SHEET INDEX

CONTENTS	SHEET NO.	SHEET ISSUE NO.
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FS 2 - RECTIFIER AND MCS "LINEAGE"® 2000 CONTROLLER	B2	6
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APP FIGS. 1,2,3,4,5,6,7,8 & 9	C1	7
APP FIGS. 10,11,12,13 & 14	C2	3
APP FIG. 16	C3	3

SHEET INDEX (CONT)

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CIRCUIT NOTES	D1	5
	D2A	6
EQUIPMENT NOTES	D2B	7
INFORMATION NOTES	D3	7
	D4	6
CADS 1,2 & 3	G1	3
BD 1	H1	4
CM1 - LOW VOLTAGE DISCONNECT CIRCUIT	J1	6

DWG ISSUE	CD ISSUE	DATE ISSUED	DRAWN	APPD
1	1	2-25-85	ZEN WF	PDT WJG
2B	1 APPX 1B	7-2-85	ZEN WF	PDT WJG JWH
3B	1 APPX 2B	8-24-86	WF	PDT WJG JWH
4A	1 APPX 3A	2-24-86	ZEN WF	PDT WJG JWH
5B	1 APPX 4B	8-1-86	ZEN WF	PDT WJG JWH
6B	1 APPX 5B	6-14-88		
7B	1 APPX 6B	2-12-91		WJG

OPTION INDEX (CONT)

APP OR WRG	RATED ON ISSUE	SEE NOTE	LOCATION
C	DA7		APP FIG. 7
D	GA7		APP FIG. 7

OPTION INDEX (CONT)

APP OR WRG	RATED ON ISSUE	SEE NOTE	LOCATION
K	STD 3		APP FIG.13,14, 7A4,8A4
J	STD 2		3E1
H	STD 2		3E1,3F1
G	STD 3		APP FIG.14,3E2,3F2, 8A4
F	STD 3		APP FIG.1,16,1A4, 6D1
E	1		APP FIG.2,2A4,
B	DA 6		APP FIG.4,3B5
A	GA 6		APP FIGS. 4,17,2F2, 2E6,2G8,3B5,6D5

OPTION INDEX (CONT)

APP OR WRG	RATED ON ISSUE	SEE NOTE	LOCATION
S	1		APP FIG. 3,7, 3A2, 4A2
R	1		APP FIG 6 3D7,3E1, 3E2,3F1, 3G1
Q	STD 2		APP FIG. 12, 6A4
P	STD 2		APP FIG. 6
N	STD 2		APP FIG. 6
M	1		APP FIG. 4,3A7
L	STD 2		APP FIG. 11, 3H4,6A1

OPTION INDEX

APP OR WRG	RATED ON ISSUE	SEE NOTE	LOCATION
Z	1		APP FIG. 6,2E2, 4F1,4F3
Y	1		1A2,1B2,2A2,2B2, 3E2,3E3,3E6,3E8, 3G1,4F1,5B2,5B5
X	1		APP FIG.14,1A2,1B2, 2A2,2B2,3E3,3E6, 3E8,3G1,4F3,4F6, 5B2,5B5,6A1,8A4,
W	1		APP FIGS. 6,14,2C2, 2E2,4F6,6A1,8A4
V	1		APP FIG.9,5A3
T	STD 2		APP FIG.10

SUPPORTING INFORMATION

CATEGORY	NO.
EQUIPMENT DWG	J855008
MANUFACTURING TEST REQUIREMENTS	X-79596
EQUIPMENT DESIGN REQUIREMENTS	802-628-001
MAINTENANCE SPEC	167-790-100

AM10

POWER SYSTEMS

"LINEAGE"® 2000 CHARGE AND DISCHARGE CIRCUIT 24 OR 48 VOLTS, 400 AMPERES MAXIMUM

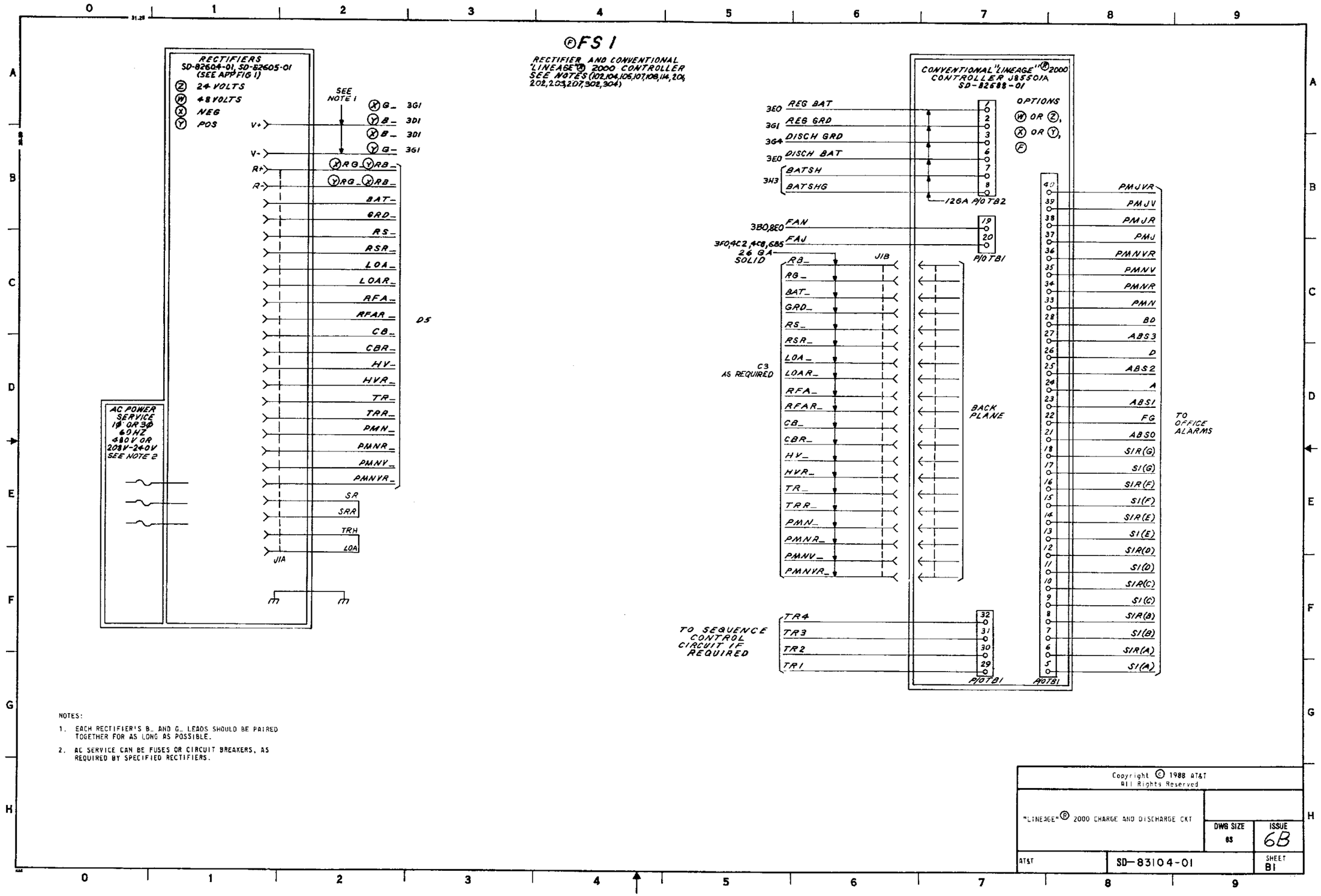
DWG SIZE 6S

ISSUE 7B

AT&T

SD-83104-01

SHEET A1 OF 20



NOTES:

1. EACH RECTIFIER'S B_ AND G_ LEADS SHOULD BE PAIRED TOGETHER FOR AS LONG AS POSSIBLE.
2. AC SERVICE CAN BE FUSES OR CIRCUIT BREAKERS, AS REQUIRED BY SPECIFIED RECTIFIERS.

"LINEAGE" 2000 CHARGE AND DISCHARGE CKT

DWG SIZE	ISSUE
8S	6B

AT&T | SD-83104-01 | SHEET B1

ⓔFS2

RECTIFIER AND MCS "LINEAGE" Ⓡ 2000 CONTROLLER SEE NOTES (102,104,105,107, 108,111,114, 201,202,203,207,302,304)

RECTIFIERS SD-82604-01, SD-82605-01 (SEE APP FIG 2)
- Ⓩ 24VOLT
- Ⓦ 48VOLT
- Ⓧ NEG
- Ⓨ POS

SEE NOTE 1

V+ — ⓍG_ 3G1, ⓎG_ 3D1
V- — ⓍB_ 3D1, ⓎG_ 3G1
R+ — ⓍRG, ⓎRB_
R- — ⓍRB, ⓎRG_
BAT_
DPG_
RS_
RSR_
VP_
ⓌHV48_
APG_
VI_
RFA_
RFAR_ — D5
PH_
CB_
CBR_
TRH_
TPO_
TPI_
TP2_
TP3_
MAN_
ⓌTR48_
ⓏTR24_
ⓏHV24_
SR
SPR
ⒶEQ

JIA

26 GA SOLID

AC POWER SERVICE 1Ø OR 3Ø 60 HZ 480V OR 208V-240V SEE NOTE 2

NOTES:
1. EACH RECTIFIER'S B_ AND G_ LEADS SHOULD BE PAIRED TOGETHER FOR AS LONG AS POSSIBLE.
2. AC SERVICE CAN BE FUSES OR CIRCUIT BREAKERS, AS REQUIRED BY SPECIFIED RECTIFIERS.

26GA SOLID

D3 AS REQUIRED

J1B

RB-
RG-
BAT-
DPG_
RS_
RSR_
VP_
HV_
APG
VI_
RFA_
PH_
CB_
TRH_
TPO_
TPI_
TP2_
TP3_
MAN_
TR_
RFAR_
CBR_
EQⒶ

3G4 DISCH GRD
3E1 DISCH BAT
3H3 BATSH, BATSHG
3G1 REG GRD
3E1 REG BAT

12GA

TB2: 3, 6, 7, 8, 2, 1

P/O TB1

380,8E0 FAN
3F0,4C2,4C8,685 FAN

TO SEQUENCE CONTROL CIRCUIT IF REQUIRED
- TR4 — 32
- TR3 — 31
- TR2 — 30
- TR1 — 29

TB1: 19, 20, 32, 31, 30, 29

MCS "LINEAGE" Ⓡ 2000 (SD-82588-01) CONTROLLER
OPTIONS Ⓦ OR ⓏⓍOR ⓎⒺ,
AND IF REQUIRED ⓎⓉ
J85501A

P/O TB1

40	PMJYR
39	PMJY
38	PMJR
37	PMJ
36	PMNVR
35	PMNV
34	PMNR
33	PMN
28	BD
27	ABS3
26	D
25	ABS2
24	A
23	ABSI
22	FG
21	ABSO
18	SIR(G)
17	SI(G)
16	SIR(F)
15	SI(F)
14	SIR(E)
13	SI(E)
12	SIR(D)
11	SI(D)
10	SIR(C)
9	SI(C)
8	SIR(B)
7	SI(B)
6	SIR(A)
5	SI(A)
4	LOMR
3	LOM
2	μPFR
1	μPF

TO OFFICE ALARMS

ⒶTH
ⒶGRD — 6EG

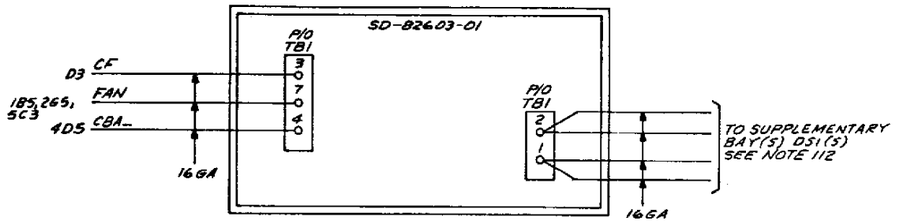
"LINEAGE" Ⓡ 2000 CHARGE AND DISCHARGE CKT

DWG SIZE: 6S
ISSUE: 6B

AT&T
SD-83104-01
SHEET: B2

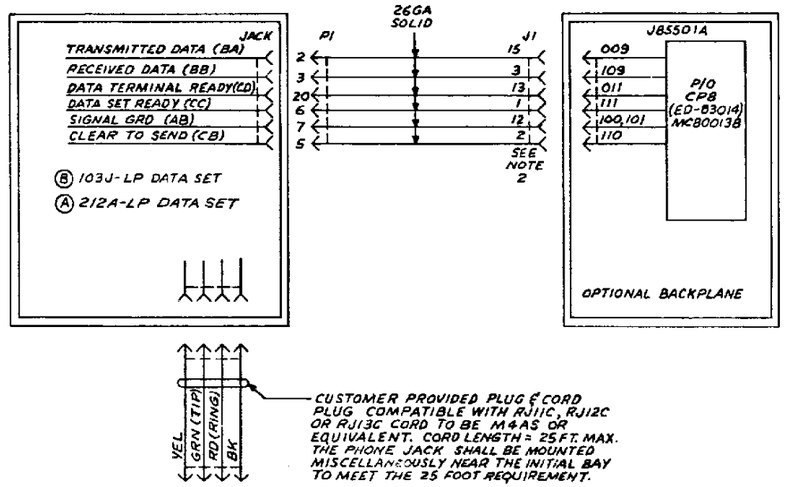
(S) FS 3

FILTER CHARGER
SEE NOTES 112, 202, 205, 301, 302, 304



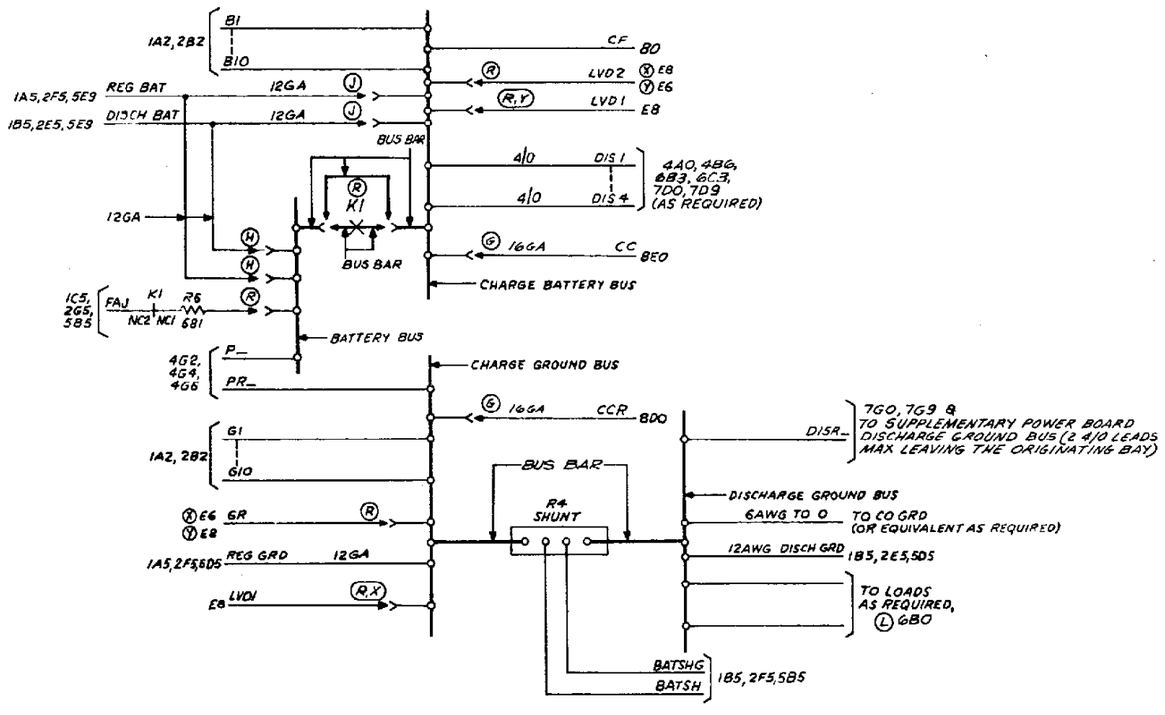
(E,M) FS 4

MODEM CONNECTION
SEE NOTE 107, 111, 201, 302



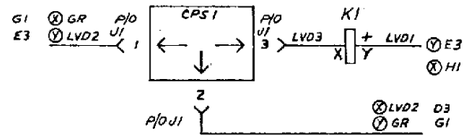
FS 5

CHARGE BATTERY BUS, CHARGE GROUND BUS, BATTERY BUS, K1 CONTACTOR AND DISCHARGE GROUND BUS
SEE NOTES 105, 114, 202, 203, 208, 210, 302, 315



