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
SHEET INDEX SUPPORTING INFORMATION	A1	1	2	3	4	5	6	7	8	9	10	11									
OPTION INDEX	A2	1	1	3	3	3	6	7	7	7	10	10									
FS 1 TIE LINE CKT-RINGDOWN MANUAL SIGNALING 414A KTU	B1	1	2	3	4	5	6	7	7	7	7	7									
FS 2 TIE LINE CKT-AUTOMATIC DC SIGNALING 415A KTU	B2	1	2	3	3	5	5	5	5	5	5	5									
FS 3 STATION LINE CKT 416A KTU	B3	1	2	3	4	5	5	5	5	5	5	5									
FS 4 THE LINE CKT-AUTOMATIC RINGDOWN SIGNALING 419A KTU	B4			3	4	5	6	7	7	7	10	10									
FS 5 TIE LINE CKT-SHORT RANGE 418A KTU FS 101 SUGGESTED METHOD FOR STRAPPING WIRING OPTIONS ON TB1 OF 418A KTU	B5			3	3	5	6	6	6	6	6	6									
FS 6 THE LINE CKT-RINGDOWN MANUAL SIGNALING 461A KTU	B6								8	9	9	9									
FS 7 LAMP EXTENDER 469A KTU	B7									9	9	9									
APP FIG. 1 414A KTU	C1	1	1	3	4	5	6	7	7	7	7	7									
APP FIG. 2 415A KTU	C2	1	1	3	3	3	3	3	3	3	3	3									
APP FIG. 3 416A KTU	C3	1	1	3	4	5	5	5	5	5	5	5									
APP FIG. 4 419A KTU	C4			3	3	5	6	7	7	7	10	10									
APP FIG. 5 418A KTU	C5			3	3	3	6	6	6	6	6	6									
APP FIG. 6 461A KTU	C6								8	8	8	8									
APP FIG. 7 469A KTU	C7									9	9	9									
CIRCUIT NOTES	D1	1	1	3	3	5	6	7	7	7	10	10									
INFORMATION NOTES WORKING LIMITS	D2			3	3	5	5	5	5	5	5	5									
CIRCUIT REQUIREMENTS TABLE	F1	1	1	3	3	5	5	5	8	8	8	8									
	F2			3	3	5	5	5	5	5	5	5									

DWG ISS	CD ISSUE	DWG ISS	CD ISSUE	DWG ISS	CD ISSUE
1	1	2D	1 APP 1D	3D	2D
4D	2D APP 1D	5B	2D APP 2B	6B	2D APP 3B
7B	3B	8D	3B APP 1D		

DWG ISS	CD ISSUE	DATE ISSUED	DRWN	APP'D
9B	3B APP 2B	3-27-75	OL	RFMc OFG JS
10B	3B APPX 3B	11-10-77	CDI OL	PD OFG JS
11D	3B APPX 4D	5-8-79	OL	JWW JRM JS

SUPPORTING INFORMATION

CATEGORY	NO.

SHEET INDEX NOTES

1. WHEN CHANGES ARE MADE IN THIS DRAWING, ONLY THOSE SHEETS AFFECTED WILL BE REISSUED.
2. 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.
3. THE ISSUE NUMBER ASSIGNED TO A CHANGED OR NEW SHEET WILL BE THE SAME ISSUE NUMBER AS THAT OF THE SHEET INDEX.
4. SHEETS THAT ARE NOT CHANGED WILL RETAIN THEIR EXISTING ISSUE NUMBER.
5. THE LAST ISSUE NUMBER OF THE SHEET INDEX IS RECOGNIZED AS THE LATEST ISSUE NUMBER OF THE DRAWING AS A WHOLE.

ISSUE 11D

1K03

STATION SYSTEMS

KEY TELEPHONE SYSTEM NO. 1A2

TIE LINE AND STATION LINE CIRCUITS

AT&TCO STANDARD

SD-69559-01-A1

20 SHEETS

BELL TELEPHONE LABORATORIES INCORPORATED

DWG SIZE 3S

PRINTED IN U.S.A.

HNDBK Dwg

SD-69559-01-A1

OPTION INDEX

APP OR WRO	LOCATION
Z	1F3, 4D5, 5E2
Y	2D4
X	1E3, 4D5
W	1G3, 2G2, 3F3, 4F3, 5E2
V	1G3, 2G3, 3F4, 4F2, 5F2
T	1G3, 2G2, 3F4, 4F3, 5E2, 5F2
S	1G3, 2G2, 3F3, 4F3, 5E2
R	1G3, 4G3, 5E2
Q	1G3, 4F3, 5D2, 5E2
N	1G3, 4G3, 5F2
M	1A5, 2B1, 3D6, 4C7, 5D2
K	5E2
H	5D2
G	APP FIG. 1, 4, 5, 1A2, 1B2, 4A4, 4C4, 5A4, 5B4
F	APP FIG. 1, 4, 5, 1A2, 1B2, 4B4, 4C4, 5A4, 5B4
E	APP FIG. 1, 4, 1B4, 4B6
D	APP FIG. 4, 4C5

