

SHEET INDEX

[illegible]

DWG ISS	CD ISSUE	DWG ISS	CD ISSUE	DWG ISS	CD ISSUE
1	1	2D	1	3D	2D
4D	2D	APPD	5B	2D	2D
7B	3B	8D	3B	APPD	
DWG ISS	CD ISSUE	DATE ISSUED	DRWN	APPR	
9B	3B	3-27-75	OL	RFN OFG JS	
10B	3B	11-10-77	CDI	PD OFG JS	
11D	3B	5-8-79	OL	JWN JRM JS	

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.

SUPPORTING INFORMATION

CATEGORY	NO.

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

ISSUE

11E

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
35

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HNDBK DUG

12

OPTION INDEX

APP OR WRG	LOCATION
Z	1F3, 4D5, 5E2
Y	2D4
X	1E3, 4D5
W	1Q3, 2Q2, 3F3, 4F3, 5E2
V	1Q3, 2Q3, 3F4, 4F2, 5F2
T	1Q3, 2Q2, 3F4, 4F3, 5E2, 5F2
S	1Q3, 2Q2, 3F3, 4F3, 5E2
R	1Q3, 4G3, 5E2
Q	1Q3, 4F3, 5D2, 5E2
N	1Q3, 4G3, 5F2
M	1A3, 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

1
3D
6B
7B

OR
HO

ISSUE

10B

TIE LINE AND STATION LINE CIRCUITS

(2)

