TECHNICAL TRAINING PUBLICATION

NZPO TYPES 120, 135, 149 PABXs CIRCUIT SUMMARIES

C O N T E N T S

Page No.

Remarks	14,720		14,324		14,690	
	rel	op	rel	op	rel	op
Marking relays (CX, RX, CY, RY) and CD, K, SD release. H does not operate as line 33 is not wired. IP slow flashes (as for busy extn) attendant restores KDQ		K		M		BR,MH,CL, M,MF.
Relays operated awaiting call to be extended normally		S		(LP)		SB,SA CA
7. Outgoing Calls set up by attendant.	ST	K		M		
7.1 attendant operates KT IPs of engaged exchange lines light. KT released		S		(LP)		SA,SB,CA, BR,CL,MF.
7.2 attendant operates KDQ of free exchange line. Busy chain closed, start chain closed, Earth to B wire to call main exchange. MH ops to A eth from exchange. KC and MH dis from exchange which is connected to attendants loop.		S		S		MH CL
Relays operated when attendant hears dial tone		LP		LP		SB,CA,BR, MH, CL
7.3 attendant dials CR ops via DON wire. Pulses direct to line. IP flashes quickly (flicker eth). Attendant is across cct for speech when called sub answers.	EC			(LP)		CR.
Relays operated when attendant across cct are same as before extending on incoming call.	NA,EC			S,(LP)		SA,SB,CA, BR,CL,CR, MF.
7.4 attendant may retire from cct. without losing call. Attendant restores KDQ		S				SB,SA CA
CL held, Exchange loop maintained. Relays operated after attendant has retired from cct. IP flashing reminds attendant or uncompleted trunk condition.	NA,EC			(LP)		MH BR,MH,CL, CR,MF.

Remarks	rel 14720	op	rel 13241	op	rel 14690	op
7.5 Attendant may extend call to an extension Position before extending is as indicated at conclusion of sect. 7.3. Extn. required is "keyed-up" and trunk extended as described from Sect. 6.3.						
7.6 Attendant can release call from dial tone (Sect. 7.3) / Attendant restores KDO			S		SB,SA CA CL MH BR	MH
MH ops until exchange equipment is restored.						
Trunk normal						
7.7 Attendant can release call after dialling main exchange number and before keying extn. / Attendant operates KR with KDO still operated / Attendant restores KR and KDO, cct. restores as in 7.6 as CL can not hold when MH ops if CR is normal so that exchange loop is broken.	EC				CR	
7.8 Attendant can release call after keying up extn if the extn has not answered. / Relays operated. LP steady		NA		S,LP		
Attendant operates KR with KDO still operated			LP.		H,M,RR.	BR,CL,CA, CA,CL,M, H,MF,RR.
7.9 Attendant releases KR and KDO.Cct. releases as in 7.6						
If an exchange caller who has been extended, clears before the extn. answers, the extn. receives "ring no reply" condition.						
8. Enquiry Calls / Relays operated when extn. connected to exchange call		NA		14670	BR,SA,SB CA,CL,M, H,MF,RR.	BR,CL,CA, H,IS,B,RG, MF.

Remarks

8.1 Extn momentarily presses button on telephone thus earthing negative wire

8.1.1 Assume enquiry cct. already engaged OR ops via NSK wire (ER3 back) and locks Ring tone to extn.

Pulse cct. operates. LP flashes
Extn. releases button
Attendant operates KDO to answer

Position is now the same as when called extn. answers with attendant across cct. (Sect. 6.4)

8.1.2 Assume Enquiry cct is free ER ops via ST wire. Exch line looped to hold.
Extn releases button
Extn d/s from exchange caller and connected via TR1 to enquiry cct.

R6 S/O Pbx... ring s...rt, pulse cct operates. Dial tone to extn.
Relays operated

9.2 Extn Dials 1st fig. (7 or 8)
8.2.1 Assume 8 - LS releases twice, - A (Exch line) operates twice - A (Enquiry cct.) releases twice - ES steps to contact 3.

Dial tone dis at ES7
End of train

Relays operated after 1st fig. (8)
ES on contacts 3

Remarks	14,720 rel	14,720 op	14,670 rel	14,670 op	14,690 rel	14,690 op
8.1						DR
8.1.1					OR,CR LP	CR (LP)
						CR
					DR	DR
						SA SS
Position is now...	DC	EC				
8.1.2				A B	ER	EB
				A		ER
				A,B		ER,CL,H,LS, B,CA,ER,EB, RG MF.
R6 S/O...		EH			LS	LS
8.2.1			A	A	A	A
Dial tone dis at ES7			CD	CD,(ES)		ER,CL,H, LS,B,CA, ER,EB,PG, MF
				A		
				E		
				A,B,E		

