

CIRCUIT DESCRIPTION

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

CD-65752-01
ISSUE 13B
APPENDIX 8D
DWG ISSUE 43D

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

B. Changes in Apparatus

B.1 Added

FF Capacitor, KS-19658, L42, 50 μ F, Option WG, App Fig. 1

FF Resistor, KS-20289, L6C, 100 Ohms, Option WG, App Fig. 1

D. Description of Changes

D.1 A momentary open toward the serving central office can be generated when a station flashes to transfer an incoming call when series 300 features are provided. This momentary open can cause a disconnect on a call originated from toll switchboards equipped with flashing recall. The momentary open (20 to 40 ms) is caused by relays FF and CT releasing simultaneously during a call transfer request for dial tone. Option WG is added as a feature option to be specified in addition to option ZX when the dial transfer station controlled feature is specified. Option WG provides a resistor - capacitor network across the winding of relay FF to slow its release. This gives relay CT time to re-operate before relay FF releases, thus preventing the momentary open from being sent to the serving central office. Option WG adds resistor FF (KS-20289, L6C, 100 ohms) and capacitor FF (KS-19658, L42, 50 μ F).

Note: App Fig. 7 (relay DRA), which was added on issue 34B, must also be added to units older than issue 34B. Option WG uses contact 3M of relay DRA to disconnect the added RC network when relay FF is released so that relay FF has a fast-operate, slow-release characteristic.

D.2 Option WH is added as a feature option to be specified in addition to option ZW when the dial transfer station controlled feature is not required. Option WH opens the path that provides audible ringback when a station flashes to recall the attendant. Audible ringback is not wanted for series 300 operation.

D.3 Option ZT is removed from Circuit Note 102 to correct a drafting error. Option ZT is the opposite option to App Fig. 5 and should not be specified when App Fig. 5 is furnished.

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DEPT 3223-GLH-FKB

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CIRCUIT DESCRIPTION

CD-65752-01
ISSUE 13B
APPENDIX 7D
DWG ISSUE 42D

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

- D.1 The title of FS6 is changed to add reference to an ESS central office.
- D.2 Circuit Note 102 is changed to show App Fig. 5 provided when 2-way CO trunk is connected to an ESS central office.
- D.3 Option WF is rated Mfr Disc.

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DEPT 3223-WVS-FLS

CIRCUIT DESCRIPTION

CD-65752-01
ISSUE 13B
APPENDIX 6D
DWG ISSUE 41D

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

D.1 The rating of this circuit is changed from AT&TCo
Standard to A&M Only.

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DEPT 3224-WVS-RVL

CIRCUIT DESCRIPTION

CD-65752-01
ISSUE 13B
APPENDIX 5B
DWG ISSUE 40B

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

B. Changes in Apparatus

B.1 Added

HD diode, 446F, App Fig. 1, option WF

D. Description of Changes

D.1 Option WF is added as Standard to prevent relay HD from releasing when the marker releases relay HM. Relay HM is released to reset the trunk hold magnet when the marker is connecting the trunk on a busy link during a camp-on connection.

D.2 The Apparatus Index is changed to add diode HD.

D.3 The Option Index is corrected to add option WF.

D.4 Circuit Note 104 is revised to reflect Issue 40B.

D.5 Information Note 303 is changed to correct some J list numbers and add SD issues for reference.

D.6 The No. 1 contact of relay S1 is changed due to a drafting error.

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DEPT 3224-WVS-RVL

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CIRCUIT DESCRIPTION

CD-65752-01
ISSUE 13B
APPENDIX 4B
DWG ISSUE 39B

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

- D.1 Option WD is designated and option WE is added.
- D.2 Circuit Note 102 is revised to change the central office information for trunks.
- D.3 Circuit Note 104 is revised to reflect Issue 39B.
- D.4 Circuit Notes 120 and 121 are added.

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DEPT 3224-WVS-RVL

CIRCUIT DESCRIPTION

CD-65752-01
ISSUE 13B
APPENDIX 3B
DWG ISSUE 38B

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

- D.1 Diode S1 is added to the Apparatus Index.
- D.2 Options WB and WC are added to the Option Index.
- D.3 Option WB is designated and rated Standard.
- D.4 Option WC is added as standard.
- D.5 Circuit Note 102 is revised to include reference to option WC.
- D.6 Circuit Note 104 is revised to reflect Issue 38B.
- D.7 Information Note 303 is expanded.

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DEPT 3221-WVS-RGP

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PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

- D.1 Option XZ is added as standard to provide cut-through of the trunk on night connections when working into a step-by-step central office.
- D.2 Option XY is added as standard to provide power failure transfer for trunks 5, 6, and 7.
- D.3 Option WS is added as standard to permit the attendant to reenter a trunk after making an error in dialing an outgoing central office call to a station.
- D.4 Options WA, XZ, and XY are added to the Option Index.
- D.5 Reference to the 402C tone generator is added to the cordless position circuit as shown in FS7.
- D.6 Circuit Notes 102 and 104 are revised to reflect Issue 37B.
- D.7 Circuit Note 107 is changed from Mfr Disc. to Standard and now includes reference to option WA.
- D.8 Information Note 303 is added.

BELL TELEPHONE LABORATORIES, INCORPORATED
DEPT 3221-WVS-RGP

PBX SYSTEMS
NO. 756A
TWO-WAY TRUNK CIRCUIT
TO CENTRAL OFFICE

CHANGES

D. Description of Changes

- D.1 This circuit is reissued to upgrade the transmission on night connections. On Issue 32B, the introduction of option XO inadvertently removes the S capacitor from across the winding of relay S, thus degrading the transmission. This is corrected by placing the S capacitor directly across the winding of relay S.
- D.2 On sheets A1 and A2, the Sheet Index is brought up to date.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 3221-SHA-RGP

PBX SYSTEMS
 NO. 756A
 TWO-WAY TRUNK CIRCUIT
 TO CENTRAL OFFICE

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This trunk circuit provides the supervisory, control, and transmission features required for originating and terminating calls in either direction between PBX and central office switching systems.

2. GENERAL METHOD OF OPERATION

A. General Functions

2.01 When the trunk is seized from the central office, the attendant is alerted by a flashing visual signal and an audible signal that an incoming call is awaiting answer.

2.02 After answering the call and determining what line is desired, the attendant steers into the PBX and dials the line number.

2.03 The attendant may remain on the line to announce the incoming call or may release immediately after receiving ringing induction.

2.04 If the called line is engaged, the central office trunk camps on the connection until the called line becomes idle; then it automatically cuts through and rings the line.

2.05 If the called line is already camped on and a second incoming central office trunk tries to establish connection to it, the trunk circuit returns a camp-on stop visual and audible indication to the attendant who then disconnects the initiated call and notifies the calling party of the busy line condition.

2.06 When a line within the PBX originates a call to the central office, the central office trunk circuit acts as a screening device either to allow or to deny toll calls.

2.07 As soon as a toll-denied line connects to a toll circuit, the central office trunk circuit disconnects the line from the toll connection and diverts it to busy tone.

2.08 A restricted line wanting an outgoing central office connection has to dial the attendant trunk code rather than the central office code.

2.09 After receiving the required information, the attendant places a hold on the attendant trunk circuit and calls the desired number over a central office trunk.

2.10 When the called party answers, the attendant holds the central office connection and steers into the PBX for local dial tone by operating the hold key.

2.11 When local dial tone is heard, the dial-back key is operated; then the attendant dials the calling restricted line number.

2.12 Under this condition, the central office trunk circuit cuts through to the line and causes the line connection held by the attendant trunk to be released.

2.13 Night service connections are established by the attendant between any idle central office trunk circuit and any PBX station.

2.14 Incoming calls can be answered from any PBX station when the PBX is provided with an auxiliary position circuit as a special service circuit and the attendant places the PBX on remote trunk answer operation. The central office trunk functions in a manner similar to that which occurs when the attendant answers and completes an incoming trunk call.

B. Options Applying to the Attendant

2.15 Optional features are provided to permit or prevent the attendant from entering the trunk circuit:

- (a) Lockout or nonlockout.
- (b) Restriction or without restriction.

2.16 The nonlockout option permits the attendant to reenter, at any time, any connection which the attendant has previously established.

2.17 Lockout prevents reentering an attendant established connection. However, the attendant may reenter the trunk circuit on a recall, camp-on, or camp-on busy condition.

2.18 With restriction, the attendant is prevented from gaining access to the trunk in order to originate a call. The attendant, however, is not prevented from gaining access to the trunk on an incoming call.

2.19 When an attendant reenters the trunk circuit (after having completed a connection) on a recall or with nonlockout, the condition of reentry is determined by the secrecy option.

2.20 The secrecy option splits the connection between the central office and the PBX. The attendant is able to talk to the PBX line but the central office is prevented from hearing the conversation between the attendant and the PBX line.

C. Incoming Call to Idle Line

2.21 An incoming call from the central office alerts the attendant with a 120-IPM flashing visual signal on the trunk lamp and an audible signal. The call is answered by operating the pickup key associated with the incoming trunk signal.

2.22 When the trunk is answered, the trunk lamp lights steadily, the audible is silenced, and the attendant is connected to the central office connection.

2.23 After obtaining the number of the line wanted, the attendant operates the hold key. This changes the trunk lamp indication to a 30-IPM visual signal and steers the attendant into the PBX for local dial tone.

2.24 When the attendant completes dialing, if the called line is idle, the trunk lamp changes to a steady signal and the station lamp starts flashing at 30 IPM, indicating that the called line is being rung.

2.25 The attendant hears ringing induction and operates the release key to release the pickup key, which disconnects her from the connection. When the called line answers, the station lamp changes to a steady visual signal and the central office cuts through to the line.

D. Camp-On

2.26 If the called line is busy, the central office trunk will camp on it (provided the line is not already camped on or the PBX is not on remote trunk answer operation), transmit a 60-IPM visual signal to the station lamp, and transmit busy tone to the attendant.

2.27 The attendant then releases the pickup key which removes the tone and connects the called line to the central office. At this time, the attendant may reenter the trunk by operating the pickup key to notify the calling party of the camp-on condition.

2.28 At calling party request, the attendant may discharge the connection by operating the hold key and then releasing the pickup key or may establish a new connection by operating the hold key twice in succession to steer into the PBX for dial tone.

2.29 If the calling party wishes to remain camped on, the attendant simply releases. When a camped-on line becomes idle, the trunk cuts through and starts ringing, changing the station lamp signal from 60 IPM to 30 IPM. The answering station trips the ringing and changes the station lamp to a steady signal.

E. Camp-On Busy

2.30 If the called line is already camped on, the central office trunk circuit returns a 120-IPM station lamp signal and tone interrupted at 120 IPM to the attendant.

2.31 The attendant then operates the hold key to discharge the connection. This action steers her back to the central office trunk and she announces the camp-on busy condition to the calling party. The attendant either disconnects or establishes a connection to another line (initiated by reoperating the hold key) at calling party request.

2.32 If a busy line is encountered when the PBX is on remote trunk answer operation, the central office trunk circuit returns busy tone interrupted at 120 IPM to the PBX station that answered the call.

F. Recall

2.33 Having once established a connection, the attendant plays no further role in the call unless recalled. If the called line depresses the switchhook momentarily, the central office trunk transmits a 120-IPM station lamp signal and a steady audible signal to the attendant.

2.34 After answering the recall signal, if the central office party is to be transferred to another line, the attendant operates the hold key which disconnects the original connection. On reoperation of the hold key, the attendant once again is steered back into the PBX for dial tone and the trunk lamp flashes at 30 IPM.

G. Automatic Disconnection

2.35 At the termination of an established call, when both parties disconnect, both trunk and station lamps are extinguished and the trunk circuit is again idle.

H. Dial Back Call

2.36 The attendant is called if a restricted line desires an outgoing central office call or a toll-denied line wishes to reach the toll office. After answering the call, the attendant instructs the calling station to remain off-hook until the connection is established.

2.37 The attendant trunk is then held and an idle central office trunk is selected. The attendant operates the central office trunk pickup key, which causes the trunk lamp to light steadily, and then dials the requested number.

2.38 Having reached the requested number, the attendant operates the hold key which changes the trunk lamp signal to 30 IPM and steers the connection into the PBX for local dial tone.

2.39 The dial back key is operated; then the number of the calling station is dialed. The central office trunk circuit connects to the held calling station, causes the attendant trunk to disconnect, and causes the trunk and station lamps to light steadily.

2.40 The attendant announces the established connection to the calling station and then disconnects, connecting the central office through to the station line.

I. Outgoing Trunk Call

2.41 The trunk circuit supervises the call to see that only toll-allowed lines are permitted to gain access to toll circuits. If a toll-denied station calls for a toll connection, the central office trunk circuit functions to divert the calling line to local busy tone and the toll trunk is freed.

2.42 Nonrestricted (toll-denied or toll-allowed) stations may dial the central office directly without the aid of the attendant. When the central office trunk circuit is seized on such calls, both trunk and calling station lamps light steadily and central office dial tone is transmitted back to the calling line.

J. Power Failure and Night Connection

2.43 When the PBX has four of the permanently wired central office trunks

connected to the alarm, transfer, and test circuit the central office cable pairs of these four trunks are connected to four predetermined station line circuits whenever a power failure occurs or they may be connected as night connections by action of the attendant.

2.44 When the PBX has three of the permanently wired central office trunks connected to the alarm, transfer, and test circuit, the attendant may establish a night connection between any idle central office and any station that is idle or busy.

2.45 The attendant operates the night service key to the night service position, operates the pickup key associated with the central office trunk to be night connected, and operates the hold key which steers the connection into the PBX.

2.46 Upon receiving dial tone, the station number that is to be connected for night service is dialed and the release key is operated. The trunk will be either connected directly to the station if the station is idle, or will camp on if the station is busy. As soon as the station becomes idle, the trunk is directly connected.

2.47 In the case of a power failure, the night connections established by the attendant are disconnected, and the three central office cable pairs of the first three central office trunks are connected to three predetermined stations.

2.48 When the PBX is provided with an auxiliary position circuit (for trunk answering from any station), the attendant should establish any night service connections required before placing the PBX on remote trunk answer operation.

SECTION II - DETAILED DESCRIPTION

1. OPTIONS

A. Options Applying to or Affecting the Central Office Trunk

1.01 Optional wiring and apparatus arrangements to provide certain basic operating features of the trunk are shown in Table A.

Restricted Access

1.02 Central office trunks may be arranged for restricted or unrestricted service by the omission or addition of an option in the dial pulse register.

(a) Restricted central office trunks are denied access to other central office trunks or ringdown tie trunks but are allowed access to dial repeating tie trunks.

(b) Unrestricted central office trunks are permitted access to other central office trunks, ringdown tie trunks, or dial repeating tie trunks.

B. Options Applying to the Attendant

1.03 Options related to lockout, secrecy, and restrictions are shown in Table B. These options determine the conditions under which the attendant may gain access to the trunk; they may be provided singly or in combination.