SD-69559-01-A2

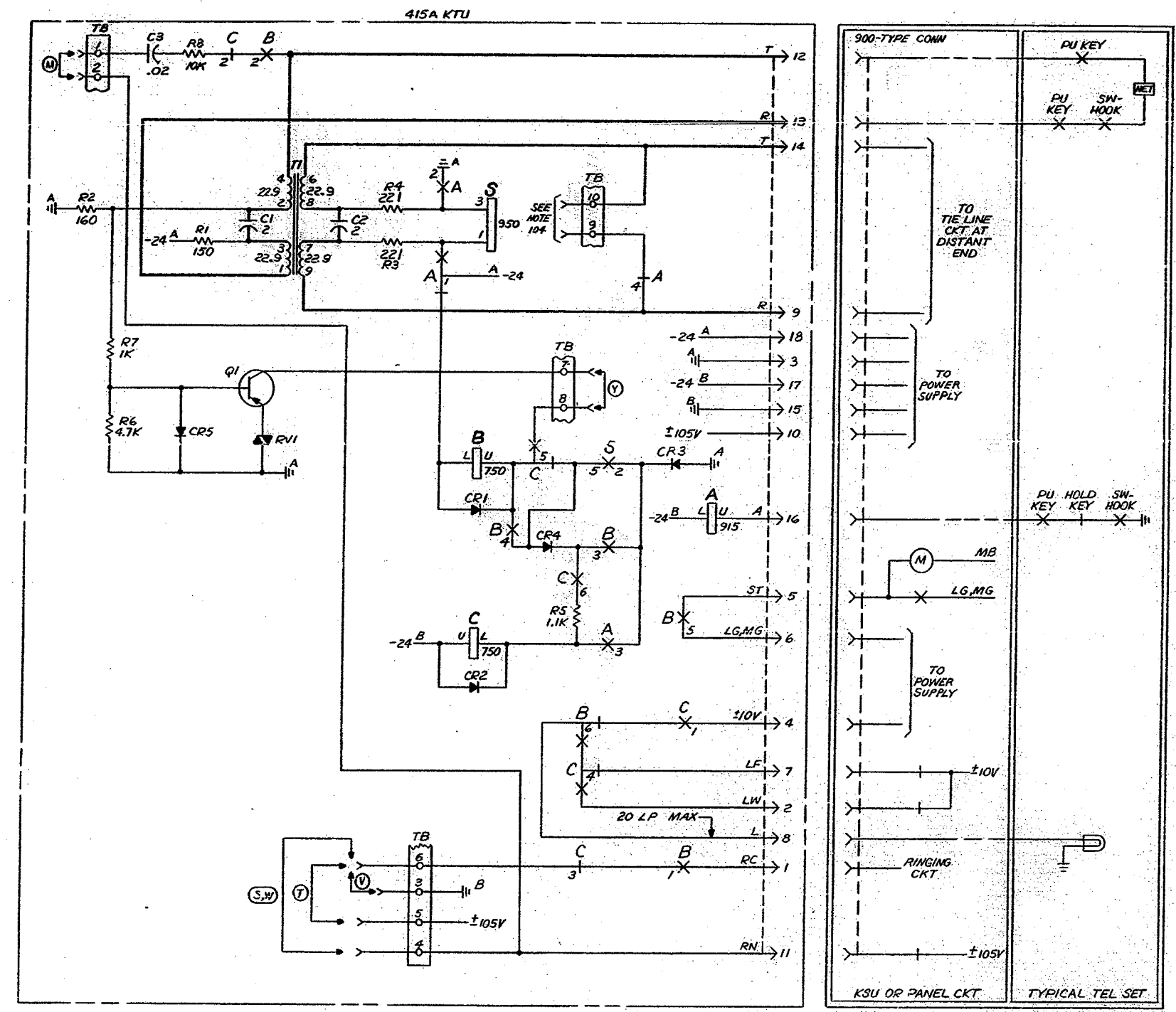
BELL TELEPHONE LABORATORIES
INCORPORATED

35

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SD-69559-01-A2

FS 2 TIE LINE CKT - AUTOMATIC DC SIGNALING



DRAWING	ISSUE
1	1
20	2
30	3
5B	4

5

SD-69559-01-B2

0 1 2 3 4 5 6 7 8 9

FS 3
STATION LINE CIRCUIT

416A KTU

900-TYPE CONN

PU KEY

PU KEY

SW-HOOK

NET

TO TELEPHONE SET AT DISTANT END

TO POWER SUPPLY

±10V

RINGING CKT

±105V

TO POWER SUPPLY

KSU OR PANEL CIRCUIT

TYPICAL TELEPHONE SET

MB

LG, MG

SD-6955

BELL TELEPHONE LABORATORIES

INCORPORATED

6S

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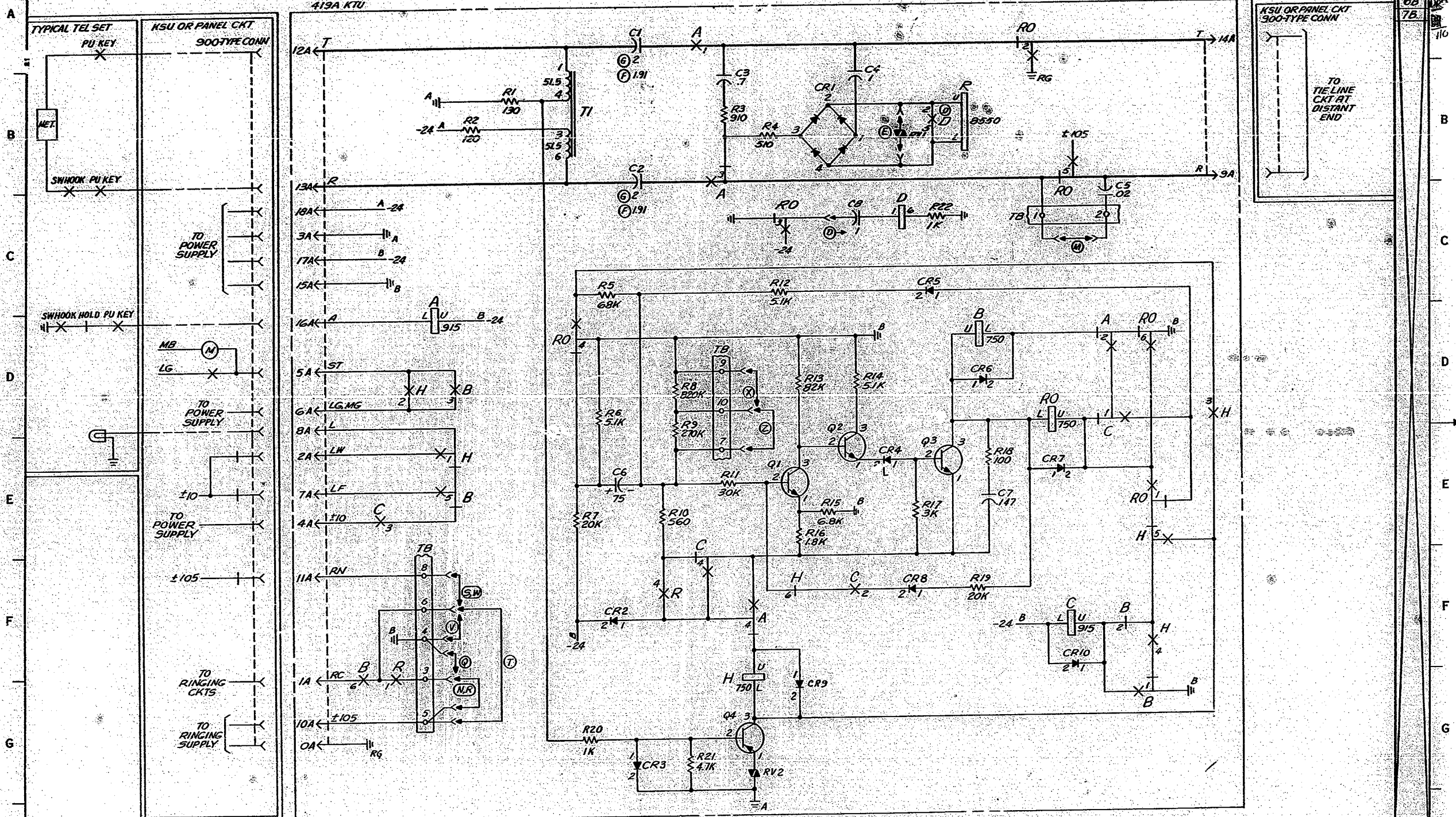
0 1 2 3 4 5 6 7 8 9