Remarks	rel	op	rel	op	rel	op
		14720		14670		14690
8.2.2 <u>Assume 7 dialled for 1st fig.</u> Cct functions the same as in 8.2.1 except that at end of pulse train ES is on contact 4. DF operates via ES8 instead of E and ES drives to contact 14 via ES1. (DF locks)						
Relays operated after 1st fig (7)		A,B,E, DF				BR,CL,H, LS,B,CA, EB,RG,ER, MF.
ES on contacts 14.						
8.3 <u>Extn. dials 2nd fig.</u> Pulses repeated to step ES			A	CD NR		LS A
NR locks						
DF releases if 7 dialled for 1st fig.			DF	A		
End of train. Called extn. tested during release lag of E.			CD	H		A
issue free. CG of called extn. operates and extn. busied.			A			
Ring tone to caller. Ringing to called extn.			E	A,B,NR		BR,CL,H LS,B,CA ER,EB,RG,
<u>Relays operated during ringing</u>				H		BR,CL,H LS,B,CA ER,EB,PG MF.
8.4 <u>Called extn. answers</u> Ring tone and ringing dis, eth off ring start			F			
<u>Relays operated</u> extns. talking			D	A,B,NR, H,F,P.		BR,CL,H, LS,B,CA, ER,EB,RG, MF.
8.5 <u>Assume called extn. was busy.</u> H does not operate, relays otherwise are the same as at the conclusion of section 6.3. Busy tone is sent to the caller.						
8.6 <u>Calling Extn. reverts to original exchange call</u>						
8.6.1 <u>Extn. Presses button</u> Z operates via DR wire and locks. Eth to ring start operates Pulse cct.			Z			DR
ER and EB hold to DR1 via Z6 and DR wire.		DR				
<u>Extn releases button</u>						

Remarks

8.6.2 Called extn. releases

ES homes

eth from ring start, enquiry cct, normal

NOTE:- If D does not release, i.e., called extn. does not clear, B is released by S/C from RP pulse via PS3. B then releases HP, Z, and NR.

8.7 Extn. transfers call to enquiry extn.
Relays operated before transfer commences.

8.7.1 Extn. replaces receiver

CO of extension released, S/C of TR removed at CD5
RP wire dis. ST (exch line cct) does not operate in series with TR
(2000 ohms)
1050 ohm batt. to J wire.
CD releases by S/C at TR6 and applies full eth to TR wire

EF hunts for marked tab on J bank (marked via RR2 and ES6)
Enquiry extn. picked, EF dis, Enquiry extn. to exch. line cct.

A (enquiry cct) ops when A in exch line cct is released.

Holding loop dis from trunk, enquiry extn. and main exchange sub connected together.

ES homes

14,720		14,670		14,690	
rel	op	rel	op	rel	op
ER,NB,	A, D, B,H,Z, F,NR			ER,NR,	BR,CL,H, LS,F,CA, ER,NB,PG, NF.
		A,B,NR, H,F,D			
	A	CD TR	B H,CA		A EH
	CD				ST,EF EF H ST,LS A B CA
	H D TR				EF,EB, ER.
	A Z B CD	A Z		CD	MH

Remarks	14720 rel	14720 op	14670 rel	14670 op	14690 rel	14690 op
Equiry circuit normal						
Relays operated in exch line cct. are the same as for "dial 1" calls	rel	NR,F				BR,CL,H, LS,B,CA, RG,NR.
8.8 and extension of incoming calls						
8.8.1 <u>Extn recalls attendant</u>						
<u>Extn presses and releases button to engage enquiry cct. (Section 8 to 8.1.2.)</u>						
<u>Relays operated when extn has dial tone from enquiry cct.</u>		A,B				BR,CL,H, LS,B,CA, ER,EB,RG, NF.
8.8.2 <u>Extn. dials 'O'</u> LS and A (Exch line cct.) follow pulses - A (enquiry cct) steps				CD,(ES)		OR CR (LP)
ES to contacts 11. Dial tone dis at ES7		CD				
End of train						
CR operates via CR wire and locks. Ring tone connected						
LP flashes. Pulse cct operates		EC		A,B		ER,EB
ES homes		A B				
Relays operated awaiting attendant to answer.		NA,EC	SB,SA.			B2,CL, H, LS,B, CA,CR,RG, MF,
8.8.3 <u>Attendant operates KDO to answer</u> Attendant to extn. via 'IN' wires		S	OR,CR			SA.
Ring tone dis., warm tone connected						SB.
8.8.4 <u>Attendant may leave extn. connected</u> to exchange line, or take over exchange line cell						
8.8.4.1 <u>Attendant clears from call by releasing KDO</u> Warm tone dis.			LS B			LS
8.8.4.2 <u>Extn. restores</u> to allow attendant to take over call CR locks to Z wire CO of extn released			H,RG.			CR