Basic Attendant Functions

1.04 Regardless of the option furnished, the attendant may do the following:

- (a) Answer incoming calls.
- (b) Reconnect to a trunk previously placed on hold.
- (c) Reconnect to a trunk any time before the called party answers.
- (d) Reconnect in response to a recall signal on any connection previously established.

1.05 In addition, regardless of the options provided, the attendant is denied access to any outgoing trunk (dial 9) connection.

TABLE A

OPTIONS APPLYING TO BASIC OPERATING CONDITIONS

OPTION	FEATURE
T	Provides for wiring certain trunks to certain station line circuits via the alarm, transfer, and test circuit.
V	Provides wiring for trunks not wired to the station line circuit via the alarm, transfer, and test circuit.
S	Arranges relay H to function with central offices having a battery voltage of 40 or more volts.
R	Arranges relay H to function with central offices having a battery voltage of 39 or less volts. (With 39 or less volts, relay H bridged across the trunk with both windings will not get enough current to operate.)
J(MD), YP, YQ	Arrange(s) the trunk for two-way assigned service (allows the trunk to be seized by the marker).
K	Arranges the trunk for unassigned or one-way incoming service (prevents the trunk from being seized by the marker).
F(MD)	Arranges the trunk in conjunction with option T for a fixed night connection.
E(MD), ZJ(MD), YM	Arranges the trunk so that the attendant may connect any station to any trunk for a night connection.

TABLE A (CON'T)

OPTIONS APPLYING TO BASIC OPERATING CONDITIONS

OPTION	FEATURE
8	Improves station telephone set transmission characteristics whenever 72-volt central office battery is provided.
XP	Arranges the trunk for 48-volt central office battery operation.

TABLE B

OPTIONS APPLYING TO ATTENDANT FEATURES
OF LOCKOUT, RESTRICTION AND SECRECY

OPTION	FEATURE
Z(MD),XK	<u>Without Lockout</u> - Attendant may reenter a trunk connection previously established.
Omit Z(MD),XK	<u>With Lockout</u> - Attendant may reenter the trunk before the called party answers or in response to a recall signal.
X(MD) Omit Y	<u>With Restriction</u> - Attendant is prevented from originating outgoing calls over the trunk.
Y	<u>Without Restriction</u> - Attendant may originate outgoing calls over the trunk
W	<u>With Secrecy</u> - The trunk is split when the attendant reenters; the central office end is on hold and the attendant is connected to the station. <u>Note:</u> When secrecy is specified, lockout must also be provided.
Omit W	<u>Without Secrecy</u> - The attendant reenters the trunk on a bridging basis and may converse with both the calling and the called parties.

2. INCOMING CALL TO IDLE STATION (SC1)

A. Central Office Seizes and Rings
Central Office Trunk

Seizure During Silent Interval

2.01 If the trunk is seized during the silent interval of machine ringing, relay H (option R or S provided) operates on tripping battery and ringing ground, and operates relay CT (with option YB or YC).

2.02 Relay CT operated:

(a) Operates relay SR.

(b) Closes part of its locking path.

(c) Connects the central office end of the trunk to the link end of the trunk (cut-through).

(d) Opens the operating path for relay MC via lead IT(90-99) to prevent the trunk from being seized by the marker.

2.03 Relay SR operated:

(a) Lights lamp TL(CDLS POS) or L(6 BUT KEY TEL SET).

(b) Connects ground to lead IT(90-99) to busy the trunk to the marker.

(c) Transfers the ring side of the trunk through the A and B dicses for future trunk-to-marker identification.

(d) Prepares a path for holding relay CT.

(e) Connects off-normal ground to the trunk.

(f) Lights lamp TRK BY in the make busy and busy display circuit to indicate that the central office trunk has been made busy to the marker by a central office trunk call.

2.04 Subsequently ringing signal from the central office operates relay R and relay R operated:

(a) Holds relay CT operated.

(b) Grounds lead LO to the auxiliary position circuit (if option ZZ is provided - see Note 109).

(c) Operates relay R1 (option YD or YE provided).

(d) Provides ground via lead NA (option YE) to 608A or 608D cord switchboard auxiliary signal, fuse alarm, battery cut-off, and miscellaneous circuit to operate audible signal.

2.05 Relay R1 operated:

- (a) Prepares an operating path for relay ACA.
- (b) Locks operated to off-normal ground under control of relay S1.
- (c) Transfers lamp TL(CDLS POS) or L(6 BUT KEY TEL SET) from steady to 120 IPM.
- (d) Extends the continuous ringing (with option ZS) or interrupted ringing at central office rate (with option ZR) via lead BZ(0-9) to operate the audible signal.
- (e) Opens an operating path for relay HM.

2.06 Relay R follows central office ringing which causes the audible signal also to follow the ringing.

2.07 Note: Relays operated: R, CT, SR and R1. Relay R following central office ringing. Lamps L(6 BUT KEY TEL SET) or TL(CDLS POS) flashing at 120 IPM.

Seizure During Ringing Interval

2.08 If the trunk is seized during the ringing interval of machine ringing, relay R operates on the rectified voltage of the ring-up circuit and causes the operation of relay CT. The following operation is the same as that described in 2.01 through 2.07.

Ring-Up Circuit

2.09 The ring-up circuit consists of relay R and associated network of varistor E, diode D, thermistor R, and capacitor R, which serves to rectify the 20-Hz ringing voltage and prevent false line signals from operating relay R.

2.10 When ringing voltage is applied to the tip and ring of this trunk at the central office, one-half cycle of ringing current will flow through capacitor R, thermistor R and diode D, bypassing relay R; but the other half cycle will be blocked by diode D, causing the current to flow through the secondary winding of relay R, thermistor R, and capacitor R to operate relay R.

2.11 Thermistor R normally has a high resistance (over 50,000 ohms), but when ringing current is applied for about one-half second or longer, its resistance is reduced. This provides an operating path for relay R.

2.12 Varistor E has two functions:

- (a) To shunt thermistor R and thus reduce heating current through it during dialing transients. This prevents false relay operation.
- (b) To protect diode D and thermistor R by providing a shunt path which has low resistance to transient voltage peaks. The varistor has a very high resistance to normal ringing and dialing voltages.

2.13 At the end of the ring cycle, relay R releases.

B. Attendant Answers Incoming Call (SC2)

2.14 The attendant answers an incoming trunk call by operating the pick-up key associated with the flashing (120 IPM) L(6 BUT KEY TEL SET) or TL(CDLS POS) lamp. With relay R1 and the pick-up key operated and relays SP and NT in the cordless position circuit normal, relay ACA operates.

2.15 Relay ACA operated:

- (a) Operates relay AC.
- (b) Prepares a holding path under control relays AC and S1.
- (c) Connects both the line and central office end of the trunk circuit to the cordless position circuit.
- (d) Connects the attendant telephone circuit across the central office end of the trunk to trip the ringing and operate relay S.
- (e) Connects, in part, leads T and U from the cordless position circuit to the marker, and leads H, HG, HM, FB, and SP from the cordless position circuit to the trunk.
- (f) Operates relay TLA. Relay TLA operated locks operated to off-normal ground under control of relay SR.

2.16 Relay AC operated transfers the pick-up key control from relay ACA to AC and splits the trunk into a line and trunk end.

2.17 Relay S operated causes relay S1 to operate and perform the following functions:

- (a) Connects a hold circuit for relays CT and ACA.

- (b) Releases relay R1.
- (c) Connects off-normal ground to the trunk in parallel with relay SR.
- (d) Releases relay H.
- (e) Transfers lamp L(6 BUT KEY TEL SET) from 120 IPM to steady battery.
- (f) Removes ground from lead NA (option YE).

18 Relay R1 released transfers lamp TL(CDLS POS) from 120 IPM to steady battery, and silences the audible signal.

2.19 Note: Relays operated: ACA, AC, S, SI, CT, SR, and TLA. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) steady.

C. Attendant Establishes PBX Dial Tone (SC5)

2.20 If the incoming trunk call requires connection from the trunk to a line within the PBX, the attendant operates the hold key (nonlocking), causing relay H in the cordless position circuit to operate momentarily which in turn operates relay HD.

2.21 Relay HD operated:

- (a) Connects relay SL to the sleeve lead.
- (b) Prepares a path for operating relay TT.
- (c) Locks to off-normal ground.
- (d) Operates relay SP in the cordless position circuit.
- (e) Connects one section of inductor H1 across the tip and ring to hold the central office end of the trunk.
- (f) Disconnects the attendant from the trunk end.
- (g) Transfers lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) from steady battery to 30 IPM.

2.22 Cordless position circuit relay SP operated:

- (a) Connects a short circuit across leads TT and TR toward the trunk end.
- (b) Leaves the attendant telephone circuit across lead LT and LR toward the line end of the trunk.
- (c) Locks to off-normal ground.

2.23 On release of the hold key, relay H in the cordless position circuit releases and performs the following functions:

- (a) Prepares a locking path for relays RS and TT via leads H and HG.
- (b) Extends ground to leads T and U, starting the marker.

2.24 Thus, when called by the central office trunk circuit, the marker functions to connect the trunk circuit to a dial pulse register. When the selector magnet timing relay in the marker operates, ground is transmitted through the operated trunk magnet relay in the marker to operate relay HM over lead ST(90-99). The marker has thus received a bid from the trunk for connection to a dial pulse register; it proceeds to operate the trunk hold magnet to establish the connection.

2.25 Relay HM and the trunk hold magnet in the marker operate in parallel. The trunk hold magnet operated:

- (a) Closes the crosspoints which connect the loop of the attendant telephone circuit to the dial pulse register via the T and R leads. This gives the attendant PBX dial tone and connects the 100-ohm sleeve ground in the register to the sleeve lead to operate relay SL.
- (b) Locks operated with relay HM. The marker having verified that the trunk hold magnet is operated, proceeds to release.

2.26 Relay HM operated:

- (a) Holds operated to off-normal ground through operated relays HD and SL and released relay MC.
- (b) Transfers holding of relay HD from lead HD to lead H.

- (c) Opens the tens and units start lead to the marker.
- (d) Opens the operating path for relay MC.
- (e) Prepares an alternate path to hold itself and the trunk hold magnet when relays AC and ACA release.
- (f) Opens an operating path for relay ACA.
- (g) Grounds lead RTK to the auxiliary position circuit (if option ZZ is provided - see Note 109).

Note: The number 6 contact of relay HM is a test point.

2.27 Note: Relays operated: CT, HD, AC, SR, HM, TLA, SL, ACA, S1, and S. Lamp L (6 BUT KEY TEL SET) or TL(CDLS POS) flashing at 30 IPM. Cordless position relay SP operated.

2.28 When the attendant has completed dialing into the PEX, the dial pulse register receives and stores the dialed information. This completes the originating function of the call. The register then engages the marker to terminate the call. When the marker functions to terminate the call, the central office trunk circuit identifies itself to the marker as the originating circuit so that the proper connections are made.

Note: This use of the term "terminate" refers to completing the connection between the trunk and the desired (terminal) PBX station.

2.29 If the call is to a station line, the marker directs the trunk to take the following actions:

- (a) Start ringing if the line is idle.
- (b) Return camp-on information if the line is already engaged.
- (c) Return camp-on-busy indication if the line is already camped on.

2.30 If the call is to a tie trunk, the marker directs the central office trunk circuit to couple inductively to the called trunk. The tie trunk furnishes talking battery to the line side of the central office trunk circuit under this condition. If all tie trunks are busy, the marker directs the central office trunk circuit to return camp-on-busy indications.

D. Trunk to Marker Identification (SC6)

2.31 When the dial pulse register has received the dialed information from the central office trunk circuit, the register engages the marker to terminate the call and reverses battery and ground over the tip and ring of the link connection to the trunk circuit. This causes current to flow through diode A and operates relay P.

2.32 Relay P operated transfers lamp L (6 BUT KEY TEL SET) from 30 IPM to steady battery and operates relay MC.

2.33 By operating relay MC, the central office trunk circuit identifies itself to the marker as the circuit requesting information.

2.34 Relay MC operated:

- (a) Releases relay P.
- (b) Locks via lead RLS(E,0) under control of the marker.
- (c) Transfers holding of relay HM and the trunk hold magnet in the marker to lead M(E,0). Relay HM and the trunk hold magnet are controlled by the marker via lead M(E,0) while the marker is engaged in termination of the call.
- (d) Connects leads for termination information as follows:
 - (1) Connects fast flash relay FF to lead FF(E,0).
 - (2) Connects busy relay BY to lead BY(E,0).
 - (3) Connects ring start relay RS to lead RS(E,0).
 - (4) Connects trunk terminating relay TT to lead TT(E,0).
 - (5) Connects no-test relay NT to lead NT.

2.35 Relay P released transfers lamp L(6 BUT KEY TEL SET) from steady battery to 30 IPM.

E. Ring Start (SC6)

2.36 If the marker finds the called station line idle, it transmits a ground on lead RS(E,0) to operate relay RS.

2.37 Relay RS operated:

- (a) Locks to off-normal ground under control of relay RT.
- (b) Prepares the trunk to transmit ringing current to called station line.

- (c) Maintains the holding bridge across the central office line.
- (d) Releases relay HD.
- (e) Maintains a holding path for relay SP in the cordless position circuit.
- (f) Prepares a path for holding relay HM and the trunk hold magnet in the marker after relays HD and MC release.
- (g) Provides an alternate operating or holding path for relay ACA.
- (h) Operates relay FB in the cordless position circuit.

2.38 Relay HD released:

- (a) Releases relay SL.
- (b) Connects resistance ground (resistor SH) to the sleeve lead to hold the station line hold magnet.
- (c) Maintains a holding path for relays SP and FB in the cordless position circuit.
- (d) Opens one of the holding paths for the trunk end of the trunk.
- (e) Provides an alternate path for holding relay HM and the trunk hold magnet when the marker releases.
- (f) Disconnects relay P from the ring side of the trunk.
- (g) Disconnects relay TT from lead TT(E,0).
- (h) Flashes lamp SL(CDLS POS) at 30 IPM.
- (i) Transfers lamp TL(CDLS POS) from 30 IPM to steady.

2.39 After the marker has transmitted its terminating data, it releases itself and the dial pulse register from the connection. Release of the marker releases relay MC.

2.40 Relay MC released:

- (a) Connects R1 ringing current through the primary winding of relay RT to the ring side of the trunk to ring the called station.
- (b) Transfers the holding circuit to relay HM and the trunk hold magnet from the marker to the trunk.
- (c) Disconnects relays BY, RS, NT, and TLA from their respective leads.

2.41 Relay FB in the cordless position circuit operated:

- (a) Provides audible ringing feedback to the attendant as an indication that the called line is being rung.
- (b) Provides transmission batteries to the called station as long as the trunk is split.

2.42 As long as the attendant remains on the connection during the establishment of the call, the transmission path between the central office and the station line remains split.