DRAWING ISSUE	SUM DWG	
1	DWG	NO
30	DWG	
68	DWG	OR
78	DWG	OR NO

21

SD-69559-01-A2

ISSUE 10B

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-A2

BELL TELEPHONE LABORATORIES INCORPORATED

DWG FILE 3S

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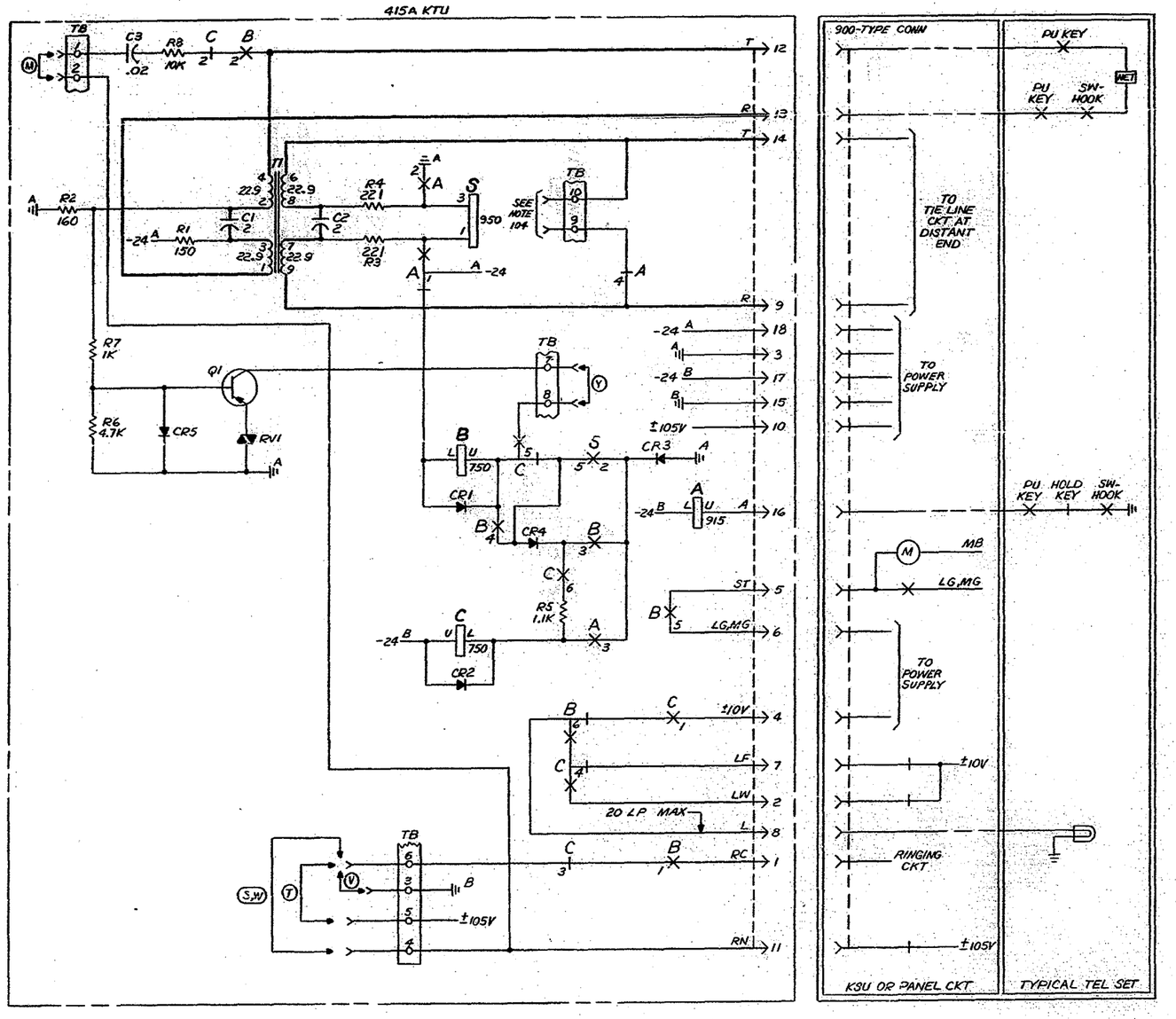
OSILVIE PRESS, INC. ACEPROOF 13X14-3

FS 2

TIE LINE CKT - AUTOMATIC DC SIGNALING



DRAWING ISSUE

1	SYM REC REV
2D	SYM REC REV
3D	SYM REC REV
5B	

5

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-B2

BELL TELEPHONE LABORATORIES INCORPORATED

SYM 6S

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SD-69559-01-B2

FS 3

STATION LINE CIRCUIT

416A KTU

900-TYPE CONN

PU KEY

PU KEY

SW-HOOK

HET

TO TELEPHONE SET AT DISTANT END

TO POWER SUPPLY

±10V

PU KEY

SIGNAL KEY

RINGING CKT

±105V

TO POWER SUPPLY

MB

LG,MG

KSU OR PANEL CIRCUIT

TYPICAL TELEPHONE SET

DRAWING ISSUE

1 TEN CIRC DLY

2D SIG DIAL DLY

3D ML DLD DLY

4D

5B

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-B3

BELL TELEPHONE LABORATORIES INCORPORATED

5

SD-69559-01-B3

FS 4

TIE LINE CKT - AUTOMATIC RINGDOWN SIGNALING

TYPICAL TEL SET | KSU OR PANEL CKT | 419A KTU

PU KEY — 900-TYPE CONN — MET — SWHOOK PU KEY — TO POWER SUPPLY — SWHOOK HOLD PU KEY — MB — LG — TO POWER SUPPLY — ±10 — TO POWER SUPPLY — ±105 — TO RINGING CKTS — TO RINGING SUPPLY

12A T — 13A R — 18A A -24 — 3A A — 17A B -24 — 15A B — 16A A L U B -24 — 5A ST — 6A LG,MG — 8A L — 2A LW — 7A LF — 4A ±10 — 11A RN — 1A RC — 10A ±105 — 0A RG

R1 130 — R2 120 — T1 — C1 .2 / 1.91 — C2 .2 / 1.91 — C3 .7 — R3 910 — R4 510 — CR1 — C4 .1 — P U D 8850 — RO — RG — T 14A — R 9A — ±105 — C5 .02 — TB 10 20 — C8 .1 — D — R22 1K

R5 68K — R12 5.1K — CR5 — R6 5.1K — TB — R8 820K — R13 82K — R14 5.1K — R9 270K — Q2 — CR4 — Q3 — R18 100 — CR7 — C6 .75 — R11 30K — Q1 — R15 6.8K — R16 1.8K — R10 560 — R7 20K — R17 3K — C7 .47 — CR2 — R19 20K — CR8 — CR9 — R20 1K — CR3 — R21 4.7K — Q4 — RV2 — CR10 — B U L 750 — CR6 — C U L 915 — H U L 750

