

FEB 16 1972

CD-20746-01  
ISSUE 3AC  
APPENDIX 1B  
DWG ISSUE 10B

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM,  
NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

CHANGES

B. Changes in Apparatus (Components)

B.1 Added

Diode SL, Option M, Code 446F

D. Description of Changes

D.1 Option K is added to provide a make-busy arrangement which eliminates the need to monitor trunks, wired per option T, during the make-busy procedure.

D.2 Option M is added to reduce the unguarded sleeve interval between overlapping calls.

F. Changes in Description of Operation

F.1 Changes in description, required by addition of options K and M, are shown in Issue 3AC.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR

## CIRCUIT DESCRIPTION

CD-20746-01  
ISSUE 3AC  
DWG ISSUE 9AC

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

### SECTION I - GENERAL DESCRIPTION

#### 1. PURPOSE OF CIRCUIT

1.01 This circuit is intended for use in panel offices which are arranged to complete on a multifrequency basis direct distance dialed calls through non-AMA crossbar tandem offices, local calls to ESS No. 1 offices, or local calls to No. 1 or No. 5 crossbar local offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

### SECTION II - DETAILED DESCRIPTION

#### 1. SEIZURE

1.01 When this circuit is seized by a district or office selector, battery and ground from the tandem or local office incoming trunk, through the windings of relay WK, are connected to the district or office selector circuit. Tip and ring continuity for the operation of WK relay is under the control of the SL relay. This relay is operated by the district sleeve ground. Relay WK does not operate at this time because the incoming trunk is in the on-hook condition.

1.02 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

#### 2. WINK SIGNAL

2.01 When the incoming trunk goes to the off-hook condition at the start of the wink signal, relay WK operates, and in turn, operates relay PW. Relay PW locks to the sleeve. When the incoming trunk goes back to the on-hook condition at the end of the wink signal, relay WK releases, and, in turn, operates relay PZ. With relays PW and PZ both operated, inductor TC is bridged across the tip and ring to hold the incoming trunk during district talking selections.

#### 3. CALLED SUBSCRIBER ANSWERS

3.01 If option S or V is wired, when the called subscriber answers and the incoming trunk goes to an off-hook condition, relay WK

operates. If option T is wired, the answer reversal permits WK to operate when the district selector closes its CS relay bridge after talk selection. The operated WK relay releases relay PW, which in turn opens the inductance bridge across the tip and ring. Option R (resistor TC) is required when option T is wired. Resistor TC increases the impedance of the TC bridge to provide sufficient current for WK operation.

#### 4. DISCONNECT

4.01 When the called subscriber disconnects, relay WK releases. When the calling subscriber disconnects, ground is removed from the sleeve lead, releasing the PZ relay and making the circuit available for other calls. However, tip and ring leads are held open until relay SL1 releases.

4.02 On calling subscriber disconnect from a no-answer call, ground is removed from the sleeve lead, releasing the PW and PZ relays which were locked in parallel. The RL diode (option W) prevents the surge from the PZ relay from entering the PW relay winding and delaying its release.

4.03 Option M reduces the unguarded sleeve interval between overlapping calls. Option M changes the shunt ground on relay SL1 from 4M of SL to the district sleeve. Thus, SL1 operates when district release removes ground from the sleeve, eliminating the release time of relay SL. Diode SL of option M prevents an increase in release time of SL and prevents SL lockup over the K option make-busy lead.

### SECTION III - REFERENCE DATA

#### 1. WORKING LIMITS

1.01 Combined originating and terminating circuits:

- (a) Maximum external circuit loop resistance: 4,000 ohms.
- (b) Minimum insulation resistance: 30,000 ohms.

1.02 Working voltage: 45 to 50 volts.

1.03 Earth potential:  $\pm 20$  volts.

## 2. FUNCTIONAL DESIGNATIONS

### 2.01 Relays

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
WK	Wink	Registers on-hook or off-hook conditions of incoming trunk
PW	Pulse W	Counts polarity reversals of incoming trunk
PZ	Pulse Z	Counts polarity reversals of incoming trunk
SL	Sleeve	Closes T and R leads
SLI	Sleeve Auxiliary	Opens T, R, and S leads

### 2.02 Inductor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TC	Trunk Closure	Applies bridge across incoming trunk during district talking selection

### 2.03 Jack

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TST	Test	Used to test relay WK

### 2.04 Diode

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
RL	Release	Reduces delay in release of relay PW

### 2.05 Resistor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TC	Trunk Closure	Applies bridge (in part) across incoming trunk during district talk selection

## 3. FUNCTIONS

3.01 Recognizes on-hook and off-hook conditions presented by the tandem or local office incoming trunk.

3.02 Places an inductor across the tip and ring conductors to maintain closure while district talk selection is being completed.

## 4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

- (a) District Selector Circuit - SD-21630-01.
- (b) Office Selector Circuit - ES-240252.
- (c) Tandem Office Incoming Trunk Circuit - SD-25887-01.
- (d) OGT Test and MB Jack Circuit - SD-96376-01.
- (e) No. 1 Crossbar Incoming Trunk Circuit - SD-26204-01.
- (f) No. 5 Crossbar Incoming Trunk Circuit - SD-26070-01.
- (g) ESS No. 1 Incoming Trunk - SD-1A166-01.

## 5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the requirements listed in the Circuit Requirements Tables.

5.02 The capacitance of capacitors T and R shall not differ by more than 0.11  $\mu$ F.

## 6. TAKING EQUIPMENT OUT OF SERVICE

6.01 On trunks wired per option T, without option K, to prevent holding an unanswered called line out of service, do not make busy while call is in audible ring stage.

6.02 Option K provides a make-busy arrangement which eliminates the need to monitor trunks, wired per option T, during the make-busy procedure. With option K, insertion of a make-busy plug operates relay SL1 when district release removes ground from the sleeve. SL1 operated grounds the sleeve as a make-busy condition in addition to opening the operate paths of relays SL, PW, and PZ.

6.03 On trunks wired per option K, blanking pins are required to be permanently inserted into the make-busy jack associated with the district or office bank multiple.

## SECTION IV - REASONS FOR REISSUE

### B. Changes in Apparatus (Components)

#### B.1 Added

Resistor TC - Option R - KS-13492, L1 - 620 Ohms

D. Description of Changes

D.1 Options T and V are added to permit insertion of the TC transformer bridge in the outgoing or incoming side of the T and R capacitors. Option T avoids false disconnects on calls to ESS No. 1 or No. 5 crossbar offices in which the answer reversal is received before the district selector closes its CS relay bridge after talk selection.

D.2 Resistor TC (option R) is added to increase the current over the district loop

for operation of relay CS in the district circuit.

D.3 Option S is added to indicate the connecting wiring to transformer TC prior to Issue 9AC.

D.4 The title of the circuit is expanded to include connection to ESS No. 1 offices.

