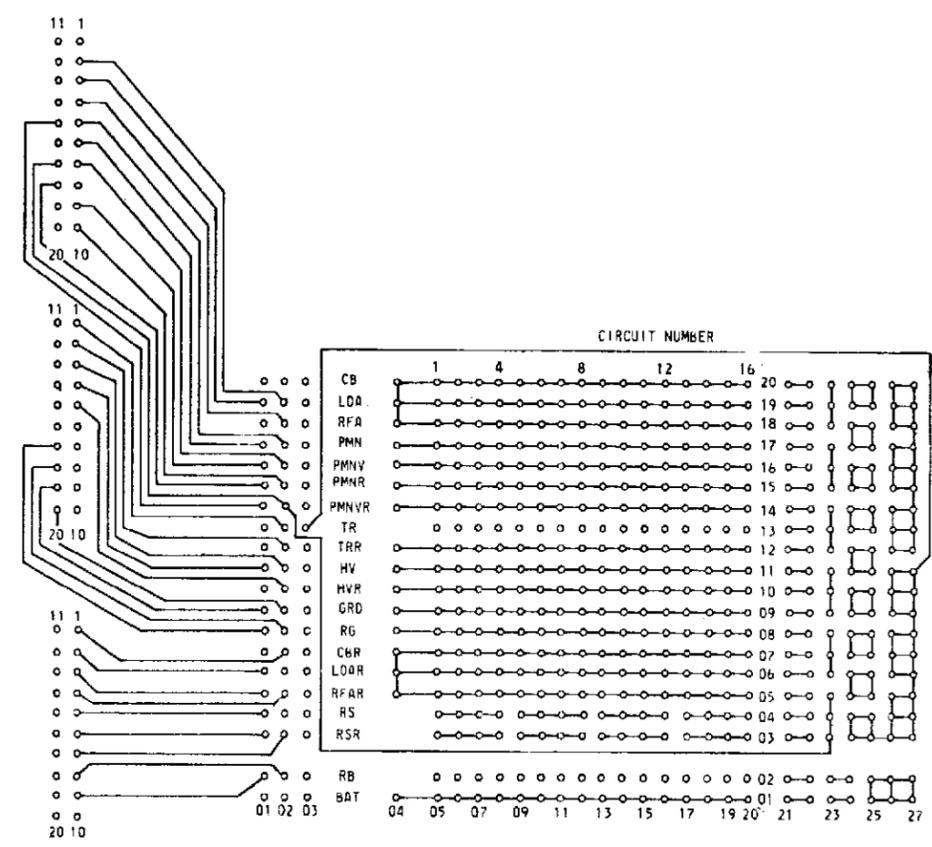
**FS5**  
DISCHARGE CIRCUIT  
SEE NOTES 105, 203 & 204