2.43 Note: Relays operated: RS, CT, HM, TLA, ACA, AC, SR, SL, and S. Lamp TL (CDLS POS) steady, lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) flashing at 30 IPM. Cordless position circuit relays SP and FB operated.

F. Attendant Releases (SC7)

2.44 When the attendant releases from the connection, operation of the release key releases the trunk pick-up key causing relay AC to release.

2.45 Relay AC released:

- (a) Connects the trunk side of the circuit to the line side.
- (b) Releases relay ACA.
- (c) Maintains the holding circuit for relay HM and the trunk hold magnet.

2.46 Relay ACA released releases relays FB and SP in the cordless position circuit and disconnects the attendant telephone circuit from the trunk.

2.47 Disconnection of the attendant telephone circuit removes the short circuit bridge from the trunk side, allowing the central office to hear ringing induction through capacitor FB.

2.48 Note: Relays operated: RS, CT, HM, TLA, SR, SL, and S. Lamp TL(CDLS POS) steady, lamp L(6 BUT KEY TEL SET) or SL (CDLS POS) flashing at 30 IPM.

G. Station Answers (SC8)

2.49 When the station answers, relay RT operates on the primary winding (after its slow-operate interval) and performs the following functions:

- (a) Locks operated through the secondary winding to off-normal ground.
- (b) Closes the operating path for relay ACA (if option Z is furnished).

- (c) Releases relay RS.
 - (d) Maintains a holding circuit for relay HM and the trunk hold magnet.
 - (e) Connects a high resistance bridge across the trunk. This bridge consists of one section of inductor H1 and 1200-ohm resistor HS; it provides non-through supervision to the central office.
 - (f) Lights lamp TRK BY INC in the make busy and busy display circuit.
- 2.50 Relay RS released (after its slow-release interval):
- (a) Removes the low holding bridge from the trunk.
 - (b) Transfers lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) from 30 IPM to steady battery.
 - (c) Transfers the line end of the trunk from ringing to the central office end.
 - (d) Opens an operating circuit for relay ACA.

2.51 The call is now extended from the attendant or from the central office if the attendant has disconnected prior to answer by the station.

2.52 Note: Relays operated: RT, CT, HM, TLA, SR, S1, and S. Lamp L(6 BUT KEY TEL SET) or SL(CDLS POS), and TL(CDLS POS) steady.

H. Remote Trunk Answer from Any Station

2.53 Relay LO- in the auxiliary position circuit is connected in parallel with relay R1 when the attendant places the PBX on remote trunk answer operation. Relay LO- operates when the central office seizes and rings the central office, and the auxiliary position circuit signals the PBX that a call is waiting.

2.54 The call is answered by dialing the remote trunk answer code from any station. The marker completes a connection between the answering station and the auxiliary position circuit.

2.55 When the auxiliary position circuit is seized by the station, the auxiliary position circuit functions to close the loop to the cordless position circuit that replaces the attendant telephone circuit and to operate relay ACA.

2.56 Relay ACA operated connects the auxiliary position circuit loop across the central office end of the trunk to trip the ringing and operate relay S. This

completes a talking path between the answering station and the central office end to the trunk via the auxiliary position circuit.

2.57 To complete the trunk call to another station, the auxiliary position circuit functions to steer the line end of the central office trunk into the PBX to establish a PBX dial tone.

2.58 The answering station dials the desired code. Trunk to marker identification and ring start proceed as described. Relay RT operates when the called station answers.

2.59 Relay RT operated opens the ground path to lead RTK- to prevent the auxiliary position circuit from releasing the connection between the called station and the line end of the trunk when the auxiliary position circuit releases.

2.60 The station that answered the trunk call disconnects to extend the call from the central office to the called station. The central office trunk functions in the same manner as when the attendant releases after the called station answers.

3. OUTGOING TRUNK CALL

A. Outgoing Dial Selected Trunk Call (SC22)

3.01 When a station, tie trunk (other than a ringdown tie trunk), or the attendant using a central office trunk or ringdown trunk dials the central office directing code, the marker tests for an idle central office trunk circuit by testing lead IT (90-99) for battery. When the select magnet test relays operate in the marker, ground is connected to lead IT(90-99) to operate relay MC.

3.02 Relay MC operated:

- (a) Locks to the marker via lead RLS(E,0).
- (b) Connects relays BY, RS, TT, TLA, NT, RT, and FF to the marker circuit via their respective leads.
- (c) Opens the primary winding of relays P and RT.
- (d) Operates relay HM and the trunk hold magnet.
- (e) Connects lead M(E,0) to lead ST (90-99).

3.03 If the station originating the call is a toll-allowed line, relay TLA operates when relay MC operates.

3.04 Relay TLA operated:

- (a) Locks operated to off-normal ground.
- (b) Connects a shunt path across diode A to prevent the operation of relay P if a toll code is dialed.

3.05 The trunk hold magnet closes the tip, ring, and sleeve of the calling line to the central office trunk circuit in parallel with the dial pulse register on the same link. Connections to and from the central office are made on a trunk class-of-call basis; that is, connections are made over a single link from the central office trunk circuit to the calling or called line.

3.06 Closure of the crosspoints performs the following functions:

- (a) Connects resistance ground (resistor SH) to sleeve lead S to hold the calling line or tie trunk.
- (b) Connects the station loop to operate relay S. The operating path for relay S is from battery at resistor BF to ground at contact 6 of relay SR.

3.07 Relay S operated operates relay S1 which performs the following functions:

- (a) Lights lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS).
- (b) Connects off-normal ground to the trunk circuit.
- (c) Opens lead IT(90-99) toward the trunk and connects ground toward the marker as a busy.
- (d) Connects ground to the ring side of the trunk toward the central office as a start ground for the line circuit.
- (e) Prepares a circuit to operate relay H when the line circuit in the central office has functioned.

3.08 After the marker tests to see that the trunk hold magnet is operated, it operates the marker release relays to release relay MC and the dial pulse register. Relay HM and the trunk hold magnet are held by off-normal ground.

3.09 When start ground is furnished to the central office, the central office line circuit operates and returns dial tone to the PEK; or, if a manual central office, the operator answers. In either case, relay H operates and in turn operates relay CT.

3.10 Relay CT operated:

- (a) Operates relay SR.

(b) Connects the trunk tip and ring to the central office for second dial tone.

(c) Prepares a holding circuit under control of relays SR and S1.

3.11 Relay SR operated:

- (a) Connects off-normal ground in parallel with relay S1.
- (b) Replaces the ground on lead IT(90-99) provided by relay S1.
- (c) Releases relay H.
- (d) Removes start ground from the ring side of the trunk.
- (e) Completes the holding circuit for relay CT.
- (f) Closes the P relay circuit (toll diversion) in the ring side of the trunk if relay TLA is unoperated. The calling station may now complete the call into the central office.

3.12 Note: Relays operated: CT, HM, SR, S1, S, TLA (if toll-allowed station). Lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS) steady.

B. Toll-Allowed Service

3.13 If a station or tie trunk (other than a ringdown tie trunk) originating a call through the central office trunk circuit is equipped for toll-allowed service, the TLA relay operates when the trunk circuit is seized.

3.14 Relay TLA operated shunts diode A and opens the P relay circuit used to sense battery reversal from the toll office. Under this condition, the P relay does not operate and the call can progress to a toll circuit.

C. Toll-Denied Service (SC23)

3.15 When a toll-denied line or tie trunk (other than a ringdown tie trunk) connects to a central office trunk circuit for outward dialing, relay TLA does not operate. On a local call, battery from the central office flows through diode A and does not operate relay P. If a toll code is dialed, the reversal of battery from the toll office causes current to flow through diode B and the primary winding of relay P which operates.

3.16 Relay P operated:

- (a) Locks operated to off-normal ground on its secondary winding.

- (b) Releases relay CT.
 - (c) Connects busy tone to the ring side of the trunk toward the calling station.
 - (d) Connects ground to the tip side of the trunk.
 - (e) Prevents the connection of start ground to the ring side of the trunk when relay SR releases.
- 3.17 Relay CT releases after its slow release interval, releases relay SR, and disconnects the trunk from the central office. The calling line is thus denied access to toll and can proceed no further.
- 3.18 If the central office trunk is seized at the central office during the time that the diverted station line is connected to the busy tone signal, relay R operates as soon as ringing current is transmitted.
- 3.19 Relay R operated:
- (a) Operates relay RL.
 - (b) Grounds lead IO to the auxiliary position circuit (if option ZZ is provided - see Note 109).
- 3.20 Relay RL operated:
- (a) Releases relay HM.
 - (b) Removes ground from lead ST(90-99) to the marker, causing the release of the trunk hold magnet and permitting the crosspoints to open.
 - (c) Connects continuous ringing (option ZS) or interrupted ringing (option ZR) to lead EZ(0-9) for audible signal.
 - (d) Transfers lamp TL(CDLS POS) from steady to 120 IPM.
- 3.21 Relay HM released:
- (a) Removes resistance ground (resistor SH) from lead S.
 - (b) Removes ground from lead RTK to the auxiliary position circuit.
 - (c) Extinguishes lamp SL(CDLS POS).
- 3.22 The local toll denied station will be returned to PEX dial tone, and the trunk will restore to normal. During the next ringing period, relay R and the trunk circuit function as under incoming calls.
- D. Attendant Originates Trunk Call - Not Restricted - Option Y (SC18)
- 3.23 If the attendant is not restricted, operation of a pick-up key associated with an idle trunk operates relay ACA.
- 3.24 Relay ACA operated:
- (a) Prepares locking circuits under control of relays AC and S1.
 - (b) Operates relay AC.
 - (c) Connects the attendant telephone circuit across the trunk.
- 3.25 Relay AC operated locks relay ACA and splits the trunk. Relay S operates via the loop through the attendant telephone circuit and operates relay S1.
- 3.26 Relay S1 operated:
- (a) Holds relay ACA.
 - (b) Prepares an operating circuit for relay H.
 - (c) Connects start ground to the ring side of the trunk.
 - (d) Connects off-normal ground to the trunk.
 - (e) Lights lamp TRK BY in the make busy and busy display circuit.
 - (f) Lights lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).
 - (g) Connects ground to lead IT(90-99) to busy the trunk to the marker.
- 3.27 The line circuit at the central office functions in response to the start ground to return dial tone or to bring in the central office operator and also operates relay H. Relay H operates relay CT.
- 3.28 Relay CT operated:
- (a) Operates relay SR.

(b) Locks under control of relays S1 and SR.

(c) Cuts the trunk through to the attendant.

3.29 Relay SR operated:

(a) Releases relay H.

(b) Locks relay CT.

(c) Transfers ground on lead IT(90-99) from relay S1 to relay SR.

(d) Removes the start ground from the ring side of the trunk.

3.30 The attendant is now connected to the central office and may complete the call.

3.31 Note: Relays operated: CT, ACA, AC, SR, S1, S. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) steady.

4. CAMP-ON

A. Camp-On Call Station Busy (SC12, 13)

4.01 When the attendant has completed dialing into the PBX, the dial pulse register receives and stores the dialed information completing the originating function on the call. The register then engages the marker to terminate the call.

4.02 When the marker functions to terminate the call, the central office trunk circuit identifies itself to the marker as the originating circuit so that the proper connections can be made.

4.03 When the dial pulse register has received the dialed information from the central office trunk circuit, it reverses battery and ground over the tip and ring of the link connection to the trunk circuit. This causes current to flow through diode A and operate relay P.

4.04 Relay P operated transfers lamp L (6 BUT KEY TEL SET) from 30 IPM to steady battery and operates relay MC.

4.05 By operating relay MC, the central office trunk circuit identifies itself to the marker as the circuit requesting termination. If the called station line is busy when the marker tests, the camp-on relays in the marker operate.

4.06 Relay MC operated:

(a) Releases relay P.

(b) Locks to lead RLS(E,O) under control of the marker.

(c) Transfers the holding of relay HM and the trunk hold magnet to lead M(E,O) (only while the marker is terminating the call).

(d) Connects relays FF, RS, BY, TT, TLA, and NT to their respective leads.

4.07 Relay P released transfers lamp L (6 BUT KEY TEL SET) from steady battery to 30 IPM. The marker in terminating the call grounds lead BY(E,O) which operates relay BY.

4.08 Relay BY operated:

(a) Disconnects the trunk tip and ring leads to the link so that ringing current will not be transmitted to the station line as long as the trunk is camped on.

(b) Operates relays DR and DRA which have no functions at this time.

(c) Releases relay SL.

(d) Partially connects a sensing circuit to lead S consisting of resistor SH and relay SL which will operate when the called station line becomes idle.

(e) Connects busy tone to the cordless position circuit.

(f) Opens the CR lead.

(g) Flashes lamp SL(CDLS POS) at 60 IPM.

(h) Locks operated under control of relays SL and HM.

4.09 During the process of marker functioning for a camp-on call, the camp-on relays in the marker release which removes ground from lead M(E,O) allowing relay HM and the trunk hold magnet to release. Relay HM released extinguishes lamp SL (CDLS POS).

4.10 The trunk is now free from its originating link on which the dial pulse register is still connected. The marker then functions to operate the select magnet for the link to which the busy station line is connected.

- 4.11 When the select magnet timing relay in the marker operates, ground is connected to lead M(E,O) which operates relay HM and the trunk hold magnet. Relay HM operated connects lamp SL(CDLS POS) to 60 IPM.
- 4.12 The trunk is now connected to the busy link. When the hold magnet timing relay in the marker operates, ground is connected to lead RS(E,O) to operate relay RS.
- 4.13 Relay RS operated:
- Releases relay HD.
 - Locks operated to the fundamental ground under control of relay RT.
 - Connects an alternate hold path for relay HM and the trunk hold magnet when relays MC and HD release.
 - Completes the sensing circuit to relay SL.
 - Maintains a holding circuit across the central office end of the trunk.
 - Prepares the trunk to ring the station when relay BY releases.
 - Prepares a circuit for the attendant to operate relay ACA.
 - Maintains the holding circuit for relay SP in the cordless position circuit when relay HD releases.
 - Operates relay FB in the cordless position circuit to provide busy tone to the attendant.
- 4.14 Relay HD released:
- Transfers lamp L(6 BUT KEY TEL SET) from 30 IPM to 60 IPM.
 - Transfers lamp TL(CDLS POS) from 30 IPM to steady battery.
 - Changes the holding circuit for relays HM, the trunk hold magnet, and relay SP in the cordless position circuit.
 - Connects leads TT and TR from the cordless position to the central office end of the trunk.
- 4.15 Having completed the connecting functions, the marker releases relay MC which restores the hold magnet control to the trunk circuit. The attendant is visually alerted with 60 IPM flashing lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) and audibly alerted by busy tone in the telephone circuit.
- 4.16 Note: Relays RS, DR, DRA, CT, BY, HM, TLA, ACA, AC, SR, Sl, S are operated. Relays SP and FB are operated in the cordless position circuit. Lamp TL(CDLS POS) is steady. Lamp SL(CDLS POS) or L(6 BUT KEY TEL SET) is flashing at 60 IPM.
- 4.17 Having received the camp-on indications, the attendant operates the release key in the cordless position circuit which mechanically releases the pickup key. When the pickup key releases, relays AC and ACA restore to normal releasing relays SP and FB in the cordless position circuit. Relay ACA released removes the busy tone from the attendant telephone circuit.
- 4.18 When the attendant reoperates the pickup key to notify the calling party of the camp-on condition, relay ACA operates in turn operating relay AC (and relay IC- if provided when option YK is specified).
- 4.19 Relay IC- operated, operates relay CS in the cordless position circuit and prepares to connect tone generator IT of the cordless position circuit to the tip and ring of the line side of the trunk.
- 4.20 Relay CS operated in the cordless position circuit:
- Completes the locking path for relays IC- and CS.
 - Connects ground to tone generator IT.
 - Prepares an operating path for relay SS in the cordless position circuit.
 - Operates relay CO in the cordless position circuit.
- 4.21 Relay CO operated, locks under control of relay IC- and opens the operating paths of all relays IC-.
- 4.22 After notifying the calling party of the camp-on condition, the attendant releases, mechanically releasing the trunk pick-up key. The pick-up key released, releases relay AC which releases relay ACA and operated relay SS in the cordless position circuit.

