

GTE AUTOMATIC ELECTRIC  
TYPE 90M TELEPHONE SET  
SHOP PROCEDURE AND REPLACEMENT PARTS

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4.	CLEANING AND INSPECTION . . . . .	9	1.01 This section contains instructions for ordering replacement parts, disassembly, cleaning, and assembly of the GTE Automatic Electric Type 90M Telephone Set (Figure 1, Series NC-902), equipped with a rotary dial. Also included is coding information for identifying a complete telephone set by a coded part number. This number is affixed to the packing carton for content identification.	
	Housing and Handset Shell and Caps . . . . .	9	1.02 This section provides a complete shop procedure for the 90M Telephone Set including the handset, base, and all component parts.	
	Interior Components . . . . .	9	2. REPLACEMENT PARTS	
5.	ASSEMBLY . . . . .	9	2.01 The component parts of the Type 90M Telephone Set are listed in Table 1, and are identified by corresponding item numbers in Figures 2, 3, and 5. To determine the part number for any component of the subject set:	
	Installing the Housing Securing Screw . . . . .	9	(1) Locate the component in Figures 2, 3, or 5 and obtain its identifying item number.	
	Transmission Unit Installation . . . . .	9	(2) Using the item number obtained in step 1, obtain the part number from Table 1.	
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Figure 1. Type 90M Telephone Set.

NOTE: For parts that are color-coded, read Table 1 horizontally and select the proper suffix letters under the appropriate column. Add the suffix letters to the part number.

### 3. DISASSEMBLY

#### Fingerwheel Removal

3.01 To remove the fingerwheel (Item 33) to stamp the number card, locate the small hole in the fingerwheel located near finger hole 6. Insert the appropriate removal tool into the small hole engaging the latching lug (located under wheel) at the left edge of the hole, and push down until the lug snaps out toward number 6 on the number plate. Remove the tool and rotate the fingerwheel clockwise one full turn until the zero (0) hole of the fingerwheel has passed the finger stop, and is over or slightly beyond the zero (0) on the number plate. The fingerwheel should disengage. Remove the fingerwheel from the dial.

NOTE: If this procedure fails to disengage the fingerwheel, rotate the fingerwheel clockwise to the finger stop and insert the tool into the small hole while applying pressure in a clockwise direction on the fingerwheel. Withdraw the dial card from the fingerwheel by pulling the elongated tab.

#### Housing Removal

3.02 To remove the housing (Item 1) of the Type 90M Telephone set:

- (1) Loosen the housing securing screw (Item 28) located in front of the housing at bottom center (Figure 1).
- (2) Swing the bottom of the housing forward sufficiently to clear the dial.
- (3) Lift the housing upward to separate it from the baseplate assembly (Item 29, Figure 2 or 3).

#### Dial Removal

3.03 To remove the rotary dial assembly (Item 4) on the Type 90M Telephone Set:

- (1) Remove the telephone set housing as instructed in Paragraph 3.02.
- (2) Press in on the dial and slide it upward until the bayonet lugs disengage from the mounting pins.
- (3) Disconnect the dial leads from the transmission unit terminals, and remove the dial from the telephone set.
- (4) Remove the three dial mounting plate screws, and lift the dial mounting plate off the dial.

NOTE: If the old dial has screw terminals, leads may be salvaged from it for connecting a replacement dial.

#### Ringer Removal

3.04 To remove the ringer (Item 6) from a Type 90M Telephone Set:

Table 1. Replacement Parts.

ITEM NO.	QTY. USED	DESCRIPTION	PART NUMBER	BLACK	SAND BEIGE	GAR-DENIA WHITE	JADE GREEN	CLASSIC IVORY	TUR-QUOISE	SUNLIGHT YELLOW	CAMELLIA PINK
1	1	Housing	D-49976-	A	B	M	D	E	G	J	L
2	1	Housing mounting bracket	D-731536-A								
3	1	Vacuum tube (when used)	D-52144-A								
		Dial (numerical 1-0 outdoor use)	D-84997-	A							
		Dial (metropolitan ABC outdoor use)	D-84998-	A							
	AS	Dial (numerical 1-0)	D-84908-	A	B	M	D	E	G	J	L
4	REQ	Dial (metropolitan ABC)	D-84909-	A	B	M	D	E	G	J	L
	1	Dial (SATT A)	D-84910-	A3	B3	M3	D3	E3	G3	J3	L3
		Dial (SATT B)	D-84911-	AXX1	BXX1	MXX1	DXX1	EXX1	GXX1	JXX1	LXX1
		Dial Blank	D-49997-	A	B	M	D	E	G	J	L
5	2	Ringer mounting screw	D-760735-A								
6	1	Ringer	D-56548-	See Table 3							
7	1	Switch assembly mounting screw	D-760775-A								
8	1	Switch assembly	D-735394-J								
9	1	Tripod assembly	D-731713-D								
10	1	Ringer mounting bracket	D-731667-A								
11	1	Switch assembly screw	D-760734-A								
12	2	Housing bracket screw	D-76491-C								
13	1	Handset	L-9053-	CA							
	1		L-9054-		CB	CM	CD	CE	CG	CJ	CL
14	1	Receiver cap	D-67708-	A	B	M	D	E	G	J	L
15	1	Gasket	D-67646-A								
16	1	Receiver capsule	D-51030-A								
17	1	Receiver cushion spring	D-109918-A								

Table 1. Replacement Parts (Continued).

ITEM NO.	QTY. USED	DESCRIPTION	PART NUMBER	BLACK	SAND BEIGE	GAR-DENIA WHITE	JADE GREEN	CLASSIC IVORY	TUR-QUOISE	SUNLIGHT YELLOW	CAMELLIA PINK
18	1	Transmitter cap	D-67442-	A	B	M	D	E	G	J	L
19	1	Transmitter capsule	D-38379-A								
20	1	Transmitter center contact spring	D-109959-A								
21	3	Screw	D-760991-A								
22	1	Retractable cord	D-543534-	A	B	M	D	E	G	J	L
23	1	Transmitter rim contact spring	D-109756-A								
24	1	Handset shell	D-52146-	A	B	M	D	E	G	J	L
25	2	Transmission unit mounting screw	D-760732-A								
26	1	Transmission unit	WA-1154-A								
27	3	Ringer mounting bracket screw	D-760764-A								
28	1	Housing securing screw	D-760773-A								
29	1	Baseplate assembly	D-780945-A								
30	1	Support spacer	D-65573-A								
31	3	Dial mounting plate screws	D-650930-A								
32	1	Dial mounting plate	D-731533-A								
33	1	Finger wheel	D-780896-A								

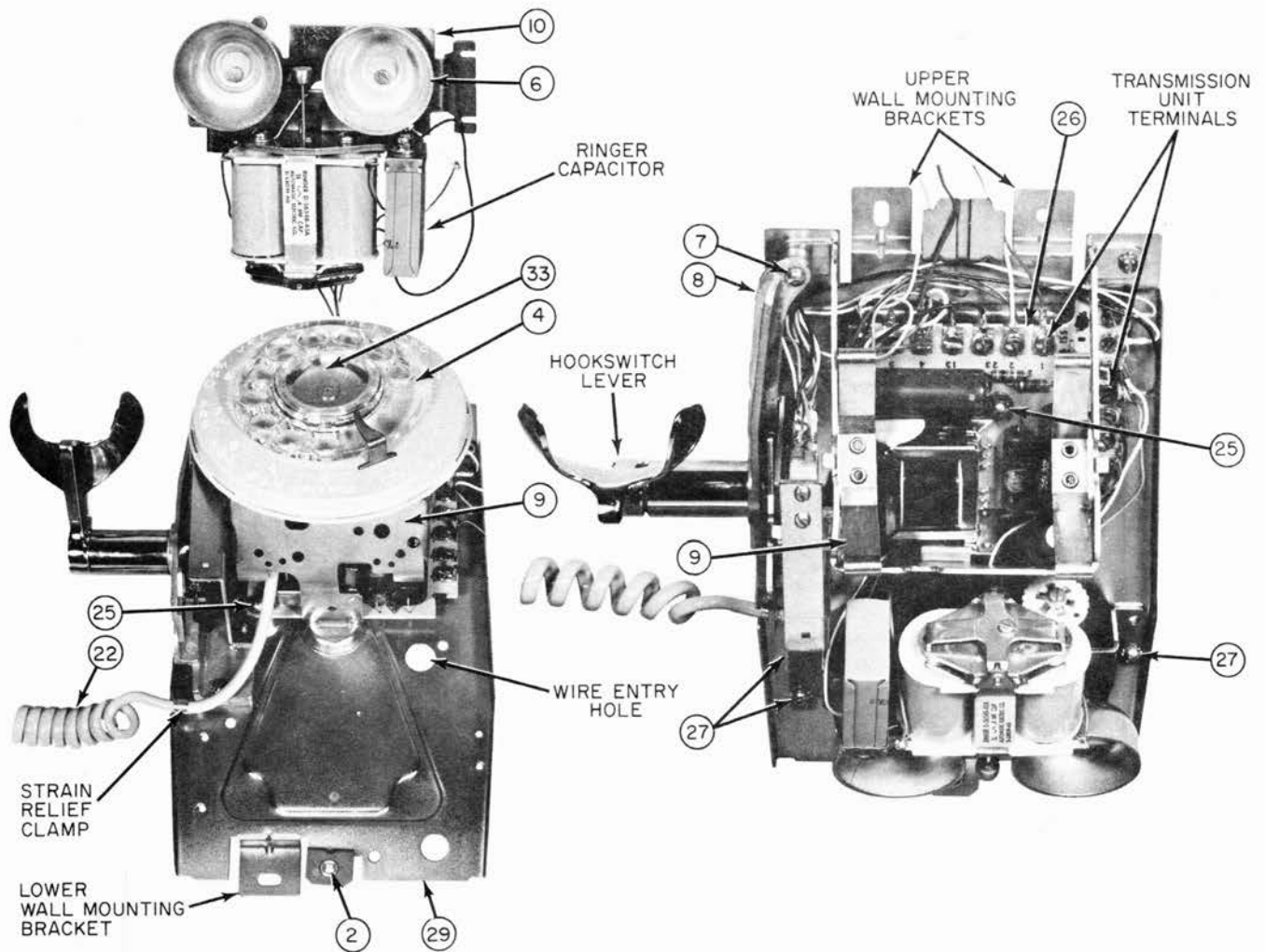


Figure 2. Type 90M Telephone Set Equipped with Printed Wiring Card Transmission Unit.