D.5 Paragraphs 4.03 and 6.02 are added to describe changes of Appendix 1B, Drawing Issue 10B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

APR 20 1972

## DRAWING NOTICE

SD-20746-01	ISSUE	10B
CD 3AC	APP.	1B
RATING A&M Only		
SYSTEM Panel		
DATE January 7, 1972		

DWG DIST CODE B99

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - No. 1 And No. 5 Crossbar Local - Offices And No. 1 ESS Offices

## DESCRIPTION

- 6.1 PROJECT : None
- 6.2 This change for TELCO consideration, is to add an improvement to an existing feature. Called lines can be held out of service. On trunks wired per option T, insertion of a make-busy plug during a call that is unanswered, will hold the connection to the called line.
- 6.21 This condition can occur when T option is furnished, because the TC transformer bridge is connected to the outgoing side of the transmission capacitors. When the calling customer abandons the unanswered call, the district selector releases and removes its CS relay bridge, which is required to operate relay WK for release of the TC transformer bridge. The TC transformer bridge is maintained by two operated relays (PW and PZ) which are held operated by the make-busy plug. Subsequent answer of the called line fails to remove the TC bridge since relay WK cannot operate without a district selector.
- 6.22 This condition is prevented from occurring by addition of a separate make-busy lead and jack (option K). This arrangement delays the effect of the make-busy plug until the trunk is released.
- 6.23 This change requires addition of one lead to the outgoing trunk test (OGT) board, minor rewiring in this circuit and provision of a separate make-busy jack.
- 6.24 This change is not necessary if precaution is taken to insure that the trunk is not off-normal before making it busy.
- 6.3 This circuit can be re seized during release and possibly hold the previous connection to the terminating office. As a result the panel sender associated with the second call times out.
- 6.31 This condition can occur because of an unguarded sleeve interval during release.

- 6.32 The probability of this occurrence is reduced by a wiring change that shortens the unguarded interval by approximately 20 milliseconds. The change eliminates the control of an intermediate relay (SL) on the operation of the relay (SL1) which delays closure of the trunk loop until the trunk is otherwise normal.
- 6.33 This change requires addition of a 446 type diode and minor rewiring (option M).
- 6.4 This B change does require WECO notification to TELCO.
- 6.5 Direct Current Drain Data is not affected by this issue.
- 6.6 Equipment information is affected and will be covered by WECO drawing J29201AP-1.
- 6.7 Equipment Design Requirements are not affected.

FEB 16 1972

CD-20746-01  
ISSUE 3AC  
APPENDIX 1B  
DWG ISSUE 10B

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM,  
NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

CHANGES

B. Changes in Apparatus (Components)

B.1 Added

Diode SL, Option M, Code 446F

D. Description of Changes

D.1 Option K is added to provide a make-busy arrangement which eliminates the need to monitor trunks, wired per option T, during the make-busy procedure.

D.2 Option M is added to reduce the unguarded sleeve interval between overlapping calls.

F. Changes in Description of Operation

F.1 Changes in description, required by addition of options K and M, are shown in Issue 3AC.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR

APR 20

# AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01  
CD 3AC  
RATING A&M Only  
SYSTEM Panel  
DATE January 7, 1972

ISSUE 9AC  
APP.

DWG DIST CODE B99

### TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - No. 1 And No. 5 Crossbar Local - Offices And No. 1 ESS Offices

### DESCRIPTION

- 6.1 PROJECT : None
- 6.2 This change is to correct a trouble condition. Calls can be falsely disconnected when the customer answers.
- 6.21 In ESS #1 and #5 Crossbar Offices, the called line can be connected and answered before the district selector in the panel office completes talk selection. At this point in operation, the trunk is open since the answer signal causes the removal of the holding bridge in this trunk, and the district selector is not in talk position. The open interval is long enough to be interpreted as a disconnect signal by the ESS #1 or #5 crossbar office.
- 6 22 The trouble is corrected by relocating connections of the bridge (TC transformer) to the trunk side of the transmission capacitors. The relocation will maintain the bridge to the terminating office until the district selector completes talk selection and closes its bridge (relay CS). Closure of the district bridge permits a relay (WK) to operate which indirectly removes the TC bridge in this trunk.
- 5.23 This change requires addition of a pigtail type resistor, and minor rewiring.
- 34 This change is to be applied to trunks connected to ESS#1 or #5 crossbar offices.
- 1.25 A related change is shown on Issue 10B of SD-20746-01.
- 3 Transmission is not affected by changes in this issue.
- 4 Direct Current Drain Data is not affected by this issue.
- 5 Equipment information is affected and will be covered by WECO drawing J29201AP-1.



PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is intended for use in panel offices which are arranged to complete on a multifrequency basis direct distance dialed calls through non-AMA crossbar tandem offices, local calls to ESS No. 1 offices, or local calls to No. 1 or No. 5 crossbar local offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 When this circuit is seized by a district or office selector, battery and ground from the tandem or local office incoming trunk, through the windings of relay WK, are connected to the district or office selector circuit. Tip and ring continuity for the operation of WK relay is under the control of the SL relay. This relay is operated by the district sleeve ground. Relay WK does not operate at this time because the incoming trunk is in the on-hook condition.

1.02 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.01 When the incoming trunk goes to the off-hook condition at the start of the wink signal, relay WK operates, and in turn, operates relay PW. Relay PW locks to the sleeve. When the incoming trunk goes back to the on-hook condition at the end of the wink signal, relay WK releases, and, in turn, operates relay PZ. With relays PW and PZ both operated, inductor TC is bridged across the tip and ring to hold the incoming trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.01 If option S or V is wired, when the called subscriber answers and the incoming trunk goes to an off-hook condition, relay WK

operates. If option T is wired, the answer reversal permits WK to operate when the district selector closes its CS relay bridge after talk selection. The operated WK relay releases relay PW, which in turn opens the inductance bridge across the tip and ring. Option R (resistor TC) is required when option T is wired. Resistor TC increases the impedance of the TC bridge to provide sufficient current for WK operation.

4. DISCONNECT

4.01 When the called subscriber disconnects, relay WK releases. When the calling subscriber disconnects, ground is removed from the sleeve lead, releasing the PZ relay and making the circuit available for other calls. However, tip and ring leads are held open until relay SL1 releases.

4.02 On calling subscriber disconnect from a no-answer call, ground is removed from the sleeve lead, releasing the PW and PZ relays which were locked in parallel. The RL diode (option W) prevents the surge from the PZ relay from entering the PW relay winding and delaying its release.

4.03 Option M reduces the unguarded sleeve interval between overlapping calls. Option M changes the shunt ground on relay SL1 from 4M of SL to the district sleeve. Thus, SL1 operates when district release removes ground from the sleeve, eliminating the release time of relay SL. Diode SL of option M prevents an increase in release time of SL and prevents SL lockup over the K option make-busy lead.

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 Combined originating and terminating circuits:

- (a) Maximum external circuit loop resistance: 4,000 ohms.
- (b) Minimum insulation resistance: 30,000 ohms.

1.02 Working voltage: 45 to 50 volts.



1.03 Earth potential:  $\pm 20$  volts.

## 2. FUNCTIONAL DESIGNATIONS

### 2.01 Relays

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
WK	Wink	Registers on-hook or off-hook conditions of incoming trunk
PW	Pulse W	Counts polarity reversals of incoming trunk
PZ	Pulse Z	Counts polarity reversals of incoming trunk
SL	Sleeve	Closes T and R leads
SLI	Sleeve Auxiliary	Opens T, R, and S leads

### 2.02 Inductor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TC	Trunk Closure	Applies bridge across incoming trunk during district talking selection

### 2.03 Jack

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TST	Test	Used to test relay WK

### 2.04 Diode

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
RL	Release	Reduces delay in release of relay PW

### 2.05 Resistor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
TC	Trunk Closure	Applies bridge (in part) across incoming trunk during district talk selection

## 3. FUNCTIONS

3.01 Recognizes on-hook and off-hook conditions presented by the tandem or local office incoming trunk.

3.02 Places an inductor across the tip and ring conductors to maintain closure while district talk selection is being completed.