KSU OR PANEL CKT 900-TYPE CONN — TO TIE LINE CKT AT DISTANT END

DRAWING ISSUE: 3D, 4D, 5B, 6B, 7B

ISSUE 10B

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-B4

BELL TELEPHONE LABORATORIES INCORPORATED — SHEET 6S

SD-69559-01-B4

FS 5

TIE LINE CKT- SHORT RANGE
SEE FS 101

DRAWING ISSUE
30 SUP OLD DEV
5B
6B
DR A

TYPICAL TEL SET STATION A
PU KEY
NET
SW HOOK
PU KEY
L
KSU OR PANEL CKT
900-TYPE CONNECTOR
TO RINGING CKTS

418A KTU

C3 F 1.91 6 2
C2 F 1.91 6 2
A 1L 1U 2U 2L P-200 S-200 -24 A
B 1U 1L 2U 2L P-200 S-200 -24 A
T1 12
R1 13
LP1 8
T2 14
R2 9
LP2 19
±10I 4
LF 7
RC1 1
RC2 0
AA 1
BB 3
AA 2
BB 4
C 5
A 3
BB 1
S 4
S 3
AA 4
B 3
TB1
9
10
7
8
5
6
3
4
1
2
Q,M,H
Q
H
R,S,W,K
S,W
T,Z
N,V
T
V
C1 .05
S 1
A 2
B 1
S 2
C 3
C 4
C 1
AA 3
C 6
BB 2
C L U 750 B -24
A 3
-24 A 18
B 15
-24 B 17
±10S 10
C 2 ST 5
A 4
B 2
LG,MG 6
RN 11
-24 B S L U 9S S1 16
A 1 AA L U 9I5
B 4 BB L U 9I5 B -24

KSU OR PANEL CKT
900-TYPE CONNECTOR
TO POWER SUPPLY
INT
±10V
RINGING CKTS
TO POWER SUPPLY
TO RING SUPPLY
LG,MG
M MB
TO POWER SUPPLY
INT
±10S
Z,Y,R,N,K
Y

TYPICAL TEL SET STATION B
PU KEY
NET
PU KEY SW HOOK
L
PU KEY SIG KEY SW HOOK
A,S

TYPICAL TEL SET STATION A
PU KEY SIG KEY SW HOOK
A,S

FS 101

SUGGESTED METHOD FOR STRAPPING WIRING OPTIONS ON TBI OF 418A KTU

M 9 10
Q 9 10 7 8 5 6
H 9 10 7 8 5 6
R,K 3 4
S,W 3 4 1 2
N 5 6 3 4
V 5 6 3 4 3 4 1 2
T 3 4 1 2
Z 3 4 1 2

* DENOTES ONE CONTINUOUS STRAP WIRE

SD-69559-01-B5

6

TIE LINE AND STATION LINE CIRCUIT

BELL TELEPHONE LABORATORIES INCORPORATED 6S

SD-69559-01-B5

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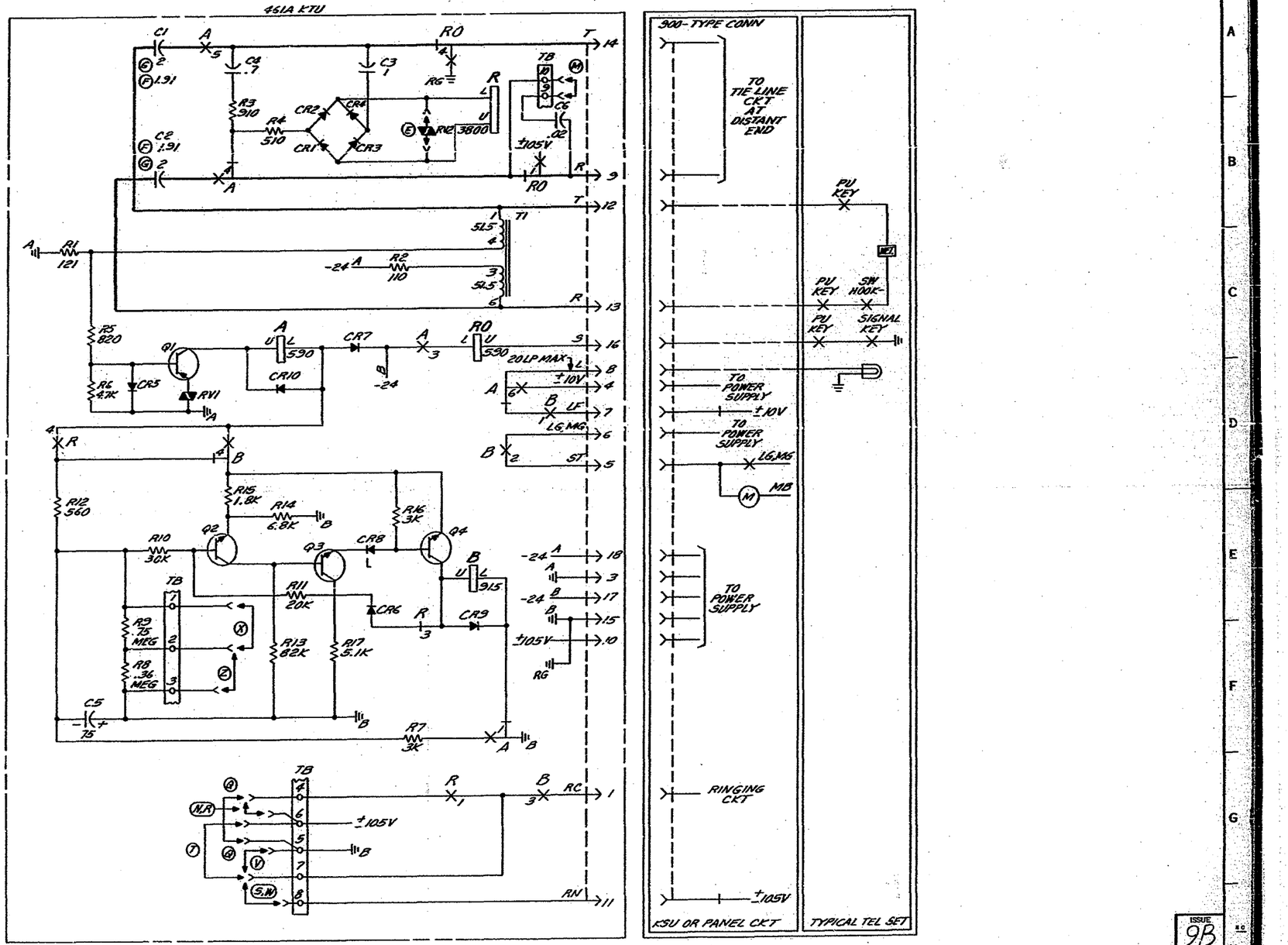
5