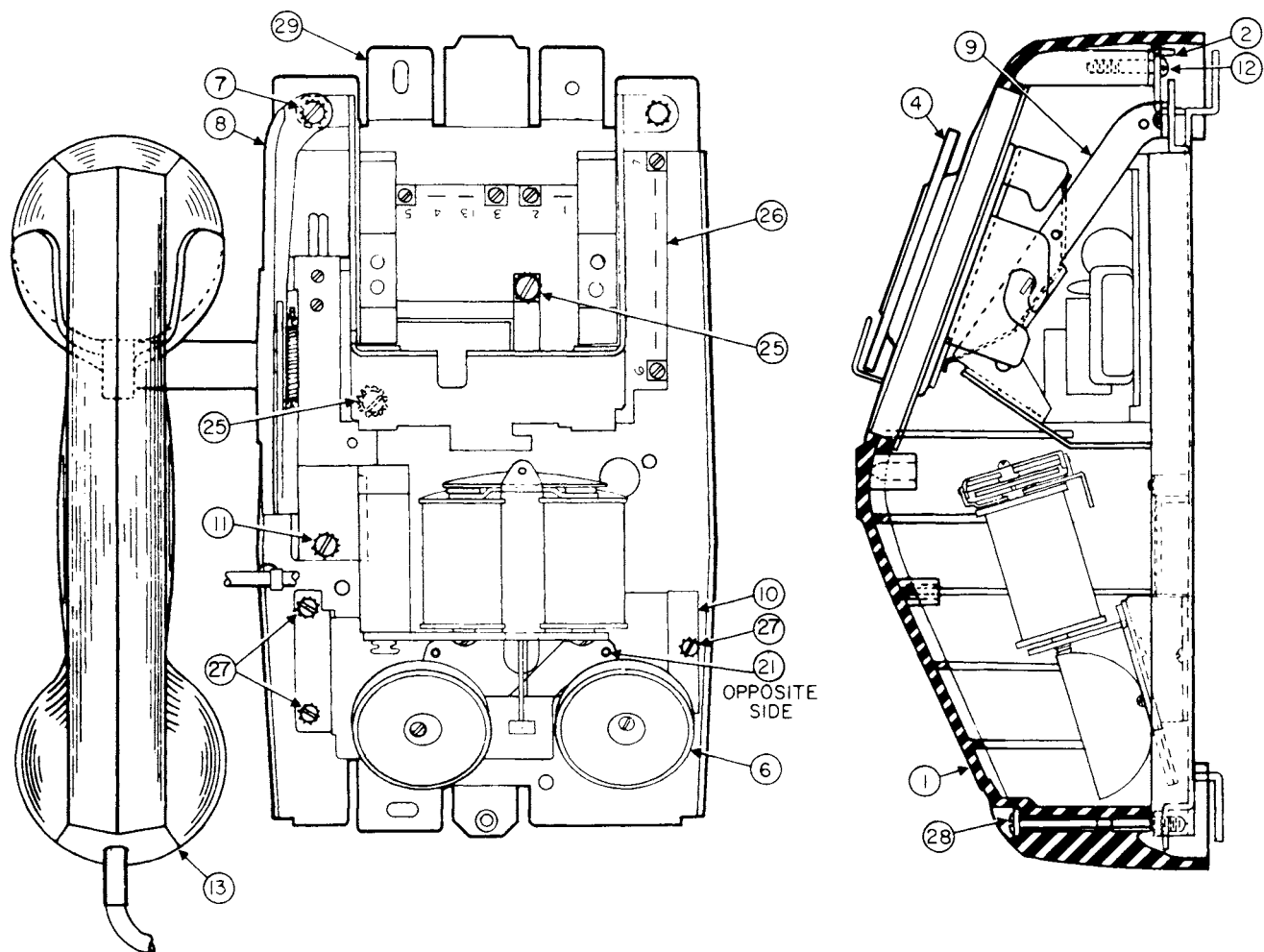


Figure 3. Type 90M Telephone Set, Front View with Cover Removed and Side View.

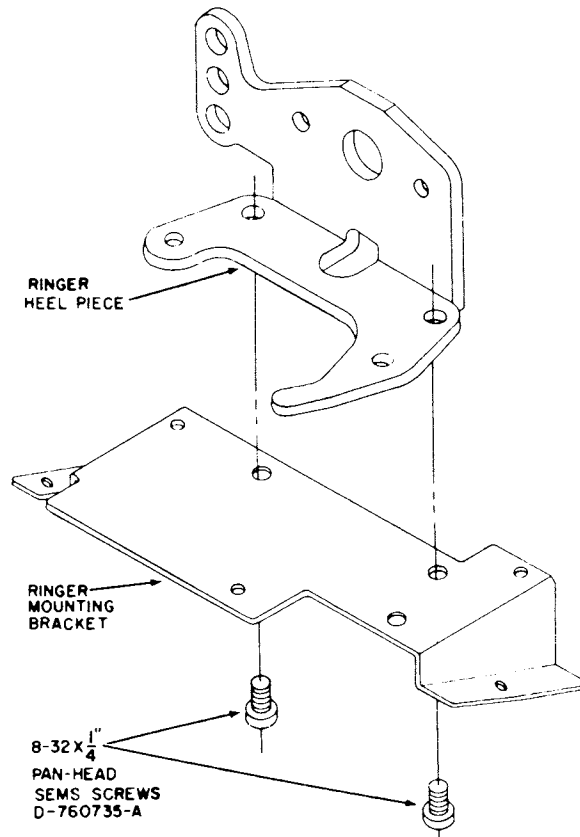


Figure 4. Attaching Ringer Mounting Bracket to Ringer.

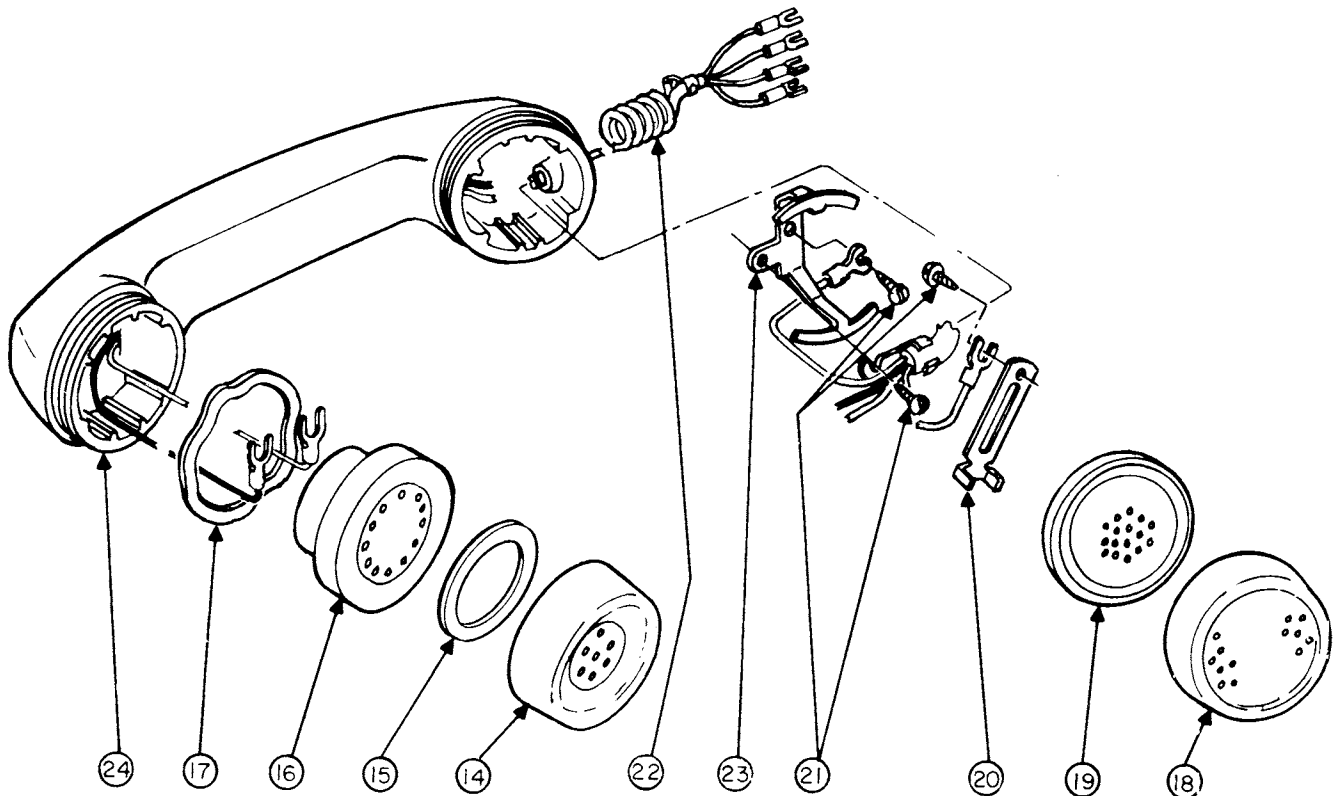


Figure 5. Exploded View of Handset for the Type 90M Telephone Set.

- (1) Remove the telephone set housing as instructed in Paragraph 3.02.
- (2) Disconnect the ringer and ringer capacitor leads from the transmission unit or terminal strip terminals.
- (3) Remove the three ringer mounting bracket securing screws (Item 27, Figure 2), and lift the ringer and mounting bracket combination out of the telephone set baseplate.
- (4) Turn the ringer and mounting bracket (Item 10) combination upside down. Remove the two ringer securing screws (Item 5) and lift the mounting bracket off the old ringer as shown in Figure 4.