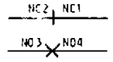
(R) FS 6

LOW VOLTAGE DISCONNECT
SEE NOTES 103, 113, 202, 302, 305



NOTES:

1. EARLY PRODUCTION UNITS MAY BE EQUIPPED WITH 553A OR 553D LEDs. THE 553 SERIES OF LEDs HAVE THE R3 RESISTOR BUILT INTERNAL TO THE DEVICE.
2. THE (J1) CONNECTOR OF FS4 MUST BE MOUNTED ON THE SAME PIN FIELD AS THE (CP8) BOARD.
3. CONTACT NUMBERING OF MICROSWITCH ON K1 IS AS FOLLOWS:

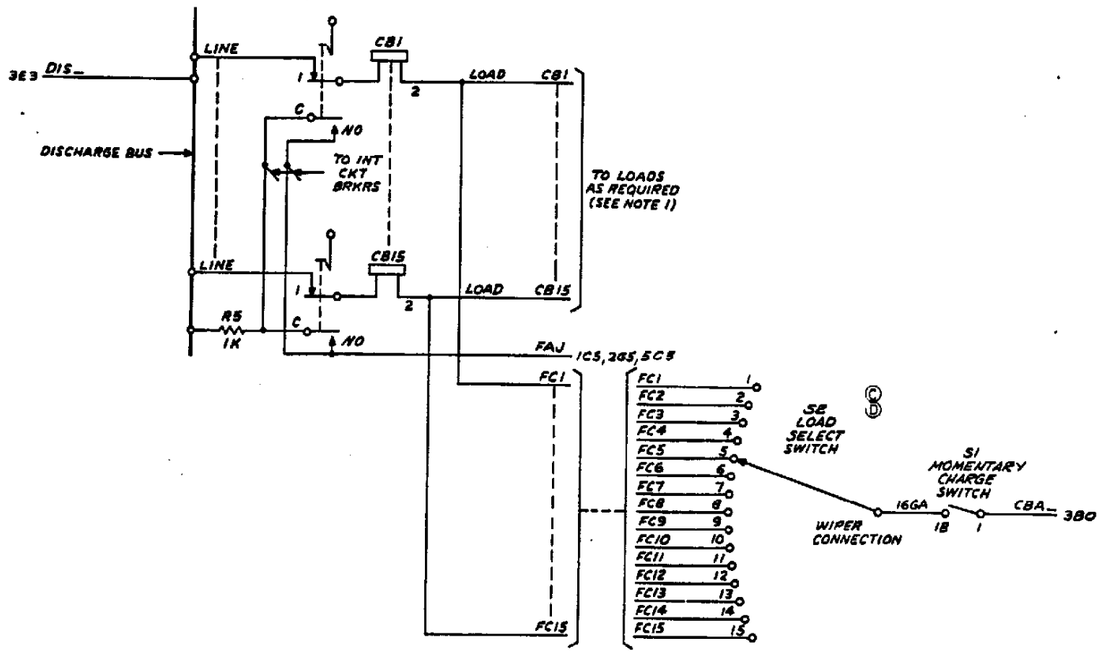


H8 ELECTRICAL

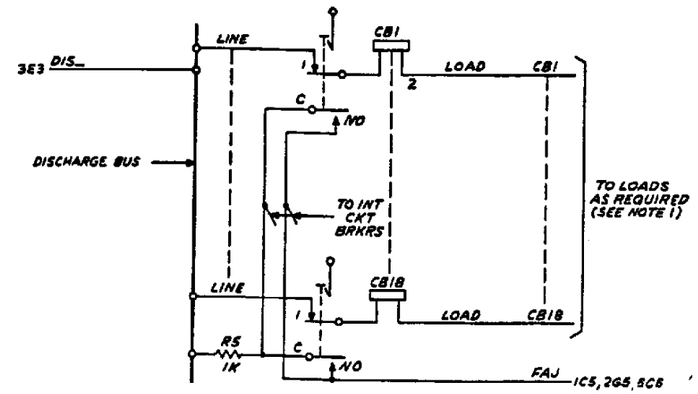
"LINEAGE" (S) 2000 CHARGE AND DISCHARGE CKT

DWG SIZE 6S | ISSUE 6B | AT&T | SD-83104-01 | SHEET B3

FS 7
DISCHARGE CIRCUIT
(SEE NOTES 109, 112, 114, 202, 204, 206, 302)

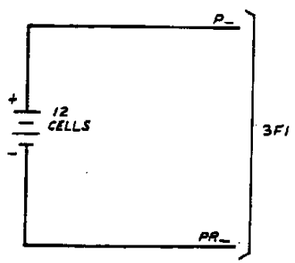


FS 8
DISCHARGE CIRCUIT
(SEE NOTES 109, 112, 116, 202, 204, 302)

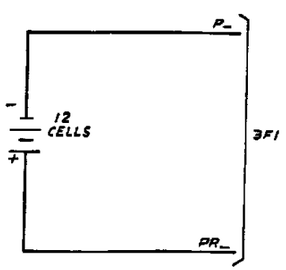


FS 9
BATTERY OPTIONS
(SEE NOTES 110, 114, 202, 206, 208)

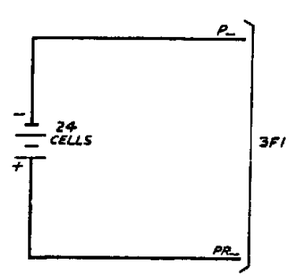
(Z,Y) POSITIVE 24V BATTERY



(Z,X) NEGATIVE 24V BATTERY



(W,X) NEGATIVE 48V BATTERY



NOTES:

1. CIRCUIT BREAKER LEADS SHOULD BE PAIRED WITH GROUND LEADS.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CKT	DWG SIZE: B5	ISSUE: 7B-
AT&T TECHNOLOGIES, INC. SD-83104-01		SHEET: B4

Ⓨ FS10

RECTIFIER AND "LINEAGE" ® 2000 SMALL CONVENTIONAL CONTROL UNIT SEE NOTES (104, 105, 106, 108, 114, 202, 203, 302, 306)

RECTIFIERS
SD-82604-01, SD-82605-01
(SEE APP FIG 9)
Ⓩ 24 VOLTS
Ⓦ 48 VOLTS
Ⓧ NEG
Ⓨ POS

SEE NOTE 1

V+
V-
R+
R-
ⓍG_ 3G1
ⓎB_ 3D1
ⓍB_ 3D1
ⓎG_ 3G1
ⓍRG_ ⓎRB_
ⓎRG_ ⓍRB_
BAT_
RS_
RSR_
LOA_
LOAR_
RFA_
RFAR_
CB_
CBR_
HV_
TR_
TRR_
D8

SR
SRR
TRH
LOA
J1A

AC POWER SERVICE
1Ø OR 3Ø
60HZ
480V OR
208V – 240V
SEE NOTE 2

SD-82646-01 Ⓡ
J855018
"LINEAGE" ® 2000 SMALL CONTROL UNIT FOR 24V OR 48V POWER PLANTS

P/O TB1.1 P/O TB1.2

ⓍBATSH ⓎBATSHG
3H3 ⓍBATSHG ⓎBATSH
3F0, 4C2, 4C8, 6B5 FAJ
3BC, 8E0 FAN
3G4 DISCH GRD
3G1 REG GRD
SPARE
SI(A)
SIR(A)
SI(B)
SIR(B)
SI(C)
SIR(C)
SI(E)
SIR(E)
PMN
PMNR
PMNV
PMNVR
PMJ
PMJR
PMJV
PMJVR
RMRS
RMRSR
D
DR
ABSO
BD
BDR
ABS2
A
AR
ABS1
ABS3
FG
TR1
TR2
TR3
TR4

TO OFFICE ALARM

TO SEQUENCE CONTROL CIRCUIT (IF REQUIRED)

TO CM1

26 GA SOLID
RB_
RG_
BAT_
RS_
RSR_
LOA_
LOAR_
RFA_
RFAR_
CB_
CBR_
HV_
TR_
TRR_
J1B
C2 (AS REQUIRED)

TB2
1 REG BAT 3E0
2 DISCH BAT 3E0

NOTES:

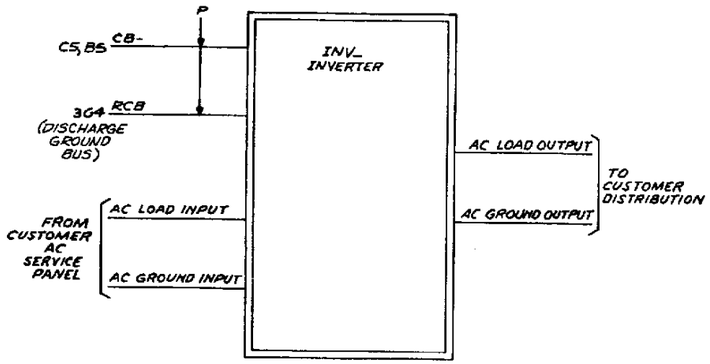
1. EACH RECTIFIER'S B_ AND G_ LEADS SHOULD BE PAIRED TOGETHER FOR AS LONG AS POSSIBLE.
2. AC SERVICE CAN BE FUSES OR CIRCUIT BREAKERS, AS REQUIRED BY SPECIFIED RECTIFIERS.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CKT

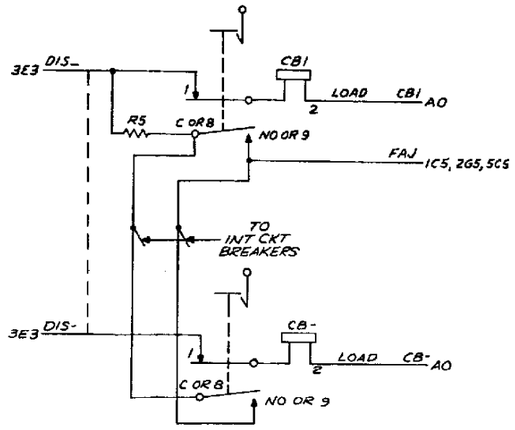
DWG SIZE	ISSUE
6S	6B

AT&T	SD-83104-01	SHEET
		B5

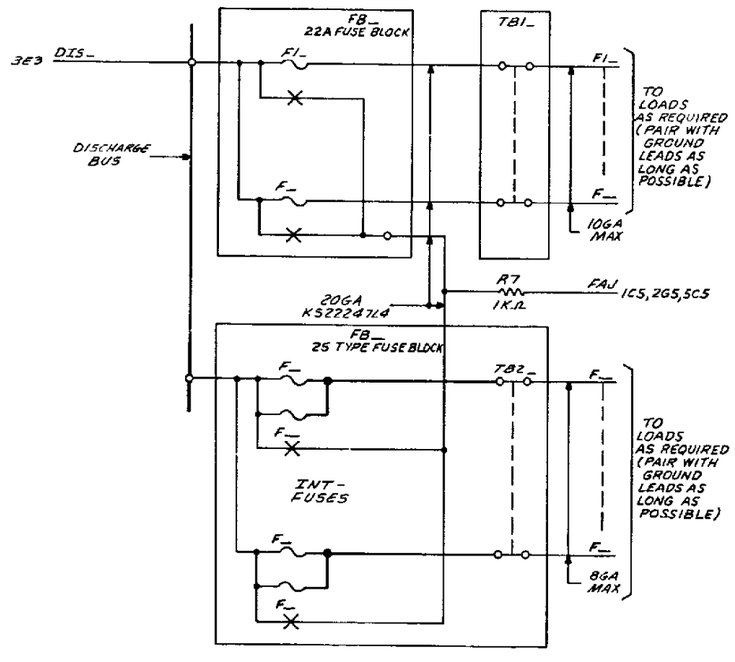
(L,W,X) FS11
(SEE NOTE 308)



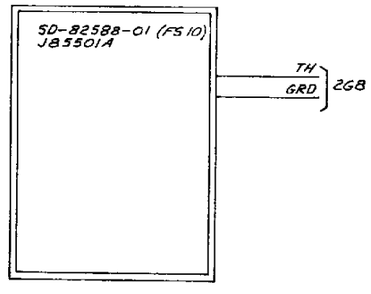
ⓆFS12
(SEE NOTES 114, 202, 204, 302, 304, 307 AND 308)



ⓅFS16
TYPICAL FUSE BLOCK DISTRIBUTION
SEE NOTES 114, 116, 117, 119, 202, 204, 302, 304, 312



ⒶFS17
BAT. RES. PRED THERM. ASSEMBLY



"LINEAGE" ® 2000 CHARGE & DISCHARGE CKT

DWG SIZE 6S | ISSUE 6B

AT&T | SD-83104-01 | SHEET B6

ⓀFS 13

74 & KS TYPE FILTER FUSE PANEL
(NOTES 104, 114, 116, 117, 118, 202, 210, 302, 304, 309, 310, 311 AND 313)

ED-82947-30 GR2
SEE NOTE 1

INVOLT (A) BUS

INVOLT (B) BUS

TO LOAD F1(A) / F1(A)R — P/O VRTN BUS (A)

TO LOAD F4(A) / F4(A)R

TO LOAD F21(A) / F21(A)R

TO LOAD F24(A) / F24(A)R

SEE NOTE 117 FAJ

F1.2 FB1.2 — FA1.2 .5A — FA4.2 .5A

NOTE 104

F21.2 FB6.2 — FA21.2 .5A — FA24.2 .5A

R1.2 (Z,V) 1.4KΩ (Y,U,J) 715 (Y,U,H) 150

DS1.2 24GA — PANEL ALARM

3E3 DIS—

SEE NOTE 117 FAN

R2.2 787 — R2.2 133

10GA, NOTE 209

FF1.2 ( )A 24GA — DS2.2 — CR1.2 — FILTER FUSE ALM

FF2.2 ( )A 24GA — DS3.2 — CR2.2 — FILTER FUSE ALM

FF3.2 ( )A 24GA — DS4.2 — CR3.2 — FILTER FUSE ALM

R3.2 (Z)619 (U)133 (V)619

R4.2 (Z)619 (U)133 (V)619

R10.2 (Z)619 (U)133 (V)619

C1.2 C2.2 C3.2 (Z)28,000 (U)66,000 (V)28,000 (V)66,000

3F4 DISR— 4/0

P/O VRTN BUS (A)

F1.2 FB7.2 — FA1.2 .5A — FA4.2 .5A

NOTE 104

F21.2 FB12.2 — FA21.2 .5A — FA24.2 .5A

DS7.2 24GA — PANEL ALM

R7.2 (Z,V) 1.4KΩ (Y,U,J) 715 (Y,U,H) 150

P/O VRTN BUS (B)

F1(B) / F1(B)R TO LOAD

F4(B) / F4(B)R TO LOAD

F21(B) / F21(B)R TO LOAD

F24(B) / F24(B)R TO LOAD

FAJ SEE NOTE 117

DISR— 3E3

FAN SEE NOTE 117

R9.2 787 — R9.2 133

10GA, NOTE 209

FF4.2 ( )A 24GA — DS5.2 — CR4.2 — FILTER FUSE ALM

FF5.2 ( )A 24GA — DS6.2 — CR5.2 — FILTER FUSE ALM

FF6.2 ( )A 24GA — DS8.2 — CR6.2 — FILTER FUSE ALM

R5.2 (Z)619 (U)133 (V)619

R6.2 (Z)619 (U)33

R8.2 (V)133 (V)619

R8.2 (Z)619 (U)133

C4.2 C5.2 C6.2 (Z)28,000 (U)66,000 (V)28,000 (V)66,000

4/0 DISR— 3F4

P/O VRTN BUS (B)