3D	ML DLV DLY	A
40	20	B
5B	19	C
		D
		E
		F
		G
5		H

TIE LINE AND STATION LINE CIRCUITS		SD-69559-01-B3 2 6S PRINTED IN U.S.A.
BELL TELEPHONE LABORATORIES INCORPORATED		

FS 4 TIE LINE CKT-AUTOMATIC RINGDOWN SIGNALING

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

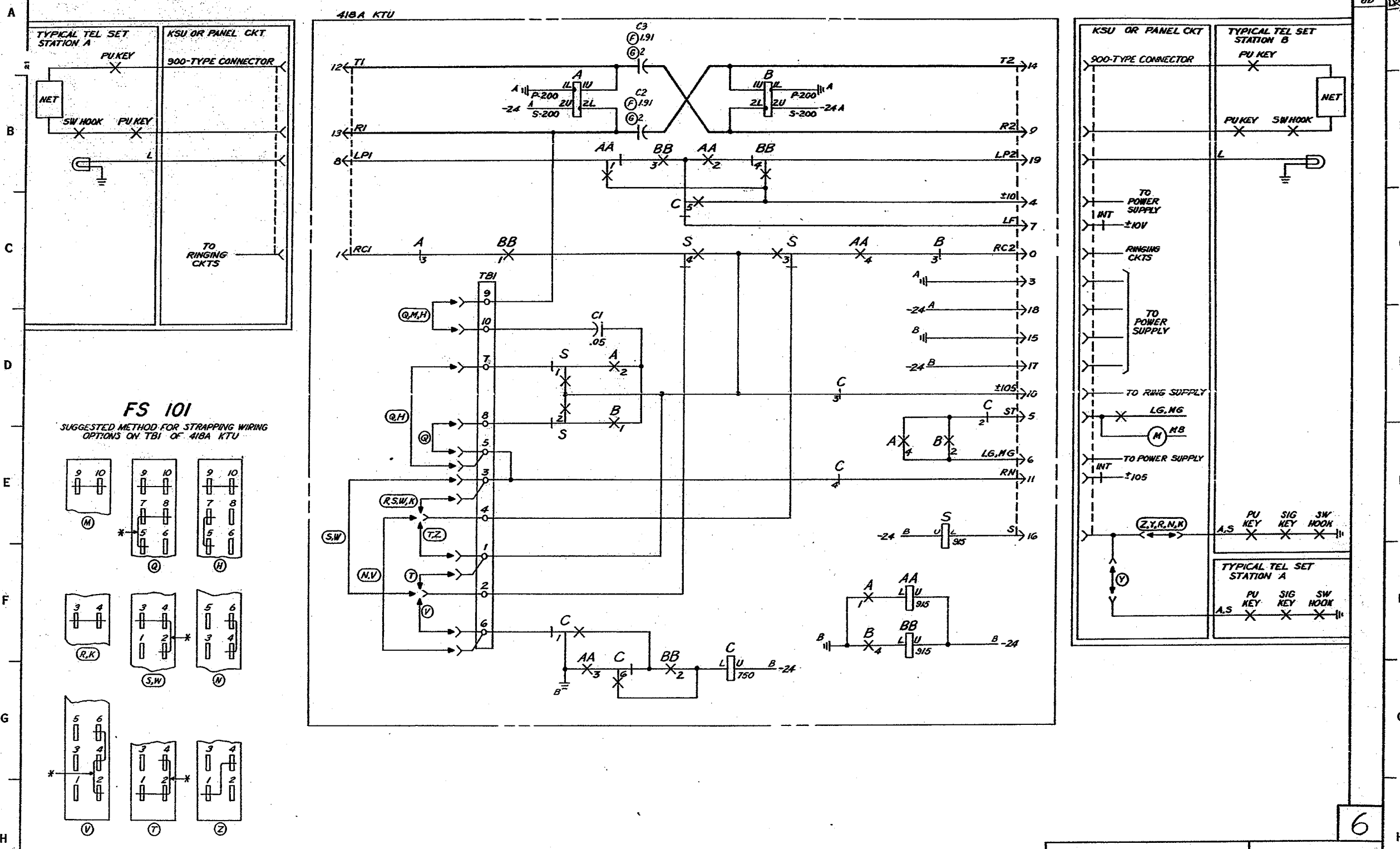


ISSUE
10B

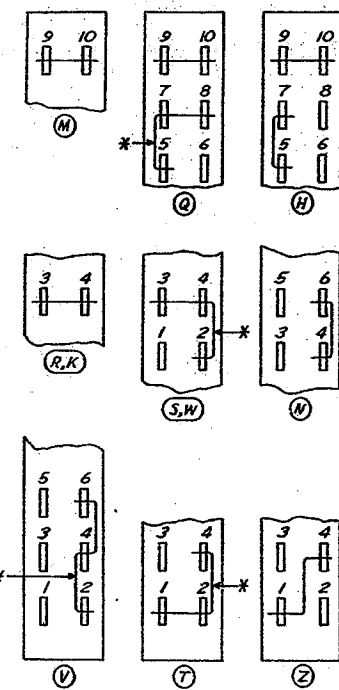
SD-69559-01-B4

FS 5