#### Cradle Switch Assembly Removal

- 3.05 To remove the cradle switch assembly (Item 8):
- (1) Remove the telephone set housing as instructed in Paragraph 3.02.
  - (2) Disconnect the cradle switch leads at the transmission unit terminals.
  - (3) Remove the cradle switch assembly securing screws (Item 7 and Figures 2 and 3).
  - (4) Lift the cradle switch assembly upward to separate it from the baseplate.

#### Handset Removal and Disassembly

- 3.06 To remove the handset cord (Item 22) from the telephone set:
- (1) Remove the telephone set housing as instructed in Paragraph 3.02.
  - (2) Disconnect the handset leads at the transmission unit and terminal strip terminals.
  - (3) Unhook the handset cord strain relief clamp from the telephone set baseplate, and pull out the handset cord.

- 3.07 To remove the receiver capsule (Item 16) from the handset (Figure 5):

- (1) Unscrew the receiver cap, and lift the receiver capsule out of the handset shell.
- (2) Disconnect the two leads (yellow and black) from the screw terminals located on the back of the receiver capsule.

NOTE: Leave the Cork Receiver Gasket (Item 15) mounted in the handset unless it requires replacement. The receiver gasket is glued to the housing of the handset.

- 3.08 To remove the transmitter capsule (Item 19) from the handset, unscrew the transmitter cap (Item 18) from the handset, and lift out the capsule.

- 3.09 To remove the handset cord (Item 22) from the handset:

- (1) Remove the receiver (Item 16) and transmitter (Item 19) capsules from the handset as instructed in Paragraphs 3.07 and 3.08, respectively.
- (2) Lift the transmitter center contact spring (Item 20) out of the handset body.
- (3) Disconnect the green lead from the transmitter center contact spring.
- (4) Disconnect the red lead from the transmitter rim contact spring.
- (5) Loosen the strain relief clamp securing screw inside the handset transmitter well, and remove the strain relief clamp from under it.
- (6) Pull the handset cord out of the handset shell.

- 3.10 To remove the transmitter rim contact spring:

- (1) Perform the operations of Paragraph 3.09.



- (2) Lift the transmitter rim contact spring out of the handset transmitter well.

#### Transmission Unit Removal

3.11 To remove the transmission unit (Item 26):

- (1) Remove the telephone set housing as instructed in Paragraph 3.02.
- (2) Perform the operations of Steps 2 and 3 of Paragraph 3.03.
- (3) Disconnect all leads from the transmission unit terminals.
- (4) Remove the two transmission unit mounting screws (Item 25, Figure 3).
- (5) Lift the transmission unit out of the telephone set baseplate.

#### Removing the Housing Securing Screw

3.12 To remove the housing securing screw (Item 28) from the telephone set housing, pull outward on the screw head while turning the screw in a counterclockwise direction. When the screw threads take, continue turning to remove the screw from the hole.

### 4. CLEANING AND INSPECTION

#### Housing and Handset Shell and Caps

4.01 To clean the telephone set housing and handset shell and caps, wash them in a mild solution of non-abrasive soap and water. Inspect all exterior plastic components for cracks or other defects. Discard and replace any found to be defective.

#### Interior Components

4.02 Wipe all the interior components of the telephone set clean. Use extreme care to prevent breaking or otherwise damaging any components. Use a 1-inch wide, flat, non-metallic brush to remove accumulated dust or other foreign matter from the components. Pay particular attention to all indentations and pockets built into the components. Check all solder joints and terminals for a proper connection. Check for frayed or poorly insulated leads and replace as

necessary. Replace any colored surface components that will not clean up to their original state.

### 5. ASSEMBLY

#### Installing the Housing Securing Screw

5.01 To install the housing securing screw (Item 28) in the telephone set housing, place the point of a screw in an appropriate hole in the telephone set housing (Figure 1), and turn the screw clockwise until all the threads have passed through the housing.

#### Transmission Unit Installation

5.02 To install the transmission unit (Item 26) in the telephone set baseplate:

- (1) Place the transmission unit into position in the telephone set baseplate (Figure 2).
- (2) Install the two transmission unit securing screws (Item 25).

#### Handset Assembly

5.03 To assemble the handset (Figure 5):

- (1) Place the transmitter rim contact spring (Item 23) in the handset transmitter well.
- (2) Insert the end of the handset cord (Item 22) with the longest conductor leads through the hole in the handset shell. Push the yellow and black conductors through the handset shell into the receiver well.
- (3) Engage the handset cord strain relief clamp with the strain relief clamp screw on the transmitter rim contact spring.
- (4) Connect the red handset cord lead to the transmitter rim contact spring.
- (5) Connect the green handset cord lead to the transmitter center contact spring (Item 20).
- (6) Install the transmitter center contact spring in the handset transmitter shell.

- (7) Place the transmitter capsule (Item 19) into position in the handset transmitter well.
- (8) Place three drops of switch lubricant on the threads of the transmitter cap (Item 18), and install it on the handset.
- (9) Place the receiver cushion spring (Item 17) into position on the handset receiver well.
- (10) Connect the black and yellow handset cord leads to the screw terminals on the back of the receiver capsule (Item 16).
- (11) Place the receiver capsule into position in the handset receiver well. Align the receiver cushion spring with the edges of the receiver well and receiver capsule.
- (12) Place three drops of switch lubricant on the threads of the receiver cap (Item 14), and install it on the handset shell over the receiver capsule.

#### Handset Installation

##### 5.04 To install the handset:

- (1) Hook the handset cord strain relief clamp through the hole in the telephone set baseplate as shown in Figure 2.
- (2) Route the handset cord to the telephone set terminals as shown in Figure 2.
- (3) To connect the handset cord leads to the telephone set terminals of series NA, NB and NC, refer to Figures 6 through 9, respectively.

#### Cradle Switch Assembly Installation

##### 5.05 To install the cradle switch assembly (Item 8):

- (1) Place the cradle switch assembly on the baseplate just to the side of the transmission unit, Figure 2.

- (2) Position the feet over their respective mounting holes.
- (3) Install the two cradle switch assembly securing screws (Items 7 and 11).
- (4) To connect the cradle switch leads to the telephone set terminals of series NA, NB, and NC, refer to Figure 6 through 9, respectively.

#### Ringer Installation

##### 5.06 To install the ringer (Item 6):

- (1) Place the ringer on the telephone set baseplate in the position indicated in Figure 2.
- (2) Install the three ringer mounting bracket securing screws (Item 27).
- (3) To connect the ringer and capacitor leads to the transmission unit terminals of series NA, NB, and NC, refer to Tables 2 through 5 respectively.

NOTE: When SATT or ANI services are used, refer to Table 2.

#### Dial Installation

##### 5.07 To install the dial assembly (Item 4) on the Type 90M Telephone Set:

- (1) Place the dial in position on the telephone set, with the bayonet lugs at the point of engagement with the mounting pins.
- (2) Press in on the dial and slide it downward to latch it in place.
- (3) To connect the dial assembly leads to the telephone set terminals of series NA, NB, and NC, refer to Figures 6 through 9, respectively.

#### Housing Installation

##### 5.08 To install the housing (Item 1) of the Type 90M Telephone Set:

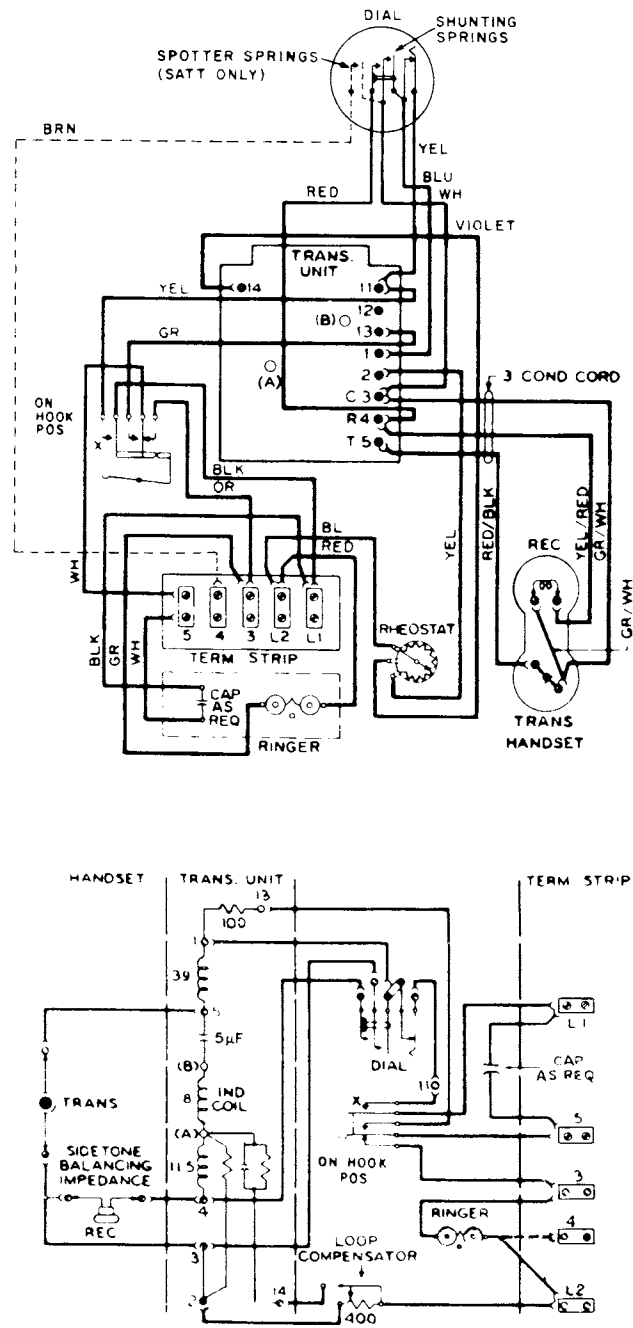


Figure 6. Manually Adjusted Type 90M Telephone Set  
(Series NA-902), Schematic and Wiring Diagrams.