FS 6

TIE LINE CKT - RINGDOWN MANUAL SIGNALING



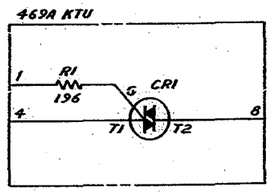
SD-69559-01-B6

ISSUE 9B

TIE LINE AND STATION LINE CIRCUITS	SD-69559-01-B6
BELL TELEPHONE LABORATORIES INCORPORATED	6S

FS 7

LAMP EXTENDER



SD-69559-01-87

ISSUE 9B	
TIE LINE AND STATION LINE CIRCUITS	SD-69559-01-87
BELL TELEPHONE LABORATORIES INCORPORATED	ENG SIZE 6S

PRINTED IN U.S.A.

APP FIG. 1

414A KTU

RELAY

DESIG	A		B		R		RO	
CODE	MB1		MA19		MA29		MA5	
OPTION								
X	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6	EBM	1D5						
5	EBM	1A3						
4	EBM	1B5	EMB	1D3	M	1D2	EBM	1A4
3	EBM	1C4	M	1G5	B	1E4	EBM	
2	EBM	1D5	M	1D5	B		EBM	
1	EBM	1F5	EBM	1D5	M	1G4	EBM	1B5
COIL	X	1C3	X	1E5	X	1A5	X	1C5

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	1A5
9	1A5
8	1G3
7	1G3
6	1G3
5	1G3
4	1G3
3	1F3
2	1F3
1	1E3

CAPACITOR

DESIG	LOC	CODE
C1	1A2	(F) 535GD,1.91
C2	1B2	535GD,1.91 (G) 542F,2
C3	1A4	542F,2
C4	1A3	542N,1
C5	1F2	535JF,.7
C6	1B5	KS-16390 L12,75
		542AA,.02

TRANSISTOR

DESIG	LOC	CODE
Q1	1C2	12H
Q2	1E3	16G
Q3	1E4	16G
Q4	1E4	16G

DIODE

DESIG	LOC	CODE
CR1	1B3	456B
CR2	1A3	
CR3	1B4	
CR4	1A4	
CR5	1D2	458A
CR6	1E4	
CR7	1C4	
CR8	1E4	459E
CR9	1E5	400J
CR10	1D3	

VARISTOR

DESIG	LOC	CODE
RV1	1D3	100G
(E) RV2	1B4	317A

INDUCTOR

DESIG	LOC	CODE
T1	1B5	1682A

RESISTOR

DESIG	LOC	CODE
R1	1C2	KS-14603 L1A,121
R2	1C4	KS-14603 L1A,110
R3	1B3	KS-13490 L1,910
R4	1B3	KS-13490 L2,510
R5	1C2	KS-13490 L1,820
R6	1D2	KS-13490 L1,4.7K
R7	1F4	KS-13490 L2,3K
R8	1E2	KS-13490 L1,.36 MEG
R9	1C2	KS-13490 L2,.75 MEG
R10	1E2	KS-13490 L1,30K
R11	1E3	KS-13490 L2,20K
R12	1E2	KS-13490 L1,560
R13	1F3	KS-13490 L1,82K
R14	1E3	KS-13490 L1,6.8K
R15	1D3	KS-13490 L1,1.8K
R16	1E4	KS-13490 L1,3K
R17	1F4	KS-13490 L1,5.1K

DRAWING ISSUE

1	SUM DHC DLV
3D	ML DLD DLV
4D	
5B	
6B	
7B	

7

TIE LINE AND STATION LINE CIRCUITS (2) SD-69559-01-CI

BELL TELEPHONE LABORATORIES INCORPORATED 3S PRINTED IN U.S.A.

SD-69559-01-CI

OGILVIE PRESS, INC. AGEPROOF 13SW-2 13107

APP FIG. 2

415A KTU

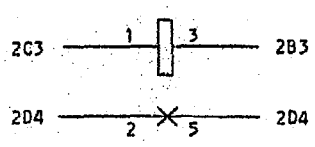
RELAY

DESIG	A		B		C	
CODE	MA19		MB16		MB17	
OPTION						
X	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6			EBM	2F4	EMB	2E4
5			M	2E4	EBM	2D4
4	EMB	2C4	M	2E3	EBM	2F4
3	M	2E4	M	2E4	EBM	2G4
2	M	2B3	M	2A2	EBM	2A2
1	EBM	2C3	EBM	2G4	EMB	2F4
COIL	X	2D5	X	2D3	X	2E3

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	2B4
9	2C4
8	2D3
7	2C3
6	2G3
5	2G3
4	2G3
3	2G3
2	2B1
1	2A1