NOTE:

1. THE Z WIRING OPTION OF ED-82947-30 GR2 (GROUP W) IS REQUIRED FOR -48 VOLT PLANTS. THE Y WIRING OPTION OF ED-82947-30 GR2 (GROUP T) IS REQUIRED FOR +24 VOLTS PLANTS.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CIRCUIT

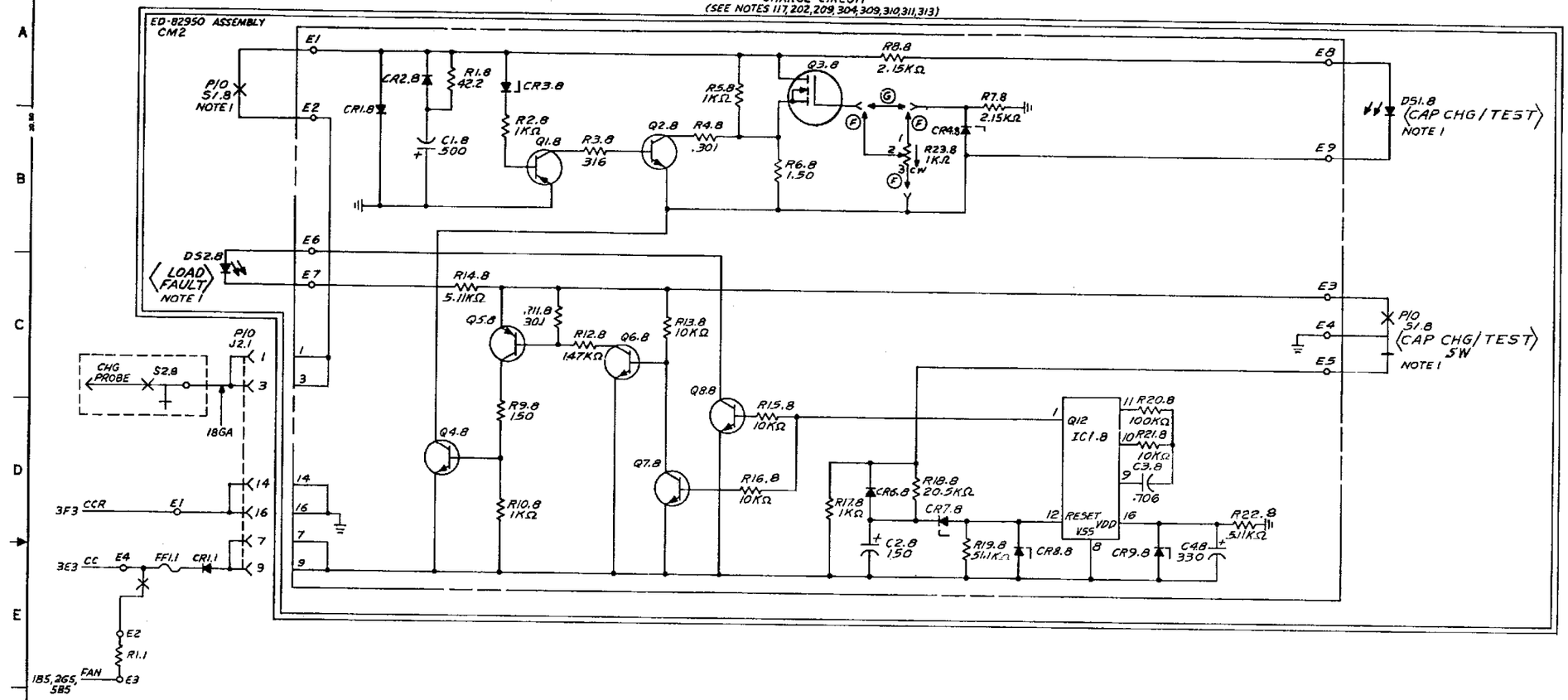
DWG SIZE	ISSUE
6S	3B

AT&T TECHNOLOGIES, INC. SD-83104-01 SHEET 87

(X,W,K,G) **FS 14**

CHARGE CIRCUIT

(SEE NOTES 117,202,209,304,309,310,311,313)



NOTES:

1. DS1.8, DS2.8 AND S1.8 ARE MOUNTED ON FRONT PLATE.

"LINEAGE"® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE	ISSUE
6S	4A

AT&T TECHNOLOGIES, INC. SD-83104-01 SHEET 88

ⓕAPP FIG. 1

CONTROL UNIT

DESIG	LOC	CODE
	1A7	J85501A ( )

RECTIFIER

DESIG	LOC	CODE
	1A1	J85502A ( )[25 AMP 1Ø] J85502B ( )[50 AMP 1Ø] J85502C ( )[125 AMP 1Ø] J85503A ( )[100 AMP 3Ø] J85503B ( )[200 AMP 3Ø]

ⓔAPP FIG. 2

CONTROL UNIT

DESIG	LOC	CODE
	2A7	J85501A ( )

RECTIFIER

DESIG	LOC	CODE
	2A1	J85502A ( )[25 AMP 1Ø] J85502B ( )[50 AMP 1Ø] J85502C ( )[125 AMP 1Ø] J85503A ( )[100 AMP 3Ø] J85503B ( )[200 AMP 3Ø]

ⓢAPP FIG. 3

CHARGE & DISCHARGE CKT (FILTER CHARGER)

DESIG	LOC	CODE
FLT CHG	3A2	ED-83012-30 OR ED-83108-30

ⓝAPP FIG. 4

DATA SET

DESIG	LOC	CODE
	3B7	ED-83012-30 G1&G3

E/W

CONNECTOR

DESIG	LOC	CODE
P1	3B6	DB-19604-432, CINCH OR CANNON PLUG OR XS-19088,L2 (DTE CONNECTOR - 25 PIN, RS-232C)
J1	3B7	963N-24 (SEE NOTE 207)

DATA SET

DESIG	LOC	CODE
DATA SET	3B6	Ⓐ 212A-LP Ⓑ 103J-LP, UNIVERSAL DATA SYSTEMS P.O. BOX 5266 HUNTSVILLE, AL 35805

APP FIG. 5

SHUNT

DESIG	LOC	CODE
R4	3G2	A-50-50,EMPRO,50 AMP SHUNT A-100-50,EMPRO,100 AMP SHUNT A-200-50,EMPRO,200 AMP SHUNT A-400-50,EMPRO,400 AMP SHUNT

ⓝAPP FIG. 6

CIRCUIT PACK

DESIG	LOC	CODE
CM1	3E7	ED-83104-30 GR1 OR GR2

CONNECTOR

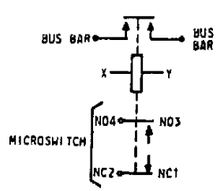
DESIG	LOC	CODE
J1		87159-4 AMP

CONTACTOR

(W,P) HB1D481RO OR JBA40024A,(200 AMP CONTACTOR MAX)
(W,N) JFA4011A
(Z) HB1D241RO OR JBA40D2Y,(200 AMP CONTACTOR)

(SEE NOTE 113)
HB PRODUCTS DIVISION
OF PRESTOLITE
TOLEDO, OHIO

K1



	LOC	CODE
BUS BAR	3E1	
X–Y	3E8	
NO4–NO3	3G7	
NC2–NC1	3G7	

RESISTOR

DESIG	LOC	CODE
R6	3F1	KS-8512,L2A,681

ⓢAPP FIG. 7

DESIG	LOC	CODE
-	-	ED-83101-30

E/W

SWITCH

DESIG	LOC	CODE
S1 (AS REQUIRED, SEE NOTE 205)	4D4	1803,1221 FROM MARQUARDT 67 ALBANY STREET, CAZENOVIA, NY
S2 (AS REQUIRED, SEE NOTE 205)	4C3	Ⓒ 399622-L OAK SWITCH, 3/4" SHAFT Ⓓ 2APA06500297(CRL) (SEE NOTE 211)

CIRCUIT BREAKERS

DESIG	LOC	CODE
(MAXIMUM OF 15 CIRCUIT BREAKERS PER PANEL, MAXIMUM OF 4 BREAKER PANELS PER PLANT) CB1-CB15,CB16-CB30, CB31-CB45 AND CB46-CB60 (TYPICAL LABELING)	4(A-C)2	KS-22010,L79 THRU 99, AS REQD

RESISTOR

DESIG	LOC	CODE
R5 (AS REQUIRED, SEE NOTE 204)	4C1	KS-14603,L1C 1K

APP FIG. 8

DESIG	LOC	CODE
-	-	ED-83101-30

E/W

CIRCUIT BREAKERS

DESIG	LOC	CODE
(MAXIMUM OF 18 CIRCUIT BREAKERS PER PANEL MAXIMUM OF 4 BREAKER PANELS PER PLANT) CB1-CB18,CB19-CB36, CB37-CB54 AND CB55-CB72 (TYPICAL LABELING)	4(A-C)8	KS-22010,L79 THRU 99, AS REQD

RESISTOR

DESIG	LOC	CODE
R5 (AS REQUIRED, SEE NOTE 204)	4C7	KS-14603,L1C,1K

ⓥAPP FIG. 9

CONTROL UNIT

DESIG	LOC	CODE
	5A6	J85501B( )

RECTIFIER

DESIG	LOC	CODE
	5A1	J85502A ( ) [25 AMP 1Ø] J85502B ( ) [50 AMP 1Ø] J85502C ( ) [125 AMP 1Ø] J85503A ( ) [100 AMP 3Ø] J85503B ( ) [200 AMP 3Ø]

"LINEAGE"® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE: B

ISSUE: 7B

AT&T

SD-83104-01

SHEET: C1

①APP FIG. 10
(SEE NOTE 112)

DESIG	LOC	CODE
-	-	ED-83101-30

E/W

CIRCUIT BREAKER

DESIG	LOC	CODE
(MAXIMUM OF 18 CIRCUIT BREAKERS PER PANEL) CB1-CB18 (TYPICAL LABELING)	-	CF1-Z74-1,30 AMPS, HEINEMANN

RESISTOR

DESIG	LOC	CODE
RS (AS REQUIRED, SEE NOTE 204)	-	KS-14603,L1C,1K

①APP FIG. 11

INVERTER

DESIG	LOC	CODE	
INV-	6A1	5338-44,(1 KVA INVERTER) 6234-42,(3 KVA INVERTER) 6254-44,(5 KVA INVERTER)	POWERMARK 3855 RUFFIN ROAD SAN DIEGO, CA 92123-1875

①APP FIG. 12

DESIG	LOC	CODE
		ED-83106-30

E/W

CIRCUIT BREAKER

DESIG	LOC	CODE
CB1,CB2 (TYPICAL LABELING)	6B5	CF1-Z75-8, 40 AMPS,HEINEMANN (FOR USE WITH 1 KVA INVERTER) CF1-Z75-14 100 AMPS, HEINEMANN (FOR USE WITH 3 KVA INVERTER) EJ1-234-15, 175 AMPS, HEINEMANN FOR USE WITH 5 KVA INVERTER).

RESISTOR

DESIG	LOC	CODE
RS (AS REQUIRED, SEE NOTES 204 AND 308).	6B4	KS-14603,L1C.1K

①APP FIG. 13
(SEE NOTES 118 AND 313)

DESIG	LOC	CODE
-	-	ED-82947-30,GR2

E/W

GROUP AX, G FOR APPLICATION OF THE PANEL IN THIS PLANT

GROUP Y FOR +24 VOLT PLANTS (Y WIRING OPTION)

GROUP W FOR -48 VOLT PLANTS (Z WIRING OPTION)

(X,W,K,D)APP FIG. 14
(SEE NOTE 313)

DESIG	LOC	CODE
-	-	ED-82947-30,GR14

E/W

CHARGE PROBE

DESIG	LOC	CODE
CHG PROBE	8C0	ED-82923-30,GR3

CIRCUIT MODULE

DESIG	LOC	CODE
CM2	8A0	ED-82950-30,GR1,A

CONNECTOR

DESIG	LOC	CODE
J2.1	8C1	225A-01522-230,AMPHENOL

DIODE (LIGHT EMITTING)

DESIG	LOC	CODE
CR1.1	8E1	8284

FUSE

DESIG	LOC	CODE	FUSE HOLDER CODE
FF1.1	8E0	70C,3A	184

RESISTOR

DESIG	LOC	CODE
R1.1	8E0	KS-20289,L6C,1K

"LINEAGE"® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE: B5

ISSUE: 3B

AT&T TECHNOLOGIES, INC.

SD-83104-01

SHEET: C2

ⓕAPP FIG. 16
(SEE NOTE 119)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G1

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	TWO 22A FUSE BLOCKS PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

TERMINAL BLOCK

DESIG	LOC	CODE
TB_	6E2	TWO 2016-YWY,CURTIS INDUSTRIES (ONE PER EACH 22A FUSE BLOCK)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G2

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	TWO 22A FUSE BLOCKS PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

TERMINAL BLOCK

DESIG	LOC	CODE
TB_	6E2	TWO 2016-YWY,CURTIS INDUSTRIES (ONE PER EACH 22A FUSE BLOCK)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G3

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	ONE 25A AND ONE 22A FUSE BLOCK PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

TERMINAL BLOCK

DESIG	LOC	CODE
TB_	6E2	2016-YWY,CURTIS INDUSTRIES, (ONE PER EACH 22A FUSE BLOCK)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G4

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	ONE 25B AND ONE 22A FUSE BLOCK PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

TERMINAL BLOCK

DESIG	LOC	CODE
TB_	6E2	2016-YWY,CURTIS INDUSTRIES (ONE PER EACH 22A FUSE BLOCK)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G5

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	ONE 25A AND ONE 25B FUSE BLOCK PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

DESIG	LOC	CODE
-	6D1	ED-83107-30,G6

E/W

FUSE BLOCK

DESIG	LOC	CODE
FB_	6E2,6F2	ONE 25A AND ONE 25B FUSE BLOCK PER FUSE PANEL

RESISTOR

DESIG	LOC	CODE
R7	6F2	KS-8512,L2A,1K (SEE NOTE 204)

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE	ISSUE
8S	3B

AT&T	SD-83104-01	SHEET
		C3

CIRCUIT NOTES:

101.

DESIG	FUSE AMP	POTENTIAL	ONE PER

102. FOR E AND F OPTIONS FR GRD CONNECTION MUST BE MADE ACCORDING TO SD-82588-01.

103. R OPTION AVAILABLE FOR Z OR W OPTION. IF DIFFERENT VALUES OF VOLTAGE DISCONNECT FROM THOSE DISCUSSED IN THE CD ARE DESIRED, SEE NOTE 4 OF CM1.

104. PROVIDE GROUNDING AS COVERED IN ATTP 802-001-180, 802-001-193 OR 802-001-195.

105. THE SHUNT LEADS ("BATSH" AND "BATSHG") COMING FROM THE SHUNT SHALL BE 12 GA AND SHALL RUN DIRECTLY FROM (TB2) TO THE METER WHEN THE F OPTION IS APPLIED. SHOULD THE DISTANCE FROM THE SHUNT TO THE METER EXCEED 30 FEET THEN THE SIZE OF THE SHUNT LEADS MUST BE INCREASED SO THAT THEIR RESISTANCE DOES NOT EXCEED 58 MILLIOHMS. THIS RESTRICTION APPLIES FOR BOTH THE E AND F OPTION (FOR THE E OPTION THE 58 MILLIOHMS IS MEASURED BETWEEN (TB2) AND THE SHUNT). WHEN THESE LEADS ARE USED WITH THE V OPTION THE SIZE OF THE LEADS ARE TO BE GOVERNED BY CD/SD-82646-01.

106. FOR OPTION V,CAD FIGS OF SD-82646-01 ARE TO BE USED BETWEEN THE CONTROL UNIT AND THE REST OF THE POWER PLANT, AND ALARMS.