4.23 Relay SS operated:

- (a) Slow releases relay CS.
- (b) Connects a second ground to tone generator IT in the cordless position circuit.
- (c) Provides a holding path for relay IC upon the release of relay CS.
- (d) Connects tone to the tip and ring of the line side of the trunk for approximately 1/2 second.

4.24 Relay CS released, slow releases relay SS which removes ground from tone generator IT turning it off and removes tone from the tip and ring leads. Relay SS released, also releases relay IC which, in turn, releases relay CO in the cordless position circuit.

4.25 Relays operated during camp-on are: RS, DR, DRA, CT, BY, HM, TLA, SR, SL, and S. Lamp TL(CDLS POS) is steady and lamp SL (CDLS POS) or L(6 BUT KEY TEL SET) is flashing at 60 IPM.

B. Camp-On Station Becomes Idle (SC8, 14)

4.26 With relays BY and RS operated, a sensing circuit is established on the sleeve of the connection to determine when the station line becomes idle.

4.27 Relay SL is connected in a bridge circuit consisting of resistors PD and SH in the central office trunk circuit, the line hold magnet in the marker, and the 100-ohm sleeve resistance in the circuit that is engaged with the busy station line.

4.28 During camp-on, the potential across relay SL is insufficient to operate it. As soon as the engaged connection releases and the 100-ohm ground on the sleeve is removed, relay SL is placed in series with the line hold magnet. Relay SL operates releasing relay BY.

4.29 Relay BY released:

- (a) Releases relays DR and DRA if the station is on-hook.
- (b) Connects the trunk tip and ring to the link toward the station for ringing.
- (c) Releases relay SL.

(d) Connects resistor SH to the sleeve lead to hold the line hold magnet.

(e) Transfers lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) from 60 IPM to 30 IPM.

4.30 Relay DR remains operated after relay BY releases if the called station is still off-hook. This action prevents the ringing current from being applied to the station line which would cause a premature ring trip condition.

4.31 When the station goes on-hook, relays DR and DRA release to establish a ringing path through the primary winding of relay RT to the ring side of the trunk.

4.32 Note: Relays RS, CT, HM, TLA, SR, SL, and S are operated. Lamp TL(CDLS POS) is steady; lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is flashing at 30 IPM.

4.33 When the station answers, relay RT operates after its slow-operate interval and:

(a) Locks to the fundamental ground via the secondary winding.

(b) Prepares an operating circuit for relay ACA (if option Z is provided).

(c) Connects a high-resistance bridge (resistor HS and inductor H1) across the trunk to hold the central office.

(d) Prepares an operating path for relay FF.

(e) Releases relay RS.

4.34 Relay RS released:

(a) Opens the low-resistance bridge (inductor H) across the trunk.

(b) Transfers lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) from 30 IPM to steady battery.

(c) Disconnects ringing from the line.

(d) Connects the trunk to the link. The central office and the station may now converse.

4.35 Note: Relays RT, CT, HM, TLA, SR, SL, and S are operated. Lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS) are steady.

C. Camp-On Discharge (SC16)

4.36 If the calling party elects to be connected to another line or to hang up after being notified of the camp-on condition, the attendant does not release but instead operates the hold key.

4.37 When the attendant operates the hold key (nonlocking), relay H operates in the cordless position circuit. Relay H operated:

- (a) Releases relay RS by opening the lead to the fundamental ground.
- (b) Maintains a holding path for the trunk hold magnet and relay HM when relay RS releases.

4.38 Relay RS releases after its slow-release interval and:

- (a) Removes the H1 inductive bridge from across the trunk.
- (b) Removes the ringing leads to the PBX end of the trunk.
- (c) Disconnects the sensing circuit to relay SL.
- (d) Partially restores the operating path for relay HD.
- (e) Removes a holding path for the trunk hold magnet and relay HM.

4.39 When the hold key is released, relay H releases. This releases the trunk hold magnet and relay HM by removing ground via lead HM from the position circuit.

4.40 When the trunk hold magnet releases, the PBX link drops but the central office end of the trunk is held by the loop provided by the attendant telephone circuit leads TT and TR and relay SP normal in the position circuit.

4.41 Relay HM released releases relay BY and extinguishes lamp SL(CDLS POS).

4.42 Relay BY releases after its slow-release interval and:

- (a) Releases relay DR.
- (b) Opens the busy tone lead BT.
- (c) Transfers lamp L(6 BUT KEY TEL SET) from 60 IPM to steady battery.

4.43 Note: Relays ACA, AC, CT, TLA, SR, SL, and S are operated. Lamp TL (CDLS POS) or L(6 BUT KEY TEL SET) is steady.

4.44 If the call is to be rerouted, the attendant operates the hold key again for PEX dial tone and the action is the same as for a new incoming call.

4.45 If the call is to be disconnected, the attendant operates the release key. The trunk restores to normal when the central office disconnects.

D. Camp-On Busy (SC15,16)

4.46 The action of the trunk, marker, and register are the same as described in 4.01 through 4.25 except for the following considerations: The marker in terminating the call grounds lead BY(E,0) to operate relay BY and in the process of link testing connects a solid ground on sleeve lead S.

4.47 When this test ground is connected to the sleeve lead S, there is a path through the trunk that has camp-on priority via contacts of operated relays BY, RS, and DR, diode F, and lead CW to operate the camp-on stop relay in the marker.

4.48 The G diode prevents the SL relay from operating in the trunk with camp-on priority. With the camp-on stop relay operated in the marker, relay FF operates.

4.49 Relay BY operated prepares a lockup circuit for relay FF. Relay FF operated:

- (a) Connects an operating path for relay ACA.
- (b) Connects in part a low shunt across the trunk.
- (c) Bridges the cut-through contacts of relay CT.
- (d) Parallels the operating path of relay DR.
- (e) Locks operated under control of relays BY and SR.
- (f) Transfers lamp L(6 BUT KEY TEL SET) from 30 IPM to 120 IPM.

4.50 Relays BY and FF jointly connect 120-IPM busy tone to the attendant telephone circuit, and relays FF and DR jointly connect lamp SL(CDLS POS) to 120 IPM.

4.51 The operation of relay FF prevents relay SL from operating regardless of whether the camp-on line becomes idle. The sensing circuit is, therefore, functionless and only the trunk that was originally camped-on will cut through and provide ringing when the line becomes idle.

4.52 When relay HM reoperates over the M(E,0) lead with relay FF operated, the SL(CDLS POS) lamp changes to 120 IPM. When relay HD releases due to the operation of relay RS, the L(6 BUT KEY TEL SET) lamp remains flashing at 120 IPM with FF operated.

4.53 Having completed the connecting functions, the marker releases relay MC which restores the hold magnet control to the trunk circuit. The attendant is visually alerted with 120-IPM flashing lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) and audibly alerted by busy tone interrupted at 120 IPM.

4.54 Note: Relays ACA, AC, RS, DR, DRA, CT, BY, HM, TLA, SR, S1, S, and FF and relays SP and FB in the cordless position circuit are operated. Lamp TL(CDLS POS) is steady and lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) is flashing at 120 IPM.

4.55 Having received the camp-on busy indication, the attendant operates the hold key which operates relay H in the cordless position circuit.

4.56 Relay H follows the action of the hold key (nonlocking). When relay H in the cordless position circuit operates, relay RS releases, in turn releasing relay SP in the cordless position circuit. Relay SP releases relay FB in the cordless position circuit.

4.57 When the hold key is released, relay H in the cordless position circuit releases releasing the trunk hold magnet and relay HM. This causes relay BY to release and in turn release relays DR and DRA.

4.58 Relay SP in the cordless position circuit released removes the short circuit from the trunk and relay FB released disconnects the 120-IPM tone. The attendant now advises the calling party of the progress of the call.

4.59 Note: Relays CT, TLA, ACA, AC, SR, S1, and S are operated. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is steady.

4.60 A make contact on relay DR is provided in lead CW to isolate the CW lead to the marker. This prevents a faulty diode in some other trunk circuit from "feeding-out" to the CW lead and falsely operating relay SL.

4.61 At calling party request, the attendant may reroute the call to another station of many disconnect. The action is the same as described in the preceding section for rerouting or disconnection.

E. PBX On Remote Trunk Answer Operation

4.62 When the PBX has been conditioned for remote trunk answering, the action of the trunk, marker, and register is the same as described for camp-on busy except for the following considerations.

4.63 The marker in terminating the call grounds leads BY and FF to operate relays BY and FF when the called station line is busy.

4.64 Relays ACA, BY, and FF operated and relays FB in the cordless position circuit operated complete a path to return busy tone, interrupted at 120 IPM, to the answering station via the auxiliary position circuit.

4.65 The auxiliary position circuit functions to operate and release relay H in the cordless position circuit to discharge the busy condition. The PBX functions to reconnect the answering station to the central office so that the calling party can be advised of the progress of the call.

5. RECALL

A. Station Recall - Option ZW (SC11)

5.01 Once a station has answered on an incoming central office call or a dial back call, the station may recall the attendant by momentarily depressing the switchhook. Relay S follows the operation of the switchhook and when released removes ground to release relay S1 and connects ground to operate relay FF.

5.02 Relay FF operated:

- (a) Prepares a circuit so the attendant may operate relay ACA.
- (b) Connects a low resistance bridge (resistor IS and inductor H1) across the central office end of the trunk.
- (c) Bridges the cut-through contacts of relay CT.
- (d) Locks under control of relays AC and SR.
- (e) Prepares circuits to transfer lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) to 120 IPM and to operate the audible signal.
- (f) Extinguishes lamp L(6 BUT KEY TEL SET) or SL(CDLS POS).

5.03 When the switchhook is released, relay S reoperates. Relay S operated:

- (a) Holds relay S1 if it has not released.

(b) Operates relay S1 if it did release.

(c) Operates relays DR and DRA.

5.04 Relay DR operated flashes lamp L (6 BUT KEY TEL SET) or SL(CDLS POS) at 120 IPM, and connects continuous ringing to the audible signal. Relay DRA operated connects audible ringing to the station line.

5.05 Note: Relays DR, DRA, CT, RT, HM, TLA, SR, S1, FF, and S are operated. Lamp TL(CDLS POS) is steady; lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) is at 120 IPM.

5.06 The attendant recognizes the 120 IPM flashing lamps and the continuous audible signal as a station recall. When the attendant answers the recall by operating the pick-up key, relay AC operates.

5.07 Relay AC operated releases relay FF and, with option W, operates relay SP in the cordless position which splits the trunk to provide secrecy.

5.08 Relay FF released:

(a) Disconnects the low-resistance bridge from the trunk.

(b) Silences the audible signal.

(c) Releases relay DR.

(d) Transfers lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) from 120 IPM to steady battery.

(e) Opens the operating path of relay ACA to prevent the attendant from re-entering for any reason other than recall (if option Z(MD) or XK is not provided).

5.09 Note: Relays CT, RT, HM, TLA, ACA, AC, SR, S1, and S are operated. Lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS) are steady.

5.10 If the switchhook is depressed until relay S1 releases, relay CT releases allowing relay SR to start to release. When relay S1 reoperates, relay CT operates through the make contact of relay FF.

5.11 Relay CT operated reestablishes the operate path for relay SR. Thus as long as relay CT can be reoperated before relay SR releases, the switchhook signal actuates a recall condition.

5.12 If the switchhook signal is of such duration that relay SR releases before relay CT is reoperated, the central office disconnects.

5.13 If the trunk is connected to a panel central office, a false recall situation occurs when the panel office disconnects. In the process of disconnect, the

potential on lead R from the panel office is removed and replaced before being finally removed. This causes relay S to release and operate relay FF as described previously.

5.14 To prevent this false recall, a detector circuit per FS7 (App Fig. 4) recognizes whether or not there is a potential on lead R. As long as the potential remains on lead R, transistor Q1 is "switched on" allowing the station to recall in the normal way. However, when the potential is removed, transistor Q1 is "switched off" which prevents relay FF from operating when relay S releases, eliminating the false recall condition.

B. Station Dial Transfer - Option ZX(SC39)

5.15 After a station has answered an incoming central office call or dial back call, the station may transfer this call to another station by momentarily depressing the switchhook.

5.16 Relay S follows the operation of the switchhook and when released removes ground to release relay S1 and connects ground to operate relay FF.

5.17 Relay FF operated:

(a) Prepares a circuit so the attendant may operate relay ACA.

(b) Connects a low-resistance bridge (resistor IS and inductor H1) across the central office end of the trunk.

(c) Bridges the cut-through contacts of relay CT.

(d) Locks under control of relays AC and SR.

(e) Prepares circuits to transfer lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) to 120 IPM.

5.18 When the switchhook is released, relay S reoperates.

5.19 Relay S operated:

(a) Holds relay S1 if it has not released.

(b) Operates relay S1 if it did release.

(c) Operates relays DR and DRA.

5.20 Relay DR operated grounds lead TP- to the station dial transfer controller circuit operating relay TP- in the controller circuit to start a station dial transfer.

C. Trunk Recall

5.21 When the central office trunk is terminated by a tie trunk other than a ringdown tie trunk, the station terminating the tie trunk may recall the attendant by momentarily depressing the switchhook. If the tie trunk is terminated by a cord switchboard, recall is accomplished by momentarily removing the cord.

5.22 In either case, relay P releases and reoperates. Relay P released:

- (a) Releases relay S by opening the bridge across the central office end of the trunk.
- (b) Transfers lamp L(6 BUT KEY TEL SET) from steady to 30 IPM.