RELAY
S
327B



TRANSFORMER

DESIG	LOC	CODE
T1	2B2	2578U

TRANSISTOR

DESIG	LOC	CODE
Q1	2D2	12H

VARISTOR

DESIG	LOC	CODE
RV1	2D2	1006

CAPACITOR

DESIG	LOC	CODE
C1	2C2	542F, 2
C2	2C2	
C3	2A1	542AA, .02

DIODE

DESIG	LOC	CODE
CR1	2D3	400J
CR2	2F3	
CR3	2D4	458A
CR4	2E4	
CR5	2D2	

RESISTOR

DESIG	LOC	CODE
R1	2C2	KS-14603 L1C, 150
R2	2B1	KS-14603 L1C, 160
R3	2C3	KS-14603 L3C, 221
R4	2B3	KS-14603 L3C, 221
R5	2E4	KS-13490 L1, 1.1K
R6	2D1	KS-13490 L1, 4.7K
R7	2C1	KS-13490 L1, 1K
R8	2A2	KS-13490 L3, 10K

DRAWING ISSUE

1	SUM DNC DLD	NO
3D	HDW DLD DLV	NO

3

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-C2

BELL TELEPHONE LABORATORIES INCORPORATED

SIZE 3S

PRINTED IN U.S.A.

SD-69559-01-C2

DOLIVIE PRESS, INC. AGEPROOF 130MC3

APP FIG.3

416A KTU

RELAY

DESIG	A		B		RO	
CODE	MB5		MB1		MA5	
OPTION						
	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6	EMB	3E6	EBM	3E6		
5	EBM	3E3	EBM	3G6		
4	EBM	3E1	EBM	3E2	EBM	3F2
3	EBM	3G6	EBM	3D5	EBM	3D5
2	EBM	3E5	EBM	3F6	EBM	3C5
1	EMB	3F5	EBM	3B4	EBM	3B4
COIL		3D3		3C5		3E2

CAPACITOR

DESIG	LOC	CODE
C1	3C1	542F,2
C2	3C2	
C3	3C5	594G,.0196

DIODE

DESIG	LOC	CODE
CR1	3F2	400J
CR2	3D3	
CR3	3C5	
CR4	3D5	
CR5	3D4	458A
CR6	3C4	
CR7	3D3	
CR8	3D2	
CR9	3E3	
CR10	3E3	
CR11	3C3	

RESISTOR

DESIG	LOC	CODE
R1	3C1	KS-14603 L1C,150
R2	3C0	KS-14603 L1C,160
R3	3C3	KS-13490 L1,620
R4	3C3	KS-14603 L3C,235
R5	3C3	KS-14603 L3C,235
R6	3D3	KS-13490 L1,390
R7	3C4	KS-13490 L1,3K
R8	3D1	KS-13490 L1,1K
R9	3D1	KS-13490 L1,4.7K
R10	3D4	KS-13490 L1,1.2K
R11	3E4	KS-13490 L1,3.3K
R12	3B5	KS-13490 L3,100
R13	3D6	KS-13490 L3,1500
R14	3E1	KS-13490 L1,75
R15	3D3	KS-13490 L1,390

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	3C5
9	3C5
8	3F4
7	3F4
6	3F4
5	3F4
4	
3	
2	
1	

TRANSFORMER

DESIG	LOC	CODE
T1	3C2	2578U

TRANSISTOR

DESIG	LOC	CODE
Q1	3D2	12H
Q2	3C4	12H
Q3	3C4	16G

VARISTOR

DESIG	LOC	CODE
RV1	3D2	100G
RV2	3C4	100G
RV3	3C3	317D

DRAWING ISSUE

1	SUM DWC DLV
3D	ML DLD DLV
4D	
5B	

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-C3

BELL TELEPHONE LABORATORIES INCORPORATED

DWG SIZE 3S

PRINTED IN U.S.A.

SD-69559-01-C3

5

DOELVIE PRESS, INC. AGEPROOF 138W-3 13707

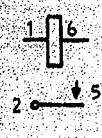
APP FIG. 4

419A KTU

RELAY

DESIG	A		B		C				H				R		RO	
CODE	MA4		MB17		MA4				MB17				MA29		MB17	
OPTION																
X	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6			EMB	4F2					EMB	4F5					EMB	4D8
5			EBM	4E3					EBM	4E8					EBM	4C7
4	EMB	4F5	EBM		EMB	4E4			EBM	4F8			M	4F4	EBM	4D3
3	EBM	4C4	EBM	4D3	EBM	4E2			EBM	4D8			B		EBM	4C5
2	EBM	4D7	EBM	4F7	EBM	4F5			EBM	4D2			B		EBM	4A7
1	EBM	4A4	EMB	4G8	EBM	4D7			EMB	4E3			M	4F2	EMB	4E8
COIL	X	4C2	X	4D6	X	4F7	X		X	4F5	X		X	4B6	X	4D7

(D) RELAY
D
348A



4C6

4B6

CAPACITOR

DESIG	LOC	CODE
C1	4A4	(F) 535GD, 1.91 (G) 542F, .2
C2	4B4	(F) 535GD, 1.91 (G) 542F, .2
C3	4B5	535JF, .7
C4	4B6	542N, 1
C5	4C7	542AA, .02
C6	4E4	KS-16390 L12, 75
C7	4E7	594Q, .147
(D) C8	4C5	KS-20736 L1, 1

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	4D5
9	4D5
8	4F2
7	4D5
6	4F2
5	4G2
4	4F2
3	4F2
2	4C7
1	4C7

DIODE

DESIG	LOC	CODE
CR1	4B5	460A
CR2	4F4	458A
CR3	4G4	458A
CR4	4E6	459E
CR5	4C6	458A
CR6	4D6	441J
CR7	4E7	441J
CR8	4F6	458A
CR9	4G5	441J
CR10	4F7	441J