**FS3 (MFR DISC)**  
CONTROL CIRCUIT

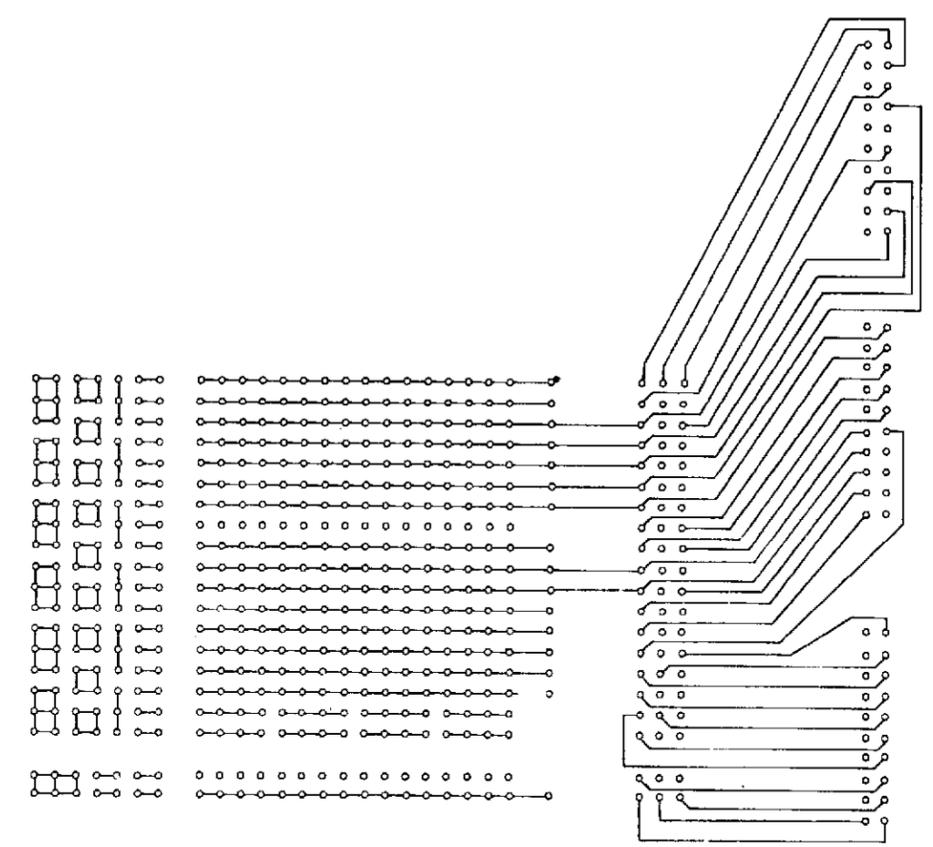


CHARGE AND DISCHARGE CIRCUIT	DWG SIZE	ISSUE
	65	2B
BELL LABORATORIES	SD-82447-01	B3

FS 10 (MFR DISC)  
BACKPLANE PWB ASSEMBLY



COMPONENT SIDE

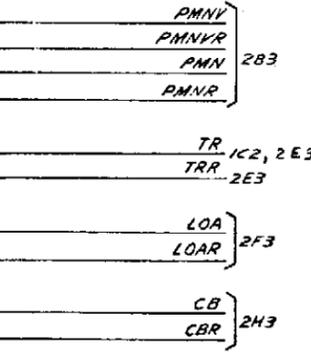
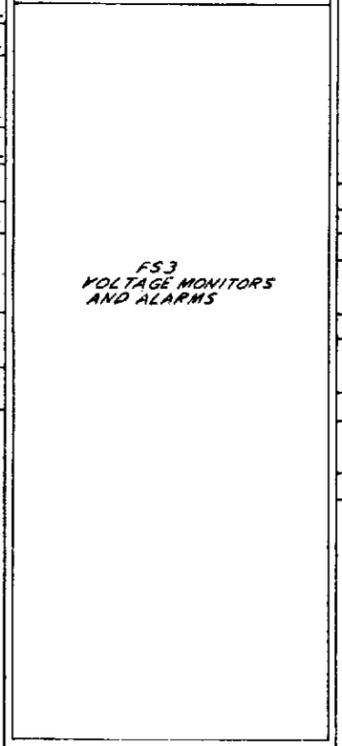
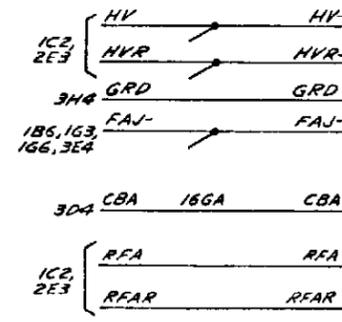
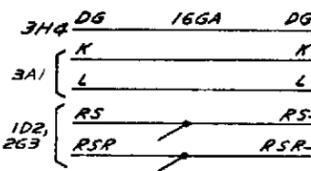
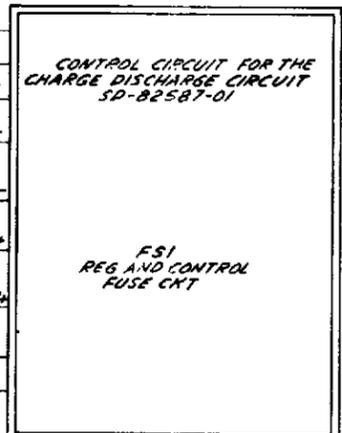
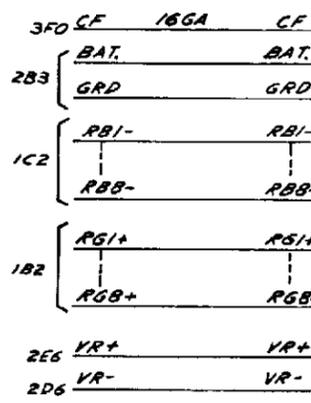


CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		6S	2B
BELL LABORATORIES	SD-82447-01	B4	

0 1 2 3 4 5 6 7 8 9

A A

**FSII**  
CONTROL CIRCUIT



B B

C C

D D

E E

F F

G G

H H

0 1 2 3 4 5 6 7 8 9

CHARGE AND DISCHARGE CIRCUIT		DWG SIZE 65	ISSUE 2B
BELL LABORATORIES	SD-82447-01	SHEET B5	

**APP FIG. 1**

SHUNT		
DESIG	LOC	CODE
R6	3A1	KS-9942,L12

**APP FIG. 5**

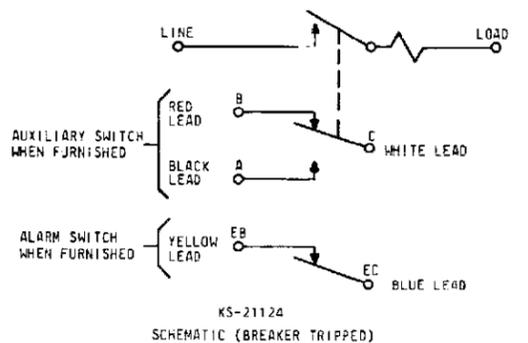
CIRCUIT BREAKER		
DESIG	LOC	CODE
CB-	1A4	KS-21124,LIST AS REQD

**APP FIG. 7**

CONTROL UNIT		
DESIG	LOC	CODE
CONTROL UNIT	5A2	J85516C-1, SD-82587-01

**APP FIG. 2**

RECTIFIER		
DESIG	LOC	CODE
RECTIFIER	2B1	J87437A



RESISTOR		
DESIG	LOC	CODE
FAJ-	1B4	KS-8512,L3A,511

SWITCH		
DESIG	LOC	CODE
S-	1C5	KS-21225,LB

**APP FIG. 3 (MFR DISC)**

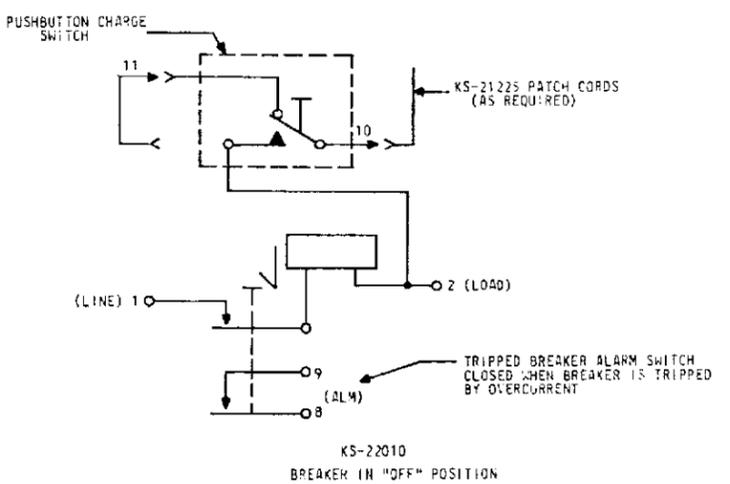
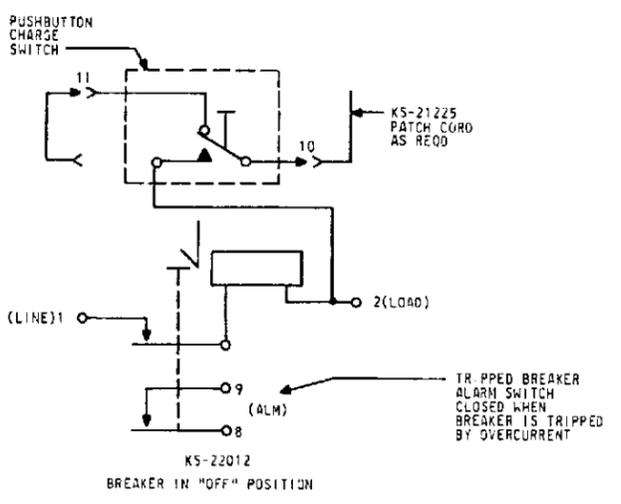
CONTROL UNIT		
DESIG	LOC	CODE
CONTROL UNIT	3B8	J85516B, SD-82454-01