## 4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

- (a) District Selector Circuit - SD-21630-01.
- (b) Office Selector Circuit - ES-240252.
- (c) Tandem Office Incoming Trunk Circuit - SD-25887-01.
- (d) OGT Test and MB Jack Circuit - SD-96376-01.
- (e) No. 1 Crossbar Incoming Trunk Circuit - SD-26204-01.
- (f) No. 5 Crossbar Incoming Trunk Circuit - SD-26070-01.
- (g) ESS No. 1 Incoming Trunk - SD-1A166-01.

## 5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the requirements listed in the Circuit Requirements Tables.

5.02 The capacitance of capacitors T and R shall not differ by more than 0.11  $\mu$ F.

## 6. TAKING EQUIPMENT OUT OF SERVICE

6.01 On trunks wired per option T, without option K, to prevent holding an unanswered called line out of service, do not make busy while call is in audible ring stage.

6.02 Option K provides a make-busy arrangement which eliminates the need to monitor trunks, wired per option T, during the make-busy procedure. With option K, insertion of a make-busy plug operates relay SL1 when district release removes ground from the sleeve. SL1 operated grounds the sleeve as a make-busy condition in addition to opening the operate paths of relays SL, PW, and PZ.

6.03 On trunks wired per option K, blanking pins are required to be permanently inserted into the make-busy jack associated with the district or office bank multiple.

## SECTION IV - REASONS FOR REISSUE

### B. Changes in Apparatus (Components)

#### B.1 Added

Resistor TC - Option R - KS-13492, L1 - 620 Ohms

D. Description of Changes

D.1 Options T and V are added to permit insertion of the TC transformer bridge in the outgoing or incoming side of the T and R capacitors. Option T avoids false disconnects on calls to ESS No. 1 or No. 5 crossbar offices in which the answer reversal is received before the district selector closes its CS relay bridge after talk selection.

D.2 Resistor TC (option R) is added to increase the current over the district loop

for operation of relay CS in the district circuit.

D.3 Option S is added to indicate the connecting wiring to transformer TC prior to Issue 9AC.

D.4 The title of the circuit is expanded to include connection to ESS No. 1 offices.

D.5 Paragraphs 4.03 and 6.02 are added to describe changes of Appendix 1B, Drawing Issue 10B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

JAN 27 1969

DRAWING NOTICE

SD-20746-01  
CD 2D  
RATING A&M Only  
SYSTEM Panel  
DATE October 9, 1968

ISSUE 8D  
APP. 6D

DWG DIST CODE 2B99

TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

DESCRIPTION

- 6.1 The following changes is made to correct a drafting error on issue 5B.  
The WECO drawings are correct, so this is a "no record" change.
- 6.12 The R Lead from the OCT test board is removed from the 2 contact SL relay  
X option, and placed on the 2 make contact SL relay X option. This will  
agree with sketch shown in LDI 4A.
- 6.2 The Current Drain Data for this circuit is not affected by changes in  
this issue.
- 6.3 D change. Does not require WECO notification to Telco.
- 6.4 Equipment information is not affected.
- 6.5 Equipment Design Requirements are not affected.

(A' CHG ENGR - SPUR)

Call from Petrucci - WECO. 11-20-71

issue 9AC.

to prevent false disc.

T option to #5XB or ESS  
V opt to all other

RPO

12-1-71

CIRCUIT DESCRIPTION

NOV 27 1968  
PR

CD-20746-01  
ISSUE 2D  
APPENDIX 6D  
DWG ISSUE 8D

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

D. Description of Changes

D.1 The following change was made on a no-record basis to agree with WECo drawings. The R lead from the OGT board test and make-busy jack is removed from the 2-contact SL relay, option X, and placed on the 2-make contact SL relay, option X.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5823-EV.-MR

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

JUL 30 1968  
JR

## DRAWING NOTICE

SD-20746-01

ISSUE 7AC

CD 2D

APP. 5AC

RATING A&amp;M Only

SYSTEM Panel

DATE May 22, 1968

DWG DIST CODE 2B99

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar Tandem -  
And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 5.1 This change provides wiring information in CAD figure 4 which was omitted on issue 5B of this drawing. This change applies to jobs having issue 5B or 6D.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 This change does not affect the plug-in units and does not require the Telco to notify WECO as to number and location of products to be changed.
- 6.4 Equipment information is not affected.
- 5 Equipment Design Requirements are not affected.



CIRCUIT DESCRIPTION

*Oct 11* JUL 9 1968  
JE  
CD-20746-01  
ISSUE 2D  
APPENDIX 5AC  
DWG ISSUE 7AC

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

D. Description of Changes

D.1 CAD Fig. 4 is changed on circuit drawing to show fuse board ground and punching which was not required prior to Issue 5B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5643-EV-MR

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

JUL 2 1968

ISSUE 6D  
APP. 4D

## DRAWING NOTICE

SD-20746-01  
CD - 2D  
RATING A&M Only  
SYSTEM Panel  
DATE April 9, 1968

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-Ama Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 The "SL1" resistor is changed on this issue from 619<sup>W</sup> to 1100<sup>W</sup>. When trk is held off normal for long periods of time, the new resistor will be cooler to the touch than the former. Neither resistance is subject to excessive heating from a circuit or fire hazard standpoint. No change in circuit operation is occasioned by this substitution. This change is on a no record basis by agreement between Mr. G. Schmalz for WECO and Mr. E. Vanderveer for BTL.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 D change. Does not require WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP.
- 6.5 Equipment Design Requirements are not affected.

CIRCUIT DESCRIPTION

MAY 23 1968

CD-20746-01  
ISSUE 2D  
APPENDIX 4D  
DWG ISSUE 6D

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

B. Changes in Apparatus

B.1 Removed

Resistor 619 $\omega$

Replaced By

Resistor 1100 $\omega$

D. Description of Changes

D.1 The SL1 resistance shown on issue 5B of this drawing is changed from 619 $\omega$  to 1100 $\omega$ . The previous resistance was hot to touch, and the new one, while cooler, does not degrade performance of the circuit.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5643-EV-RM

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

FEB 13 1968

SD-20746-01

ISSUE 5B  
APP. 3B

## DRAWING NOTICE

CD	2D
RATING	A&M Only
SYSTEM	Panel
DATE	December 6, 1967

## TITLE

Panel Systems - Outgoing Trunk Circuit - M F Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 If trunk conditions are such as to cause the WK relay of this circuit to chatter prior to completion of district talking selection, this circuit may release and reseize forward, causing a stuck sender in the remote office. X wiring and apparatus are added on this issue to overcome this malfunction. Greater protection is also obtained in respect to the unguarded interval at the Panel office, when trunk is released before called party answered.
- 6.11 This change will require the addition of <sup>2</sup>AK 24 relay, 600<sup>W</sup> resistor and an AG 33 relay to replace the present PW relay.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 B change. Requires WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP-().
- 6.5 Equipment Design Requirements are not affected.