107. FOR OPTIONS E AND F CAD FIGS OF SD-82588-01 ARE TO BE USED FOR CONNECTIONS BETWEEN THE CONTROL UNIT AND THE REST OF THE POWER PLANT AND ALARMS.

108. RECTIFIER POLARITY SHALL BE FURNISHED TO MATCH PLANT POLARITY OPTIONS.

109. THE MAXIMUM LIST TWO CURRENT FOR FS7 OR FS8 IS 175 AMPERES, WHEN THE DIS- LEAD FEEDING THE DISCHARGE BUS IS A 4/0. IF IT IS REQUIRED TO INCREASE THE LIST TWO AMPACITY OF THE PANEL UP TO 300 AMPERES THE DIS- LEAD SHALL BE INCREASED TO 2 2/0 CABLES OF EQUAL LENGTH WHICH ARE TERMINATED AT APPROXIMATELY THE SAME ELECTRICAL POINT ON BOTH THE CHARGE BATTERY BUS AND THE DISCHARGE BUS. THE POWER PLANT LIST TWO DRAIN SHALL NOT EXCEED 400 AMPERES. THIS INFORMATION SHALL APPEAR ON A STAMP ON EACH FS7 AND FS8 CIRCUIT BREAKER PANEL. SEE NOTE 120.

110. INTERCELL CONNECTORS SHALL BE SIZED FOR THE ULTIMATE MAXIMUM CURRENT THAT WILL BE REQUIRED FROM THE BATTERIES.

111. OPTION V AND OPTION T OF SD-82588-01 ARE REQUIRED WHEN OPTION M OF THIS SD IS UTILIZED.

112. APP FIGURE 7 IS UTILIZED WHEN ANY LOADS BEING FED FROM A BREAKER PANEL REQUIRE FILTER CHARGING. WHEN NO LOADS FROM A BREAKER PANEL REQUIRE FILTER CHARGING APP FIGURE 8 CAN BE UTILIZED. APP FIG 8 ALLOWS THREE MORE KS-22010 CIRCUIT BREAKERS IN LIEU OF THE FILTER CHARGE SWITCHES. THE LABELING OF BREAKERS AND THE LABELING OF LEADS TO AND FROM THE BREAKERS CAN BE CHANGED TO REFLECT THE ACTUAL COMBINATION OF BREAKERS USED. APP FIG. 10 IS UTILIZED TO FEED LOADS THAT HAVE HIGH INRUSH CURRENTS AND DON'T UTILIZE OPTION S.

113. HB1D481R0 AND HB1D241R0 HAVE ALARM MICROSWITCHES THAT HAVE A MAXIMUM AMPACITY OF .1 AMPS. THE JF44011A CONTACTOR IS TO BE USED FOR ANY -48 VOLT PLANT APPLICATION WHERE THAT PLANT COULD EVENTUALLY GROW LARGER THAN 200 AMPERES. IF THE K1 CONTACTOR IS PROVIDED WITH A DIODE, THE CATHODE END OF THE DIODE IS TO BE ELECTRICALLY COMMON WITH THE "+" TERMINAL OF K1. IF A "+" IS NOT STAMPED ON THE K1 CONTACTOR BY THE VENDOR, IT SHOULD BE STAMPED ON THE CONTACTOR AT THE FACTORY.

114. SECTION 1. THIS NOTE PROVIDES INFORMATION FOR ECONOMIC OPTIMIZATION OF THE BATTERY AND CABLE INVESTMENT TO ASSURE SYSTEM OPERATION DURING AC POWER OUTAGES. EXAMPLES HEREIN ARE BASED ON THE ARRANGEMENT SHOWN IN BD1 FOR A 24 VOLT SYSTEM WITH A MINIMUM EQUIPMENT VOLTAGEOF 21.0 VOLTS (Vme). THIS EXAMPLE ASSUMES ALL BATTERY STRINGS ARE TERMINATED IN THE BATTERY PLANT DIRECTLY.

SECTION 2. REFER TO AT&T PRACTICES SECTION 790-100-655 FOR DETAILS OF BATTERY SELECTION. THE BATTERY RESERVE TIME SHALL BE SPECIFIED BY THE CUSTOMER. DO NOT CHANGE BATTERY RESERVE TIME UNLESS REQUESTED TO DO SO BY THE CUSTOMER. IF ENERGY CONSERVATION IS A CONSIDERATION, THE COST OF ENERGY DISSIPATED DUE TO CONDUCTOR HEATING SHOULD BE INCLUDED IN COST MINIMIZATION (SECTION 14). BATTERY RESERVE TIME AS USED IN THIS SCHEMATIC IS ASSUMED TO BE APPROPRIATELY DERATED PER AT&T PRACTICES SECTION 790-100-655.

CIRCUIT NOTES: (CONT)

114. (CONT)

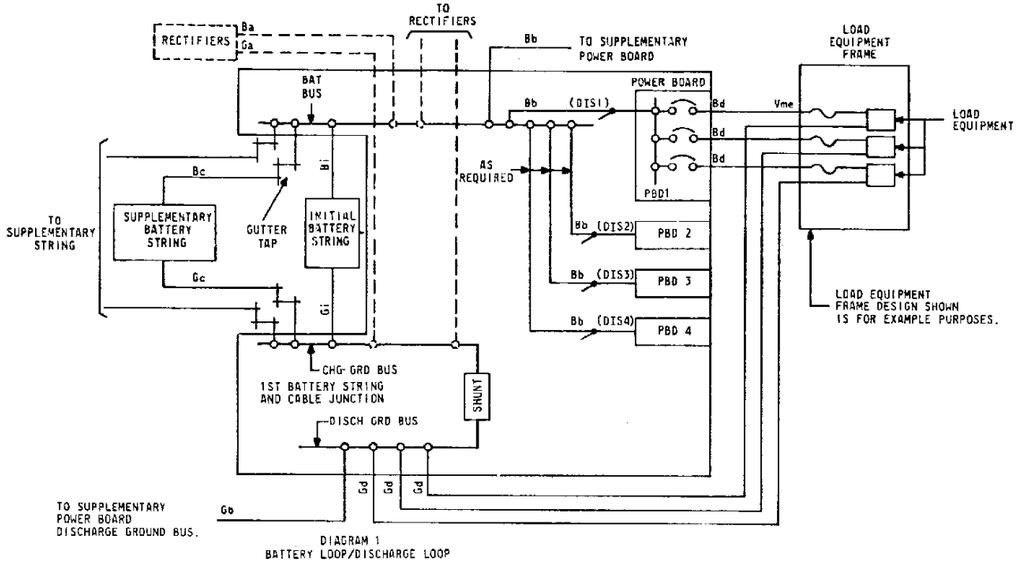


DIAGRAM 1
BATTERY LOOP/DISCHARGE LOOP

114. (CONT)

SECTION 3. LEADS Ba, Ga (SEE DIAGRAM 1): THE MAXIMUM LOOP VOLTAGE DROP OF LEADS Ba AND Ga SHALL NOT EXCEED 2 VOLTS. THE MINIMUM LEAD SIZE SHALL BE CAPABLE OF CARRYING THE MAXIMUM RATED OUTPUT OF THE RECTIFIER AND SHALL PERMIT PROPER OPERATION OF THE RECTIFIER OUTPUT PROTECTIVE APPARATUS.

SECTION 4. THE SIZES OF CONDUCTORS BETWEEN BATTERIES AND VARIOUS LOAD EQUIPMENTS SERVED BY THE POWER PLANT ARE CALCULATED TO RESTRICT VOLTAGE DROP SO THAT VOLTAGE DELIVERED TO ANY LOAD EQUIPMENT FRAME AT THE END OF THE PRESCRIBED RESERVE PERIOD IS NOT LESS THAN THE MINIMUM EMERGENCY VOLTAGE (Vme) SPECIFIED FOR THE LOAD EQUIPMENT FRAME.

SECTION 5. CONDUCTOR MATERIAL IS A FACTOR IN THE CALCULATION OF VOLTAGE DROP. ALLOWED MATERIALS AND THEIR RESISTANCES ARE LISTED BELOW.

KS-20189 ALUMINUM = 17.4 OHMS CM/FOOT
KS-5482-01 COPPER = 11.1 OHMS CM/FOOT

CM = CIRCULAR MILS

SECTION 6. THE FOLLOWING INFORMATION IS REQUIRED FOR CALCULATING THE OPTIMUM ALLOWABLE JOB VARIABLE VOLTAGE DROP:

a. SPECIFIED BATTERY RESERVE TIME

b. MINIMUM EMERGENCY VOLTAGE, Vme.

c. SPECIFIED CONDUCTOR MATERIAL (IN SOME CASES, APPLICABLE SYSTEM DOCUMENTS MIGHT RESTRICT THE CHOICE OF MATERIALS).

d. ULTIMATE LIST 2 BUSY HOUR DRAIN.(SEE SECTION 21)

e. LENGTHS OF DC DISTRIBTION CABLES FOR THE ULTIMATE ARRANGEMENT.(SEE SECTION 21)

f. COST PER INSTALLED FOOT OF STANDARD POWER LEADS.

114. (CONT)

SECTION 6. (CONT)

g. CODE OF BATTERY CELLS.

h. PRICE OF BATTERY (ENGINEER,FURNISH AND INSTALL).

i. BATTERY CAPACITY IN AMPS FOR SPECIFIED BATTERY RESERVE TIME VERSUS BATTERY FINAL VOLTS (Vbf) PER STRING FROM POWER DATA SHEETS OR AT&T PRACTICES SECTION 790-100-655.

j. IF CAPITAL EQUIVALENT OF ENERGY IS SPECIFIED AS A CONSIDERATION, REFER TO AT&T PRACTICES SECTION 790-100-353, PARA 4.02 FOR CAPITAL EQUIVALENT OF ENERGY.

SECTION 7. THE CALCULATIONS USED FOR SELECTING THE MOST ECONOMICAL VOLTAGE DROP IS A PROCESS OF TRADING COST OF BATTERY UTILIZATION VERSUS CABLE COST, WHEN AC POWER IS LOST AND THE BATTERY IS POWERING THE LOAD, THE BATTERY VOLTAGE AT THE END OF THE SPECIFIED BATTERY RESERVE TIME SHOULD EQUAL, AT LEAST, THE HIGHEST EQUIPMENT MINIMUM EMERGENCY VOLTAGE (Vme) PLUS THE VOLTAGE DROP ACROSS THE DC DISTRIBUTION SYSTEM. THREE ELEMENTS OF COST ARE INVOLVED.

a. COST OF BATTERY UTILIZATION (ALSO CALLED BATTERY MARGINAL COST) EXPRESSED IN PRICE/DISCHARGE ($/AMP), FOR A GIVEN RESERVE TIME, INCREASES AS BATTERY FINAL VOLTS ARE INCREASED BECAUSE AVAILABLE DISCHARGE AMPS DECREASE. THEREFORE, INCREASING DISTRIBUTION VOLTAGE DROP INCREASES BATTERY MARGINAL COST.

b. COST OF CABLES TO PRODUCE THE VOLTAGE DROP. SIZE OF CABLES, AND THEREFORE THE COST OF CABLES, VARIES INVERSELY WITH THE ALLOWABLE VOLTAGE DROP.

c. COST OF ENERGY LOST DUE TO HEATING OF THE CABLES WHEN CARRYING CURRENT.

CIRCUIT NOTES: (CONT)

114. (CONT)

SECTION 8. TWO DC LOOPS ARE DEFINED IN DIAGRAM 1 FOR THE PURPOSES OF THIS SCHEMATIC:

a. BATTERY LOOP-FROM DISCHARGE GROUND BUS TO POWER BOARD DISCHARGE BUS; THIS LOOP INCLUDES THE AMMETER SHUNT, THE BATTERY AND ASSOCIATED BUS BARS AND CABLES AND THE BATTERY FEEDER Bb TO THE POWER BOARD.

b. DISCHARGE LOOP-FROM THE POWER BOARD DISCHARGE BUS TO THE DISCHARGE GROUND BUS; THIS LOOP INCLUDES THE FEEDERS TO THE LOAD EQUIPMENT FRAMES(Bd LEADS), THE FEEDERS TO THE LOAD EQUIPMENT (IN THE LOAD EQUIPMENT FRAMES), THE LOAD EQUIPMENT AND THE GROUND RETURN LEADS FROM THE LOAD EQUIPMENT TO THE DISCHARGE GROUND BUS.

SECTION 9. (SEE DIAGRAM 1). SUPPLEMENTARY POWER BOARDS MUST BE CONNECTED TO THE CHARGE BATTERY BUS (OR CABLE JUNCTION).

SECTION 10. LEAD Bb (SEE DIAGRAM 1): THE MAXIMUM ALLOWABLE LOOP VOLTAGE DROP FOR THE BATTERY LOOP IS 0.25V. ALLOW 0.05V(50mV) MAXIMUM VOLTAGE DROP ACROSS THE SHUNT. ALLOW 0.10 VOLTS FOR THE Bb LEADS. THE Bb LEADS IN THIS PLANT ARE WIRED IN THE POWER PLANT FRAME AND ARE CALLED DIS1 THROUGH DIS4. THEY ARE A MAXIMUM OF 5 FOOT LONG AND ARE 4/0 CABLE. THIS LEAVES 0.10V FOR THE REST OF THE LOOP. CALCULATE THE MAXIMUM VOLTAGE DROP ACROSS LEADS Bi AND Gi USING THE FORMULA:

VD=KIL/CM

WHERE I=BATTERY DISCHARGE AT SELECTED Vbf (UTILIZING SECTION 12, TABLE A, COLUMN 2 AND THE SPECIFIED RESERVE TIME)
K=11.1 FOR COPPER OR 17.4 FOR ALUMINUM
L=TOTAL LENGTH OF LEADS IN FEET;
CM=SIZE OF LEADS IN CIRCULAR MILS;
VD=VOLTAGE DROP ACROSS LEADS.

SECTION 11. LEADS Bc AND Gc (SEE DIAGRAM 1):
WHEN SUPPLEMENTARY BATTERY STRINGS ARE PROVIDED, THE VOLTAGE DROP ACROSS LEADS Bc AND Gc SHOULD EQUAL THE VOLTAGE DROP ACROSS LEADS Bi AND Gi. USE THE FORMULA IN SECTION 10 TO CALCULATE THE SIZE OF LEADS Bc AND Gc IN CM OR SELECT THE CM 10 PROVIDE THE PROPER AMPACITY, WHICHEVER IS HIGHER. IF MORE THAN FOUR 4/0 CABLES (4 X 211,600 CM) ARE REQUIRED, USE THE PROPER NUMBER OF 750MCM CABLES IN OVERHEAD CABLE RACKS WITH THE PROPER NUMBER OF 4/0 DROP LEADS TO CONNECT THE 750MCM CABLES AT THE BATTERY TERMINALS AND AT THE BATTERY AND CHARGE GROUND BUSES USING KS-21500 TYPE GUTTER TAP CONNECTORS.
THE PURPOSE OF ATTEMPTING TO PROVIDE EQUAL DROPS ACROSS Bc,Gc AND Bi,Gi IS TO OBTAIN ROUGHLY THE SAME RATE OF DISCHARGE FROM EACH BATTERY STRING. HOWEVER, THIS IS NOT ALWAYS POSSIBLE BECAUSE THE NUMBER OF 750MCM LEADS MIGHT BE EXCESSIVE OR THE POWER PLANT DRAWING SPECIFIES FIXED LEAD SIZES. THE MOST ECONOMICAL LEAD SIZES CAN BE CALCULATED BY INCLUDING THE SELECTION OF LEADS Bc,Gc IN THE APPLICATION OF SECTION 14. THE HIGHER DROP IN THESE LEADS WILL INCREASE THE FINAL BATTERY VOLTAGE IN THE SUPPLEMENTARY BATTERY STRING AND THEREBY REDUCE UTILIZATION OF THE SUPPLEMENTARY STRING. THE DISCHARGE AVAILABLE FROM THIS SUPPLEMENTARY STRING AT THE DESIRED RESERVE TIME CAN BE CALCULATED BY A TRAIL-AND-ERROR METHOD. ASSUME A DISCHARGE RATE AND CALCULATE THE VOLTAGE DROP FROM THE SUPPLEMENTARY STRING TO THE BATTERY BUS AND CHARGE GROUND BUS. ADD THIS DROP TO THE VOLTAGE AT THE BATTERY BUS (BATTERY BUS VOLTAGE IS THE INITIAL STRING FINAL VOLTAGE MINUS THE DROP IN Bi,Gi) AND DIVIDE THE SUM BY 12. THIS IS THE TERMINAL VOLTS PER CELL FOR THE ASSUMED DISCHARGE. CHECK THE BATTERY DISCHARGE TABLES OR CURVES AS TO WHETHER THIS DISCHARGE AND VOLTS PER CELL CORRESPONDS TO THE DESIRED RESERVE TIME (DERATED, IF NECESSARY). REPEAT THIS PROCESS UNTIL THE DISCHARGE IS FOUND.