Remarks	14720		14670		14690	
	rel	op	rel	op	rel	op
Attendant may now key trunk caller to another extn. (Sect. 6.3) Relays operated		NA, S,EC.				BR,JI,CA, CR,SA,SD, MF.
8.9. Extn. cannot transfer call before enquiry extn answers. Relays operated when enquiry extn is being rung.		NA		A,B,NR,H		BR,CL,CA, H,S,LS,PR, EB,RG,JH.
8.9.1 Extn restores before waiting for enquiry extn to answer				LS		A
COs of extns. release. Pulse cct. operates IP flashes		EC	A B CD,NR,H	CD	OR CR,MH,(IP).	H,CA, EB,JH, RG,OR. A
Relays operated awaiting attendant to answer		NA,EC.				BR,MH,CL, CR,MF.
8.9.2 Attendant operates FDO to answer. Attendant connected to exchange caller via "OUT" wires		S			MH	SA SB,CA
Relays operated		NA,S, EC.				BR,CL,CA, CR,SA,SB, MF.
Position is now the same as when extn restored for attendant to take over call (8.8.4.2)						
9. Night Service						
9.1 Attendant operates KNS to night switch. NSK eth dis from exchange line ccts. Cct prepared to give busy tone if '0' dialled from enquiry cct. Alternative eth dis. from night service busy load. OIW wire dis. Extn bell cct prepared.						

Remarks / Relays	rel	14,720 op	rel	14690 op

9.2 Incoming ring on exchange line

Start and busy chains closed. Pulse cct operates.

EC operating will also either (i) ring a night service extn number (89) or (ii) ring night service bells.

op 14720: EC
op 14690: XC, CR, HH / BR, BR, MH

9.2.1 Assume (i) night service extn. 89 connected (tags 82 and 83 strapped in 14/20)

ECR operates from EC1. Eth to ring start.
HT operates in series with CO extn 89
Continuous ring to extn. 89 via bank strip connection
HT released by S/C from H7
Relays operated awaiting extn to answer

rel 14720: ECR, HT, NE, EC,ECR / HT,NE / F / BS
op 14720: ECR, HT, NE, EC,ECR / HT,NE / F / BS
rel 14690: (AC),CR, / BR,MH,MF.
op 14690: EF / H

Extn 89 extended to exch. line cct.

Extra answers
AS dis. Marking batt. to J wire of EF bank
EF hunts for marked contact
Contact picked, EF dis.
CO of 89 retained

rel 14720: HT / NE / F / BS
rel 14690: ST / EF / ET / H
op 14690: LS / B / CL / CA

Extn. 89 connected to exch. caller
Pulse start dis

op 14720: EC
op 14690: ET / ST / B / CA / CL / MH,AC,CR / RG.

9.2.2 Assume (ii) night service bells connected. Tags 85 and 86 strapped and night-service bells connected to tag 83 and 84 (14720)

Relays operated - night service bells ringing

rel 14720: ECR
op 14720: EC
op 14690: BR,CL,H, / LS,B,CA. / RG,MF.

Night service extn cct normal
Relays operated during speech are the same as after extension of incoming calls (Sect.6.5)

op 14690: AC,CR,BR, / MH,MF.

Remarks

Answering extn. lifts receiver and gets dial tone
Relays operated (Sect.1)
Extn dials '2' A follows pulse train CS steps to contact 9.
Dial tone dis.

End of train
R8 1150 ohm batt. to J wire via LP2
ST operates via night-service start eth.

ET hunts for marked J contact
Contact picked. Drive cut.
H retains CD of answering extn.
FT releases by S/C. Extn. to LS

Extn. connected to exch; caller
CS homes - con. cct. normal

Relays operated during speech are the same as after
extension of incoming calls (Sect.6.5)

9.3 Attempt to transfer exchange call to attendant after
night-switching
Relays operated before transfer attempted.
Extn has dial tone from enquiry cct. (Sect.6).

Extn dials '0' LS and A (exch line cct) and A (Enquiry cct)
step ES to contact 11
End of train
Busy tone to extn. (CR and CR of exch. line cct. do not
operate because NR is released)

	14650		14720		14690	
	rel	op	rel	op	rel	op
	A,B,FT,K, LP1.					
	IP1	CD N				ST FT. CL MH,AC,CR RG
		CD E G N		BS		BR,CL,H, LS,B,CA, RG,MF.
		FT K G,E,A B N	BS			ST EP ET H LS B CA
			EC			BR,CL,H, LS,B,CA, ER,EB,RG, NR.
	14670	A,B,				
	(A)	CD(ES)				
	CD	NR				

Remarks

Relays operated

	14670		14720		14690	
rel	op	rel	op	rel	op	
	A,B,NR					

Extn. reverts to exch. caller by pressing button and releasing

ES homes,
Enquiry cct. normal, Exch. line cct is in the same
condition as before the transfer was attempted.

A
B
Z,NR.

Z			DR, ER,EB		BR,CL,H, LS,F,CA,RC, ER,EB,MF, DR

10. Alternative Access

Outgoing access on two routes can be provided as described in I.S. 1035, addendum No.3. This involves fitting a new relay, CS, to the miscellaneous cct, as shown on CBW.14720 Mod A and also modifications to the connecting ccts, and Extn line ccts as shown on the Mod. A version of the relevant circuit diagrams. The modifications provide for connecting some exchange line relay sets for dial "1" access and some for dial "3". The CS relay prevents "crossing" of dial 1, 2 or 3 calls, and allows access to dial 3 by extns. barred from dial 1, if required.