**APP FIG. 6**

CIRCUIT BREAKER		
DESIG	LOC	CODE
CB-	1F5	KS-22010,LIST AS REQD

**APP FIG. 4**

CIRCUIT BREAKER		
DESIG	LOC	CODE
CB-	1F1	KS-22012,LIST AS REQD



RESISTOR		
DESIG	LOC	CODE
FAJ-	1G0	KS-8512,L3A,511

RESISTOR		
DESIG	LOC	CODE
FAJ-	1G4	100C,500

CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		6S	2B
BELL LABORATORIES	SD-82447-01	-C1	

CIRCUIT NOTES:

101.

DESIG	FUSE AMP	POTENTIAL	ONE PER
R	1-1/3	48	PLANT
VM2	1-1/3	48	PLANT
BAT	1-1/3	48	PLANT

BATTERY SYMBOL	GROUND SYMBOL	VOLTAGE RANGE
		44-52V

102.

FEATURE OR OPTION	PROVIDE	
	APP FIG.	APP OR WRG
48 VOLT RECTIFIER NEGATIVE OUTPUT, 100 AMP, 3B	2	AS REQD
48 VOLT RECTIFIER NEGATIVE OUTPUT, 100 AMP, 1B	3	AS REQD

CIRCUIT NOTES: (CONT)

103.

CHANGED ON ISS	IF JOB RECORDS DO NOT SPECIFY	THIS OPTION WAS FURN	SEE NOTE	USE IN CIRCUIT		
				STD	A&M	MD
2B				APP FIG. 7	APP FIG. 3	
				FS11	FS3	FS9 FS10

104. PROVIDE GROUNDING AS COVERED IN BSP 802-001-193 OR 802-001-195.

105. (A) FOR LEAD LENGTHS EXCEEDING TABLE VALUES, A LEAD SHALL BE CALCULATED FOR 2 VOLTS LOOP DROP AT MAX. CHARGE CAPACITY OF THE RECTIFIER.

VOLTAGE DROP =  $\frac{IKL}{CM}$  WHERE K = 11.1 FOR COPPER, K = 17.4 FOR ALUMINUM, I IS CURRENT IN AMPERES, L IS LOOP LENGTH IN FEET AND CM IS CONDUCTOR CROSS SECTION IN CIRCULAR MILS.

TABLE A

RECTIFIER CAPACITY	a LEAD			
	COPPER		ALUMINUM	
	MIN SIZE	LOOP LENGTH	MIN SIZE	LOOP LENGTH
200 AMP	0	85 FT	350,000	180 FT
100 AMP	2	100 FT	0	100 FT

CIRCUIT NOTES: (CONT)

105. (CONT) (B) THE c LEADS SHALL BE CALCULATED FOR CIRCUIT PEAKS WHERE THE CIRCUIT PEAK IS DEFINED AS THE BUSY HOUR LOAD TIMES 1.33 FOR VARIABLE LOADS AND IS EQUAL TO THE BUSY HOUR LOAD FOR FIXED LOADS.