TIE LINE CKT- SHORT RANGE
SEE FS 101

DRAWING
ISSUE
30
DUP
BY
5B
6B



FS 101
SUGGESTED METHOD FOR STRAPPING WIRING
OPTIONS ON TBI OF 418A KTU



* DENOTES ONE CONTINUOUS
STRAP WIRE

TIE LINE AND STATION LINE CIRCUIT

SD-69559-01-B5

BELL TELEPHONE LABORATORIES
INCORPORATED

6S

PRINTED U.S.A.

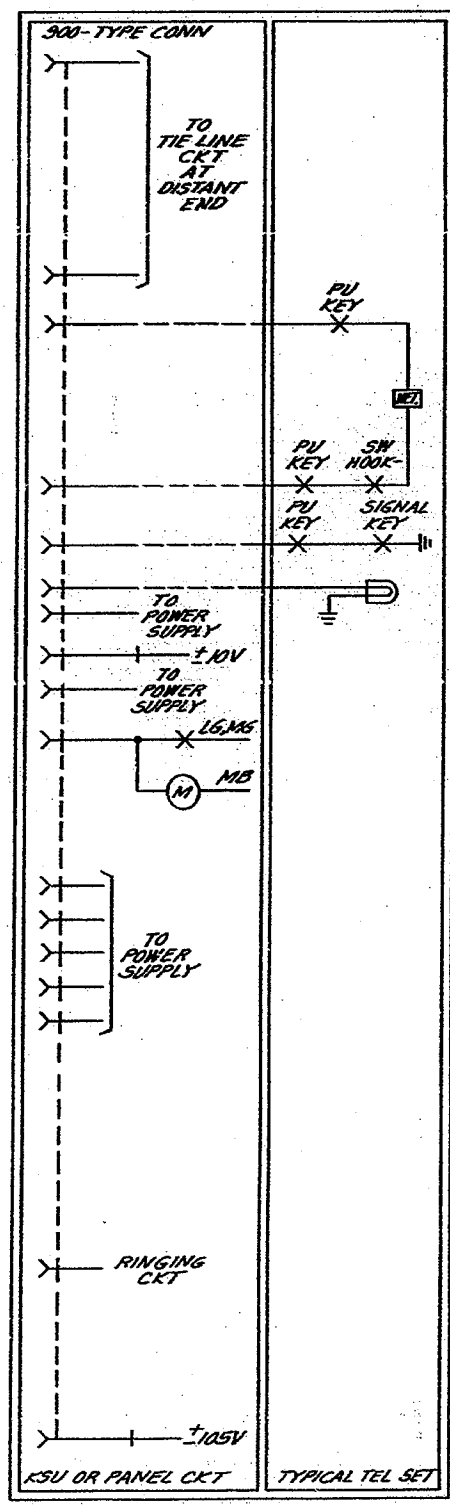
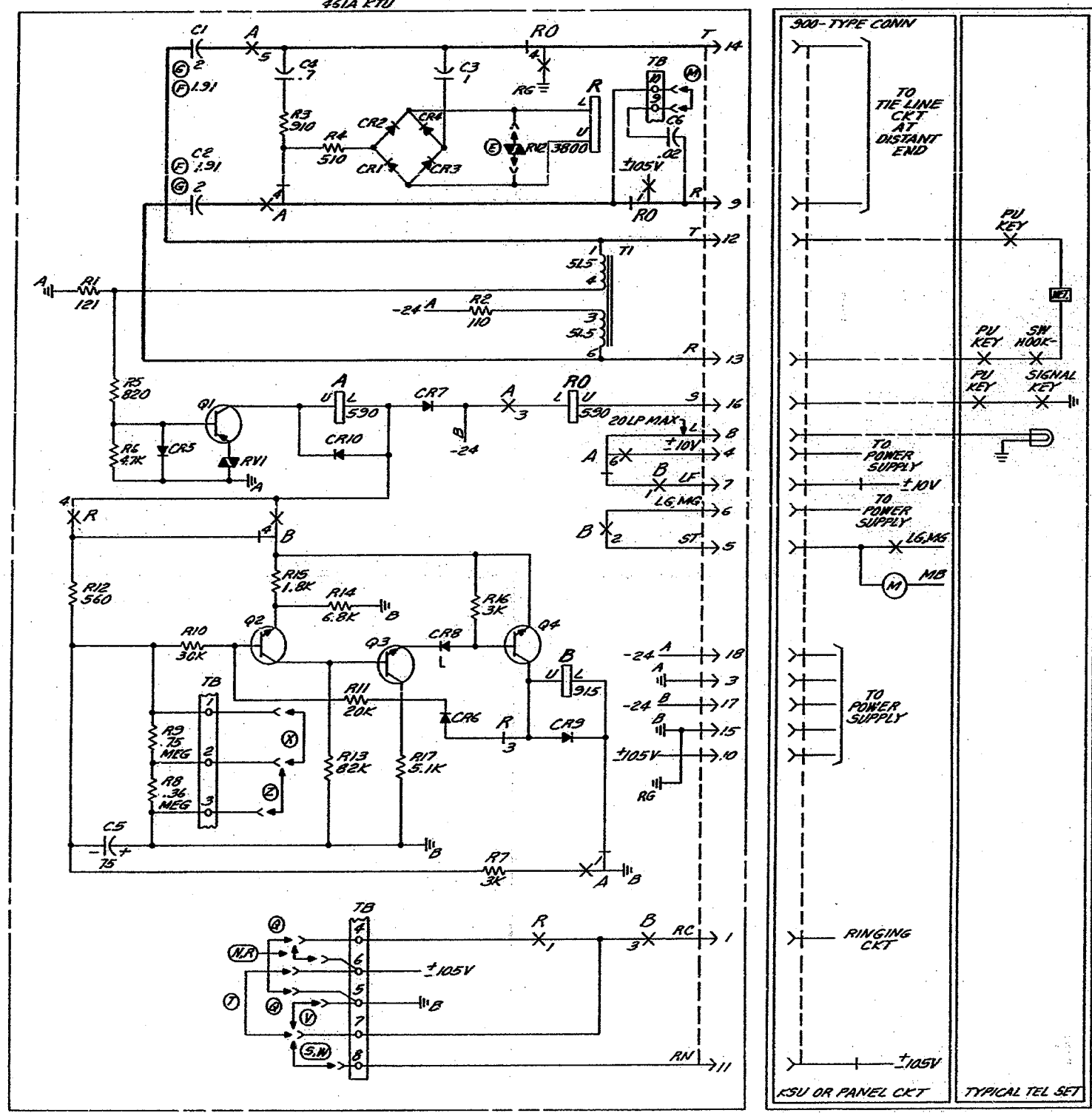
SD-69559-01-B5