Relays operated when extn. has dial tone
Extn. dials 3. CS steps to contact 8
End of train
CS and G op. in series. AS and BS dis. 1150 ohm marking batt.
to J wire. Eth to start chain "in" wire of dial 3 exch line ccts.
Eth hurts for marked J contact and call proceeds as in 5.1.

	14720 Mod.A.		14650		14690	
rel	op	rel	op	rel	op	
	CS	CD		A,B,FU,K. CD (CS)	G	ST, EF	MF

11. Mains fail

Normally MF relays in exchange line ccts are held operated. Selected extn lines are prewired to exchange line ccts, so that while MFs are operated, they function as normal extensions but, in the event of a mains failure, the releasals of MFs route the extns directly to the relative exchange lines via LB relays, so that they then function as individual subscribers in a P.B.X. group.

Remarks:

Mains fail. MF releases, AC dis, extn direct to line via IB, MH dis.
In call goes directly to extn.
Out call: extn. must press button momentarily to cth the B wire to get dial tone from main exchange. IB operates in either case, MF dis and if mains are restored before call is finished, BR operates to maintain exchange line cct busy.
Extn clears when mains restored:-
Conditions restored to normal.

12.
12.1 Alarms
P.G. Alarm. Condition originates when an extn. holds dial tone or does not release con. cct. after use. Under these circumstances P operates (pulse cct.) while LP1 (con. cct) lights.
TH takes about 30 secs.
TH dis. PG locks, LP13 (P.G. Alarm) lights. No audible alarm

Condition clears when con. cct. clears.

12.2 Auto Alarm. Condition is signalled by LP14 (Auto alarm) glowing and the buzzer operating. Auto alarms originate from fuse operations, ring failures and mains failure if required. Reference should be made to common service drawing 13200 sheet 1 fig. 1A.

12.2.1 Fuse Alarm. Fuse operates
Fuse alarm lamp and buzzer operate
Attendant operates KCO AO operates and locks. (KCO can then be released)
Buzzer stops

__Faulty fuse removed__

14.690	
rel	op
MF	IB
IB	BR
BR	MF

14/11		14.720	
rel	op	rel	op
TH	P		
	TH		
	PG		
		BZ1	LP14,BZ1
			AO

14.720	
rel	op
AL	AL
AO,LP14	LP14

Remarks

12.2.2 Ring fail alarm
Normal operation. RS ops to ring start

RR ops to TR1 output.
If ringing is insufficient to operate RR.
RS ops to ring start

RB locks to RS2

RB further locks to RB1. Alarm conditions applied and maintained even after
RS releases. Alarm conditions removed when ringing is restored and RR ops.

12.2.3 Mains fail See drawing 13280, sheet 1, fig. 14. Mains failure connects earth
to battery connected winding of A. Alarm functions as in 12.2.1.

13. Attendant's cabinet - remaining features not already covered
13.1 Splitting keys (KSS and KSB) When attendant enters an exchange line cct by operating KDO,
attendant, extn, and exch. caller are all connected (ref. 14690, 13241).
KSS when operated leaves attendant connected to extn only.
KST when operated leaves attendant connected to exchange only.

13.2 Flash and Cancel key (KF) When attendant is across an exchange line, calls
can be cancelled (auto) or if exch. line connected to a CB exchange,
cancelled or flashed to exchange operator.
Relays operated when attendant across cct:- Pulse cct operation

Attendant operates KF. Exch loop opened at KF1
CA released (auto) or released by S/C on FK wire.
CR held to MH. MH will hold to manual hold condition from exchange
KF restored. Loop to exchange closed.

If exch. is released when FK is operated MH releases

	rel	op
	14,700	
		RS
		(VB)
		RR,RR,
		RS
		(VB?)
		RA
		RB
		RA
		LP1
13241	rel	op
		S,LP
		CL,CR,MF,
		S1,SB,CA,
		BB.
	14690	
		CA
		MH
		CA
		MH
		CL
		CR
	LP	

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Remarks

If IDQ is restored S(13241) SA and SB (14690) will release
and exch line cct is normal.
If IDQ is left operated and KF restored, CA ops, eth. to exch on B
wire
Eth. back on A wire
loop to exch, dial tone to operator
Relays operated are the same as when attendant had dial tone on
an outgoing call (7.2)

13.3 IDO (alarm cut-off key) AO operates as for fuse alarm (Sect.12.2.1)

	13241		14690	
	rel	op	rel	op
		BR	CA	MH CL

PART 2 35/49 line systems:
Description of circuits which differ from those used in 20 line systems i.e., connecting and enquiry
circuits.