VARISTOR

DESIG	LOC	CODE
(E) RV1	4B6	317A
RV2	4G5	100Q

INDUCTOR

DESIG	LOC	CODE
T1	4B3	1682A

RESISTOR

DESIG	LOC	CODE
R1	4B3	KS-14603 L1A, 130
R2	4B3	KS-14603 L1A, 120
R3	4B5	KS-13490 L1, 910
R4	4B5	L2, 510
R5	4C4	L1, 68K
R6	4D4	L1, 5.1K
R7	4E3	L1, 20K
R8	4D4	L1, 820K
R9	4D4	L1, 270K
R10	4E4	L1, 560
R11	4E4	L1, 30K
R12	4C5	L1, 5.1K
R13	4D5	L1, 82K
R14	4D6	L1, 5.1K
R15	4E5	L1, 6.8K
R16	4E5	L1, 1.8K
R17	4E6	L1, 3K
R18	4E7	L1, 100
R19	4F6	L2, 20K
R20	4G3	L1, 1K
R21	4G4	KS-13490 L1, 4.7K
(D) R22	4C6	KS-13490 L1, 1K

TRANSISTOR

DESIG	LOC	CODE
Q1	4E5	16G
Q2	4E5	16G
Q3	4E6	16G
Q4	4G5	12H

DRAWING ISSUE
3D
5B
6B
7B

ISSUE 10B

TIE LINE AND STATION LINE CIRCUITS (2)

SD-69559-01-C4

BELL TELEPHONE LABORATORIES INCORPORATED

SIZE 3S

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SD-69559-01-C4

APP FIG. 5

110A KTU

RELAY

DESIG	A		AA		B		BB				C				S				DESIG
CODE	MA24		MA1		MA24		MA1				MB17				MA1				CODE
OPTION																			OPTION
X	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	X
6											EMB	5F4							6
5											EBM	5C4							5
4	M	5E6	EBM	5C6	M	5F6	EBM	5B5			EBM	5E6			EBM	5C4			4
3	B	5C2	EBM	5F4	B	5C6	EBM	5B4			EBM	5D5			EBM	5C5			3
2	M	5D4	EBM	5B4	M	5E6	EBM	5F4			EBM	5D7			EBM	5E3			2
1	M	5F6	EBM	5B4	M	5D4	EBM	5C3			EMB	5F3			EBM	5D3			1
COIL	X	5B3	X	5F6	X	5B5	X	5F6	X		X	5F5	X		X	5E8	X		COIL

CAPACITOR

DESIG	LOC	CODE
C1	5D4	5424W, .05
C2	5D5	(F) 539GD, 1.91 (G) 542F, 2
C3	5A4	539GD, 1.91 542F, 2

TERMINAL BOARD

DESIG	TB1
CODE	77A
OPTION	
10	5D3
9	5C3
8	5D3
7	5D3
6	5F3
5	5E3
4	5E3
3	5E3
2	5F3
1	5F3

DRAWING ISSUE
3D ML DLD DLV
6B DR

SD-69559-01-C5

6

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-C5

BELL TELEPHONE LABORATORIES INCORPORATED

SIZE 3S

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APP FIG. 6

461A KTU

RELAY

DESIG	A		B		R		PO	
CODE	MB1		MA19		MA29		MA5	
OPTION								
X	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6	EBM	1D5						
5	EBM	1A3						
4	EBM	1B3	EMB	1D3	M	1D2	EBM	1A4
3	EBM	1C4	M	1G5	B	1E4	EBM	
2	EBM		M	1D5	B		EBM	
1	EBM	1F5	EBM	1D5	M	1G4	EBM	1B5
COIL	X	1C3	X	1E5	X	1A5	X	1C5

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	1A5
9	1A5
8	1G3
7	1G3
6	1G3
5	1G3
4	1G3
3	1F3
2	1F3
1	1E3

CAPACITOR

DESIG	LOC	CODE
C1	1A2	(F) 535GD, 1.91 (G) 542F, 2
C2	1B2	(F) 535GD, 1.91 (G) 542F, 2
C3	1A4	542N, 1
C4	1A3	535JF, .7
C5	1F2	KS-16390 L12, 75
C6	1B5	542AA, .02

DIODE

DESIG	LOC	CODE
CR1	1B3	456B
CR2	1A3	
CR3	1B4	
CR4	1A4	
CR5	1D2	458A
CR6	1E4	
CR7	1C4	
CR8	1E4	459E
CR9	1E5	400J
CR10	1D3	

INDUCTOR

DESIG	LOC	CODE
T1	1B5	1682A

RESISTOR

DESIG	LOC	CODE
R1	1C2	KS-14603 L1A, 121
R2	1C4	KS-14603 L1A, 110
R3	1B3	KS-13490 L1, 910
R4	1B3	KS-13490 L2, 510
R5	1C2	KS-13490 L1, 820
R6	1D2	KS-13490 L1, 4.7K
R7	1F4	KS-13490 L2, 3K
R8	1F2	KS-13490 L1, .36 MEG
R9	1E2	KS-13490 L2, .75 MEG
R10	1E2	KS-13490 L1, 30K
R11	1E3	KS-13490 L2, 20K
R12	1E2	KS-13490 L1, 560
R13	1F3	KS-13490 L1, 82K
R14	1E3	KS-13490 L1, 6.8K
R15	1D3	KS-13490 L1, 1.8K
R16	1E4	KS-13490 L1, 3K
R17	1F4	KS-13490 L1, 5.1K

TRANSISTOR

DESIG	LOC	CODE
Q1	1C2	12H
Q2	1E3	16G
Q3	1E4	16G
Q4	1E4	16G

VARISTOR

DESIG	LOC	CODE
RV1	1D3	100G
(F) RV2	1B4	317A

DRAWING ISSUE

ISSUE 8D

TIE LINE AND STATION LINE CIRCUITS (1)

SD-69559-01-C6

BELL TELEPHONE LABORATORIES INCORPORATED

DWG SIZE 3S

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APP FIG. 7

469A KTU

RESISTOR

DESIG	LOC	CODE
R1	7B0	KS-14603 L3A;196

THYRISTOR

DESIG	LOC	CODE
CR1	7B1	40575 RCA, 15AMP

DRAWING ISSUE

9B

TIE LINE AND STATION LINE CIRCUITS

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CIRCUIT NOTES:

101.