0 1 2 3 4 5 6 7 8 9

FS 6

TIE LINE CKT - RINGDOWN MANUAL SIGNALING

451A KTU



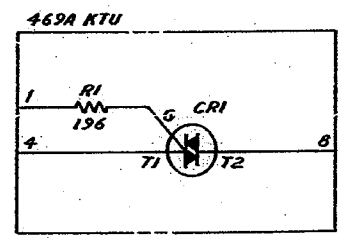
SD-69559-01-B6

9B

0 1 2 3 4 5 6 7 8 9

A
B
C
D
E
F
G
H

FS 7
LAMP EXTENDER



ISSUE
9B

TIE LINE AND STATION LINE CIRCUITS		SD-69559-01-87
BELL TELEPHONE LABORATORIES INCORPORATED	6S	

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0 1 2 3 4 5 6 7 8 9

SD-69559-01-87

APP FIG.1

414A KTU

RELAY

DESIG	A	B	R	RO
CODE	MB1	MA19	MA29	MA5
OPTION				
6	EBM	ID5		
5	EBM	IA3		
4	EBM	ID3	EM	ID2
3	EBM	IC4	EM	IE4
2	EBM	ID5	EM	IE4
1	EBM	IE5	EM	IC4
COIL	IC3	IE5	IA5	IC5

TERMINAL BOARD

DESIG	TB
CODE	
OPTION	
10	IA5
9	IA5
8	IG3
7	IG3
6	IG3
5	IG3
4	IG3
3	IF3
2	IF3
1	IE3

CAPACITOR

DESIG	LOC	CODE
C1	IA2	535GD, 1.91
C2	IB2	535GD, 1.91
C3	IAA	542N, 1
C4	IA3	535JF, .7
C5	IF2	KS-16390 L12, 75
C6	IB5	542AA, .02