*This change was not added to older  
Seattle circuits. A 400W diode across  
winding of (PW) relay accomplished same  
purpose. See Engr. Complaint 975 PTW,  
QSM # SS-07-23-1122, Nov. 13, 1967.*

# CIRCUIT DESCRIPTION

CD-20746-01  
ISSUE 2D  
APPENDIX 3B  
DWG ISSUE 5B

## PANEL SYSTEMS OUTGOING TRUNK CIRCUIT MF PULSING TO NON-AMA CROSSBAR TANDEM AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

### CHANGES

#### B. Changes in Apparatus

##### B.1 Added

SL, SL1 - AK24 Relay  
SL1 - Resistor KS-14603,L2

##### B.2 Removed

##### Replaced By

PW-AF531 Relay      PW-AG33 Relay

#### D. Description of Changes

D.1 FS 1 has been revised to show the addition of X wiring and apparatus. Wiring formerly not designated has been designated W option and rated Mfr Disc.

D.2 Y option is also rated Mfr Disc.

#### F. Changes in CD Section

F.1 In 1.01 add after first sentence: tip and ring continuity for the operation of WK relay is under the control of the SL relay. This relay is operated by the district sleeve ground.

F.2 In 4.01 add to paragraph: However tip and ring leads are held open until SL1 relay releases. SL1 relay in turn is held operated by slower releasing relays involved in the release of trunk.

F.3 Under Section III, 2.01 add:

#### Relays

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
SL	Sleeve	Close T&R Lead
SL1	Sleeve Aux	Open T&R&S Lead

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-EV-RMW



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01

ISSUE 4B

CD 2D

APP. 2B

RATING A&amp;M Only

SYSTEM Panel

DATE August 16, 1965

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 The change applied in Issue 3AR changed the locking circuit of the PZ relay which removes the necessity of the PW relay being slow release.
- 6.11 The slow release AG9 relay is replaced by an AF531 relay to provide a faster release relay to reduce the unguarded interval on disconnect from unanswered calls.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 B change. Requires WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP.
- 6.5 Equipment Design Requirements are not affected.

No engineering letter will be issued.

# AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01

ISSUE 3AR

CD 2D

APP. 1AR

RATING A&M Only

SYSTEM Panel

DATE August 16, 1965

### TITLE

Panel Systems - OUTGOING TRUNK CIRCUIT - MF Pulsing - To Non-AMA Crossbar Tandem -  
And No. 1 and No. 5 Crossbar Local Offices.

### DESCRIPTION

- 6.1 This circuit is reissued to correct a trouble condition which occurred on high usage trunk groups when the circuit was immediately re seized after calling subscriber disconnect from a previous don't answer call. The PW relay which in slow release held upon the succeeding call changing the sequence of operation of the PW and PZ relays and preventing the proper transmission of the wink signal and trunk test condition. This resulted in stuck senders at the originating office.
  - 6.11 A 400E diode is added in the locking circuit of the PW relay to reduce its release time.
  - 6.12 A minor wiring change is made in the locking circuit of the PZ relay to prevent its release on a called subscribers flash.
  - 6.2 The Current Data for this circuit is not affected by changes in this issue.
  - 6.3 Equipment information is affected and will be covered by drawing J29201AP-( ).
  - 6.4 Equipment Design Requirements are not affected.
- No engineering letter will be issued.

CIRCUIT DESCRIPTION

CD-20746-01  
ISSUE 2D  
APPENDIX 2B  
DWG ISSUE 4B

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

B. Changes in Apparatus

B.1 REMOVED

Relay PW, AG9, Z Option

REPLACED BY

Relay PW, AF531, Y Option

D. Description of Changes

D.1 Due to the change in the locking circuit of the PZ relay made on Issue 3AR, the PW relay is no longer required to be slow release. The slow release AG9 relay PW is designated Z option and is rated Mfr Disc. It is replaced by the Y option, AF531, relay which is faster release and reduces the unguarded interval on the sleeve lead of the trunk.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-WMS-JEM

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

## CHANGES

B. Changes in ApparatusB.1 ADDED

Diode RL, 400E

D. Description of Changes

D.1 This circuit is reissued to eliminate a trouble condition which caused originating senders to stick when the circuit was seized, immediately after calling subscriber disconnect from a pervious no-answer call. This was due to the slow release PW relay holding operated from the previous call. To correct this condition, a diode is inserted in the locking path of the PW relay to reduce its release time. The locking circuit of the PZ relay is changed to connect directly to the sleeve instead of through make contact 6 of the PW relay.

F. Changes in CD SectionsF.1 In 2, Section II, add:

2.04 Diode

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
RL	Release	Prevents delay in release of PW relay.

F.2 Change 4, Section II, to read as follows:

4.01 When the called subscriber disconnects, relay WK releases. When the calling subscriber disconnects, ground is removed from the sleeve lead releasing the PZ relay and making the circuit available for other calls.

4.02 On calling subscriber disconnect from a no-answer call, ground is removed from the sleeve lead releasing the PW and PZ relays which were locked in parallel. The RL diode prevents the surge from the PZ relay from entering the PW relay winding and delaying its release.

*delayed by  
iss 5B*

*cancelled by  
iss 5B  
RL diode removed*

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-WMS-JEM

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

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MAR 18 1965  
JO

DRAWING NOTICE

SD-20746-01

CD 2D

RATING A & M Only

SYSTEM Panel

DATE January 20, 1965

ISSUE 2D  
APP.

TITLE

Panel Systems - OUTGOING TRUNK CIRCUIT - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 and No. 5 Crossbar Local Offices

DESCRIPTION

- 6.1 Reissued sheets 1, 2, 3  
Total reissued sheets 3
- 6.2 This circuit is reissued to standardize its use in completing local  
calls from a Panel Office on an MF basis to No. 1 or No. 5 Crossbar  
local office.
- 6.21 This requires only a change in circuit title.

The circuit title formerly read:

Panel Systems  
Outgoing Trunk Circuit  
For Direct Distance Dialing  
For Non-AMA Offices

- 6.3 To insure toll grade transmission in this trunk, a limit is applied  
to the allowable unbalance between the capacitors in the tip and  
ring leads. This is covered by a circuit note which is added.
- 6.4 The Current Drain Data for this circuit is not affected by changes  
on this issue.
- 6.5 D change. Does not require WECO notification to Tel Co.
- 6.6 Equipment information will be covered by drawing J-29201AP.
- 6.7 Equipment Design Requirements are not affected.

No engineering letter will be issued.



PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is intended for use in panel offices which are arranged to complete on a multifrequency basis either direct distance dialed calls through non-AMA crossbar tandem offices or local calls to No. 1 or No. 5 crossbar local offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 When this circuit is seized by a district or office selector, battery and ground from the tandem or local office incoming trunk, through the windings of relay WK, is connected to the district or office selector circuit. Relay WK does not operate at this time because the incoming trunk is in the on-hook condition. *oper. of WK is under control of (S)*

1.02 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.01 When the incoming trunk goes to the off-hook condition at the start of the wink signal, relay WK operates, and in turn, operates relay PW. Relay PW locks to the sleeve. When the incoming trunk goes back to the on-hook condition at the end of the wink signal, relay WK releases and in turn, operates relay PZ. With relays PW and PZ both operated, inductor TC is bridged across

2. FUNCTIONAL DESIGNATIONS2.01 Relay

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
WK	Wink	Registers on-hook or off-hook conditions of incoming trunk.
PW	Pulse W	Counts polarity reversals of incoming trunk.
PZ	Pulse Z	Counts polarity reversals of incoming trunk.

2.02 Inductor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
TC	Trunk Closure	Applies bridge across incoming trunk during district talking selections.

2.03 Jack

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
TST	Test	Used to test relay WK.

the tip and ring to hold the incoming trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.01 When the called subscriber answers, the incoming trunk goes to an off-hook condition and operates relay WK. Relay WK operated, releases relay PW which in turn, opens the inductance bridge across the tip and ring.