DESIG	FUSE AMP	POTENTIAL	ONE PER
A		-24 TALK	*
B		-24 SIG	*

BATTERY SYMBOL	VOLTAGE RANGE
-24	20-26

* FUSE PROVIDED ON ASSOCIATED KSU OR PANEL CKT.

103.

RECORD OF APP FIGURES, WIRING, AND APPARATUS CHANGES							
CHANGED ON ISS	IF JOB RECORDS DO NOT SPECIFY	THIS OPTION WAS FURN	SEE NOTE	USE IN CIRCUIT			
				STD	A&M	MD	
6B	F OR G	G		F		G	
7B	E	E				E	
10B	D	NONE		D			

102.

FEATURE OR OPTION			APP FIG.	PROVIDE APP OR WRG	PROVIDE QUANTITY
TIME-OUT CONTROL	LONG-TIME DELAY		1,4	X	1 PER LINE
	INTER-TIME DELAY			Z	
	SHORT-TIME DELAY			X	
VISUAL HOLD			2	Y	
AUDIBLE SIGNAL	INTERRUPTED RING		2,3	W	1 PER LINE
	STEADY RING			T	
	CONN WITH REL CONT			V	
	CONN WITH DIODE MATRIX CONT			S	
	UNDER CONTROL OF TIME-OUT	INTERRUPTED RING	1,4	W	1 PER LINE
		STEADY RING		T	
		CONN WITH REL CONT		V	
		CONN WITH DIODE MATRIX CONT		S	
	UNDER CONTROL OF (R) RELAY	STEADY RING		R	
		CONN WITH REL CONT		Q	
		CONN WITH DIODE MATRIX CONT		N	
AUDIBLE RINGBACK SEE NOTE 105			1,2,3,4	M	
SIGNALING	TWO-WAY AUTOMATIC	INTERRUPTED RING	5	W	1 PER LINE
		STEADY RING		T	
		COM. AUD WITH RELAY CONTROL		V	
		COM. AUD WITH DIODE MATRIX CONT		S	
	ONE-WAY AUTOMATIC ONE-WAY MANUAL SEE NOTE 108, 110	INTERRUPTED RING		R	1 PER LINE
		STEADY RING		Z	
		COM. AUD WITH RELAY CONTROL		N	
		COM. AUD WITH DIODE MATRIX CONT		K	
	TWO-WAY MANUAL SEE NOTE 108			Y	1 PER LINE
AUDIBLE RINGBACK SEE NOTE 105	TWO-WAY AUTOMATIC			Q	1 PER LINE
	ONE-WAY AUTO, ONE-WAY MAN			H	
	TWO-WAY MANUAL			M	

* LONG-TIME DELAY IS FUNCTION OF CIRCUIT WITH OPTION X AND Z REMOVED.

104. CONNECT 910-OHM RESISTOR AND 2-MICROFARAD CAPACITOR IN SERIES BETWEEN TERMINALS 9 AND 10 FOR AN IDLE LINE TERMINATION.
RES. KS-13490, L1, 910
CAP. 542F, 2 UF

105. THE AUDIBLE RINGBACK SIGNAL IS SATISFACTORY ONLY IF THE RINGING SUPPLY CONTAINS AN AUDIBLE COMPONENT.

106. WHEN MORE THAN ONE POWER SUPPLY IS USED TO SUPPLY TALK BATTERY AND SIGNAL BATTERY, THE GROUND TERMINALS OF THE TWO SUPPLIES ARE TO BE BONDED TOGETHER.

107. THE CIRCUIT LOOP BETWEEN THE STATION AND THE KTU SHALL NOT EXCEED 50 OHMS.

108. FOR MANUAL SIGNALING, THE AUDIBLE SIGNAL AT THE DISTANT STATION IS UNDER THE CONTROL OF THE (S) RELAY AND MAY BE CONNECTED WITH OR WITHOUT COMMON AUDIBLE. COMMON AUDIBLE MUST BE FURNISHED BY MEANS OF A DIODE MATRIX.

109. WHERE LAMPS ARE OPERATED FROM THE 418A KTU WITHOUT AUXILIARY EQUIPMENT, THE NORMAL 50 OHM LOOP RANGE APPLIES.

110. STATION "A" IS ALWAYS ASSIGNED AS THE AUTOMATIC SIGNALING STATION WHENEVER THE ONE-WAY AUTOMATIC, ONE-WAY MANUAL SIGNALING OPTION IS USED.

DRAWING ISSUE
3D ML DLH DLY HQ
5B DM
6B DR
7B DRR
10B

ISSUE 10B HQ

TIE LINE AND STATION LINE CIRCUITS (2)
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BELL TELEPHONE LABORATORIES INCORPORATED
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DRAWING ISSUE	
3D	ML DLD DLV
5B	

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. THESE RINGING RANGES ARE ALSO VALID WITH UNIGAUGE PLANT WHICH MAY UTILIZE AN E6 REPEATER IN EACH SUBSCRIBER LOOP.

21

WORKING LIMITS:

MAXIMUM RINGING RANGES IN OHMS FOR 414A AND 419A

FREQUENCY	MINIMUM GENERATOR RINGING VOLTAGE (RMS)	MINIMUM LEAKAGE RESISTANCE = 20K
		RINGING RANGE (OHMS) SEE NOTE 302
20-CYCLE	75	4000
	84	4600
	92	5000
30-CYCLE	110	5000
	120	5400

MAXIMUM DC SIGNALING RANGE IN OHMS FOR 415A AND 416A WITH A BATTERY VOLTAGE OF -20 VOLTS.