TRANSISTOR

DESIG	LOC	CODE
Q1	IC2	12H
Q2	IE3	16G
Q3	IE4	16G
Q4	IE4	16G

DIODE

DESIG	LOC	CODE
CR1	IB3	
CR2	IA3	
CR3	IB4	456B
CR4	IA4	

VARIATOR

DESIG	LOC	CODE
RV1	ID3	100G
RV2	IB4	317A

CR5	ID2	
CR6	IE4	458A
CR7	IC4	
CR8	IE4	459E

CR9	IE5	
CR10	ID3	400J

INDUCTOR

DESIG	LOC	CODE
T1	IB5	1682A

RESISTOR

DESIG	LOC	CODE
R1	IC2	KS-14603 L1A, 121
R2	IC4	KS-14603 L1A, 110
R3	IB3	KS-13490 L1, 910
R4	IB3	KS-13490 L2, 510
R5	IC2	KS-13490 L1, 820
R6	ID2	KS-13490 L1, 4.7K
R7	IF4	KS-13490 L2, 3K
R8	IF2	KS-13490 L1, .36 MEG
R9	IE2	KS-13490 L2, .75 MEG
R10	IE2	KS-13490 L1, 30K
R11	IE3	KS-13490 L2, 20K
R12	IE2	KS-13490 L1, 560
R13	IF3	KS-13490 L1, 82K
R14	IE3	KS-13490 L1, 6.8K
R15	ID3	KS-13490 L1, 1.8K
R16	IE4	KS-13490 L1, 3K
R17	IF4	KS-13490 L1, 5.1K

DRAWING

ISSUE	NO.
1	1.0
2	1.0
3	1.0
4	1.0
5	1.0
6	1.0
7	1.0

B

C

D

E

F

G

H

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-C1

BELL TELEPHONE LABORATORIES

35

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SD-69559-01-C1

03197

APP FIG. 2

415A KTU

RELAY

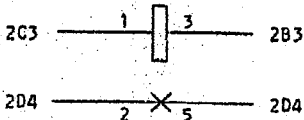
DESIG	A	B	C
CODE	MA19	MB16	MB17
OPTION			
6	CONT ARR	LOC	CONT ARR
5		LOC	CONT ARR
4	EMB	2C4	M
3	M	2E4	M
2	M	2B3	M
1	EMB	2C3	EMB
COIL	2D5	2D3	2E3

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	100G

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, 1.1K
R7	2C1	KS-13490 L1, 1K
R8	2A2	KS-13490 L3, 10K

DRAWING

ISSUE	REV	DATE
1	000	000
3D	000	000

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-C2

BELL TELEPHONE LABORATORIES
INCORPORATED

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SD-69559-01-C2

APP FIG.3

416A KTU

RELAY

DESIG	A		B		RD	
CODE	MB5		MB1		MAS	
OPTION						
	CONT ARR	LOC	CONT ARR	LOC	CONT ARR	LOC
6	EMB	3E6	EBM	3E6		
5	EBM	3E3	EBM	3E6		
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

TRANSFORMER

DESIG	LOC	CODE
T1	3C2	2578U

TRANSISTOR

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

CAPACITOR

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

VARISTOR

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

DIODE

DESIG	LOC	CODE
CR1	3F2	
CR2	3D3	400J
CR3	3C5	
CR4	3D5	
CR5	3D4	
CR6	3C4	458A
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	

DRAWING

ISSUE

1	SUM	ONE	DAY
3D	ML	DLD	DLV
4D			
5B			

TIE LINE AND STATION LINE CIRCUITS

BELL TELEPHONE LABORATORIES
INCORPORATED

SD-69559-01-C3

SD-69559-01-C3

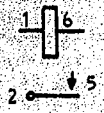
APP FIG. 4

419A KTU

RELAY																	
DESIG	A		B		C				H				R		RO		
CODE	MA4		MB17		MA4				MB17				MA29		MB17		
OPTION																	
✕	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	EBM	4C8	EBM	4D7			EBM	4E3			M	4F2	EMB	4E6	
COIL	✕	4C2	✕	4D6	✕	4F7	✕		✕	4F5	✕		✕	4B6	✕	4D7	