4. DISCONNECT

4.01 When the called subscriber disconnects, relay WK releases which in turn, releases relay PZ restoring this circuit to normal. When the calling subscriber disconnects, ground is removed from the sleeve lead making the circuit available for other calls.

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 Combined originating and terminating circuits:

Maximum external circuit loop resistance 4,000 ohms

Minimum insulation resistance 30,000 ohms

1.02 Working voltage 45 to 50 volts

1.03 Earth potential  $\pm 20$  volts

3. FUNCTIONS

5.01 Recognizes on-hook and off-hook conditions presented by the tandem or local office incoming trunk.

02 Places an inductor across the tip and ring conductors to bridge an opening which occurs while district talking selections are being completed.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

- (a) District Selector Circuit - SD-21630-01.
- (b) Office Selector Circuit - ES-240252.
- (c) Tandem Office Incoming Trunk Circuit - SD-25887-01.
- (d) OGT Test and MB Jack Circuit - SD-96376-01.
- (e) No. 1 Crossbar Incoming Trunk Circuit - SD-26204-01.
- (f) No. 5 Crossbar Incoming Trunk Circuit - SD-26070-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the

requirements listed in the Circuit Requirements tables.

5.02 The capacitance of capacitors T and R shall not differ by more than 0.11 pf.

SECTION IV - REASONS FOR REISSUEA. Changed and Added Functions

A.1 The use of this circuit is expanded to include completion of local calls from a panel office to a crossbar No. 1 or 5 office on a multifrequency basis.

B. Changes in ApparatusB.1 REPLACEDREPLACED BY

T and R Capacitors, T and R Capacitors,  
437A 437QA

D. Description of Changes

D.1 Prior to this issue the circuit title read as follows:

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
FOR DIRECT DISTANCE DIALING  
FOR NON-AMA OFFICES

D.2 The code of the T and R capacitors is changed without record to agree with WECO drawings.

D.3 Circuit Note 105 is added to limit the unbalance of the T and R capacitors to insure toll grade transmission in this trunk.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-JLB-JEM

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

SD-20746-01

CD 1

ISSUE 1  
APP.

## DRAWING NOTICE

RATING A&amp;M Only

SYSTEM Panel - Ckt.

DATE December 27, 1956

## TITLE

Panel Systems - Outgoing Trunk Circuit - For Direct Distance Dialing -  
To Non-AMA Offices

## DESCRIPTION

6.1 This outgoing trunk circuit is intended for use in panel offices which are arranged to complete direct distance dialing calls through non-AMA crossbar tandem offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

6.11 This circuit consists of:

- 1 - AG Type Relay
- 1 - AF Type Relay
- 1 - 280 Type Relay
- 1 - 274 Type Inductor
- 1 - 290 Type Jack
- 2 - 4UF Capacitors

6.2 Current Drains will be available about 4-1-57.

6.3 Equipment information will be covered by J-29201AP.

6.4 Equipment Design Requirements are covered in BSP Section AA220.010 (J-29201), Iss. 12.

No engineering letter will be issued.



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APP.SD-20746-01  
CD 1

## DRAWING NOTICE

RATING A&M Only  
SYSTEM Panel - Ckt.  
DATE December 27, 1956

## TITLE

Panel Systems - Outgoing Trunk Circuit - For Direct Distance Dialing -  
To Non-AMA Offices

## DESCRIPTION

6.1 This outgoing trunk circuit is intended for use in panel offices which are arranged to complete direct distance dialing calls through non-AMA crossbar tandem offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

6.1.1 This circuit consists of:

- 1 - AG Type Relay
- 1 - AF Type Relay
- 1 - 280 Type Relay
- 1 - 274 Type Inductor
- 1 - 290 Type Jack
- 2 - 4UF Capacitors

6.2 Current Drains will be available about 4-1-57.

6.3 Equipment information will be covered by J-29201AP.

6.4 Equipment Design Requirements are covered in BSP Section AA220.010 (J-29201), Iss. 12.

No engineering letter will be issued.

CIRCUIT DESCRIPTION  
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-20746-01  
Issue 1  
Dwg. Issue 1

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
FOR DIRECT DISTANCE DIALING  
TO NON-AMA OFFICES

SECTION I - GENERAL DESCRIPTION

This circuit is intended for use in panel offices which are arranged to complete direct distance dialing calls through non-AMA crossbar tandem offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION

1. SEIZURE

1.1 When this circuit is seized by a district or office selector, battery and ground from the crossbar tandem trunk, through the windings of relay WK, is connected to the district or office selector circuit. Relay WK does not operate at this time because the tandem trunk is in the "on hook" condition.

1.2 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.1 When the tandem trunk goes to the "off-hook" condition at the start of the wink signal, relay WK operates, and in turn operates relay PW. Relay PW locks to the sleeve. When the tandem trunk goes back to the "on-hook" condition at the end of the wink signal, relay WK releases and in turn operates relay PZ. With relays PW and PZ both operated, inductor TC is

bridged across the tip and ring to hold the tandem trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.1 When the called subscriber answers, the tandem trunk goes to an "off-hook" condition and operates relay WK. Relay WK operated releases relay PW which in turn opens the inductance bridge across the tip and ring.

4. DISCONNECT

4.1 When the called subscriber disconnects, relay WK releases which in turn releases relay PZ restoring this circuit to normal. When the calling subscriber disconnects, ground is removed from the sleeve lead making the circuit available for other calls.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.1	Combined originating and terminating circuits	
	Max. external circuit loop resistance	4,000 ohms
	Min. insulation resistance	30,000 ohms
1.2	Working voltage	45-50 volts
1.3	Earth potential	± 20 volts

2. FUNCTIONAL DESIGNATIONS

Relay	Meaning	Primary Functions
WK	Wink	Registers "on-hook" or "off-hook" conditions of tandem trk.
PW	Pulse W	Counts polarity reversals of tandem trunk.
PZ	Pulse Z	Counts polarity reversals of tandem trunk.
Inductor TC	Trunk Closure	Applies bridge across tandem trunk during district talking selections.
Jack TST	Test	Used to test relay WK.



3. FUNCTIONS

3.1 Recognizes "on-hook" and "off-hook" conditions presented by the crossbar tandem trunk.

3.2 Places an inductor across the tip and ring conductors to bridge an opening which occurs while district talking selections are being completed.

4. CONNECTING CIRCUITS

4.1 District Selector Circuit -  
SD-21630-01

4.2 Office Selector Circuit -  
ES-240252

4.3 Incoming Trunk Circuit -  
SD-25887-01

4.4 OGT Test and MB Jack Circuit -  
SD-96376-01

5. MANUFACTURING TEST REQUIREMENTS

This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the requirements listed in the Circuit Requirements tables.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2314-NL-CGM-QM

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

JAN 27 1969

SD-20746-01

CD 2D

RATING

SYSTEM

DATE

A&amp;M Only

Panel

October 9, 1968

ISSUE 8D

APP. 6D

## DRAWING NOTICE

DWG DIST CODE 2B99

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 The following changes is made to correct a drafting error on issue 5B.  
The WECO drawings are correct, so this is a "no record" change.
- 6.12 The R Lead from the OCT test board is removed from the 2 contact SL relay X option, and placed on the 2 make contact SL relay X option. This will agree with sketch shown in LDI 4A.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 D change. Does not require WECO notification to Telco.
- 6.4 Equipment information is not affected.
- 6.5 Equipment Design Requirements are not affected.