1. Local call extn. to extn.

1.1 Extn. loop, 1150 ohm batt. and CO. to HF wire (LF)
to line start.

PS held via R1
PS stops
PA and PB interact to step PS 2½ times a sec. E ops
from IS1 via FS4 and locks to HOLD wire

E hunts for calling line
Calling line picked LF dis
Dial tone to A relay, start chain rerouted, line start
dis, dial tone to extn.

Relays operated

	13210		13241		14741		14660		13210	
	rel	op	rel	op	rel	op	rel	op	rel	op
		LS								
					PS,PA PB	PA FB,PS				
		CO			PA		E A B			
	LS			CO		P	K	FT		
				CO		P	E	LPI A,B,FT,		K

Circuits described in these summaries:

GBW 13210 - Extension line circuits 20 and 35/49 line P.A.B.X.s.

GBW 13230 - 20, 35 and 49 line P.A.B.X. Marker circuit.

GBW 13241 - Attendant's circuit 20, 35 and 49 line P.A.B.X.s.

GBW 14650 - 20 line P.A.B.X. connecting circuit.

GBW 14660 - 35/49 line P.A.B.X. connecting circuit.

GBW 14670 - 20 line P.A.B.X. Enquiry circuit.

GBW 14680 - 35/49 line P.A.B.X. Enquiry circuit.

GBW 14690 - 20, 35 and 49 line P.A.B.X. Exchange line circuit.

GBW 14700 - P.A.B.X. Ringing and tone circuit.

GBW 14711 - Pulse circuit 20, 35 and 49 line P.A.B.X.

GBW 14720 - Attendant's line, Night service, start, Alarms and miscellaneous
circuits.   20, 35 and 49 line P.A.B.X.

Part 1, 20 Line System

All circuit numbers are CBW

Remarks	13210 rel	13210 op	14711 rel	14711 op	14650 rel	14650 op	13210 rel	13210 op
1. Local call Extn. to Extn.								
1.1 Extn loop - 1150 ohm batt + CO to		LS						
HF wire (L/E): line start earthed.				PA				
PS held via R1.				PB,PS				
PS Steps								
PA and PB interact to step PS 2½			PA					
steps per sec.			PB,PS	PA				
E ops from LS1 eth via PS4 and						E		
locks to LS1 via 'hold' wire						A		
						B		
LF Hunts for calling line				P		LF,LP1		
Line picked, LF drive dis.		CO				FT		
Extn. loop to A, Start chain dis,	LS					K		
line start dis.				PA				
D.T. to caller. Start chain re-routed.					E			
Relays operated at dial tone:-		CO		P		A,B,FT, K,LP1 Glows		
1.2 Extn. dials 1st fig. (7 or 8)								
1.2.1 Assume 8 dialled - A follows						CD,(CS)		
pulse train - CS steps twice								
N locks, D.T. dis.						N		
End of train. CS on step 3			P			LP1 CD		
Relays operated awaiting 2nd fig.		CO				E A,B,FT,K, N,E,		
1.2.2 If 1st fig had been 7. DF would								
have operated via CS2 when CD re-leased.								
					CD			
						E,DF. CS		
CS drives to step 14								
Relays operated awaiting 2nd fig.						A,B,FT,K, N,E,DF		
1.3 2nd fig. dialled - A follows pulse						CD(CS) NR		
train - CS steps accordingly. (DF rels. if operated).								
Ring start earthed.				RS	DF			
End of train - CD rel - E rel				PA,VB	CD			
slowly called line tested				PB,RR				
(assume free).						H		CO
PA, PB interact to step PS. RA			PA	RA	E			
ops via PS 2			PB					
Int. ring to line, ring tone to			RA					
caller								
Relays operated during ringing		CO		RS,VB RR		A,B,FT,K, N,H,NR		CO
PS Stepping, RA operating and releasing.								
4. Called extn. answers.						F		
Ringing, Ring tone, Ring start dis,				RS		D		
pulse cct. normal				RR,VB				
Relays operated during speech		CO				A,B,FT,K, N,H,F, D, NR		CO

Remarks	13210 rel	13210 op	14711 rel	14711 op	14650 rel	14650 op	13210 rel	13210 op
1.5 Releases								
1.5.1 Calling extn clears first					A B			
P operates P.G. Alarm after delay (Sec 11.1).	CO			P	FT,K	LP1		
Relays operated awaiting called extn. to release.				P	NR	N,D,H, F,LP1		CO
Called extn releases LP1 out, CS homes via CS1.				P	D H F N			CO
Conditions normal								
1.5.2 Called extn. clears first P.G. Alarm after delay (Sec 11.1).				P	D H	LP1		CO
Relays operated awaiting calling extn. to release		CO		P		A,B, FT,K, N,NR,F LP1		
Calling extn. releases CS homes	CO				A B N,K, FT.			
LP out				P	F,NR			
1.6 Called extn busy H does not operate when CD releases after 2nd fig. and in 1.3. Pulse cct. steps and busy tone is connected. Relay BT is the busy tone interrupter.								
Relays operated during busy tone Pulse cct. stepping – BT op and release		CO		RS		A,B,FT,K, N,NR,		
Release (caller restores) CS homes	CO				A B K,NR, FT N			
Conditions normal				RS				
2. Extn. dials wrong first digit								
2.1 Relays operated during dial tone		CO		P		A,B,FT,K, LP1		
2.2 Extn. dials (9,6,5,4 or 3) D.T. Dis.						CD,(CS) N		
End of train (CS on step 2,5,6, 7 or 8)					LP1,CD			
Busy tone to caller. Pulse cct stepping.				RS		NR		
Relays operated after wrong 1st fig.		CO		RS		A,B,FT,K, N,NR		
2.3 Release same as Section 1.6								
3. Extn. dials attendant ('0) Relays operated during dial tone NA is always operated when night service key is normal.		CO		P		A,B,FT,K, LP1	14720	NA