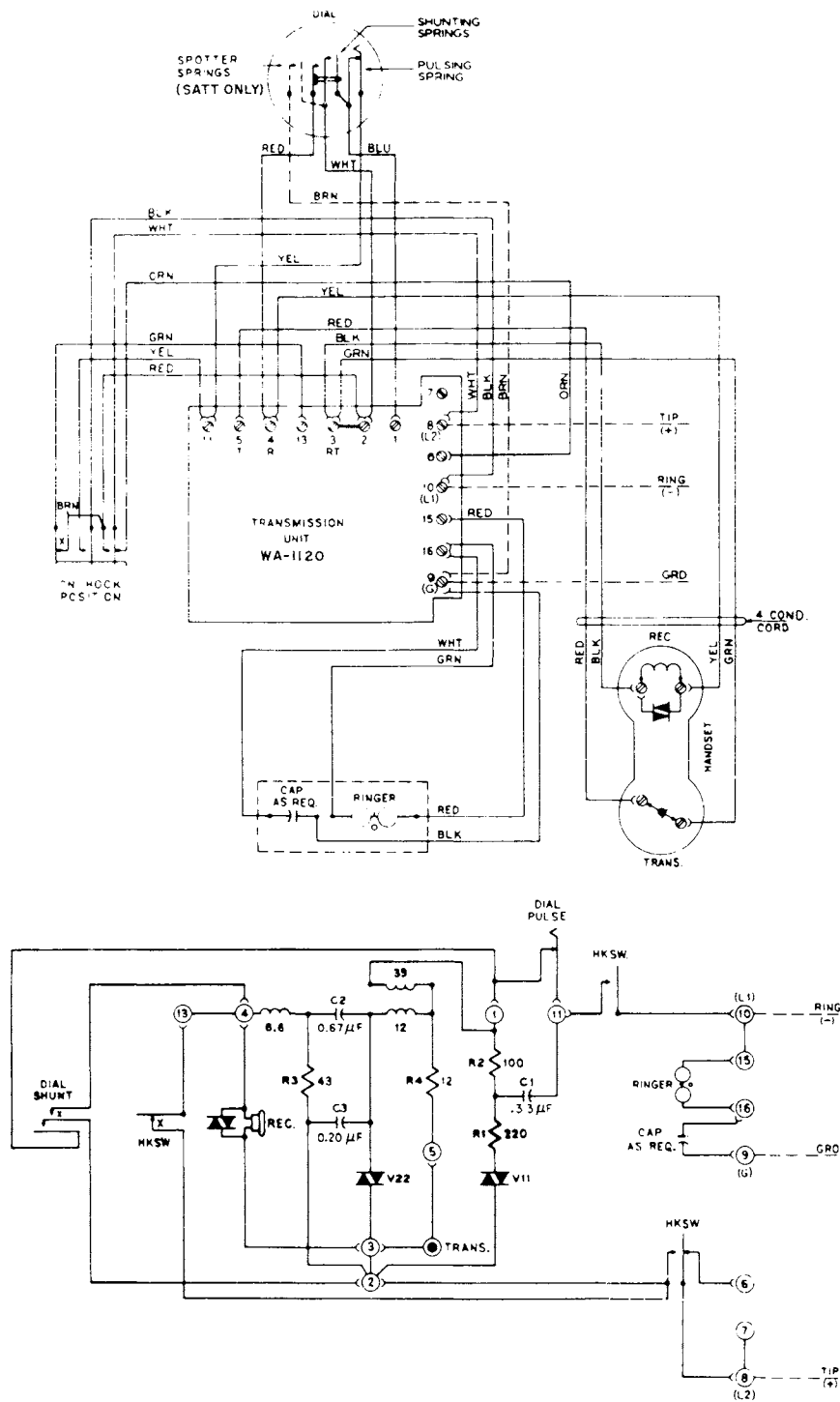


Figure 7. Type 90M Self-Compensating Telephone Set with Printed Wiring Card Transmission Unit (Series NB-902), Schematic and Wiring Diagrams.

# NOTES

- 1- "X" CONTACTS TO BREAK LAST
- 2- IF BELLS OF BIASED RINGER TAP WHEN DIALING FROM ANOTHER TELEPHONE ON THE LINE REVERSE RINGER CONNECTIONS AT L1 AND 5
- 3- IF NO DIAL IS USED, MOVE YELLOW HOOK SWITCH LEAD FROM TERMINAL 11 TO TERMINAL 1.
- 4- WITH STANDARD DIAL WIRING AT TERMINAL STRIP SHOWN FOR METALLIC (BRIDGED) RINGING FOR GROUND (DIVIDED) RINGING L1 (-RING) TO GROUND MOVE BLACK CAPACITOR LEAD AT TERMINAL STRIP FROM TERMINAL L2 TO 4G TO RING FROM L2 (+TIP) TO GROUND MOVE BLACK CAPACITOR LEAD FROM TERMINAL L2 TO 4G AND REVERSE TIP AND RING LEADS OF INTERIOR WIRING
- 5- FOR HOOKLATCH OPERATION CHANGE WIRING AS FOLLOWS
  - (A) MOVE GREEN SWITCH WIRE FROM NETWORK TERM 2 AND CONNECT TO L2 OF TERM STRIP
  - (B) MOVE WHITE SWITCH WIRE FROM TERMINAL L2 AND CONNECT TO NETWORK TERMINAL 2
  - (C) MOVE ORANGE SWITCH WIRE FROM 3 OF TERMINAL STRIP AND CONNECT TO NETWORK TERMINAL 1
  - (D) MOVE BLACK SWITCH WIRE FROM L1 OF TERMINAL STRIP TO 3 OF TERMINAL STRIP
  - (E) REMOVE VIOLET SWITCH WIRE FROM NETWORK TERMINAL 13 AND TAPE
  - (F) MOVE YELLOW DIAL WIRE FROM NETWORK TERMINAL 11 TO 3 OF TERMINAL STRIP
  - (G) ADD STRAP FROM L1 OF TERMINAL STRIP TO TERMINAL 11 OF NETWORK
- 6- WITH SATT DIAL
  - (A) SPOTTER SPRINGS TO OPERATE WHEN PULSING SPRINGS ARE CLOSED.
  - (B) MONOPHONE IS FURNISHED WITH RINGER WIRED FOR METALLIC (BRIDGED) RINGING TO RING FROM L1 (-RING) TO GROUND MOVE BLACK CAPACITOR LEAD FROM TERMINAL L2 TO 4G OF TERMINAL STRIP TO RING FROM L2 (+TIP) TO GROUND MOVE RED RINGER WIRE FROM L1 TO 4G OF TERMINAL STRIP
  - (C) DO NOT REVERSE LINE LEADS POLARITY OF LINE MUST BE MAINTAINED AS SHOWN

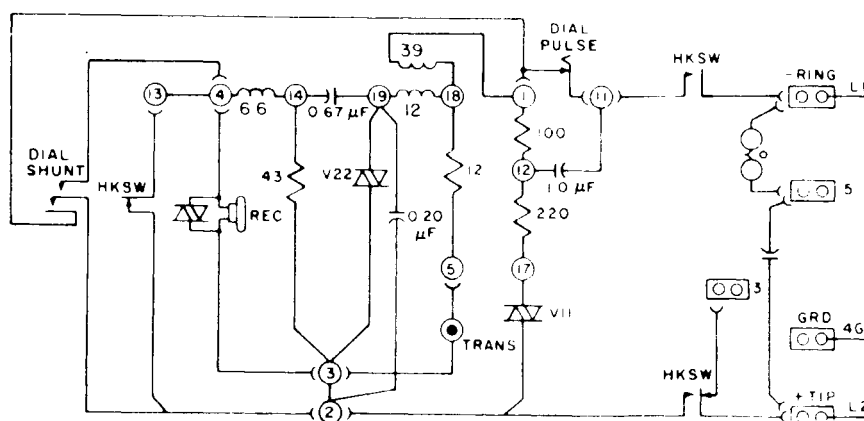
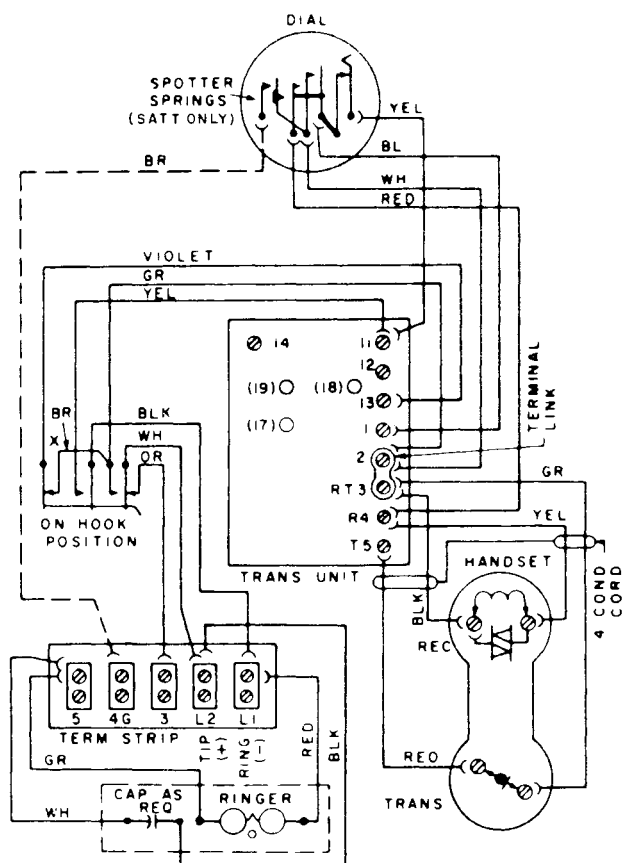


Figure 8. Type 90M Self-Compensating Telephone Set with Potted Transmission Unit (Series NB-902), Schematic and Wiring Diagrams.