5.23 Relay S released operates relay FF.

5.24 Relay FF operated:

- (a) Provides a path for the attendant to operate relay ACA.
- (b) Connects low-resistance shunt (resistor LS and one winding of inductor H) across the central office end of the trunk.
- (c) Bridges the cut-through contacts of relay CT.
- (d) Locks operated under control of relay AC.
- (e) Prepares a circuit to operate relay DR.
- (f) Transfers lamp L(6 BUT KEY TEL SET) from 30 IPM to the contacts of relay DR.

5.25 When relay P reoperates, it operates relay S which in turn operates relays DR and DRA. Relay DRA operated connects audible ringing to the station line. Relay DR operated connects continuous ringing to lead BZ(0-9) to activate the audible signal and connects lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) to 120 IPM. The attendant is now alerted for a tie trunk recall.

5.26 Note: Relays P, DR, DRA, CT, TT, RT, HD, HM, TLA, SL, SR, S1, FF, and S are operated. Lamp TL(CDLS POS) is steady, and lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) is at 120 IPM.

5.27 When the attendant answers the recall, the trunk action is the same as described in 5.01 through 5.14 except that relays P, HD, TT, and SL remain operated.

6. RERING

A. Toll-Allowed Station (SC28)

6.01 If a toll-allowed station originates a call to the toll office and elects to hang up while the toll operator holds the connection, relay S releases causing relay S1 to release.

6.02 Relay S1 released:

- (a) Causes relay H to operate from the hold connection.
- (b) Removes the holding circuit for relay CT.
- (c) Removes one of the parallel fundamental grounds.
- (d) Restores the locking path for relay RL.
- (e) Extinguishes lamp SL(CDLS POS) leaving lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) lighted steady.

6.03 Relay H operated holds relay CT. When the toll operator rerings on the circuit, only the station is rung. Relay R operates on the ringing current but since relay TLA is operated, relay RL is prevented from operating.

6.04 With relay RL normal, the attendant is bypassed. When the station answers, relay S operates, in turn operating relay S1. Relay S1 operated:

- (a) Releases relay H.
- (b) Holds relay CT.
- (c) Connects a parallel off-normal ground.
- (d) Lights lamp SL(CDLS POS).

6.05 If the toll operator had disconnected instead of reringing, relay H would have released, in turn releasing relay CT. Relay CT released releases relay SR which removes the fundamental ground, releases relay HM and the trunk hold magnet, and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).

B. Toll-Denied or Restricted Station (SC32)

6.06 If a toll-denied or a restricted station has been connected to a toll office by the attendant using the no-test key and the station elects to hang up, relay S releases, in turn releasing relay S1 and operating relay FF.

6.07 Relay FF operated:

- (a) Provides a path for the attendant to operate relay ACA.
- (b) Connects a low-resistance bridge (resistor LS and inductor H1) across the trunk toward the trunk office.
- (c) Bridges the cut-through contacts of relay CT.
- (d) Locks operated under control of relays AC and SR.
- (e) Extinguishes lamp SL(CDLS POS). Relay S1 released connects relay H to the trunk circuit and releases relay CT which in turn releases relay SR.

6.08 Relay SR released:

- (a) Releases relay FF.
- (b) Removes ground from lead IT(90-99).
- (c) Removes the fundamental ground which releases relay HM and the trunk hold magnet.

6.09 The station is now disconnected since the crosspoints are open. As long as the toll operator holds, the circuit relay H remains operated. When relay FF restores to normal, relay CT operates in turn operating relay SR.

6.10 Relay SR operated connects the fundamental ground to the trunk and connects ground to lead IT(90-99) to busy the trunk. The trunk circuit is now in the same condition as if it were seized at the central office during the silent interval of the ringing cycle. When the toll operator rerings, the attendant receives the signal as an incoming call.

C. Attendant Originated Call to Toll Office

6.11 With option A, if the attendant disconnects, the toll operator may rering. The rering operates relay R in turn operating relay R1 (relay TLA normal). Relay R1 operated locks to the fundamental ground under control of relay S1 and changes lamp TL(CDLS POS) to 120 IPM.

6.12 Relays R and R1 operated jointly connect ringing current to the audible signal in the cordless position circuit. (The audible signal follows the rering.)

6.13 With option A, if the attendant holds instead of releasing, the toll operator may rering. The rering operates relay R in turn operating relay R1. Relay R1 operated flashes lamp TL(CDLS POS) at 120 IPM

and relays R and R1 operated jointly connect ringing current to the audible signal. (The audible signal and 120-IPM flashing lamp TL(CDLS POS) follow the rering.)

7. HOLDING

A. Attendant Holds Incoming Call (SC19)

Register Seized Before Attendant Releases

7.01 If a register is seized and a dial tone connection is established, the course of events is as described in 2.20 through 2.30. The operation of the release key in the cordless position circuit releases the pick-up key which in turn releases relay AC.

7.02 Relay AC released:

- (a) With relay HD operated, connects inductor H in series with diode C across the line side of the trunk.
- (b) Releases relay ACA.
- (c) Maintains a holding circuit for relay HD.

7.03 Relay ACA released:

- (a) Disconnects the attendant telephone circuit from the trunk.
- (b) Releases relay SP.
- (c) Opens leads H, HG, HD, HM, SP, SR, BT, NT, T, U, and FB.

7.04 The disconnection of the attendant telephone circuit removes the loop causing relay L in the dial pulse register to release. (Diode C presents an open circuit to relay L.)

7.05 Relay L released causes the dial pulse register to release which removes the 100-ohm ground from the sleeve of the link. The removal of this ground releases the register hold magnet and relay SL.

7.06 Relay SL released releases relay HM (relay TLA operated has opened an alternate holding path) and releases the trunk hold magnet. Relay HD remains operated to keep lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) flashing at 30 IPM, and maintains the holding bridge (inductor H1) across the trunk toward the central office.

Attendant Releases Before Register is Seized

7.07 If the attendant holds a trunk and a register is not seized due possibly to heavy traffic, the operation of the hold key (nonlocking) operates relay H in the cordless position circuit.

7.08 Relay H follows the action of the hold key to operate relay HD and prepares a circuit to operate relay SP in the cordless position circuit.

7.09 Relay HD operated:

- (a) Locks to off-normal ground.
- (b) Operates relay SP in the cordless position circuit.
- (c) Connects inductor H1 across the trunk to hold the central office.
- (d) Disconnects the attendant from the central office end of the trunk.
- (e) Transfers lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) from steady battery to 30 IPM.

7.10 The operation of the release key releases the pick-up key which releases relay AC. Relay AC released releases relay ACA. Since the dial pulse register was not seized, the release of relays AC and ACA simply disconnects the attendant telephone circuit from the trunk. Relay HD remains operated to hold the central office and to keep lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) flashing at 30 IPM.

7.11 Note: Relays CT, HD, TLA, SR, S1, S are operated. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is flashing at 30 IPM.

B. Attendant Reenters Held Incoming Trunk (SC20)

7.12 The attendant reenters a held trunk by operating the pick-up key associated with the held call. Relay ACA operates through relay HM normal and Y option, or through relay HM normal, relay S1 operated.

7.13 Relay ACA operated:

- (a) Connects the attendant telephone circuit to the trunk.
- (b) Extends leads FB, HD, SP, H, HM, HG, T, U, NT, and BT to the cordless position circuit.
- (c) Operates relay AC.
- (d) Prepares a locking circuit for relay HM.
- (e) Locks up under control of relay AC.

7.14 Relay AC operated:

- (a) Splits the trunk.
- (b) Releases relay HD.

(c) Locks relay ACA.

7.15 When relay HD releases, it connects the attendant to the central office end of the trunk, and transfers lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) from 30 IPM to steady battery.

7.16 Note: Relays ACA, AC, CT, S, S1, SR, and TLA are operated. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is steady.

7.17 If the attendant wishes to complete the incoming call, the hold key must be operated to establish PBX dial tone. The action is the same as described in 2.20 through 2.30 except that relay TLA is already operated (if option A is provided).

8. MISCELLANEOUS

A. Dial-Back Call (SC21)

8.01 When a station line dials the attendant trunk code for assistance in establishing a central or toll office connection, the attendant instructs the calling line to remain off-hook until the connection is established.

8.02 The attendant then:

- (a) Holds the attendant trunk circuit.
- (b) Completes a call to the central office as described in 3.23 through 3.31.
- (c) Requests the called central office party to remain on the line.
- (d) Holds the central office trunk to establish PBX dial tone as described in 7.01 through 7.11.
- (e) Operates the no-test key in the cordless position circuit.
- (f) Dials the station that is being held on the attendant trunk circuit, operating relay P over its secondary winding.

8.03 Relay P operates after its slow-operate interval and:

- (a) Operates relay MC.
- (b) Transfers lamp L(6 BUT KEY TEL SET) from 30 IPM to steady battery.

8.04 Relay MC operated:

- (a) Locks under control of the marker.
- (b) Operates relay NT in the marker.
- (c) Operates relay TLA.
- (d) Releases relay P.

- 8.05 Relay NT in the marker operated:
- (a) Operates relay RT over its secondary winding.
 - (b) Lights lamp TRK BY INC in the make busy and busy display circuit.
- 8.06 Relay P released, transfers lamp L(6 BUT KEY TEL SET) from steady to 30 IPM.
- 8.07 Relay RT operates after its slow-operate interval and:
- (a) Opens the locking path for relay RS.
 - (b) Locks to the off-normal ground.
 - (c) Connects a high-resistance bridge across the trunk.
 - (d) Provides alternate holding paths for relay HM and SP(in the cordless position circuit).
 - (e) Lights lamp SL(CDLS POS).
- 8.08 The marker in terminating the call extends ground over lead RS(E,O) to operate relay RS.
- 8.09 Relay RS operated:
- (a) Releases relay HD.
 - (b) Operates relay FB in the cordless position circuit.
- 8.10 Relay HD released:
- (a) Removes the holding bridge from the trunk but relay SP in the cordless position still has the trunk end short circuited.
 - (b) Extends the trunk to the attendant telephone circuit.
 - (c) Releases relay SL.
 - (d) Provides a holding path for relay HM and the trunk hold magnet.
 - (e) Lights lamp SL(CDLS POS).
 - (f) Transfers lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) from 30 IPM to steady battery.
 - (g) Connects the 100-ohm resistor SH to lead S to hold the line hold magnet.
- 8.11 Since the marker performs as if the call were going to camp-on, the central office trunk circuit is transferred from its originating link, on which the dial tone connection was established, to the link on which the calling station is waiting.
- 8.12 Relay NT operated in the marker also connects ground to the KO (kick-off) lead to the attendant trunk circuit operating relay TM which in turn releases relay B in that circuit.
- 8.13 Relay B released releases the attendant trunk hold magnet which opens the crosspoints allowing the attendant trunk to release.
- 8.14 After the marker has transmitted its terminating data, it releases itself and the dial pulse register from the connection. The release of the marker causes relay MC to release.
- 8.15 Relay MC released transfers the holding path for relay HM and the trunk hold magnet from marker control to trunk control and disconnects relays BY, RS, NT, and TLA from their respective leads.
- 8.16 Relays FB and SP in the cordless position circuit remain operated as long as the attendant remains on the connection. Relay FB provides transmission battery for the called station and relay SP keeps the short circuit across the central office end of the trunk.
- 8.17 When the attendant releases, the station and central office are connected, the station receiving transmission battery from the central office.
- 8.18 Note: Relays CT, RT, HM, TLA, SR, SL, S are operated. Lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) and TL(CDLS POS) is/are steady.
- 8.19 If the trunk is connected to any busy station other than the station awaiting service on a dial-back basis, the attendant may discharge the connection by operating the hold key.

B. Disconnection - Called Station Remains Unanswered

- 8.20 The condition of the trunk prior to the operation of the release key is the same as for ring start, dial-back call, or trunk terminating as described in 2.36 through 2.43, 8.01 through 8.19, and 8.40 through 8.50, respectively. If the attendant has not released after dialing is completed, the call may be discharged and the attendant may reconnect to the central office end of the trunk by operating the hold key.
- 8.21 The operation of the hold key, which is nonlocking, causes relay H to operate in the cordless position circuit. Relay H operated opens the locking path over leads H and HG to release relays TT and HD or RS depending upon the type of connection.

8.22 Relays SP and SL or FB in the cordless position circuit subsequently release in sequence due to the elimination of holding paths previously supplied by relay HD or RS.

8.23 When the hold key is released, relay HM and the trunk hold magnet in the marker release since there is no longer a holding path to the fundamental ground.

8.24 The attendant is now connected to the central office end of the trunk. Relays ACA, AC, CT, S, Sl, SR, and TLA are operated; and lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is steady.

8.25 If the attendant had released from the connection after dialing was completed, the condition of the trunk would be the same as described above prior to the operation of the release key except that relays ACA, AC, SP, and FB would release when the key is operated.

8.26 It is therefore necessary that the attendant operate the pick-up key to operate relays ACA and AC. The action of the trunk when the attendant subsequently operates the hold key is the same as described above.

8.27 Should the attendant wish to reroute the call, the hold key must be re-operated for PBX dial tone.

8.28 If the attendant wishes to disconnect the trunk, the release key is operated. Relays AC and ACA release in sequence which removes the attendant telephone circuit from the trunk allowing relay S to release and release relay Sl.

8.29 Relay Sl released releases relays CT, SR, and TLA in sequence restoring the trunk to normal.

8.30 If the central office does not disconnect immediately, relay H operates when relay Sl releases to hold relay CT operated. When the central office disconnects, relay H releases releasing relays CT, SR, and TLA and restoring the trunk to normal.

8.31 When the PBX is on remote trunk answer operation, the answering station remains on the line after dialing is completed. The auxiliary position circuit holds relays AC and ACA operated.

8.32 The answering station causes the auxiliary position to operate and release relay H in the cordless position circuit to discharge the call. The PBX functions to discharge the call and reconnect the answering station to the central office as previously described.

8.33 Should the answering station wish to reroute the call, the auxiliary position circuit functions to operate and release relay H in the cordless position circuit and the PBX functions to return dial tone.

8.34 If the answering station wishes to disconnect the trunk, the handset is placed on the switchhook. The auxiliary position circuit functions to release relays AC and S and disconnection proceeds as previously described..

C. Emergency Trunk Service - Options V, T, E(MD), ZJ(MD), YM, and F(MD)

8.35 Central office trunks 0, 1, 2, and 5 (option F) or central office trunks 0, 1, and 2 (option E or ZJ or YM) are wired to station line circuits 30, 31, 32, and 33 or to line circuits 30, 31, and 32, respectively, through the alarm transfer and test circuit (per option T).

8.36 When there is a power failure, relays AT and ATA release in the alarm transfer and test circuit to transfer the above central office cable pairs from the central office end of the trunk units directly to the station instruments, effectively bypassing the trunks. These stations will receive incoming central office calls.

8.37 To make outgoing central office calls, a start key which is provided with each of these stations must be operated to connect start ground to the ring side of the cable pair and cause the central office line circuit to function.