TABLE B

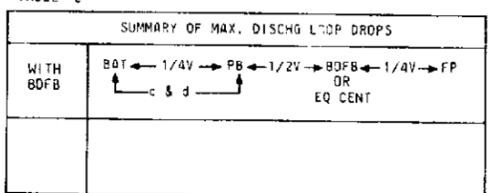
ULT PEAK LOAD	c LEAD WITH BDFB OR EQ CENT		c LEAD WITHOUT EQ CENT	
	MIN SIZE	LOOP LENGTH	MIN SIZE	LOOP LENGTH
100-250	2/350,000	54 FT	350,000	54 FT
251-400	2/500,000	50 FT	500,000	50 FT
401-600	2/750,000	50 FT	750,000	50 FT
601-900	2/750,000	35 FT	750,000	35 FT

ULT PEAK LOAD	c LEAD WITH BDFB OR EQ CENT		c LEAD WITHOUT EQ CENT	
	MIN SIZE	LOOP LENGTH	MIN SIZE	LOOP LENGTH
100-250	2/350,000	54 FT	350,000	54 FT
251-400	2/750,000	50 FT	750,000	50 FT
401-600	3/750,000	50 FT	2/500,000	45 FT
601-900	3/750,000	35 FT	2/750,000	44 FT

VOLTAGE DROP IN POWER BOARD INTERNAL WIRING MAY BE IGNORED. BATTERY AND GROUND SUPPLY LEADS TO BDFB OR EQUIPMENT FUSE PANELS SHALL BE CALCULATED ON CIRCUIT PEAKS.

TABLE C



d LEADS SHALL HAVE AMPACITY FOR AVERAGE AMPERES PER BATTERY STRING OR 1/4 OF THE B HOUR AMPERE HOUR RATING OF THE CELL SIZE USED OR WHICHEVER IS LARGER.

AVERAGE AMP =  $\frac{\text{AMP LOAD (ULTIMATE)}}{\text{NO. OF STRINGS OF CELLS (ULTIMATE)}}$

WHEN SUPPLEMENTARY BATTERY STRINGS ARE PRESENT, THE c LEAD CALCULATIONS IN TABLE B MUST BE ADJUSTED APPROPRIATELY TO TAKE INTO ACCOUNT THE DROP OF THE d LEAD WHILE STILL MAINTAINING THE 1/4 VOLT LOOP DROP BETWEEN THE BATTERY AND PB.

FOR THE PURPOSE OF CALCULATING c AND d LEADS TO MEET MAXIMUM DISCHARGE LOOP VOLTAGE DROP REQUIREMENTS, CALCULATE THE c LEAD LOOP VOLTAGE DROP BETWEEN POWER BOARD AND CABLE JUNCTION BUSES AT THE 1ST BATTERY:

$VD_c = \frac{I_c K L_c}{CM_c}$  WHERE  $I_c$  = ULTIMATE

PLANT CIRCUIT PEAK, K = 11.1 FOR CU OR 17.4 FOR AL. RESISTANCE PER CM FOOT.  $L_c$  = LOOP LENGTH IN FEET OF c LEAD.  $CM_c$  = CIRCULAR MIL OF MINIMUM c LEAD PER ULTIMATE PEAK LOAD (SEE TABLE B).

THE d LEAD SHALL BE 2-4/0 MINIMUM. IF REQUIRED THE d LEAD SHALL BE AUGMENTED WITH ADDITIONAL 4/0. TO DETERMINE NEED, CALCULATE c + d LEAD LOOP VOLTAGE DROP:

$VD_{c+d} = \frac{I_c K L_d}{N_d CM_d} + VD_c$

WHERE  $L_d$  = LOOP LENGTH OF d LEAD,  $N_d$  = ULTIMATE NO. OF BAT STRINGS,  $CM_d$  = 423,000 CM (2-4/0). IF  $VD_{c+d}$  IS GREATER THAN ALLOWED  $VD_{c+d}$  (SEE TABLE C) AUGMENT d WITH ADDITIONAL 4/0.

CIRCUIT NOTES: (CONT)

- 106. RECTIFIER POLARITY OPTIONS SHALL BE FURNISHED TO MATCH PLANT POLARITY OPTIONS.
- 107. WHEN KS-21124 CIRCUIT BREAKERS ARE USED THE MAGNETIC TRIP SHALL BE SET IN THE "LO" POSITION.

CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		65	2B
BELL LABORATORIES	SD-82447-01	DI	

EQUIPMENT NOTES:

- 201. ALL WIRING TO BACK PLANE SHALL BE 24 GAUGE SOLID KS-19195, L1. ALL OTHER WIRE TO BE 22 GAUGE KS-19195, L1 UNLESS OTHERWISE SPECIFIED.
- 202. BATTERY EQUIPMENT SHALL BE ORDERED SEPARATELY AS REQUIRED PER J87122 OR J87124.
- 203. ADDITIONAL WIRING USED IN THIS PLANT IS:

SIZE	WIRE TYPE	REMARKS
0	KS-5482	TO GROUND
6 GA	KS-5482	FRAME TO GROUND BUS BAR
12 GA	KS-5482	VR LEADS

- 204. ONE (FAJ-) RESISTOR SHALL BE PROVIDED WITH EACH DISCHARGE FUSE PANEL ON CIRCUIT BREAKER PANEL. MOUNTED AS CLOSE AS POSSIBLE TO THE BATTERY SUPPLY BUS BAR TO MINIMIZE POTENTIAL HAZARDS TO UNFUSED BATTERY SUPPLY LEADS FEEDING THE ALARM CIRCUIT.

INFORMATION NOTES:

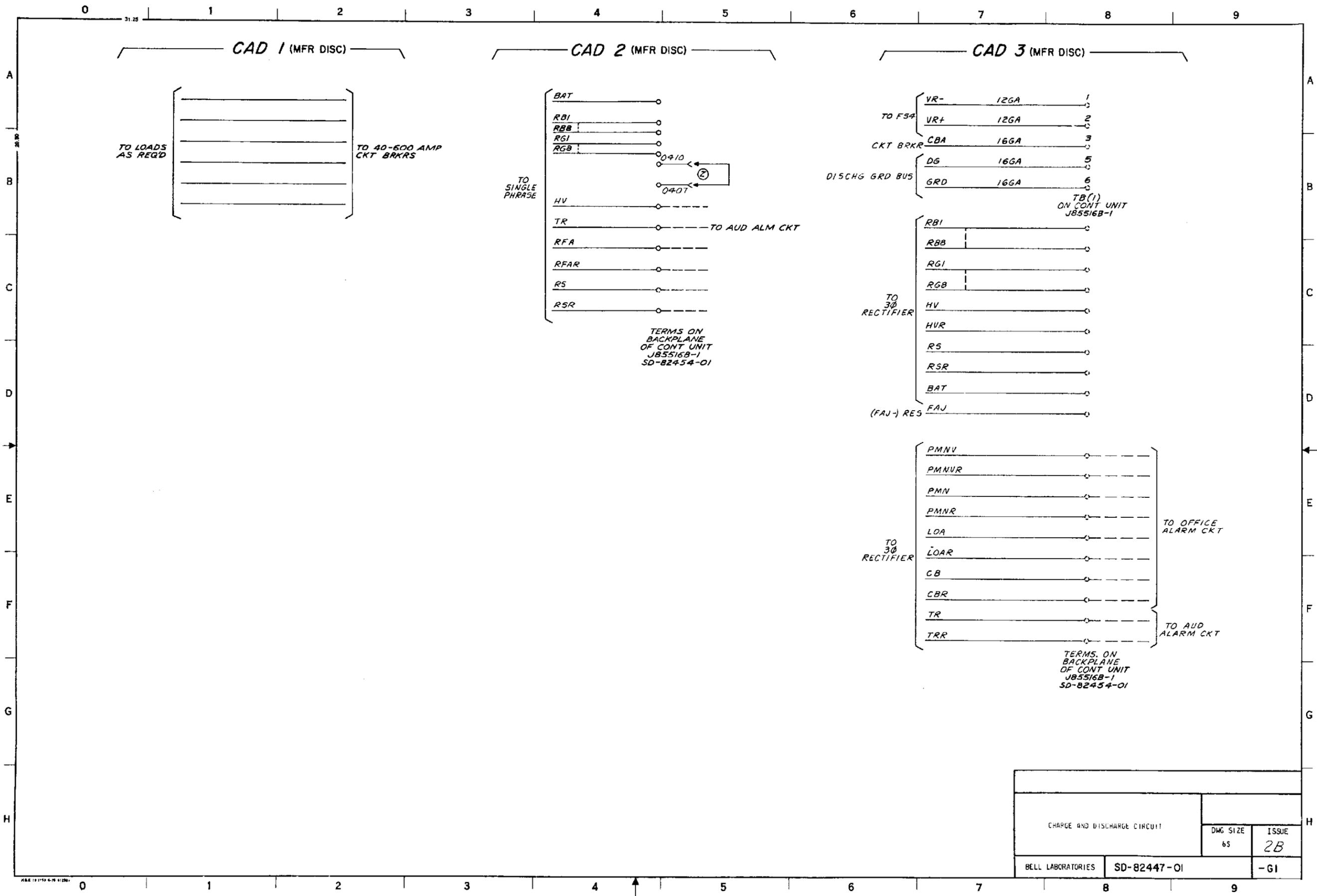
- 301. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, VALUES PRECEDED BY THE SYMBOL + (PLUS) OR - (MINUS) ARE VOLTS.
- 302. ALARM INDICATIONS