NOTES:

1. "X" CONTACTS TO MAKE FIRST AND BREAK LAST.
2. IF BELLS OF BIASED RINGER TAP WHEN DIALING FROM ANOTHER TELEPHONE ON THE LINE REVERSE RINGER CONNECTIONS AT TERMINALS 15 AND 16 (NOTE 5).
3. IF NO DIAL IS USED, MOVE YELLOW HOOKSWITCH LEAD FROM TERMINAL 11 TO TERMINAL 1.
4. FOR HOOKLATCH OPERATION, CHANGE WIRING AS FOLLOWS:
  - A - MOVE RED SWITCH WIRE FROM TERMINAL 2 AND CONNECT TO TERMINAL 8(L2).
  - B - MOVE WHITE SWITCH WIRE FROM TERMINAL 8(L2) AND CONNECT TO TERMINAL 2.
  - C - MOVE ORANGE SWITCH WIRE FROM TERMINAL 6 AND CONNECT TO TERMINAL 1.
  - D - MOVE BLACK SWITCH WIRE FROM TERMINAL 10(L1) TO TERMINAL 6.
  - E - REMOVE GREEN SWITCH WIRE FROM TERMINAL 13 AND TAPE.
  - F - MOVE YELLOW DIAL WIRE FROM TERMINAL 11 TO TERMINAL 6.
  - G - ADD STRAP FROM TERMINAL 10(L1) TO TERMINAL 11.
5. WHEN SATT DIALS OR "AN1" SERVICE ARE USED, DO NOT REVERSE LINE OR RINGER LEADS, POLARITY OF LINE MUST BE MAINTAINED AS SHOWN IN TABLE 2.

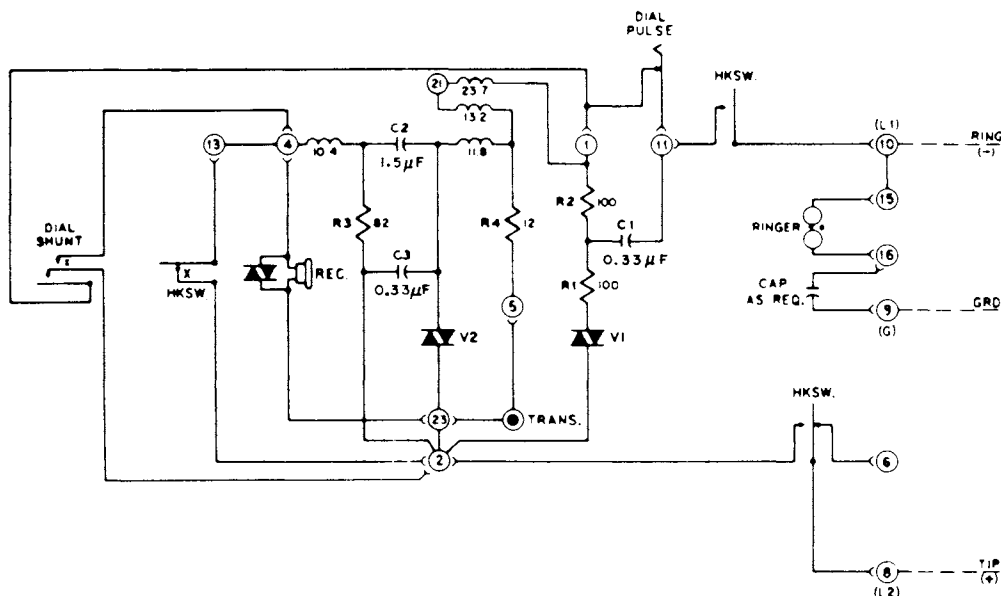
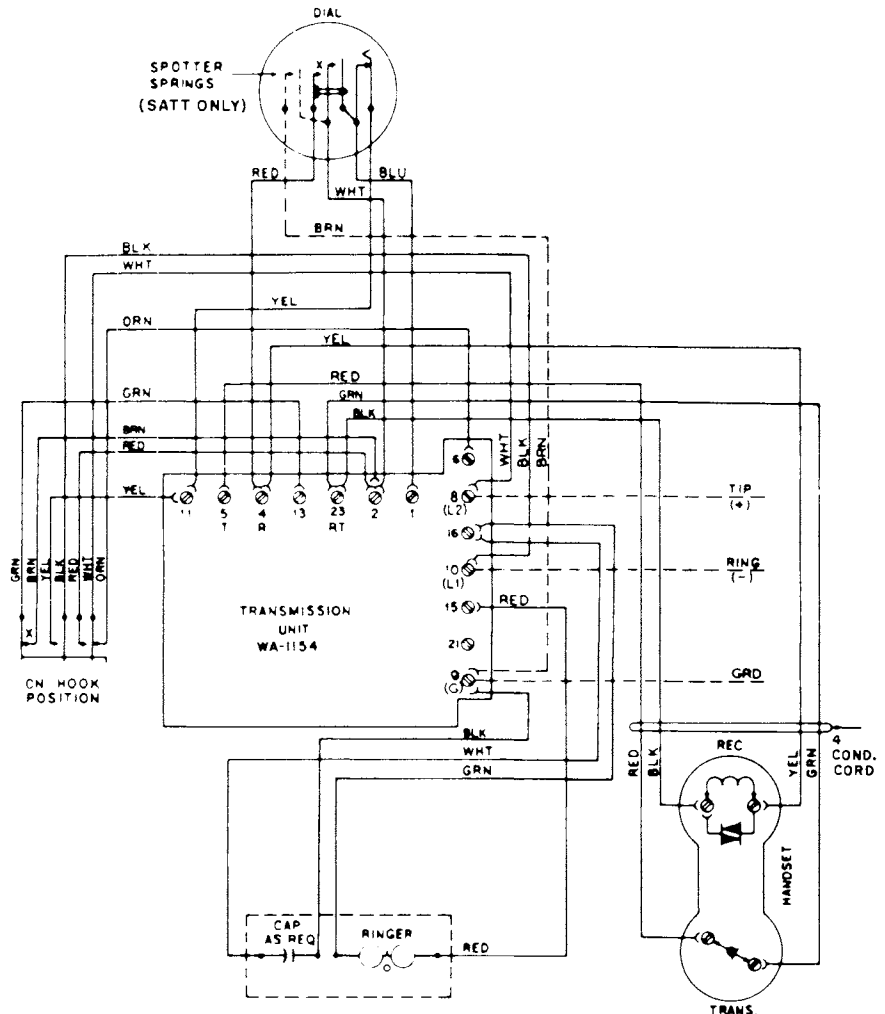


Figure 9. Type 90M Self-Compensating Telephone Set with Printed Wiring Card Transmission Unit (Series NC-902), Schematic and Wiring Diagrams.



Table 2. Lead Connections for Series NA-902 Telephone Set.

	TRANSMISSION UNIT TERMINALS						TERMINAL STRIP TERMINALS											
	HOOK- SWITCH LEADS		DIAL LEADS				RINGER LEADS		CAPACITOR LEADS		HOOKSWITCH LEADS			STATION WIRES			DIAL WIRE	
	YEL	GRN	RED	WHT	BLU	YEL	GRN	RED	WHT	BLK	ORN	WHT	BLK	RED	GRN	YEL	BRN	
Type 90M Standard Manually Adjusted Telephone Circuit Label D-530253-A																		
Bridged Ringing (Std Dial)	11	13	R(4)	C(3)	1	11	3	L2	5	L1	3	5	L1	L1	L2			Connect loop compensator blue lead to terminal strip terminal L2.
Divided Ringing +(L2) to Ground (Std Dial)	11	13	R(4)	C(3)	1	11	3	R4	5	11	3	5	L1	L2	L1	4		Connect loop compensator blue lead to terminal strip terminal L2.
Divided Ringing-(L1) to Ground (Std Dial)	11	13	R(4)	C(3)	1	11	3	R4	5	L1	3	5	L1	L1	L2	4		Connect loop compensator blue lead to terminal strip terminal L2.
Type 90M SATT A System Telephone using Ringer Capacitor for Spark Suppression Circuit Label D-530255-A																		
Bridged Ringing	11	13	R(4)	C(3)	1	11	3	L2	5	L1	3	5	L1	L1	L2	4	4	
Type 90M SATT B System Telephone with 1.0μF Spark Suppression Capacitor Circuit Label D-530256-A																		
Bridged Ringing	11	13	R(4)	C(3)	1	11	3	L2	L1	3	5	L1	L1	L1	L2	4	4	
Divided Ringing +(L2) to Ground	11	13	R(4)	C(3)	1	11	3	L2	L2	3	5	L1	L1	L1	L2	4		
Divided Ringing -(L1) to Ground	11	13	R(4)	C(3)	1	11	3	4	L1	3	5	L1	L1	L1	L2	4		
Type 90M Non SATT and SATT A System with 1.0μF Spark Suppression Capacitor Circuit Label D-530258-A																		
Bridged Ringing (Non SATT)	11	13	R(4)	C(3)	1	11	3	L2	3	5	5	L1	L1	L1	L2			
Bridged Ringing SATT A	11	13	R(4)	C(3)	1	11	3	L2	3	5	5	L1	L1	L1	L2	4	4	
Divided Ringing +(L2) to Ground	11	13	R(4)	C(3)	1	11	3	L2	3	5	5	4	L1	L1	L2	4		
Divided Ringing -(L1) to Ground	11	13	R(4)	C(3)	1	11	3	4	3	5	5	4	L1	L1	L2	4		
Hooklatch	NO WIRING CHANGES																	

- (1) Engage the slot in the upper housing bracket with the stud on the telephone set baseplate.
- (2) Lower the housing until it rests on the lower half of the dial.
- (3) Press the top edge of the dial in enough to cause the housing to drop into place.
- (4) Tighten the housing securing screw (Item 28) located in the front of the housing at bottom center (Figure 1).

#### Fingerwheel Installation

5.09 To install the telephone number card and the fingerwheel (Item 33) for Type 90M Telephone Set, place the dial card into the fingerwheel with the tabs in the slots provided, and

press in place. Place the fingerwheel over the locking disc (on the dial shaft) so that the zero (0) hole of the fingerwheel is between numbers 8 and 9 on the number plate. Rotate the wheel counter-clockwise until the wheel snaps into correct position.

#### 6. TEST PROCEDURE

6.01 The Type 90M Telephone, when reassembled, may be tested in the following way:

- (a) Connect the set to a test line.
- (b) Lift the handset, and place a call to the reverting call connector, testboardman, or an operator. Have the testboardman or operator call the line being tested.
- (c) Restore the handset and await the incoming signal.