(A' CHG ENGR-SNULE)

Call from Petrocelli - WECO. 11-20-71.

issue 9AC.

to prevent false disc.

T option to #51B or ESS  
V opt to all other

RPP

12-1-71

CIRCUIT DESCRIPTION

NOV 27 1968  
PF

CD-20746-01  
ISSUE 2D  
APPENDIX 6D  
DWG ISSUE 8D

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

D. Description of Changes

D.1 The following change was made on a no-record basis to agree with WECO drawings. The R lead from the OGT board test and make-busy jack is removed from the 2-contact SL relay, option X, and placed on the 2-make contact SL relay, option X.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5823-EV.-MR

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

JUL 30 1968  
JCE

## DRAWING NOTICE

SD-20746-01

ISSUE 7AC

CD 2D

APP. 5AC

RATING A&amp;M Only

SYSTEM Panel

DATE May 22, 1968

DWG DIST CODE 2B99

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar Tandem -  
And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 This change provides wiring information in CAD figure 4 which was omitted on issue 5B of this drawing. This change applies to jobs having issue 5B or 6D.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 This change does not affect the plug-in units and does not require the Telco to notify WECO as to number and location of products to be changed.
- 6.4 Equipment information is not affected.
- 6.5 Equipment Design Requirements are not affected.

CIRCUIT DESCRIPTION

CD-20746-01  
ISSUE 2D  
APPENDIX 5AC  
DWG ISSUE 7AC

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

D. Description of Changes

D.1 CAD Fig. 4 is changed on circuit drawing to show fuse  
board ground and punching which was not required prior  
to Issue 5B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5643-EV-MR



JUL 2 1968  
VE

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01	ISSUE	6D
CD - 2D	APP.	4D
RATING	A&M Only	
SYSTEM	Panel	
DATE	April 9, 1968	

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-Ama Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 The "SL1" resistor is changed on this issue from 619<sup>W</sup> to 1100<sup>W</sup>. When trk is held off normal for long periods of time, the new resistor will be cooler to the touch than the former. Neither resistance is subject to excessive heating from a circuit or fire hazard standpoint. No change in circuit operation is occasioned by this substitution. This change is on a no record basis by agreement between Mr. G. Schmalz for WECO and Mr. E. Vanderveer for BTL.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 D change. Does not require WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP.
- 6.5 Equipment Design Requirements are not affected.

MAY 23 1968

CD-20746-01  
ISSUE 2D  
APPENDIX 4D  
DWG ISSUE 6D

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

B. Changes in Apparatus

B.1 Removed

Resistor 619 $\omega$

Replaced By

Resistor 1100 $\omega$

D. Description of Changes

D.1 The SL1 resistance shown on issue 5B of this drawing is changed from 619 $\omega$  to 1100 $\omega$ . The previous resistance was hot to touch, and the new one, while cooler, does not degrade performance of the circuit.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5643-EV-RM

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

SD-20746-01

CD

RATING

SYSTEM

DATE

2D

A&amp;M Only

Panel

December 6, 1967

ISSUE

APP.

5B

3B

## DRAWING NOTICE

## TITLE

Panel Systems - Outgoing Trunk Circuit - M F Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 If trunk conditions are such as to cause the WK relay of this circuit to chatter prior to completion of district talking selection, this circuit may release and reseize forward, causing a stuck sender in the remote office. X wiring and apparatus are added on this issue to overcome this malfunction. Greater protection is also obtained in respect to the unguarded interval at the Panel office, when trunk is released before called party answered.
- 6.11 This change will require the addition of an AK 24 relay, 600<sup>W</sup> resistor and an AG 33 relay to replace the present PW relay.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 B change. Requires WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP-().
- 6.5 Equipment Design Requirements are not affected.

CIRCUIT DESCRIPTION

CD-20746-01  
ISSUE 2D  
APPENDIX 3B  
DWG ISSUE 5B

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

B. Changes in Apparatus

B.1 Added

SL, SL1 - AK24 Relay  
SL1 - Resistor KS-14603,L2

B.2 Removed

Replaced By

PW-AF531 Relay PW-AG33 Relay

D. Description of Changes

D.1 FS 1 has been revised to show the addition of X wiring and apparatus. Wiring formerly not designated has been designated W option and rated Mfr Disc.

D.2 Y option is also rated Mfr Disc.

F. Changes in CD Section

F.1 In 1.01 add after first sentence: tip and ring continuity for the operation of WK relay is under the control of the SL relay. This relay is operated by the district sleeve ground.

F.2 In 4.01 add to paragraph: However tip and ring leads are held open until SL1 relay releases. SL1 relay in turn is held operated by slower releasing relays involved in the release of trunk.

F.3 Under Section III, 2.01 add:

Relays

<u>Designation</u>	<u>Meaning</u>	<u>Primary Function</u>
SL	Sleeve	Close T&R Lead
SL1	Sleeve Aux	Open T&R&S Lead

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5641-EV-RMW

OCT 22 1965  
FE

## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01	ISSUE 4B
CD 2D	APP. 2B
RATING A&M Only	
SYSTEM Panel	
DATE August 16, 1965	

## TITLE

Panel Systems - Outgoing Trunk Circuit - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 And No. 5 Crossbar Local Offices

## DESCRIPTION

- 6.1 The change applied in Issue 3AR changed the locking circuit of the PZ relay which removes the necessity of the PW relay being slow release.
- 6.11 The slow release AG9 relay is replaced by an AF531 relay to provide a faster release relay to reduce the unguarded interval on disconnect from unanswered calls.
- 6.2 The Current Drain Data for this circuit is not affected by changes in this issue.
- 6.3 B change. Requires WECO notification to Tel Co.
- 6.4 Equipment information is affected and will be covered by drawing J29201AP.
- 6.5 Equipment Design Requirements are not affected.

No engineering letter will be issued.



## AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK, N.Y. 10007

## DRAWING NOTICE

SD-20746-01

CD 2D

RATING A&amp;M Only

SYSTEM Panel

DATE August 16, 1965

ISSUE 3AR  
APP. 1AR

## TITLE

Panel Systems - OUTGOING TRUNK CIRCUIT - MF Pulsing - To Non-AMA Crossbar Tandem -  
And No. 1 and No. 5 Crossbar Local Offices.

## DESCRIPTION

- 6.1 This circuit is reissued to correct a trouble condition which occurred on high usage trunk groups when the circuit was immediately resealed after calling subscriber disconnect from a previous don't answer call. The PW relay which in slow release held upon the succeeding call changing the sequence of operation of the PW and PZ relays and preventing the proper transmission of the wink signal and trunk test condition. This resulted in stuck senders at the originating office.
- 6.11 A 400E diode is added in the locking circuit of the PW relay to reduce its release time.
- 6.12 A minor wiring change is made in the locking circuit of the PZ relay to prevent its release on a called subscribers flash.
- 6.2 The Current Data for this circuit is not affected by changes in this issue.
- 6.3 Equipment information is affected and will be covered by drawing J29201AP-( ).
- 6.4 Equipment Design Requirements are not affected.

No engineering letter will be issued.