KTU	MINIMUM LEAKAGE RESISTANCE	
	10K	15K
	SIGNALING RANGE (OHMS)	
415A	2200	2325
416A	700	750

MAXIMUM DC SIGNALING RANGE FOR 418A WITH A BATTERY VOLTAGE OF -20 VOLTS IS 100 OHMS. (SEE NOTE 109)

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TIE LINE AND STATION LINE CIRCUITS	SD-69559-01-D2
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E-74564-5 (8-68)

SD-69559-01

CIRCUIT REQUIREMENTS

TIE LINE AND STATION LINE CIRCUITS

DRAWING ISSUE: 1 SUM DHC DLY; 3D WBC DLL DLV; 5B

APPARATUS DESIG	APPARATUS CODE	OPT	FIG.	MECH REQT BSP FIG.	MECH REQT CONT PRESS.	MECH REQT ARM. TRVL	CIRCUIT PREPARATION BLOCK OR INSULATE	TEST CLIP DATA CONN BAT.	TEST CLIP DATA CONN GRD	TEST SET PREP	SEE TEST NOTE	DIRECT CURRENT FLOW REQT TEST WDG	TEST FOR	AFTER SOAK MA.	TEST MA.	READJ MA.	REMARKS
RELAYS																	
414A KTU																	
A	MB1		1	200				U	L	B/G	2,3		O		25.5		
B	MA19		1	105				U	L	B/G	2,3		O		17.		
								U	L	B/G	2,3		R		1.1		
R	MA29		1	6				U	L	B/G	2,3		O		4		
RO	MA5		1	100				U	L	B/G	2,3		O		21.		
415A KTU																	
A	MA19		2	105					U	GRD	1,2		O		17.		
								U	U	GRD	1,2		R		1.1		
B	MB16		2	201				U	L	B/G	2,3		O		20.		
								U	L	B/G	2,3		R		1.2		
C	MB17		2	203				U	L	B/G	2,3		O		21.		
								U	L	B/G	2,3		H		7.5		
S	3278		2					1	3	B/G	2,3		O		3.8		
								1	3	B/G	2,3		R		0.4		
416A KTU																	
A	MB5		3					U	L	B/G	2,3		O		25.5		
B	MB1		3					U	L	B/G	2,3		O		25.5		
RO	MA5		3					U	L	B/G	2,3		O		21.		
418A KTU																	
A	MA24		5	5				2L	1U	GM	2,5	P1/P2	O		21		
AA	MA1		5	100				U	L	B/G	2,3		O		17		
								U	L	B/G	2,3		H		7.3		
													NO		11.3		
B	MA24		5	5				2L	1U	GM	2,5	P1/P2	O		21		
								L		B/G	2,3		R		1.2		
BB	MA1		5	100				U	L	B/G	2,3		O		17		
													H		7.3		
C	MB17		5	203				U	L	B/G	2,3		O		21		
								U	L	B/G	2,3		H		7.5		
													NO		11.8		
RO	MA5		5	100					L	B/G	2,3		O		17.		
S	MA1		5	100					L	GRD	2,4		O		17.		
													NO		11.3		
461A KTU																	
A	MB1		6	200				U	L	B/G	2,3		O		25.5		
B	MA19		6	105				U	L	B/G	2,3		O		17		
								U	L	B/G	2,3		R		1.1		
R	MA29		6	6				U	L	B/G	2,3		O		4		
RO	MA5		6	100				U	L	B/G	2,3		O		2		

TEST NOTES:

1. OPEN A LEAD TO TELEPHONE SETS.
2. RELAY NOT ADJUSTABLE, REPLACE WHERE THERE IS A MALFUNCTION.
3. THE CURRENT FLOW INFORMATION LISTED APPLIES ONLY WHEN THE RELAY TO BE TESTED IS REMOVED FROM THE PRINTED WIRING BOARD.
4. OPEN S LEAD TO TELEPHONE SETS.
5. OPEN TIP AND RING LEADS TO TELEPHONE SET.

PAGE 1

ISSUE 8D

TIE LINE AND STATION LINE CIRCUITS

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SD-69559-01 — 14 3/4

CIRCUIT REQUIREMENTS

TIE LINE AND STATION LINE CIRCUITS

DRAWING ISSUE: 30 ML DLD DLV — 5B

APPARATUS DESIG	CODE	OPT	FIG.	MECH REQT BSP FIG.	MECH REQT CONT PRESS.	MECH REQT ARM. TRVL	CIRCUIT PREPARATION BLOCK OR INSULATE	TEST CLIP DATA CONN BAT.	TEST CLIP DATA CONN GRD	TEST SET PREP	SEE TEST NOTE	DIRECT CURRENT FLOW REQT TEST WDG	TEST FOR	AFTER SOAK MA.	TEST MA.	READJ MA.	REMARKS
RELAYS																	
419A	KTU																
A	MA4		4	101					L	GRD	1,2		O		17		
									L	GRD	1,2		R		11.9		
B	MB17		4	203				U	L	B/G	2,3		O		21		
								U	L	B/G	2,3		H		7.5		
													NO		11.8		
C	MA4		4	101				U	L	B/G	2,3		O		17		
								U	L	B/G	2,3		R		1.9		
H	MB17		4	203				U	L	B/G	2,3		O		21		
													H		7.5		
													NO		11.8		
R	MA29		4	6				U	L	B/G	2,3		O		4		
RO	MB17		4	203				U	L	B/G	2,3		O		21		
								U	L	B/G	2,3		H		7.5		
													NO		11.8		

TEST NOTES:

1. OPEN A LEAD TO TELEPHONE SETS.
2. RELAY NOT ADJUSTABLE, REPLACE WHERE THERE IS A MALFUNCTION.
3. THE CURRENT FLOW INFORMATION LISTED APPLIES ONLY WHEN THE RELAY TO BE TESTED IS REMOVED FROM THE PRINTED WIRING BOARD.
4. OPEN S LEAD TO TELEPHONE SETS.
5. OPEN TIP AND RING LEADS TO TELEPHONE SET.

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-F2

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SD-69559-01-F2

E-7484-4 (8-58)