Table 3. Lead Connections for Series NB-902 Telephone Sets with Potted Transmission Unit.

	TRANSMISSION UNIT TERMINALS					TERMINAL STRIP TERMINALS								
	HOOKSWITCH LEADS					RINGER LEADS		CAPACITOR LEADS		HOOKSWITCH LEADS				
	ORN	WHT	YEL	GRN	VIO	GRN	RED	WHT	BLK	ORN	WHT	BLK	GRN	
Bridged Ringing (Std Dial)			11	2	13	5	L1	5	L2	3	L2	L1		
Divided Ringing +(L2) to Ground (Std Dial)			11	2	13	5	L1	5	4G	3	L2	L1		
Divided Ringing-(L1) to Ground (Std Dial)			11	2	13	5	L1	5	4G	3	L2	L1		
Bridged Ringing (SATT Dial)			11	2	13	5	L1	5	L2	3	L2	L1		
Divided Ringing-(L1) to Ground (SATT Dial)			11	2	13	5	L1	5	4G	3	L2	L1		
Divided Ringing +(L2) to Ground (SATT Dial)			11	2	13	5	4G	5	L2	3	L2	L1		
Hooklatch	1	2	Same as for ringing scheme used, except remove Vio switch wire from transmission unit terminal 13 and tape.								3	L2	Add strap from terminal strip terminal L1 to transmission unit terminal 11	
	INTERIOR WIRES			DIAL WIRES										
	TERMINAL STRIP			TRANSMISSION UNIT				TERMINAL STRIP						
	RED	GRN	YEL	RED	WHT	BLU	YEL	YEL	BRN					
Bridged Ringing (Std Dial)	L1	L2		R4	2	1	11							
Divided Ringing +(L2) to Ground (Std Dial)	L2	L1	4G	R4	2	1	11							
Divided Ringing-(L1) to Ground (Std Dial)	L1	L2	4G	R4	2	1	11							
Bridged Ringing (SATT Dial)	L1	L2	4G	R4	2	1	11		4G					
Divided Ringing +(L2) to Ground (SATT Dial)	L1	L2	4G	R4	2	1	11		4G					
Divided Ringing-(L1) to Ground (SATT Dial)	L1	L2	4G	R4	2	1	11		4G					
Hooklatch	L1	L2	SATT 4G	R4	2	1		3		Add strap from terminal strip terminal L1 to transmission unit terminal L1				

Table 4. Lead Connections for Series NB-902 Telephone Sets  
with Printed Wiring Card Transmission Unit.

	TRANSMISSION UNIT TERMINALS																	
	RINGER LEADS		CAPACITOR LEADS		HOOKSWITCH LEADS						DIAL LEADS					STATION WIRES		
	GRN	RED	WHT	BLK	ORN	WHT	BLK	YEL	GRN	RED	RED	WHT	BLUE	YEL	BRN	RED	GRN	YEL
Bridged Ringing (Std Dial)	16	15	16	7	6	8(L2)	10(L1)	11	13	2	4	2	1	11		10(L1)	8(L2)	
Divided Ringing -L1 to Ground (Std Dial)	16	15	16	9(G)	6	8(L2)	10(L1)	11	13	2	4	2	1	11		10(L1)	8(L2)	9(G)
Divided Ringing +L2 to Ground (Std Dial)	16	15	16	9(G)	6	8(L2)	10(L1)	11	13	2	4	2	1	11		8(L2)	10(L1)	9(G)
Bridged Ringing (SATT Dial)	16	15	16	7	6	8(L2)	10(L1)	11	13	2	4	2	1	11	9(G)	10(L1)	8(L2)	9(G)
Divided Ringing -L1 to Ground (SATT Dial)	16	15	16	9(G)	6	8(L2)	10(L1)	11	13	2	4	2	1	11	9(G)	10(L1)	8(L2)	9(G)
Divided Ringing +L2 to Ground (SATT Dial)	16	7	16	9(G)	6	8(L2)	10(L1)	11	13	2	4	2	1	11	9(G)	10(L1)	8(L2)	9(G)
Hooklatch*					1	2	6	11	Tape	8(L2)	4	2	1	6		10(L1)	8(L2)	9(G)

\* On hooklatch also add strap from Terminal 10(L1) to Terminal 11.

- (d) Lift the handset to trip ring.

## 7. ADJUSTMENT SPECIFICATIONS

7.01 This adjustment applies to small, high impedance telephone ringers. Typical piece numbers are as follows:

- (a) D-56515, straight line, coils wired in series.
- (b) D-56517, harmonic, coils wired in series.
- (c) D-56535, D-56548 AVT and CVT, superimposed, with 2000-ohm coils wired in parallel, as manufactured prior to 9-19-61.
- (d) D-56548-A51, decimonic, coils wired in series.

- (e) D-56548 AVT and CVT, superimposed, with 1000-ohm coils wired in series as manufactured after 9-19-61.

### Ringers - Straight Line and Superimposed

7.02 The straight line and superimposed ringer adjustment specifications are as follows:

- (a) The armature shall not bind on its bearings nor have excessive side play (minimum 0.004 inch, maximum 0.024 inch).
- (b) The armature residual over the left hand coil shall cause the air gap between the armature and the coil core to be not less than 0.011 inch.
- (c) The armature stroke shall be not less than 0.034 inch nor more than 0.040 inch gauged between the residual and the core of the left-hand coil.

Table 5. Lead Connections for Series NC-902 Telephone Sets.

	TRANSMISSION UNIT TERMINALS						
	RINGER LEADS		CAPACITOR LEADS		STATION WIRE		
	GRN	RED	WHT	BLK	RED	GRN	YEL
Bridged Ringing (Std Dial)	16	15	16	8	10(L1)	8(L2)	
Divided Ringing -L1 to Ground (Std Dial)	16	15	16	9(G)	10(L1)	8(L2)	9(G)
Divided Ringing +L2 to Ground (Std Dial)	16	15	16	9(G)	8(L2)	10(L1)	9(G)
Bridged Ringing (SATT Dial)*	16	15	16	8	10(L1)	8(L2)	9(G)
Divided Ringing -L1 to Ground (SATT Dial)*	16	15	16	9(G)	10(L1)	8(L2)	9(G)
Divided Ringing +L2 to Ground (SATT Dial)*	16	8	16	9(G)	10(L1)	8(L2)	9(G)

\* Party identity pulse must be on positive side of the line.

- (d) The clapper rod shall be approximately straight and at right angles to the armature at all points.

- (e) The clapper rod shall not strike the ringer frame while operating.

#### Right-Hand Gong Adjustment

7.03 The right-hand gong (bias adjuster side) of straight line ringers shall be adjusted so that with the armature against the left-hand coil core the clapper shall clear the gong by approximately 0.010 inch.

7.04 The right-hand gong (bias adjuster side) of superimposed ringers shall be adjusted so that with the armature against the left-hand coil

core the clapper shall clear the gong by approximately 0.060 inch.

#### Left-Hand Gong Adjustment

7.05 The left-hand gong of straight line ringers shall be adjusted so that with the armature against the right-hand coil core the clapper shall clear the gong by approximately 0.060 inch.

7.06 The left-hand gong of superimposed ringers shall be adjusted so that with the armature against the right-hand coil core the clapper shall clear the gong by approximately 0.010 inch.

#### Biasing Spring Adjustment

7.07 The biasing spring shall be as straight as possible.

7.08 The biasing spring of straight line ringers shall be tensioned to the maximum value that will still allow the clapper to strike both gongs when tested in accordance with the current flow requirements given in Table 6.

7.09 The biasing spring adjustment shall prevent the bell from tapping when connected across a standard ten-pulse-per-second dial to a standard 48 or 24-volt selector over a zero loop resistance. This requirement need be met on one polarity only. This is done during final inspection of the completed telephone.

7.10 The biasing spring of superimposed ringers shall be tensioned to meet the values specified in paragraphs 7.22 and 7.23.

7.11 The clapper of the straight line ringer with volume control cam must strike one gong on the "soft" setting of the cam.

#### Ringer - Harmonic and Decimonic

7.12 The harmonic and decimonic ringer adjustments are as follows:

7.13 The armature supporting reed shall not be twisted or bent out of shape.

7.14 With the armature at normal, the stroke shall be set to provide approximately the space shown in Table 7, between each coil core and the armature measured at the nearest point.

NOTE: This adjustment may be varied from these values as required to meet the requirements of paragraphs 7.16 and 7.17, but such variation in adjustment shall not allow the armature to strike either coil core before the clapper strikes the corresponding gong.

Table 6. Current Flow Requirements.

RINGER	CAPACITOR
Straight Line 16.6, 20 25 30, 33.3 40, 42, 50, 54, 60, 66, 66.6	0.4 $\mu$ F 0.7 $\mu$ F 0.3 $\mu$ F 0.2 $\mu$ F 0.08 $\mu$ F
ADJUSTMENT VALUES	INSPECTION VALUE
3.4 mA	3.6 mA Unmounted 3.8 mA Mounted

NOTE: Straight Line Ringers (Test with 20 Hz Ringing Current).

Table 7. Stroke, Gong Spacing, and Current Flow Requirements  
for Harmonic and Decimonic Ringers.