"LINEAGE"® 2000 CHARGE AND DISCHARGE CKT

DWG SIZE: 03
ISSUE: 58

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SHEET: 01

CIRCUIT NOTES:(CONT)

114. (CONT)

SECTION 12. THE FOLLOWING TABLE APPLIES TO LOAD EQUIPMENT WITH Vme SPECIFIED AT 21 VOLTS. THE POWER PLANT BATTERY CONSISTS OF 12 CELLS.

TABLE A

BATTERY FINAL VOLTS (Vbf) AT END OF BATTERY RESERVE		MAXIMUM ALLOWABLE LOOP VOLTAGE DROP FOR BATTERY LOOP	MINIMUM VOLTAGE FOR DISCHARGE LOOP	MAXIMUM ALLOWABLE LOOP VOLTAGE DROP FOR Bd AND Gd LEADS
VOLTS PER CELL (VPC)	VOLTS PER STRING (VPS)			
(1)	(2)	(3)	(4)	(5)
1.78	21.36	0.25	21.11	0.11
1.80	21.60	0.25	21.35	0.35
1.82	21.84	0.25	21.59	0.59
1.84	22.08	0.25	21.83	0.83
1.86	22.32	0.25	22.07	1.07
1.88	22.56	0.25	22.31	1.31
1.90	22.80	0.25	22.55	1.55

COLUMN 3, THE BATTERY LOOP DROP, IS SPECIFIED AT 0.25V THE RANGE OF VPC AVAILABLE IS 1.75V TO 1.90V THE VALUES AND INCREMENTS IN COLUMN 1 ARE DETERMINED BY THE AVAILABILITY OF PUBLISHED BATTERY DATA:
COLUMN 2 = COLUMN 1 X 12.
COLUMN 4 = COLUMN 2 - COLUMN 3.
COLUMN 5 = COLUMN 4 - Vme (SEE SECTION 4.)

SECTION 13. USE THE FOLLOWING FORMULA TO CALCULATE CONDUCTOR SIZE:
CM = IKL/VD WHERE
I = BUSY HOUR LIST 2 CURRENT DRAIN IN AMPS
K = 11.1 FOR COPPER OR 17.4 FOR ALUMINUM
L = CONDUCTOR LENGTH IN FEET (LOOP LENGTH IF VD IS LOOP VOLTAGE DROP OR ONE-WAY IF VD IS ONE WAY VOLTAGE DROP)
VD= ALLOWABLE VOLTAGE DROP IN VOLTS, LOOP OR ONE WAY DEPENDING ON WHETHER L IS LOOP OR ONE-WAY
CM= CONDUCTOR SIZE IN CIRCULAR MILS.

SELECT THE NEAREST STANDARD CABLE SIZE TO SATISFY AMPACITY REQUIREMENT AND TO PROVIDE THE CIRCULAR MILS CALCULATED ABOVE. THE SIZE OF THE CABLE SHOULD ALSO BE COORDINATED WITH ANY SERIES PROTECTIVE DEVICES TO ASSURE OPERATION OF THESE DEVICES WHEN NECESSARY.

SECTION 14. IN THE DISCHARGE LOOP, THE VOLTAGE DROP FOR THE SEGMENT OF THE LOOP NOT SPECIFIED IN THE APPLICABLE SYSTEMS DRAWING IS JOB VARIABLE AND ITS VALUE DEPENDS ON THE ECONOMICS OF THE JOB. THE FOLLOWING SUMMARIZES THE CALCULATIONS FOR OPTIMIZING THE SELECTION OF THE VOLTAGE DROP ON AN ECONOMICAL BASIS. THE SECTIONS REFERRED TO PROVIDE THE DETAILED METHOD OF CALCULATION.

STEP 1. CALCULATE THE BATTERY MARGINAL COST FOR A 0.11 VOLT(FIRST ENTRY OF COLUMN 5 OF TABLE A) DROP, SAY A $/AMP. (SECTION 15).

STEP 2. CALCULATE LEAD SIZES, USING STANDARD CABLES, FOR EACH POWER BOARD. SAY S1, S2...SN FOR N PBD'S. (SECTION 16).

STEP 3. CALCULATE INSTALLED COST OF LEADS S1,S2...SN, SAY B $/AMP. (SECTION 17).

STEP 4. CALCULATE WATTS LOST IF ENERGY COST IS TO BE INCLUDED. (SECTION 18).

STEP 5. CALCULATE CAPITAL EQUIVALENT OF WATTS LOST (ALSO CALLED, WORTH OF WATT), SAY C $/AMP. (SECTION 19). (OMIT THIS STEP IF STEP 4 WAS OMITTED).

STEP 6. CALCULATE TOTAL COSTS, SAY D $/AMP. (SECTION 20).

CIRCUIT NOTES: (CONT)

114. (CONT)

SECTION 14. (CONT)

STEP 7. REPEAT STEPS 1 THROUGH 6 AFTER SUBSTITUTING A 0.35 VOLT DROP FOR THE 0.11 VOLT DROP, SAY NEW TOTAL = E $/AMP.

STEP 8. IF D IS LESS THAN OR EQUAL TO E, USE 0.11 VOLT AS THE ALLOWED VOLTAGE DROP AND SKIP THE SUBSEQUENT STEPS IN THIS SECTION.

STEP 9. IF D IS GREATER THAN E, REPEAT STEPS 1 THROUGH 6 FOR A 0.59 VOLT DROP TO CALCULATE A STILL NEW TOTAL, SAY F $/AMP.

STEP10. COMPARE E AND F AS WAS DONE FOR D AND E IN STEPS 8 AND 9 AND DECIDE WHETHER THE ALLOWED VOLTAGE DROP IS 0.35 VOLT OR WHETHER TO PROCEED TO REPEAT THE CALCULATIONS USING THE NEXT HIGHER VOLTAGE DROP OF 0.83 VOLT.

STEP11. THE ABOVE PROCESS CAN BE REPEATED IN STEPS OF VOLTAGE DROP FROM SECTION 12, TABLE A, COLUMN 5, UNTIL A BATTERY FINAL VOLTS PER CELL OF 1.90 VOLTS IS REACHED OR UNTIL AN OPTIMUM ALLOWED VOLTAGE DROP IS INDICATED. THE ALLOWED VOLTAGE DROP SHOULD BECOME PART OF THE JOB RECORDS.

SEE SD-83103-01 FOR A TYPICAL EXAMPLE OF HOW THESE CALCULATIONS ARE TOO BE DONE.

SECTION 15. BATTERY MARGINAL COST CALCULATION.

FOR A GIVEN DISCHARGE RATE PER STRING THERE IS A CORRESPONDING BATTERY FINAL VOLTAGE AT THE END OF RESERVE TIME. USING TABLE A IN SECTION 12, OBTAIN THE VPC(VOLTS PER CELL) FOR THE SELECTED VOLTAGE DROP(0.11 V IN THE FIRST ITERATION). USING BATTERY DISCHARGE CURVES OR TABLES IN POWER DATA SHEETS OR AT&T PRACTICES SECTION 790-100-655, OBTAIN DISCHARGE PER STRING FOR THE SELECTED VPC AND SPECIFIED RESERVE TIME. USING THE AT&T TECHNOLOGIES BROAD GAUGE PRICE ESTIMATING GUIDE OR OTHER SUITABLE SOURCE OBTAIN THE PRICE OF ONE STRING OF THE SELECTED BATTERY (ENGINEER, FURNISH AND INSTALL).

$$\text{MARGINAL COST OF BATTERY} = \frac{\text{PRICE OF BATTERY STRING}}{\text{DISCHARGE IN AMPS PER STRING}}$$

MARGINAL COST OF BATTERY IS IN UNITS OF $/AMPERE

THIS CALCULATION SHOULD BE REPEATED FOR A NEW DISCHARGE CORRESPONDING TO THE NEXT HIGHER VOLTAGE DROP IN THE ITERATION, IF NECESSARY.

FOR N STRINGS OF BATTERY WITH UNEQUAL DISCHARGES IN PARALLEL,

$$\text{MARGINAL COST OF BATTERY} = \frac{\text{TOTAL PRICE OF N STRINGS}}{\text{SUM OF DISCHARGES OF N STRINGS}} \ \$/\text{AMP}$$

SECTION 16. CALCULATION OF LEAD SIZES.

REFER TO SECTION 13 TO CALCULATE LEAD SIZES.

SECTION 17. CABLE COST CALCULATION.

USING THE AT&T TECHNOLOGIES BROAD GAUGE PRICE ESTIMATING GUIDE OR OTHER SUITABLE SOURCE OBTAIN THE COST PER FOOT (ENGINEER, FURNISH AND INSTALL) OF THE SELECTED CABLES. THE BROAD GAUGE, UNDER POWER APPLICATION NOTES, PROVIDES MATERIAL, INSTALLATION AND ENGINEERING COST SEPARATELY PER 100FT. LENGTH FOR EACH CABLE SIZE, ADD THE THREE COSTS AND DIVIDE BY 100 FOR EACH CABLE SIZE TO OBTAIN COST PER FOOT. FOR EACH CABLE SIZE CALCULATED IN SECTION 14, STEP 2, MULTIPLY COST PER FOOT BY ITS TOTAL LENGTH AND DIVIDE BY L-2 BUSY HOUR DRAIN THE CABLE WAS DESIGNED FOR IN STEP 2. THIS GIVES THE $/AMP FOR EACH CABLE SIZE. ADD ALL THE CABLE COST/AMP AND ARRIVE AT THE TOTAL CABLE COSTS IN $/AMP.

SECTION 18. CALCULATION OF ENERGY LOST DUE TO CONDUCTOR HEATING

(OMIT THIS STEP IF THE CUSTOMER SPECIFIES MINIMUM FIRST COST WITH NO CONSIDERATION OF ENERGY CONSERVATION). CALCULATE THE ACTUAL VOLTAGE DROP IN THE LEADS SELECTED IN SECTION 14, STEP 2 USING THE FORMULA IN SECTION 13; THIS DROP IS EQUAL TO WATTS PER AMP. CM = CIRCULAR MILS OF THE LEADS CALCULATED IN SECTION 14, STEP 2.

CIRCUIT NOTES: (CONT)

114. (CONT)

SECTION 19. WORTH OF A WATT CALCULATIONS.

(OMIT THIS STEP IF THE STEP IN SECTION 18 WAS OMITTED). AT&T SECTION 790-100-653, PARA. 4.02 PROVIDES INFORMATION ON CALCULATING THE CAPITAL EQUIVALENT OF OF WATTS LOST. IN THIS SECTION, FIGURE 3.23 PROVIDES A GRAPH DEPICTING WORTH OF A WATT FOR A 20-YEAR STUDY PERIOD AND AN 8% ENERGY COST INFLATION RATE. FOR A DIFFERENT STUDY PERIOD AND/OR A DIFFERENT INFLATION RATE USE THE METHOD PROVIDED IN SECTION 790-100-653, PARA. 4.02 TO CALCULATE WORTH OF A WATT FOR DIFFERENT VALUES OF ENERGY COST. MULTIPLY THE VOLTAGE DROPS CALCULATED IN SECTION 18 BY THE WORTH OF A WATT IN $ FOR THE CONDITIONS OF THE JOB TO OBTAIN THE CAPITAL EQUIVALENT OF WATTS LOST PER AMP IN EACH CABLE. ADD ALL THE WORTH-OF-A-WATT FIGURES FOR ALL THE CABLES TO ARRIVE AT A TOTAL CAPITAL EQUIVALENT OF WATTS LOST IN $/AMP. THERE ARE SOME CAPITAL COSTS AND EXPENSES THAT ARE RELATED TO THE ENERGY DISSIPATED BY CONDUCTORS BUT THESE COSTS DO NOT AFFECT THE PRODUCTION OF THIS ENERGY, FOR EXAMPLE, A PORTION OF AIR CONDITIONING COSTS. THESE COSTS MAY BE INCLUDED IN THE CABLE SELECTION PROCESS BUT IT IS IMPORTANT TO NOTE THAT THE WATTS LOST DEPEND ONLY ON THE CURRENT, THE CROSS-SECTION OF THE CONDUCTOR, ITS LENGTH AND MATERIAL.

SECTION 20. TOTAL COST CALCULATION

ADD THE TOTAL COST OF CABLES FROM SECTION 17 TO THE BATTERY MARGINAL COST FROM SECTION 15; THIS SUM IS THE TOTAL FIRST COST IN $/AMP FOR THE VOLTAGE DROP THE CABLES WERE DESIGNED FOR. IF WORTH OF A WATT IS TO BE INCLUDED, ADD TO THIS SUM THE TOTAL CAPITAL EQUIVALENT OF WATTS LOST FROM SECTION 19. THIS SUM IS THE TOTAL COST IN $/AMP.

SECTION 21. ULTIMATE LOAD IS INTENDED TO MEAN MAXIMUM FORECASTED LOAD. THE CUSTOMER'S ABILITY TO FORECAST LOAD IN TERMS OF CURRENT DRAINS AFFECTS THE SELECTION OF THE OPTIMUM VOLTAGE DROP FOR THE JOB VARIABLE SEGMENT OF THE DISTRIBUTION LOOP. ONCE SELECTED, THE ALLOWED VOLTAGE DROP REMAINS FIXED DURING FUTURE LOAD GROWTH AND/OR BATTERY ADDITIONS. ANY UNFORECASTED GROWTH WITH LONGER CABLE RUNS MIGHT IMPOSE A CABLE PENALTY BY REQUIRING LARGER CABLES THAN IF THE RUNS WERE INCLUDED IN THE INITIAL VOLTAGE DROP SELECTION PROCESS. ON THE OTHER HAND, IF THE INITIAL FORECAST IS UNREALISTICALLY HIGH WITH LONG RUNS THE ULTIMATE BATTERY COSTS MIGHT BE EXCESSIVE. A RECOMMENDED DESIGN PHILOSOPHY IS TO PROVIDE SEVERAL SMALL POWER PLANTS WITH SHORT CABLE RUNS THAN A LARGE CENTRAL PLANT WITH EXCESSIVELY LONG CABLE RUNS.

SECTION 22. POWER SCHEMATICS VARY IN THE TERMINOLOGY USED. THE FOLLOWING INDICATES FUNCTIONAL EQUIVALENCE TO SOME OF THE TERMS USED IN THIS SCHEMATIC.

a. POWER BOARD (PBD) - BATTERY CONTROL BOARD (BCB), POWER DISTRIBUTION FUSE BOARD.

b. POWER DISTRIBUTION FRAME (PDF) - POWER DISTRIBUTION CABINET (PDC), BATTERY DISTRIBUTION FUSE BOARD (BDFB), BATTERY DISTRIBUTION CIRCUIT BREAKER BOARD (BDCBB), POWER DISTRIBUTION PANEL.

SECTION 23. THE SIZE OF THE CABLES USED FOR DISTRIBUTION SHOULD BE COORDINATED WITH THE SIZE OF THE PROTECTIVE DEVICES.

SECTION 24. LEADS SHOULD BE PROPERLY PAIRED, EXCEPT AS OTHERWISE NOTED.