RELAY

D 348A



CAPACITOR

DESIG

LOC

CODE

C1
C2
C3
C4

4A4
4B4
4B5
4B6

535GD, 1.91
535GD, 1.91
535JF, .7
542N, 1

C5
C6
C7
C8

4C7
4E4
4E7
4C5

542AA, .02
KS-16390 L12, 75
594G, .147
KS-20736 L1, 1

DIODE

DESIG

LOC

CODE

CR1
CR2
CR3
CR4

4B5
4F4
4G4
4E6

460A
458A
458A
459E

CR5
CR6
CR7
CR8
CR9
CR10

4C6
4D6
4E7
4F6
4G5
4F7

458A
441J
441J
458A
441J
441J

INDUCTOR

DESIG

LOC

CODE

T1

4B3

1682A

RESISTOR

DESIG

LOC

CODE

R1
R2
R3
R4

4B3
4B3
4B5
4B3

KS-14603 L1A, 130
KS-14603 L1A, 120
KS-13490 L1, 910
L2, 510

R5
R6
R7
R8

4C4
4D4
4E3
4D4

L1, 68K
L1, 5.1K
L1, 20K
L1, 820K

R9
R10
R11
R12

4D4
4E4
4E4
4C5

L1, 270K
L1, 560
L1, 30K
L1, 5.1K

R13
R14
R15
R16

4D5
4D6
4E5
4E5

L1, 82K
L1, 5.1K
L1, 6.8K
L1, 1.8K

R17
R18
R19
R20

4E6
4E7
4F6
4G3

L1, 3K
L1, 100
L2, 20K
L1, 1K

R21
R22

4G4
4C6

KS-13490 L1, 4.7K
KS-13490 L1, 1K

TRANSISTOR

DESIG

LOC

CODE

Q1
Q2
Q3
Q4

4E5
4E5
4E6
4G5

16G
16G
16G
12H

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

VARISTOR

DESIG

LOC

CODE

RV1

4B6

317A

RV2

4G5

100G

DRAWING

ISSUE

3D

5B

6B

7B

DR

10

ISSUE

10B

THE LINE AND STATION LINE CIRCUITS

2

SD-69559-01-C4

BELL TELEPHONE LABORATORIES

3S

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SD-69559-01-C4

APP FIG. 5

410A KTU

RELAY

DESIG	A		AA		B		BB				C				S		DESIG
CODE	MA 24		MA 1		MA 24		MA 1				MB 17				MA 1		CODE
OPTION	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC	OPTION
6											EMB	SF4					6
5											EBM	SC4					5
4	M	SE6	EBM	SC6	M	SF6	EBM	SB5			EBM	SE8			EBM	SC4	4
3	B	SC2	EBM	SF4	B	SC6	EBM	SB4			EBM	SD5			EBM	SC5	3
2	M	SD4	EBM	SB4	M	SEC	EBM	SF4			EBM	SD7			EBM	SE3	2
1	M	SF6	EBM	SB4	M	SD4	EBM	SC3			EMB	SF3			EBM	SD3	1
COIL		SB3		SF6		SB5		SF6				SF5			SE8		COIL

CAPACITOR

DESIG	LOC	CODE
C1	SD4	542W, .05
C2	SB4	539G0, 1.91
C3	SA4	539G0, 1.91

TERMINAL BOARD

DESIG	TB1
CODE	77A
OPTION	
10	SD3
9	SC3
8	SD3
7	SD3
6	SF3
5	SE3
4	SC3
3	SE3
2	SF3
1	SF3

DRAWING

ISSUE

3D

ML

DLD

DLY

6B

DR

6

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-C5

BELL TELEPHONE LABORATORIES

INCORPORATED

3S

PRINTED IN U.S.A.

SD-69559-01-C5

APP FIG. 6

461A KTU

RELAY

DESIG	A		B		R		PO	
CODE	MB1		MA19		MA29		MA5	
OPTION	CONT	LOC	CONT	LOC	CONT	LOC	CONT	LOC
	ARR		ARR		ARR		ARR	
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		1C3		1E5		1A5		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	535GD, 1.91
C2	1B2	535GD, 1.91
C3	1A4	542N, 1
C4	1A3	535JF, .7
C5	1F2	KS-16390 L12, 75
C6	1B5	542AA, .02

TRANSISTOR

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

DIODE

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

VARISTOR

DESIG	LOC	CODE
RV1	1D3	100G
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	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

DRAWING
ISSUE

ISSUE

8D

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-C6

BELL TELEPHONE LABORATORIES
INCORPORATED

1

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

A

B

C

D

E

F

G

H

9B

TIE LINE AND STATION LINE CIRCUITS

1

SD-69559-01-C7

BELL TELEPHONE LABORATORIES
INCORPORATED

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3-H

CIRCUIT NOTES:

101.

DESIG	FUSE AMP	POTENTIAL	ONE PER
A		-24 TALK	X
B		-24 SIG	X
BATTERY SYMBOL		VOLTAGE RANGE	
-24		20-26	

X FUSE PROVIDED ON ASSOCIATED KSU OR PANEL CKT.

102.