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

CHANGES

B. Changes in Apparatus

B.1 REMOVED

Relay PW, AG9, Z Option

REPLACED BY

Relay PW, AF531, Y Option

D. Description of Changes

D.1 Due to the change in the locking circuit of the PZ relay made on Issue 3AR, the PW relay is no longer required to be slow release. The slow release AG9 relay PW is designated Z option and is rated Mfr Disc. It is replaced by the Y option, AF531, relay which is faster release and reduces the unguarded interval on the sleeve lead of the trunk.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-WMS-JEM

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

## CHANGES

B. Changes in ApparatusB.1 ADDED

Diode RL, 400E

D. Description of Changes

D.1 This circuit is reissued to eliminate a trouble condition which caused originating senders to stick when the circuit was seized, immediately after calling subscriber disconnect from a previous no-answer call. This was due to the slow release PW relay holding operated from the previous call. To correct this condition, a diode is inserted in the locking path of the PW relay to reduce its release time. The locking circuit of the PZ relay is changed to connect directly to the sleeve instead of through make contact 6 of the PW relay.

F. Changes in CD Sections

F.1 In 2, Section II, add:

## 2.04 Diode

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
RL	Release	Prevents delay in release of PW relay.

F.2 Change 4, Section II, to read as follows:

4.01 When the called subscriber disconnects, relay WK releases. When the calling subscriber disconnects, ground is removed from the sleeve lead releasing the PZ relay and making the circuit available for other calls.

4.02 On calling subscriber disconnect from a no-answer call, ground is removed from the sleeve lead releasing the PW and PZ relays which were locked in parallel. The RL diode prevents the surge from the PZ relay from entering the PW relay winding and delaying its release.

*delayed by  
iss 5C*

*cancelled by  
iss 5C  
RL diode removed*

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-WMS-JEM

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK, N.Y. 10007

MAR 18 1965  
JO

DRAWING NOTICE

SD-20746-01  
CD 2D  
RATING A & M Only  
SYSTEM Panel  
DATE January 20, 1965

ISSUE 2D  
APP.

TITLE

Panel Systems - OUTGOING TRUNK CIRCUIT - MF Pulsing - To Non-AMA Crossbar  
Tandem - And No. 1 and No. 5 Crossbar Local Offices

DESCRIPTION

- 6.1 Reissued sheets 1, 2, 3  
Total reissued sheets 3
- 6.2 This circuit is reissued to standardize its use in completing local  
calls from a Panel Office on an MF basis to No. 1 or No. 5 Crossbar  
local office.
- 6.21 This requires only a change in circuit title.

The circuit title formerly read:

Panel Systems  
Outgoing Trunk Circuit  
For Direct Distance Dialing  
For Non-AMA Offices

- 6.3 To insure toll grade transmission in this trunk, a limit is applied  
to the allowable unbalance between the capacitors in the tip and  
ring leads. This is covered by a circuit note which is added.
- 6.4 The Current Drain Data for this circuit is not affected by changes  
on this issue.
- 6.5 D change. Does not require WECO notification to Tel Co.
- 6.6 Equipment information will be covered by drawing J-29201AP.
- 6.7 Equipment Design Requirements are not affected.

No engineering letter will be issued.

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES

SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is intended for use in panel offices which are arranged to complete on a multifrequency basis either direct distance dialed calls through non-AMA crossbar tandem offices or local calls to No. 1 or No. 5 crossbar local offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 When this circuit is seized by a district or office selector, battery and ground from the tandem or local office incoming trunk, through the windings of relay WK, is connected to the district or office selector circuit. Relay WK does not operate at this time because the incoming trunk is in the on-hook condition. *oper. of WK is under control of (S<sub>1</sub>)*

1.02 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.01 When the incoming trunk goes to the off-hook condition at the start of the wink signal, relay WK operates, and in turn, operates relay PW. Relay PW locks to the sleeve. When the incoming trunk goes back to the on-hook condition at the end of the wink signal, relay WK releases and in turn, operates relay PZ. With relays PW and PZ both operated, inductor TC is bridged across

2. FUNCTIONAL DESIGNATIONS2.01 Relay

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
WK	Wink	Registers on-hook or off-hook conditions of incoming trunk.
PW	Pulse W	Counts polarity reversals of incoming trunk.
PZ	Pulse Z	Counts polarity reversals of incoming trunk.

2.02 Inductor

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
TC	Trunk Closure	Applies bridge across incoming trunk during district talking selections.

2.03 Jack

<u>Designation</u>	<u>Meaning</u>	<u>Primary Functions</u>
TST	Test	Used to test relay WK.

the tip and ring to hold the incoming trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.01 When the called subscriber answers, the incoming trunk goes to an off-hook condition and operates relay WK. Relay WK operated, releases relay PW which in turn, opens the inductance bridge across the tip and ring.

4. DISCONNECT

4.01 When the called subscriber disconnects, relay WK releases which in turn, releases relay PZ restoring this circuit to normal. When the calling subscriber disconnects, ground is removed from the sleeve lead making the circuit available for other calls. *see issue 573.*

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 Combined originating and terminating circuits:

Maximum external circuit loop resistance 4,000 ohms

Minimum insulation resistance 30,000 ohms

1.02 Working voltage 45 to 50 volts

1.03 Earth potential  $\pm 20$  volts



3. FUNCTIONS

- 3.01 Recognizes on-hook and off-hook conditions presented by the tandem or local office incoming trunk.
- 3.02 Places an inductor across the tip and ring conductors to bridge an opening which occurs while district talking selections are being completed.

CONNECTING CIRCUITS

- 4.01 When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

- (a) District Selector Circuit - SD-21630-01.
- (b) Office Selector Circuit - ES-240252.
- (c) Tandem Office Incoming Trunk Circuit - SD-25887-01.
- (d) OGT Test and MB Jack Circuit - SD-96376-01.
- (e) No. 1 Crossbar Incoming Trunk Circuit - SD-26204-01.
- (f) No. 5 Crossbar Incoming Trunk Circuit - SD-26070-01.

5. MANUFACTURING TESTING REQUIREMENTS

- 5.01 This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the

requirements listed in the Circuit Requirements tables.

- 5.02 The capacitance of capacitors T and R shall not differ by more than 0.11  $\mu$ f.

SECTION IV - REASONS FOR REISSUEA. Changed and Added Functions

- A.1 The use of this circuit is expanded to include completion of local calls from a panel office to a crossbar No. 1 or 5 office on a multifrequency basis.

B. Changes in ApparatusB.1 REPLACED REPLACED BY

T and R Capacitors, T and R Capacitors,  
437A 437QA

D. Description of Changes

- D.1 Prior to this issue the circuit title read as follows:

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
FOR DIRECT DISTANCE DIALING  
FOR NON-AMA OFFICES

- D.2 The code of the T and R capacitors is changed without record to agree with WECO drawings.

- D.3 Circuit Note 105 is added to limit the unbalance of the T and R capacitors to insure toll grade transmission in this trunk.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2364-JLB-JEM

AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
195 BROADWAY, NEW YORK 7

## DRAWING NOTICE

SD-20746-01

CD 1

RATING A&amp;M Only

SYSTEM Panel - Ckt.

DATE December 27, 1956

ISSUE  
APP.

## TITLE

Panel Systems - Outgoing Trunk Circuit - For Direct Distance Dialing -  
To Non-AMA Offices

## DESCRIPTION

6.1 This outgoing trunk circuit is intended for use in panel offices which are arranged to complete direct distance dialing calls through non-AMA crossbar tandem offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

6.11 This circuit consists of:

- 1 - AG Type Relay
- 1 - AF Type Relay
- 1 - 280 Type Relay
- 1 - 274 Type Inductor
- 1 - 290 Type Jack
- 2 - 4UF Capacitors

6.2 Current Drains will be available about 4-1-57.

6.3 Equipment information will be covered by J-29201AP.

6.4 Equipment Design Requirements are covered in BSP Section AA220.010 (J-29201), Iss. 12.

No engineering letter will be issued.