SECTION 25. THIS METHOD IS NOT INTENDED TO PROVIDE A TOTAL COST PICTURE. ONLY COSTS WHICH VARY DURING THE PROCESS OF SELECTING VOLTAGE DROPS ARE INCLUDED TO FACILITATE THE SELECTION OF LEAD SIZES VIS-A-VIS THE BATTERY RESERVE TIME AT MINIMUM COST. ESSENTIALLY, THE METHOD INVOLVES ADDING TOGETHER THOSE COSTS ASSOCIATED WITH A VARIABLE VOLTAGE DROP AND REPEATING THE CALCULATIONS FOR DIFFERENT VOLTAGE DROPS UNTIL A MINIMUM COST IS ARRIVED AT. ALSO, THE METHOD CAN BE USED TO STUDY THE EFFECT OF VARYING DIFFERENT PARAMETERS. FOR INSTANCE, THE EFFECT OF CHANGING RESERVE TIME CAN BE STUDIED BY VARYING BATTERY DISCHARGE AMPS AND THEREBY THE BATTERY MARGINAL COST.

CIRCUIT NOTES: (CONT)

114. (CONT)

SECTION 26. IF A SUPPLEMENTARY POWER BOARD IS USED WITH THE POWER PLANT, THE Bb, Bd, Gb AND Gd LEADS MUST BE ABLE TO CARRY THE AMPACITY OF THE SUPPLEMENTARY POWER BOARD. THE VOLTAGE DROP FOR THE ORIGINATING POWER BOARD LEADS (Bb, Bd, AND Gd) AND SUPPLEMENTARY POWER BOARD LEADS (Bb, Bd,Gb AND Gd) SHOULD BE EQUAL. THE LARGEST Bb LEAD THAT CAN LEAVE THE ORIGINATING BAY IS 4/0 THE LARGEST Gb LEAD THAT CAN LEAVE THE ORIGINATING OR SUPPLEMENTARY BAY IS 2, 4/0 CABLES. THE DISR- LEAD SHALL BE SIZED SO THAT THE SMALLEST CABLE USED IN THE DISR- LEAD WILL BE CAPABLE OF CARRYING THE CURRENT REQUIREMENTS OF THE SUPPLEMENTAL BAY. TO MEET VOLTAGE DROP REQUIREMENTS, THESE LEADS CAN BE GUTTER TAPPED.

WHEN THE VOLTAGE DROP CAN NOT BE EQUALIZED BETWEEN THE SUPPLEMENTARY POWER BOARD LOOP AND THE ORIGINATING POWER BOARD LOOP DUE TO EXCESSIVE CABLE REQUIREMENTS FOR THE SUPPLEMENTARY POWER BOARD. THE MOST ECONOMICAL LEAD SIZE CAN BE CALCULATED BY INCLUDING THE SELECTION OF SUPPLEMENTARY POWER BOARD LEADS IN THE APPLICATION OF SECTION 14.

THE SUPPLEMENTARY BAY SHALL NOT EXCEED 200 AMPERES MAXIMUM DRAIN.

115. "M" WIRING OPTION IS REQUIRED FOR USE OF THE "R" OPTION WITH THE "E" OPTION. THE "M" OPTION HAS BEEN RATED "DA" AND THUS, THE MCS CONTROLLER CAN NOT BE USED WITH THE LOW VOLTAGE FEATURE.

116. NOTE 114 CAN BE USED WITH OPTION K OR F WITH THE APPROPRIATE SUBSTITUTION OF FUSE INFORMATION FOR CIRCUIT BREAKER INFORMATION.

117. THE FAU LEADS FROM FS13 MULTS TO OTHER DISTRIBUTION FAU LEADS AND EVENTUALLY TERMINATES ON THE CONTROL UNITS OF FS1, FS2 OR FS10. THE FAN LEADS FROM FS13 AND FS14 MULTS TO OTHER FAN LEADS AND EVENTUALLY TERMINATES ON THE CONTROL UNITS OF FS1, FS2 OR FS10.

118. THE 74 AND KS TYPE FILTER FUSE PANELS COME EQUIPPED WITH 48 FUSE AND INDICATING TYPE (70 TYPE) FUSE-POSITIONS. 24 LOAD FUSES AND 24 INDICATING FUSES PER INVOLT ( ) BUS. THE MAXIMUM CURRENT THROUGH EACH 30B FUSE BLOCK IS 45 AMPERES (PER ATT SPEC X-75533). THE MAXIMUM CURRENT THROUGH EACH INVOLT ( ) BUS IS 200 AMPERES. THIS INFORMATION SHALL APPEAR AS A STAMP ON EACH FS13 FILTER FUSE PANEL. FUSES SHALL BE RATED AT 150% OF MAXIMUM LOAD CURRENT.

THE ED-82947-30,GROUP 2 CAN BE ORDERED WITH THE FOLLOWING GROUPS:

GROUP AX, G FOR APPLICATION OF THE PANEL IN THIS PLANT
GROUP T FOR +24 VOLT PLANTS
GROUP W FOR -48 VOLT PLANTS

119. ED-83107-30,GROUPS 1 THROUGH 6 PROVIDE DIFFERENT COMBINATIONS OF FUSE BLOCKS AND MOUNTING LOCATIONS. FS16 SHOWS ED-83107-30,GROUP 3 IN THE ORIGINATING BAY FOR INFORMATION ON WIRING THE 22A, 25A OR 25B FUSE BLOCKS. THE APP FIGURE 16 FUSE PANELS CAN COME EQUIPPED WITH ONE OF THE FOLLOWING COMBINATIONS OF FUSE BLOCKS:

A. 32 "70 TYPE" FUSE POSITIONS (TWO 22A FUSE BLOCKS) PER FUSE PANEL FOR FEEDING LOADS ARE PROVIDED IN ED-83107-30,GROUP 1 OR GROUP 2. THE DIS- LEAD, WHEN THIS PANEL IS IN THE ORIGINATING BAY OR SUPPLEMENTARY BAY, WILL FEED A BUS BAR DETAIL (DISCHARGE BUS) AND SHALL BE A 2 AWG LEAD.

B. 16 "70" TYPE FUSE POSITIONS PER FUSE PANEL FOR FEEDING LOADS (ONE 22A FUSE BLOCK) ALONG WITH B "74 OR KS-19780" TYPE FUSE POSITIONS FOR FEEDING LOADS, THAT HAVE ACCOMPANYING INDICATING FUSE POSITIONS (ONE 25A FUSE BLOCK) ARE PROVIDED IN ED-83107-30,GROUP 3 OR 4. THE DIS- LEAD, WHEN THIS PANEL IS IN THE ORIGINATING BAY OR SUPPLEMENTARY BAY, WILL FEED A BUS BAR DETAIL (DISCHARGE BUS) AND SHALL BE A 2/0 AWG LEAD.

C. 16 "74 OR KS-19780" TYPE FUSE POSITIONS PER FUSE PANEL FOR FEEDING LOADS THAT HAVE ACCOMPANYING INDICATING FUSE POSITIONS (ONE 25A AND ONE 25B FUSE BLOCK) ARE PROVIDED IN ED-83107-30, GROUP 5 OR 6. THE DIS- LEAD,WHEN THIS PANEL IS IN THE ORIGINATING BAY OR SUPPLEMENTARY BAY, WILL FEED A BUS BAR DETAIL (DISCHARGE BUS) AND SHALL BE A 4/0 AWG LEAD.

"LINEAGE"® 2000 CHARGE AND DISCHARGE CKT

DWG SIZE: 6S | ISSUE: 6B

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CIRCUIT NOTES: (CONT)

119. (CONT)
THE MAXIMUM CURRENT THROUGH EACH 22A FUSE BLOCK IS 48 AMPERES (3 AMPERES PER FUSE POSITION). THE MAXIMUM CURRENT THROUGH EACH 25A OR 25B FUSE BLOCK IS GOVERNED BY INFORMATION NOTE 114. THIS INFORMATION SHALL APPEAR AS A STAMP ON EACH ED-83107-30,GROUP 1 THROUGH 6 FUSE PANEL. "7G" TYPE FUSES SHALL BE RATED AT LEAST 150% OF MAXIMUM LOAD CURRENT. "7A" AND "KS-19780" TYPE FUSES SHALL BE RATED AT LEAST 125% OF MAXIMUM LOAD CURRENT. NOTE 114 SHOULD BE CONSULTED FOR VOLTAGE DROP CONSIDERATIONS. ODD NUMBER ED-83107-30 GROUPS ARE FOR THE LEFT SIDE OF THE BAY. EVEN NUMBER ED-83107-30 GROUPS ARE FOR THE RIGHT SIDE OF THE BAY.

120. THIS NOTE IS TO REPLACE NOTE 109. THE DIS- LEAD TO FS7 OR FS8 SHALL BE 2 2/0 CABLES OF EQUAL LENGTH WHICH ARE TERMINATED AT APPROXIMATELY THE SAME ELECTRICAL POINT ON BOTH THE CHARGE BATTERY BUS AND THE DISCHARGE BUS. EACH CIRCUIT BREAKER PANEL SHALL CONTAIN NO MORE THAN 300 AMPERES OF CIRCUIT BREAKERS. THE 2 2/0 CABLES SHALL BE RUN ONLY INTERNALLY IN A BAY. THE POWER PLANT LIST TWO DRAIN SHALL NOT EXCEED 400 AMPERES. THIS INFORMATION SHALL APPEAR AS A STAMP ON EACH FS7 AND FS8 CIRCUIT BREAKER PANEL THAT IS UTILIZED IN A POWER PLANT THAT IS RATED OVER 300 AMPERES.

EQUIPMENT NOTES:

201. ALL WIRING NOT SPECIFIED SHALL BE 24 GAUGE SOLID KS-22247,L4. EXCEPT FOR FS13 AND FS14, IN WHICH CASE THE UNSPECIFIED WIRE SHALL BE 20 GAUGE KS-22247,L4.

202.

SIZE	WIRING TYPE	REMARKS
20 GA	KS-22247	FAJ,FAN,LVD1,LVD2, LVD3 AND GR
16 GA	KS-22247	FC-,FAJ,FAN,CC,CCR
12 GA	KS-5482 OR KS-22247	DISCH BAT,DISCH GRD, REG BAT,REG GRD (SEE NOTE 203)
0	KS-5482	CO GRD
4/0	KS-5482	P-,PR-
4/0	KS-20921	DIS1-DIS4 (WHEN THE DIS- LEAD IS FEEDING FS16 THE LEAD SIZE MAXIMUM CAN BE REDUCED BY ANY CAVEAT IN NOTE 119) THE DIS- LEAD CAN BE EITHER KS-5482 OR KS-20921 WHEN BEING RUN FROM THE ORIGINATING BAY TO THE SUPPLEMENTARY BAY.
12 GA MIN SEE SECTION 25 OF NOTE 114	KS-22247 KS-5482 OR KS-20921	BATSH,BATSHG (SEE NOTE 105) DISR-

203. SPECIAL CARE SHOULD BE TAKEN TO ENSURE THAT THE "REG GRD", "REG BAT", "DISCH BAT" AND "DISCH GRD" LEADS ARE ADEQUATELY SECURED AND PROTECTED IN ACCORDANCE WITH THE REQUIREMENTS COVERED IN AT&T PRACTICE SECTIONS 800-614-152 AND 800-612-157. WHEN THESE LEADS ARE USED WITH THE V OPTION THE SIZE OF THE LEADS ARE TO BE GOVERNED BY CD/SD-82646-01.

204. R5 OR R7 THE RESISTOR ASSOCIATED WITH THE DISCHARGE CIRCUIT FED FROM DIS-. ONE RESISTOR (R5 OR R7) SHALL BE PROVIDED WITH EACH LOAD PANEL. RESISTOR R5 OR R7, SHALL BE MOUNTED AS CLOSE AS POSSIBLE TO ITS RESPECTIVE DISCHARGE BUS. THE FAJ LEADS FROM EACH PANEL SHALL BE MULTED TOGETHER WITH A LEAD THAT IS RUN TO FAJ TERMINAL OF THE PLANT CONTROL UNIT.

205. THERE EXISTS ONE S1 AND ONE S2 PER FS7 FIGURE THAT HAS LOADS REQUIRING FILTER CHARGING.

206. BATTERY EQUIPMENT SHALL BE ORDERED SEPARATELY PER J85504A OR J85504B. "A" ARE PLASTIC STANDS. "B" ARE SHEET METAL. IF IT IS DESIRED TO USE BATTERIES OTHER THAN THOSE SPECIFIED IN J85504A OR J85504B, "A" ARE PLASTIC STANDS, "B" ARE SHEET METAL, AT&T BELL LABORATORIES AND/OR THE POWER SYSTEM PRODUCTS BUSINESS MANAGEMENT ORGANIZATION SHOULD BE CONSULTED FOR GUIDANCE.

207. WHEN THE 963 TYPE CONNECTORS ARE INSERTED ON THE CONTROLLER, THE BLACK SEGMENT OF THE CONNECTOR MUST BE ON THE LEFT SIDE.

208. THE P- AND PR- LEADS FROM THE INITIAL BATTERY STRING SHALL BE LESS THAN 16 FEET IN TOTAL LENGTH.
P- AND PR- LEADS CAN BE INCREASED TO 750 MCM CABLES IF REQUIRED. THE POWER PLANT CAN TERMINATE FOUR 4/0 BATTERY CABLES OR TWO FLEXIBLE 750 MCM BATTERY CABLES (KS-20921) DIRECTLY. IF THIS IS NOT ADEQUATE THEN A JOB ENGINEERED CABLE JUNCTION APPLIQUE MUST BE ADDED TO THE POWER PLANT.

209. ALL WIRING TO CM2 SHALL BE KS-22247,L4 20 GA.

210. WHEN THE PLANT UTILIZES THE K OPTION THE LEAD TO THE "CO GRD" FROM THE DISCHARGE GROUND BUS CAN BE FED FROM THE VRTN BUS (A) OF FS13 IF THE DISCHARGE GROUND BUS HAS INSUFFICIENT SPACE.

211. IF A 2APA06500297 Ⓒ SWITCH IS BEING ORDERED AS A REPLACEMENT FOR A 399622-LⒸ SWITCH, ORDER A 845199537 PLATE.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CKT

DWG SIZE: B3 | ISSUE: 7B

AT&T TECHNOLOGIES, INC. | SD-83104-01 | SHEET: D2B

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 IN VOLTS.

302.

FEATURE OR OPTION	PROVIDE		
	APP FIG	APP OR WRG	QUANTITY
125 AMP RECTIFIER	1,2,9	-	AS REQD
100 AMP RECTIFIER	1,2,9	-	AS REQD
50 AMP RECTIFIER	1,2,9	-	AS REQD
25 AMP RECTIFIER	1,2,9	-	AS REQD
24 VOLT PLANT	-	Z	
48 VOLT PLANT	-	W	
NEGATIVE PLANT	-	X	
POSITIVE PLANT	-	Y	
MCS CONTROL UNIT	2	E	1
CONVENTIONAL CONTROL UNIT	1	F	1
MODEM (FOR USE WITH MCS)	4	M	1
LOW VOLTAGE DISCONNECT	6	R	1
FILTER CHARGE CIRCUIT	3	S	1
MAX 15 CIRCUIT BREAKER PANELS	7	S	AS REQD 4 PANELS MAX.
MAX 18 CIRCUIT BREAKER PANELS	8	-	
LINEAGE SMALL CONTROL UNIT	9	V	1
HIGH INRUSH CIRCUIT BREAKERS (MAXIMUM 18 PER PANEL)	10	T	
DEDICATED BREAKERS FOR FEEDING L OPTION INVERTERS	12	Q	AS REQD 4 MAX.
200 AMP, 48 VOLT DC CONTACTOR	6	P	1
48 VOLT DC CONTACTOR FOR PLANTS UP TO 400 AMPERE	6	N	1
THREE PORT INVERTER (USE ONLY WITH -48V PLANTS)	11	L	AS REQD
FILTER FUSE PANEL	13	K	
CAPACITOR CHARGE FOR K OPTION, ONLY WITH W AND X OPTION	14	G	1
DISTRIBUTION UTILIZING 22A, 25A OR 25B FUSE BLOCKS	16	F	AS REQD 4 PANELS MAX.
200 AMP RECTIFIER	1,2,9	-	AS REQD

INFORMATION NOTES: (CONT)

303.