8.38 When power is restored, relays AT and ATA reoperate to transfer the trunk circuits to the cable pairs and the station instruments to their respective line circuits. If one of these stations is busy when power is restored, the central office connection is broken.

8.39 The remainder of the central office trunk circuits are wired per option V and do not have the transfer feature.

D. Trunk Terminating

Other Than Ringdown Tie Trunk

8.40 If the incoming call requests a connection to a tie trunk other than a ringdown tie trunk, the initial action is the same as when the attendant establishes PBX dial tone and trunk-to-marker identification as described in 2.20 through 2.35.

8.41 The marker in terminating the call connects a ground from the dial pulse register to lead TT(E,O) causing relay TT to operate. Since relay TK8 in the marker is operated, there is no ground connected to lead RS.

8.42 Relay TT operated:

- (a) Locks to off-normal ground.
- (b) Transfers lamp TL(CDLS POS) from 30 IPM to steady battery.
- (c) Connects lamp SL(CDLS POS) to 30 IPM.
- (d) Prepares a path for the attendant to reoperate relay ACA.
- (e) Connects inductor H into the trunk circuit. This inductively couples the PEX and central office ends of the trunk circuit.

8.43 If the attendant remains on the line, the loop through the attendant telephone circuit or, if the attendant disconnects, the loop through one winding of inductor H, causes the tie trunk to function.

8.44 When the tie trunk answers, battery is reversed to provide supervision. The reversed battery operates relay P through its primary winding.

8.45 Relay P operated:

- (a) Transfers lamp L(6 BUT KEY TEL SET) from 30 IPM to steady battery.
- (b) Operates relay RT over its secondary winding.
- (c) Opens the operating path (via relay TT) for relay ACA.
- (d) Provides a holding circuit for relay S when relay RT operates.

8.46 Relay RT operates after its slow-operate interval and:

- (a) Locks to off-normal ground.
- (b) Provides a path for the attendant to operate relay ACA (if option Z is used).
- (c) Connects resistor HS in parallel with relay S as a high-resistance bridge across the trunk.
- (d) Transfers lamp SL(CDLS POS) from 30 IPM to steady battery.
- (e) Prepares a path to operate relay FF if relay S releases.

8.47 The central office trunk and tie trunk (other than a ringdown tie trunk) are now connected.

8.48 Note: Relays P, CT, TT, RT, HD, HM, TLA, SL, SR, S1, and S are operated. Lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS) are steady.

Ringdown Tie Trunk

8.49 If a ringdown tie trunk code is dialed by the attendant, the action is the same as described above except that in answering, the ringdown tie trunk will not reverse battery and ground to operate relay P.

8.50 Under this condition, relay RT does not operate and lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) remain at 30 IPM. There is no supervision to the attendant other than a steady TL(CDLS POS) lamp and a flashing L(6 BUT KEY TEL SET) or SL(CDLS POS) lamp; hence, the attendant must challenge this connection periodically.

E. Cord Switchboard Used as Attendant Equipment - App Fig. 2

8.51 When the central office trunk has an appearance on the cord switchboard, an incoming call from the central office causes the trunk circuit to:

- (a) Connect battery to lead C.
- (b) Connect continuous ringing to the audible signal when 556A switchboard is used; provides ground to 608A or 608D auxiliary signal, fuse alarm, battery cut-off, and miscellaneous circuit to operate audible signal when 608A or 608D switchboard is used.
- (c) Connect 120-IPM battery via lead L to flash the switchboard L lamp.

8.52 The attendant inserts a cord into the trunk jack T associated with the flashing lamp. Relay SEO-9 is operated via lead SL to ground at the answering jack. Relay SL operated completes the tip and ring paths to connect the attendant to the trunk.

8.53 Battery through resistance lamp SLO-9 (option ZE) or ground through resistor SLO-9(option ZF) causes the cord sleeve relays to function.

8.54 To make an outgoing call, the attendant inserts a cord into trunk jack T. If the central office trunk circuit is idle, battery via lead C and Y option operates relay SEO-9. Relay SEO-9 operated connects the tip and ring leads to the cord circuit. The loop of the cord circuit operates relay S from ground to the tip via relay SR operated to battery via resistor BF.

8.55 Relay SEO-9 operated connects the tip and ring leads to the cord circuit. The loop of the cord circuit operates relay S from ground to the tip via relay SR operated to battery via the BF resistor.

8.56 Relay S operated operates relay S1 which operates lamp L (FS5) and activates the trunk in a manner similar to the action described for cordless operation.

8.57 If the central office trunk circuit had been busy, lamp L would have been lighted as a busy lamp.

8.58 Note: Attendant options X(MD), Y, Z(MD), and XK apply to the cord switchboard attendant the same as for a cordless operation.

8.59 Night connections may be established by using the cord circuit with the night and through dialing key operated. When the plug is inserted into trunk jack T, relay SEO-9 operates on battery via lead C and option Y. Relay SEO-9 operated connects the tip and ring leads to the plug of the cord. Outgoing calls function as described for cordless operation.

F. Direct Station Selection

Incoming Central Office Call

8.60 The attendant operates the pickup key and, after determining that the calling party wishes to be connected to a station, momentarily depresses the push button key associated with the station to be called if the particular station busy lamp is dark.

8.61 This key, when depressed, results in the same functions as operating the hold key, receiving dial tone, and dialing the station.

8.62 If the central office calling party wishes to be completed to a busy line (indicated by a lighted station busy lamp), the attendant immediately informs the calling party of the busy condition of the station.

8.63 If the central office party wishes to wait, the attendant depresses the station key. This causes the central office trunk to camp on the busy line.

8.64 The operation of the station key operates relays H, HA, and DS in the cordless position circuit.

8.65 Relay DS operated prepares a path to operate relay CS in the cordless circuit position and prevents cordless position relay SS from operating.

8.66 The marker in terminating the call grounds lead BY(E,O) which operates relays BY and IC- (with option YK).

8.67 Relay IC- operated performs the same function as described in 4.01 through 4.25.

8.68 The attendant receives audible and visual indications of camp-on at the end of register and marker action.

8.69 With the camp-on connection completed, the attendant releases the station key which releases relay HA in the cordless position circuit.

8.70 The attendant then operates the release key which mechanically releases the pick-up key. When the pick-up key releases, relays AC and ACA release. Relay AC released, operates relay SS in the cordless position circuit.

8.71 Relay SS operated performs the same functions as described in 4.01 through 4.25 except relay SPA released, releases relay DS.

Dial Back

8.72 To complete outgoing calls on a dial back basis, the no-test key in the cordless position circuit is operated after the attendant has been connected to the central office party. The attendant then depresses the station key which starts register and marker action to complete the connection between the station and central office.

G. Station Message Registration

Message Register Pulsing

8.73 Each operation of relay SX in the station message register pulse and surcharge circuit applies positive 48 volts to the sleeve via lead SS1, operating the station message register in multiple with the line hold magnet. The positive voltage holds the line hold magnet during message registration.

Message Register Surcharging

8.74 When the calling station goes on-hook relay S releases, releasing relay S1. Relay S1 released slowly releases relay P (furnished for panel only) and removes a shunting ground from lead S1 which operates relay DS in the station message register pulse and surcharge circuit.

8.75 Station message register pulse and surcharge circuit relay DS operated prevents new calls from ringing until all surcharge pulses have been registered. When surcharge pulsing is completed, relay MS in the station message register pulse and surcharge circuit will release releasing the trunk. The release of relay SR will release station message register pulse and surcharge circuit relay DS.

H. Traffic Measurement System Remote Scanner

Trunk Seizure to Trunk Answer

8.76 When the central office trunk is seized, relay R follows central office ringing. Relay R in operating operates relay CT which in turn operates relay SR. Relay SR operated operates

relay R1. Relay R1 operated extends a busy ground signal over lead TU(T-A) to the TMS remote scanner.

Trunk Answer to Trunk Release

8.77 Each operation of relay SR in the central office trunk circuit extends a busy ground signal over lead TU(T-) to indicate a busy condition to the TMS remote scanner circuit.

9. NIGHT CONNECTIONS

A. Fixed Night Connections - Option F (MD)

9.01 When the attendant operates the night service key, relays AT and ATA release in the alarm, transfer and test circuit.

9.02 Relay AT released transfers the tip and ring of stations 30, 31, 32, and 33 from their associated line relays to back contacts of relay ATA.

9.03 Relay ATA released transfers the central office cable pairs from central office trunks 0, 1, 2, and 5 to stations 30-33. The stations are now connected directly to the central office.

9.04 Calls are completed as described for emergency trunk service except that relays AT and ATA are under control of the night service key.

B. Flexible Night Connections - Options Y, E(MD), YM(MD), and XO

Idle Trunk to Idle Station (SC33, 34)

9.05 When the attendant operates the night service key, relay NS releases in the alarm, transfer, and test circuit. This connects ground to leads NSO and NSE and connects leads NC(0-9) to leads CN(0-9).

9.06 The attendant then operates the pick-up key associated with a central office trunk to be night connected. Relays ACA, AC, S, and S1 operate; lamp TL(CDLS POS) or L(6 BUT KEY TEL SET) lights as described for an attendant-originated call with the following exceptions and additions:

9.07 When the pick-up key is operated, relay N1 operates in parallel with relay ACA.

9.08 If the PBX is provided with an auxiliary position circuit, relay NC- in the auxiliary position circuit operates in parallel with relays N1 and ACA.

9.09 Since relay BN in the auxiliary position circuit is operated when the PBX is on remote trunk answer operation and thus opens the operate path for relay N1 and relay NC- in the auxiliary position circuit, the attendant cannot set up night connections after placing the PBX on remote trunk answer operation.

9.10 Relay N1 operated:

- (a) Disconnects the trunk circuit from the central office conductors with the exception of the ringing bridge.
- (b) Connects battery and ground to the tip and ring to operate relay H.

(c) Locks operated under the control of relays ACA and S1 (via lead J).

(d) Prepares the operate path for relay H (with option ZZ).

9.11 Relay ACA operated provides holding ground for relay N1 and operates relay N.

9.12 Relay H operated:

(a) Connects ground to the trunk.

(b) Lights lamp TRK BY in the make busy and busy display circuit.

(c) Locks operated under control of relay NS in the alarm, transfer, and test circuit.

(d) Opens ringing lead R1.

(e) Partially completes a path to prevent the connection of two trunks to one station.

(f) Prepares a lockup path for relay RS.

9.13 After relay H operates, relays CT and SR operate, and relay H releases.

9.14 Note: Relays ACA, AC, CT, N, N1, S, S1, SR, and TLA are operated. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is steady.

9.15 The attendant operates the hold key for PBX dial tone, and operates relay TLA (with option A). Upon receiving dial tone, the attendant dials the number of the station to be night connected and the action is the same as trunk to marker identification.

9.16 Note: Relays ACA, AC, CT, HD, HM, N, N1, S, S1, SL, SR, and TLA are operated. Lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) is flashing at 30 IPM. Relay SP is operated in the ~~cordless-position~~ circuit.

9.17 If the marker finds the called station line idle, the marker, register, and trunk function as described for ring start except that ringing is not applied to the called station since operated relay N had opened ringing lead R1.

9.18 Note: Relays ACA, AC, CT, HM, N, N1, RS, S, S1, SR, and TLA are operated. Lamp TL is steady. Lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) is flashing at 30 IPM. Relays SP and FB are operated in the cordless position circuit.

9.19 Lamp SL(CDLS POS), flashing at 30 IPM is an indication to the attendant that the station and trunk are connected.

9.20 The attendant operates the release key which releases, in sequence, relays AC, ACA, and relays FB and SP in the cordless position circuit.

9.21 In addition, relay ACA released releases relay RS. Relay RS released removes the holding bridge from the trunk allowing relay S to release in turn releasing relay SL.

9.22 Relay S1 released:

- (a) Releases relay CT.
- (b) Releases relay N1 by removing ground from diode J.
- (c) Extinguishes lamp SL(CDLS POS).

9.23 Relay CT released releases relay SR and extinguishes lamp TL(CDLS POS) or L(6 BUT KEY TEL SET).

9.24 Relay N1 released removes battery and ground from the trunk and connects the trunk conductors to the central office.

9.25 Note: Relays TLA, N, and HM will remain operated as long as the night service key remains operated.

C. Camp-On (SC33-36)

9.26 If the attendant sets up a night connection and the station to be connected is busy, the sequence of events up to the time the register responds to the attendant dial is the same as described above. The action from this point on is the same as for a camp-on call, including the operation of the release key by the attendant after receiving visual and audible indication of the connection.

9.27 Preparation of a night connection to a busy station is now complete. The night connection will be established without further attendant action.

9.28 Note: Relays RS, DR, DRA, CT, BY, HM, TLA, N1, N, SR, S1, and S are operated. Lamp TL(CDLS POS) is steady. Lamp L(6 BUT KEY TEL SET) or SL(CDLS POS) are flashing at 60 IPM.

D. Camped-On Station Becomes Idle (SC36)

9.29 Relay SL operates and releases; relays BY and DR release when the camp-on station becomes idle. However, when relay DR releases during a night connected camp-on condition, relay RS releases since, with relay N operated, there is no locking path via lead CL.

9.30 Relay N operated also prevents ringing via the R1 lead when the camped on station becomes idle.

9.31 Relay RS released removes the holding bridge from the trunk allowing relay S to release.

9.32 Relay S released releases, in sequence, relays S1, N1, CT, and SR which extinguish lamps L(6 BUT KEY TEL SET), SL(CDLS POS), and TL(CDLS POS) as explained for attendant release. The trunk and station are now connected for night service.

9.33 Note: Relays TLA, N, and HM remain operated as long as the night service key remains operated.

9.34 The path between sleeve lead S and lead CW is provided to prevent two trunks from being connected to one station.

9.35 If the attendant attempts to connect a second trunk to an existing night-connected trunk, which is either idle or camped on, a camp-on busy condition will exist; 120-IPM busy tone will be connected to the attendant and lamp SL(CDLS POS) will flash at 120 IPM.

9.36 The attendant must remove this condition by the following (sequential) procedure:

- (a) Restore the night service key. This releases all night connections.
- (b) Operate the pick-up key associated with the flashing SL lamp.
- (c) Operate the hold key.
- (d) Operate the release key.
- (e) Reestablish all night service connections.

9.37 When the attendant releases the night connections at the start of business, any busy connection will not be disturbed; upon becoming idle, the trunks will restore to normal.

E. Incoming Central Office Call to Night Connected Stations

9.38 If the trunk is seized by the central office during the silent interval, relay H operates.

9.39 When the central office applies ringing current, relay R operates but does not operate relay R1 since relay TLA remains operated during night service connections.

9.40 Relay R operated, operates relay RS. Relay RS follows relay R to repeat central office ringing, and continuous ringing is applied to the station through contacts of relays RS and N.