LEAD DESIG	FUNCTION			
	MAJOR	MINOR	OFF ALM CKT	ALM SEND CKT
SI (E) SIR (E)	/			/
	OPERATED DISCHARGE FUSE			
SI (C) SIR (C)	/			/
	RECT FAIL, OPERATED CONTROL FUSE			
SI (B) SIR (B)	/			/
	HIGH VOLTAGE			
SI (A) SIR (A)	/			/
	LOW VOLTAGE			
SI (D) SIR (D)	/			/
	VERY LOW VOLTAGE			
PMN PMNR	/	/	/	/
	RECT FAIL, LOW VOLTAGE OPERATED CONTROL FUSE			
PMJ PMJR	/	/	/	/
	HIGH VOLTAGE, VERY LOW VOLTAGE OPERATED DISCHARGE FUSE			
PMJV PMJVR	/	/	/	/
	HIGH VOLTAGE, VERY LOW VOLTAGE OPERATED DISCHARGE FUSE			
PMNV PMNVR	/	/	/	/
	OPERATED CONTROL FUSE, LOW VOLTAGE, RECTIFIER FAIL			

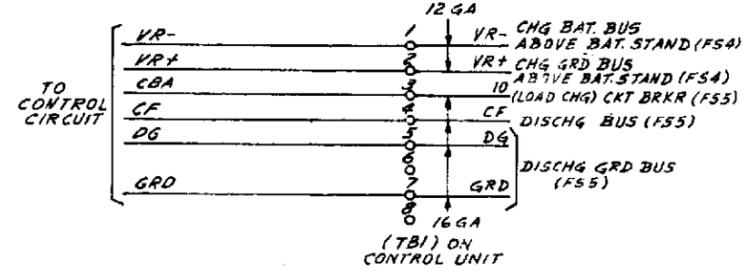
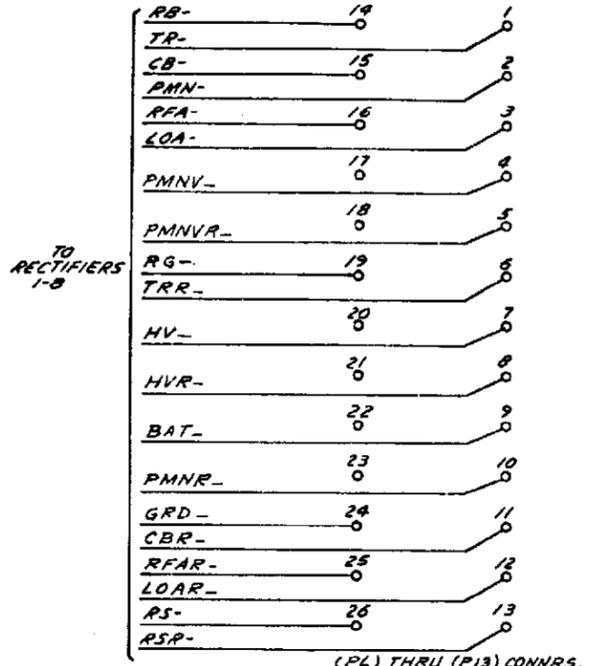
IT IS RECOGNIZED THAT ALARM LEADS DESIGNATED AS MAJOR MAY BE CONNECTED TO MINOR ALARMS AND VICE VERSA. HOWEVER, SUCH DEVIATIONS SHOULD NOT BE MADE UNLESS A CAREFUL EVALUATION OF LOCAL CONDITIONS HAS BEEN MADE IN LIGHT OF THE ALARM TABLE.