RECORD OF APP FIGURES, WIRING AND APPARATUS CHANGES							
CHANGES ON ISS	IF JOB RECORDS DO NOT SPECIFY	THIS OPTION WAS FURN	SEE NOTE	USE IN CIRCUIT		
				STD	A&M	MD
2B	H,J	J	115	H,J		
			308	L		
	N,P	P	113	N,P		
			307	Q		
			112	T		
3B			313	K		
			312, 313	G		
				F		
			109			D
			120	C		
4A			115	J		H
				AVAIL		DA
6B (SEE NOTE 316)	A	B		A		B
7B	D	C		D		C

INFORMATION NOTES: (CONT)

304. ALARM INDICATORS FOR E AND F OPTIONS

LEAD DESIGN	FUNCTION			
	MAJOR	MINOR	OFF.ALM CKT	ALM SENDING
SI(E) SIR(E)	X			X
	OPERATED CTF(F17), BAT(F20), ABS(F21), DISCHARGE FUSE OR CIRCUIT BREAKER OR DISCONNECTED BATTERY			
SI(C) SIR(C)		X		X
	OPERATED RB1(F1)-RB16(F16), MINOR PWR FEED(F19), F22 OR MINOR SENSE(F18) FUSE, RECT FAIL OR CHARGE FUSE OR CAPACITOR FILTER FUSE OPERATED.			
SI(B) SIR(B)	X			X
	HIGH VOLTAGE			
SI(A) SIR(A)	X			X
	LOW VOLTAGE, VERY LOW VOLTAGE			
SI(D) SIR(D)	X			X
	VERY LOW VOLTAGE			
PMN PMNR		X	X	
	RECT FAIL OR CHARGE FUSE OPERATED			
PMNV PMNVR		X	X	
	RECT FAIL OR CHARGE FUSE OPERATED			
PMJ PMJR	X		X	
	HIGH VOLTAGE,VERY LOW VOLTAGE, LOW VOLTAGE OR OPERATED F17,F20,F21, DISCHARGE FUSE OR CIRCUIT BREAKER OR BATTERY DISCONNECTED			
PMJV PMJVR	X		X	
	HIGH VOLTAGE, VERY LOW VOLTAGE, LOW VOLTAGE OR OPERATED F17, F20, F21, DISCHARGE FUSE OR CIRCUIT BREAKER OR BATTERY DISCONNECTED			
8D	X			X
	LOW VOLTAGE			
D	X			X
	HIGH VOLTAGE, VERY LOW VOLTAGE, LOW VOLTAGE OR OPERATED F17, F20, F21, DISCHARGE FUSE OR CIRCUIT BREAKER OR BATTERY DISCONNECTED			
B		X		X
	RECT FAIL			

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

305. INFORMATION SHOWN IN BRACKETS[ ]ARE FOR REFERENCE ONLY.

306. FOR ALARM INDICATORS FOR OPTION V, SEE SD-82646-01 NOTE 304. IF THE PLANT UTILIZES THE R OPTION, WHEN THE BATTERIES ARE DISCONNECTED THE SAME ALARMS OCCUR THAT OCCUR WHEN A DISCHARGE BREAKER OPERATES.

307. THE Q OPTION IS UTILIZED WHEN IT IS DESIRED TO FEED AN L OPTION INVERTER.

INFORMATION NOTES: (CONTINUED ON D4)

314. THE 25A FUSE BLOCK INFORMATION (CONTINUED ON D4)

INFORMATION NOTES:- (CONT)

308. THIS INVERTER HAS DC AS WELL AS AC INPUT WITH AC OUTPUT. THE INPUT AND OUTPUT LEADS SHOULD UTILIZE KS-5482 OR EQUIVALENT WIRE. THE FOLLOWING TABLE DELINEATES THE MINIMUM RECOMMENDED BREAKER SIZE AND LEAD SIZE THAT SHOULD BE USED:

LEAD	1 KVA INVERTER LEAD SIZE	BREAKER (AMP)	3 KVA INVERTER LEAD SIZE	BREAKER (AMP)	5 KVA INVERTER LEAD SIZE	BREAKER (AMP)
DC LOAD INPUT	8 AWG	40	2 AWG	100	00	175
DC GROUND INPUT	8 AWG	-	2 AWG	-	00	-
AC LOAD INPUT	14 AWG	*10	10 AWG	*30	6 AWG	*50
AC GROUND INPUT	14 AWG	-	10 AWG	-	6 AWG	-
AC LOAD OUTPUT	14 AWG	**10	10 AWG	**30	6 AWG	**50
AC GROUND OUTPUT	14 AWG	-	10 AWG	-	6 AWG	-

* TO BE PROVIDED BY THE CUSTOMER
** TO BE PROVIDED BY THE THREE PORT INVERTER VENDOR

THE AC INPUT AND THE AC OUTPUT LEADS OF THE THREE PORT INVERTER SHALL BE ELECTRICALLY SHIELDED FROM OTHER LEADS IN THE POWER PLANT BY THE USER BY UTILIZING ATT PRACTICES. THE AC INPUT SHALL BE FED FROM THE CUSTOMERS AC SERVICE. THE THREE PORT INVERTER IS FED FROM A NOMINAL 120 VOLT SINGLE PHASE SOURCE. THE INVERTERS PRODUCE NOMINAL 120V SINGLE PHASE AC. THE AC LEADS VOLTAGE DROPS ARE TO BE CONSIDERED BY THE CUSTOMER. THE DC POWER LEADS ARE TO FOLLOW THE SAME RULES AS ANY OTHER DC LOAD FED BY THIS PLANT. THE PLANT WILL ACCOMODATE UP TO 4 ø1 KVA THREE PORT INVERTERS, 2ø 3 KVA THREE PORT INVERTERS OR 1ø 5KVA THREE PORT INVERTER. DIFFERENT INVERTERS TYPES OR SIZES ARE NOT TO BE MIXED IN THE POWER PLANT. THE CUSTOMER WILL NOT BE ABLE TO PARALLEL THE OUPUT FROM THE INVERTERS. THE INVERTER VENDOR WILL PROVIDE MOUNTING HARDWARE FOR 25" RACK MOUNTING OF THE INVERTERS. TYPICAL SUGGESTED INVERTER MOUNTING POSITIONS IN A BARE FRAME WILL BE SHOWN IN AN ENGINEERING NOTE IN J855004,B.
IF MORE THAN ONE Q OPTION CIRCUIT BREAKER IS BEING UTILIZED IN THE PLANT, ONLY THE FIRST CIRCUIT BREAKER REQUIRES AN R5 RESISTOR. ALL OTHER Q OPTION CIRCUIT BREAKERS ARE TO HAVE THEIR C OR 8 TERMINALS MULTED TO TERMINAL C OR 8 OF THE FIRST Q OPTION CIRCUIT BREAKER. THIS IS ALSO TRUE FOR THE NO OR 9 TERMINALS.

309. WHEN A FILTER FUSE(S) FF( ) IS (ARE) OPEN OR REMOVED, THE FILTER CAPACITOR(S) MOUNTED ON THE 74 TYPE FUSE PANEL WILL DISCHARGE TO 0V DC.
IF IN ADDITION TO THE REMOVAL OF A FILTER FUSE(S) THE CONTROL PANEL FUSE (FF1) IS ALSO REMOVED*, THE CAPACITOR VOLTAGE WILL BLEED DOWN TO 0 VOLTS.
*WARNING: REMOVAL OF THE CONTROL PANEL FF1 WILL DISABLE THE CHARGE CIRCUIT.

310. INSTRUCTIONS FOR USING THE CHARGE PROBE ARE AS FOLLOWS:

1. TO CHARGE THE LOAD CAPACITANCE ON EITHER BUS( ) -
   A. INSERT THE CHARGE PROBE INTO THE INDICATING FUSE HOLDER (IF NOT PROVIDED - CHARGE AS PER STEP 2).
   B. PRESS THE "CAP CHG" SWITCH (S2) AND WAIT UNTIL THE "CAP CHG" LED EXTINGUISHES*.
   C. WHEN THE "CAP CHG" LED EXTINGUISHES AND THE "LOAD FAULT" LED IS ALSO EXTINGUISHED
      1. INSERT THE LOAD FUSE.
      2. RELEASE THE "CAP CHG" SWITCH.
      3. REMOVE THE CHARGE PROBE.
      4. INSERT THE INDICATING FUSE.
2. TO CHARGE THE PANEL FILTER CAPACITORS -
   A. INSERT THE CHARGE PROBE INTO THE FUSE HOLDER.
   B. PRESS THE "CAP CHG" SWITCH (S2) AND WAIT UNTIL THE "CAP CHG" LED EXTINGUISHES*.
   C. WHEN THE "CAP CHG" LED EXTINGUISHES AND THE "LOAD FAULT" LED IS ALSO NOT LIGHTED -
      1. RELEASE S2.
      2. REMOVE THE CHARGE PROBE.
      3. INSERT THE LOAD FUSE WITHIN 12 SECONDS.

*WARNING: IF THE "CAP CHG" LED EXTINGUISHES, BUT, THE "LOAD FAULT" LED LIGHTS, A LOAD FAULT (SHORT CIRCUIT, OVERLOAD, OR ANY CONDITION THAT KEEPS THE LOAD CAPACITORS FROM BEING CHARGED) CONDITION EXISTS.

311. WHEN THE LOAD FUSES OR LOAD INDICATING FUSES OF FS13 OPERATE, THE "PANEL ALARM" LED LIGHTS. WHEN THE CAPACITOR FILTER FUSE OF FS13 OPERATES, THE "FILTER FUSE ALARM" LED LIGHTS. IF THE CHARGE CIRCUIT OF FS14 FAILS DUE TO A SHORT CIRCUIT, THE "LOAD FAULT" LED LIGHTS.

312. OPTION G REQUIRES FRONT AND REAR ACCESS.

313. THE CIRCUIT INFORMATION SHOWN IN FS13 AND FS14 RELATIVE TO ED-82947-30 AND ED-82923-30 AND ED-82950 IS SHOWN FOR INFORMATION ONLY. SD-82518-02 GOVERNS THE COMPONENTS OF THESE EDs.

"LINEAGE"® 2000 CHARGE AND DISCHARGE CKT

DWG SIZE: B3
ISSUE: 78

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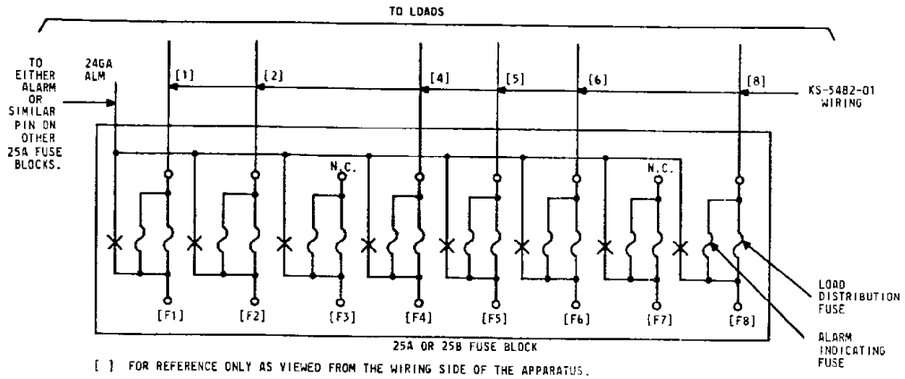
INFORMATION NOTES: (CONT)

314. WHEN ASSIGNING FUSES IN 25A OR 25B FUSE BLOCKS, FOR EACH FUSE OVER 15 AMPS, AN ADJACENT FUSE POSITION IS TO REMAIN UNUSED AND DEDICATED TO ONLY THAT FUSE.



[ ] FOR REFERENCE ONLY AS VIEWED FROM THE WIRING SIDE OF THE APPARATUS.

TYPICAL EXAMPLE:

FUSES F4 AND F8 ARE LARGER THAN 15 AMPS. WIRING IS DONE TO SUIT JOB ASSIGNMENT. THE FRONT PANEL MARKING DESIGNATION STRIP FOR THE FUSE BLOCKS SHALL SHOW THE FUSES, SUCH AS F3 AND F7 DESIGNATED "NC" (NOT CONNECTED) WITH DUMMY FUSES MOUNTED IN THOSE UNUSED POSITIONS TO HELP RETAIN CAPS.

THE FUSING ASSIGNMENTS FOR A 25A OR 25B FUSE BLOCK MUST FOLLOW THE GUIDELINES LISTED BELOW TO PREVENT THE FUSE BLOCK FROM DISSIPATING MORE POWER THAN IS RECOMMENDED (7.65 WATTS PER X-75533):

A. IF THE FUSING SCHEME IS MADE UP OF ONLY 74A, 74B, 74C, KS-19780,L1, L2, L4, L5 OR SMALLER FUSES, ALL POSITIONS (ALLOWING 2 POSITIONS FOR L4, L5) MAY BE ASSIGNED AND THE BLOCK WILL NOT DISSIPATE MORE THAN 7.65 WATTS.

B. IF THE FUSING SCHEME MATCHES ONE OF THE FOLLOWING COMBINATIONS, CHECK THE TOTAL LIST 2 CURRENT DRAIN THROUGH THE FUSES OF THE BLOCK. IF IT IS MORE THAN THE "MAX TOTAL CURRENT ALLOWED" OF THE TABLE BELOW, REASSIGN THE LOADS.

FUSING SCHEME	KS-19780 FUSES						74 TYPE FUSES						MAX TOTAL CURRENT ALLOWED
	L6	L5	L4	L3	L2	L1	F	E	D	C	B	A	
1	4												88 AMPS
2				8									96 AMPS
3							4						61 AMPS
4								8					68 AMPS
5									8				61 AMPS
6	3	1											88 AMPS
7	3		1										88 AMPS
8	3			2									84 AMPS
9	3				2								84 AMPS
10	3					2							80 AMPS
11	1	3											84 AMPS
12		3		1									72 AMPS
13							3	2					61 AMPS
14							3		2				60 AMPS
15							3			2			56 AMPS

FUSE RATINGS: L6 IS 30 AMPS, L5 IS 25 AMPS, L4 IS 20 AMPS, L3 IS 15 AMPS, L2 IS 10 AMPS, L1 IS 5 AMPS, F IS 20 AMPS, E IS 15 AMPS, D IS 10 AMPS, C IS 5 AMPS, B IS 3 AMPS AND A IS 1.5 AMPS.

INFORMATION NOTES: (CONT)

314. (CONT)

C. FOR ALL OTHER POSSIBLE COMBINATIONS, THE FUSING SCHEME FOR EACH 25A OR 25B FUSE BLOCK MUST SATISFY THE FOLLOWING ALGEBRAIC EQUATION:

$$\sum_{n=1}^{8} .0038_n I^2_{L6} + .0035_n I^2_{L5} + .0047_n I^2_{L4} + .0070_n I^2_{L3}$$

$$+.0125_n I^2_{L2} + .025_n I^2_{L1} + .0082_n I^2_F + .0097_n I^2_E$$

$$+.0161_n I^2_D + .035_n I^2_C + .055_n I^2_B + .12_n I^2_A < 7.65$$

WHERE n IS AN INDEXER FOR THE NUMBER OF THE SAME TYPE OF FUSES USED IN THE BLOCK, L6 THROUGH L1 AND F THROUGH A ARE USED TO IDENTIFY FUSE TYPE e.g.

$2I^2_{L5}$ IS THE LIST TWO CURRENT DRAIN THROUGH THE SECOND KS-19780,L5 FUSE IN THE FUSE BLOCK.

315. AFTER 10 OPERATIONS AT THE "K1" CONTACTOR, THE MAIN CONTACTS SHOULD BE CLEANED TO REMOVE ANY DEPOSITION CAUSED BY ARCING.