9.41 If the trunk is seized during the ringing intervals, relay R operates causing relay RS to operate. Relay RS operated functions as described above; ringing current operates the station ringer.

9.42 Note: Relays HM, TLA, and N are operated with R and RS following central office ringing. Lamp SL (CDLS POS) flashes intermittently with ringing.

9.43 If the station answers during the silent interval, the loop trips ringing and operates relay S which in turn operates relay S1. Relay S1 operated, lights lamp SL(CDLS POS) of L(6 BUT KEY TEL SET) steadily, and operates relay CT through a contact of relay H. Relay CT operated, operates relay SR, and the central office ringing is tripped. The station is now cut through to the central office.

9.44 If the station answers during the ringing interval, a dc path is closed, operating relay RT. Relay RT operated, releases relay RS which disconnects ringing from the station. With relays RS and R released, relay RT releases. The operation of relays S, S1, CT, and SR is the same as station answering during the silent interval.

9.45 When the station hangs up, relays S, S1, CT, and SR release, lamps SL(CDLS POS) and TL(CDLS POS) are extinguished, lamp L(6 BUT KEY TEL SET) is extinguished, and relay H is operated. When the central office disconnects, relay H releases.

F. Outgoing Call from a Station on Night Connection

9.46 When the station goes off-hook, relay S operates from battery through resistor BF, the station loop, and to ground.

9.47 Relay S operated operates relay S1 which furnishes a start ground to the ring side of the central office line circuit, and lights lamp(s) TL(CDLS POS) and SL(CDLS POS) or L(6 BUT KEY TEL SET).

9.48 Once the start ground is furnished to the central office, the central office line circuit functions to return dial tone or if a manual central office, the operator answers.

9.49 This action causes relay H to operate in turn operating relay CT.

9.50 Relay CT operated:

- (a) Operates relay SR.

- (b) Locks operated through the operated S1 and SR contacts.

- (c) Closes the tip and ring of the trunk through to the central office which gives the station central office dial tone.

9.51 Relay SR operated releases relay H and removes the start ground from the ring side of the trunk.

9.52 Disconnection is the same as for an incoming central office call to a night-connected station.

10. DISCONNECTION (SC9-10)

A. Incoming Central Office Trunk Call Connected to a Station

10.01 If the station disconnects first, the removal of the station loop releases relay S which operates relay FF and releases relay S1. Relay FF operated extinguishes lamp L(6 BUT KEY TEL SET) or lamp SL(CDLS POS).

10.02 Relay S1 released connects relay H across the tip and ring toward the central office, releases relay CT, and lights lamp L(6 BUT KEY TEL SET). Relay H operates on central office battery.

10.03 Relay CT releases relay SR which removes the off-normal ground to release relays RT, HM, TLA, FF, and the trunk hold magnet, extinguishes lamps TRK BY and TRK BY INC in the make busy and busy display circuit, and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).

10.04 Relay FF released operates relay CT which operates relay SR.

10.05 Relay SR operated lights lamp L(6 BUT KEY TEL SET) or TL(CDLS POS), connects the fundamental ground to the trunk, and lights lamp TRK BY in the make busy and busy display circuit.

10.06 When the central office disconnects, relay H releases in turn releasing relay CT which releases relay SR. Relay SR released, extinguishes lamp TRK BY in the make busy and busy display circuit, and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).

10.07 If a central office arranged for calling party control disconnects first, all relays release, all lamps are extinguished, and the station is returned to local PBX dial tone.

10.08 If a central office arranged for joint control disconnects first, no action occurs until the central office times out; then the action is as above.

B. Incoming Central Office Trunk Call
Connected to the Attendant

10.09 If the attendant disconnects first
(SC3 and 4), operation of the
release key causes relay AC to release in
turn releasing relay ACA.

- 10.10 Relay ACA released disconnects the attendant telephone set from the trunk causing relay S to release in turn releasing relay S1.
- 10.11 Relay S1, released with S or R option, connects relay H in the trunk which operates from the central office.
- 10.12 Relay H operated holds relay CT in turn holding SR and holds lamp L (6 BUT KEY TEL SET) or TL(CDLS POS) steady.
- 10.13 When the central office times out or disconnects, relay H releases in turn releasing relay CT which releases relay SR. Relay SR released extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).
- 10.14 If a central office arranged for calling party control releases first, relay S releases in turn releasing relay S1.
- 10.15 Relay S1 released releases relays ACA and CT.
- 10.16 Relay ACA released releases relay AC.
- 10.17 Relay CT released releases relay SR which removes the fundamental ground and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS) restoring the trunk to normal.
- 10.18 If option Y is provided and the attendant has not disconnected when relay SR releases, the action is the same as if the attendant initiates an outgoing call.
- 10.19 When the attendant disconnects, all relays release and all lamps are extinguished.
- 10.20 If a central office arranged for joint control disconnects first, no action occurs until the central office times out at which time the action is as above.
- C. Incoming Central Office Trunk Call Held by the Attendant
- 10.21 If a central office arranged for calling party control disconnects from a hold condition after the attendant has released and the call was originated at the central office, the trunk relays release in the following order: S, S1, CT, SR, TLA, and HD. Lamp L(6 BUT KEY TEL SET) or TL (CDLS POS) is extinguished when relay SR releases.
- 10.22 If the attendant has not restored the pick-up key with option Y furnished, all operated relays release; but when the HM relay and SR relay release, relays ACA and S reoperate causing the trunk to function as for an attendant originated call.

When the attendant disconnects, all reoperated relays release and all lamps are extinguished.

- 10.23 If the central office disconnects from a hold condition before the attendant restores the pick-up key and option X is furnished, relay S releases releasing relays ACA and S1.
- 10.24 Relay ACA released releases relays HD, AC, and SP in cordless position circuit.
- 10.25 Relay HD released releases relay S1. Relay S1 released releases relay CT which releases relay SR removing the off-normal ground.
- 10.26 Relays HM and TLA release and all lamps are extinguished.
- 10.27 If the central office is arranged for joint control and the central office disconnects, the holding bridge in the trunk holds the connection until the central office times out at which time disconnection is the same as above.

D. Outgoing Call from Station to Central Office

- 10.28 If the central office disconnects first, no action takes place in the trunk circuit and when the station disconnects, all trunk relays release in order as follows: relay S, S1, CT, SR, TLA, and HM. (RT releases if call was completed on a dial back basis.)
- 10.29 Relay SR released extinguishes lamp(s) L(6 BUT KEY TEL SET), or SL(CDLS POS) and TL(CDLS POS).
- 10.30 If the station disconnects first, all relays release as above and the trunk is restored to normal.

E. Trunk Camped On Busy Station

- 10.31 If the central office is arranged for calling party control and the central office disconnects before the camped on trunk cuts through to the station, relay S releases in turn releasing relays S1 and DR.
- 10.32 Relay S1 released releases relay CT which releases relay SR. Relay SR removes the off-normal ground causing relays TLA, HM, and RS to release and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS). Relay HM released releases relay BY and extinguishes lamp SL(CDLS POS).
- 10.33 If the central office is arranged for joint control and the calling party disconnects before the trunk cuts through to the station, the bridge in the trunk holds the connection until such time that the office times out. After time out, the trunk releases as above.

F. Trunk in a Camped On Busy Condition

- 10.34 If a central office arranged for calling party control disconnects first after the attendant has advised the calling party of the progress of the call, relay S releases causing relays DR and SL to release.
- 10.35 Relay SL released releases relay CT in turn releasing relay SR.
- 10.36 Relay SR released removes the off-normal ground to release relays SP and FB in the cordless position circuit, releases relays RS, HM, TLA, and FF, and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).
- 10.37 Relay HM released extinguishes lamp SL(CDLS POS) and releases relay BY.
- 10.38 If option Y is not provided, relay ACA releases when FF and RS release releasing relay AC.
- 10.39 If option Y is furnished, relay ACA remains operated or reoperates when relay HM releases causing the trunk to function as for an attendant originated outgoing call.
- 10.40 When the attendant disconnects, all relays release and all lamps are extinguished.
- 10.41 If the attendant disconnects first relay AC releases in turn releasing relay ACA which releases relays SP and FB in the cordless position circuit. When the central office disconnects, the trunk releases as described above.
- 10.42 If the central office is arranged for joint control, the bridge in the attendant telephone circuit holds the connection until the office times out which causes the trunk to disconnect as described for calling party control. Otherwise when the attendant disconnects, the bridge is removed from the trunk causing the central office to release.

G. Tie Trunk (Other than Ringdown) to Central Office

- 10.43 If a tie trunk is connected to a central office trunk circuit and the central office disconnects first, no action takes place in the central office trunk circuit. When the tie trunks disconnect, the action is the same as for a station.

H. Incoming Central Office Trunk to Tie Trunk (Other than Ringdown)

- 10.44 When a central office trunk is connected to a tie trunk and the central office arranged for calling party control disconnects first, relay S releases causing relays SL, CT, and SR to release in turn.
- 10.45 Relay SR released releases relays HD, HM, TLA, TT, RT, and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS).
- 10.46 Relay HM released extinguishes lamp SL and relay HD released releases relays P and SL. The central office trunk is now normal.
- 10.47 If the tie trunk disconnects first, relay P releases causing relays S, SL, CT, and SR to release in turn.
- 10.48 Relay SR released functions as above to release the trunk.
- 10.49 If the central office still has not disconnected, the action is the same as a seizure from the central office during the silent period.
- 10.50 If a central office arranged for joint control disconnects first, no action occurs until the central office times out; then the action is as above.

I. Ringdown Tie Trunk to Central Office

- 10.51 When a ringdown tie trunk is connected to a central office arranged for calling party control and the tie trunk disconnects first or last, nothing happens.
- 10.52 When the central office disconnects, relays S, SL, CT, and SR release in turn.
- 10.53 Relay SR released releases relays TLA and HM and extinguishes lamp L(6 BUT KEY TEL SET) or TL(CDLS POS). Relay SL released extinguishes lamp SL(CDLS POS).
- 10.54 If a central office is arranged for joint control, no action occurs until the central office times out; then the action is as above.

J. Central Office Trunk to Ringdown Tie Trunk

- 10.55 The only difference between this type call and a ringdown tie trunk call to a central office is that relay TT is operated when the central office trunk is connected.

K. Incoming Central Office Trunk Call
Connected to a Station Via the
Auxiliary Position Circuit

10.56 When the PBX is on remote trunk answer operation and the answering station disconnects, the auxiliary position circuit opens the loop to the central office through which relay S is held operated and opens the path holding relay AC operated.

10.57 Relays S and AC released function as described under disconnection for an incoming central office trunk call connected to the attendant.

11. EXPLANATION OF OPTIONS

A. Option A

11.01 When the attendant places a call to a toll office and disconnects for any reason, the toll operator is unable to rering on the central office trunk circuit unless option A is provided.

11.02 The inability to rering on the trunk circuit is due to the operation of relay TLA which opens the operating path of relay RL which is required to operate the audible signal and flash the trunk lamp.

11.03 Wiring option A prevents relay TLA from operating unless the attendant operates the hold key in the cordless position circuit. With this wiring option, the toll operator may rering the PBX attendant as follows.

11.04 If the attendant disconnects, the rering locks in a flashing trunk lamp and the audible signal follows the ringing current.

11.05 If the attendant holds, the flashing trunk lamp and audible signal both follow the ringing current.

11.06 Diode A prevents the locking of relay H after the toll-allowed relay in the trunk circuit has operated.

B. Option ZB

11.07 When the secrecy feature is provided and the central office trunk camps on a busy station, the attendant is prevented from reporting back to the calling central office party unless the trunk is removed from the camp-on condition.

11.08 Option ZB adds a contact of the ring start relay in the control path of splitting relay of the cordless position circuit; therefore, the connection will not be split until the ring start relay has operated.

C. Option ZH (MD)

11.09 If a trunk is camped on a busy station and the party connected to the busy station disconnects while the busy station remains in the off-hook condition it is possible for the busy station and the party connected to the camped on trunk to talk with reduced transmission through the FB capacitor.

11.10 To prevent this, option ZH is added in conjunction with one of options ZL or ZJ. With option ZH, the path through the FB capacitor is opened when relay DR operates.

D. Option ZD

11.11 When the attendant operation of a 756A PBX is transferred to a 6-button key telephone set, the common ringer continues to ring on calls over central office and attendant trunks which do not appear on the 6-button key telephone set unless option ZD is provided.

11.12 Option ZD provides for each BZ (buzzer) lead to be separate and to connect to relay contacts in the cordless position circuit.

11.13 Straps are added across the make and break contact of each BZ lead associated with a trunk appearance on the 6-button key telephone set. When the operations are transferred, the added relays in the cordless position circuit operate and the BZ leads not strapped are opened. Only those BZ leads strapped will cause the common ringer to operate.

E. Option ZN (MD)

11.14 With option ZN, trunk units 8 and 9 are used as single-digit, dial-8 long distance trunks. On incoming calls from the toll office, the trunks function as a regular central office trunk; outgoing they are not available unless a single-digit 8 is dialed and converted to 90.

11.15 When the SD relay in the dial pulse register operated, the IT(90-99) lead is connected toward the marker circuit and the trunk is selected.

F. Option ZO

11.16 Option ZO prevents preliminary pulse emission upon seizure of the central office trunk.

G. Option ZP (MD)

11.17 Option ZP extends delay single-digit dialing to trunks 6 and 7. Option ZP and ZN are the same otherwise.

H. Option ZQ (MD)

11.18 Option ZQ makes the trunk busy to the marker when the trunk is being used for a night connection with a cord switchboard.

I. Option ZS

11.19 Option ZS provides steady audible signal to a switchboard attendant when the central office trunk is seized by an incoming call.

J. Option ZV

11.20 Option ZV isolates a trunk ground from the central office ground on the ring side of the line when the attendant reconnects after camp-on.

K. Option ZZ

11.21 Option ZZ enables the trunk to function with the auxiliary position circuit for remote trunk answering.

L. Options YA(MD) and YI

11.22 Option YA or YI provides wiring associated with App Fig. 6 to provide indication of camp-on.

M. Options YQ, YS, and XL

11.23 With options YQ, YS, and XL trunk units 6, 7, 8, and 9 are used as single-digit dial and long distance trunks.

N. Options YP and YR

11.24 Options YP and YR make the trunk busy to the marker when the trunk is being used for a night connection with a cord switchboard.

O. Options J(MD), YP, and YQ

11.25 Option J, or options YP and YQ is/are arranged for 2-way assigned service.

P. App Fig. 5

11.26 App Fig. 5 prevents false flashing signals (false recall) when the trunk is wired to a panel central office.

Q. App Fig. 6

11.27 App Fig. 6 connects a warning tone of approximately one-half second from the cordless position circuit to the tip and ring as an indication of a central office trunk camped on a busy station.

R. Option XP

11.28 Option XP arranges the trunk for 48-volt central office battery operation.

S. App Fig. 8

11.29 App Fig. 8 improves station telephone set transmission characteristics whenever 72-volt central office battery is supplied.