- 303. INFORMATION SHOWN IN BRACKETS ( ) IS FOR REFERENCE ONLY.

CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		6S	/
BELL LABORATORIES	SD-82447-01	- D2	



CAD 4



CAD 5

SWITCH 3 PLANT OPTIONS

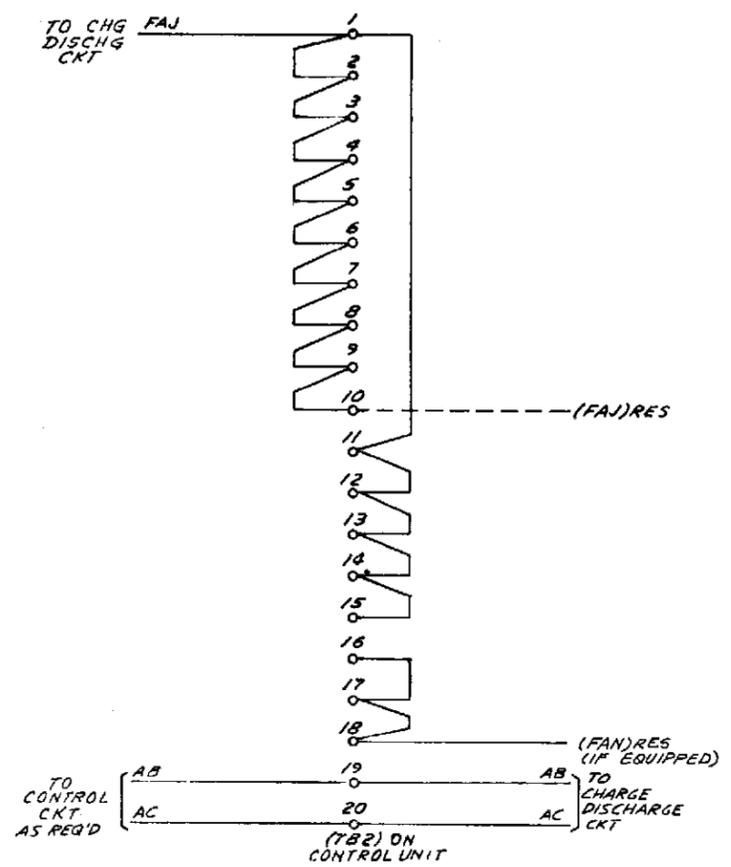
OPTIONS	W, X, (-48V)		Z, X, (-24V)		Z, Y, (+24V)	
	CLOSE	OPEN	CLOSE	OPEN	CLOSE	OPEN
1	/			/		/
2		/	/		/	
3		/	/		/	
4	/		/		/	
5	SEE NOTE 103					
6		/		/	/	/
7	/		/		/	/
8		/		/	/	
9		/	/			/
10		/	/			/
11		/		/	/	
12	/			/	/	/

SWITCH 4 PLANT OPTIONS

CONTACTS	APPLICATION	
	CLOSE	OPEN
1	CLOSE	ESS OFFICE ALARM CONNECTIONS
	OPEN	OTHER THAN ESS OFFICE ALARM CONNECTIONS
2	CLOSE	SINGLE PHASE 100 AMP RECT. APPLICATIONS
	OPEN	THREE PHASE 100 AMP RECT. APPLICATIONS

CONTACTS	W, X, (-48V)		Z, X, (-24V)		Z, Y, (+24V)	
	CLOSE	OPEN	CLOSE	OPEN	CLOSE	OPEN
3	/			/		/

CAD 6



CHARGE AND DISCHARGE CIRCUIT		DWG SIZE	ISSUE
		65	2B
BELL LABORATORIES	SD-82447-01	SHEET G2	