Remarks	13210 rel	13210 op	14711 rel	14711 op	14650 rel	14650 op	14720 rel	14720 op
3.2 Extn dials '0'. CS steps to contact 11 .						CD,(CS)		
D.T. dis						N		
CS drives to step 25 via CS2.				P	LP1, CD			
						E		
						NR		
Attendant's line tested during release lag of E				RS		H		KA
Pulse cct stepping, Ringing cct. operating				(PA)	E			
				(VB)				
Ring tone to caller, LP11 flashing to flicker earth				(PB)				
from PA2, Alarm buzzer ops if KAA operated.			PB	RR RA				
Relays operated awaiting attendant to answer.		CO		RS		A,B,FT,K,		NA
Pulse and ringer operating						N,NR,H		KA,(LP11)
3.3 Attendant operates KO to answer								SA
Buzzer dis. CS ops via DM wire LP11 dis. (Relay S is in						CS		S
marker cct.)							KA	
CS steps to contact '1'					CS			SB
F ops from attendant's loop via 3 and 1 out wires						F		CO
Pulse and Ringer ccts normal				RS		D		
Relays operated during		CO				A,B,FT,K,		NA,
speech						N,NR,H,F.		SA,SB,
						D		CO,S
3.4 Release. Attendant restores KO								S SA SB
Con. cct releases as in sec. 1.5.2						D		
Attendant's line normal						H		CO
3.5 Attendant's line already talking								
Relays operated when testing attendant's line (E holding		CO		RS		A,B,FT,K,		NA,CO,
on release lag)						N,NR,E		SA,SB,
Pulse and Ringer ccts operating								S
Relays in GBW.14720 op from previous call.								
H and KA op via OLW wire						H		KA
LP12 to flicker earth					E			(LP12)
Relays operated awaiting		CO		RS		A,B,FT,K,		NA,CO,
attendant to restore. LP12						N,NR,H		SA,SB,S,
flashing, Ring tone to caller								KA.
Attendant Restores KO								SA
LP12 dis LP11 flashes. Call								S,SB (LP11)
proceeds and in Sect. 3.3.								LP12.

3.6 Second call made to attendant before first call is answered. CS of both con. ccts on terminal 25. H of 2nd cct does not operate, being shunted by 1st H7 earth. Busy tone sent to caller of 2nd call. NOTE:- This condition will also apply to the third of three simultaneous calls to attendant, i.e., 1st call talking, 2nd in waiting, third receiving busy tone.

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Remarks	14720 rel	14720 op	14711 rel	14711 op	14650 rel	14650 op
4. Attendant calls extn.						
4.1 Attendant operates KO		SA				
Buzzer dis. Earth to line start		SB,LS,S				
1150 ohm batt. + CO to OLHF wire				(PA-PB)		
Pulse cct. steps. (See section1)						
						E
						A
						B
LF hunts for attendant's line				P		LF,LP1
Attendant's line picked - LF dis.		CO				FT
Eth. off line start	LS					K
Dial tone to attendant via 3 + 1-Out					E	
Relays operated during dial tone		CO,SA,SB, S, NA		P		A,B,FT,K, LP1
4.2 Attendant dials Con. cct operates as in Sections 1.2, 1.3, 1.4 or 1.6.						
Relays operated during speech (also CO of called extn).		CO,SA,SB, S,NA				A,B,FT,K, N,NR,H,F, D
4.3 Release. Attendant restores KO	SA					
Release of con. cct. proceeds as in 1.5.1	S,SB				A	
					B	
Attendant's circuit normal	CO		P			