CIRCUIT DESCRIPTION  
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-20746-01  
Issue 1  
Dwg. Issue 1

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
FOR DIRECT DISTANCE DIALING  
TO NON-AMA OFFICES

SECTION I - GENERAL DESCRIPTION

This circuit is intended for use in panel offices which are arranged to complete direct distance dialing calls through non-AMA crossbar tandem offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION

1. SEIZURE

1.1 When this circuit is seized by a district or office selector, battery and ground from the crossbar tandem trunk, through the windings of relay WK, is connected to the district or office selector circuit. Relay WK does not operate at this time because the tandem trunk is in the "on hook" condition.

1.2 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.1 When the tandem trunk goes to the "off-hook" condition at the start of the wink signal, relay WK operates, and in turn operates relay PW. Relay PW locks to the sleeve. When the tandem trunk goes back to the "on-hook" condition at the end of the wink signal, relay WK releases and in turn operates relay PZ. With relays PW and PZ both operated, inductor TC is

bridged across the tip and ring to hold the tandem trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.1 When the called subscriber answers, the tandem trunk goes to an "off-hook" condition and operates relay WK. Relay WK operated releases relay PW which in turn opens the inductance bridge across the tip and ring.

4. DISCONNECT

4.1 When the called subscriber disconnects, relay WK releases which in turn releases relay PZ restoring this circuit to normal. When the calling subscriber disconnects, ground is removed from the sleeve lead making the circuit available for other calls.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.1	Combined originating and terminating circuits	
	Max. external circuit loop resistance	4,000 ohms
	Min. insulation resistance	30,000 ohms
1.2	Working voltage	45-50 volts
1.3	Earth potential	± 20 volts

2. FUNCTIONAL DESIGNATIONS

Relay	Meaning	Primary Functions
WK	Wink	Registers "on-hook" or "off-hook" conditions of tandem trk.
PW	Pulse W	Counts polarity reversals of tandem trunk.
PZ	Pulse Z	Counts polarity reversals of tandem trunk.
Inductor TC	Trunk Closure	Applies bridge across tandem trunk during district talking selections.
Jack TST	Test	Used to test relay WK.

3. FUNCTIONS

- 3.1 Recognizes "on-hook" and "off-hook" conditions presented by the crossbar tandem trunk.
- 3.2 Places an inductor across the tip and ring conductors to bridge an opening which occurs while district talking selections are being completed.

4. CONNECTING CIRCUITS

- 4.1 District Selector Circuit - SD-21630-01

- 4.2 Office Selector Circuit - ES-240252

- 4.3 Incoming Trunk Circuit - SD-25887-01

- 4.4 OGT Test and MB Jack Circuit - SD-96376-01

5. MANUFACTURING TEST REQUIREMENTS

This circuit shall be capable of performing the functions outlined in this circuit description and shall meet the requirements listed in the Circuit Requirements tables.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2314-NL-CGM-GM

PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM,  
NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

CHANGES

B. Changes in Apparatus (Components)

B.1 Added

Diode SL, Option M, Code 446F

D. Description of Changes

D.1 Option K is added to provide a make-busy arrangement which eliminates the need to monitor trunks, wired per option T, during the make-busy procedure.

D.2 Option M is added to reduce the unguarded sleeve interval between overlapping calls.

F. Changes in Description of Operation

F.1 Changes in description, required by addition of options K and M, are shown in Issue 3AC.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR



PANEL SYSTEMS  
OUTGOING TRUNK CIRCUIT  
MF PULSING  
TO NON-AMA CROSSBAR TANDEM  
AND NO. 1 AND NO. 5 CROSSBAR LOCAL OFFICES  
AND NO. 1 ESS OFFICES

SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is intended for use in panel offices which are arranged to complete on a multifrequency basis direct distance dialed calls through non-AMA crossbar tandem offices, local calls to ESS No. 1 offices, or local calls to No. 1 or No. 5 crossbar local offices. It provides trunk closure during district talking selections to hold the incoming trunk during these selections.

SECTION II - DETAILED DESCRIPTION1. SEIZURE

1.01 When this circuit is seized by a district or office selector, battery and ground from the tandem or local office incoming trunk, through the windings of relay WK, are connected to the district or office selector circuit. Tip and ring continuity for the operation of WK relay is under the control of the SL relay. This relay is operated by the district sleeve ground. Relay WK does not operate at this time because the incoming trunk is in the on-hook condition.

1.02 On seizure, the district or office selector also connects ground to lead S to make this circuit test busy to other hunting selectors.

2. WINK SIGNAL

2.01 When the incoming trunk goes to the off-hook condition at the start of the wink signal, relay WK operates, and in turn, operates relay PW. Relay PW locks to the sleeve. When the incoming trunk goes back to the on-hook condition at the end of the wink signal, relay WK releases, and, in turn, operates relay PZ. With relays PW and PZ both operated, inductor TC is bridged across the tip and ring to hold the incoming trunk during district talking selections.

3. CALLED SUBSCRIBER ANSWERS

3.01 If option S or V is wired, when the called subscriber answers and the incoming trunk goes to an off-hook condition, relay WK

operates. If option T is wired, the answer reversal permits WK to operate when the district selector closes its CS relay bridge after talk selection. The operated WK relay releases relay PW, which in turn opens the inductance bridge across the tip and ring. Option R (resistor TC) is required when option T is wired. Resistor TC increases the impedance of the TC bridge to provide sufficient current for WK operation.

4. DISCONNECT

4.01 When the called subscriber disconnects, relay WK releases. When the calling subscriber disconnects, ground is removed from the sleeve lead, releasing the PZ relay and making the circuit available for other calls. However, tip and ring leads are held open until relay SL1 releases.

4.02 On calling subscriber disconnect from a no-answer call, ground is removed from the sleeve lead, releasing the PW and PZ relays which were locked in parallel. The RL diode (option W) prevents the surge from the PZ relay from entering the PW relay winding and delaying its release.

4.03 Option M reduces the unguarded sleeve interval between overlapping calls. Option M changes the shunt ground on relay SL1 from 4M of SL to the district sleeve. Thus, SL1 operates when district release removes ground from the sleeve, eliminating the release time of relay SL. Diode SL of option M prevents an increase in release time of SL and prevents SL lockup over the K option make-busy lead.

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 Combined originating and terminating circuits:

- (a) Maximum external circuit loop resistance: 4,000 ohms.
- (b) Minimum insulation resistance: 30,000 ohms.

1.02 Working voltage: 45 to 50 volts.

D. Description of Changes

D.1 Options T and V are added to permit insertion of the TC transformer bridge in the outgoing or incoming side of the T and R capacitors. Option T avoids false disconnects on calls to ESS No. 1 or No. 5 crossbar offices in which the answer reversal is received before the district selector closes its CS relay bridge after talk selection.

D.2 Resistor TC (option R) is added to increase the current over the district loop

for operation of relay CS in the district circuit.

D.3 Option S is added to indicate the connecting wiring to transformer TC prior to Issue 9AC.

D.4 The title of the circuit is expanded to include connection to ESS No. 1 offices.

D.5 Paragraphs 4.03 and 6.02 are added to describe changes of Appendix 1B, Drawing Issue 10B.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5223-JFT-MR