FREQ. (Hz)	PIECE NUMBER	DESCRIPTION	STROKE	GONG SPACING	ADJ.	INSPECTION	
						UNMT'D	MOUNTED
16.6	D-56548-A16	Multiple (Type 80 phone)	.070"	3/4"	1.2	1.4	1.6
20	D-56516-F D-56548-A20	Non-Multiple, Decimonic	.075"	3/4"	1.4	1.6	1.9
25	D-56516-B D-56548-A25	Multiple	.060"	5/8"	1.6	1.7	1.8
30	D-56516-G D-56548-A30	Non-Multiple, Decimonic	.050"	5/8"	1.2	1.3	1.4
33.3	D-56516-C D-56548-A33	Multiple	.065"	5/8"	1.8	1.9	2.0
40	D-56516-L D-56548-A40	Decimonic	.050"	5/8"	1.0	1.1	1.2
42	D-56516-H D-56548-A42	Non-Multiple	.050"	5/8"	1.0	1.1	1.2
50	D-56516-D D-56548-A50	Multiple	.045"	9/16"	1.0	1.1	1.2
50	D-56516-N D-56548-A51	Decimonic	.070"	1/2"	1.5	1.6	1.7
54	D-56516-J D-56548-A54	Non-Multiple	.050"	1/2"	1.1	1.2	1.3
60	D-56548-A60	Decimonic, 860 $\Omega$ coils, nickel iron cores and spacers, type 80 phones.	.050"	9/16"	1.8	1.9	2.0
66	D-56548-A66	Non-Multiple, 860 $\Omega$ coils, nickel iron cores and spacers, type 80 phones.	.045"	9/16"	1.8	1.9	2.0
66.6	D-56548-A67	Multiple, 860 $\Omega$ coils, nickel iron cores and spacers, type 80 phones.	.045"	9/16"	1.8	1.9	2.0



7.15 The clapper rod shall be approximately straight and at right angles to the armature.

7.16 The total width between gongs shall be approximately the values given in Table 7. The gongs shall be adjusted so that the clapper ball strikes both gongs with approximately equal force.

7.17 The clapper weight shall be set as required to produce a strong ring when the ringer is operated on the correct frequency with the current shown in Table 7 flowing in the coils. A perceptible build-up time shall be allowed, after the circuit to the ringer is closed, for the clapper weight to strike both gongs. The increase in amplitude of the clapper rod vibration shall be continuous until the clapper strikes the gongs. This requirement shall be judged visually. If, when the ringer is operated on the specified current value at the required frequency, the clapper rod is retarded by hand or the ringer circuit is momentarily opened, the clapper rod must again start vibrating and strike both gongs when the clapper rod is released or the circuit is again closed.

NOTE: The clapper rod may extend a maximum of 5/32 inch beyond the outer edge of the weight, but at no time may the weight extend beyond the rod on:

1. Ringers with staked clapper rod weights.
2. Ringers of 40 Hz and above.

On all other ringers the weight may extend beyond the end of the rod but shall at no time extend more than one half the distance from the screw threads to the end of the weight.

7.18 The clapper of a harmonic ringer must not strike either gong on any frequency in the same series except that for which the ringer is designed. This requirement shall be met by applying ringing current (through a protective resistance only) to the ringer on test for periods of approximately one-half second at one second intervals.

NOTE: When the ringer is mounted in a Type 90M wall mounting telephone

set, the weight of the clapper pulls it closer to the lower (left) gong and further from the upper (right) gong. Thus, the left gong must be moved out, and the right gong moved in, to make the gong clearances approximately equal. For a preliminary adjustment, this can be judged by eye with the ringer in the mounting position. Final adjustment is made by touching up the gong clearance to get a good ring on both gongs after the instrument is installed.

7.19 It will usually be sufficient to check for overring only on those frequencies where overring is most likely to occur, refer to Table 8.

#### Current Flow Requirements

7.20 The current flow requirements must be met with the ringer and proper capacitor connected in series, refer to Table 6.

7.21 For stroke, gong spacing, and current flow requirements for harmonic and decimonic ringers, refer to Table 7.

7.22 The following current flow values apply only to unmounted superimposed ringers with 2000 ohm coils wired in parallel, as manufactured prior to 9-19-61. These values shall be met by adjustment of the biasing spring:

- (a) The ringer shall not ring on 7.0 milliamperes of 20 Hz current.
- (b) The clapper may vibrate slightly but shall not strike either gong.
- (c) The ringer shall ring on 9.0 milliamperes of 20 Hz current.
- (d) The clapper may strike one gong only.

7.23 The following current flow values apply only to unmounted superimposed ringers with 1000-ohm coils wired in series, as manufactured after 9-19-61:

- (a) The ringer shall not ring on 4.0 milliamperes of 20 Hz current.

Table 8. Overring Ringer Frequency.

RINGER FREQUENCY (Hz)	CHECK FOR OVERRING ON
16.6	25
20	30
25	16.6, 33.3
30	20, 40, 42
33.3	16.6, 25, 50
40	20, 30, 50
42	30, 54
50 Harmonic	25, 33.3, 66.6
50 Decimonic	20, 30, 40, 60
54	42, 66
60	30, 50
66	54
66.6	33.3, 50

- (b) The clapper may vibrate slightly but shall not strike either gong.
- (c) The ringer shall ring on 5.0 milliamperes of 20 Hz current.
- (d) The clapper may strike one gong only.

Test for Superimposed Ringers Mounted in  
Telephones or Ringer Boxes with No. 333 A  
Tube

7.24 The ringer shall meet the requirements specified in Paragraphs 7.02 through 7.11, and Paragraphs 7.20 through 7.23.

NOTE: The tests described in Paragraphs 7.25 and 7.26 are to be made using a 20 Hz ac generator whose output wave form approximates a sine wave.

7.25 The ringer shall ring on 55 volts (rms), 20 Hz ac, in series with 48 volts dc  $\pm$  2 volts (one side of ac generator connected to negative battery) under the following conditions:

- (a) If the yellow wire of the tube goes to the positive (+) ringer terminal, connect the ac generator lead to the negative (-) ringer terminal. Connect

the positive (+) battery (48 Vdc) lead to the black and red wires of the tube (Figure 10a).

- (b) If the red and black wires of the tube go to the negative (-) ringer terminal, connect the ac generator lead to the yellow wire of the tube. Connect the positive (+) battery (48 Vdc) lead to the positive (+) ringer terminal (Figure 10b).

7.26 The ringer shall not ring on 120 volts (rms), 20 Hz ac, in series with 48 volts dc  $\pm$  2 volts (one side of ac generator connected to negative battery) under the following conditions:

- (a) If the yellow wire of the tube goes to the positive (+) ringer terminal, connect the ac generator to the black and red wires of the tube. Connect positive (+) battery to negative (-) ringer terminal (Figure 11a).
- (b) If the red and black wires of the tube go to the negative (-) ringer terminal, connect the ac generator lead to the positive (+) ringer terminal. Connect the positive (+) battery lead to the yellow wire of the tube (Figure 11b).

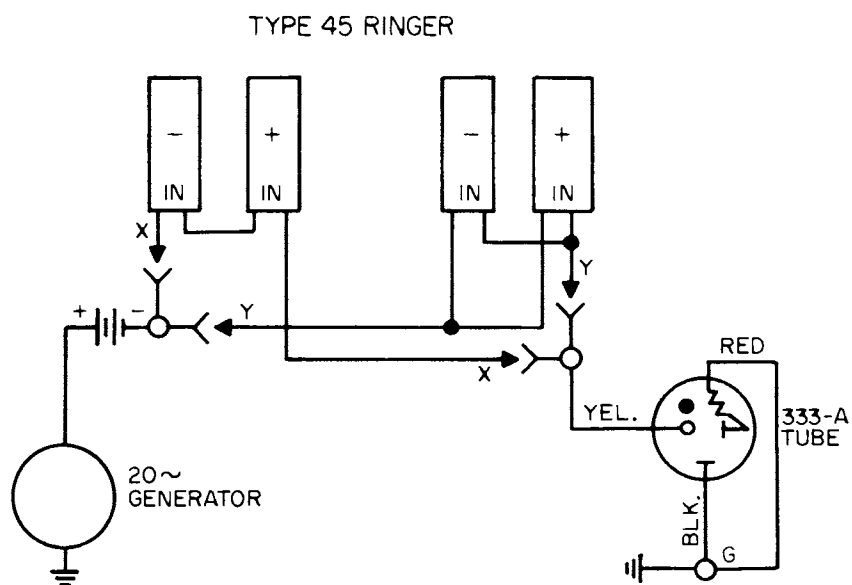


Figure 10a. Negative Station.

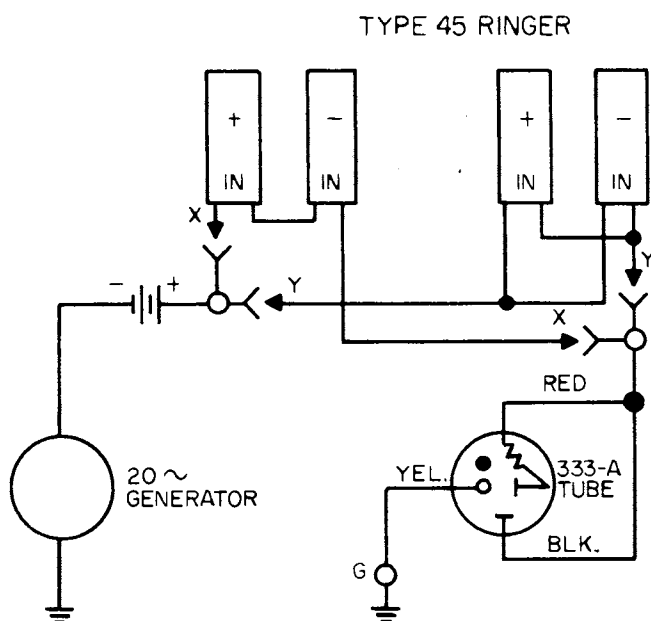


Figure 10b. Positive Station.

Figure 10. Test Connections for Ring.

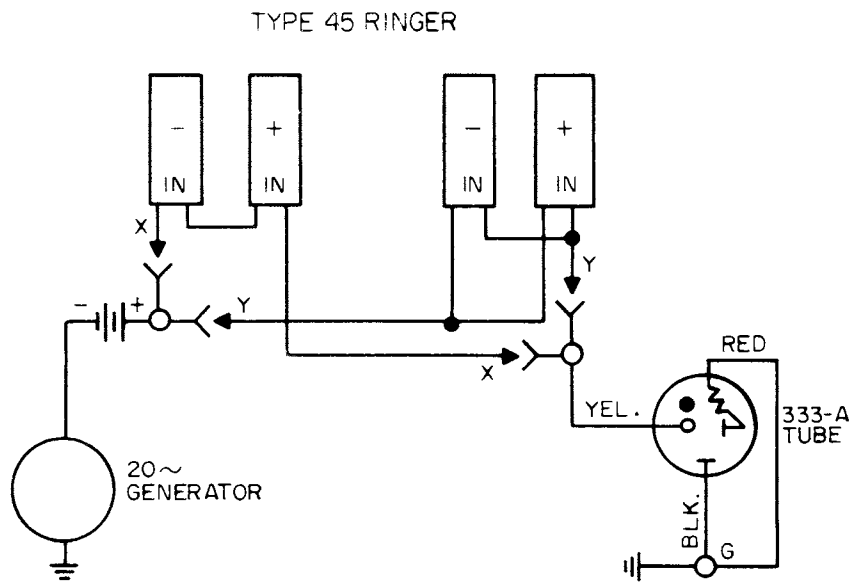


Figure 11a. Negative Station.