Remarks	13210 rel	13210 op	14711 rel	14711 op	14720 rel	14720 op	14650 rel	14650 op	14690 rel	14690 op
5. Extn. calls main exchange (Dial '1')										
5.1 Relays operated when extn hears dial tone (See Section 1) MF (14690) is operated as long as mains supply exists.										MF
5.2 Extn dials '1' CS steps to contact 10		CO		P		NA		A,B,FT K,		MF
End of train		CO		P		NA	LP1 CD	CD,(CS) N	E. G	CD N
Etths to pulse start and PS5, 1150 ohm batt to J wire via LP2								E		EF
Pulse cct steps ST ops via PS5 and start chain. EF hunts for calling extn. (marked by J wire) Marked terminal picked: EF drive dis.				(PA-PB)						ST EF / EH H LS
Extn to exchange line FT rcl from S/C by H7 (exch. line) which holds CO of calling extn.								FT		LS
Busy chain to next exch line cct closed, Eth to B wire to call exchange CS hones via CS1 Con. cct. normal Exch line connected – eth from A wire operates MH to mid-point of voltage divider R7 – R8. Exch line looped – CL locks RG locks Dial tone to extn from main exchange **Relays operated**				PA-PB		4S	K G,A / B N			B BR,CA. / MH / CL RG
5.3 Extn. dials main exchange number. A operates on releasals of LS Pulses repeated to exch, B holds		CO				NA			LS / A	A / LS
5.4 Relays operated during speech are same as when dial tone heard.										LS A
5.5 Release. Extn restores Exch loop opened									MF,H,LS, B,BR,CA, RG,CL. / LS	A

5.5.1 If exch equipment has not released, MH ops to A wire and holds CL if "note 9" strap is in, preventing further release. This enables the operator at the main exchange in case of a call to toll or other manual board with manual hold facility. When extn. lifts off LS, B, CA op A, MH release, exch. loop is reclosed.

5.5.2 Assume exch equipt. has released.

Exch line cct normal

5.6 All exch. lines busy
Relays operated after '1' dialled (E not yet operated) All exch line BRs op.
NR ops via CS6 (terminal 10) LM1 wiper to busy chain eth.
B cct dis. Busy tone to caller.
Relays operated during busy tone

5.7 Ex barred direct access has local terminals E and ED strapped.
This operates NR in the same manner as in section 5.6.
Calling extn. therefore gets busy tone.

6. Incoming call from Auto main exchange (NA and MF normally op)
NOTE:- Relays of marker cct GSW.13230 are shown in explanatory form on GSW.13241 which will be referred to throughout for convenience.

	13210		14711		14720		14650		14690	
	rel	op	rel	op	rel	op	rel	op	rel	op
								B. CA		MH
								A,B,FT, K,N,NR		MH CL BR A
								A,B,FT, K N NR		H,RG, A
				RS						
		CO		CO						
	CO									
								13241		

Remarks	13210 rel	13210 op	14711 rel	14711 op	14720 rel	14720 op	13244 rel	13244 op	14690 rel	14690 op
6.1 Incoming ring MH ops to ring return to busy circuit by operating HR if "note 1" strap is in.										MF AC MH CR BR.
Attendant's buzzer operates if KAA operated. Start chain closed.				(PA-PB)		NA				
Busy chain closed. Pulse cct steps.										
LP of associated line flashes from flicker eth. from PA				(PA-PB)		EC				
Relays operated awaiting attendant to answer								(LP)(LP)		AC,CR,BR, MH,MF
6.1.1 If an incoming call appears before the exch line cct. relays have released, MH holds to ring return and SC ops to ringing.										
GR locks										AC CR
CR locks								CL H,RG A GR		CR
Relays operated are the same as for a normal incoming call, LP flashes, as described in Section 6.1.										
6.2 Attendant answers by operating KDO. Attendants 'out' wires to exch.line circuit.								S		SA
SA, SB, and S hold in series. Attendant's 'in' wires to TR1.								S		CA, SB
Exch ring tripped. CL locks										CL
Relays operated when attendant answers (LP still flashes)				(PA-PB)		NA,EC		S,(LP)		CR,BR,SA. SB,CA,CL. MF
6.3 Attendant keys required extn (assume 75)				PA-PB		EC NA				
6.3.1 Attendant presses key 7						LP				CR
Key 7 released CX + BX hold in series with RX								CX,BX, RX ST		CR
LP dis										
Pulse circuit stops										
Relays operated awaiting pressing of 2nd key								S,CX,BX, RX, ST.		BR,SA,SB, CA,CL,MF.

Remarks	13210		14711		14720		13241		14690	
	rel	op	rel	op	rel	op	rel	op	rel	op
6.3.2 Attendant presses key 5 Key 5 released. 1Y, BY hold in series with RY								1Y, BY RY		EF
EF Drives via 'D' wire hunting for marked 7 terminal on M wire										EF
Terminal picked. EF drive dis		CD						SD		EF
K has not time to op. EF Hunts for marked 75 terminal on M wire		CD						GD		H
Terminal picked. EF Dis								GD		M
M ops via M1 wire and holds via Z wire Pulse and Ringer ccts operating. RS op from M6 Required extn. tested (assume free)(H and CO operate from pulse earth via PS3, TP or ATP wire) Called line busied. Ringing to extn.		CO		RS				ST CD,SD RX,EX CX RY,BY 1Y		BR,SA,SB, CA,CL,RR, M,H,MF.
LP steady, Ring tone to exch. caller Relays operated awaiting extn. to answer. LP steady.		CO		RS		NA		K S,LP		HR
NOTE:- If 79 had been keyed CD would have been retained when SD operated. EF would have remained on terminal marked by first figure (7).										
6.4 Called extn. answers Ringing Dis. from extn.			RS	RS RS		NA		LP		ST,RR B RG
LS to extn. loop. Ring tone dis.										
Warm tone connected Attendant can speak to extn. if desired (via 'in' wire) Relays operated		CO		RS				S		BR,SA,SB, CA,CL,RG, H,LS, MF.