FEATURE OR OPTION		PROVIDE		
		APP FIG.	APP OR WRG	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	1,4	S	1 PER LINE
	UNDER CONTROL OF TIME-OUT		W	
	STEADY RING		T	
	CONN WITH REL CONT		V	
	CONN WITH DIODE MATRIX CONT		S	
	UNDER CONTROL OF (R) RELAY		R	
	STEADY RING		Q	
	CONN WITH REL CONT		H	
	CONN WITH DIODE MATRIX CONT		N	
AUDIBLE RINGBACK SEE NOTE 105		1,2,3,4	M	
SIGNALING	INTERRUPTED RING	5	W	1 PER LINE
	STEADY RING		T	
	COM AUD WITH RELAY CONTROL		V	
	COM AUD WITH DIODE MATRIX CONT		S	1 PER LINE
	ONE-WAY AUTO-MATIC		R	
	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		Q	1 PER LINE
	TWO-WAY AUTOMATIC		H	
	ONE-WAY AUTO, ONE-WAY MAN		M	
	TWO-WAY MANUAL			

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

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			

104. CONNECT 910-OHM RESISTOR AND 2-MICROFARAD CAPACITOR IN SERIES BETWEEN TERMINALS 9 AND 10 FOR AN IDLE LINE TERMINATION. RES. KS-13480, 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

5B

6B

7B

10B

10B

10B

10B

10B

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10B

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10B

TIE LINE AND STATION LINE CIRCUITS

2

SD-69559-01-D1

BELL TELEPHONE LABORATORIES

35

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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.

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)

DRAWING
ISSUE3D ML
DLV

5B

D.R.

5

TIE LINE AND STATION LINE CIRCUITS

SD-69559-01-D2

BELL TELEPHONE LABORATORIES
INCORPORATEDDWG SIZE
35

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CIRCUIT REQUIREMENTS

TIE LINE AND STATION LINE CIRCUITS

APPARATUS				MECH REQ			CIRCUIT PREPARATION				DIRECT CURRENT FLOW REQ						REMARKS
DESIG	CODE	OPT	FIG.	BSP FIG.	CONT PRESS.	ARM. TRVL	BLOCK OR INSULATE	TEST CLIP DATA		TEST SET PREP	SEE TEST NOTE	TEST WDG	TEST FOR	AFTER SOAK MA.	TEST MA.	READJ MA.	
								CONN. BAT.	CONN. GRD.								
RELAYS																	
414A KTU																	
A	MB1		1	200				U	L	B/G	2,3		0		25.5		
B	MA19		1	105				U	L	B/G	2,3		0		17		
								U	L	B/G	2,3		R		1.1		
R	MA29		1	6				U	L	B/G	2,3		0		4		
RO	MA5		1	100				U	L	B/G	2,3		0		21		
415A KTU																	
A	MA19		2	105				U	U	GRD	1,2		0		17		
								U	U	GRD	1,2		R		1.1		
B	MB16		2	201				U	L	B/G	2,3		0		20		
								U	L	B/G	2,3		R		1.2		
C	MB17		2	203				U	L	B/G	2,3		0		21		
								U	L	B/G	2,3		H		7.5		
S	3278		2					1	3	B/G	2,3		0		3.8		
								1	3	B/G	2,3		R		0.4		
416A KTU																	
A	MB5		3					U	L	B/G	2,3		0		25.5		
B	MB1		3					U	L	B/G	2,3		0		25.5		
RO	MA5		3					U	L	B/G	2,3		0		21		
418A KTU																	
A	MA24		5	5				2L	1U	B/G	2,5	P1/P2	0		21		
AA	MA1		5	100				U	L	B/G	2,3		0		17		
								U	L	B/G	2,3		H		7.5		
B	MA24		5	5				2L	1U	B/G	2,5	P1/P2	0		21		
								L		B/G	2,3		R		1.1		
BB	MA1		5	100				U	L	B/G	2,3		0		17		
													H		7.5		
C	MB17		5	203				U	L	B/G	2,3		0		21		
								U	L	B/G	2,3		H		7.5		
													NO		11.8		
RO	MA1		5	100					L	B/G	2,3		0		17		
S	MA1		5	100					L	GRD	2,4		0		17		
													H		11.2		
461A KTU																	
A	MB1		6	200				U	L	B/G	2,3		0		25.5		
B	MA19		6	105				U	L	B/G	2,3		0		17		
								U	L	B/G	2,3		R		1.1		
R	MA29		6	6				U	L	B/G	2,3		0		4		
RO	MA5		6	100				U	L	B/G	2,3		0		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.

DRAWING
ISSUE

1
3D
5B

PAGE 1

ISSUE

8D

TIE LINE AND STATION LINE CIRCUITS

2

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14-1/4

CIRCUIT REQUIREMENTS
TIE LINE AND STATION LINE CIRCUITS

DRAWING
ISSUE

3D ML
DLV
5B

APPARATUS				CIRCUIT PREPARATION												DIRECT CURRENT FLOW REQ					REMARKS
DESIG	CODE	OPT	FIG.	BSP FIG.	CONT PRESS.	ARM. TRVL	BLOCK OR INSULATE	TEST CLIP DATA		TEST SET PREP	SEE TEST NOTE	TEST WDG	TEST FOR	AFTER SOAK MA.	TEST MA.	READJ MA.					
								CONN BAT.	CONN GRD												
								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.
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 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.

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TIE LINE AND STATION LINE CIRCUITS

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INCORPORATED

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