12. FUNCTION OF MAKE BUSY AND BUSY DISPLAY CIRCUIT

A. Central Office Trunk Key Normal

12.01 With the central office trunk key (CO TRK key) normal in the make busy and busy display circuit, the trunk busy lamp (TRK BY lamp) will light when ground is applied to lead IT9- directly or through relay S- in the line, link, and marker circuit. The lighting of lamp TRK BY indicates that the central office trunk has been made busy to the marker by a central office trunk call.

12.02 The trunk busy incoming lamp (TRK BY INC lamp) in the make busy and busy display circuit is an additional busy lamp to indicate an incoming central office trunk call. Lamp TRK BY INC will light whenever ground is applied to the secondary winding of the ring trip (RT) relay in the trunk circuit. The lighting of lamp TRK BY INC indicates the central office trunk has been made busy to the marker by an incoming central office trunk call.

B. Central Office Trunk Made Busy

12.03 If it is desired to make a central office trunk busy to the marker for outgoing central office trunk calls, key CO TRK in the make busy and busy display circuit is operated. Key CO TRK operated:

- (a) Opens the associated IT9- lead to the line, link, and marker circuit.
- (b) Applies ground to lamp TRK BY in the make busy and busy display circuit.

12.04 The lighting of lamp TRK BY indicates that the central office trunk has been made busy. Opening lead IT9- prevents the operation of the associated S relay in the marker circuit. The ground applied to lead IT9- makes the trunk appear busy to the marker for outgoing central office trunk calls.

12.05 To prevent the use of the central office trunk circuit by an incoming call, the central office trunk must be made busy at the central office.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

- 1.01 Maximum external loop resistance for tripping during the silent interval - 1400.
- 1.02 Maximum external loop resistance for tripping during the ringing interval - 2000.
- 1.03 The trunk conductor loop resistance plus the maximum station loop resistance of the S relay shall not exceed the central office subscriber range of the connecting central office less 65 ohms.

2. FUNCTIONAL DESIGNATIONS

2.01 The functional meanings of the designations of the relays of the central office trunk circuit are listed below.

<u>Designation</u>	<u>Meaning</u>
AC,ACA	Attendant Connector
BY	Busy
CT	Cut Through
DR	Delayed Ring
DRA	Delayed Ringing Auxiliary
FF	Fast Flash
H	Historical Designation (Monitors Tip and Ring Toward Central Office)
HD	Hold
HM	Hold Magnet Slave
IC	Indicate Camp-On
MC	Marker Connector
N	Night Service
N1	Auxiliary Night Service
P	Polarized
R	Ringup
R1	Ringup Auxiliary
RS	Ring Start
RT	Ring Trip
S	Supervisory
S1	Supervisory Auxiliary
SE	Sleeve of Answer Jack
SL	Sleeve
SR	Slow Release
TLA	Toll Allowed
TT	Trunk Terminating

3. FUNCTIONS

A. Incoming Calls

- 3.01 To make the link end of the trunk busy to the marker when the central office end is seized.
- 3.02 To light the trunk lamp steadily when the central office trunk is seized during the silent interval of the ringing cycle.
- 3.03 To flash the trunk lamp at 120 IPM and operate the cordless position audible signal when central office ringing is received.

- 3.04 To trip ringing, light the trunk lamp steadily, silence the cordless position audible signal, and complete the transmission path to the cordless position circuit when the attendant answers.
- 3.05 To hold and split the central office end of the trunk from the attendant, flash the trunk lamp at 30 IPM, and complete the transmission and dialing path from the cordless position to the line end of the trunk (thereby furnishing local dial tone) when the hold key is momentarily depressed.
- 3.06 To provide for tandem operation from a tie trunk which is arranged for tandem dial operation.
- 3.07 To flash the station lamp at 30 IPM when dialing is completed until the called line answers.
- 3.08 To exclude the central office from the talking circuit until the attendant releases after dialing into the PBX.
- 3.09 To light the trunk and station lamps steadily when the talking circuit is completed.
- 3.10 To camp on a busy station line and give a warning tone to the station user as an indication of camp-on.
- 3.11 To flash the station lamp at 60 IPM and transmit busy tone to the attendant when the trunk circuit camps-on a busy line.
- 3.12 To flash the station lamp at 120 IPM and transmit 120-IPM busy tone to the attendant when the trunk circuit encounters a camp-on busy.
- 3.13 To provide camp-on busy indications in response to an all called trunks busy condition.
- 3.14 To remove the splitting feature and disconnect the attendant when the release key is operated, preparatory to reporting a busy to the calling party.
- 3.15 To reconnect the transmission path between the central office and the attendant when the pick-up key is reoperated to report a busy to the calling party.
- 3.16 To release the called line, extinguish the station lamp, and steer the attendant to the central office when the hold key is momentarily operated to discharge a camp-on, camp-on busy, or line does not answer call.
- 3.17 To flash the station lamp at 120 IPM and operate the cordless position ringer steadily when the called line recalls the attendant.

3.18 To light the station lamp steadily, silence the ringer, and bridge the attendant on the talking circuit when the pickup key is operated to answer a recall.

3.19 To exclude the central office from the talking circuit when the attendant answers a recall if the secrecy option is provided.

3.20 To release the calling line and extinguish the station lamp when the attendant momentarily operates the hold key to transfer a call.

3.21 To flash the trunk lamp at 30 IPM, hold the central office, and re-engage the PBX equipment to provide local dial tone when the hold key is momentarily reoperated to transfer a call.

3.22 To release and extinguish the station and trunk lamps on disconnect.

3.23 To provide delay-through supervision.

3.24 To provide a busy indication to the TMS remote scanner.

B. Outgoing Calls from Stations or Trunks

3.25 To light the trunk and station lamps steadily and make the circuit test busy to the marker after seizure.

3.26 To signal the central office.

3.27 To connect the calling line to the central office when the operator answers in the case of a manual central office or when the dial equipment functions and is ready to receive dial pulses in the case of a dial central office.

3.28 To disconnect toll-denied lines from the central office and divert them to busy tone when a toll trunk is called.

3.29 To provide for reringing a toll-allowed station from the toll office when toll delays are experienced.

3.30 To provide outgoing central office connections from restricted stations on a dial-back basis.

3.31 To rering the cordless position circuit when the toll operator rerings on a delayed toll call to a restricted station.

3.32 To release the station line, extinguish the station lamp, flash the trunk lamp at 120 IPM, and operate the cordless position ringer if the trunk circuit is seized by an incoming call after the station has been diverted to busy tone due to being denied access to toll.

3.33 To hold the PBX end of the trunk busy until the central office end of the trunk is released.

3.34 To provide a disconnect signal to the central office when the PBX station disconnects.

3.35 To extinguish both station and trunk lamps when both the PBX line and central office finally disconnect from the trunk circuit.

3.36 To provide a busy indication to the TMS remote scanner.

C. Outgoing Calls Originated by the Attendant

3.37 To light the trunk lamp steadily and make the circuit test busy to the marker when the attendant originates an outward call.

3.38 To signal the central office.

3.39 To connect the attendant telephone circuit through to the central office when the operator answers in a manual office or when the dial central office is ready to receive dial pulses.

3.40 To flash the trunk lamp at 30 IPM and place a holding bridge across the central office end of the trunk when the attendant momentarily operates the hold key and then the release key to hold the trunk.

3.41 To light the trunk lamp steadily and remove the holding bridge when the trunk circuit is reentered again by the attendant.

3.42 To permit rering from the central office into the holding bridge, to flash the trunk lamp at 120 IPM, and operate the cordless position ringer.

3.43 To provide a disconnect signal to the central office when the attendant disconnects.

3.44 To extinguish the trunk lamp when the attendant disconnects.

3.45 To provide a busy indication to the TMS remote scanner.

D. Functions With Key Telephone Set Used as Attendant Position

3.46 To provide only the moving lamp signal when moving signals are present.

3.47 To operate exactly the same as the cordless position does except that the switchhook replaces the pickup and release keys and no no-test key is provided.

3.48 To provide the attendant a means of establishing night connections between any central office trunk and any station.

3.49 To provide a busy indication to the TMS remote scanner.

E. Functions When Trunk is Used With A Cord Switchboard

3.50 To provide a trunk appearance at a cord switchboard.

3.51 To make the trunk busy to the marker when being used for night connections.

3.52 To provide a steady audible signal to a switchboard attendant on incoming calls.

3.53 To provide a busy indication to the TMS remote scanner.

F. Functions With Auxiliary Position Circuit When PBX is on Remote Trunk Answer Operation

3.54 To signal the auxiliary position circuit to activate the remote answer signal when an incoming call is received.

3.55 To trip ringing and complete the transmission path to the cordless position circuit when the call is answered by a PBX station.

3.56 To hold and split the central office end of the trunk from the answering station and complete the dialing path from the auxiliary position circuit to the line end of the trunk (thereby furnishing local dial tone) when the call is to be completed to another station.

3.57 To exclude the central office from the talking circuit until the trunk answering station disconnects after dialing into the PBX and answer by the called station.

3.58 To provide camp-on busy indication in response to a called station busy condition.

3.59 To release the called line and steer the trunk answering station to the central office under control of a signal from the trunk answering station.

3.60 To release the called line and then release if the trunk answering station disconnects without discharging a called station busy or called line does not answer call.

3.61 To release on disconnect.

3.62 To provide delay-through supervision.

3.63 To provide a busy indication to the TMS remote scanner.

G. Functions With Station Dial Transfer: Trunk Circuit and Controller Circuit When PBX is Arranged for Station Dial Transfer Operation

3.64 To signal the station dial transfer controller circuit on station recall.

3.65 To light the trunk and station lamps steadily while transferring occurs.

3.66 To activate the marker in calling a dial pulse register when a station has been attached to the transfer trunk circuit.

3.67 To transmit dial tone to a transferring station when a dial pulse register has been attached to a transfer trunk circuit.

3.68 To transmit pulses into the register when pulsing starts after a register is attached to the line end of the trunk circuit.

3.69 To trip ringing and complete the transmission path through the station dial transfer circuits when a transfer call is answered by a PBX station.

3.70 To flash the station lamp at 120 IPM and operate the cordless position audible signal when a PBX station dials zero when transferring.

3.71 To hold and split the central office end of the trunk and complete the transmission and dialing path when a PBX station momentarily operates his switch-hook to transfer a call.

3.72 To make the trunk busy to the marker when being used in transferring a call.

3.73 To return a transferring station to the attendant without going through an attendant trunk.

3.74 To release a PBX station attached to the line end of the trunk after the transfer has taken place.

3.75 To release the transferring and transferred lines when the trunk end station disconnects.

3.76 To release or disconnect.

3.77 To provide delay-through supervision.

3.78 To provide a busy indication to the TMS remote scanner.

H. Functions With Make Busy and Busy Display Circuit

- 3.79 To provide a trunk busy indication to the make busy and busy display circuit on all trunk calls.
- 3.80 To provide an additional trunk busy indication to the make busy and busy display circuit on all incoming trunk calls.
- 3.81 To provide for being made busy by the make busy and busy display circuit for outgoing calls only.
- 3.82 To provide a busy indication to the TMS remote scanner.

4. CONNECTING CIRCUITS

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

- (a) 756A PBX Line, Link, and Marker Circuit - SD-65740-01.
- (b) 756A PBX Alarm, Transfer, and Test Circuit - SD-66796-01.
- (c) 756A PBX Cabling Diagrams - SD-65746-01.
- (d) 756A PBX Cordless Position Circuit - SD-65757-01.
- (e) Subscriber Line Circuit Arranged for Ground Signaling on the Ring Conductor - SD-25553-01(typical).
- (f) Long Trunk Circuit - SD-66192-01 (typical).
- (g) SXS Toll Diverting Trunk Circuit - SD-32067-01.
- (h) Ringing Circuit - SD-81288-01.
- (i) Power Supply Circuit - SD-81326-01.
- (j) No. 556A Cord, Telephone, Dial, Battery, Buzzer and Ringing Circuit - SD-65658-01.
- (k) No. 608A Auxiliary Signal, Fuse Alarm, Battery Cut-Off, and Miscellaneous Circuit - SD-66722-01.
- (l) Toll Subscribers Line Circuit - SD-56501-01.
- (m) 756A Station Dial Transfer Controller Circuit - SD-66909-01.
- (n) 756A Auxiliary Position Circuit - SD-66910-01.
- (o) 756A PBX Feature Cabling Diagram - SD-66920-01.

- (p) Station Message Register Pulse and Surcharge Circuit - SD-5E021-01.
- (q) Line or Trunk Access Circuit - SD-1E045-01.
- (r) 552A, 552B, 552D, 552E, 605A, 607A, 607B, or 608A Jack Circuit - SD-65778-01.
- (s) 608D Jack and Lamp Circuit - SD-65997-01.
- (t) 608A or 608B Auxiliary Signal, Fuse Alarm, Battery Cut-Off, and Miscellaneous Circuit - SD-66722-01.
- (u) 608D Auxiliary Signal, Fuse Alarm, Battery Cut-Off, and Miscellaneous Circuit - SD-67039-01.
- (v) Make Busy and Busy Display Circuit - SD-5E029-01.
- (w) Traffic Measuring System No. 1A Remote Scanner and Encoder Circuit - Portable Type - SD-3B200-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The 2-way central office trunk shall be capable of performing all the service functions specified in this circuit description and of meeting all the requirements of the Circuit Requirements Table.

6. TAKING EQUIPMENT OUT OF SERVICE

- 6.01 When the make busy and busy display circuit is not provided, the central office trunk circuit can be taken out of service by removing the strap between terminals 18 and 28 on the unit terminal strip and connecting a strap between terminals 18 and 17. This busies the trunk toward the marker. To prevent incoming calls, the central office trunk should be made busy at the central office.
- 6.02 When the make busy and busy display circuit is provided, the central office trunk may be taken out of service as follows: make sure that the central office trunk busy lamp (TRK BY lamp) in the make busy and busy display circuit is not lighted and operate key CO TRK. This busies the trunk toward the marker, thereby preventing outgoing trunk calls. To prevent incoming trunk calls, the central office trunk should be made busy at the central office.

7. ALARM INFORMATION

A. Fuse Alarm

7.01 An operated fuse supplying the 2-way central office trunk circuit will result in a major alarm being transmitted to the plant service center if alarm sending is provided and in any case by a visual signal at the attendant position and in the alarm transfer and test circuit.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 Contact 2EBM of relay N1 is added per option XX to prevent audible ringing tone to the attendant position circuit when establishing flexible night connections. This change must be coordinated with Issue 51B of SD-65746-01.

D.2 Apply the application to prevent ringing pretrip for the 103A data set as well as for the other circuits mentioned in Circuit Note 116.

D.3 Circuit Notes 104 and 116, App Fig. 1, and the Sheet and Option Indexes are revised to reflect the change in this issue.

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