316. PRIOR TO ISSUE 6B, COLUMNS HEADED "STD", "MD", ETC., CONVEYED APPLICATION INFORMATION. AT ISSUE 6B, COLUMNS HEADED "AVAIL" AND "DA" NOW INDICATE THE AVAILABILITY OF THE PRODUCT.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE 8S | ISSUE 6B

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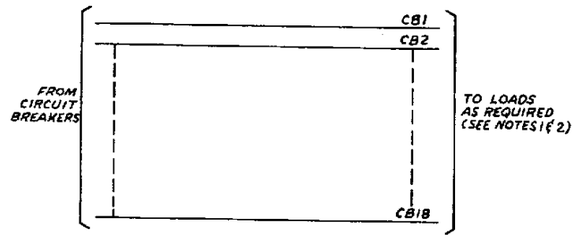
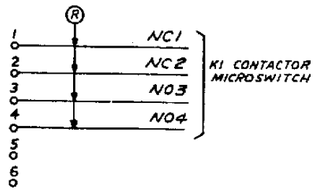
CAD 1

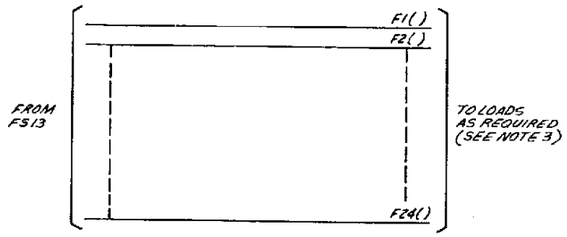
(SEE NOTES 103, 104, 106, 107, 112, 113, 114, 202)

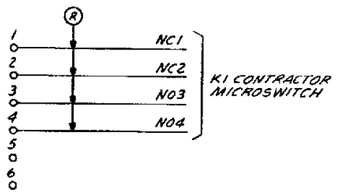




ⓚ CAD 2

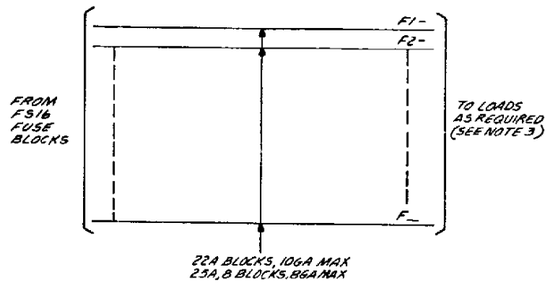
SEE NOTES 103, 104, 106, 107, 114, 116, 117, 118, 202)

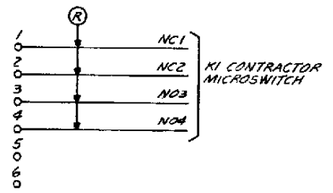


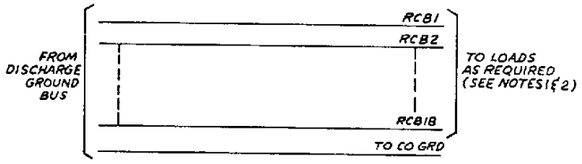


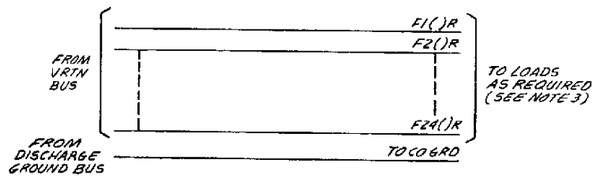
ⓕ CAD 3

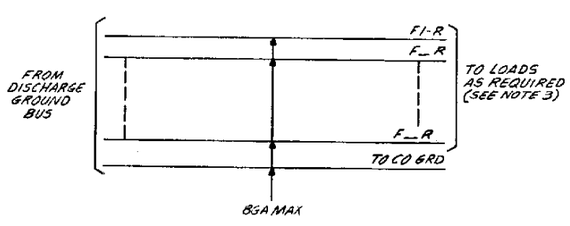
(SEE NOTES 103, 104, 106, 107, 114, 116, 119, 202, 204)











NOTES:

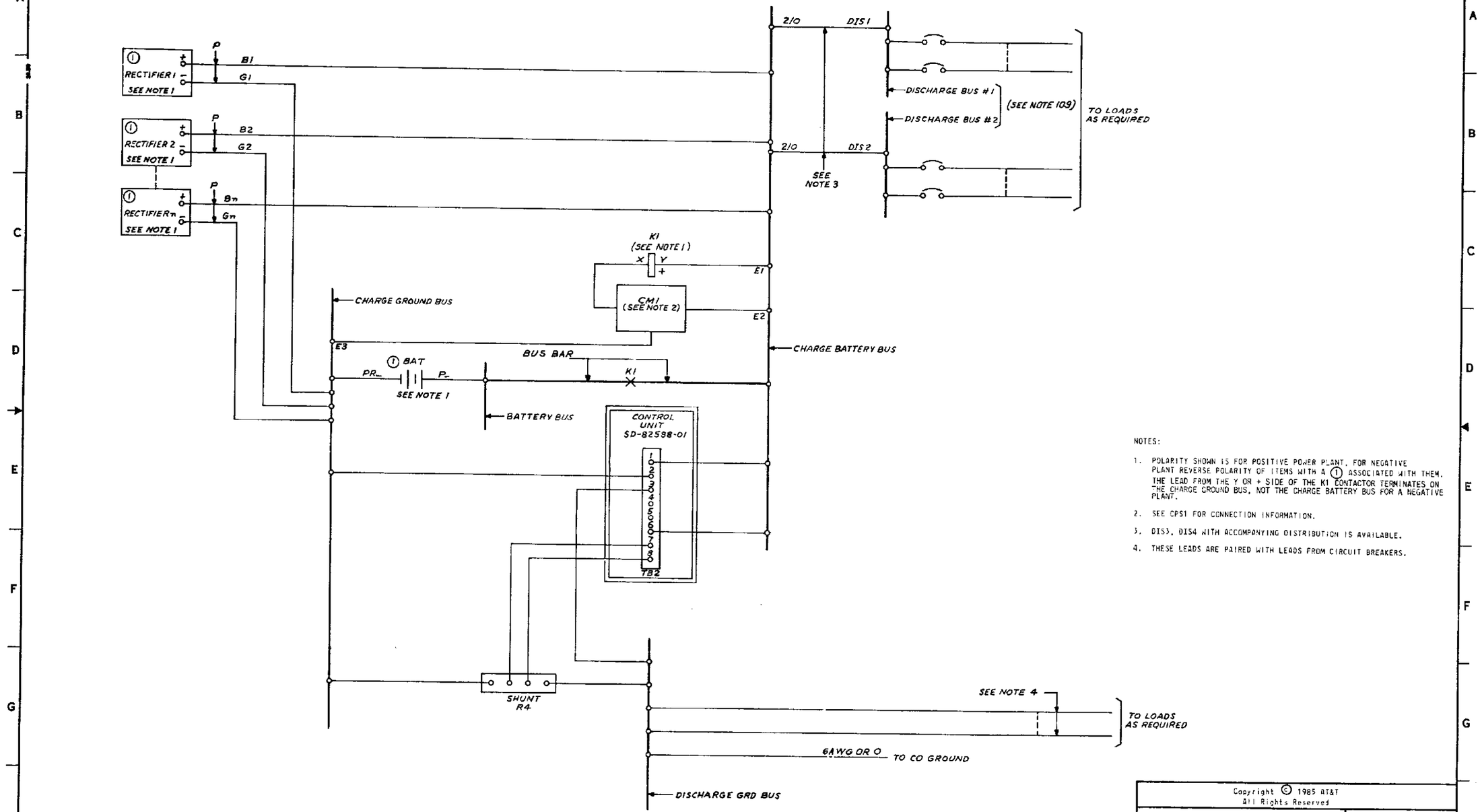
1. ALL CIRCUIT BREAKER RETURN LEADS SHALL BE PAIRED WITH THEIR APPROPRIATE CIRCUIT BREAKER LOAD LEADS AS LONG AS POSSIBLE.
2. CB1 - CB18 AND APPROPRIATE RETURN LEADS SHOW TYPICAL CONNECTIONS FOR A CIRCUIT BREAKER PANEL.
3. ALL FUSE RETURN LEADS SHALL BE PAIRED WITH THEIR APPROPRIATE FUSE LOAD LEADS AS LONG AS POSSIBLE.

"LINEAGE" ® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE	ISSUE
6S	3B

AT&T TECHNOLOGIES, INC. | SD-83104-01 | SHEET 61

®BD 1



NOTES:

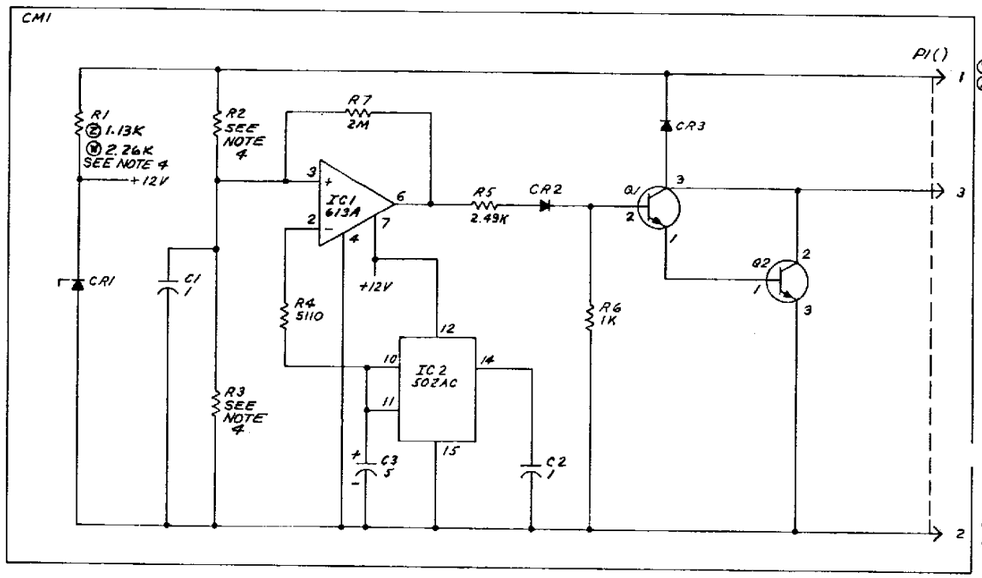
1. POLARITY SHOWN IS FOR POSITIVE POWER PLANT. FOR NEGATIVE PLANT REVERSE POLARITY OF ITEMS WITH A (1) ASSOCIATED WITH THEM. THE LEAD FROM THE Y OR + SIDE OF THE K1 CONTACTOR TERMINATES ON THE CHARGE GROUND BUS, NOT THE CHARGE BATTERY BUS FOR A NEGATIVE PLANT.
2. SEE CPS1 FOR CONNECTION INFORMATION.
3. DIS3, DIS4 WITH ACCOMPANYING DISTRIBUTION IS AVAILABLE.
4. THESE LEADS ARE PAIRED WITH LEADS FROM CIRCUIT BREAKERS.

"LINEAGE® 2000 CHARGE AND DISCHARGE CIRCUIT

DWG SIZE	ISSUE
BS	4A

AT&T TECHNOLOGIES, INC. | SD-83104-01 | SHEET H1

®CM1
LOW VOLTAGE DISCONNECT CKT



COIL(K1): TERMINAL X OR THE TERMINAL OPPOSITE THE + TERMINAL

MANUFACTURING REFERENCES

CATEGORY	NO.
CIRCUIT PACK CODE	ED-83104-30 G1 FOR Ⓩ 24V G2 FOR Ⓦ 48V
CONNECTOR ON FRAME	87159-4 AMP

COMPONENT LIST

CAPACITOR

DESIG	CODE
C1	KS-20736,L1,1
C2	KS-20736,L1,1
C3	601A,5

CONNECTOR

DESIG	CODE
P1( )	87632-3 AMP

DIODE

DESIG	CODE
CR1	808J (12V ZENER)
CR2	449A
CR3	813B

INTEGRATED CIRCUIT

DESIG	CODE
IC1	613A
IC2	502AC

RESISTOR

DESIG	CODE
R1	KS-20289,L6C, Ⓩ 1.13K, Ⓦ 2.26K, SEE NOTE 4
R2	KS-20616,L1A, SEE NOTE 4
R3	KS-20616,L1A, SEE NOTE 4
R4	KS-20616,L1A,5110
R5	KS-20616,L1A,2.49K
R6	KS-20616,L1A,1K
R7	KS-20810,L1A,2M

TRANSISTOR

DESIG	CODE
Q1	66AS
Q2	D44Q,GE

NOTES: (CONT)

4. ED-83104-30,GR1 OPTION Z IS FOR A LOW VOLTAGE DISCONNECT OF 21.3 ± 0.25 VOLTS. ED-83104-30,GR2 OPTION W IS FOR LOW VOLTAGE DISCONNECT OF 43.1 ± 0.5 VOLTS. IF OTHER VALUES OF LOW VOLTAGE DISCONNECT ARE DESIRED, ORDER THE ED-83104-30 GROUP BASED ON THE TABLE BELOW. THESE WIRING OPTIONS DELETE THE R2 AND/OR R3 RESISTORS FROM THE Z OR W OPTION AND ADD THE PROPER R2 AND/OR R3 RESISTOR. THE DIFFERENCE IN CARDS IS BASED ON RESISTOR R2 AND R3 BEING CHANGED. R1 REMAINS 1.13K OHMS FOR 24 VOLT PLANTS AND 2.26K OHMS FOR 48 VOLT PLANTS. THE CIRCUIT PACKS ARE TO BE TESTED AGAINST X-79596 BUT ARE TO UTILIZE THE WIRING OPTIONS TOLERANCES AND NOMINAL VALUES LISTED BELOW.

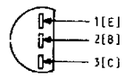
ED-83104-30 GROUP NUMBER	NOMINAL VOLTAGE	TOLERANCE (VOLTS)	R2 (K OHMS)	R3 (K OHMS)	RESISTOR TYPE	WIRING OPTION
GR1	21.32	± 0.25	18.7	7.32	KS-20616,L1A	Z
GR1	21.65	± 0.25	19.1	7.32	KS-20616,L1A	ZA
GR1	22.03	± 0.25	19.1	7.15	KS-20616,L1A	ZB
GR1	22.42	± 0.25	19.1	6.98	KS-20616,L1A	ZC
GR1	22.83	± 0.25	Ⓐ 19.1	6.81	KS-20616,L1A	ZD
GR1	23.29	± 0.25	Ⓑ 18.7	6.65	KS-20616,L1A	ZE
GR1	23.69	± 0.25	18.7	6.34	KS-20616,L1A	ZF

ED-83104-30 GROUP NUMBER	NOMINAL VOLTAGE	TOLERANCE (VOLTS)	R2 (K OHMS)	R3 (K OHMS)	RESISTOR TYPE	WIRING OPTION
GR2	43.11	± 0.5	36.5	5.90	KS-20616,L1A	W
GR2	40.56	± 0.25	34.8	6.04	KS-16312,L4F	ZG
GR2	41.39	± 0.25	34.8	5.90	KS-16312,L4F	ZH
GR2	42.25	± 0.25	34.8	5.76	KS-16312,L4F	ZI
GR2	43.11	± 0.25	36.5	5.90	KS-16312,L4F	ZJ
GR2	44.02	± 0.25	36.5	5.76	KS-16312,L4F	ZK
GR2	44.95	± 0.25	34.8	5.36	KS-16312,L4F	ZL

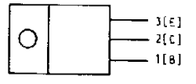
NOTES:

1. UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, VALUES PRECEDED BY THE SYMBOL +(PLUS) OR − (MINUS) ARE IN VOLTS.

2. THE TERMINAL NUMBER ARRANGEMENT OF 66 TYPE TRANSISTOR IS:



3. THE TERMINAL NUMBER ARRANGEMENT OF THE D44Q TRANSISTOR IS:



"LINEAGE" ® 2000 CHARGE AND DISCHARGE CKT

OWG SIZE 8S | ISSUE 6B

AT&T | SD-83104-01 | SHEET J1