Remarks	13210 rel	13210 op	14711 rel	14711 op	14720 rel	14720 op	13241 rel	13241 op	14690 rel	14690 op
6.5 Attendant restores KDO										
Relays operated when call connected and talking		CO		RS		NA	SA,SB.			BR,CA,RG, CL,K,LS, B,MT.
6.6 Called extn busy										
Relays operated when testing called extn. As called extn. is busy, H and ER do not operate. LP flashes to busy cth (BT2 in pulse cct.) If attendant does not restore KDO, called line will continue to be tested from ATP wire (Section 6.3.2) Call will proceed when line is free.				RS		NA		S		BR,SA,SB, Ca,CL,M, MF,LP.
6.7 Attendant trunk offers										
6.7.1 Relays operated before trunk offering										
6.7.2 attendant operates KSS Call can now be offered to busy extn. via TO Wires. Warn tone to extn. (FB2 in pulse cct) Exchange caller cannot overhear (TO in circuits 14720 and 13241 is the same relay).				RS	TO	NA TO		S		BR,SA,SB CA,CL,M MF,(LP).
6.3. M will release when ST in marker cct operates and will reoperate when K operates.					TO					
6.7.3 Alternatives										
6.7.3.1 Extn rejects call and caller is rerouted to another extn. attendant restores KSS attendant keys 2nd extn and call proceeds as in 6.3.					TO		S			
6.7.3.2 Extn. rejects call which is cancelled attendant restores KSS attendant operates KR LP out indicates KR can now be released attendant restores KDO										M LP SB,SA CA

Remarks	13210		14711		14720		13241		14690	
	rel	op	rel	op	rel	op	rel	op	rel	op
MH will operate if exchange has not released and will hold BR to maintain exch. line cct busy. Assume exchange has released									CL	MH
6.7.3.3 Extn. accepts call and former connections release immediately when called extn. line is free, H operates and re-operates CO. Call proceeds as in 6.3.2.									MH	BR
6.7.3.4 Extn. will accept call when existing connection is finished, caller left camped on busy. (in waiting). Attendant restores KSS Attendant restores KDQ attendant dis from trunk and TR1.					TO		S		SB,SA, CA.	MH
MH ops to main exch. eth to hold CL								(LP)		BR,MH,CL, M,MF.
Relays operated awaiting called extn. to clear. LP slow flashing				RS		NA				
6.7.3.4.1 Exch. caller clears before extn free. Exchange line cct. will not release because CL is retained by M7. When called extn. restores, Exch. line cct. is extended but extn. gets "ring no reply" condition. Exch. line cct. clears when extn. restores.									RR,ST	H RR ST
6.7.3.4.2 Called extn clears. Extn. seized, line rung Ring tone to caller Extn. answers Ringing Dis. Ring tone Dis.		CO				NA			M B CA,RG MH	M RR,ST LS B CA,RG BR,CL,CA, RG,H,LS, B, MF.
6.8 Release Extn. Restores — See Section 5.5 Relays operated during speech		CO		RS					LS	

Remarks

6.9 Rapid consecutive testing of extns
Relays operated when exch. call received, extn. busy
and attendant still across circuit.

6.9.1 Attendant keys 1st fig. of 2nd choice extn.(assuem 8 of 83)

Key 8 released, AX, BX, CX hold in series with RX.
Z wire opened to destroy previous calling condition
(i.e., M releases)
Condition of ccts 13241 and 14690 is now the same
as at conclusion of section 6.3.1 except that
different marking relays are operated.

6.9.2 Attendant presses key 3. Call proceeds as in 6.3.2.
Calls may also be similarly keyed to consecutive
"no reply" extns. H and RR releasing with M when
Z wire opened by ST.

6.10 Incoming call cannot be extended immediately, held
on "dial 3" facility
Relays operated when call answered and attendant
across line.

6.10.1 Attendant keys 1st fig. (3)
Key 3 released. CX holds in series with RX.

6.10.2 Attendant keys 2nd fig. (3)
Key 3 released. CY holds in series with RX.
EF hunts for marked terminal 25 on M wire
Terminal picked. EF drive dis.
CD holds

	13120 rel	op	14711 rel	op	14720 rel	op	1324.1 rel	op	14590 op
6.9								S,(LP)	BR,SA,SB, CA,CL,M, MF.
6.9.1					LP	AX,BX, CX, RX. ST			M
6.10					NA,DC / EC			S,(LP)	BR,SA, SB,CA,CL, MF.
6.10.1					LP			CX RX ST	CR
6.10.2					EC			CY RX CD SD	EF