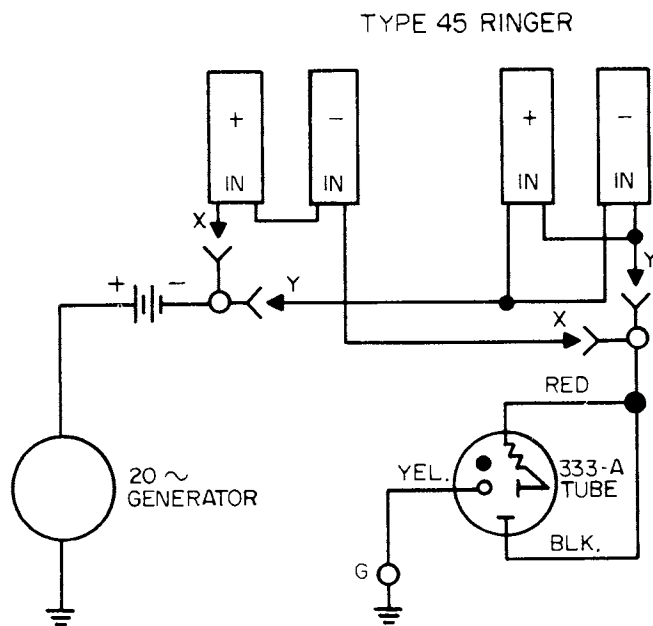


Figure 11b. Positive Station.

Figure 11. Test Connections for No-Ring.

NOTE: The ringer on test shall meet ring and no-ring conditions with the direct current voltages specified in Table 9 for the ringing voltage of the office. The polarity of the direct current battery as shown must be observed.

Table 9. Ringer Voltage of Office.

AC VOLTS	RING	NO-RING
88-90	15 V dc	10 V dc
91-95	10 V dc	15 V dc
96-100	5 V dc	20 V dc
101-105	0	25 V dc

#### Dial Unit Adjustment

7.27 To perform dial unit adjustments on the Type 90M Telephone Set, refer to the appropriate section in the 997-300 series of GTE Practices.

#### Hookswitch Lever Adjustment

7.28 With all of the play in the hookswitch assembly taken up in either direction the spring actuating buffer shall pass freely through the hole in the dust cover.

7.29 With the hookswitch in the ring position the buffer arm shall be bent, if necessary, to allow the dust cover (when used) to be removed completely.

7.30 Prior to adjusting the hookswitch the hookswitch stopping arm shall be adjusted so that in the talk position there shall be a clearance between the buffer arm and the dust cover of 0.025 inch (gauged visually).

7.31 The hookswitch lever shall not bind at any point against the mounting bracket.

#### Hookswitch Springs

7.32 Twin contacts of a spring combination shall make or break within 0.002 inch of each other, as gauged visually.

7.33 With a spring pile-up cover in place (when used) and with the hookswitch in the ring position:

- (a) The cover latch spring shall have sufficient pressure to hold the cover firmly against the bracket.
- (b) The hole closing spring shall be flat against the under side of the cover in the area of the buffer hole.

7.34 With the hookswitch in the ring position:

- (a) The break springs shall follow a minimum of 0.010 inch when the tension of its lever spring is removed.
- (b) The lever spring of the break-make combination shall follow only perceptibly when the tension of the make combination is removed from it.

NOTE: For purpose of definition, break springs are "closed" with the hookswitch in the "ring" position and make springs are "closed" with the hookswitch in the "talk" position.

7.35 With the hookswitch in the ring position there shall be perceptible clearance, as gauged visually, between the hole closing spring (when used) and the first buffer.

7.36 With the hookswitch in either the talk or ring position, there shall be a clearance of 0.010 inch minimum between springs not designed to make contact.

7.37 At the time the break contacts just open there shall be a minimum of 0.010 inch, as gauged visually, between the lever spring and the make spring of the break-make combination.

7.38 At the time the make springs of the break-make combinations just close, there shall be a minimum of 0.010 inch clearance, as gauged visually, between the contacts of the single make combination.

7.39 With the hookswitch in the talk position, the single break combination shall have 0.010 inch minimum contact separation.

7.40 At the time the single make combination just closes, there shall be perceptible to 0.005 inch clearance between the lever spring of the single make combination and buffer of the single break lever spring.

NOTE: This requirement does not apply when the telephone set is equipped with hooklatch or a card actuated hookswitch.

Card Actuated Hookswitch Adjustment  
(When Used)

7.41 At the time the single make combination just closes, there shall be perceptible to 0.005 inch clearance between the lever spring of the single break combination and buffer of the single make lever spring.

7.42 There shall be a minimum follow of 0.015 inch in the make spring of each individual make combination.

Auxiliary Springs for Grounding Pushbuttons

7.43 The under side of the make spring shall be 2-11/16 inch + 1/32 inch from the top side of the telephone set base plate.

7.44 The stop spring shall be adjusted so that, in the unoperated position, the contact separation of the armature and make springs will be 1/16 inch minimum.

7.45 The lever spring tension against the stop spring shall be 30 grams minimum, measured between the contact and buffer at a point near the buffer.

NOTE: Some end play will be allowed with the pushbutton in the unoperated position. There shall be approximately 1/32 inch spring follow, gauged visually.

Hooklatch

7.46 When the hooklatch is used, the latch lever shall operate freely. With the hookswitch lever in the latched position, the latch lever shall rest against the stopping surface on the hookswitch lever.

7.47 In the latched position, the make springs of the break-make combinations shall have a minimum of 0.010 inch follow, as gauged visually.

7.48 In the latched position, there shall be a minimum of 0.010 inch separation between the contacts of the individual make combinations, as gauged visually.

Restoring Spring

7.49 In the talk position, the hookswitch restoring spring shall cause the hookswitch lever to rest against the base.

7.50 The tension in the restoring spring is to be adjusted by bending the arm of the hookswitch bracket so that the lever will be deflected from the talk position and the hookswitch shall bottom against the frame when the associated handset is used.

Inspection

7.51 With the handset in place, the hookswitch shall bottom against the frame. It shall not "float free". If this condition is not met, check adjustment per Paragraph 7.50.

8. LUBRICATION

8.01 The telephone set should be inspected and, where necessary, lubricated as follows:

(a) Distribute one dip of spindle oil (GTE Automatic Electric Specification 5231) at both ends of the restoring spring hooks.

(b) Apply one dip of blended lubricant (GTE Automatic Electric Specification 5684) to the lever bearing surface on each end where it passes through the lever.

NOTE: The blended lubricant required in the following steps is the same specification as that in step (b).

(c) Distribute one dip of blended lubricant over the reset lever area on the hookswitch lever.

(d) Apply one dip of blended lubricant to the pivot point where the screw passes through the reset lever.



## 9. SCHEMATIC AND WIRING DIAGRAM

9.01 The wiring diagrams of the GTE Automatic Electric Type 90M (NA, NB, or NC series) Telephone Set are shown in Figures 6 through 9.

## 10. CODING THE TYPE 90M TELEPHONE SET FOR PACKING

10.01 Coding the Type 90M Telephone Set prior to packing requires the formulation of a part

number. The coded part number consists of a base number and a variety of suffixes, each having its own particular meaning. The part number is then affixed to the packing carton for identification purposes. The example part number breakdown, shown in Table 10 represents a Type 90M base, beige in color, with a straight line ringer. Use the breakdown shown in Table 10 when formulating the part number of the base. Part number suffixes for indicating ringer frequency and operating mode are shown in Table 11.

Table 10. Type 90M Telephone Set Coding Chart.

	4TH & 5TH DIGIT STOCKLIST					6TH DIGIT	1ST SUFFIX STOCKLIST							
							DIAL SUFFIXES							
							A	B	C	D	E	M	N	
COLOR	4TH & 5TH DIGIT	HANDSET & RETRACTILE CORD L-9053-	HANDSET & RETRACTILE CORD L-9054-	HOUSING D-49976-		D-84908 (1-0)	D-49997- (BLANK)	D-84909- (ABC)	D-84910- (SATT A)	D-84911- (SATT B)	D-84997- (1-0)	D-84998- (A-B-C)		
BLACK	00	CA		A	0	A	A	A	A3	AXX1	A	A		
SAND BEIGE	10		CB	B	0	B	B	B	B3	BXX1				
JADE GREEN	12		CD	D	0	D	D	D	D3	DXX1				
CLASSIC IVORY	13		CE	E	0	E	E	E	E3	EXX1				
TURQUOISE	15		CG	G	0	G	G	G	G3	GXX1				
SUNLIGHT YELLOW	17		CJ	J	0	J	J	J	J3	JXX1				
CAMELLIA PINK	18		CL	L	0	L	L	L	L3	LXX1				
GARDENIA WHITE	19		CM	M	0	M	M	M	M3	MXX1				

BASIC NO  
 NC-902  
 COLOR  
 10  
 SPECIAL FEATURE  
 0  
 DIAL  
 C  
 RINGER  
 SA

CODE EXPLANATION

Table 11. Ringer Frequency and Operating Mode.

SUFFIX	DESCRIPTION OF RINGER	FREQ. (Hz)
16	Harmonic	16.6
20	Harmonic or Decimonic	20
25	Harmonic	25
30	Harmonic or Decimonic	30
33	Harmonic	33.3
40	Decimonic	40
42	Harmonic	42
50	Harmonic	50
51	Decimonic	50
54	Harmonic	54
60	Decimonic	60
66	Harmonic	65
67	Harmonic	67